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MEMORANDUM

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Date:	1 August 2025
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Document Number:	J-NZ0233-014-M-Rev1
Document Title:	SPLP and SEM EDS Analysis

EXECUTIVE SUMMARY

Mine Waste Management Limited (MWM) has provided this memorandum to Matakanui Gold Limited (MGL) for the proposed Bendigo-Ophir Gold Project (BOGP Project) on additional geochemical testing of the project materials.

Objectives of this Study

The objectives of this memorandum are to:

- Understand the potential constituents of concern (PCOC) that could be mobilised from materials that will be disturbed as part of the BOGP.
- Understand the forms of sulfur, its mineral form, and mobility.

Findings

A range of BOGP materials were sampled:

- Diamond drillcore from TZ3 and TZ4/RSSZ.
- Grab samples from historic legacy mine waste rock - mullock (mined < 100 years ago).
- Weathered TZ4 materials from the local road cutting near the CIT battery.

Testing included acid base accounting (ABA), Synthetic Precipitation Leaching Procedure (SPLP), and Scanning Electron Microscope (SEM) with Energy Dispersive X-ray Spectroscopy (EDS) of TZ3 and TZ4 materials to determine sulfur speciation.

ABA data confirmed all samples are classified as non-acid forming (NAF). SPLP testing and subsequent metal ecotoxicity quotient (MEQ) analysis against proposed water quality compliance limits (Ryder, 2025) for the BOGP (and ANZG (2018) where limits were not defined by Ryder (2025)) identified that:

- The following metals are elevated in the SPLP test, and it is recommended that compliance monitoring should be undertaken for aluminium (Al), arsenic (As), cobalt (Co), and copper (Cu).

- The following metals are slightly elevated in the SPLP test, and performance monitoring should be undertaken for cadmium (Cd) and vanadium (V) at the ELF, TSF, and underground mine discharge points as this is likely to be the domains that will be potentially elevated.

SEM – EDS indicated a range of sulfide minerals and anglesite, a lead sulfate mineral. Oxidation of sulfide minerals identified by SEM could lead to the release of PCOC that include sulfate (SO_4), As, iron (Fe), and trace metals that include Co, Cu, lead (Pb), and zinc (Zn). However, Pb is not identified as being elevated in the SPLP test.

GENERAL BACKGROUND

MGL is proposing to establish the BOGP, which comprises gold mining operations, processing operations, ancillary facilities and environmental mitigation measures on Bendigo and Ardgour Stations in the Dunstan Mountains of Central Otago. The project site is located approximately 20 km north of Cromwell and will have a maximum disturbance footprint of 550 hectares.

The total Mineral Resource Estimate for the BOGP using a 0.5 g/t cut-off for open pit and 1.5 g/t for underground is 34.3 Mt at 2.1 g/t for 2.34 M oz (MGL, 2025). The Bendigo-Ophir resources occur in four deposits: Come in Time (CIT), Rise and Shine (RAS), Srex (SRX), Srex East (SRE). The majority of identified mineral resources are located within the RAS deposit. Three primary geological units are recognised at site:

- RSSZ – Rise and Shine Shear Zone
- TZ3 – Lower Greenschist facies Textural Zone 3 rocks of the Otago Schist
- TZ4 – Upper Greenschist facies Textural Zone 4 rocks of the Otago Schist

The resources will be mined by open pit methods at each deposit within the project site, with underground mining methods also proposed to be utilised at RAS to access the deeper gold deposits. The majority of the mining activities, ancillary facilities and associated infrastructure will be located in the Shepherds Valley – which includes a conventional carbon-in-leach (CIL) gold processing plant and water treatment plant, a tailing storage facility, three engineered landforms, internal haul roads, topsoil stockpiles, water pipelines, underground utilities and electrical supply - with non-operational infrastructure located on the adjoining Ardgour Terrace. The BOGP also involves the taking of groundwater from the Bendigo Aquifer for use in mining-related activities and the realignment of Thomson Gorge Road via Ardgour Station.

The following mine facilities are proposed:

- Open pits targeting the RAS, SRX, SRE, and CIT deposits.
- An underground mine targeting the RAS deposit.
- Three ex-pit engineered landforms (ELFs) – Shepherds ELF, SRX ELF, and West ELF (WELF).
- Two in-pit landforms (backfill) – CIT and SRE[1].
- Plant and processing area, where CIL extraction technologies will be used as part of the ore recovery process.

[1] *Note: SRE Pit is backfilled by the SRX ELF.*

- A tailings storage facility (TSF) and TSF Embankment.
- Other ancillary support services / structures (e.g., roads, water management infrastructure, water treatment plants, etc).

OBJECTIVES

The objectives of this memorandum are to:

- Understand the potential constituents of concern (PCOC) that could be mobilised from materials that will be disturbed as part of the BOGP.
- Understand the forms of sulfur, its mineral form, and mobility.

The objectives were achieved by the following tests:

- ABA to quantify the geochemical nature of the materials (i.e., the potential to generate acid rock drainage or not).
- SPLP on BOGP material to understand PCOC mobilisation.
- SEM with EDS of TZ3 and TZ4 materials to determine sulfur speciation.

SAMPLE SELECTION

Samples were obtained by Matakanui from:

- Diamond drillcore from TZ3 and TZ4/RSSZ.
- Grab samples from historic legacy mine waste rock (mined < 100 years ago).
- Weathered TZ4 materials from the local road cutting near the CIT battery.

Sample details are provided in

Table 1 with sample locations provided in Figure 1 to Figure 3. Where no material remained after earlier testing, additional drillcore was obtained from the original location, yet was provided with a new sample ID. These samples are identified by Original Sample ID and Sample ID in

Table 1.

Table 1: Sample details.

SAMPLE ID	ORIGINAL SAMPLE ID	PROSPECT	ZONE/ LOCATION	HOLE ID	FROM	TO
Drillcore Sample – SPLP Test (Verum Group Laboratory)						
MG55789	-	CIT	TZ3	MDD347	55	56
MG55790	MG46045	RAS	TZ4/RSSZ	MDD206	301	302
MG55795	MG40061	RAS	TZ4/RSSZ	MDD236	252.1	253
MG55796	MG37922	RAS	TZ4/RSSZ	MDD210	173	174
MG54045	-	RAS	TZ3	MDD372	149	150

SAMPLE ID	ORIGINAL SAMPLE ID	PROSPECT	ZONE/ LOCATION	HOLE ID	FROM	TO
MG54046	-	RAS	TZ3	MDD375	145	146
MG54047	-	RAS	TZ3	MDD239	166	167
Grab Sample – Shake Flask Test (SGS Laboratory)						
Rock CIT TZ4	-	CIT TZ4	Weathered road cutting		-	-
Waste Rock RAS Mullock	-	RAS	Historic mullock pile		-	-
Waste Rock CIT RSSZ	-	CIT RSSZ	Historic mullock pile		-	-

Source: Matakanui

- hyphen indicates no additional sample ID

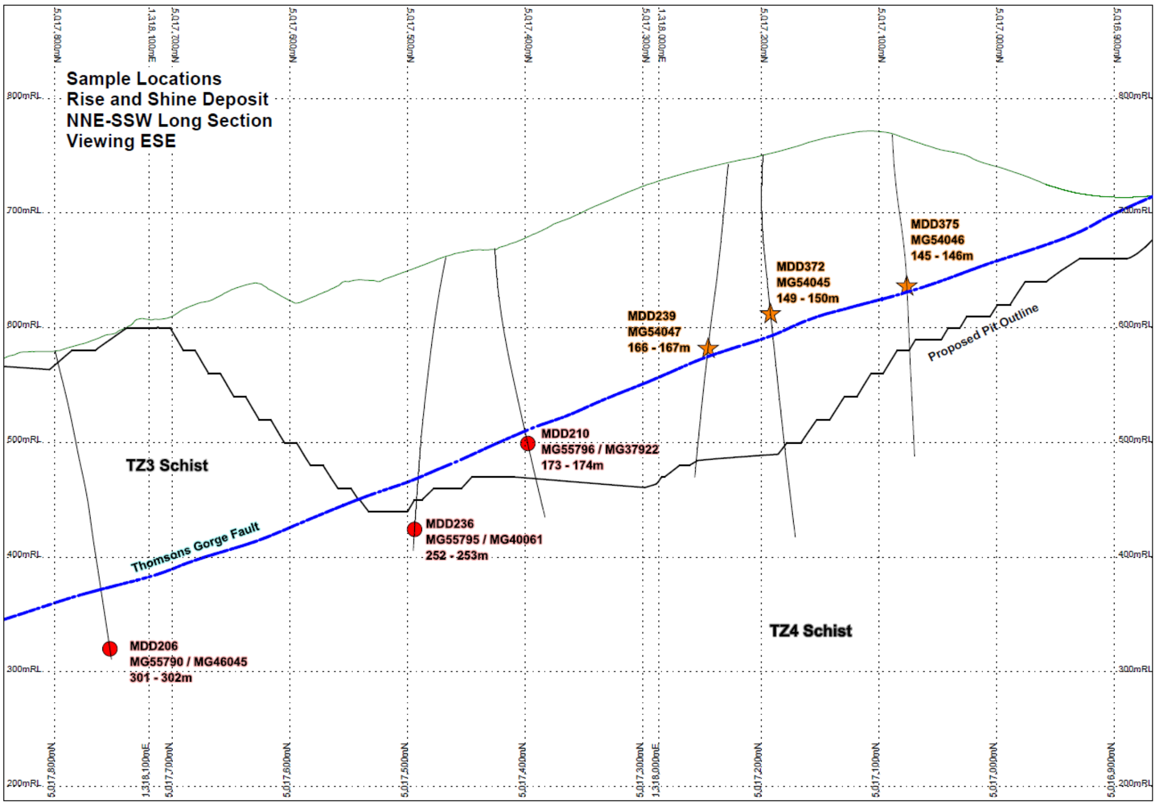

Figure 1: Drillcore sample locations.

Image source: Matakanui.

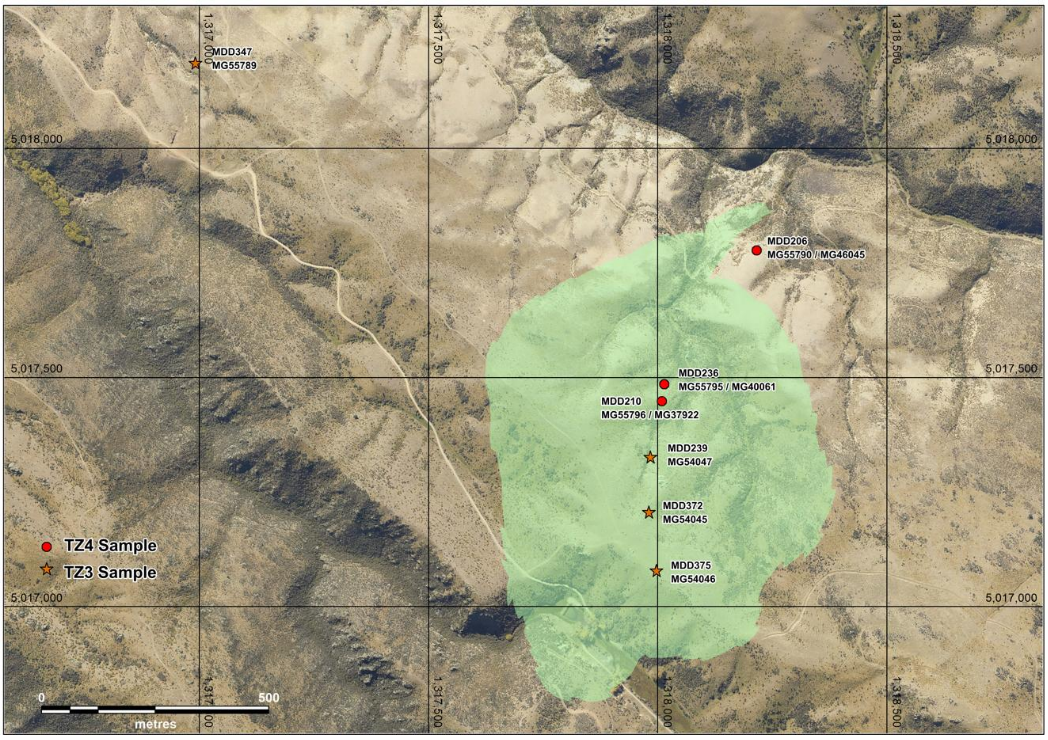

Figure 2. Location of drillhole collars for drill core samples.

Image source: Matakanui. RAS proposed pit outline in green.

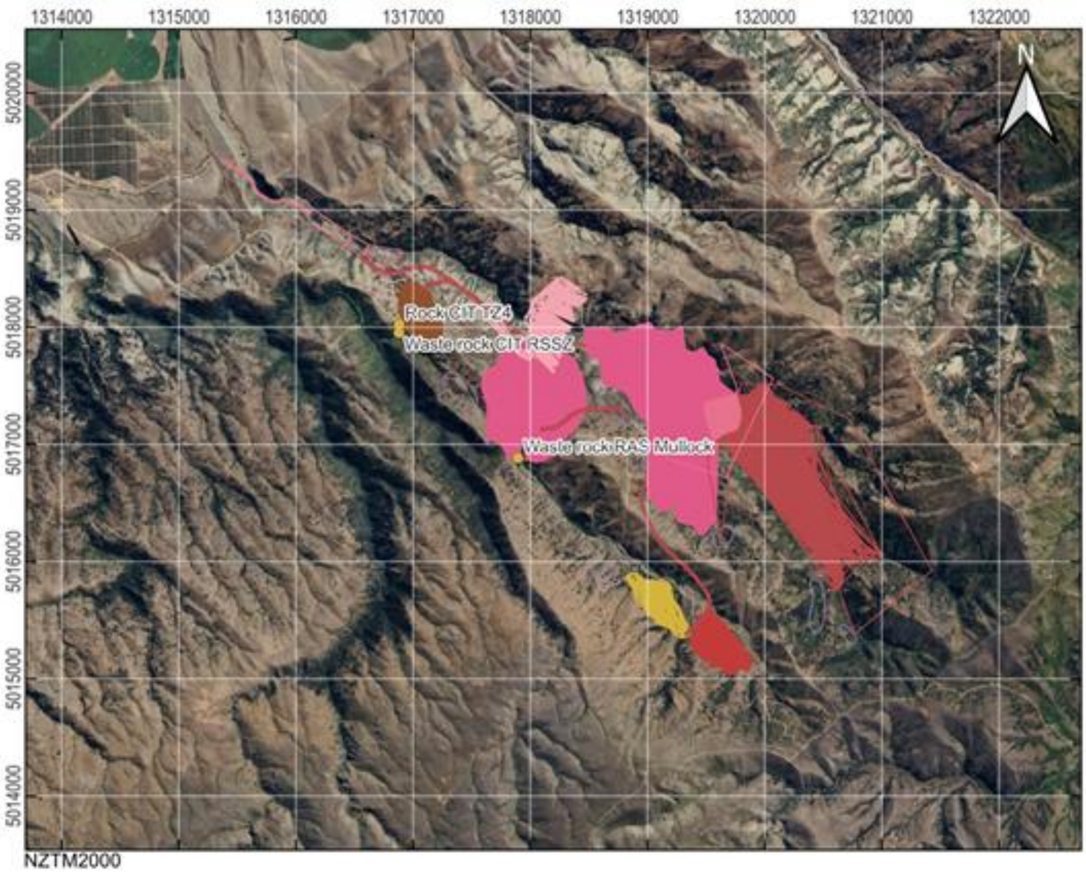

Figure 3. Grab sample locations.

RESULTS: ACID BASE ACCOUNTING

Acid base accounting (ABA) data are presented in Table 2. Tabulated data are provided in Attachment B and laboratory certificates are provided in Attachment C. All samples are classified as non-acid forming (NAF) using:

- AMIRA (2002) where NAG pH > 4.5 and the calculated net acid producing potential (NAPP) < 0 kg H_2SO_4/t based on NAPP = MPA[2] – ANC[3].
- Price (2009) where the neutralisation potential ratio (NPR) > 2.

Circum-neutral pH drainage is expected from the materials that have been tested, which is in alignment with other studies including:

- ABA data for > 377 samples from the BOGP (MWM, 2025c).
- Column leach testing identified all samples as NAF (MWM, 2025b).

Table 2: ABA data.

SAMPLE ID	ZONE	PASTE pH	S (wt%)	MPA kg/H_2SO_4/t	ANC kg/H_2SO_4/t	NAPP kg/H_2SO_4/t	NAG pH	NPR
Grab Samples – Shake Flask Test (SGS laboratory)								
Rock CIT TZ4	Weathered road cutting	7.6	0.0025	0.075	6	-6	6	78.4
Waste Rock RAS Mullock	Historic mullock pile	9.5	0.093	2.9	52	-49	7.1	18.3
Waste Rock CIT RSSZ	Historic mullock pile	8.9	0.006	0.18	36	-36	7.2	196.1
Drill Core – SPLP Test (Verum Laboratory)								
MG55789	TZ3	8.95	0.057	1.74	48.89	-47.15	9.22	28.0
MG55790 (MG46045)	TZ4/RSSZ	8.95	0.32	9.79	79.45	-69.66	9.84	8.1
MG55795 (MG40061)	TZ4/RSSZ	9.20	0.24	7.34	61.09	-53.75	9.97	8.3
MG55796 (MG37922)	TZ4/RSSZ	9.00	0.17	5.20	70.88	-65.68	10.31	13.6
MG54045	TZ3	9.45	0.052	1.59	67.32	-65.73	9.66	42.3
MG54046	TZ3	9.15	0.033	1.01	91.8	-90.79	10.69	90.9
MG54047	TZ3	9.29	0.032	0.98	88.11	-87.13	9.82	90.0

Red data are half the limit of reporting (LOR).

[2] *Maximum potential acidity*
[3] *Acid neutralisation capacity*

SYNTHETIC PRECIPITATION LEACHING PROCEDURE

The SPLP developed by the USEPA[4] uses 50 g of sample and 1 L of deionised water with bottle rolling for 16 hours to evaluate the mobilisation of PCOC from the solid residue phase to provide an indication of the water quality of materials once wetted.

Methodology

Samples were analysed by Verum Group Limited (including sample preparation, ABA testing, and SPLP testing) with Hill Laboratories undertaking the water quality analysis. Testing used crushed waste rock instead of rock pulps, making the method suitable for assessing engineered landform (ELF) runoff influenced only by natural precipitation. Deionised water was used at a 1:20 solid-to-liquid ratio, with a 16-hour contact time (Verum Group).

Previous shake-flask testing was undertaken by SGS Laboratory in Westport for several samples. This process is comparable to the SPLP test, yet a 1:10 solid-to-liquid ratio was used with an 18-hour contact time. Leachates were examined for major, trace, and ultra-trace elements using ICP-MS and ICP-AES.

Although the solid:liquid ratios are different for the two tests, the data remain comparable as solid:liquid ratio is normalised by converting mg/L to mg/kg.

Results

SPLP results for PCOC are presented in Table 3 (TZ3 and TZ4/RSSZ) and Table 4 (grab samples). All data recorded at the LOR[5] are presented as half the LOR.

A metal ecotoxicity quotient (MEQ) is used in this report to identify potential constituents of concern (PCOC) that may be elevated with respect to water quality guidelines, compliance limits, or trigger values that mange ecotoxicity risks (Weber and Olds, 2016). For this report, the proposed BOGP surface water quality compliance limits (Ryder, 2025) are used as a MEQ screening tool to determine whether baseline water quality data were elevated. The approach does not use toxicity modification factors to calculate MEQ and uses conservative data when available (e.g., chronic limits rather than acute limits).

Where no limit was provided by Ryder (2025), other guideline values, together with Ryder (2025), were applied to have a water quality limit (WQ Limit) for assessment purposes (see Attachment A for these limits and further details on MEQ).

Results are not presented for the following analytes as all data are below LOR:

- TZ3 and TZ4/RSSZ: Ag, Co, Cs, La, Ni, Pb, Se, Sn, Tl.
- Grab Samples: Ag, Cd, Cr, Hg, Mo, Pb, Se, Sn, Tl, V, Zn, Cyanide.

Full results are tabulated in Attachment B with laboratory reports provided in Attachment C. PCOC highlighted by MEQ that are greater than 1 in Table 3 and Table 4 include:

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[4] *https://www.epa.gov/sites/default/files/2015-12/documents/1312.pdf*
[5] *Limit of Reporting.*

TZ3

Data suggests that Al and V could be elevated based on MEQ. Data are reasonable for Al to be considered elevated, although elevated Al at circum-neutral pH may be an artifact of the testing process (e.g., colloidal Al). Only one sample is above the ANZG (2018) limit of 0.006 mg/L for V and this is for an unknown level of species protection. Column leach test (CLT) data (MWM, 2025b) suggests that V can be elevated in TZ3 materials, although results are only slightly above the ANZG (2018) limits. Based on these results:

- Compliance monitoring is recommended for Al.
- Performance monitoring is recommended for V at the ELF, TSF, and underground mine discharge points as this is likely to be the domains that will be potentially elevated.

TZ4/RSSZ

Data suggests that Al, As, and Cd could be elevated based on MEQ. Data are reasonable for Al and As to be considered elevated, although elevated Al at circumneutral pH may be an artifact of the testing process (e.g., colloidal Al). Only one sample is above the ANZG (2018) limit of 0.0004 mg/L for Cd (without hardness modification). CLT data (MWM, 2025b) suggest it is not elevated. Based on these results:

- Compliance monitoring is recommended for Al and As.
- Performance monitoring is recommended for Cd at the ELF, TSF, and underground mine discharge points as this is likely to be the domains that will be potentially elevated.

CIT TZ4 (weathered TZ4 road cutting)

Data suggests that Al, As, Co, and Cu could be elevated based on MEQ. Data are reasonable for Al, and As to be considered elevated, although elevated Al at circum-neutral pH may be an artifact of the testing process (e.g., colloidal Al). Based on these results:

- Compliance monitoring is recommended for Al, As, Co, and Cu.

RAS Mullock

Data suggests that Al and As could be elevated based on MEQ. Data are reasonable for Al and As to be considered elevated, although elevated Al at circum-neutral pH may be an artifact of the testing process (e.g., colloidal Al). Based on these results:

- Compliance monitoring is recommended for Al and As.

CIT RSSZ

Data suggests that As could be elevated based on MEQ, data are reasonable for As to be considered elevated. Based on these results:

- Compliance monitoring is recommended for As.

Table 3: SPLP for drillcore from TZ3 and TZ4/RSSZ.

ANALYTE	TRIGGER VALUE*	MG54045	MG54046	MG54047	MG55789	MG55790	MG55795	MG55796	MEQ MAXIMUM	MEQ MAXIMUM
Zone		TZ3	TZ3	TZ3	TZ3	TZ4/RSSZ	TZ4/RSSZ	TZ4/RSSZ	TZ3	TZ4/RSSZ
SO_4	500	0.70	1.10	1.00	0.70	0.60	0.25	0.25	0.002	0.001
Al	0.08	0.96	0.64	0.77	0.39	1.17	0.77	1.10	12.0	14.6
Sb	0.074	0.002	0.0086	0.0022	0.0008	0.0014	0.0023	0.0019	0.12	0.03
As	0.042	0.011	0.004	0.005	0.003	0.12	0.17	0.082	0.27	4.0
Ba	-	0.0025	0.027	0.013	0.006	0.0025	0.0025	0.0025	-	-
B	0.94	0.020	0.024	0.021	0.009	0.009	0.012	0.011	0.03	0.01
Cd	0.0004	0.000025	0.000025	0.00024	0.00009	0.00048	0.000025	0.000025	0.60	1.20
Ca	-	6.20	6.90	6.30	4.00	7.00	7.50	8.30	-	-
Cr	0.0033	0.0005	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.15	0.08
Cu	0.0018	0.00025	0.00025	0.00025	0.00025	0.00050	0.00025	0.00025	0.14	0.28
Fe	0.3^	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.03
Li	-	0.0008	0.0019	0.0013	0.0025	0.0022	0.0021	0.0027	-	-
Mg	-	0.79	0.92	0.92	4.50	2.40	1.94	2.10	-	-
Mn	-	0.00025	0.00025	0.00025	0.00510	0.01010	0.00390	0.0053	-	-
Mo	0.034	0.0014	0.00	0.00	0.00	0.00	0.00	0.0002	0.07	0.02
K	-	5.40	4.40	4.90	2.70	4.00	3.70	3.50	-	-
Rb	-	0.00157	0.0014	0.0016	0.0016	0.0014	0.0015	0.0013	-	-
Na	-	2.50	3.00	3.00	1.05	0.72	0.88	0.90	-	-
Sr	2.5	0.70	0.88	1.24	0.08	0.37	0.28	0.40	0.50	0.16
U	0.03^	0.00036	0.00095	0.00011	0.0023	0.00054	0.00055	0.00041	0.08	0.02
V	0.006	0.0047	0.006	0.0065	0.0005	0.0005	0.0012	0.0005	1.08	0.20
Zn	0.015	0.0005	0.0005	0.0015	0.0005	0.0005	0.0005	0.0005	0.10	0.03

All data in mg/L. Data in red indicates MEQ ≥ 1, data in orange indicates MEQ between 0.5 and 1.

** Trigger values discussed in Attachment A.*

^ Groundwater WQ limit.

Table 4: SPLP test results for grab samples.

ANALYTE	TRIGGER VALUE*	CIT TZ4	MEQ	RAS MULLOCK	MEQ	CIT RSSZ	MEQ
pH	6.5 – 9.0	6.9	-	9.2	-	8.7	-
EC (µS/cm)	-	59	-	73	-	99	-
Total Alkalinity as $CaCO_3$	-	30	-	40	-	50	-
Acidity (mg/L)	-	<5		<5	-	<5	-
Al	0.08	0.153	1.9	0.211	2.6	0.029	0.36
Sb	0.074	0.0005	0.01	0.0005	0.01	0.001	0.01
As	0.042	0.082	2.0	0.22	5.2	2.61	62.1
Ba	-	0.006	-	0.001	-	0.001	-
B	0.94	0.04	0.04	0.015	0.02	0.015	0.02
Ca	-	5.9	-	8.2	-	14.2	-
Co	0.001	0.001	1.0	0.00025	0.25	0.00025	0.25
Cu	0.0018	0.003	1.7	0.0008	0.44	0.0011	0.61
Fe	0.3^	0.19	0.63	0.08	0.27	0.005	0.02
Mg	-	0.84	-	2.96	-	0.55	-
Mn	-	0.18	-	0.003	-	0.0005	-
Ni	0.011	0.001	0.09	0.00025	0.02	0.00025	0.02
K	-	5.3	-	2.7	-	6.0	-
Na	-	0.8	-	0.6	-	0.6	-
Sr	2.5	0.025	0.01	0.096	0.04	0.030	0.01
Ti	-	0.0020	-	0.00025	-	0.00025	-
U	0.03^	0.0001	0.003	0.001	0.03	0.0005	0.02
Total N	-	3.95		0.47		1.43	
Ammonia N	0.4	0.30	0.75	0.005	0.01	0.07	0.18
Total P	-	23.8	-	0.32	-	0.45	-
F	-	0.16	-	0.03	-	0.06	-
Cl	-	0.17	-	0.09	-	0.10	-
NO_3-N	3.5	1.19	0.34	0.08	0.02	1.04	0.30
NO_2-N	-	0.08	-	0.005	-	0.005	-
SO_4	500	0.89	0.002	1.88	0.004	0.83	0.002
Dissolved Oxygen	-	8.2	-	9.3	-	9.2	-

All data in mg/L unless otherwise indicated. Data in red indicates MEQ ≥ 1, data in orange indicates MEQ between 0.5 and 1.

** Trigger values discussed in Attachment A.*

^ Groundwater WQ limit.

Stored Water Soluble PCOC Load

SPLP data can be converted into a load (i.e., mg/kg) based on the solid:liquid ratio and the subsequent analytical data, which can then be used to understand the stored water soluble PCOC load. These data are presented in Table 5 with average TZ3 and TZ4/RSSZ data. Analytes where all data is below LOR is not presented.

Table 5: Stored water soluble PCOC load (mg/kg).

ANALYTE	CIT TZ4	RAS MULLOCK	CIT RSSZ	AVERAGE TZ3[1]	AVERAGE TZ4/RSSZ[2]
Sample Type	Grab	Grab	Grab	Drillcore	Drillcore
Al	1.53	2.11	0.29	13.80	20.27
Sb	0.005	0.005	0.01	0.068	0.037
As	0.82	2.17	26.1	0.12	2.47
Ba	0.06	0.01	0.01	0.24	0.05
B	0.40	0.15	0.15	0.37	0.21
Cd	0.001	0.001	0.001	0.0019	0.0035
Ca				117	152
Cr	0.005	0.005	0.005	0.006	0.005
Co	0.01	0.0025	0.0025	0.002	0.002
Cu	0.03	0.008	0.011	0.005	0.007
Fe	1.9	0.8	0.1	0.20	0.20
Pb	0.005	0.0025	0.0025	0.001	0.001
Li				0.033	0.047
Mg	8.4	29.6	5.5	35.7	42.9
Mn	1.83	0.03	0.005	0.03	0.13
Mo	0.005	0.0025	0.0025	0.032	0.009
Ni	0.01	0.0025	0.0025	0.005	0.005
K	53	27	60	87	75
Rb				0.031	0.028
Na	8	6	6	48	17
Sr	0.25	0.96	0.3	14.5	7.0
U	0.001	0.01	0.005	0.019	0.010
V	0.0025	0.005	0.0025	0.089	0.015
Zn	0.01	0.01	0.01	0.015	0.010
SO_4	8.9	18.8	8.3	17.5	7.33
Total N	39.5	4.7	14.3	-	-
Ammonia N	3	0.05	0.7	-	-
Total P	0.035	0.035	0.035	-	-
F	238	3.16	4.53	-	-
Cl	1.6	0.3	0.6	-	-
NO_3-N	1.7	0.9	1	-	-
NO_2-N	11.9	0.8	10.4	-	-
S (wt%)	0.0025	0.093	0.006	0.044[1]	0.24[2]
Total S (mg/kg)	25	930	60	440	2,400
% of S mobilised by deionised water	35.6	2.0	13.8	4.0	0.3

[1]Average of MG54045, MG54046, MG54047, MG55789.

[2]Average of MG55790, MG55794, MG55796.

Data in blue is <LOR.

Analysis: TZ3 and TZ4/RSSZ

This section reviews the stored water soluble PCOC load (mg/kg) derived from the deionised water extraction testing (SPLP) for TZ3 and TZ4 materials. The following key observations from average TZ3 and TZ4/RSSZ data are provided:

- TZ3 materials have higher sulfate concentration compared to TZ4 (Figure 4), which suggests more sulfate can be mobilised from the TZ3 waste rock that is independent of oxidation processes. Given the proportions of TZ3 that will be disturbed at the BOGP, this load represents a large initial source of sulfate.
- TZ4/RSSZ material is elevated in arsenic compared to TZ3 (Figure 5).
- Notable variation includes the following elements that are elevated in the TZ3 compared to the TZ4/RSSZ materials: Ba (4.8x), Mo (3.7x), Na (2.9x), Sr (2.1x), and V (5.9x)
- TZ4/RSSZ material is elevated in Mn (4.4x) compared to the TZ3 materials.

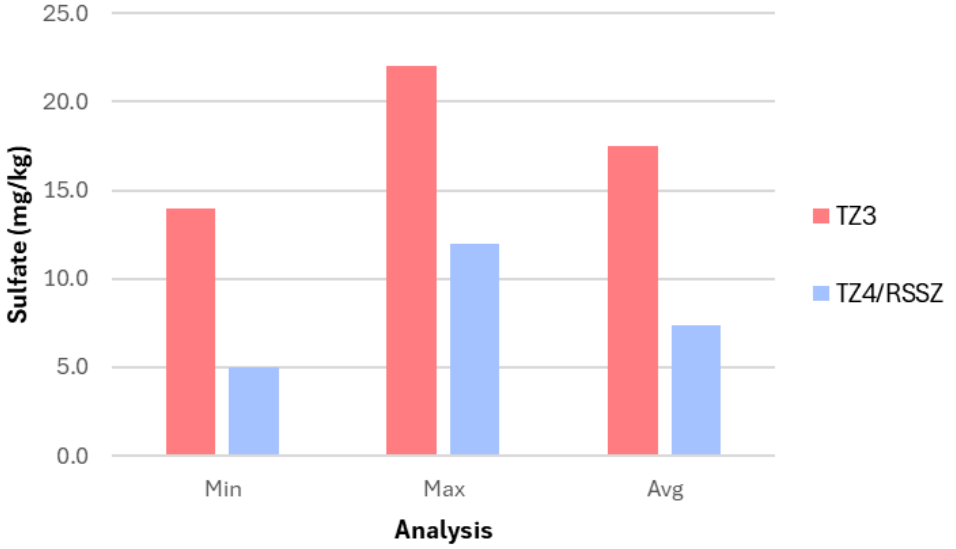

Figure 4: Sulfate (mg/kg) in TZ3 and TZ4/RSSZ samples.

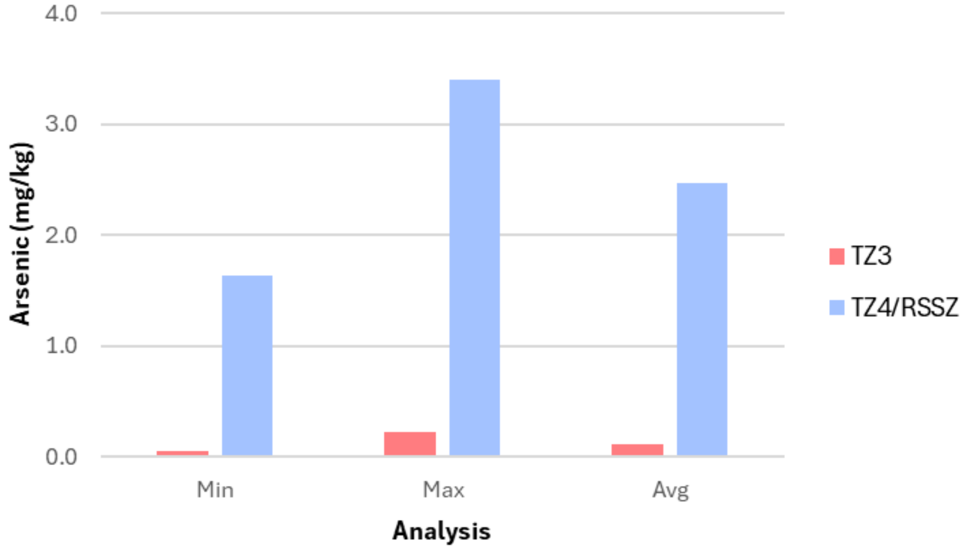

Figure 5: Arsenic (mg/kg) in TZ3 and TZ4/RSSZ samples.

SEM EDS

Several samples were analysed by Microanalysis Laboratory in Perth by scanning electron microscope (SEM) to confirm the sulfur species present as either sulfide or sulfate. A total of 7 samples were selected for the analysis:

- TZ3 – 4 samples
- TZ4/RSSZ – 3 samples

Methodology

Each sample was mounted in epoxy resin and polished to a flat surface before being carbon coated to ensure optimal imaging conditions. The analysis was performed using a Carl Zeiss EVO50 SEM, equipped with an Oxford INCA X-Max EDS. Backscatter electron (BSE) imaging was used to capture high-resolution images of the samples and provide quantitative elemental analysis.

Results

The mineralogical composition for each of the 7 samples is summarised in Table 6.The full report is provided in Attachment D.

Table 6: SEM EDS mineralogical summary of observed sulfur-based particles.

ZONE	SAMPLE	ASSUMED COMPOUND	ASSUMED PHASE
TZ4/RSSZ	MG55790	Arsenic-iron sulfide	Arsenopyrite
		Zinc sulfide	Sphalerite
		Iron sulfide	Pyrite
	MG55795	Arsenic-iron sulfide	Arsenopyrite
		Zinc sulfide	Sphalerite
		Iron sulfide	Pyrite/pyrrhotite
		Iron-copper sulfide	Chalcopyrite
	MG55796	Arsenic-iron sulfide	Arsenopyrite
		Zinc sulfide	Sphalerite
		Iron sulfide	Pyrite/pyrrhotite
TZ3	MG54045	Arsenic-cobalt sulfide	Cobaltite
		Lead sulfide	Galena
		Copper sulfide	Chalcocite
	MG55789	Iron sulfide	Pyrite/pyrrhotite
		Zinc sulfide	Sphalerite
		Lead sulfide	Galena
		Arsenic-cobalt sulfide	Cobaltite
	MG54046	Iron sulfide	Pyrite/pyrrhotite
		Arsenic-iron sulfide	Arsenopyrite
		Copper-iron sulfide	Chalcopyrite
		Arsenic-cobalt sulfide	Cobaltite
		Lead sulfate	Anglesite
	MG54047	Copper-iron sulfide	Chalcopyrite
		Lead sulfate	Anglesite

The SEM EDS assessment was inconclusive regarding identification of sulfate minerals, except for minor anglesite. Additional mineralogical studies could be undertaken to understand why the TZ3 materials generate higher concentrations of sulfate compared to the TZ4/RSSZ samples in the deionised water extractions. However, these SPLP results and CLT studies (MWM, 2025b) suggest that this occurs and that is sufficient for understanding effects.

Data shown in Table 6 indicates that the oxidation of these sulfide minerals could lead to the release of PCOC that include: SO_4, As, Fe, and trace metals that include Co, Cu, Pb, and Zn. These contaminants have been identified as potentially being elevated in BOGP baseline water quality studies (MWM, 2024a) or in the geoenvironmental hazards assessment study (MWM, 2024c).

SUMMARY

ABA data confirmed all samples are classified as non-acid forming (NAF). SPLP testing and subsequent metal ecotoxicity quotient (MEQ) analysis against proposed water quality compliance limits (Ryder, 2025) for the BOGP (and ANZG (2018) where limits were not defined by Ryder (2025)) identified that:

- The following metals are elevated, and it is recommended that compliance monitoring should be undertaken for Al, As, Co, Cu.
- The following metals are slightly elevated, and performance monitoring should be undertaken for Cd and V at the ELF, TSF, and underground mine discharge points as this is likely to be the domains that will be potentially elevated.

SEM – EDS indicated a range of sulfide minerals and anglesite, a lead sulfate mineral. Oxidation of sulfide minerals identified by SEM could lead to the release of PCOC that include SO_4, As, Fe, and trace metals that include Co, Cu, Pb, and Zn. However, Pb is not identified a being elevated in the SPLP test.

CLOSING REMARKS

Please do not hesitate to contact Paul Weber at +64 3 242 0221 or paul.weber@minewaste.com.au should you wish to discuss this memorandum in greater detail.

Attachments:	Attachment A	–	Proposed Water Quality Limits
	Attachment B	–	Tabulated Results
	Attachment C	–	Laboratory Reports
	Attachment D	–	SEM EDS Laboratory Reports

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ATTACHMENT A – PROPOSED WATER QUALITY LIMITS

Proposed Water Quality

Proposed water quality compliance limits (WQ Limit) for MEQ analysis are provided in Table 7 as modified from Ryder (2025). The most conservative (chronic) values have been used where relative for MEQ analysis. Where no limit was provided, other guideline values were applied (see MEQ Section below).

Table 7. PCOC and WQ Limits for MEQ Analysis.

PARAMETER	SURFACE WATER*	GROUND WATER
Units are mg/L unless stated otherwise	*Recommended compliance limit(s)*	*Recommended compliance limit(s)*
pH (unitless)	6.5 – 9.0	–
NH_3-N (Annual 95th%ile)	<0.4	0.24 [1]
NO_3-N (Annual 95th%ile)	<3.5	11.3 (MAV)
BOD_5	≤2	–
Cyanide (CN^-)	0.011 [2]	0.6 (MAV)
Sulfate	500 [3]	≤250
Sulfide	≤0.0015	–
Ag (diss)	0.00005 [4]	0.00005 [4]
Al (diss)	0.08 [5]	1 (MAV)
As(V) (diss)	≤0.042	0.01 (MAV)
B (diss)	0.94 [4]	0.94 [4]
Cd (diss)	≤0.0004 [6]	0.004 (MAV)
Co (diss)	0.001 (chronic)	<1 (LDW)
Cr (diss)	≤0.0033 (Cr(III)) [6]	≤0.05 (MAV, Total)
Cu (diss)	0.0018 [7]	≤0.5
Fe (total)	–	≤0.3*
Pb (diss)	0.0034 [4]	0.01 (MAV)
Mn (diss)	-	0.4 (MAV)
Mo (diss)	0.034	<0.01 (LDW)
Ni (diss)	0.011 [4]	0.011 [4]
Sb (total)	0.074 (chronic)	0.02 (MAV)
Se (diss)	0.011 [4]	<0.02 (LDW)
Sr (diss)	2.5 [8]	4
U (diss)	–	0.03*
V (diss)	0.006 [4]	0.006 [4]
Zn (diss)	0.015 [9]	≤1.5

Source: Ryder (2025) and other guidelines as shown in blue.

** Surface water quality limits applied to MEQ with the exception of Fe and U where groundwater limits applied.*

1. – NPS for Freshwater Management (MfE, 2020)

2. – ANZG (2018) guidelines – modification for pH and temperature

3. – Modification for hardness and chloride concentrations

4. – ANZG (2018) guidelines for 95% protection of freshwater species.

5. – ANZG (2018) guidelines for 90% protection of freshwater species. This was done to simplify calculations

6. – Modification for hardness

7. – ANZG (2018) guidelines for 90% protection of freshwater species. Modification for dissolved organic carbon (DOC)

8. – Canadian Federal Environmental Quality Guidelines (2020)

9. - ANZG (2018) guidelines for 90% protection of freshwater species. Modification for hardness.

MAV = Maximum Acceptable Value

LDW = Livestock drinking water (ANZG, 2023).

MEQ

A metal ecotoxicity quotient (MEQ) is used in this report to identify potential constituents of concern (PCOC) that may be elevated with respect to water quality guidelines, compliance limits, or trigger values that mange ecotoxicity risks (Weber and Olds, 2016). For this report, the proposed BOGP water quality compliance limits (Ryder, 2025) are used as a MEQ screening tool to determine whether baseline water quality data were elevated. The approach does not use toxicity modification factors to calculate MEQ and uses conservative data when available (e.g., chronic limits rather than acute limits).

For this report, water quality data were assessed against the proposed BOGP water quality compliance limits for surface water quality (Ryder, 2025), with the exception of Fe and U where groundwater quality limits are used . Where no limit was provided, other guideline values were applied to have a water quality limit (WQ Limit) for assessment purposes:

- The 95% ANZG (2018) default guideline values (DGVs).
- The 90% ANZG (2018) DGVs for Al, Cu and Zn.
- Guidelines from the NPS[6] for Freshwater Management (MfE, 2020) for ammoniacal-N in groundwater: 0.24 mg/L.
- A limit of 2.5 mg/L was applied to Sr (strontium). This guideline is based on the Canadian Federal Environmental Quality Guidelines (2020).
- No hardness modifications[7] were applied as this was conducted as a screening assessment to determine exceedances.

The MEQ value for a PCOC is determined by dividing the measured maximum concentration by the WQ Limit. MEQ values greater than 1 indicate parameters that exceed the relevant WQ Limit. Conversely, MEQ values less than 1 are below the relevant WQ Limit. If any constituents are within 50% of the WQ Limit (i.e., MEQ ≥0.5) they are considered potentially elevated (and are noted as being potentially elevated in this report) and ongoing monitoring is recommended to confirm trends and/or potential hazards. This approach is similar to using 50% of maximum acceptable value (MAV) for New Zealand drinking water where it is used as a screening level for follow up action (Taumata Arowai, 2022).

MEQ data are colour coded for ease of analysis and data interpretation where:

- Red MEQ indicates that concentrations exceed the WQ Limits or similar guidelines.
- Orange MEQ indicate MEQ between ≤ 1.0 and ≥ 0.5 (i.e., potentially elevated).
- Blue MEQ indicates all data are influenced by the limit of reporting (LOR) being higher than the WQ Limits and may not be elevated.

NPS = National Policy Statement

[7] *Hardness correction algorithms used to convert chronic toxicity data for Cd, Cr, Pb, Ni, and Zn at a given test water hardness to a hardness of 30 mg $CaCO_3$/L (ANZG, 2018).*

ATTACHMENT B – TABULATED RESULTS

TZ3 and TZ4/RSSZ SPLP data

Sample	**MG54045**	**MG54046**	**MG54047**	**MG55789**	**MG55790**	**MG55795**	**MG55796**
Zone	**TZ3**	**TZ3**	**TZ3**	**TZ3**	**TZ4/RSSZ**	**TZ4/RSSZ**	**TZ4/RSSZ**
Lab Number	3765226.1	3765226.2	3765226.3	3718838.1	3718838.2	3718838.3	3718838.4
Sulphate	0.7	1.1	1	0.7	0.6	< 0.5	< 0.5
Dissolved Aluminium	0.96	0.64	0.77	0.39	1.17	0.77	1.1
Dissolved Antimony	0.002	0.0086	0.0022	0.0008	0.0014	0.0023	0.0019
Dissolved Arsenic	0.0112	0.0044	0.0045	0.0029	0.119	0.17	0.082
Dissolved Barium	< 0.005	0.027	0.013	0.006	< 0.005	< 0.005	< 0.005
Dissolved Boron	0.02	0.024	0.021	0.009	0.009	0.012	0.011
Dissolved Cadmium	< 0.00005	< 0.00005	0.00024	0.00009	0.00048	< 0.00005	< 0.00005
Dissolved Caesium	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Calcium	6.2	6.9	6.3	4	7	7.5	8.3
Dissolved Chromium	0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Cobalt	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Dissolved Copper	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0005	< 0.0005	< 0.0005
Dissolved Iron	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Dissolved Lanthanum	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Lead	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Lithium	0.0008	0.0019	0.0013	0.0025	0.0022	0.0021	0.0027
Dissolved Magnesium	0.79	0.92	0.92	4.5	2.4	1.94	2.1
Dissolved Manganese	< 0.0005	< 0.0005	< 0.0005	0.0051	0.0101	0.0039	0.0053
Dissolved Molybdenum	0.0014	0.0025	0.0022	0.0003	0.0007	0.0004	0.0002
Dissolved Nickel	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Potassium	5.4	4.4	4.9	2.7	4	3.7	3.5
Dissolved Rubidium	0.00157	0.00141	0.00157	0.0016	0.00141	0.00146	0.0013
Dissolved Selenium	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Dissolved Silver	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Sodium	2.5	3	3	1.05	0.72	0.88	0.9
Dissolved Strontium	0.7	0.88	1.24	0.079	0.37	0.28	0.4
Dissolved Thallium	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Tin	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Uranium	0.00036	0.00095	0.00011	0.0023	0.00054	0.00055	0.00041
Dissolved Vanadium	0.0047	0.006	0.0065	< 0.0010	< 0.0010	0.0012	< 0.0010
Dissolved Zinc	< 0.0010	< 0.0010	0.0015	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Grab Sample SPLP data

Sample	CIT T24 Road	RAS Mullock	CIT RSSZ.003
Location	**Weathered TZ4 roadcut**	**Historic Mullock**	**Historic Mullock**
Lab number	WP24-13842	WP24-13842	WP24-13842
pH	6.9	9.2	8.7
Conductivity @ 25 °C	59	73	99
Acidity pH 4.0	<5	<5	<5
Acidity pH 5.0	<5	<5	<5
Acidity pH 7.0	<5	<5	<5
Total Alkalinity as $CaCO_3$ (mg/L)	30 mg/l	40 mg/l	50 mg/l
Aluminium, Al g/m3	0.153	0.211	0.029
Antimony, Sb g/m3	<0.001	<0.001	0.001
Arsenic, As g/m3	0.082	0.217	2.61
Barium, Ba g/m3	0.006	<0.002	<0.002
Boron, B g/m3	0.04	<0.03	<0.03
Cadmium, Cd g/m3	<0.0002	<0.0002	<0.0002
Calcium, Ca g/m3	5.9	8.2	14.2
Chromium, Cr g/m3	<0.001	<0.001	<0.001
Cobalt, Co g/m3	0.001	<0.0005	<0.0005
Copper, Cu g/m3	0.003	0.0008	0.0011
Iron, Fe g/m3	0.19	0.08	<0.01
Lead, Pb g/m3	<0.001	<0.0005	<0.0005
Magnesium, Mg g/m3	0.84	2.96	0.55
Manganese, Mn g/m3	0.183	0.003	<0.001
Mercury, Hg g/m3	<0.0005	<0.0005	<0.0005
Molybdenum, Mo g/m3	<0.001	<0.0005	<0.0005
Nickel, Ni g/m3	0.001	<0.0005	<0.0005
Potassium, K g/m3	5.3	2.7	6
Selenium, Se g/m3	<0.005	<0.005	<0.005
Silver, Ag g/m3	<0.0005	<0.0005	<0.0005
Sodium, Na g/m3	0.8	0.6	0.6
Strontium, Sr g/m3	0.025	0.096	0.03
Thallium, Tl g/m3	<0.0005	<0.0005	<0.0005
Tin, Sn g/m3	<0.0005	<0.0005	<0.0005
Titanium, Ti g/m3	0.002	<0.0005	<0.0005
Uranium, U g/m3	<0.0002	0.001	<0.001
Vanadium, V g/m3	<0.0005	<0.001	<0.0005
Zinc, Zn g/m3	<0.002	<0.002	<0.002
Total N	3.95	0.47	1.43
Ammonia N g/m^3	0.3	<0.01	0.07
WAD CN	<0.007	<0.007	<0.007
Total phosphorus	23.8	0.316	0.453
Fluoride	0.16	0.03	0.06
Chloride	0.17	0.09	0.1
Nitrate Nitrogen, NO_3-N	1.19	0.08	1.04
Nitrite Nitrogen, NO_2-N	0.08	<0.01	<0.01
Sulphate, SO_4	0.89	1.88	0.83
Dissolved Oxygen	8.2	9.3	9.2

ATTACHMENT C – LABORATORY REPORTS

Verum Group

ABA analysis

Prepared for

Mine Waste Management

February 2025
25-76

Author	M.Young
Verum Group reference	25/76
Client name	Mine Waste Management
Client address	
Distribution (other than client)	Nil
Date of Issue	13/02/2025
Reviewed by	Mike Young National Laboratory Manager
Approved by	Mike Young National Laboratory Manager

Document tracking

Version	Date	Changes made	Reviewer(s)

1. Method Notes

Sample prep	Samples were received were dried and crushed in a jaw mill with a split then crushed in the ring mill and screened to confirm fineness.	
1 – Paste pH/EC	Fine ground sample 1:2 sample to water. Measured after sitting overnight (approx. 16hrs)	
2 – Total Sulphur	Leco combustion furnace	
3 – ANC Acid Neutralising Capacity	AMIRA Handbook 2002 (App C)	
4 – NAG Net Acid Generation	AMIRA Handbook 2002 (App D)	pH after H_2O_2 digestion was greater than 7 no titration was required.
5 – SPLP extraction	Jaw crushed sample (-6mm) 1:20 rolled with distilled water overnight (approx. 16hrs)	
6 – Trace elements	Extended trace element suit	Analysed by Hill Laboratories

A total of 3 samples were received. Samples were identified with as MG54045, MG54046 and MG54047

All tests listed above were completed for all four samples.

Quality assurance and sample duplicates were run as required by the methods.

Data included in this report is also supplied in Excel files.

2. Sample and Analysis data

Verum	MWM ID	Paste pH	EC	Sulphur	MPA	ANC	ANC	ANC	ANC	NAG pH
Sample				%w	kg H2SO4/t	Fizz rating	Digested pH	kg H2SO4/t	%CaCO3	after digest
25/76-01	MG54045	9.45	465	0.052	1.6	2	1.18	67.32	6.87	9.66
25/76-02	MG54046	9.15	478	0.033	1.0	2	1.21	91.80	9.37	10.69
25/76-03	MG54047	9.29	486	0.032	1.0	2	1.21	88.11	8.99	9.82

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Certificate of Analysis

SPv1

Client:	Verum Group Limited	**Lab No:**	3765226
Contact:	Mike Young	**Date Received:**	29-Jan-2025
	C/- Verum Group Limited	**Date Reported:**	04-Feb-2025
	PO Box 29415	**Quote No:**	134778
	Riccarton	**Order No:**	25/76-1/2/3
	Christchurch 8440	**Client Reference:**	
		Submitted By:	Mike Young

Sample Type: Aqueous

Sample Name:		25/76-1 28-Jan-2025	25/76-2 28-Jan-2025	25/76-3 28-Jan-2025
Lab Number:		3765226.1	3765226.2	3765226.3
Individual Tests				
Sulphate	g/m³	0.7	1.1	1.0
ICP-MS Extended Dissolved Metals, trace level				
Dissolved Aluminium	g/m³	0.96	0.64	0.77
Dissolved Antimony	g/m³	0.0020	0.0086	0.0022
Dissolved Arsenic	g/m³	0.0112	0.0044	0.0045
Dissolved Barium	g/m³	< 0.005	0.027	0.013
Dissolved Boron	g/m³	0.020	0.024	0.021
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	0.00024
Dissolved Caesium	g/m³	< 0.00010	< 0.00010	< 0.00010
Dissolved Calcium	g/m³	6.2	6.9	6.3
Dissolved Chromium	g/m³	0.0005	< 0.0005	< 0.0005
Dissolved Cobalt	g/m³	< 0.0002	< 0.0002	< 0.0002
Dissolved Copper	g/m³	< 0.0005	< 0.0005	< 0.0005
Dissolved Iron	g/m³	< 0.02	< 0.02	< 0.02
Dissolved Lanthanum	g/m³	< 0.00010	< 0.00010	< 0.00010
Dissolved Lead	g/m³	< 0.00010	< 0.00010	< 0.00010
Dissolved Lithium	g/m³	0.0008	0.0019	0.0013
Dissolved Magnesium	g/m³	0.79	0.92	0.92
Dissolved Manganese	g/m³	< 0.0005	< 0.0005	< 0.0005
Dissolved Molybdenum	g/m³	0.0014	0.0025	0.0022
Dissolved Nickel	g/m³	< 0.0005	< 0.0005	< 0.0005
Dissolved Potassium	g/m³	5.4	4.4	4.9
Dissolved Rubidium	g/m³	0.00157	0.00141	0.00157
Dissolved Selenium	g/m³	< 0.0010	< 0.0010	< 0.0010
Dissolved Silver	g/m³	< 0.00010	< 0.00010	< 0.00010
Dissolved Sodium	g/m³	2.5	3.0	3.0
Dissolved Strontium	g/m³	0.70	0.88	1.24
Dissolved Thallium	g/m³	< 0.00005	< 0.00005	< 0.00005
Dissolved Tin	g/m³	< 0.0005	< 0.0005	< 0.0005
Dissolved Uranium	g/m³	0.00036	0.00095	0.00011
Dissolved Vanadium	g/m³	0.0047	0.0060	0.0065
Dissolved Zinc	g/m³	< 0.0010	< 0.0010	0.0015

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

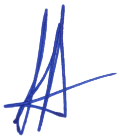
Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
ICP-MS Extended Dissolved Metals, trace level	0.45µm Filtration, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00002 - 0.05 g/m^3	1-3
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m^3	1-3

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 31-Jan-2025 and 04-Feb-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.



Ara Heron BSc (Tech)
Client Services Manager - Environmental

Verum Group

ABA analysis

Prepared for

Mine Waste Management

December 2024
24-1098

Author	M.Young
Verum Group reference	24-1098
Client name	Mine Waste Management
Client address	
Distribution (other than client)	Nil
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Reviewed by	Mike Young National Laboratory Manager
Approved by	Mike Young National Laboratory Manager

Document tracking

Version	Date	Changes made	Reviewer(s)
2	19/12/24	Addition of sulphate to Hill's Laboratory report	MCY

1. Method Notes

Sample prep	Samples were received were dried and crushed in a jaw mill with a split then crushed in the ring mill and screened to confirm fineness.	
1 – Paste pH/EC	Fine ground sample 1:2 sample to water. Measured after sitting overnight (approx. 16hrs)	
2 – Total Sulphur	Leco combustion furnace	
3 – ANC Acid Neutralising Capacity	AMIRA Handbook 2002 (App C)	
4 – NAG Net Acid Generation	AMIRA Handbook 2002 (App D)	pH after H_2O_2 digestion was greater than 7 no titration was required.
5 – SPLP extraction	Jaw crushed sample (-6mm) 1:20 rolled with distilled water overnight (approx. 16hrs)	
6 – Trace elements	Extended trace element suit	Analysed by Hill Laboratories

A total of 4 samples were received. Samples were identified with as MG55789, MG55790, MG55795 and MG55796

All tests listed above were completed for all four samples.

Quality assurance and sample duplicates were run as required by the methods.

Data included in this report is also supplied in Excel files.

2. Sample and Analysis data

Verum	MWM ID	Paste pH	EC	Sulphur	MPA	ANC	ANC	ANC	ANC	NAG pH
Sample				%w	kg H2SO4/t	Fizz rating	Digested pH	kg H2SO4/t	%CaCO3	after digest
24/1098-01	MG55789	8.95	412	0.057	1.7	2	1.45	48.89	4.99	9.22
24/1098-02	MG55790	8.95	562	0.32	9.8	2	1.50	79.45	8.11	9.84
24/1098-03	MG55795	9.20	498	0.24	7.3	2	1.43	61.09	6.23	9.97
24/1098-04	MG55796	9.00	440	0.17	5.2	2	1.46	70.88	7.23	10.31

Hill Labs
R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand
0508 HILL LAB (44 555 22)
+64 7 858 2000
mail@hill-labs.co.nz
www.hill-labs.co.nz

Certificate of Analysis

Client:	Verum Group Limited	**Lab No:**	3718838	SPv2
Contact:	Mike Young	**Date Received:**	19-Nov-2024	
	C/- Verum Group Limited	**Date Reported:**	19-Dec-2024	**(Amended)**
	PO Box 29415	**Quote No:**	134778	
	Riccarton	**Order No:**		
	Christchurch 8440	**Client Reference:**		
		Submitted By:	Mike Young	

Sample Type: Aqueous

Sample Name:		24/1098-1 13-Nov-2024	24/1098-2 13-Nov-2024	24/1098-3 13-Nov-2024	24/1098-4 13-Nov-2024
Lab Number:		3718838.1	3718838.2	3718838.3	3718838.4
Individual Tests					
Sulphate	g/m^3	0.7	0.6	< 0.5	< 0.5
ICP-MS Extended Dissolved Metals, trace level					
Dissolved Aluminium	g/m^3	0.39	1.17	0.77	1.10
Dissolved Antimony	g/m^3	0.0008	0.0014	0.0023	0.0019
Dissolved Arsenic	g/m^3	0.0029	0.119	0.170	0.082
Dissolved Barium	g/m^3	0.006	< 0.005	< 0.005	< 0.005
Dissolved Boron	g/m^3	0.009	0.009	0.012	0.011
Dissolved Cadmium	g/m^3	0.00009	0.00048	< 0.00005	< 0.00005
Dissolved Caesium	g/m^3	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Calcium	g/m^3	4.0	7.0	7.5	8.3
Dissolved Chromium	g/m^3	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Cobalt	g/m^3	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Dissolved Copper	g/m^3	< 0.0005	0.0005	< 0.0005	< 0.0005
Dissolved Iron	g/m^3	< 0.02	< 0.02	< 0.02	< 0.02
Dissolved Lanthanum	g/m^3	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Lead	g/m^3	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Lithium	g/m^3	0.0025	0.0022	0.0021	0.0027
Dissolved Magnesium	g/m^3	4.5	2.4	1.94	2.1
Dissolved Manganese	g/m^3	0.0051	0.0101	0.0039	0.0053
Dissolved Molybdenum	g/m^3	0.0003	0.0007	0.0004	0.0002
Dissolved Nickel	g/m^3	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Potassium	g/m^3	2.7	4.0	3.7	3.5
Dissolved Rubidium	g/m^3	0.00160	0.00141	0.00146	0.00130
Dissolved Selenium	g/m^3	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Dissolved Silver	g/m^3	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Sodium	g/m^3	1.05	0.72	0.88	0.90
Dissolved Strontium	g/m^3	0.079	0.37	0.28	0.40
Dissolved Thallium	g/m^3	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Tin	g/m^3	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Uranium	g/m^3	0.0023	0.00054	0.00055	0.00041
Dissolved Vanadium	g/m^3	< 0.0010	< 0.0010	0.0012	< 0.0010
Dissolved Zinc	g/m^3	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Analyst's Comments

Amended Report: This certificate of analysis replaces report '3718838-SPv1' issued on 26-Nov-2024 at 8:36 am.
Reason for amendment: Further testing added.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous

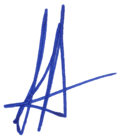
Test	Method Description	Default Detection Limit	Sample No
ICP-MS Extended Dissolved Metals, trace level	0.45µm Filtration, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.00002 - 0.05 g/m^3	1-4
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) : Online Edition.	0.5 g/m^3	1-4

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 25-Nov-2024 and 19-Dec-2024. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Ara Heron BSc (Tech)
Client Services Manager - Environmental

ANALYSIS REPORT
WP24-13842.001

Client:
Matakanui Gold Limited
PO Box 11

7842 Hokitika NEW ZEALAND
Attention: KIM .

Received: 4/06/2024
Completed: 15/10/2024
Job Number: WP24-13842
Report Number: 0000029708
Order Reference: J-NZ0233

Description:
Sample ID: Rock CIT T24

Analysis	Method	Result	Unit
Sulphur	SGS Global method	<0.005	%
Carbon 0.01-30%*	SGS Global method	0.38	%
pH (1:2) aged overnight/12 hours*	NEPM103 1:2 extraction	7.6	pH unit
Conductivity after PH1_2 (12 hours)*	NEPM103 1:2 extraction	360	µS/cm
Acid Neutralising Capacity (kg H2SO4/T)*	SGS inhouse method	6	KGH2SO4/T
Acid Neutralising Capacity (% CaCO3 equivalent)*	SGS inhouse method	0.6	%
Total Acid Potential (kg H2SO4/T)*	SGS inhouse method	<0.15	KGH2SO4/T
Nett Acid Producing Potential (kg H2SO4/T)*	SGS inhouse method	-6	KGH2SO4/T
NAG pH*	SGS Global method	6.0	pH unit
Net Acid Generation to pH 4.5 (kg H2SO4/T)*	SGS Global method	0	KGH2SO4/T
Nett Acid Generation (kg H2SO4/T)*	SGS Global method	11	KGH2SO4/T
pH in Water analysed within 6 hour holding time	APHA 4500 H SGS Westport	6.9	pH unit
Electrical conductivity at 25 °C	APHA 2510 SGS Westport	59	µS/cm
Acidity to pH 4.0	APHA 2310	<5	mg/l
Acidity to pH 5.0	APHA 2310	<5	mg/l
Acidity to pH 7.0	APHA 2310	<5	mg/l
Total Alkalinity as CaCO3	APHA 2320B	30	mg/l CaCO3
Aluminium (Al) dissolved*	APHA 3125 subcon SGS Waihi	0.153	g/m3
Antimony (Sb) dissolved*	APHA 3125 subcon SGS Waihi	<0.001	g/m3
Arsenic (As) dissolved*	APHA 3125 subcon SGS Waihi	0.082	g/m3
Barium (Ba) dissolved*	APHA 3125 subcon SGS Waihi	0.006	g/m3
Boron (B) dissolved*	APHA 3125 subcon SGS Waihi	0.040	g/m3
Cadmium (Cd) dissolved*	APHA 3125 subcon SGS Waihi	<0.0002	g/m3
Calcium (Ca) dissolved*	APHA 3125 subcon SGS Waihi	5.9	g/m3
Chromium (Cr) dissolved*	APHA 3125 subcon SGS Waihi	<0.001	g/m3
Cobalt (Co) dissolved*	APHA 3125 subcon SGS Waihi	0.0010	g/m3
Copper (Cu) dissolved*	APHA 3125 subcon SGS Waihi	0.0030	g/m3
Iron (Fe) dissolved*	APHA 3125 subcon SGS Waihi	0.190	g/m3
Lead (Pb) dissolved*	APHA 3125 subcon SGS Waihi	<0.001	g/m3
Magnesium (Mg) dissolved*	APHA 3125 subcon SGS Waihi	0.84	g/m3
Manganese (Mn) dissolved*	APHA 3125 subcon SGS Waihi	0.183	g/m3
Mercury (Hg) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Molybdenum (Mo) dissolved*	APHA 3125 subcon SGS Waihi	<0.001	g/m3
Nickel (Ni) dissolved*	APHA 3125 subcon SGS Waihi	0.001	g/m3
Potassium (K) dissolved*	APHA 3125 subcon SGS Waihi	5.3	g/m3
Selenium (Se) dissolved*	APHA 3125 subcon SGS Waihi	<0.005	g/m3
Silver (Ag) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Sodium (Na) dissolved*	APHA 3125 subcon SGS Waihi	0.8	g/m3
Strontium (Sr) dissolved*	APHA 3125 subcon SGS Waihi	0.025	g/m3
Thallium (Tl) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Tin (Sn) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Titanium (Ti) dissolved*	APHA 3125 subcon SGS Waihi	0.002	g/m3
Uranium (U) dissolved*	APHA 3125 subcon SGS Waihi	<0.0002	g/m3
Vanadium (V) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Zinc (Zn) dissolved*	APHA 3125 subcon SGS Waihi	<0.002	g/m3
Total nitrogen in water	APHA 4500-NO3 I Subcontracted ELS	3.95	g/m3
Ammonia nitrogen by CFA/FIA	APHA 4500 NH3 H online edition subcontracted ELS	0.30	g/m3
Total Cyanide by digestion and colorimetric finish*	APHA4500 CN-I subcontracted SGS Waihi	<0.007	g/m3

Analysis	Method	Result	Unit
Total phosphorus in water	APHA 4500-P G subcontracted ELS	23.800	g/m3
Fluoride	APHA 4110 B subcontracted ELS	0.16	g/m3
Chloride	APHA 4110 B subcontracted ELS	0.17	g/m3
Nitrate Nitrogen, NO3-N	APHA 4110 B subcontracted ELS	1.19	g/m3
Nitrite Nitrogen, NO2-N	APHA 4110 B subcontracted ELS	0.08	g/m3
Sulphate as SO4	APHA 4110 B subcontracted ELS	0.89	g/m3
Dissolved Oxygen*	HACH method 10360 USEPA 40 CFR Part 136 approved	8.2	mg/l

* denotes test not IANZ accredited.

NAG pH for blank was 5.9
Dissolved Metals analysed at Eurofins Els 85 Port Road Seaview Lower Hutt Wellington 5010 : AR-24-NW-058652-01
WAD CN analysed at SGS Waihi- 43 Victoria Street Waihi report WAI24-02248

Date Start/End Analysis (4/7/2024 - 15/10/2024)

Reported: 15/10/2024 2:07:02PM

ANALYSIS REPORT
WP24-13842.002

Client:
Matakanui Gold Limited
PO Box 11

7842 Hokitika NEW ZEALAND
Attention: KIM .

Received: 4/06/2024
Completed: 15/10/2024
Job Number: WP24-13842
Report Number: 0000029708
Order Reference: J-NZ0233

Description:
Sample ID: Waste Rock RAS Mullock

Analysis	Method	Result	Unit
Sulphur	SGS Global method	0.093	%
Carbon 0.01-30%*	SGS Global method	0.91	%
pH (1:2) aged overnight/12 hours*	NEPM103 1:2 extraction	9.5	pH unit
Conductivity after PH1_2 (12 hours)*	NEPM103 1:2 extraction	200	µS/cm
Acid Neutralising Capacity (kg H2SO4/T)*	SGS inhouse method	52	KGH2SO4/T
Acid Neutralising Capacity (% CaCO3 equivalent)*	SGS inhouse method	5.3	%
Total Acid Potential (kg H2SO4/T)*	SGS inhouse method	2.9	KGH2SO4/T
Nett Acid Producing Potential (kg H2SO4/T)*	SGS inhouse method	-49	KGH2SO4/T
NAG pH*	SGS Global method	7.1	pH unit
Net Acid Generation to pH 4.5 (kg H2SO4/T)*	SGS Global method	0	KGH2SO4/T
Nett Acid Generation (kg H2SO4/T)*	SGS Global method	0	KGH2SO4/T
pH in Water analysed within 6 hour holding time	APHA 4500 H SGS Westport	9.2	pH unit
Electrical conductivity at 25 °C	APHA 2510 SGS Westport	73	µS/cm
Acidity to pH 4.0	APHA 2310	<5	mg/l
Acidity to pH 5.0	APHA 2310	<5	mg/l
Acidity to pH 7.0	APHA 2310	<5	mg/l
Total Alkalinity as CaCO3	APHA 2320B	40	mg/l CaCO3
Aluminium (Al) dissolved*	APHA 3125 subcon SGS Waihi	0.211	g/m3
Antimony (Sb) dissolved*	APHA 3125 subcon SGS Waihi	<0.001	g/m3
Arsenic (As) dissolved*	APHA 3125 subcon SGS Waihi	0.217	g/m3
Barium (Ba) dissolved*	APHA 3125 subcon SGS Waihi	<0.002	g/m3
Boron (B) dissolved*	APHA 3125 subcon SGS Waihi	<0.03	g/m3
Cadmium (Cd) dissolved*	APHA 3125 subcon SGS Waihi	<0.0002	g/m3
Calcium (Ca) dissolved*	APHA 3125 subcon SGS Waihi	8.2	g/m3
Chromium (Cr) dissolved*	APHA 3125 subcon SGS Waihi	<0.001	g/m3
Cobalt (Co) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Copper (Cu) dissolved*	APHA 3125 subcon SGS Waihi	0.0008	g/m3
Iron (Fe) dissolved*	APHA 3125 subcon SGS Waihi	0.080	g/m3
Lead (Pb) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Magnesium (Mg) dissolved*	APHA 3125 subcon SGS Waihi	2.96	g/m3
Manganese (Mn) dissolved*	APHA 3125 subcon SGS Waihi	0.003	g/m3
Mercury (Hg) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Molybdenum (Mo) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Nickel (Ni) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Potassium (K) dissolved*	APHA 3125 subcon SGS Waihi	2.7	g/m3
Selenium (Se) dissolved*	APHA 3125 subcon SGS Waihi	<0.005	g/m3
Silver (Ag) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Sodium (Na) dissolved*	APHA 3125 subcon SGS Waihi	0.6	g/m3
Strontium (Sr) dissolved*	APHA 3125 subcon SGS Waihi	0.096	g/m3
Thallium (Tl) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Tin (Sn) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Titanium (Ti) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Uranium (U) dissolved*	APHA 3125 subcon SGS Waihi	0.001	g/m3
Vanadium (V) dissolved*	APHA 3125 subcon SGS Waihi	<0.001	g/m3
Zinc (Zn) dissolved*	APHA 3125 subcon SGS Waihi	<0.002	g/m3
Total nitrogen in water	APHA 4500-NO3 I Subcontracted ELS	0.47	g/m3
Ammonia nitrogen by CFA/FIA	APHA 4500 NH3 H online edition subcontracted ELS	<0.01	g/m3
Total Cyanide by digestion and colorimetric finish*	APHA4500 CN-I subcontracted SGS Waihi	<0.007	g/m3

SGS

Analysis Report:
WP24-13842.002

Analysis	Method	Result	Unit
Total phosphorus in water	APHA 4500-P G subcontracted ELS	0.316	g/m3
Fluoride	APHA 4110 B subcontracted ELS	0.03	g/m3
Chloride	APHA 4110 B subcontracted ELS	0.09	g/m3
Nitrate Nitrogen, NO3-N	APHA 4110 B subcontracted ELS	0.08	g/m3
Nitrite Nitrogen, NO2-N	APHA 4110 B subcontracted ELS	<0.01	g/m3
Sulphate as SO4	APHA 4110 B subcontracted ELS	1.88	g/m3
Dissolved Oxygen*	HACH method 10360 USEPA 40 CFR Part 136 approved	9.3	mg/l

* denotes test not IANZ accredited.

NAG pH for blank was 5.9
Dissolved Metals analysed at Eurofins Els 85 Port Road Seaview Lower Hutt Wellington 5010 : AR-24-NW-058652-01
WAD CN analysed at SGS Waihi- 43 Victoria Street Waihi report WAI24-02248

Date Start/End Analysis (4/7/2024 - 15/10/2024)

Reported: 15/10/2024 2:07:02PM

ANALYSIS REPORT
WP24-13842.003

Client:
Matakanui Gold Limited
PO Box 11

7842 Hokitika NEW ZEALAND
Attention: KIM .

Received: 4/06/2024
Completed: 15/10/2024
Job Number: WP24-13842
Report Number: 0000029708
Order Reference: J-NZ0233

Description:
Sample ID: Waste Rock CIT RSSZ

Analysis	Method	Result	Unit
Sulphur	SGS Global method	0.006	%
Carbon 0.01-30%*	SGS Global method	0.51	%
pH (1:2) aged overnight/12 hours*	NEPM103 1:2 extraction	8.9	pH unit
Conductivity after PH1_2 (12 hours)*	NEPM103 1:2 extraction	220	µS/cm
Acid Neutralising Capacity (kg H2SO4/T)*	SGS inhouse method	36	KGH2SO4/T
Acid Neutralising Capacity (% CaCO3 equivalent)*	SGS inhouse method	3.7	%
Total Acid Potential (kg H2SO4/T)*	SGS inhouse method	0.18	KGH2SO4/T
Nett Acid Producing Potential (kg H2SO4/T)*	SGS inhouse method	-36	KGH2SO4/T
NAG pH*	SGS Global method	7.2	pH unit
Net Acid Generation to pH 4.5 (kg H2SO4/T)*	SGS Global method	0	KGH2SO4/T
Nett Acid Generation (kg H2SO4/T)*	SGS Global method	0	KGH2SO4/T
pH in Water analysed within 6 hour holding time	APHA 4500 H SGS Westport	8.7	pH unit
Electrical conductivity at 25 °C	APHA 2510 SGS Westport	99	µS/cm
Acidity to pH 4.0	APHA 2310	<5	mg/l
Acidity to pH 5.0	APHA 2310	<5	mg/l
Acidity to pH 7.0	APHA 2310	<5	mg/l
Total Alkalinity as CaCO3	APHA 2320B	50	mg/l CaCO3
Aluminium (Al) dissolved*	APHA 3125 subcon SGS Waihi	0.029	g/m3
Antimony (Sb) dissolved*	APHA 3125 subcon SGS Waihi	0.001	g/m3
Arsenic (As) dissolved*	APHA 3125 subcon SGS Waihi	2.61	g/m3
Barium (Ba) dissolved*	APHA 3125 subcon SGS Waihi	<0.002	g/m3
Boron (B) dissolved*	APHA 3125 subcon SGS Waihi	<0.03	g/m3
Cadmium (Cd) dissolved*	APHA 3125 subcon SGS Waihi	<0.0002	g/m3
Calcium (Ca) dissolved*	APHA 3125 subcon SGS Waihi	14.2	g/m3
Chromium (Cr) dissolved*	APHA 3125 subcon SGS Waihi	<0.001	g/m3
Cobalt (Co) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Copper (Cu) dissolved*	APHA 3125 subcon SGS Waihi	0.0011	g/m3
Iron (Fe) dissolved*	APHA 3125 subcon SGS Waihi	<0.01	g/m3
Lead (Pb) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Magnesium (Mg) dissolved*	APHA 3125 subcon SGS Waihi	0.55	g/m3
Manganese (Mn) dissolved*	APHA 3125 subcon SGS Waihi	<0.001	g/m3
Mercury (Hg) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Molybdenum (Mo) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Nickel (Ni) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Potassium (K) dissolved*	APHA 3125 subcon SGS Waihi	6.0	g/m3
Selenium (Se) dissolved*	APHA 3125 subcon SGS Waihi	<0.005	g/m3
Silver (Ag) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Sodium (Na) dissolved*	APHA 3125 subcon SGS Waihi	0.6	g/m3
Strontium (Sr) dissolved*	APHA 3125 subcon SGS Waihi	0.030	g/m3
Thallium (Tl) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Tin (Sn) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Titanium (Ti) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Uranium (U) dissolved*	APHA 3125 subcon SGS Waihi	<0.001	g/m3
Vanadium (V) dissolved*	APHA 3125 subcon SGS Waihi	<0.0005	g/m3
Zinc (Zn) dissolved*	APHA 3125 subcon SGS Waihi	<0.002	g/m3
Total nitrogen in water	APHA 4500-NO3 I Subcontracted ELS	1.43	g/m3
Ammonia nitrogen by CFA/FIA	APHA 4500 NH3 H online edition subcontracted ELS	0.07	g/m3
Total Cyanide by digestion and colorimetric finish*	APHA4500 CN-I subcontracted SGS Waihi	<0.007	g/m3

SGS

Analysis Report:
WP24-13842.003

Analysis	Method	Result	Unit
Total phosphorus in water	APHA 4500-P G subcontracted ELS	0.453	g/m3
Fluoride	APHA 4110 B subcontracted ELS	0.06	g/m3
Chloride	APHA 4110 B subcontracted ELS	0.10	g/m3
Nitrate Nitrogen, NO3-N	APHA 4110 B subcontracted ELS	1.04	g/m3
Nitrite Nitrogen, NO2-N	APHA 4110 B subcontracted ELS	<0.01	g/m3
Sulphate as SO4	APHA 4110 B subcontracted ELS	0.83	g/m3
Dissolved Oxygen*	HACH method 10360 USEPA 40 CFR Part 136 approved	9.2	mg/l

* denotes test not IANZ accredited.

NAG pH for blank was 5.9
Dissolved Metals analysed at Eurofins Els 85 Port Road Seaview Lower Hutt Wellington 5010 : AR-24-NW-058652-01
WAD CN analysed at SGS Waihi- 43 Victoria Street Waihi report WAI24-02248
Date Start/End Analysis (4/7/2024 - 15/10/2024)

Reported: 15/10/2024 2:07:02PM

Signed and dated on 15-Oct-2024

ABennetts

Alesha BENNETTS
Laboratory Technician

ATTACHMENT D – SEM EDS LABAORATORY REPORTS

5 Alvan Street
Mount Lawley
WA 6050

Client:	Mine Waste Management NZ	**Date received:**	27/11/2024
Client address:	5 Sir William Pickering Drive BURNSIDE NZ 8053	**Date analysed:**	20/12/2024
Job number:	24_2171	**Date reported:**	20/12/2024
Lab ID:	24_2171_001		
Client ID:	**MG55789**		
Analysis:	Scanning electron microscopy (SEM) with elemental analysis by energy dispersive spectroscopy (EDS)		
Revision number:	0		
Comments:	None		

Sample preparation

The sample was supplied to Microanalysis Australia as a bulk drill core sample.

The sample was mounted in epoxy resin and polished to a flat surface before being carbon coated. Non-conducting samples require coating prior to SEM analysis to prevent charging whilst being analysed by the electron beam.

Analysis

The sample was analysed using a Carl Zeiss EVO50 scanning electron microscope (SEM) fitted with an Oxford INCA X-Max energy dispersive spectrometer (EDS).

EDS is a semi-quantitative technique (at best) on well prepared, optically flat samples. Factors such as sample unevenness may adversely bias elemental concentration interpretation. EDS has a spatial resolution of ~5 µm meaning spectra from particles less than this size may contain elemental concentrations biased by their surroundings. Analysis was conducted at 20 KeV unless otherwise stated.

No calibration standards (standardless quant) were used in the EDS detector standardization prior to analysis.

Summary

All images were acquired using backscatter electrons (BSE) unless otherwise specified. For BSE, image contrast is directly proportional to average atomic number i.e. the brighter the area, the higher the atomic number.

The mineralogy of particles identified has been summarised in the following table (**Table 1: Mineralogy summary of particles observed**) and have been listed in order of abundance i.e. major, minor or trace quantities of particles.

Analyst: Damon Blakey, *B.Sc. (Forensic Biology and Toxicology)*

Reported: Damon Blakey, *B.Sc. (Forensic Biology and Toxicology)*

Approved: Rick Hughes, B.Sc.(Hons)Physics, MAIP

Table 1: Mineralogy summary of sulfur-based particles observed

Compound/phase relative abundance[2]	Size range (µm)	Observed morphology	Observed composition (elements present)				Assumed compound/phase	Compound/phase confidence[1] (Likely/possible)
			Major	Minor	Trace	Varying		
Major	<5 - ~170	Angular and aggregated particulate	S, Fe	-	Cu, Si, Al	-	Iron sulfide (pyrite/ pyrrhotite)	Likely
Minor	<5 - ~80	Angular and aggregated particulate	S, Zn	-	Fe, O	Na (trace to minor)	Zinc sulfide (sphalerite)	Likely
Trace	<5 - ~70	Irregular particulate	O, Pb, S	-	Se	O, Fe (trace to minor)	Lead sulfide (galena)	Possible
Trace	~10	Subangular particle	S, As, Co	Ni, Fe	Si	-	Arsenic-cobalt sulfide (cobaltite)	Possible

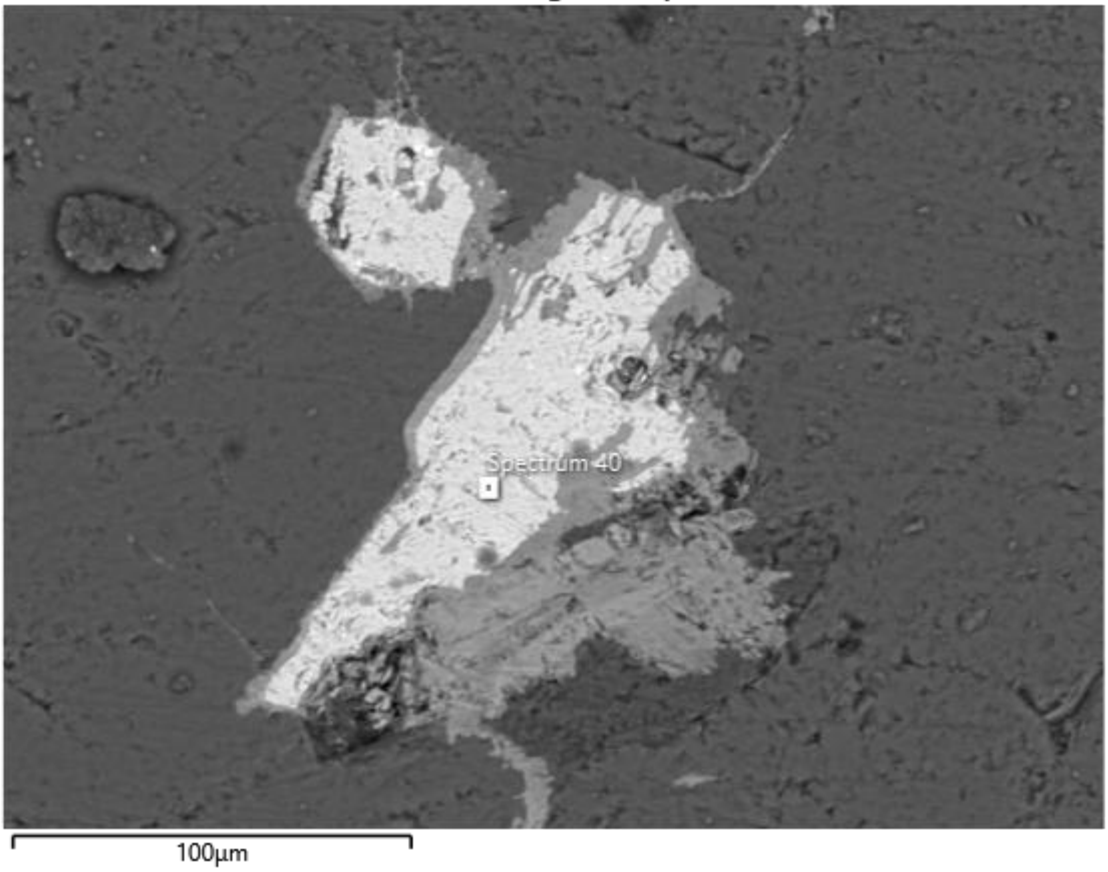
[1] indicates whether multiple options may be possible with similar stoichiometries. Confirmation by other techniques such as XRD or FTIR may be necessary for increased confidence. *Most of the sulfur-based minerals are surrounded by oxygen-containing minerals such as silica, iron oxides and various aluminosilicates. The oxygen from the surrounding materials may interfere with the sulfur-containing particles, allowing oxygen to show as a trace or minor element in the analysis of the sulfur particles. As 'trace' detected oxygen may be from the surrounding materials, however we assign a 'possible' confidence as to not rule out the possibility of partial oxidation of the sulfur-containing mineral present.*

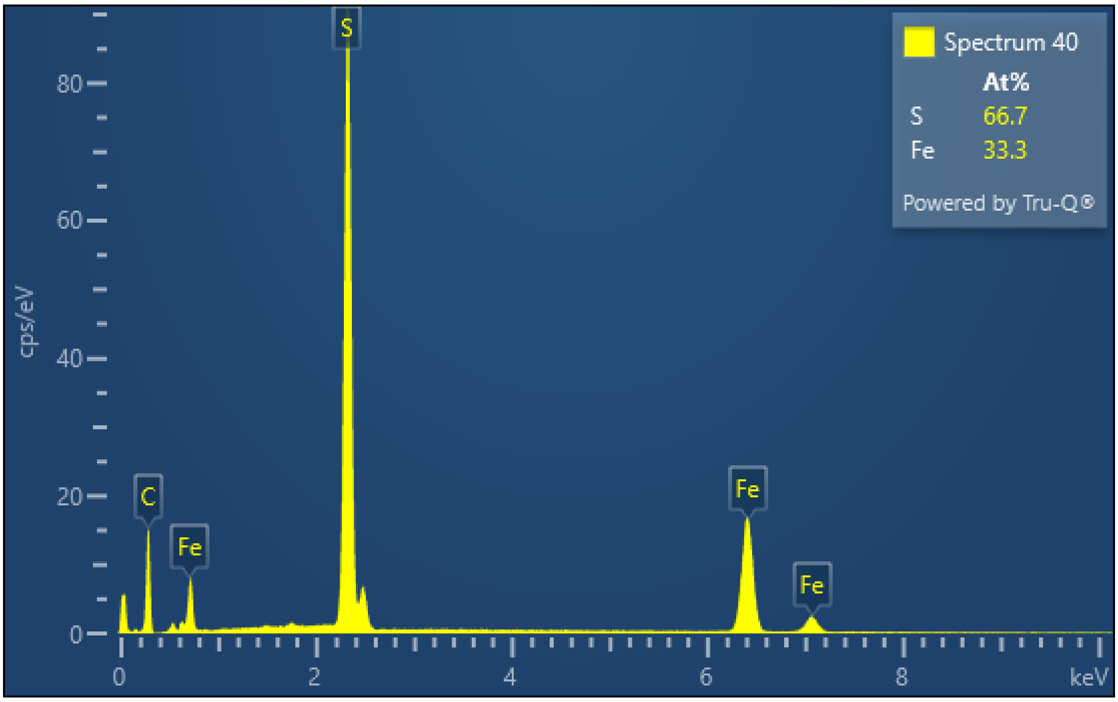
[2] The interpreted compound abundance qualifiers (major, minor, trace) are based on the following categories and are presented by number (count) of observed particles as opposed to wt% or ppm as would be reported by ICP/XRF. **All sulfur-based phases within the sample are trace. This is an abundance relative only to each other type of sulfur-based mineral present.**

Qualifier	*Approximate* range, number %
Major	> ~30
Minor	~1 to ~30
Trace	< ~1

The range (above) is stated as '*Approximate*' as the technique is more a qualitative measure of relative abundance as opposed to a quantitative absolute abundance. The abundance is stated as number percent as no calculations have been made to transform geometric sizes into particle volumes, nor density values used to calculate weight fractions that would enable weight percentages to be quoted

Electron Image 19 (Input1)





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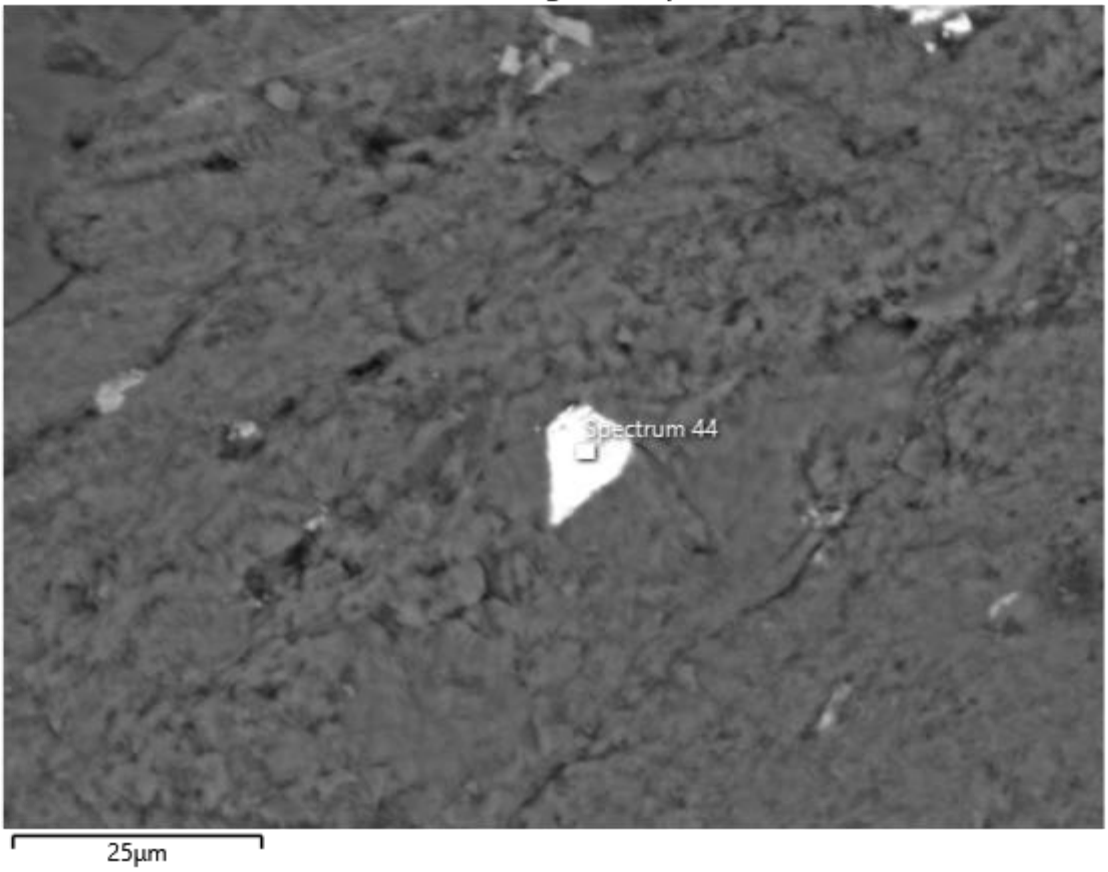
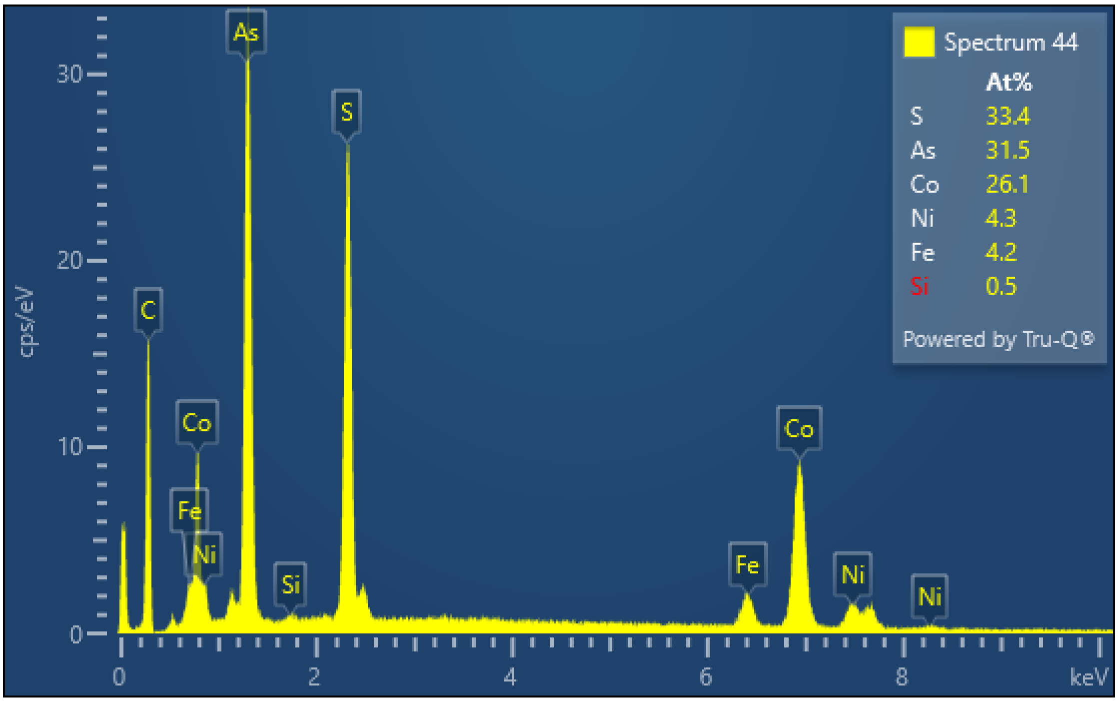
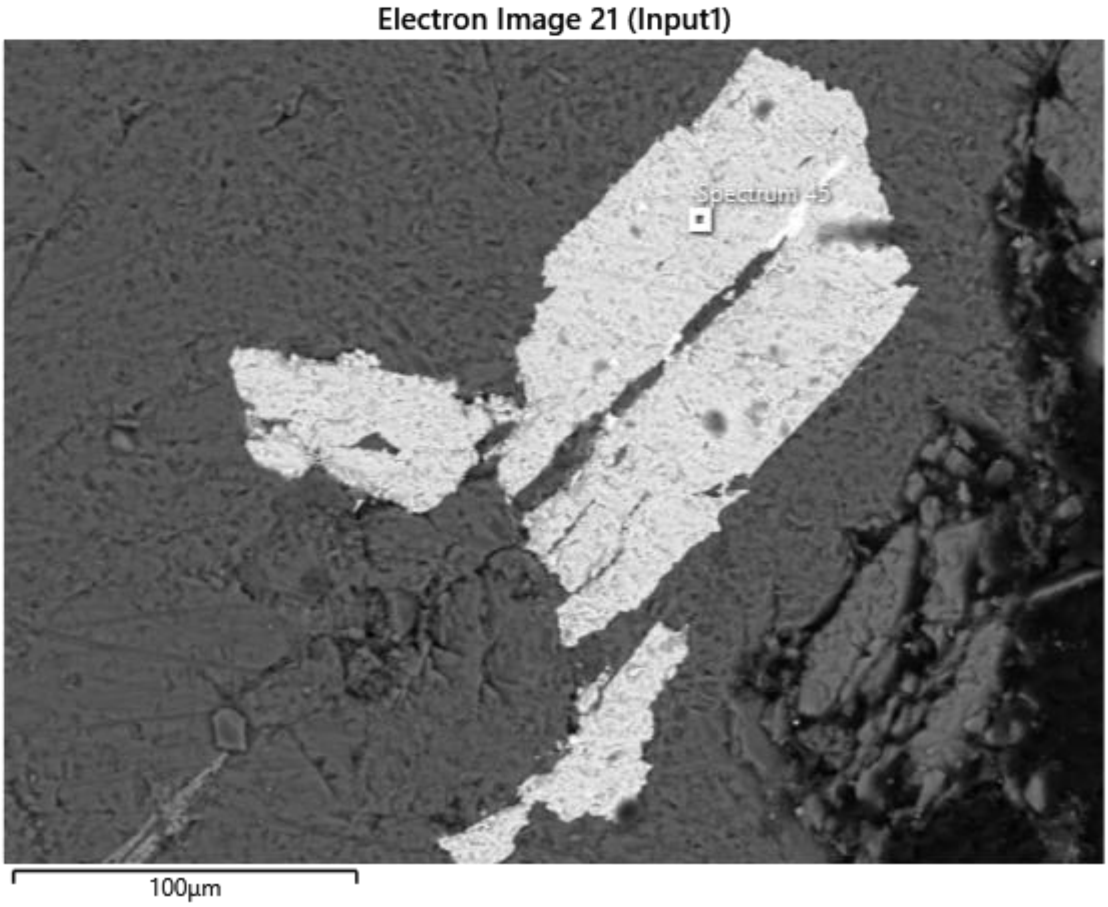
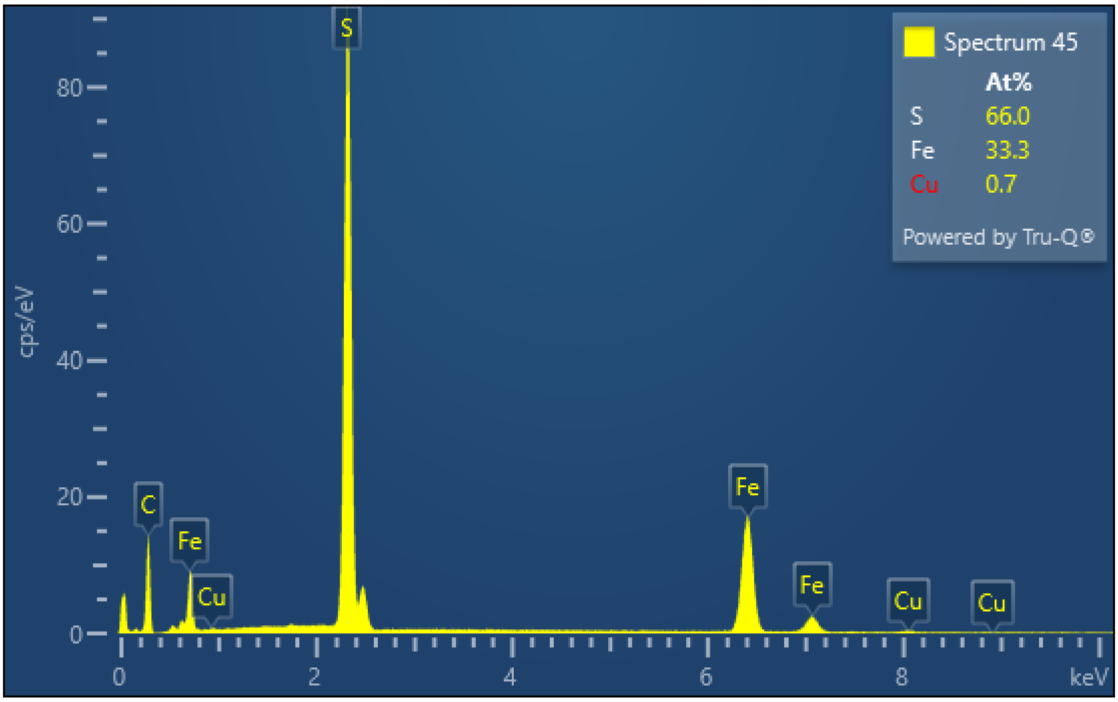
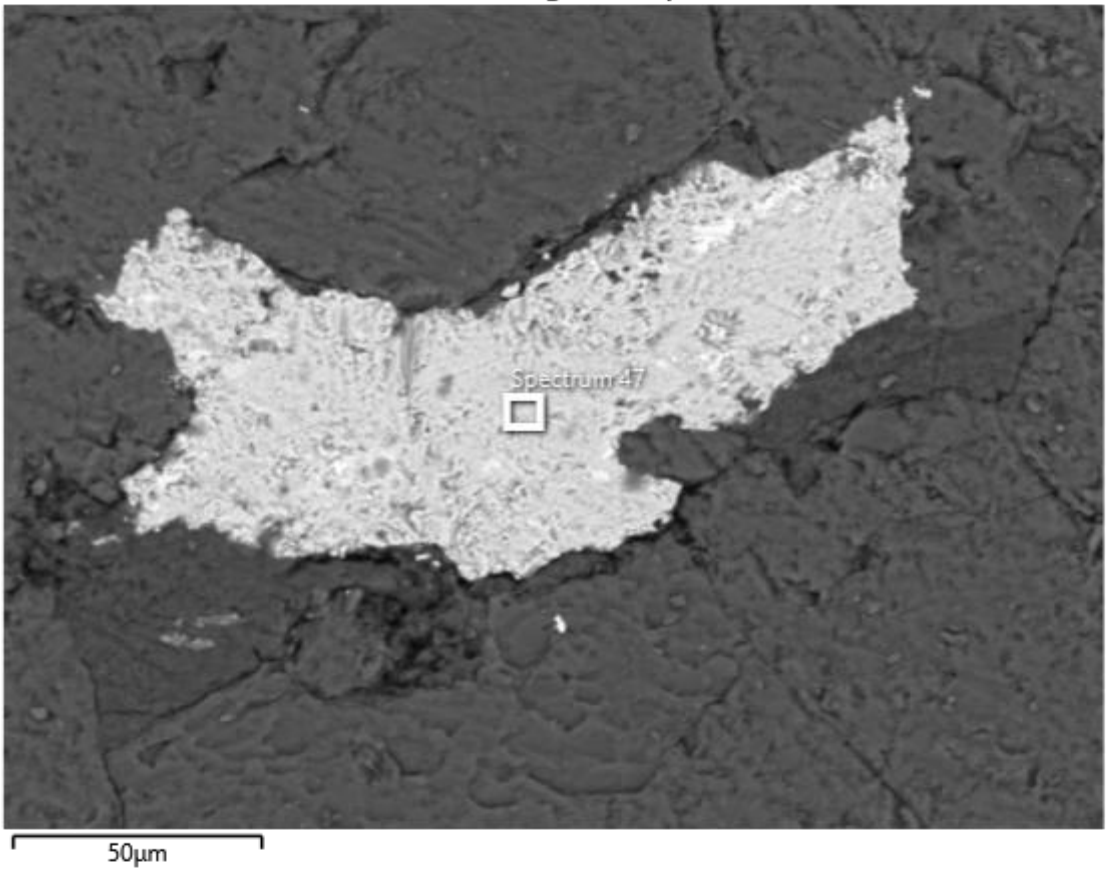


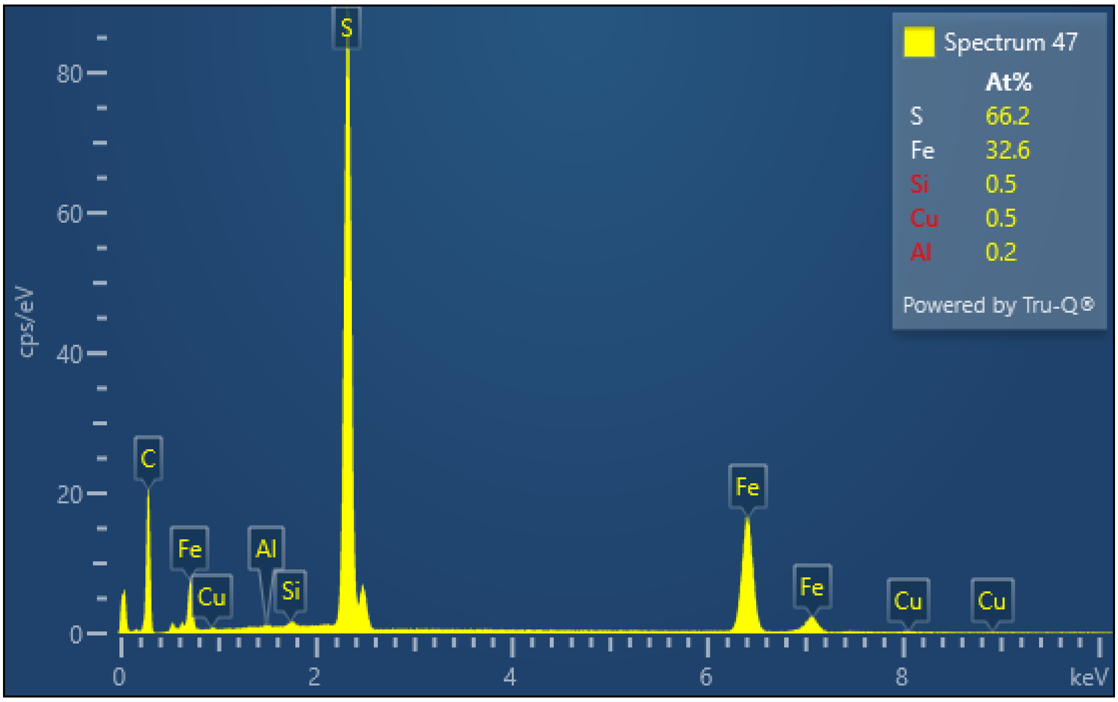



Electron Image 21 (Input1)
Spectrum 45
100µm


Spectrum 45
At%
S 66.0
Fe 33.3
Cu 0.7
Powered by Tru-Q®
cps/eV
80
60
40
20
0
S
C
Fe
Cu
Fe
Fe
Cu
Cu
0
2
4
6
8
keV

Electron Image 22 (Input1)





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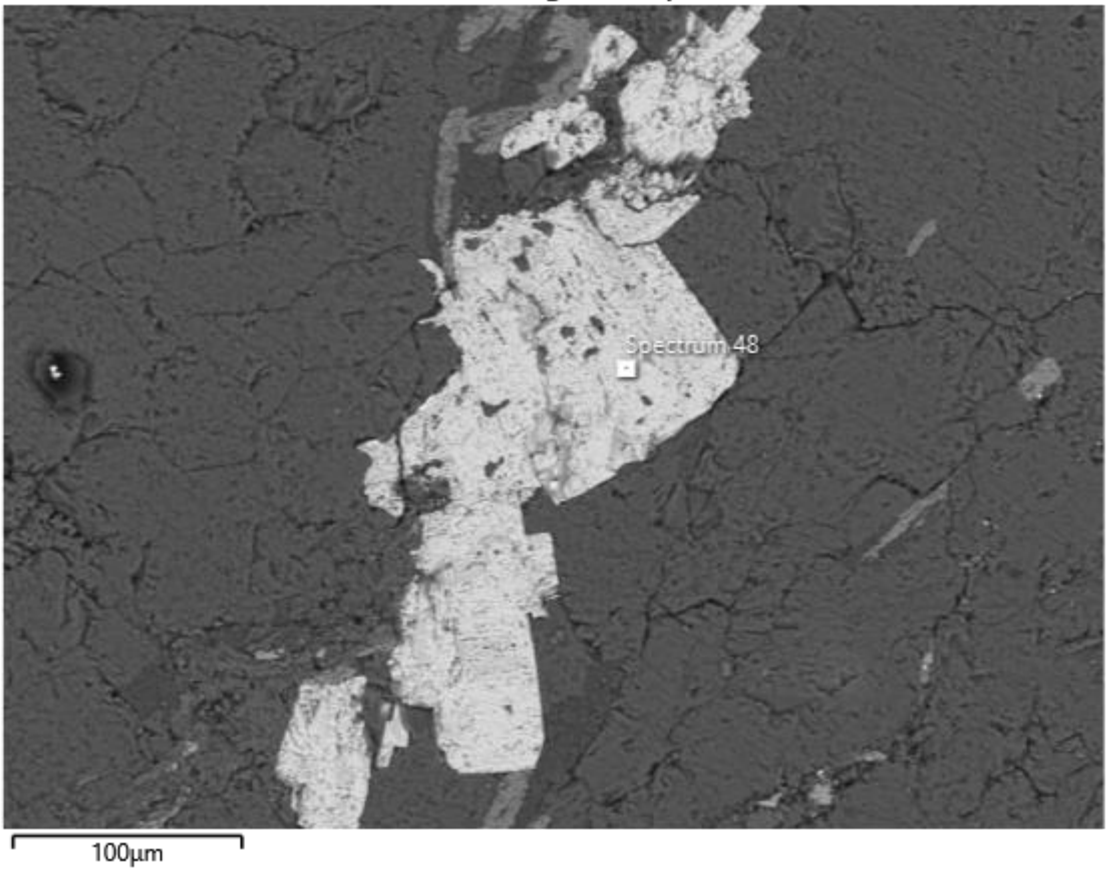
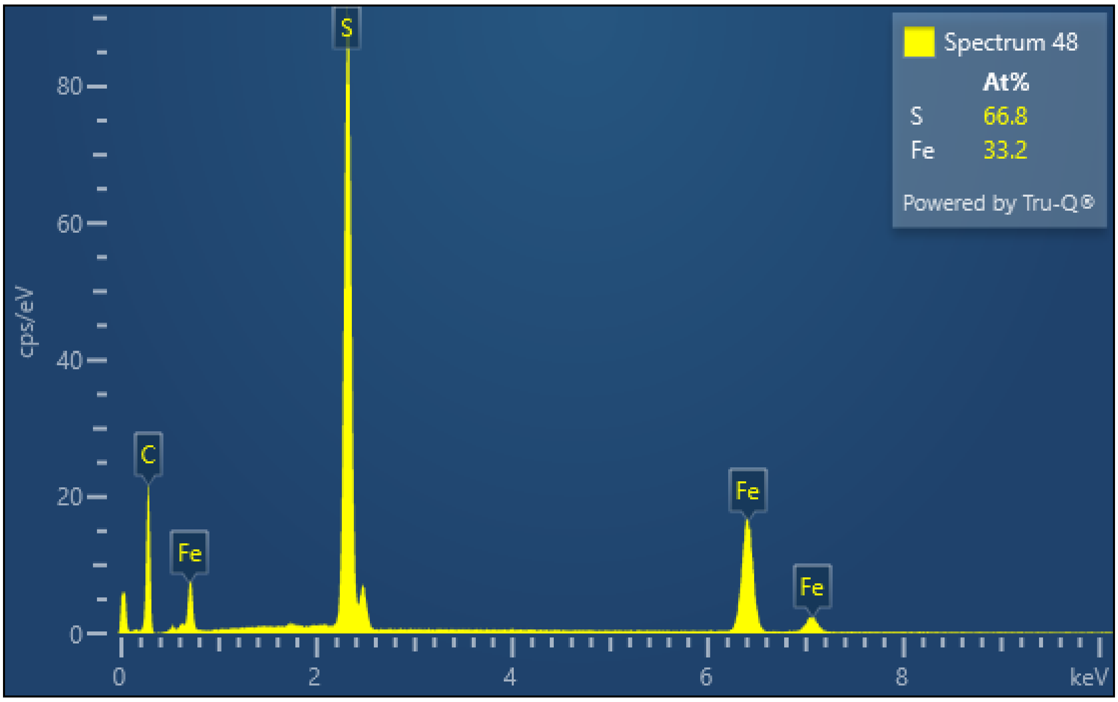
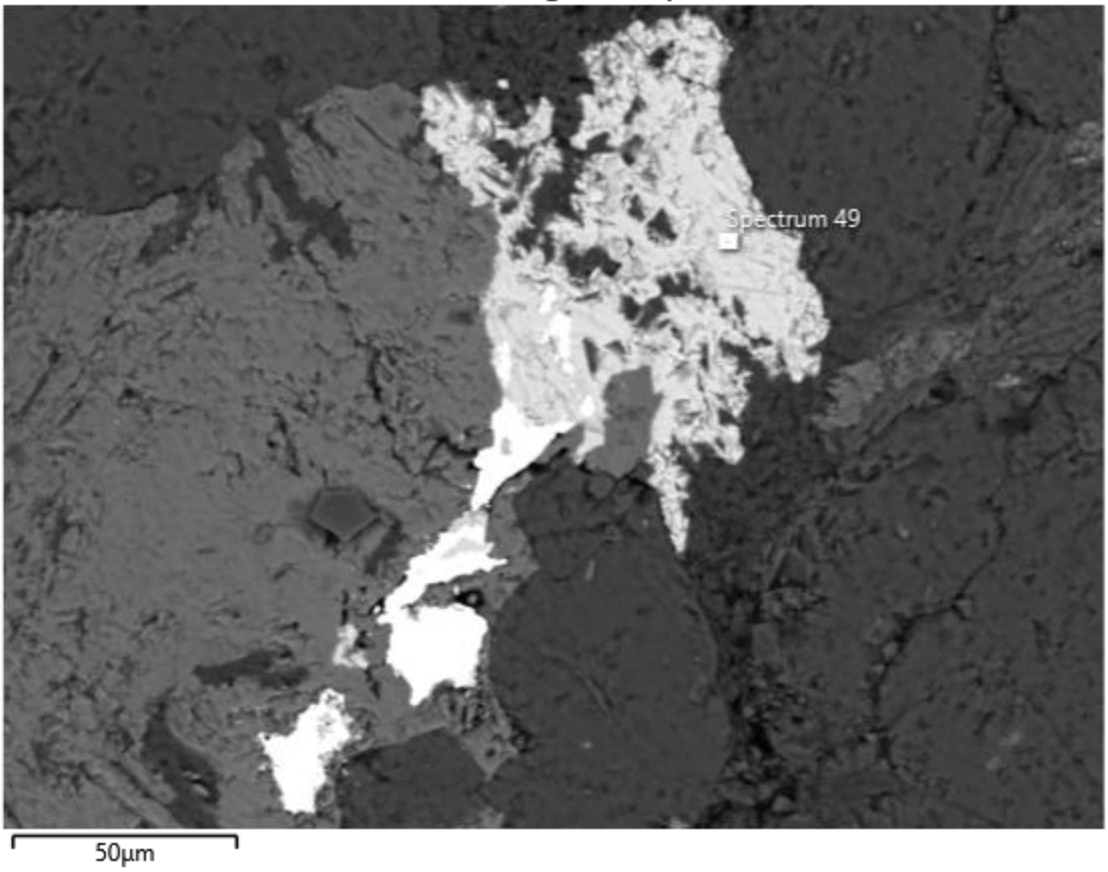
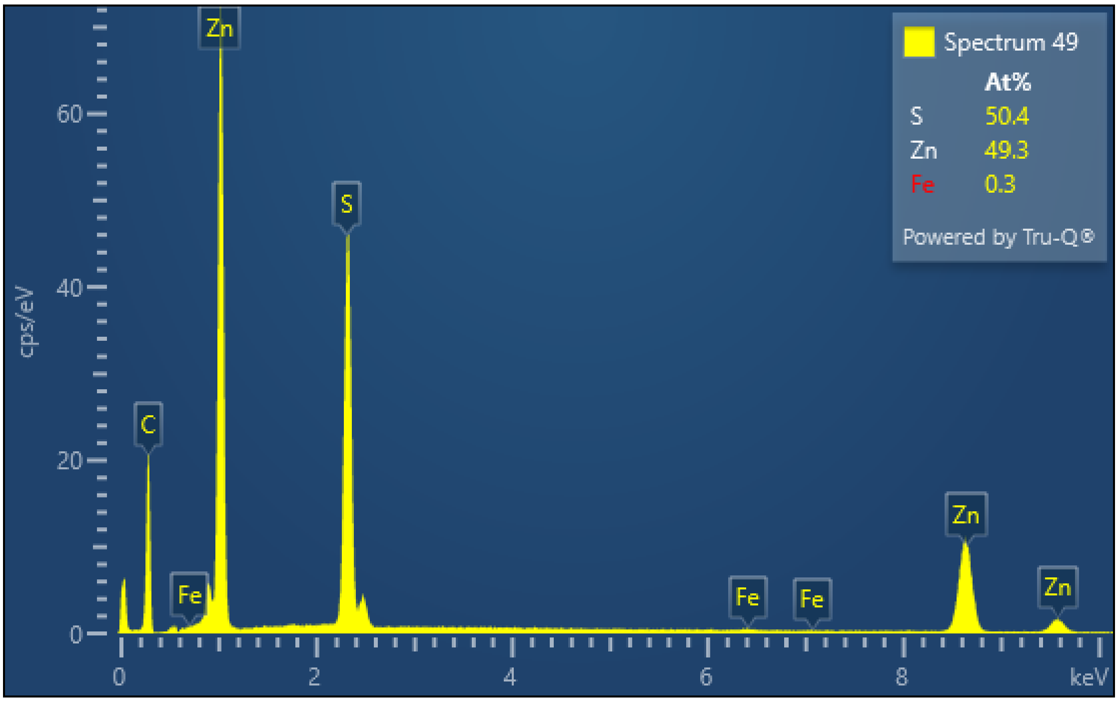




Electron Image 24 (Input1)





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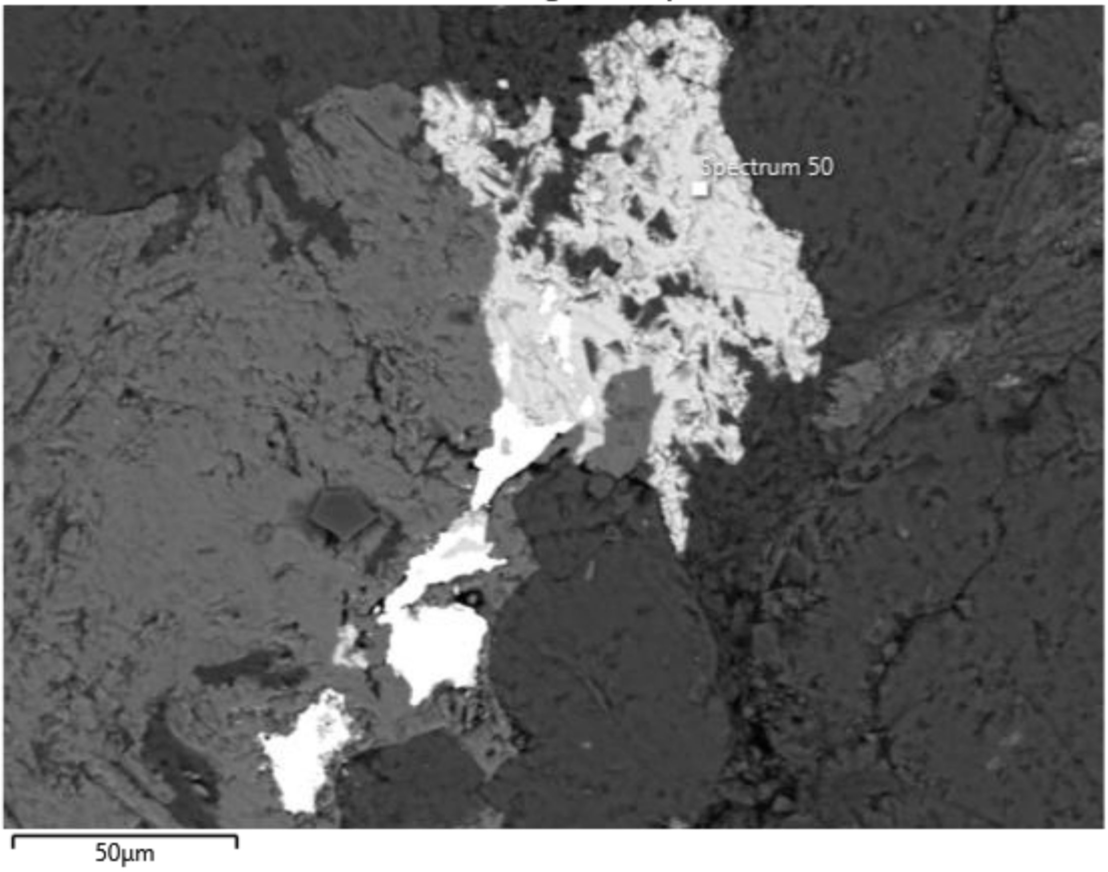

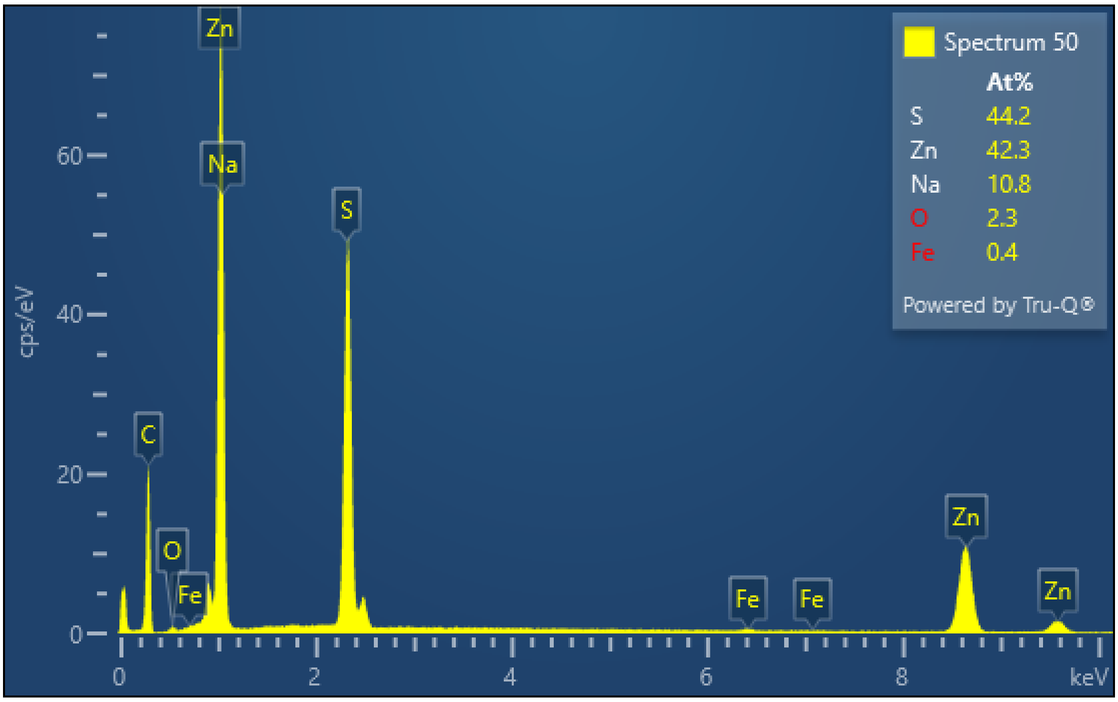

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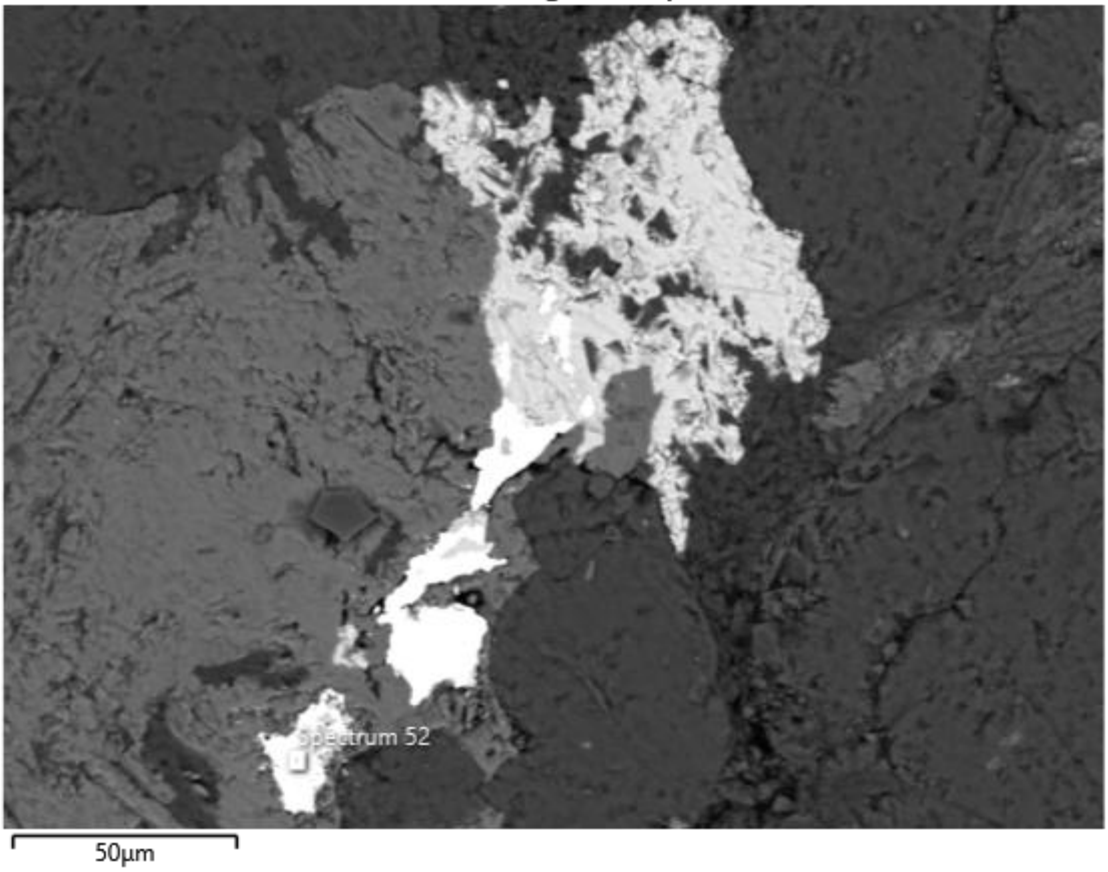
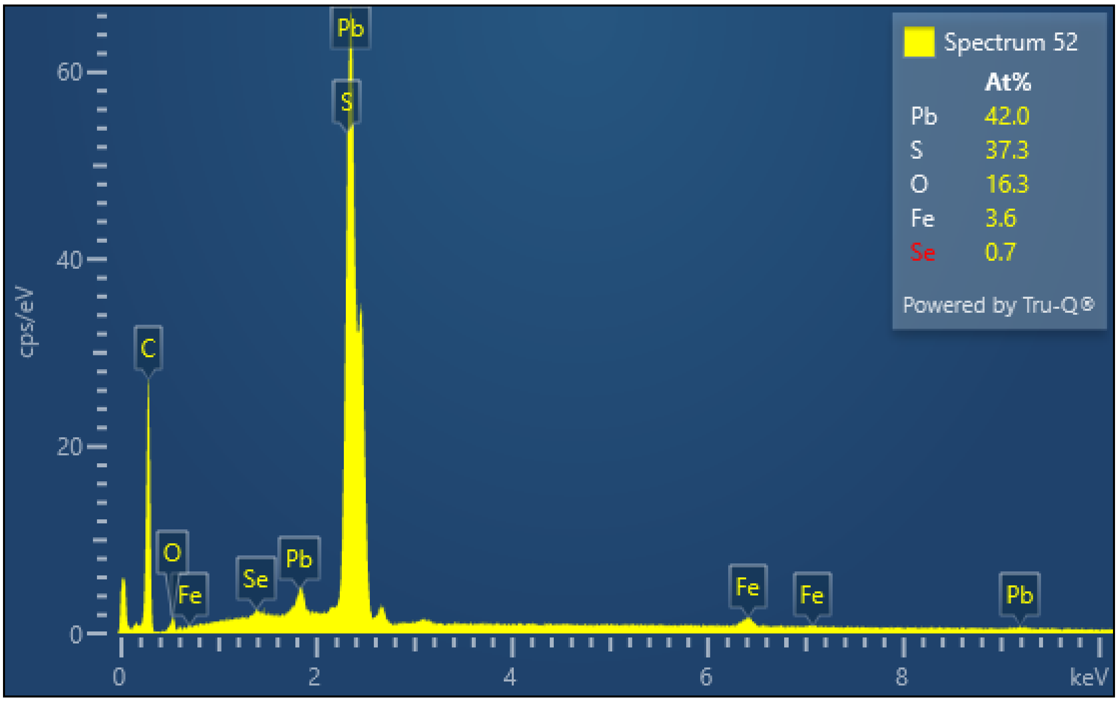
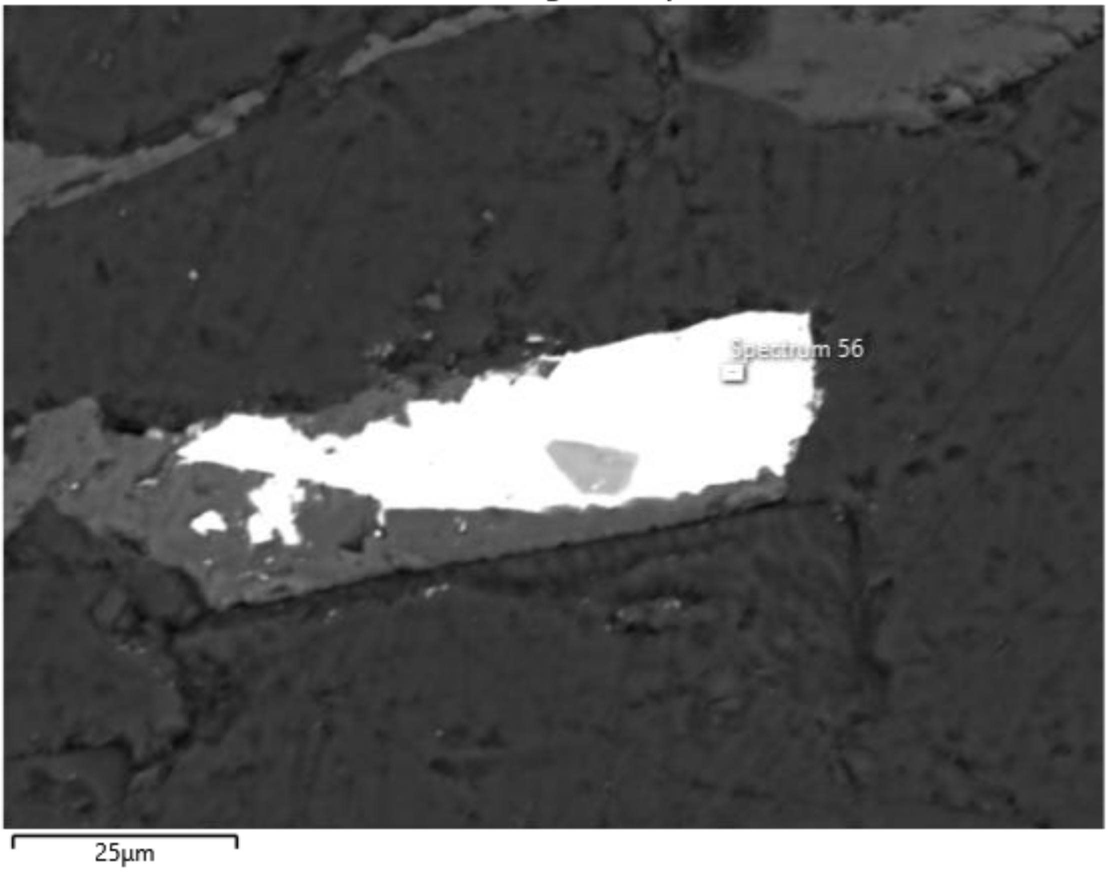
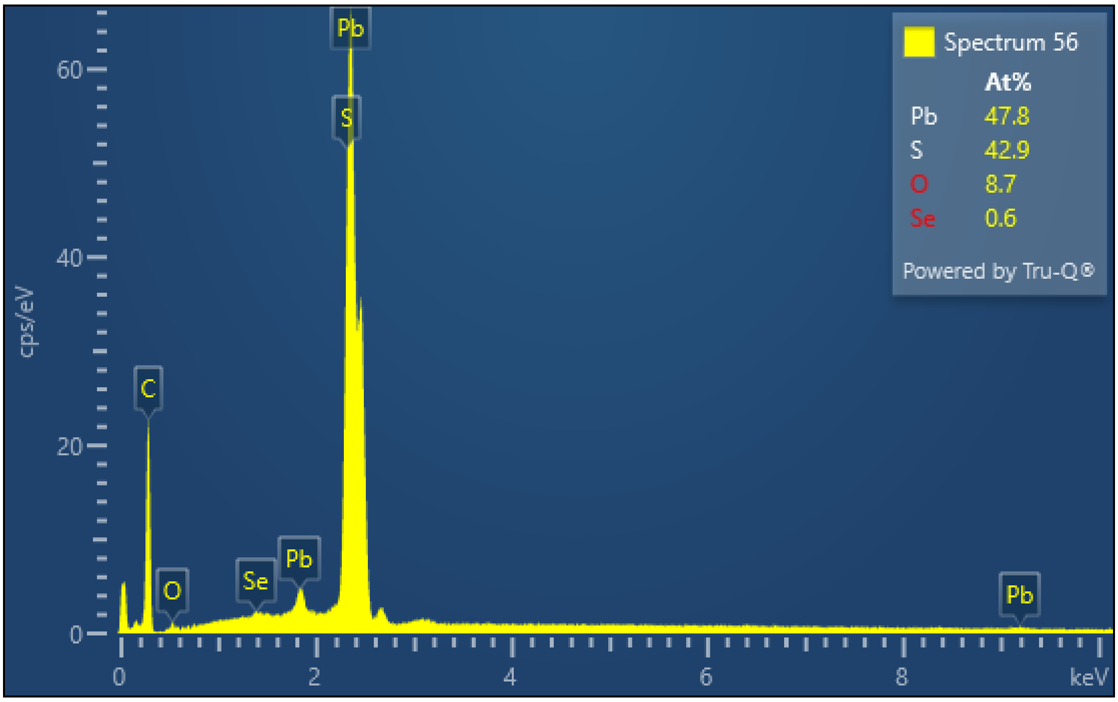




Electron Image 25 (Input1)





5 Alvan Street
Mount Lawley
WA 6050

Client:	Mine Waste Management NZ	**Date received:**	27/11/2024
Client address:	5 Sir William Pickering Drive BURNSIDE NZ 8053	**Date analysed:**	19/12/2024
Job number:	24_2171	**Date reported:**	20/12/2024
Lab ID:	24_2171_002		
Client ID:	**MG55790**		
Analysis:	Scanning electron microscopy (SEM) with elemental analysis by energy dispersive spectroscopy (EDS)		
Revision number:	0		
Comments:	None		

Sample preparation

The sample was supplied to Microanalysis Australia as a bulk drill core sample.

The sample was mounted in epoxy resin and polished to a flat surface before being carbon coated. Non-conducting samples require coating prior to SEM analysis to prevent charging whilst being analysed by the electron beam.

Analysis

The sample was analysed using a Carl Zeiss EVO50 scanning electron microscope (SEM) fitted with an Oxford INCA X-Max energy dispersive spectrometer (EDS).

EDS is a semi-quantitative technique (at best) on well prepared, optically flat samples. Factors such as sample unevenness may adversely bias elemental concentration interpretation. EDS has a spatial resolution of ~5 µm meaning spectra from particles less than this size may contain elemental concentrations biased by their surroundings. Analysis was conducted at 20 KeV unless otherwise stated.

No calibration standards (standardless quant) were used in the EDS detector standardization prior to analysis.

Summary

All images were acquired using backscatter electrons (BSE) unless otherwise specified. For BSE, image contrast is directly proportional to average atomic number i.e. the brighter the area, the higher the atomic number.

The mineralogy of particles identified has been summarised in the following table (**Table 1: Mineralogy summary of particles observed**) and have been listed in order of abundance i.e. major, minor or trace quantities of particles.

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Approved: Rick Hughes, B.Sc.(Hons)Physics, MAIP

Table 1: Mineralogy summary of sulfur-based particles observed

Compound/phase relative abundance[2]	Size range (µm)	Observed morphology	Observed composition (elements present)				Assumed compound/phase	Compound/phase confidence[1] (Likely/possible)
			Major	Minor	Trace	Varying		
Major	<5 - ~110	Angular and aggregated particulate	S, Fe, As	-	Ca, Si, Al	O (trace to minor)	Asrsenic-iron sulfide (arsenopyrite)	Likely
Minor	<5 - ~100	Angular and aggregated particulate	S, Zn	Na	Fe, O	-	Zinc sulfide (sphalerite)	Likely
Trace	<5 - ~25	Angular and aggregated particulate	S, Fe	-	-	-	Iron sulfide (pyrite)	Likely

[1] indicates whether multiple options may be possible with similar stoichiometries. Confirmation by other techniques such as XRD or FTIR may be necessary for increased confidence. *Most of the sulfur-based minerals are surrounded by oxygen-containing minerals such as silica, iron oxides, and various aluminosilicates. The oxygen from the surrounding materials may interfere with the sulfur-containing particles, allowing oxygen to show as a trace or minor phase in the analysis of the sulfur particles. Most of the time this will be from the surrounding materials, however we assign a 'possible' confidence as to not rule out the possibility of partial oxidation of the sulfur mineral present.*

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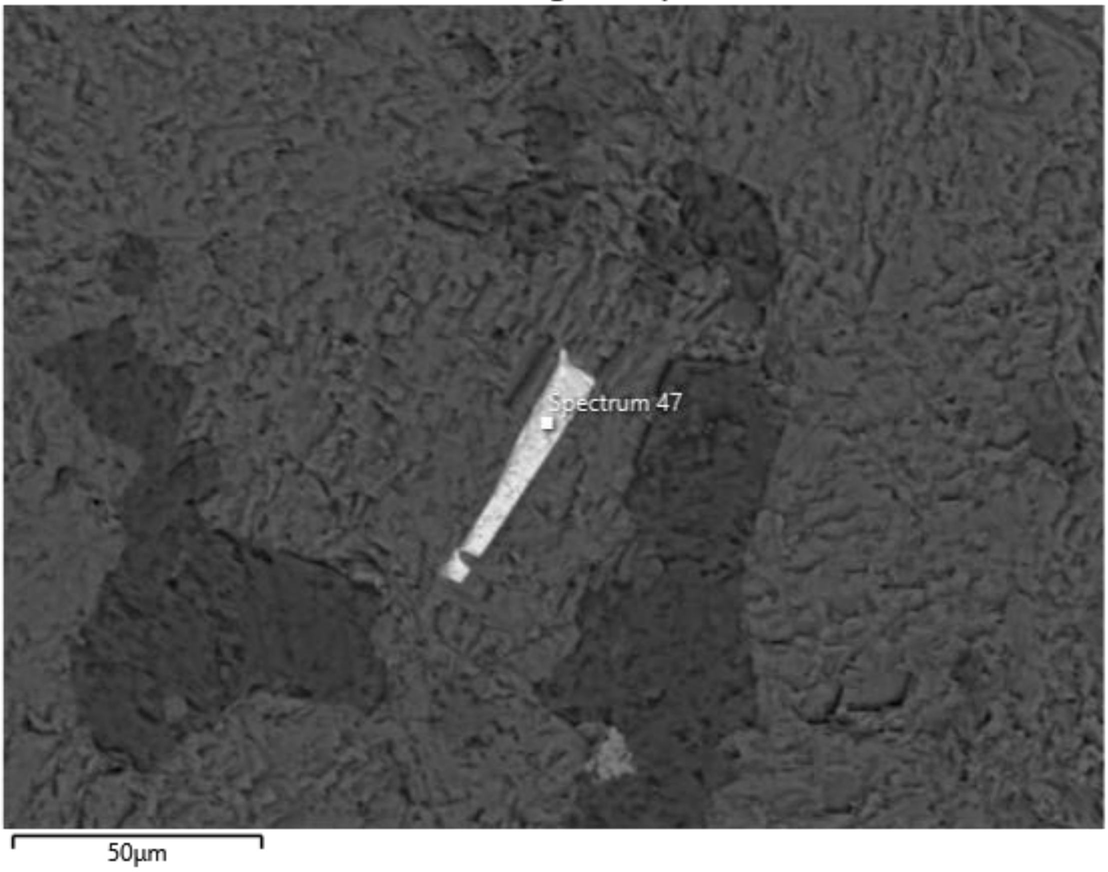
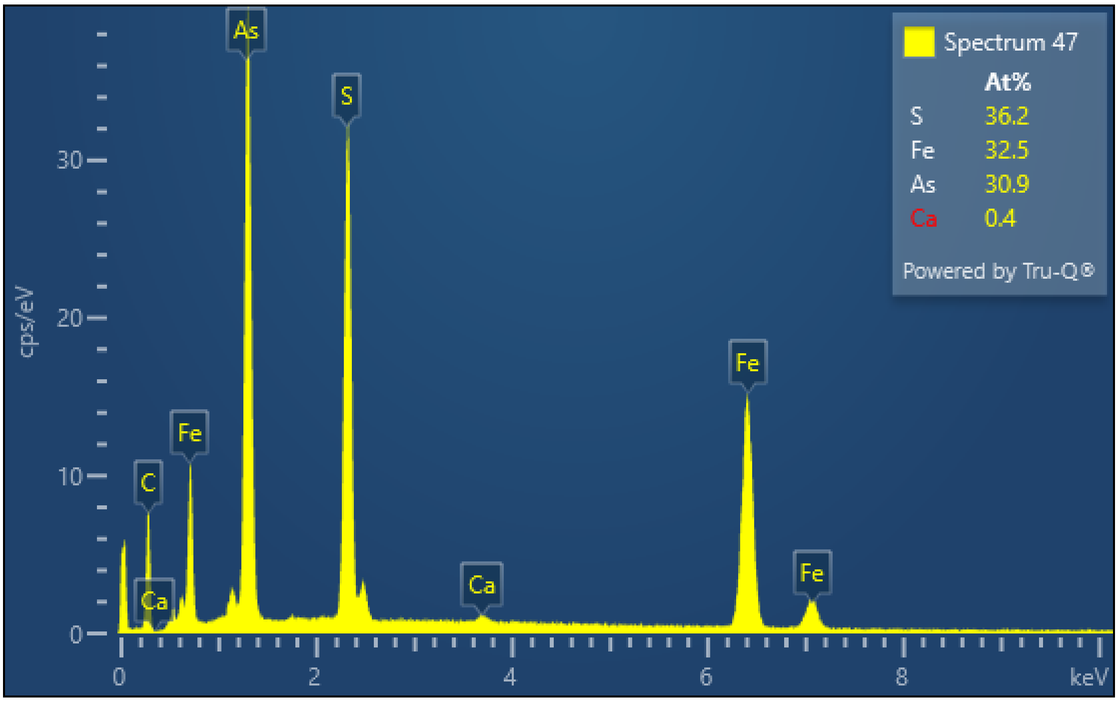
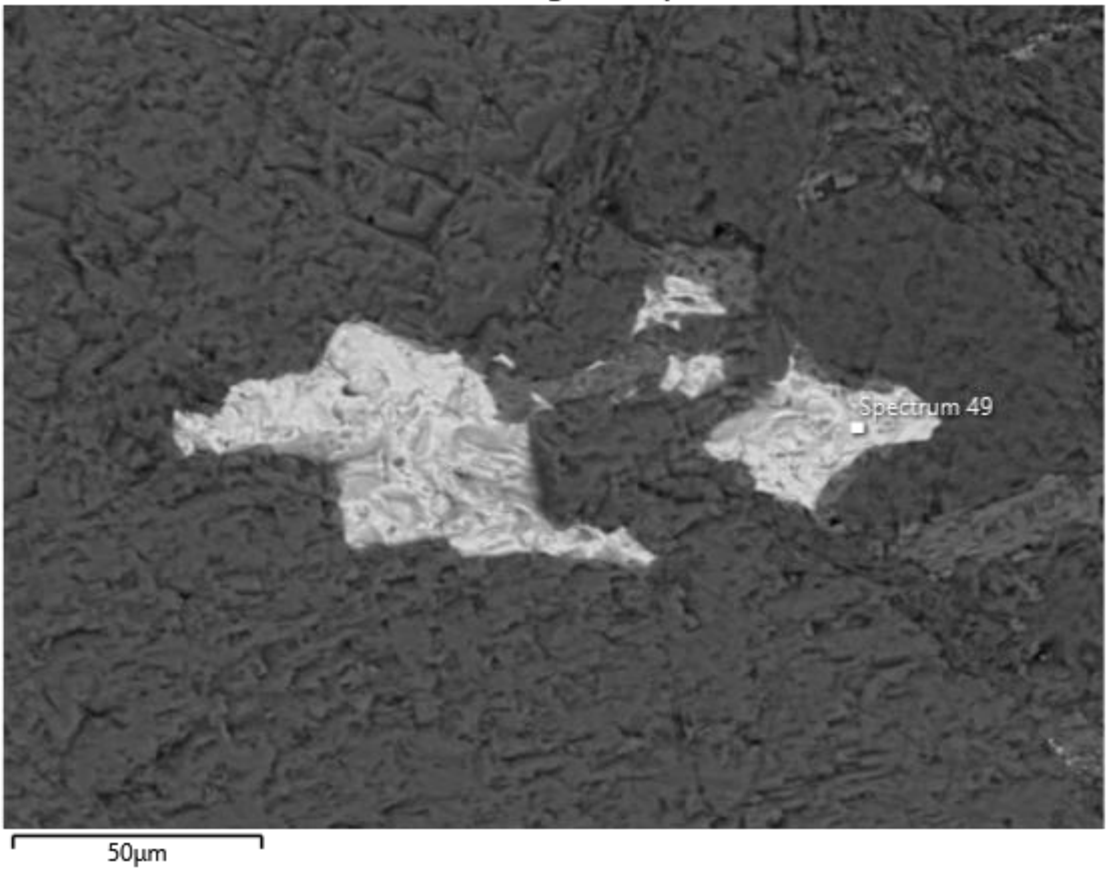
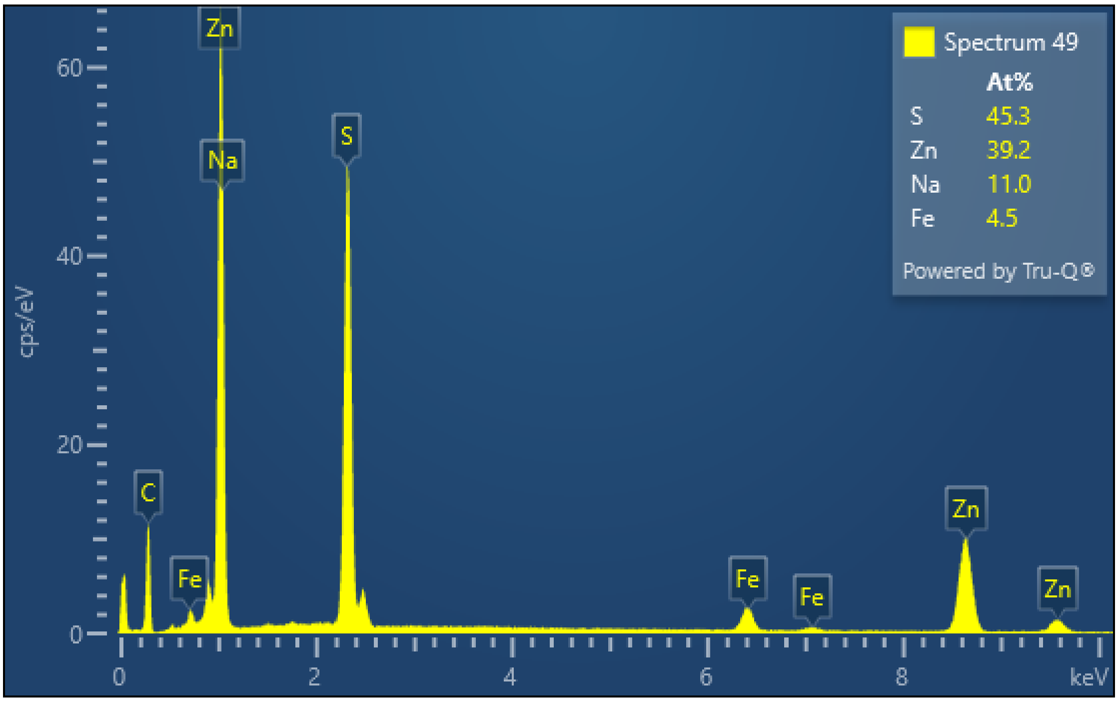
Electron Image 11 (Input1)



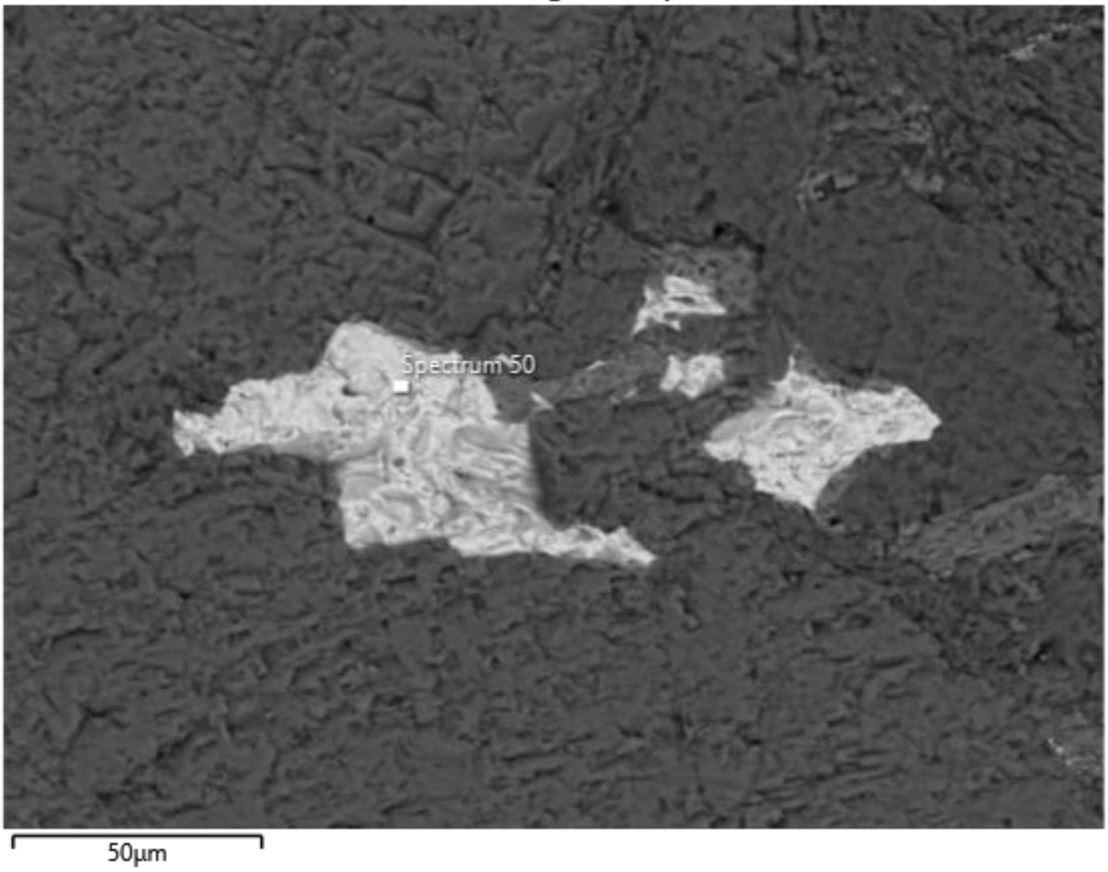


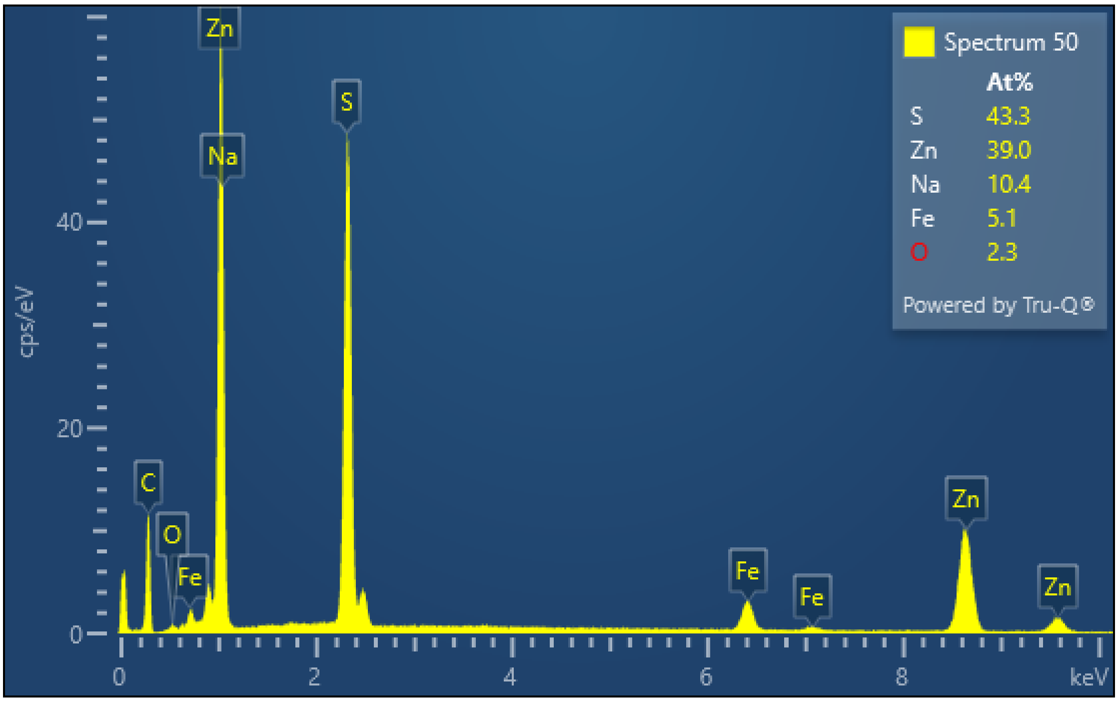
Electron Image 12 (Input1)



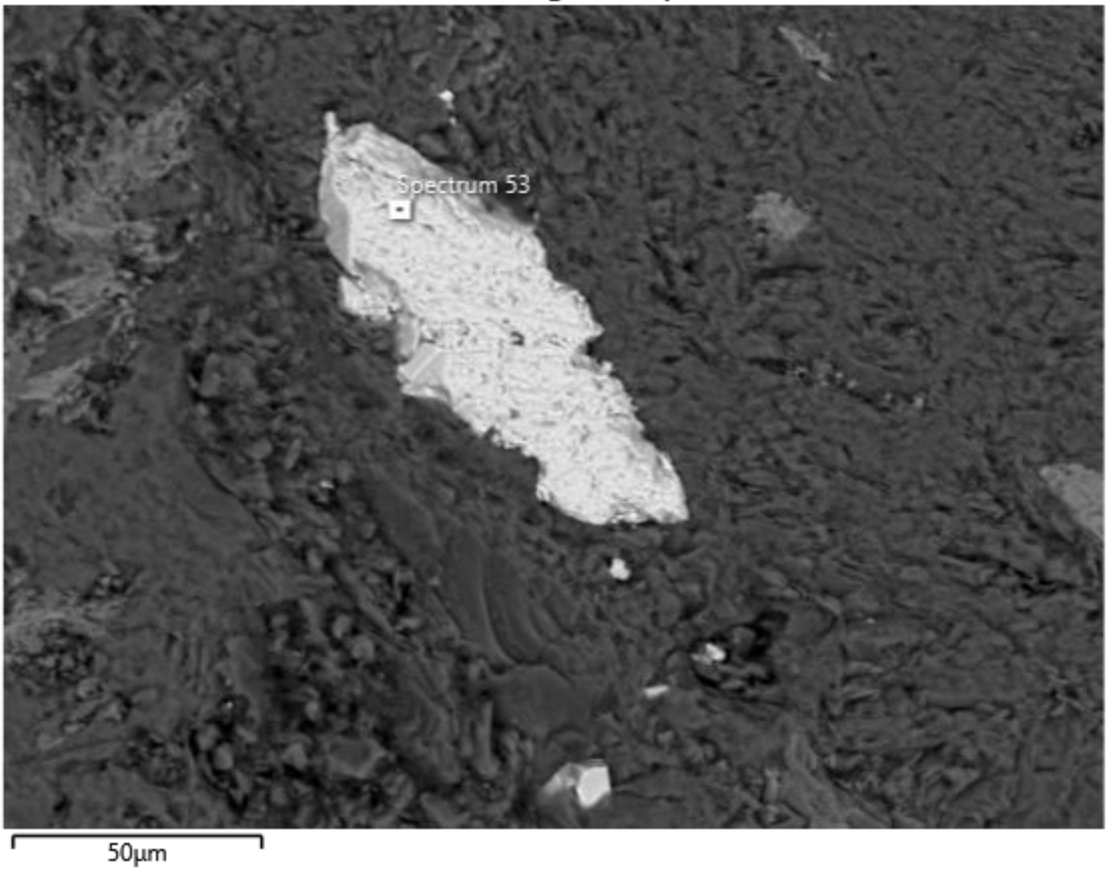


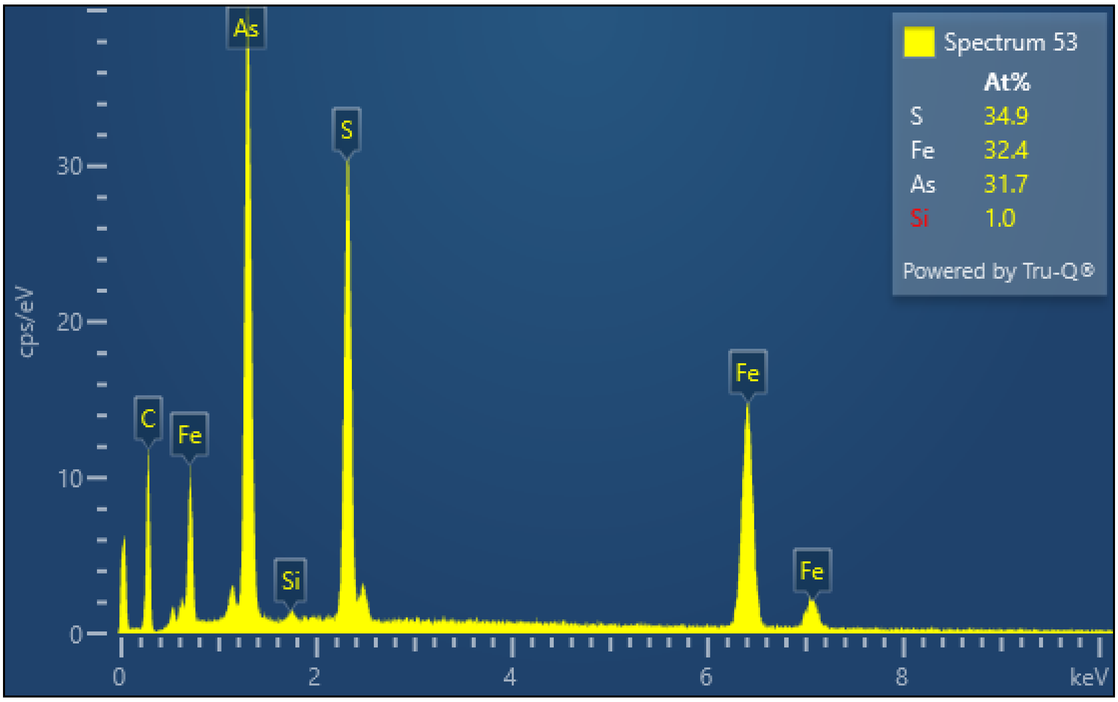
Electron Image 12 (Input1)



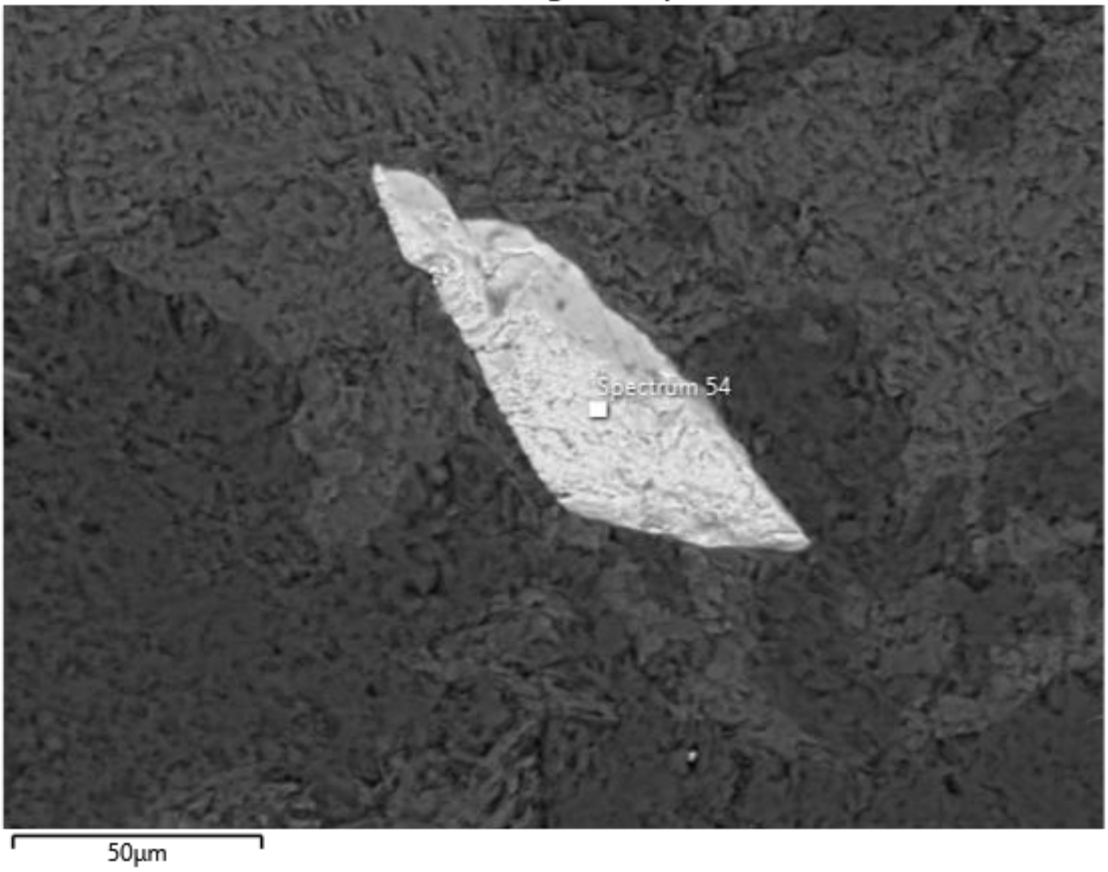


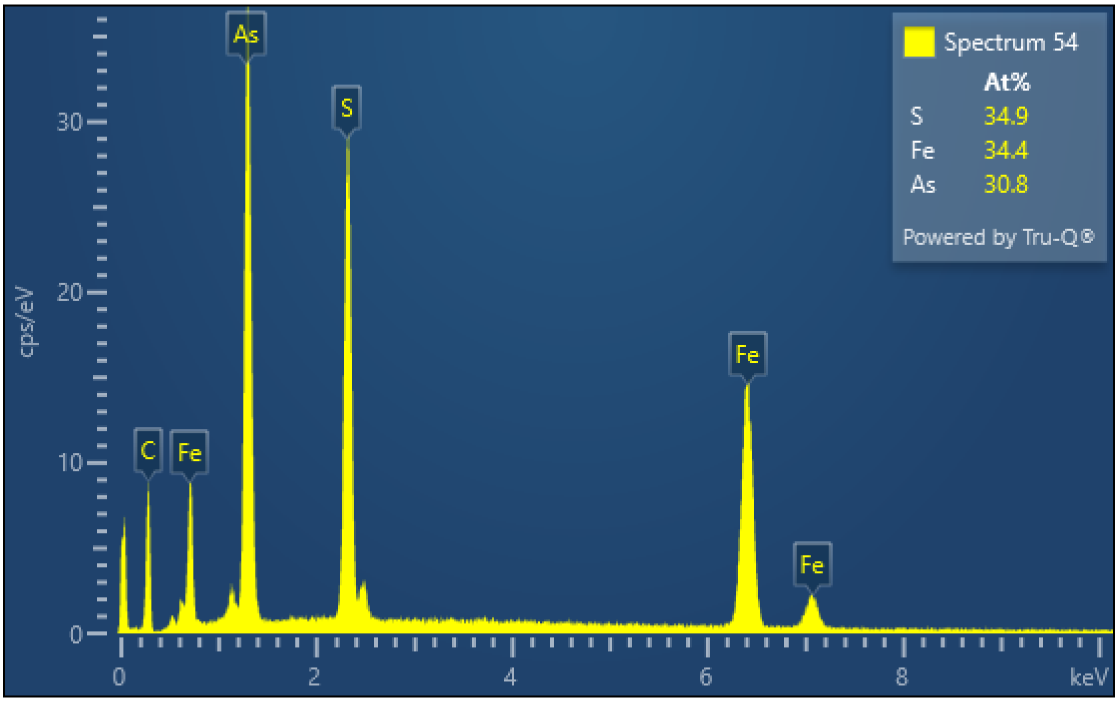
Electron Image 13 (Input1)



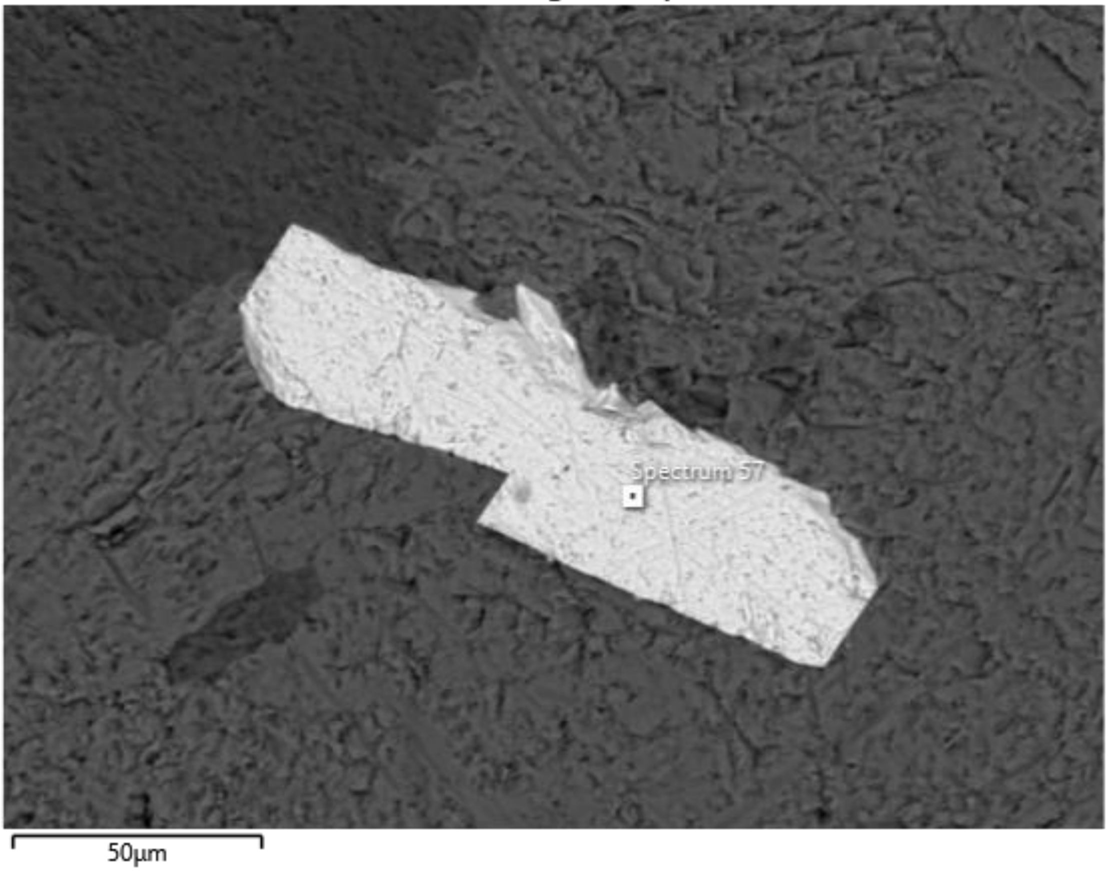


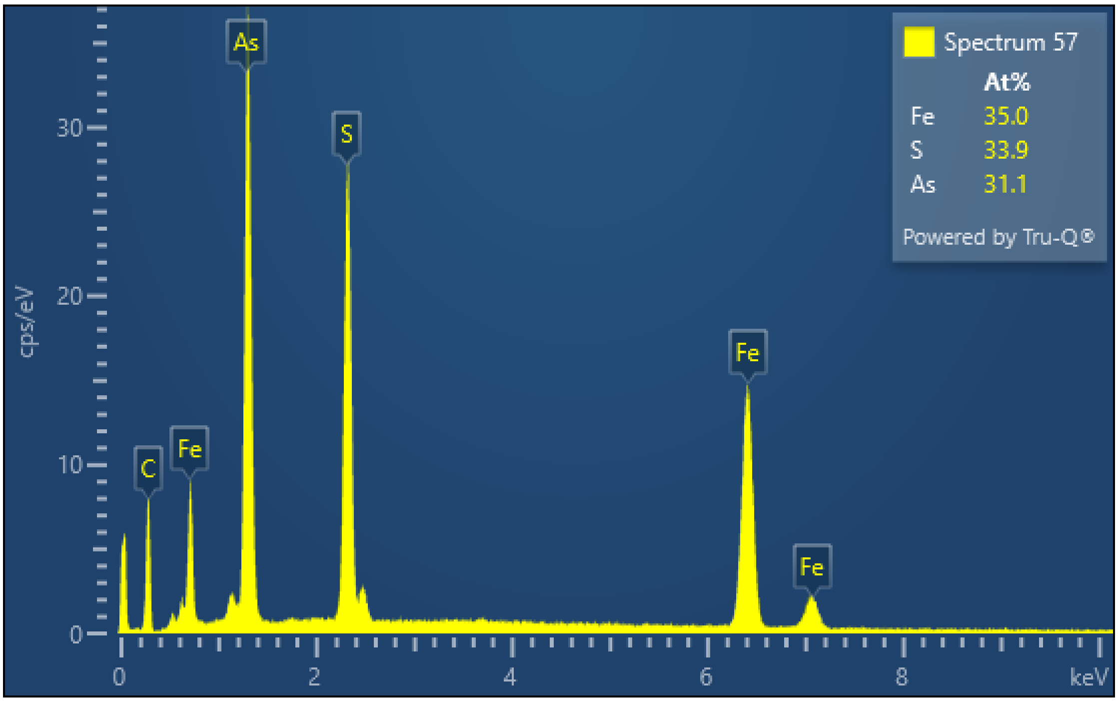
Electron Image 14 (Input1)



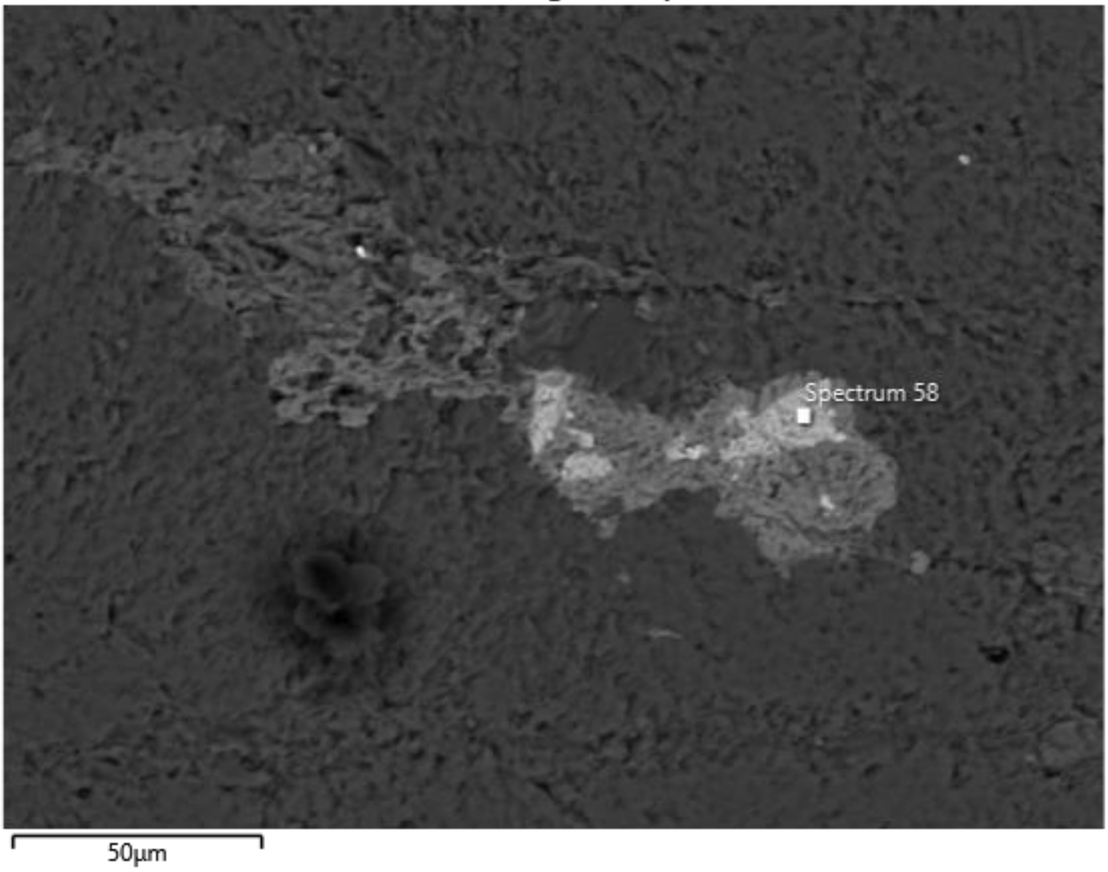


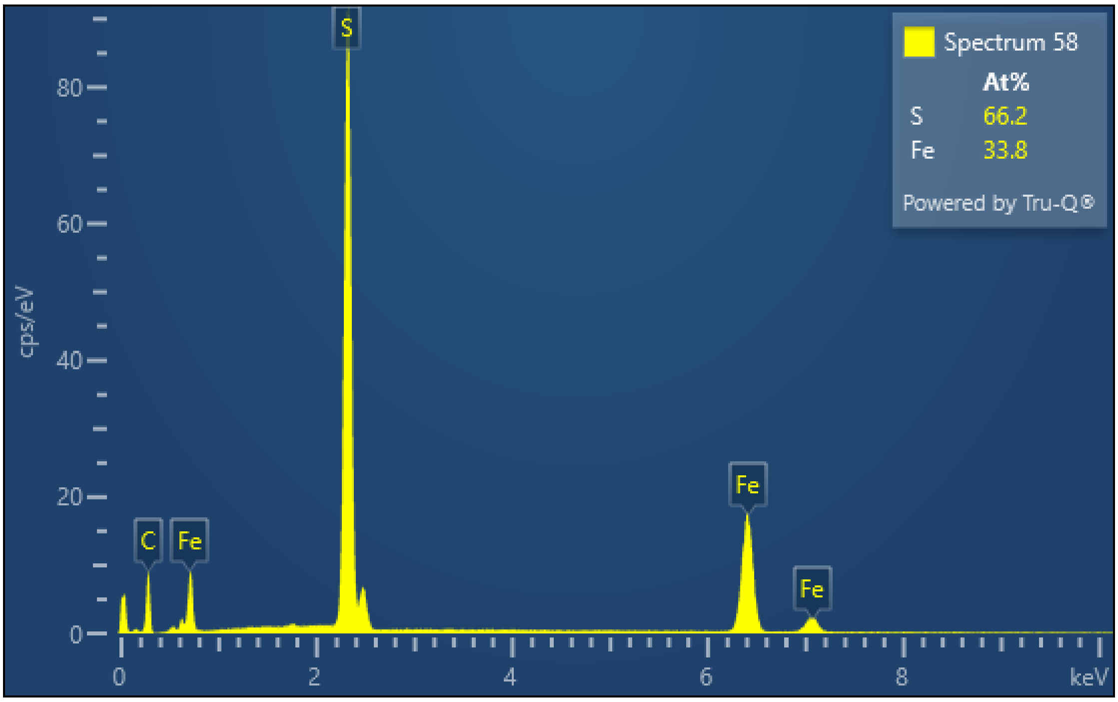
Electron Image 15 (Input1)





Electron Image 16 (Input1)





5 Alvan Street
Mount Lawley
WA 6050

Client:	Mine Waste Management NZ	**Date received:**	27/11/2024
Client address:	5 Sir William Pickering Drive BURNSIDE NZ 8053	**Date analysed:**	19/12/2024
Job number:	24_2171	**Date reported:**	20/12/2024
Lab ID:	24_2171_003		
Client ID:	**MG55795**		
Analysis:	Scanning electron microscopy (SEM) with elemental analysis by energy dispersive spectroscopy (EDS)		
Revision number:	0		
Comments:	None		

Sample preparation

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Approved: Rick Hughes, B.Sc.(Hons)Physics, MAIP

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Minor	<5 - ~180	Angular and aggregated particulate	S, Zn	Na	Si, K	O, Fe (trace to minor)	Zinc sulfide (sphalerite)	Possible
Minor	<5 - ~100	Angular and aggregated particulate	S, Fe, Cu	-	Ca	O (trace to minor)	Iron-copper sulfide (chalcopyrite)	Likely
Trace	<5 - ~250	Angular and aggregated particulate	S, Fe, As	-	Si	-	Arsenic-iron sulfide (arsenopyrite)	Likely

[1] indicates whether multiple options may be possible with similar stoichiometries. Confirmation by other techniques such as XRD or FTIR may be necessary for increased confidence. *Most of the sulfur-based minerals are surrounded by oxygen-containing minerals such as silica, iron oxides, and various aluminosilicates. The oxygen from the surrounding materials may interfere with the sulfur-containing particles, allowing oxygen to show as a trace or minor phase in the analysis of the sulfur particles. Most of the time this will be from the surrounding materials, however we assign a 'possible' confidence as to not rule out the possibility of partial oxidation of the sulfur mineral present.*

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Trace	< ~1

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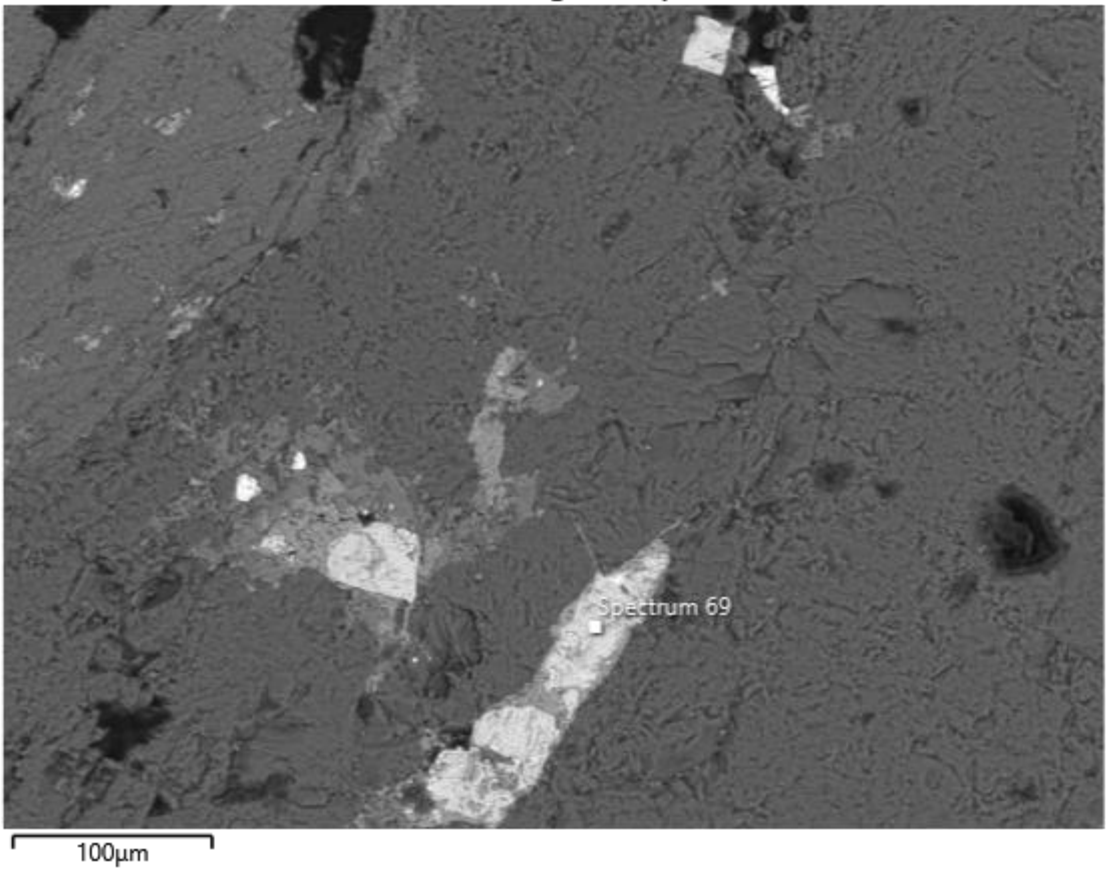
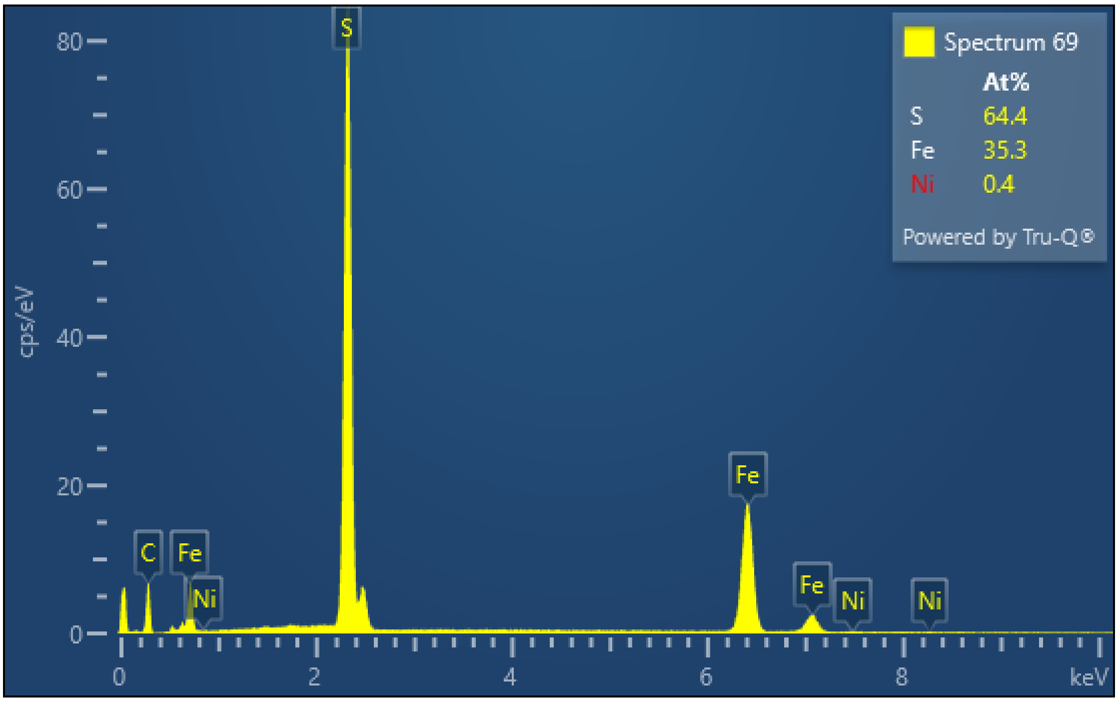
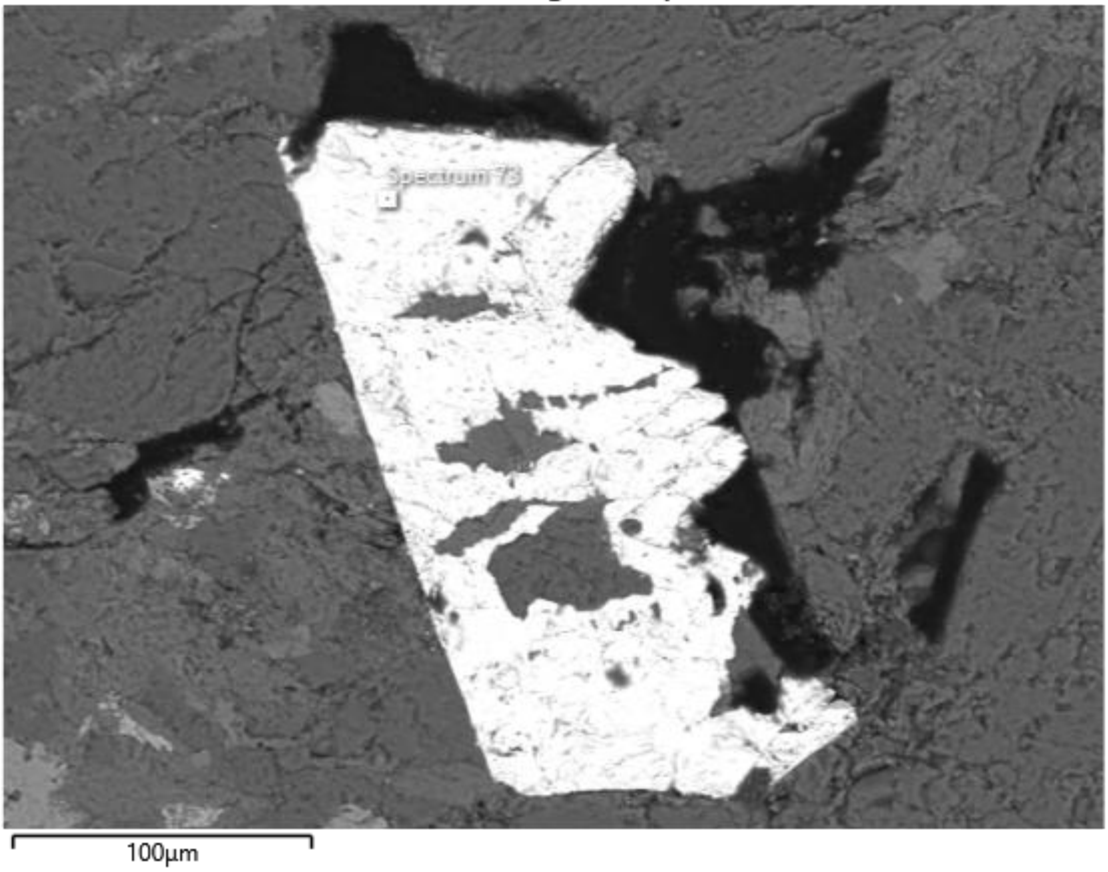
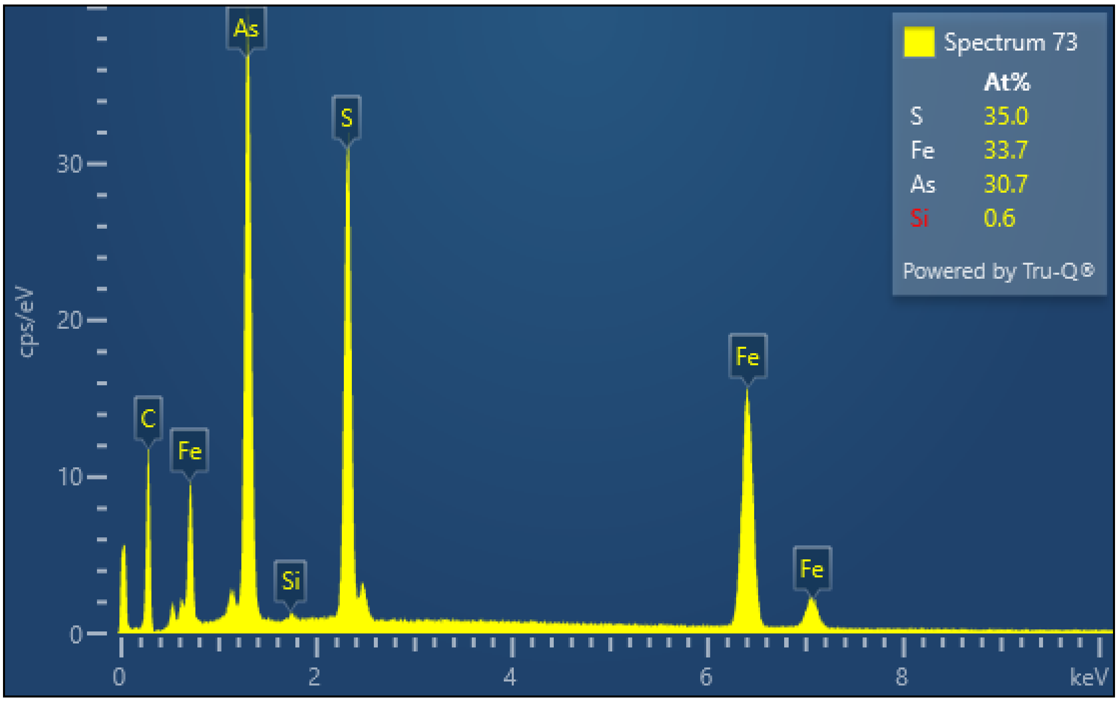
Electron Image 11 (Input1)



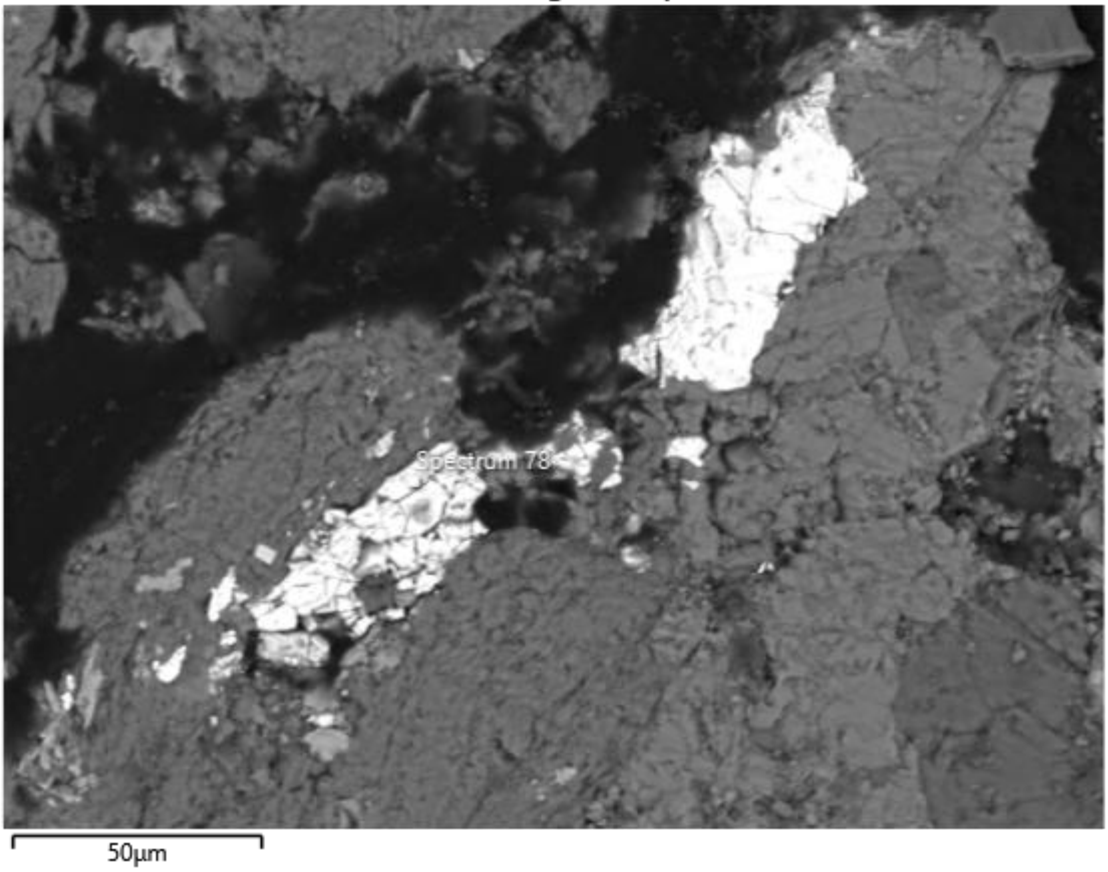


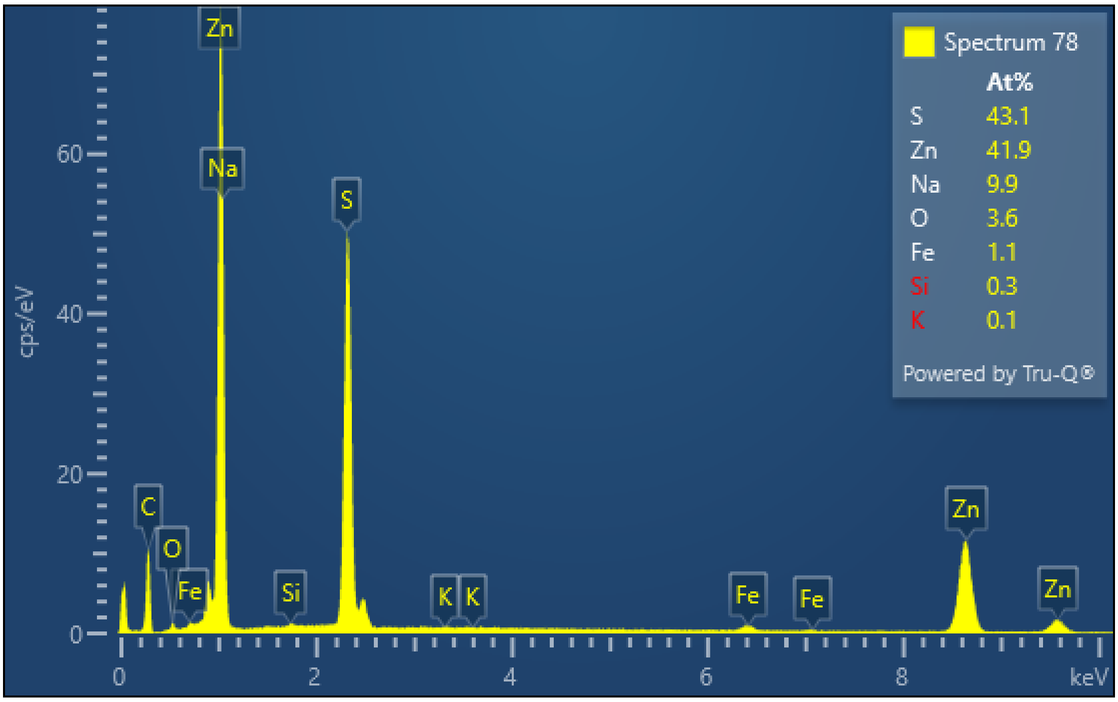
Electron Image 12 (Input1)



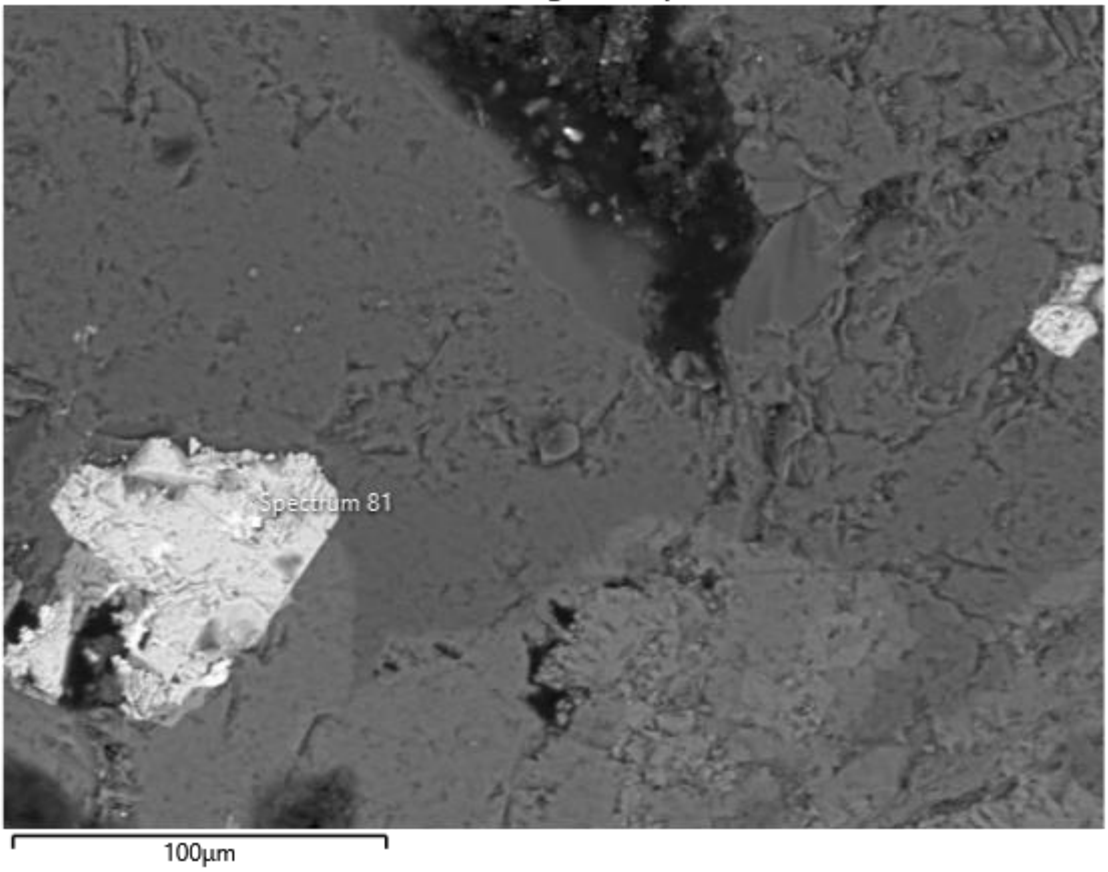


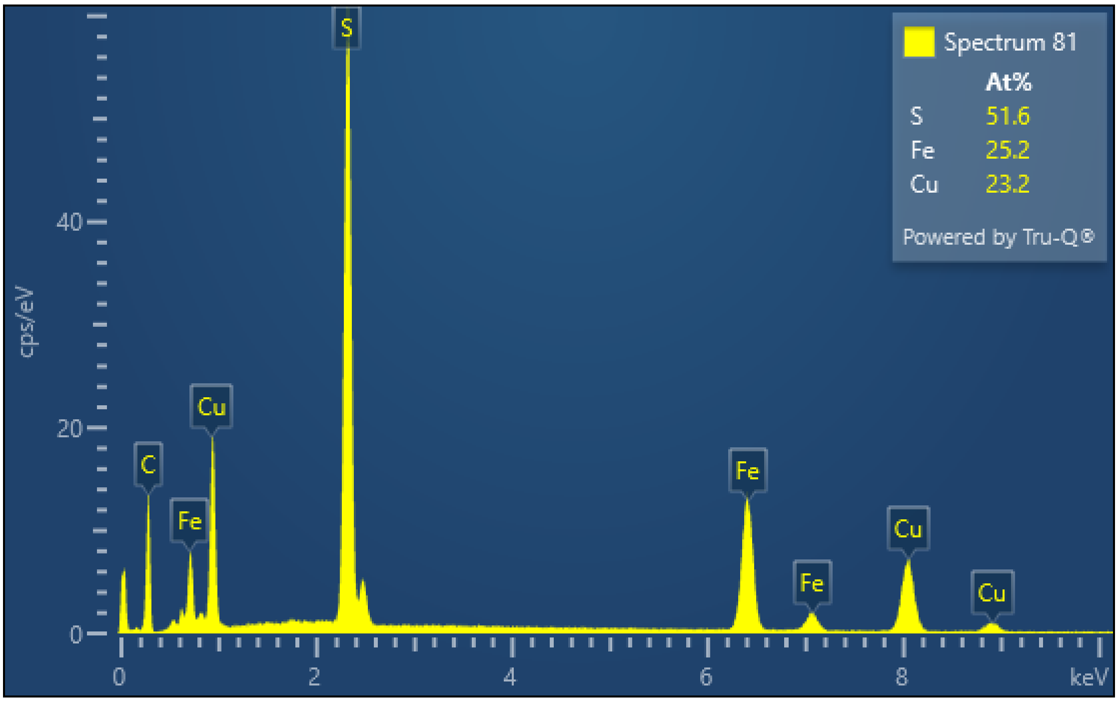
Electron Image 13 (Input1)



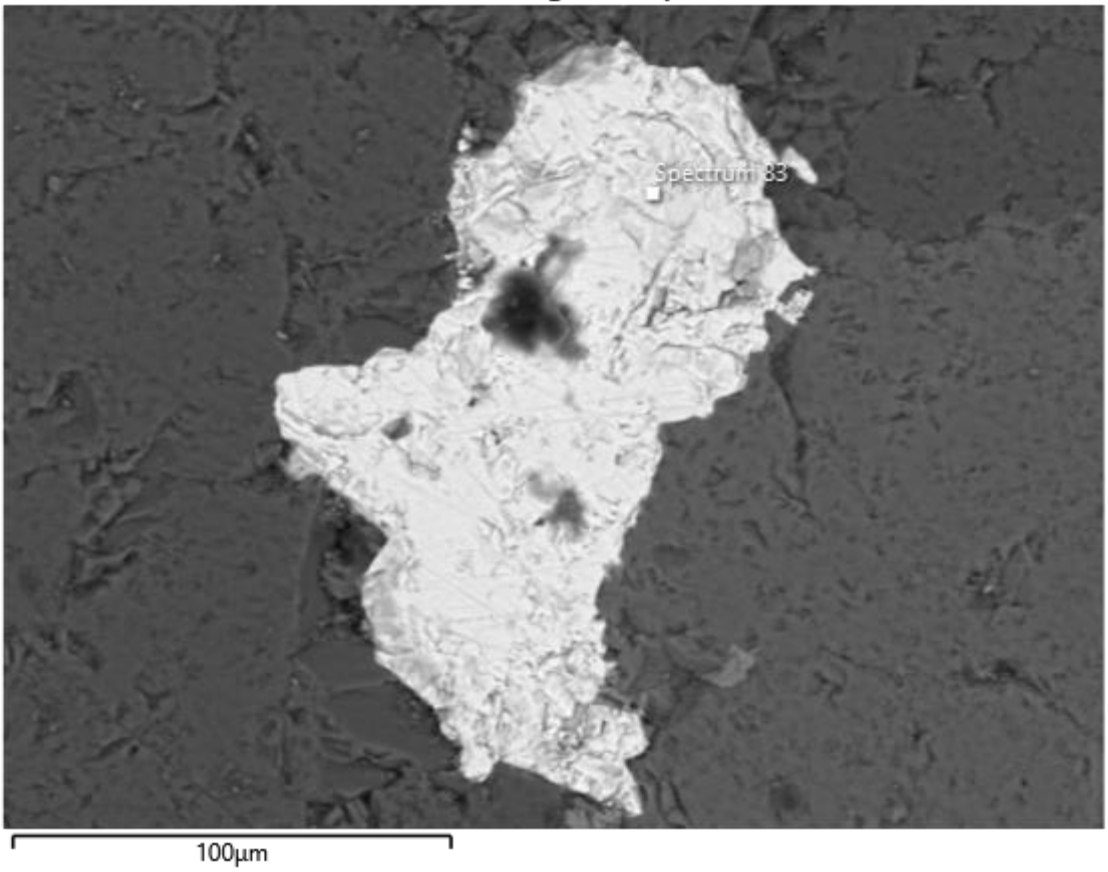


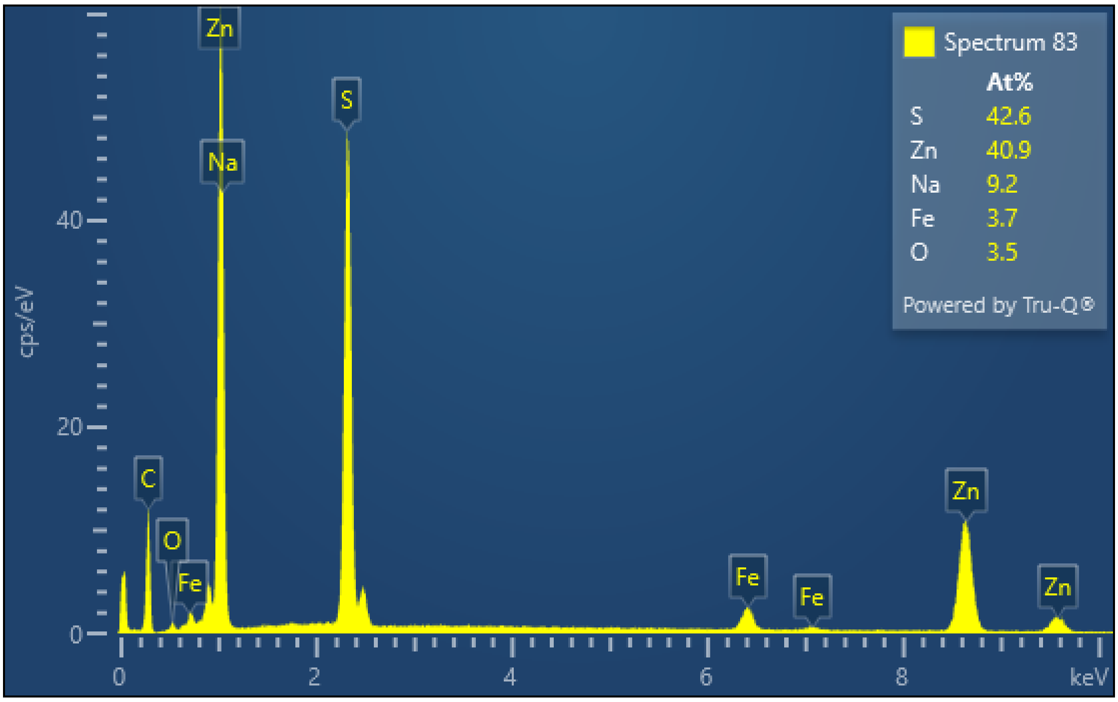
Electron Image 14 (Input1)



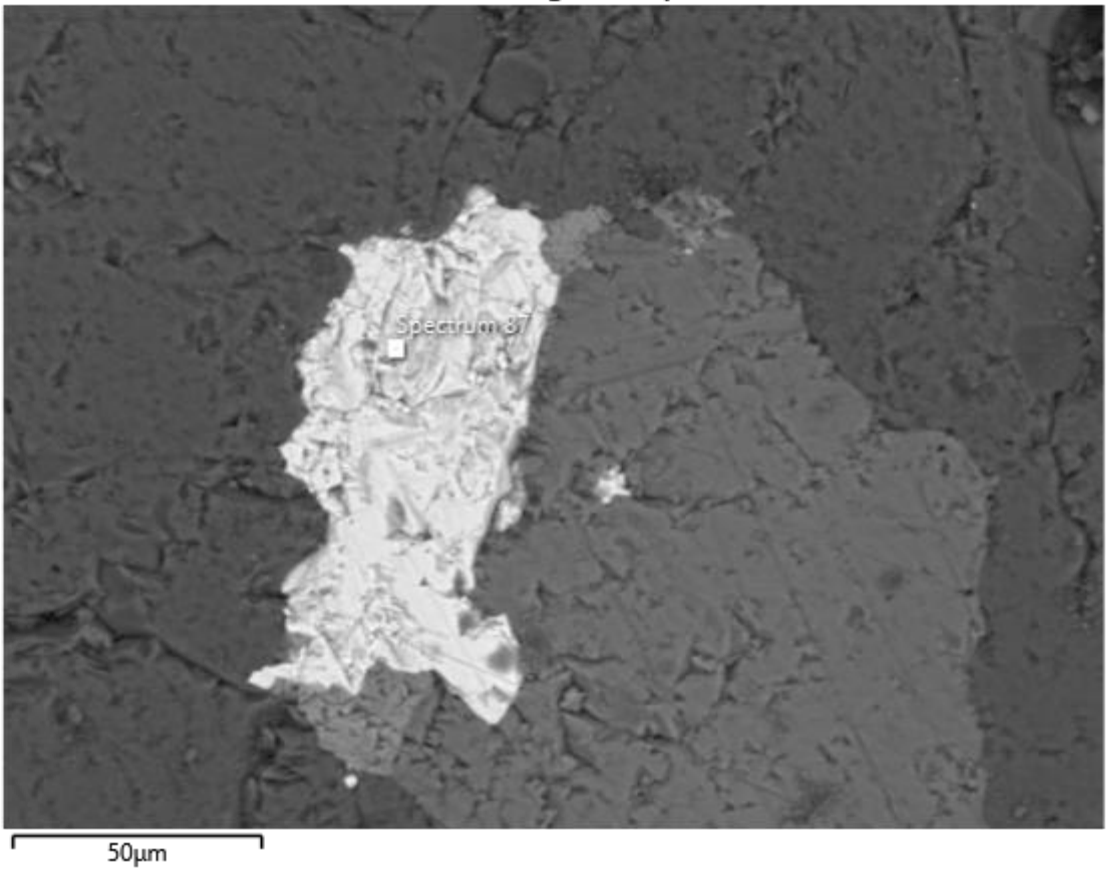


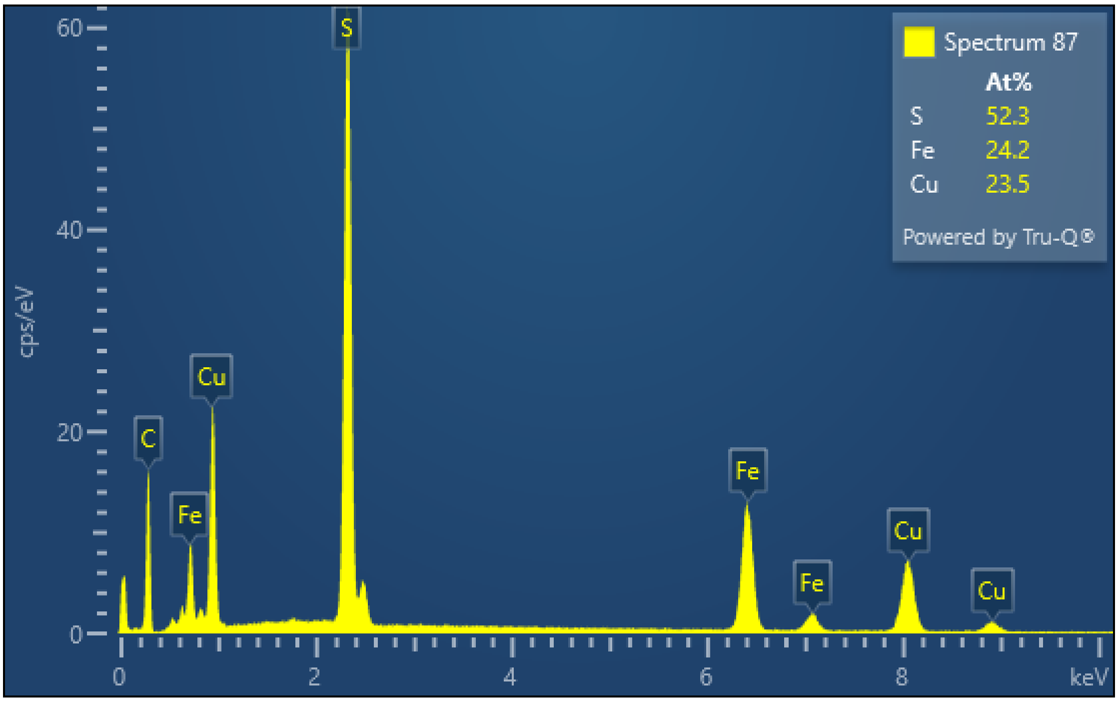
Electron Image 15 (Input1)



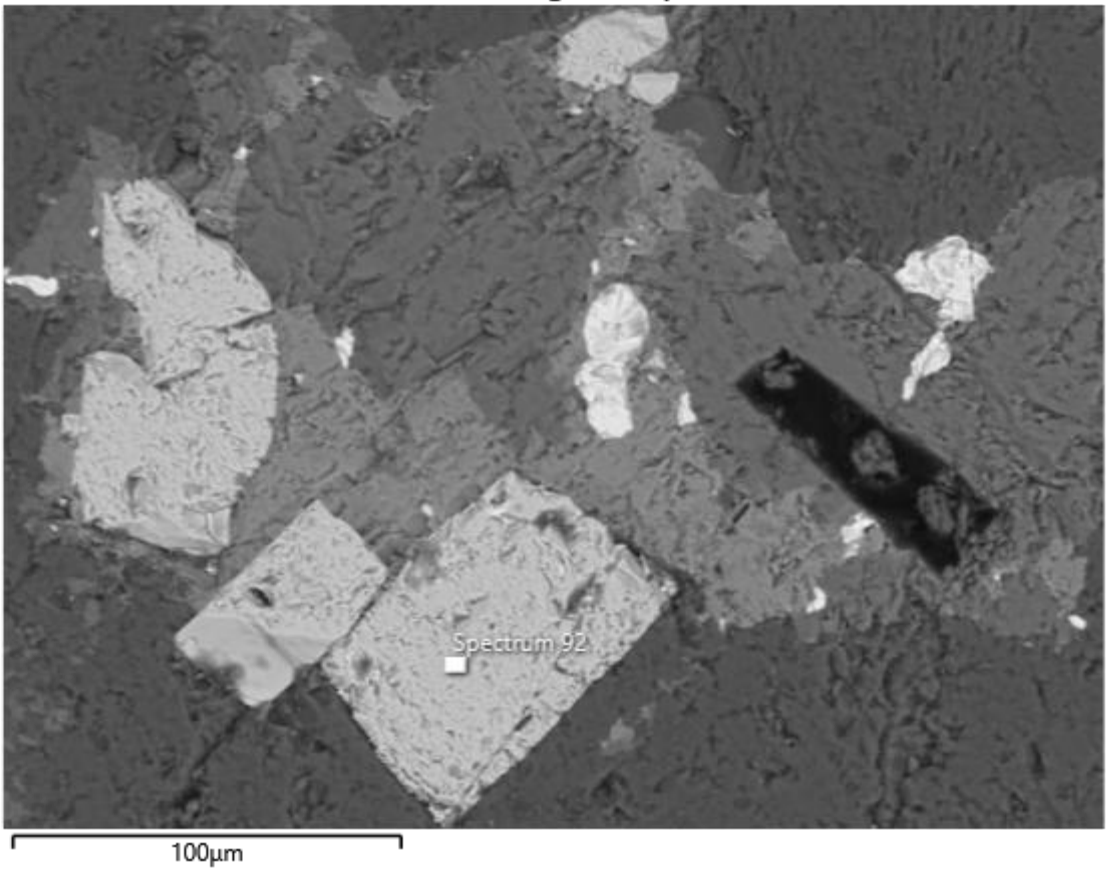


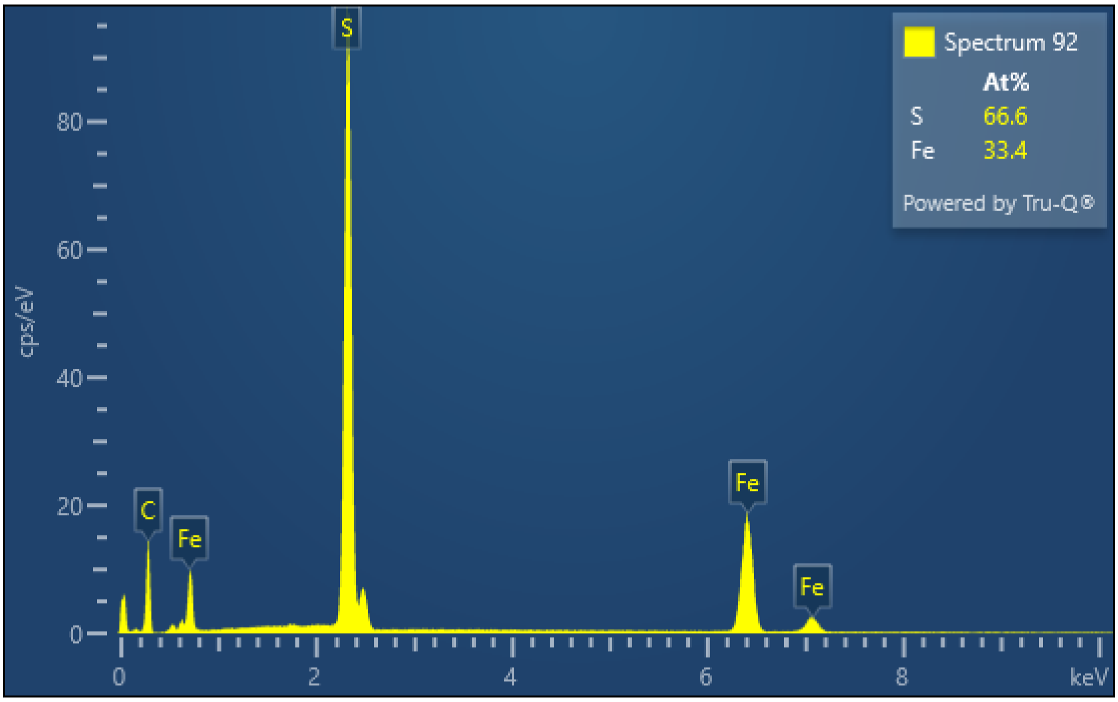
Electron Image 16 (Input1)



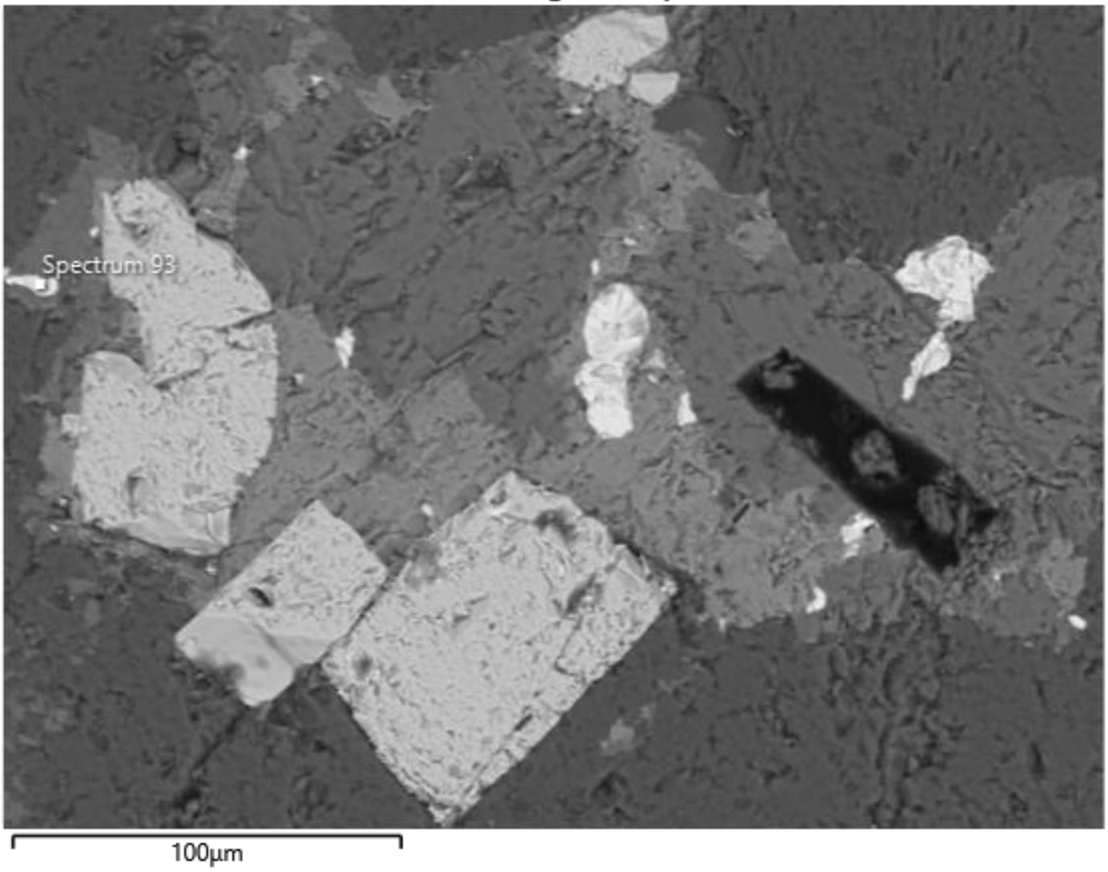


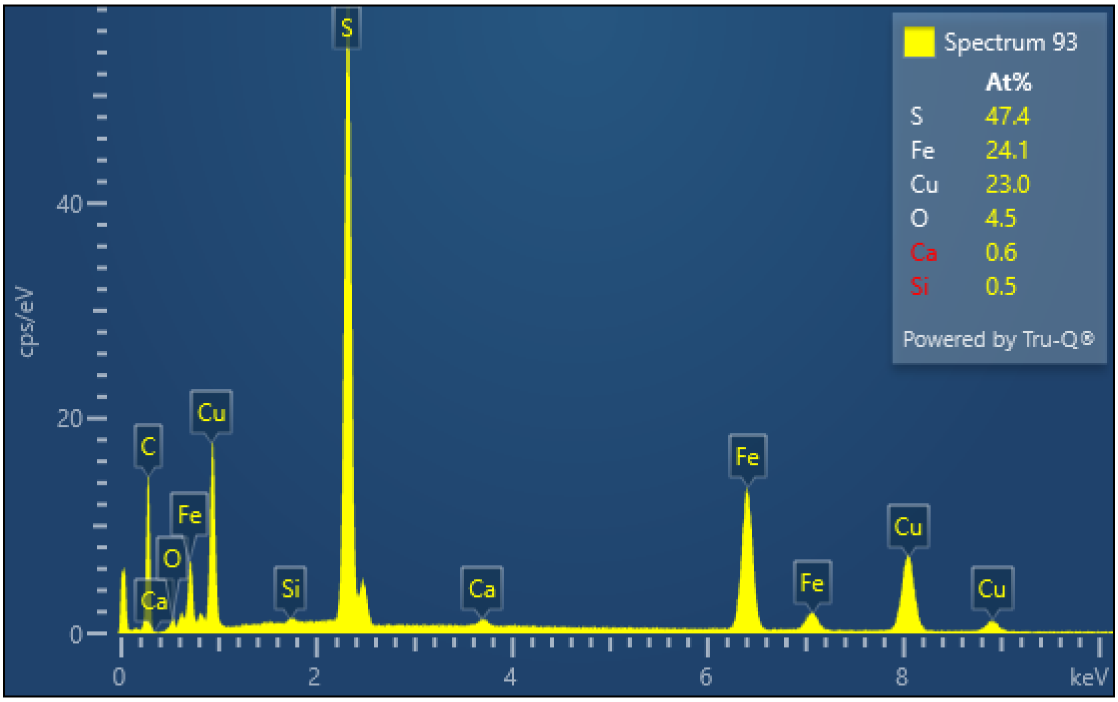
Electron Image 17 (Input1)





Electron Image 17 (Input1)





5 Alvan Street
Mount Lawley
WA 6050

Client:	Mine Waste Management NZ	**Date received:**	27/11/2024
Client address:	5 Sir William Pickering Drive BURNSIDE NZ 8053	**Date analysed:**	19/12/2024
Job number:	24_2171	**Date reported:**	20/12/2024
Lab ID:	24_2171_004		
Client ID:	**MG55796**		
Analysis:	Scanning electron microscopy (SEM) with elemental analysis by energy dispersive spectroscopy (EDS)		
Revision number:	0		
Comments:	None		

Sample preparation

The sample was supplied to Microanalysis Australia as a bulk drill core sample.

The sample was mounted in epoxy resin and polished to a flat surface before being carbon coated. Non-conducting samples require coating prior to SEM analysis to prevent charging whilst being analysed by the electron beam.

Analysis

The sample was analysed using a Carl Zeiss EVO50 scanning electron microscope (SEM) fitted with an Oxford INCA X-Max energy dispersive spectrometer (EDS).

EDS is a semi-quantitative technique (at best) on well prepared, optically flat samples. Factors such as sample unevenness may adversely bias elemental concentration interpretation. EDS has a spatial resolution of ~5 µm meaning spectra from particles less than this size may contain elemental concentrations biased by their surroundings. Analysis was conducted at 20 KeV unless otherwise stated.

No calibration standards (standardless quant) were used in the EDS detector standardization prior to analysis.

Summary

All images were acquired using backscatter electrons (BSE) unless otherwise specified. For BSE, image contrast is directly proportional to average atomic number i.e. the brighter the area, the higher the atomic number.

The mineralogy of particles identified has been summarised in the following table (**Table 1: Mineralogy summary of particles observed**) and have been listed in order of abundance i.e. major, minor or trace quantities of particles.

Analyst: Damon Blakey, *B.Sc. (Forensic Biology and Toxicology)*

Reported: Damon Blakey, *B.Sc. (Forensic Biology and Toxicology)*

Approved: Rick Hughes, B.Sc.(Hons)Physics, MAIP

Table 1: Mineralogy summary of sulfur-based particles observed

Compound/phase relative abundance[2]	Size range (µm)	Observed morphology	Observed composition (elements present)				Assumed compound/phase	Compound/phase confidence[1] (Likely/possible)
			Major	Minor	Trace	Varying		
Major	<5 - ~630	Angular particulate	S, Fe, As	-	Ca	-	Arsenic-iron sulfide (arsenopyrite)	Likely
Minor	<5 - ~250	Angular and aggregated particulate	S, Fe	-	Cu, Ni, As	-	Iron sulfide (pyrite/pyrrhotite)	Likely
Minor	<5 - ~35	Angular and aggregated particulate	S, Zn	Na	-	Fe, O (trace to minor)	Zinc sulfide (sphalerite)	Possible

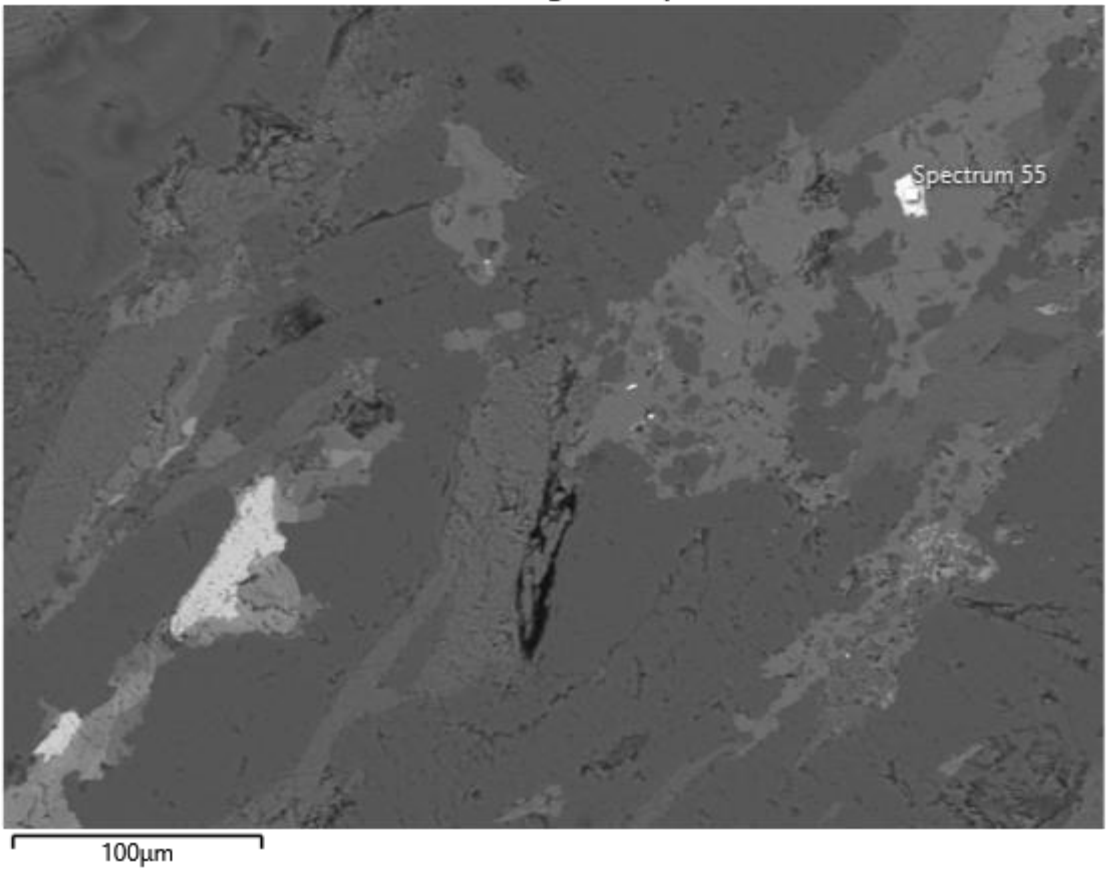
[1] indicates whether multiple options may be possible with similar stoichiometries. Confirmation by other techniques such as XRD or FTIR may be necessary for increased confidence. *Most of the sulfur-based minerals are surrounded by oxygen-containing minerals such as silica, iron oxides, and various aluminosilicates. The oxygen from the surrounding materials may interfere with the sulfur-containing particles, allowing oxygen to show as a trace or minor phase in the analysis of the sulfur particles. Most of the time this will be from the surrounding materials, however we assign a 'possible' confidence as to not rule out the possibility of partial oxidation of the sulfur mineral present.*

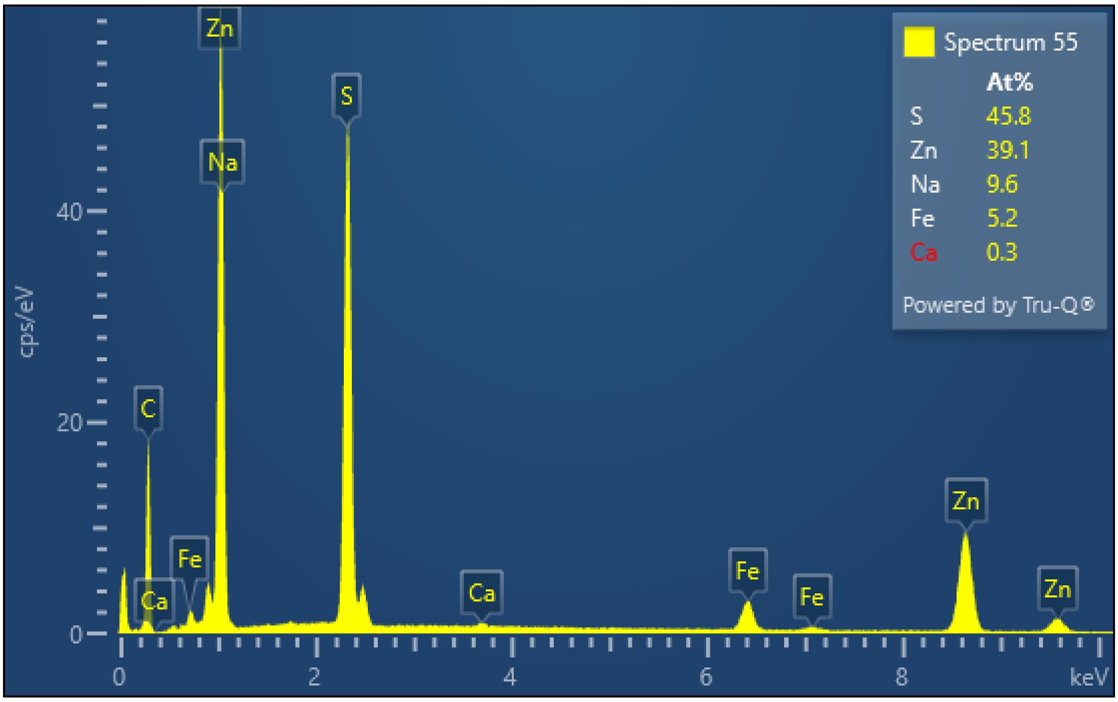
[2] The interpreted compound abundance qualifiers (major, minor, trace) are based on the following categories and are presented by number (count) of observed particles as opposed to wt% or ppm as would be reported by ICP/XRF. **All sulfur-based phases within the sample are trace. This is an abundance relative only to each other type of sulfur-based mineral present.**

Qualifier	*Approximate* range, number %
Major	> ~30
Minor	~1 to ~30
Trace	< ~1

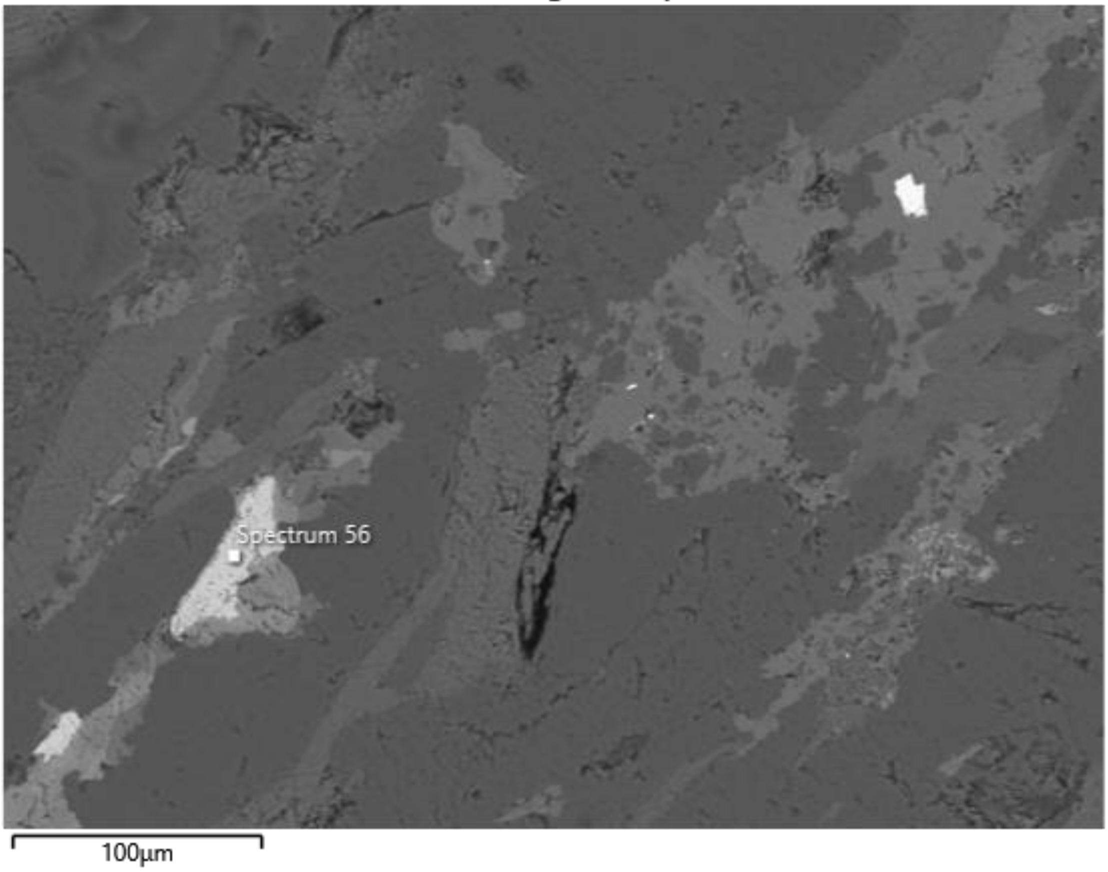
The range (above) is stated as '*Approximate*' as the technique is more a qualitative measure of relative abundance as opposed to a quantitative absolute abundance. The abundance is stated as number percent as no calculations have been made to transform geometric sizes into particle volumes, nor density values used to calculate weight fractions that would enable weight percentages to be quoted.

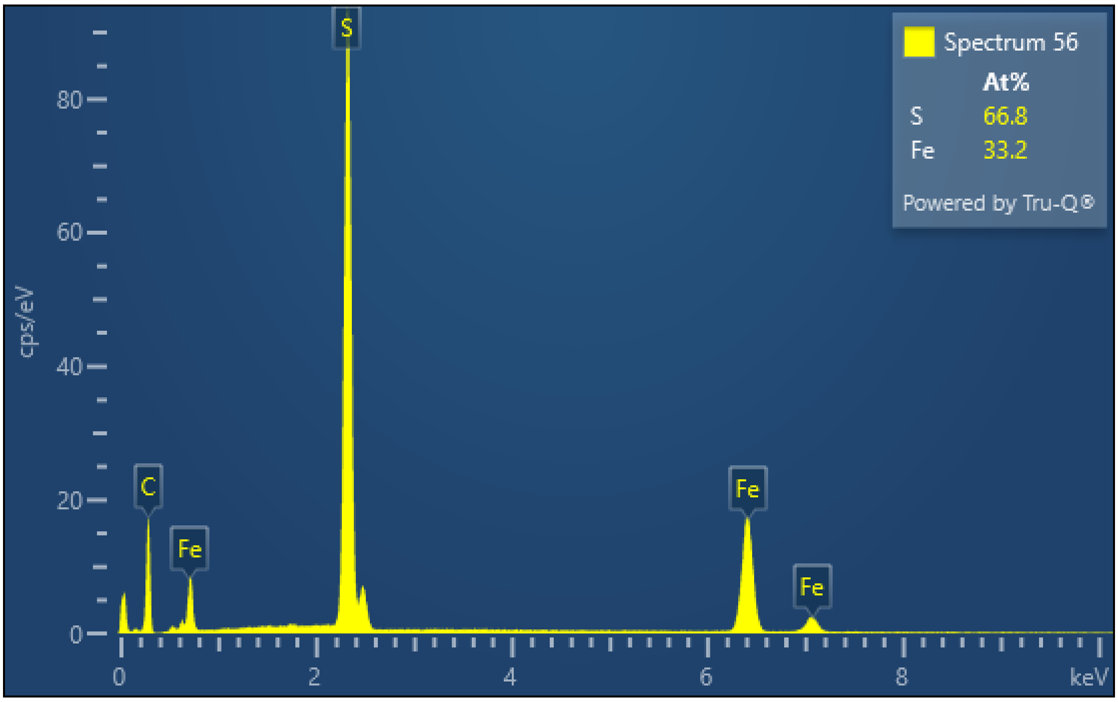
Electron Image 16 (Input1)



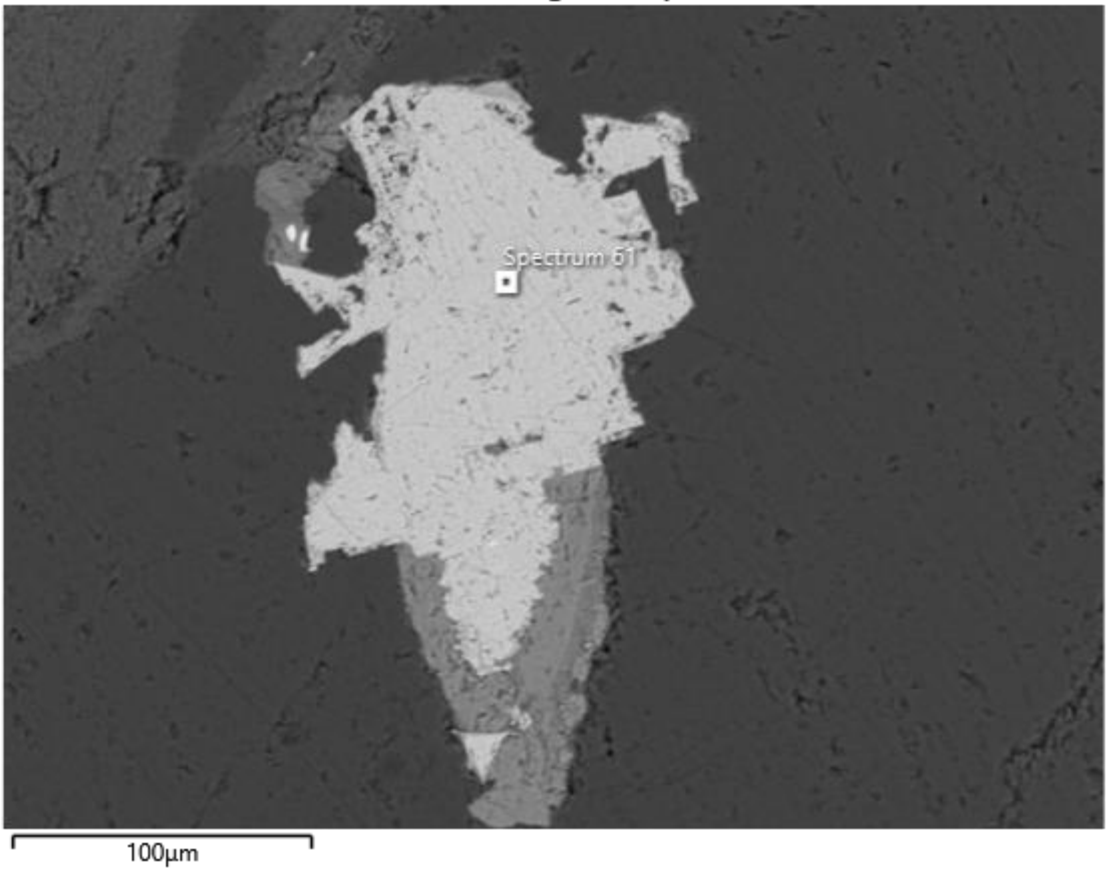


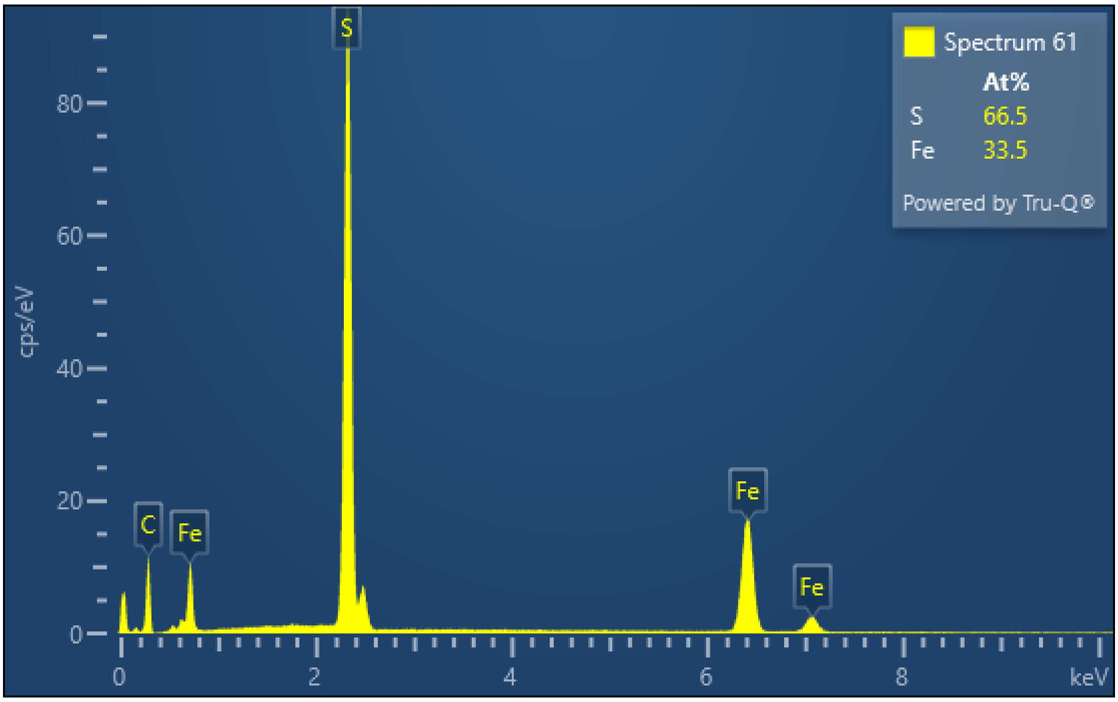
Electron Image 16 (Input1)



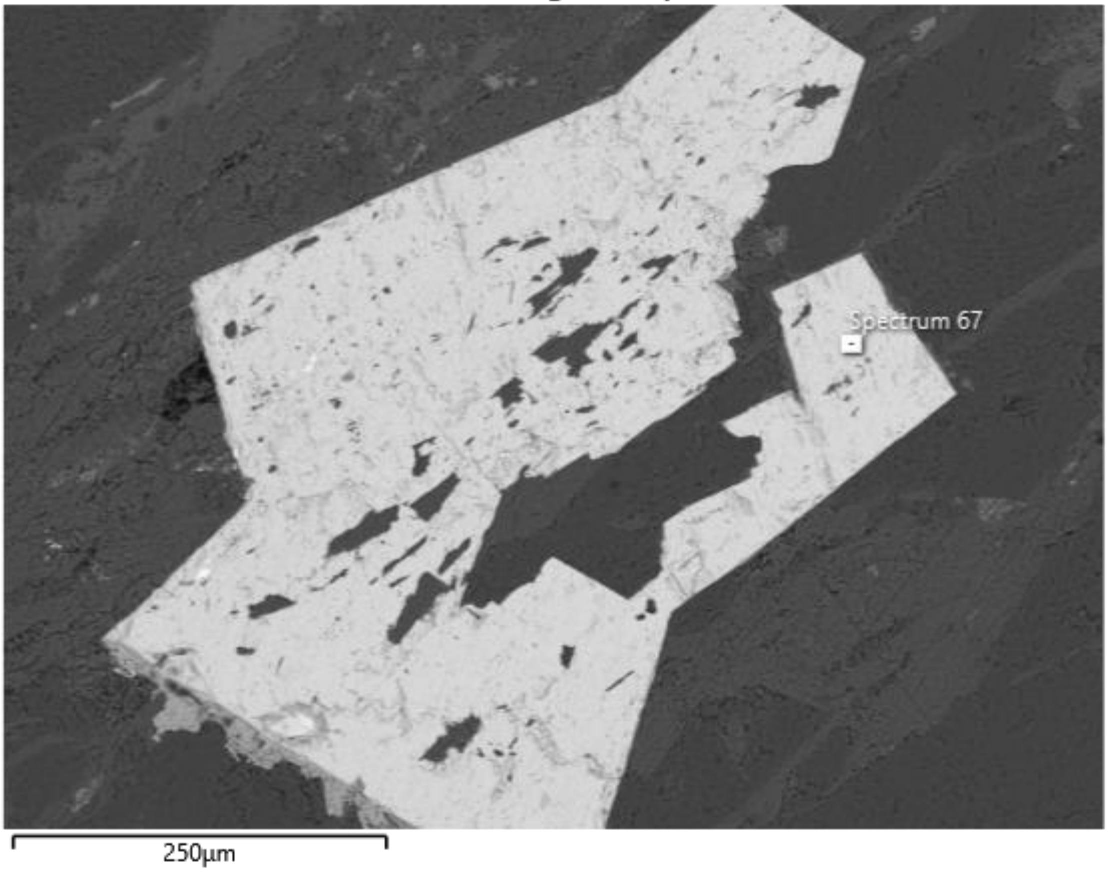


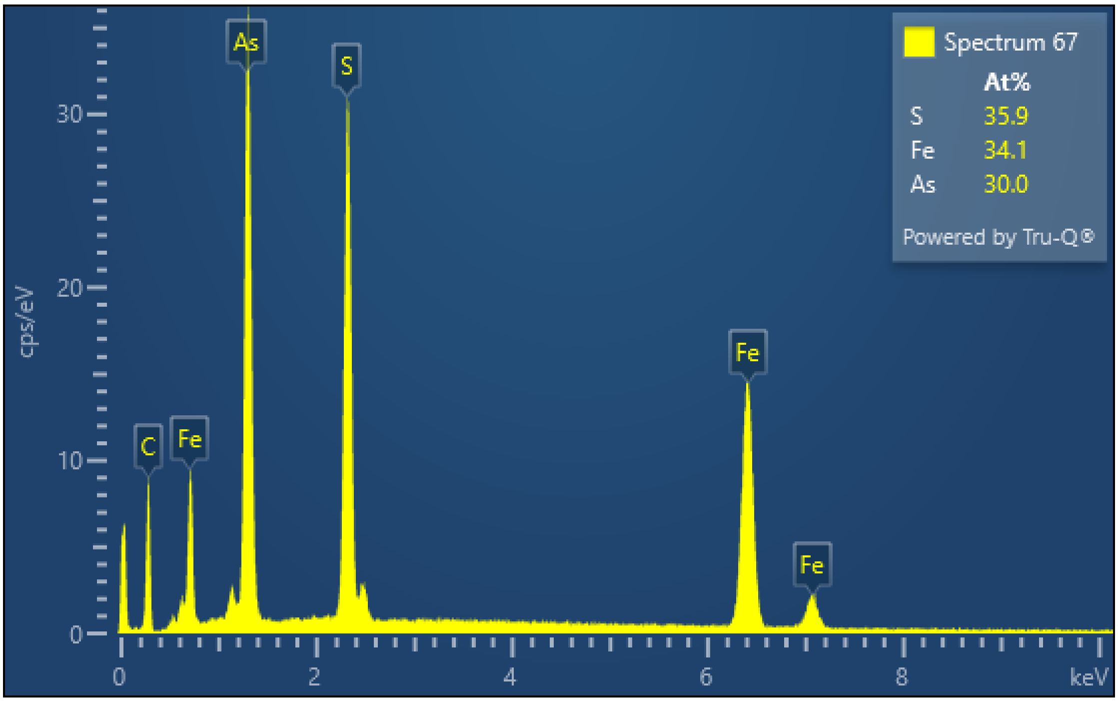
Electron Image 17 (Input1)



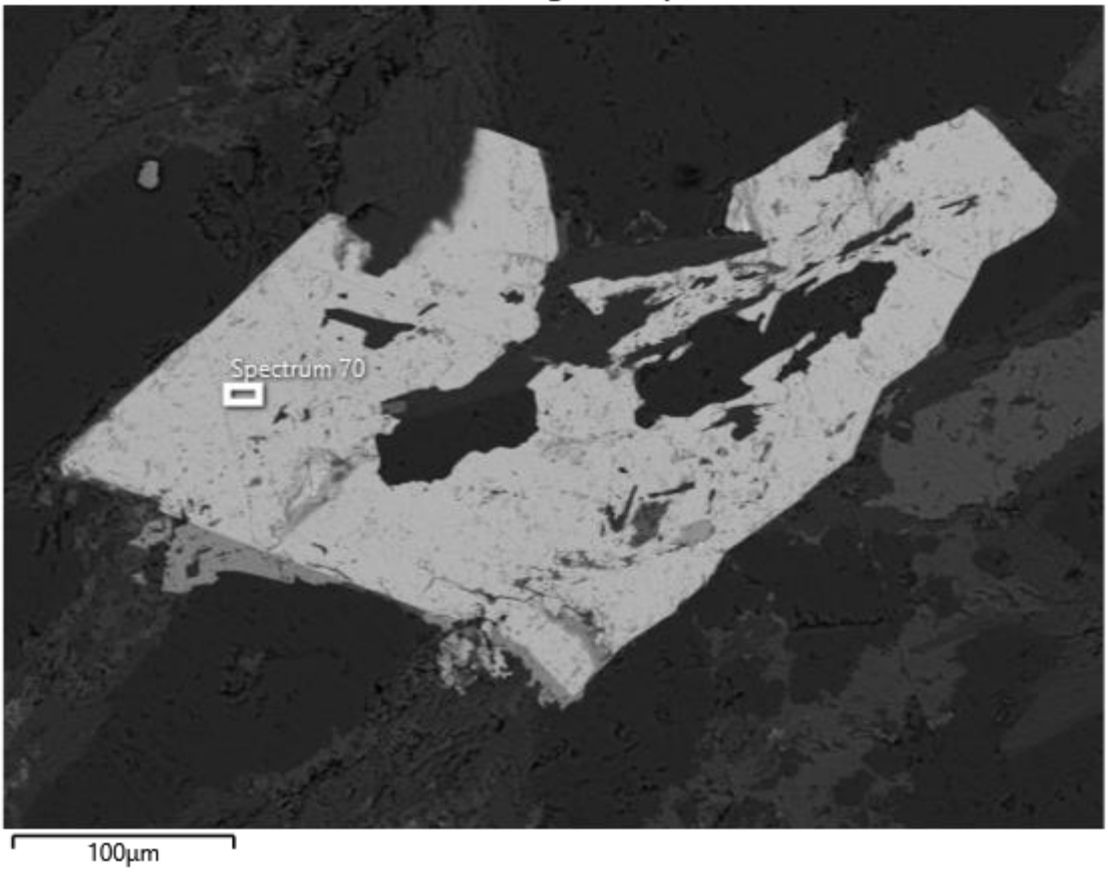


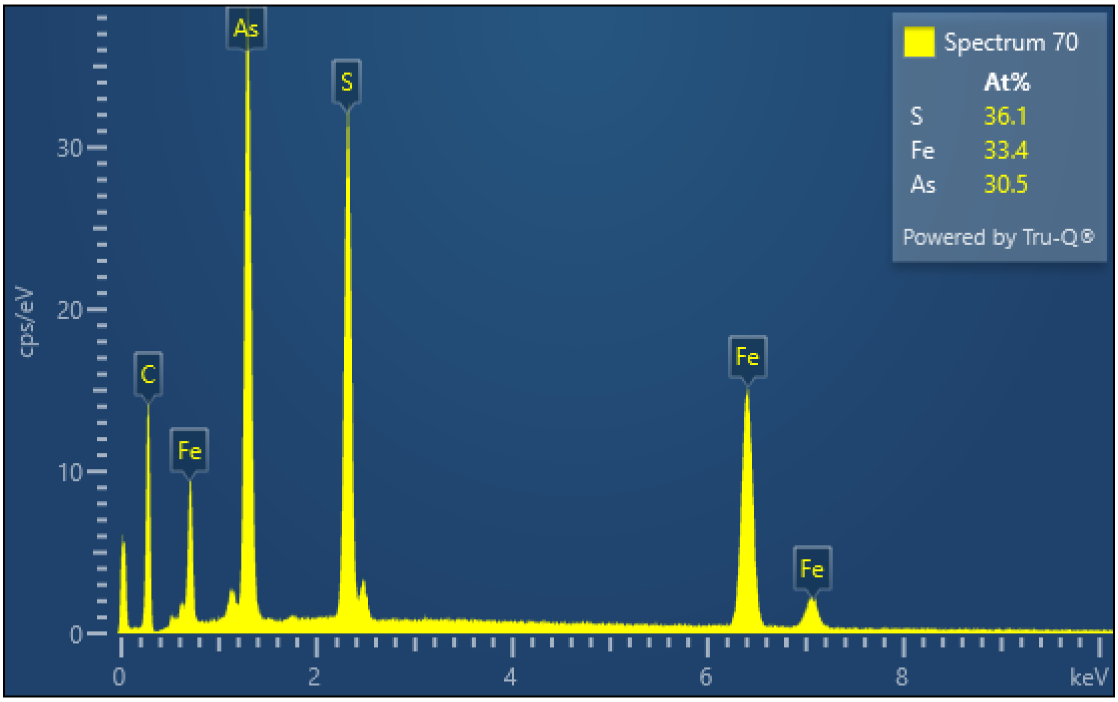
Electron Image 18 (Input1)



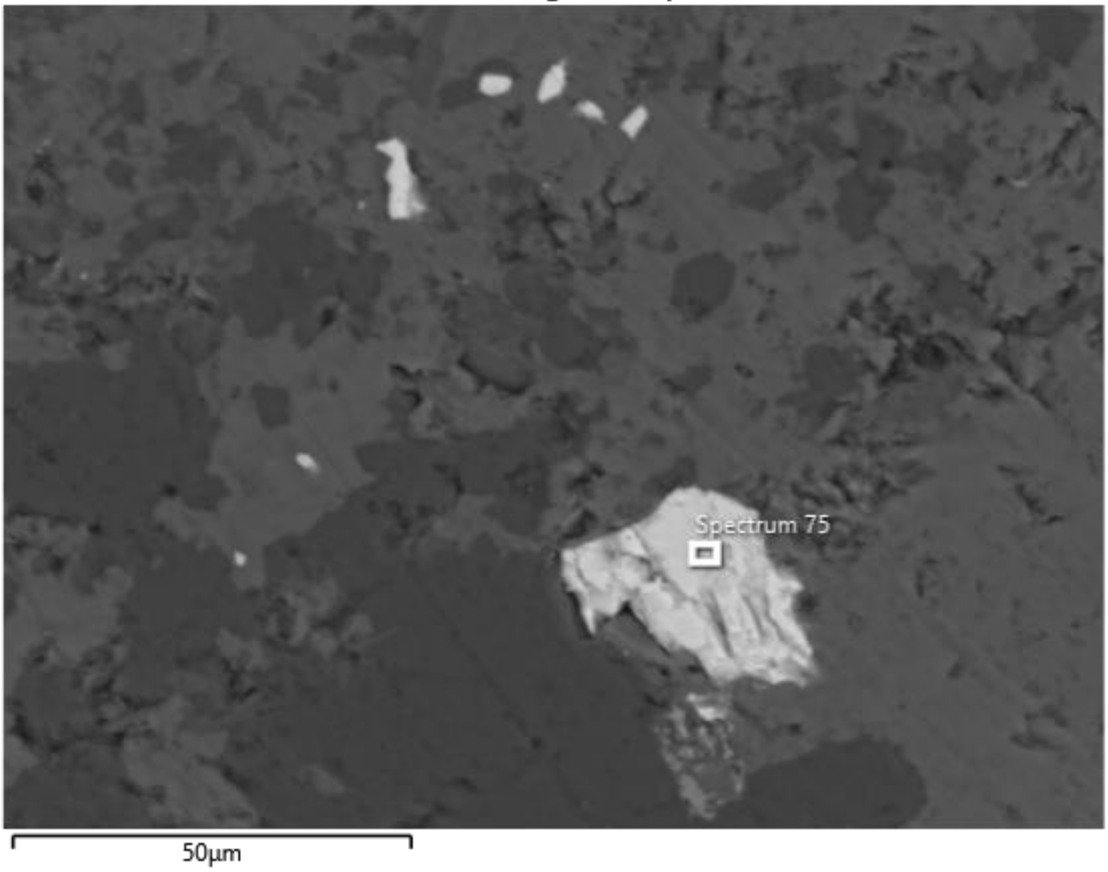


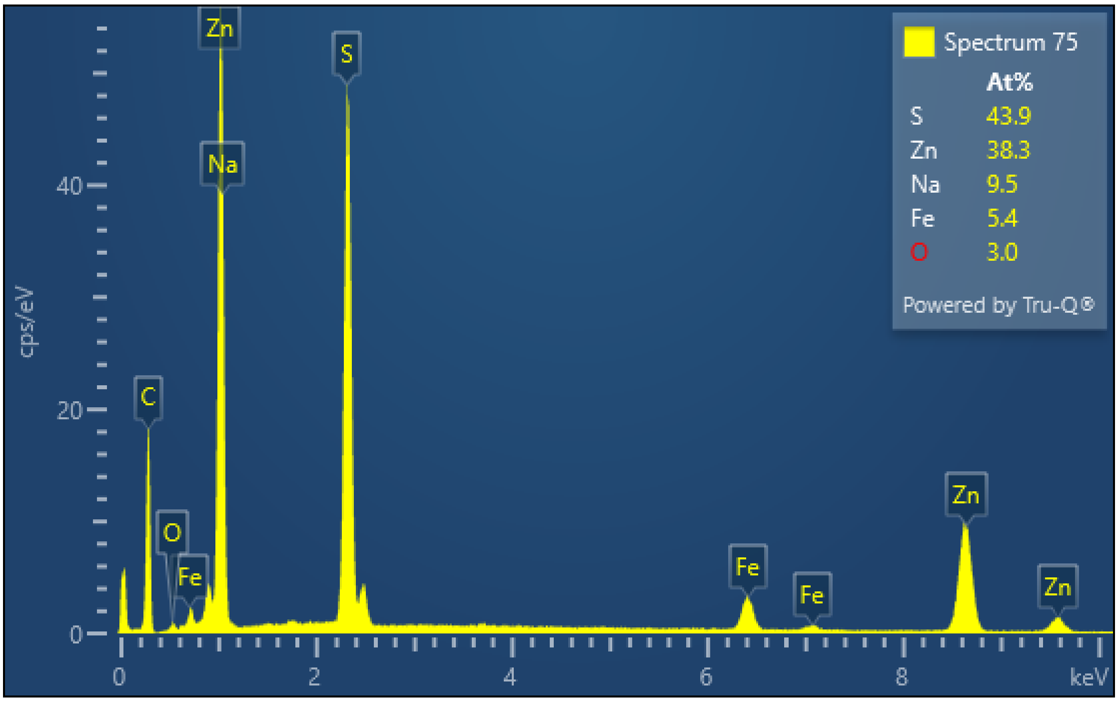
Electron Image 19 (Input1)



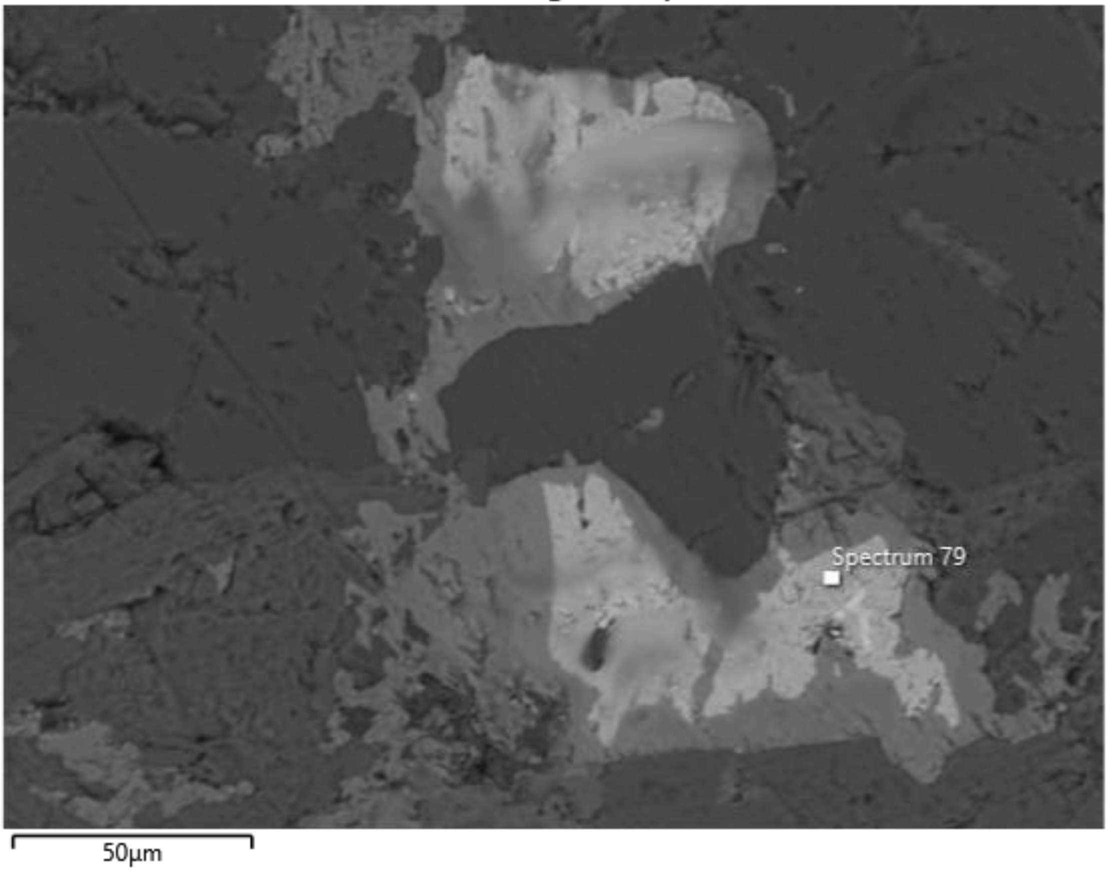


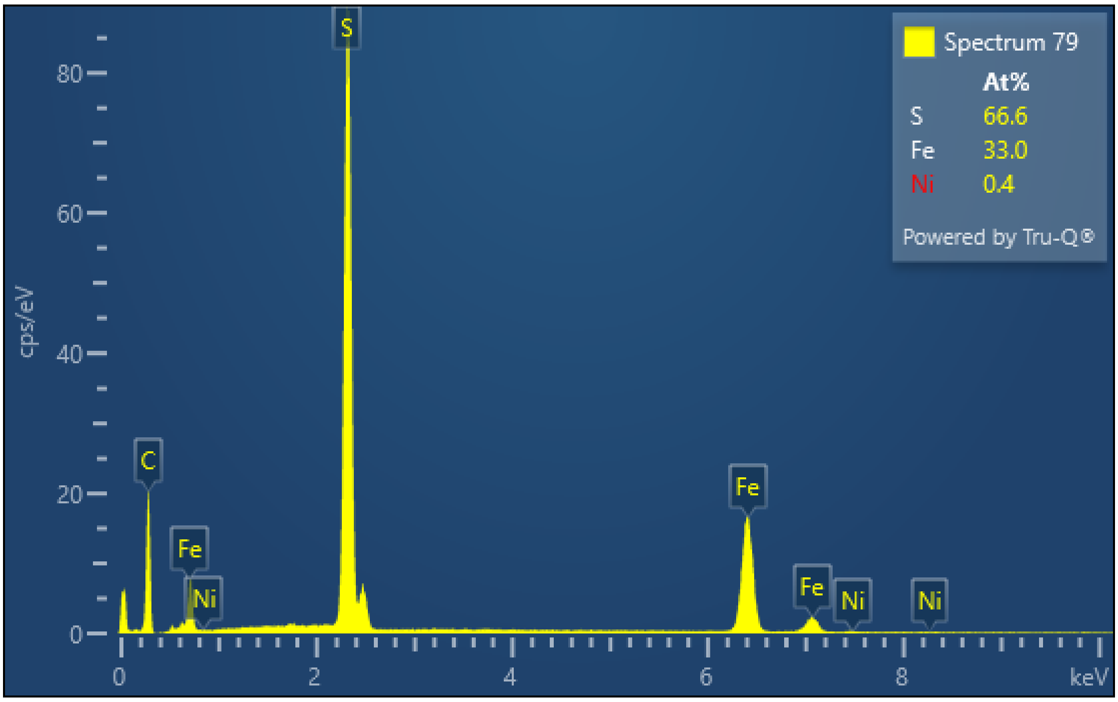
Electron Image 20 (Input1)



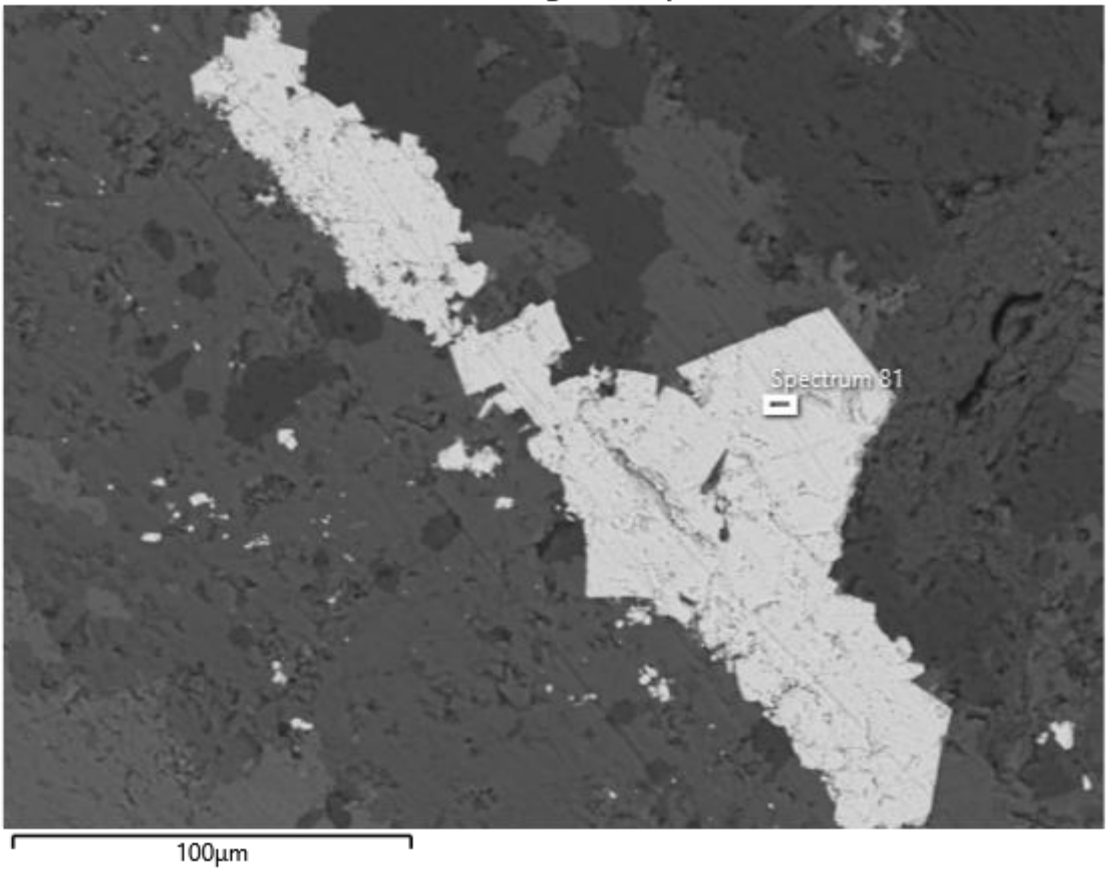


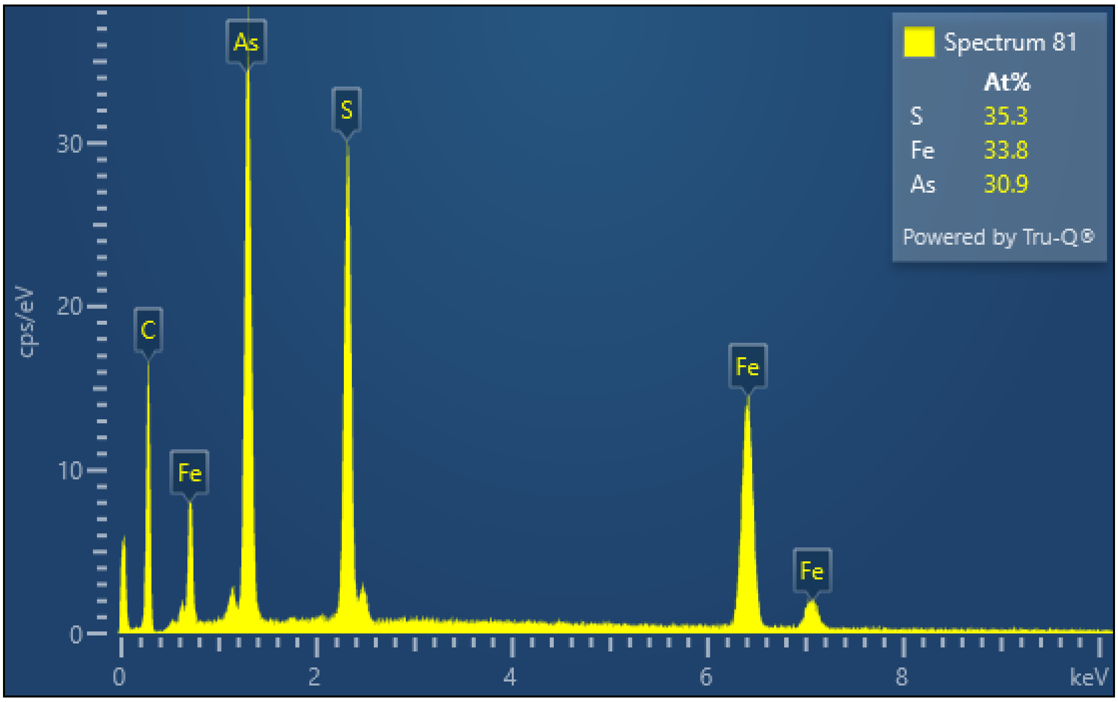
Electron Image 21 (Input1)



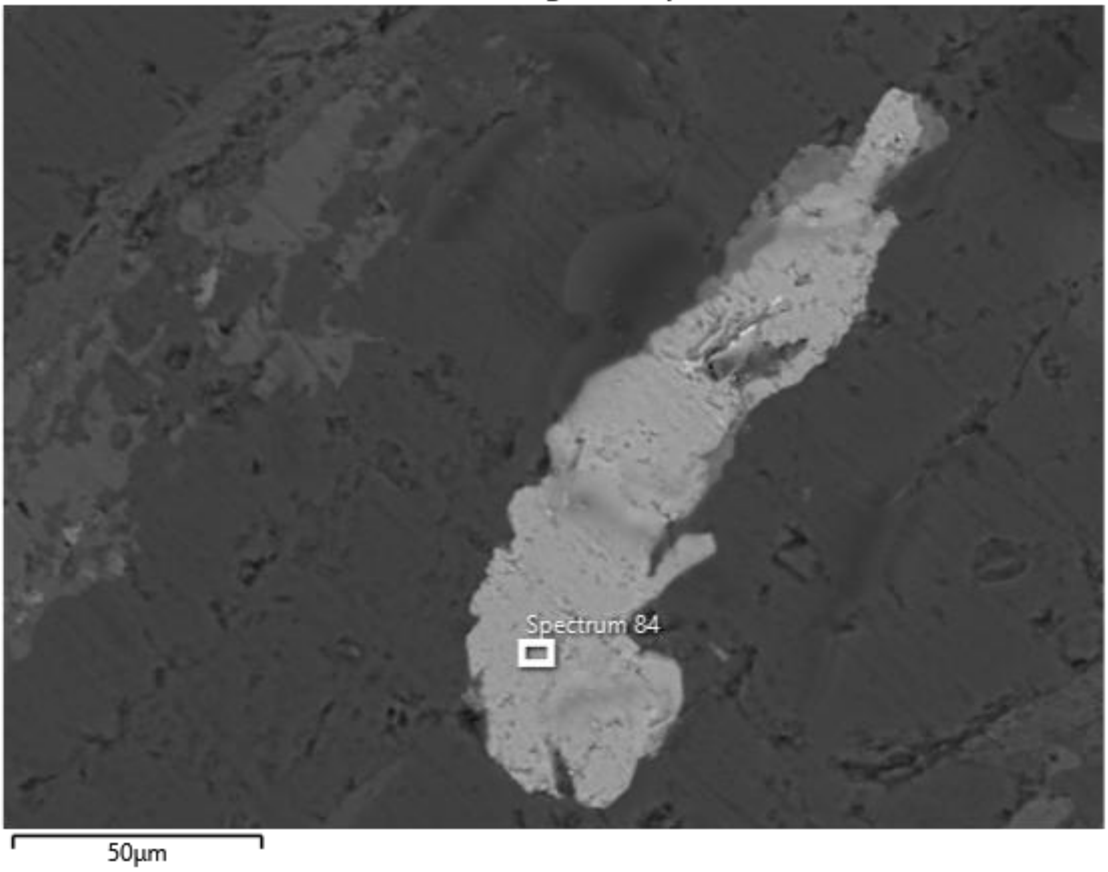


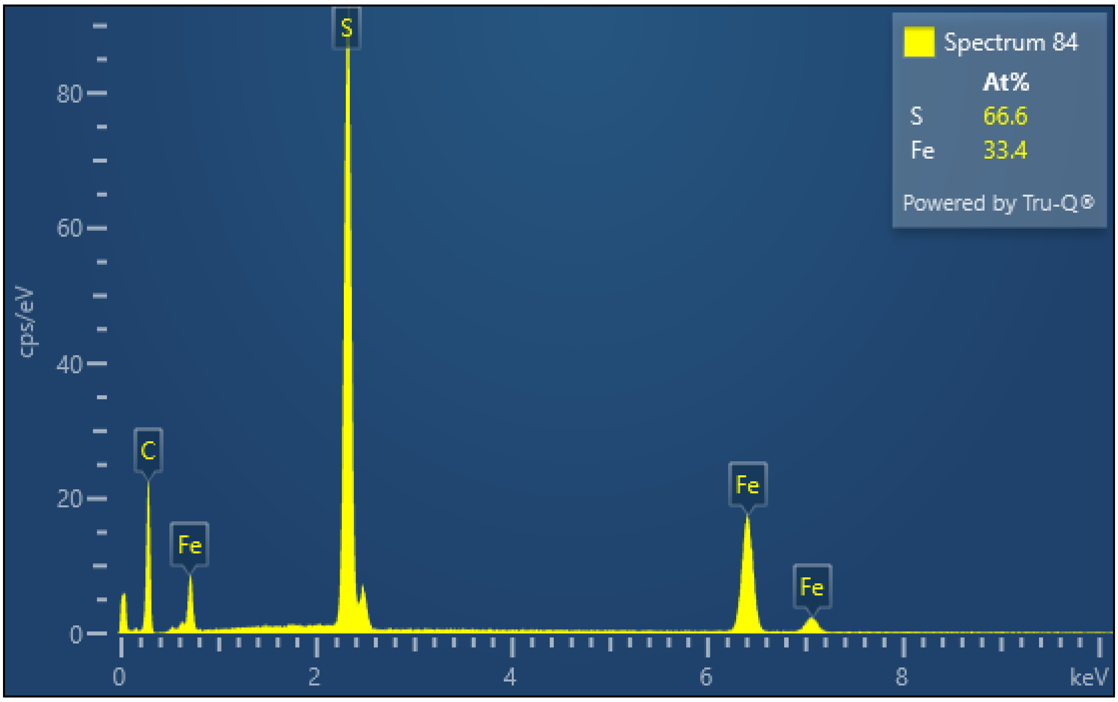
Electron Image 22 (Input1)





Electron Image 23 (Input1)





microanalysis australia

5 Alvan Street
Mount Lawley
WA 6050

Client:	Mine Waste Management NZ	**Date received:**	27/11/2024
Client address:	5 Sir William Pickering Drive BURNSIDE NZ 8053	**Date analysed:**	19/12/2024
Job number:	24_2171	**Date reported:**	23/12/2024
Lab ID:	24_2171_005		
Client ID:	**MG54045**		
Analysis:	Scanning electron microscopy (SEM) with elemental analysis by energy dispersive spectroscopy (EDS)		
Revision number:	0		
Comments:	None		

Sample preparation

The sample was supplied to Microanalysis Australia as a bulk drill core sample.

The sample was mounted in epoxy resin and polished to a flat surface before being carbon coated. Non-conducting samples require coating prior to SEM analysis to prevent charging whilst being analysed by the electron beam.

Analysis

The sample was analysed using a Carl Zeiss EVO50 scanning electron microscope (SEM) fitted with an Oxford INCA X-Max energy dispersive spectrometer (EDS).

EDS is a semi-quantitative technique (at best) on well prepared, optically flat samples. Factors such as sample unevenness may adversely bias elemental concentration interpretation. EDS has a spatial resolution of ~5 µm meaning spectra from particles less than this size may contain elemental concentrations biased by their surroundings. Analysis was conducted at 20 KeV unless otherwise stated.

No calibration standards (standardless quant) were used in the EDS detector standardization prior to analysis.

Summary

All images were acquired using backscatter electrons (BSE) unless otherwise specified. For BSE, image contrast is directly proportional to average atomic number i.e. the brighter the area, the higher the atomic number.

The mineralogy of particles identified has been summarised in the following table (**Table 1: Mineralogy summary of particles observed**) and have been listed in order of abundance i.e. major, minor or trace quantities of particles.

Analyst: Damon Blakey, *B.Sc. (Forensic Biology and Toxicology)*

Reported: Damon Blakey, *B.Sc. (Forensic Biology and Toxicology)*

Approved: Rick Hughes, B.Sc.(Hons)Physics, MAIP

Table 1: Mineralogy summary of sulfur-based particles observed

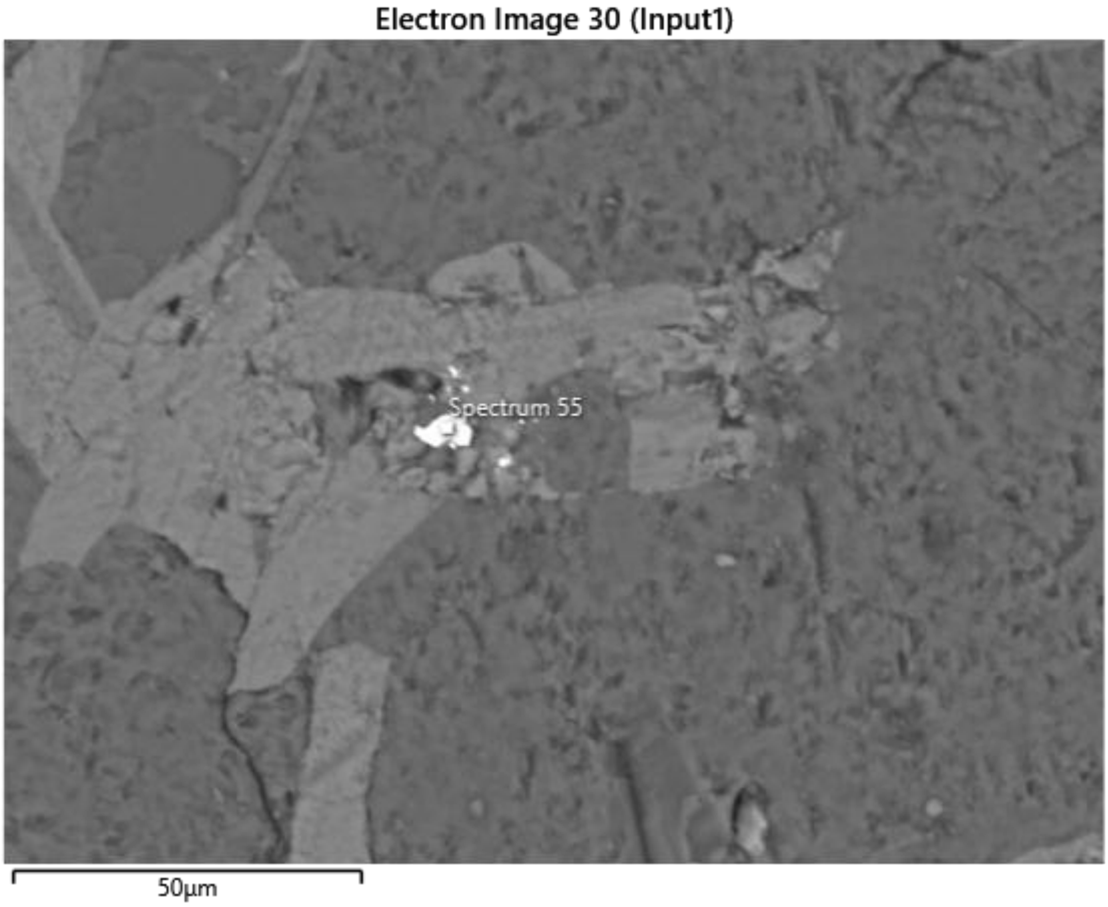
Compound/phase relative abundance[2]	Size range (µm)	Observed morphology	Observed composition (elements present)				Assumed compound/phase	Compound/phase confidence[1] (Likely/possible)
			Major	Minor	Trace	Varying		
Major	<5 - ~15	Angular and aggregated particulate	S, As, Co	Fe, Ni	Ti	O, Si, Al (trace to minor)	Arsenic-cobalt sulfide (cobaltite)	Possible
Trace	<5 - ~10	Irregular particulate	Pb, S	Fe, O	-	-	Lead sulfide (galena)	Possible
Trace	10 - ~15	Subangular particulate	Cu, S	Fe, O	Si, Al	-	Copper sulfide (chalcocite)	Possible

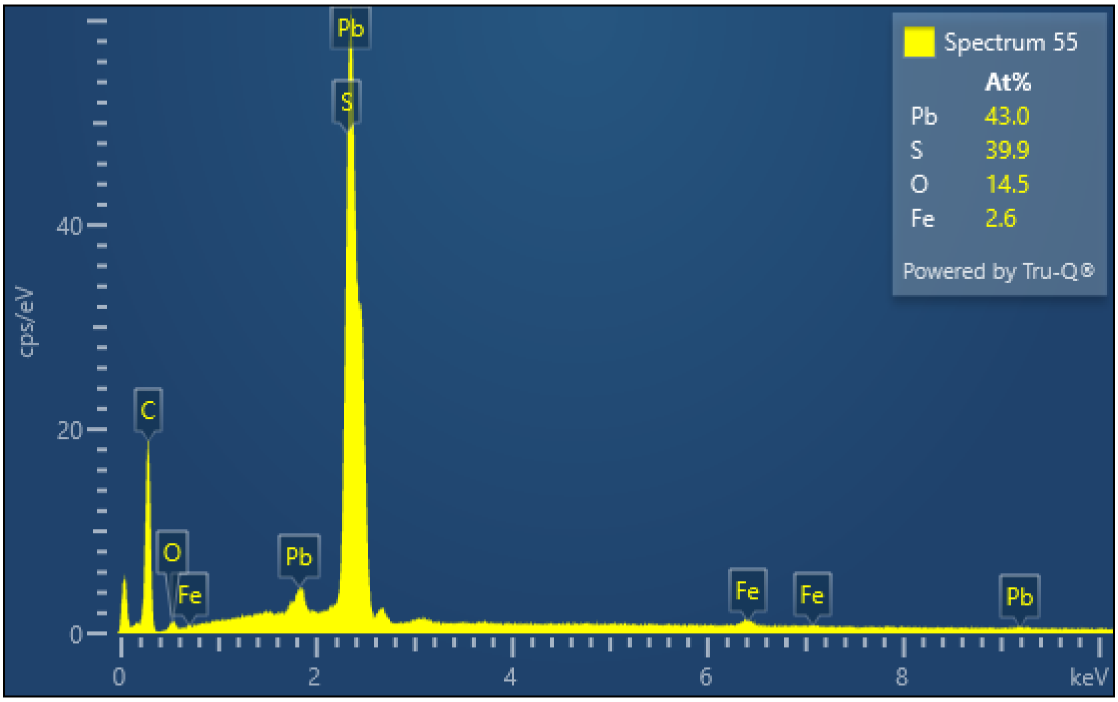
[1] indicates whether multiple options may be possible with similar stoichiometries. Confirmation by other techniques such as XRD or FTIR may be necessary for increased confidence. *Most of the sulfur-based minerals are surrounded by oxygen-containing minerals such as silica, iron oxides, and various aluminosilicates. The oxygen from the surrounding materials may interfere with the sulfur-containing particles, allowing oxygen to show as a trace or minor phase in the analysis of the sulfur particles. Most of the time this will be from the surrounding materials, however we assign a 'possible' confidence as to not rule out the possibility of partial oxidation of the sulfur mineral present.*

[2] The interpreted compound abundance qualifiers (major, minor, trace) are based on the following categories and are presented by number (count) of observed particles as opposed to wt% or ppm as would be reported by ICP/XRF. **All sulfur-based phases within the sample are trace. This is an abundance relative only to each other type of sulfur-based mineral present.**

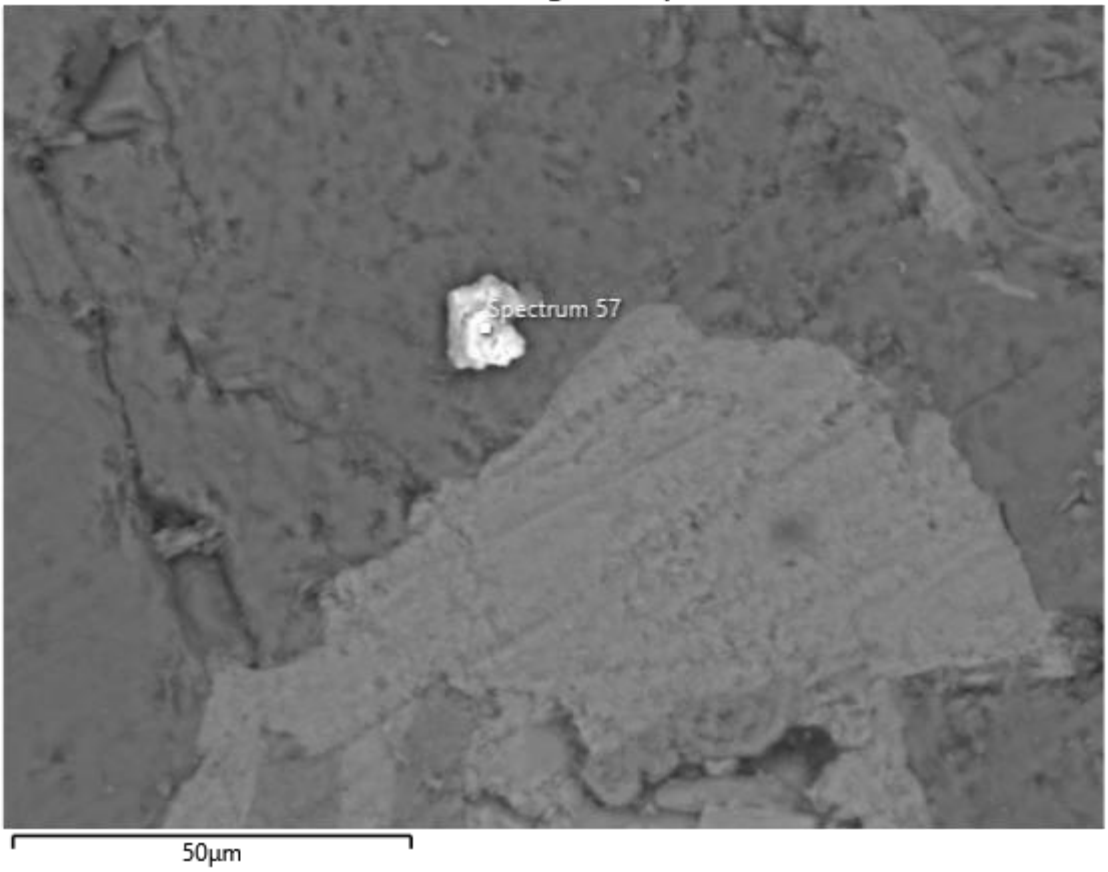
Qualifier	***Approximate* range, number %**
Major	> ~30
Minor	~1 to ~30
Trace	< ~1

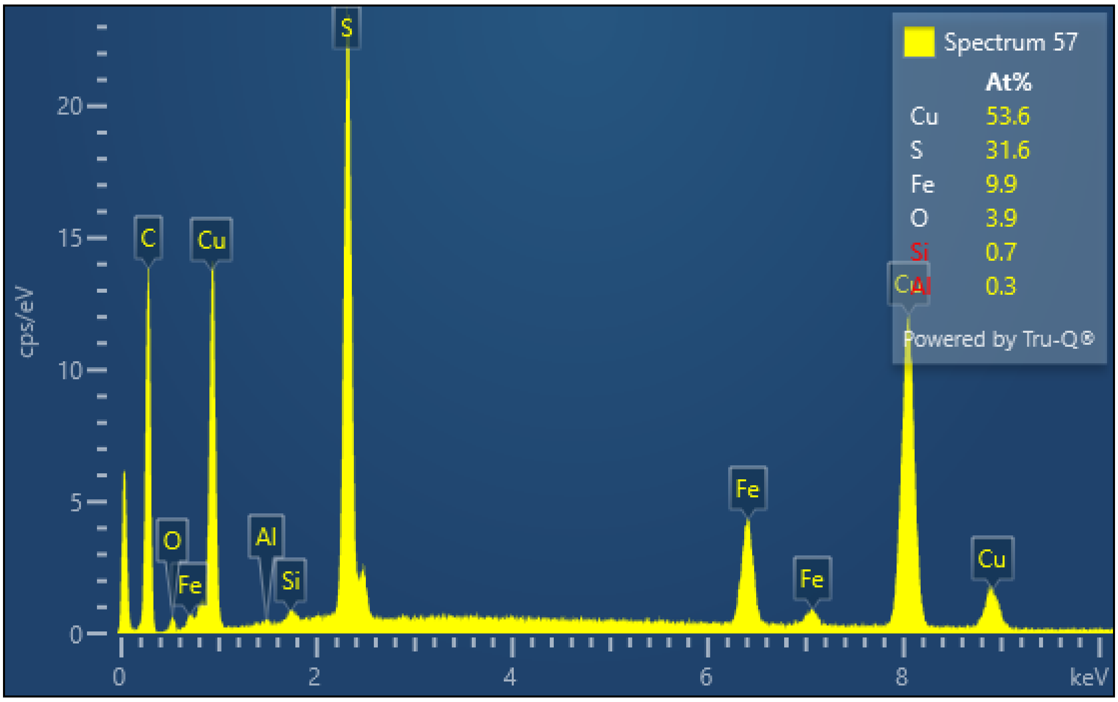
The range (above) is stated as '*Approximate*' as the technique is more a qualitative measure of relative abundance as opposed to a quantitative absolute abundance. The abundance is stated as number percent as no calculations have been made to transform geometric sizes into particle volumes, nor density values used to calculate weight fractions that would enable weight percentages to be quoted.


Electron Image 30 (Input1)
Spectrum 55
50µm

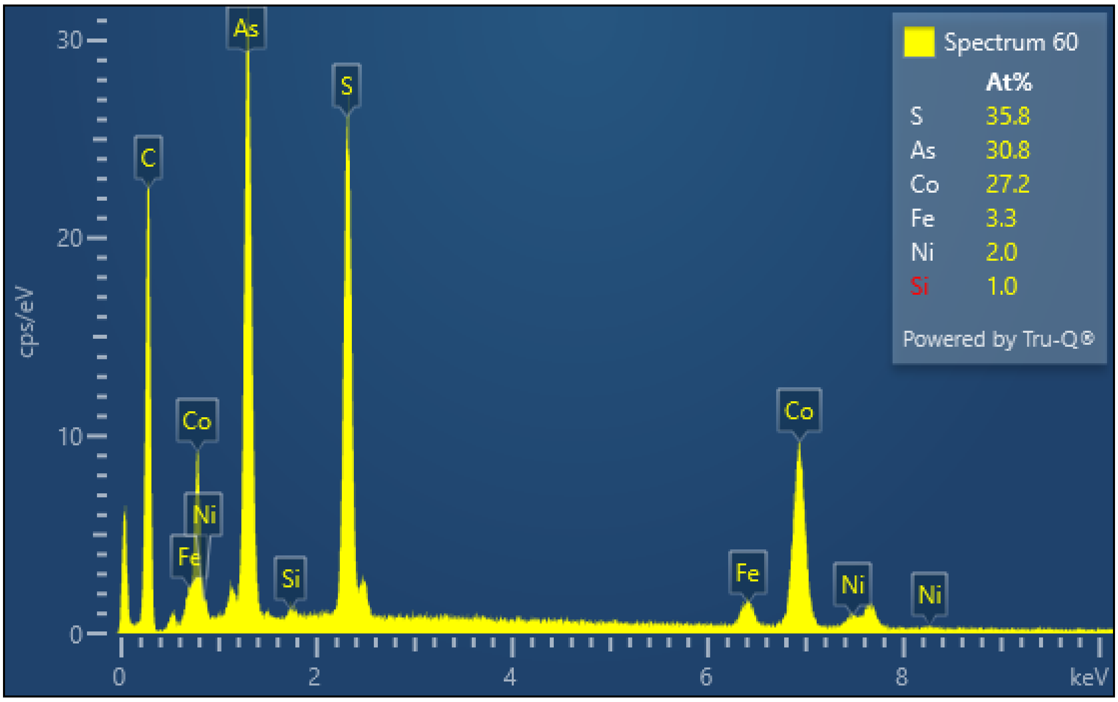

Spectrum 55
At%
Pb 43.0
S 39.9
O 14.5
Fe 2.6
Powered by Tru-Q®
cps/eV
0
20
40
0
2
4
6
8
keV
C
O
Fe
Pb
S
Pb
Fe
Fe
Pb

Electron Image 31 (Input1)

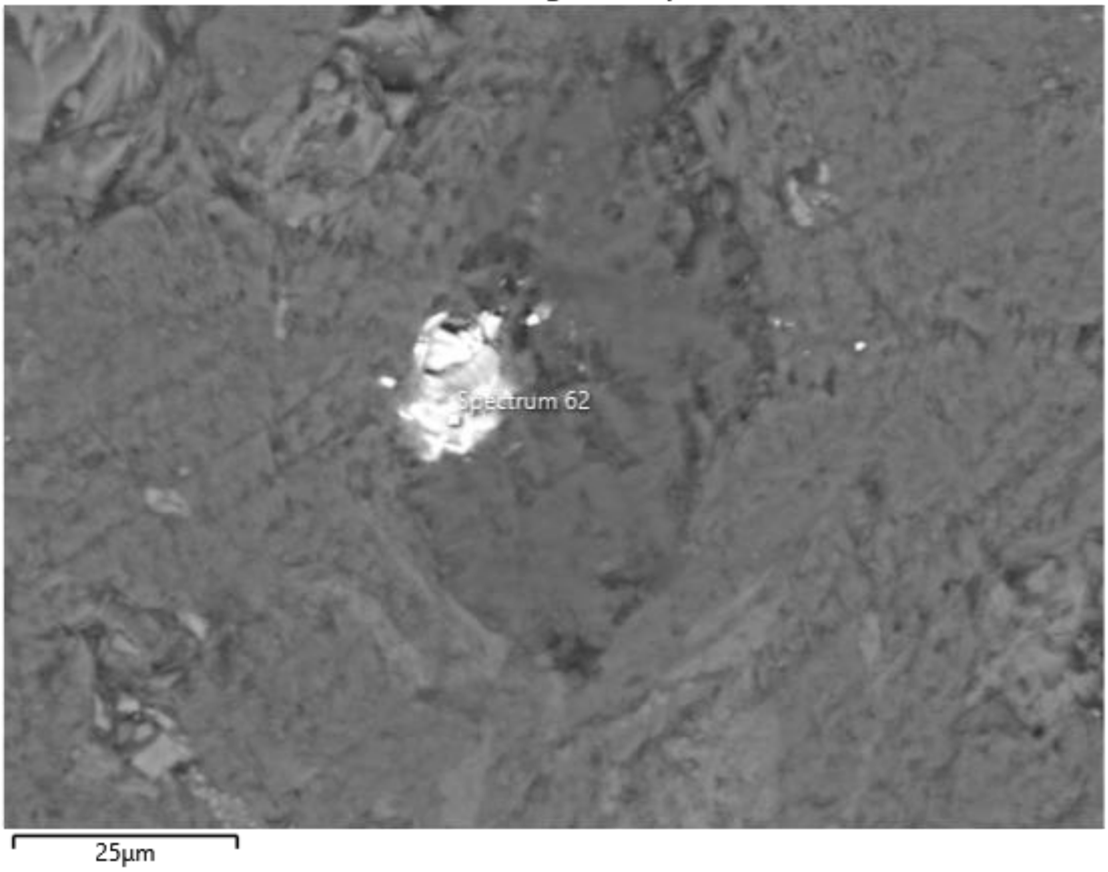


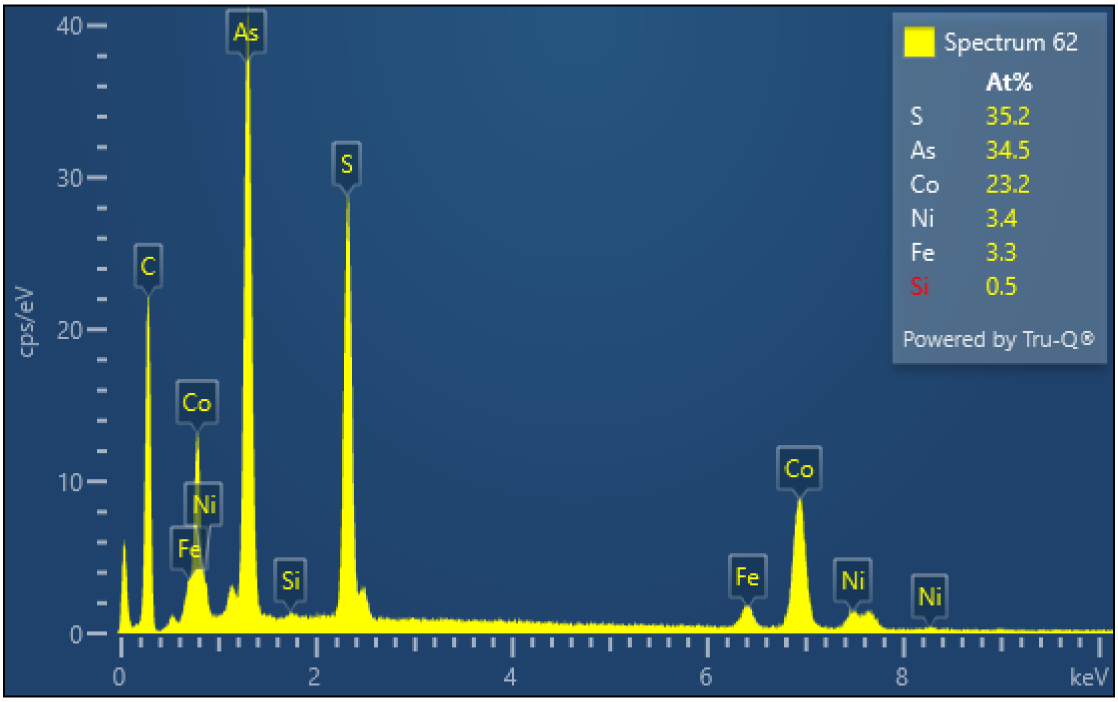


Electron Image 32 (Input1)

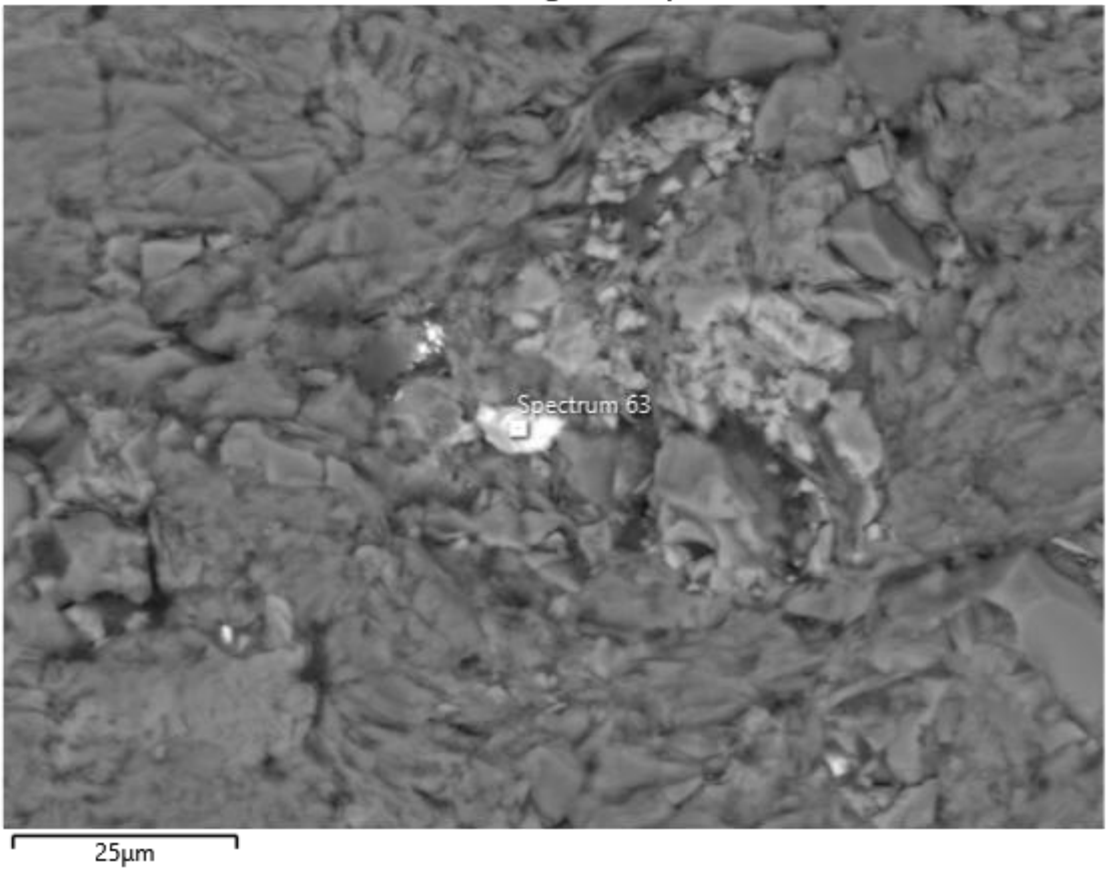


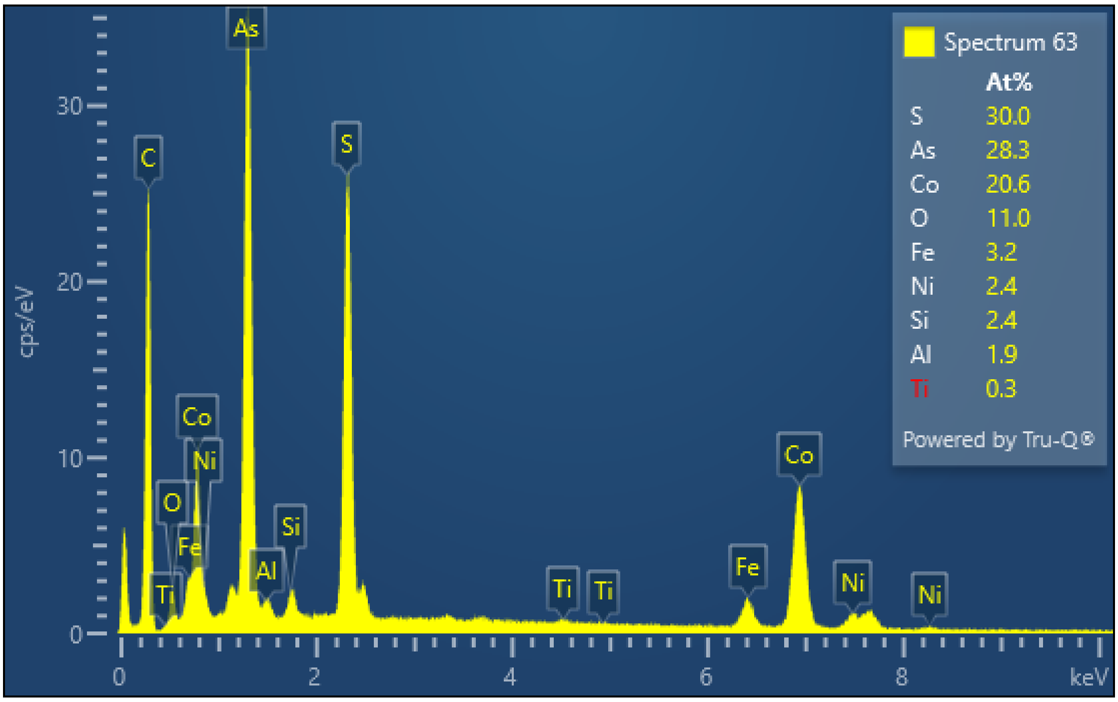
Electron Image 33 (Input1)





Electron Image 34 (Input1)





microanalysis australia

5 Alvan Street
Mount Lawley
WA 6050

Client:	Mine Waste Management NZ	**Date received:**	27/11/2024
Client address:	5 Sir William Pickering Drive BURNSIDE NZ 8053	**Date analysed:**	19/12/2024
Job number:	24_2171	**Date reported:**	23/12/2024
Lab ID:	24_2171_006		
Client ID:	**MG54046**		
Analysis:	Scanning electron microscopy (SEM) with elemental analysis by energy dispersive spectroscopy (EDS)		
Revision number:	0		
Comments:	None		

Sample preparation

The sample was supplied to Microanalysis Australia as a bulk drill core sample.

The sample was mounted in epoxy resin and polished to a flat surface before being carbon coated. Non-conducting samples require coating prior to SEM analysis to prevent charging whilst being analysed by the electron beam.

Analysis

The sample was analysed using a Carl Zeiss EVO50 scanning electron microscope (SEM) fitted with an Oxford INCA X-Max energy dispersive spectrometer (EDS).

EDS is a semi-quantitative technique (at best) on well prepared, optically flat samples. Factors such as sample unevenness may adversely bias elemental concentration interpretation. EDS has a spatial resolution of ~5 µm meaning spectra from particles less than this size may contain elemental concentrations biased by their surroundings. Analysis was conducted at 20 KeV unless otherwise stated.

No calibration standards (standardless quant) were used in the EDS detector standardization prior to analysis.

Summary

All images were acquired using backscatter electrons (BSE) unless otherwise specified. For BSE, image contrast is directly proportional to average atomic number i.e. the brighter the area, the higher the atomic number.

The mineralogy of particles identified has been summarised in the following table (**Table 1: Mineralogy summary of particles observed**) and have been listed in order of abundance i.e. major, minor or trace quantities of particles.

Analyst: Damon Blakey, *B.Sc. (Forensic Biology and Toxicology)*

Reported: Damon Blakey, *B.Sc. (Forensic Biology and Toxicology)*

Approved: Rick Hughes, B.Sc.(Hons)Physics, MAIP

Table 1: Mineralogy summary of sulfur-based particles observed

Compound/phase relative abundance[2]	Size range (μm)	Observed morphology	Observed composition (elements present)				Assumed compound/phase	Compound/phase confidence[1] (Likely/possible)
			Major	Minor	Trace	Varying		
Major	<5 - ~50	Angular and aggregated particulate	S, Fe	-	Ca, Si	-	Iron sulfide (pyrite/pyrrhotite)	Likely
Trace	<5 - ~10	Angular particulate	S, Fe, As	-	-	-	Arsenic-iron sulfide (arsenopyrite)	Likely
Trace	~10	Angular and aggregated particulate	S, Cu, Fe	Si, O, Sb	Al	-	Copper-iron sulfide (chalcopyrite)	Possible
Trace	<5 - ~15	Angular and aggregated particulate	S, As, Co	O, Fe	Si	-	Arsenic-cobalt sulfide (cobaltite)	Possible
Trace	<5	Angular particle	O, Pb, S	Si, Al, Na	Fe	-	Lead sulfate (anglesite)	Possible

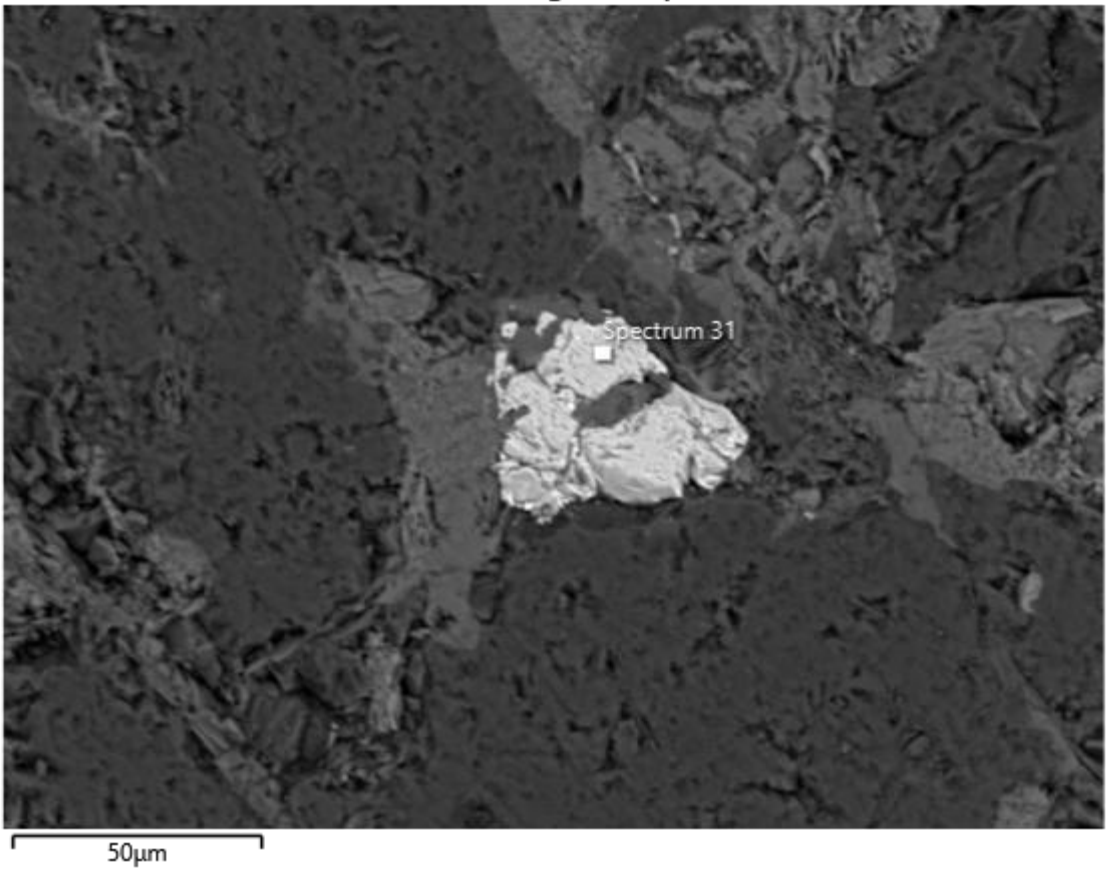
[1] indicates whether multiple options may be possible with similar stoichiometries. Confirmation by other techniques such as XRD or FTIR may be necessary for increased confidence. *Most of the sulfur-based minerals are surrounded by oxygen-containing minerals such as silica, iron oxides, and various aluminosilicates. The oxygen from the surrounding materials may interfere with the sulfur-containing particles, allowing oxygen to show as a trace or minor phase in the analysis of the sulfur particles. Most of the time this will be from the surrounding materials, however we assign a 'possible' confidence as to not rule out the possibility of partial oxidation of the sulfur mineral present.*

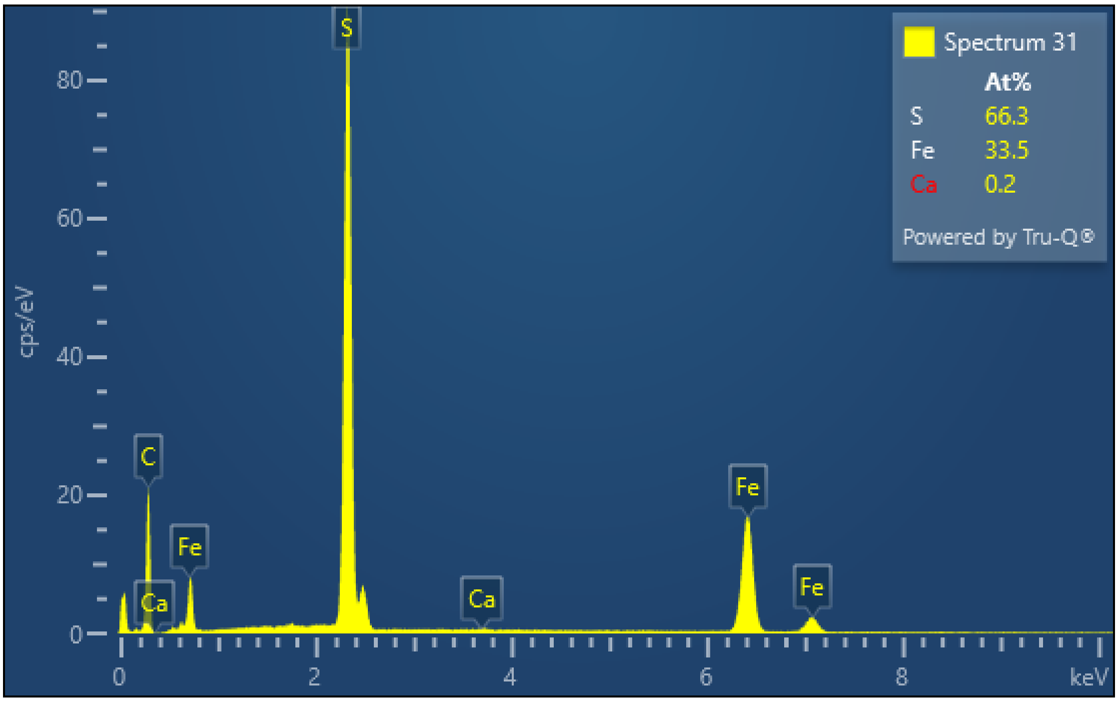
[2] The interpreted compound abundance qualifiers (major, minor, trace) are based on the following categories and are presented by number (count) of observed particles as opposed to wt% or ppm as would be reported by ICP/XRF. **All sulfur-based phases within the sample are trace. This is an abundance relative only to each other type of sulfur-based mineral present.**

Qualifier	*Approximate* range, number %
Major	> ~30
Minor	~1 to ~30
Trace	< ~1

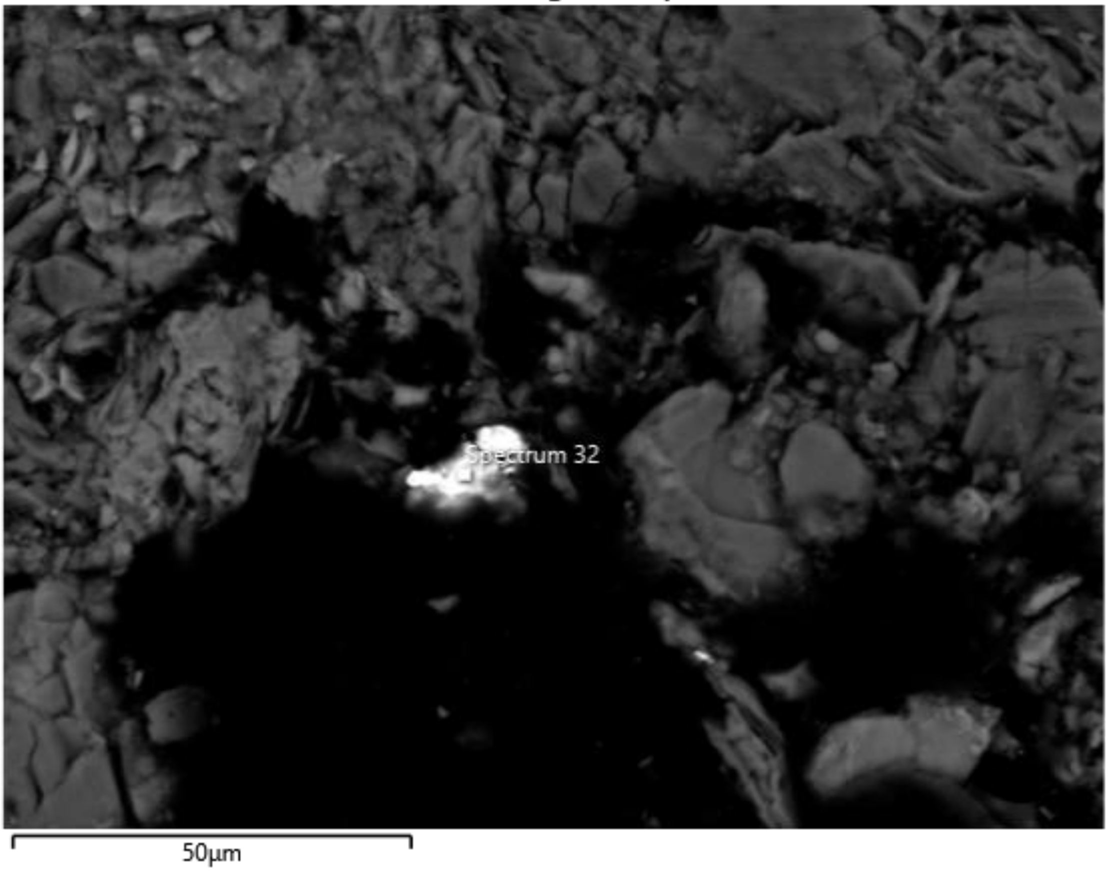
The range (above) is stated as '*Approximate*' as the technique is more a qualitative measure of relative abundance as opposed to a quantitative absolute abundance. The abundance is stated as number percent as no calculations have been made to transform geometric sizes into particle volumes, nor density values used to calculate weight fractions that would enable weight percentages to be quoted.

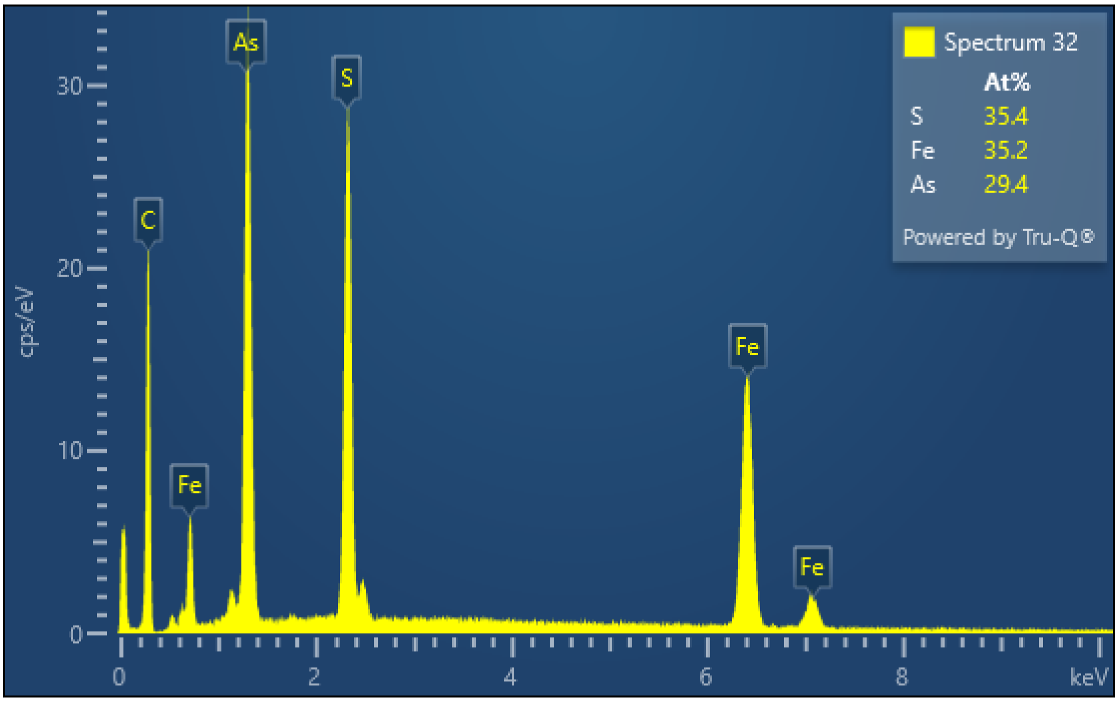
Electron Image 15 (Input1)



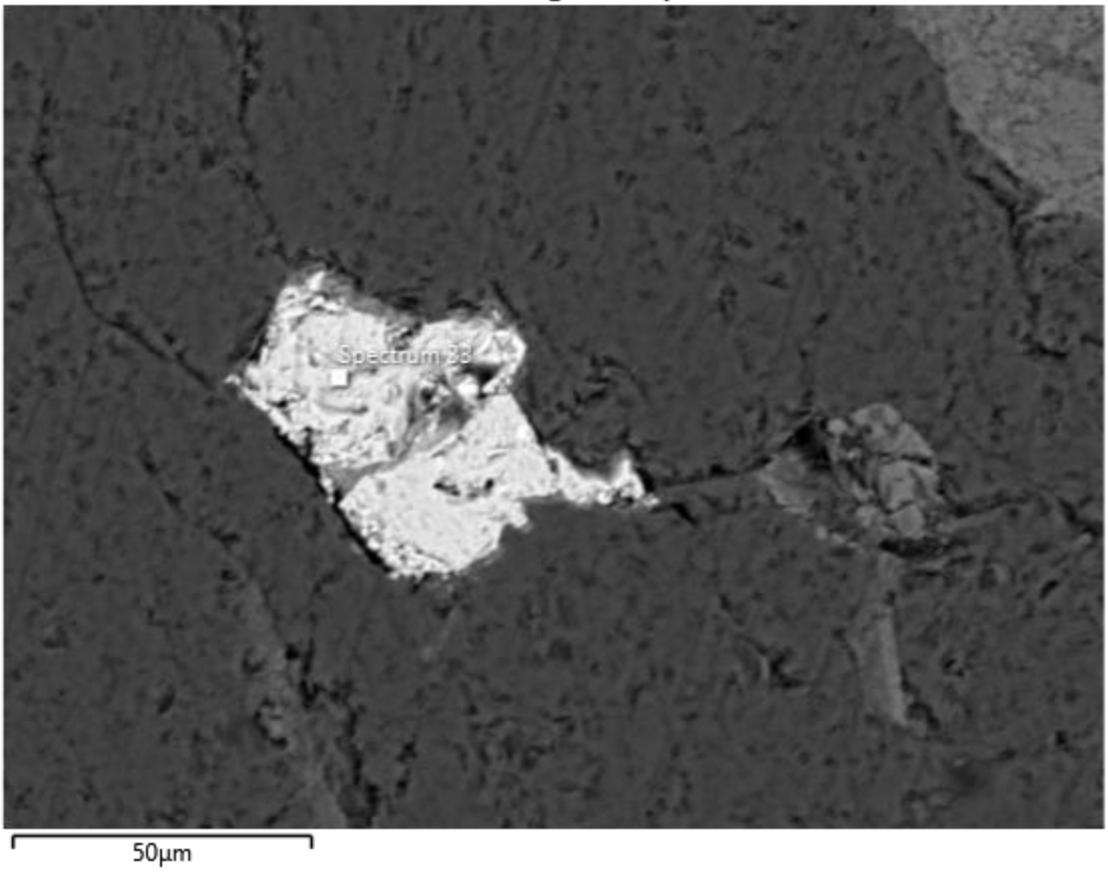


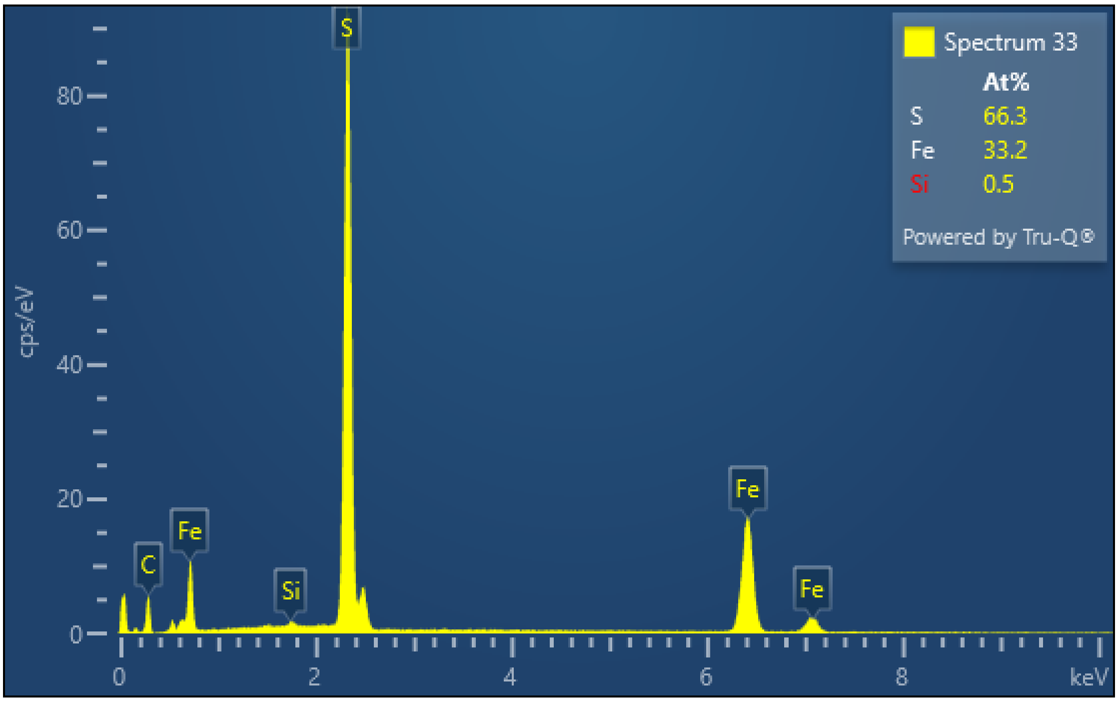
Electron Image 16 (Input1)



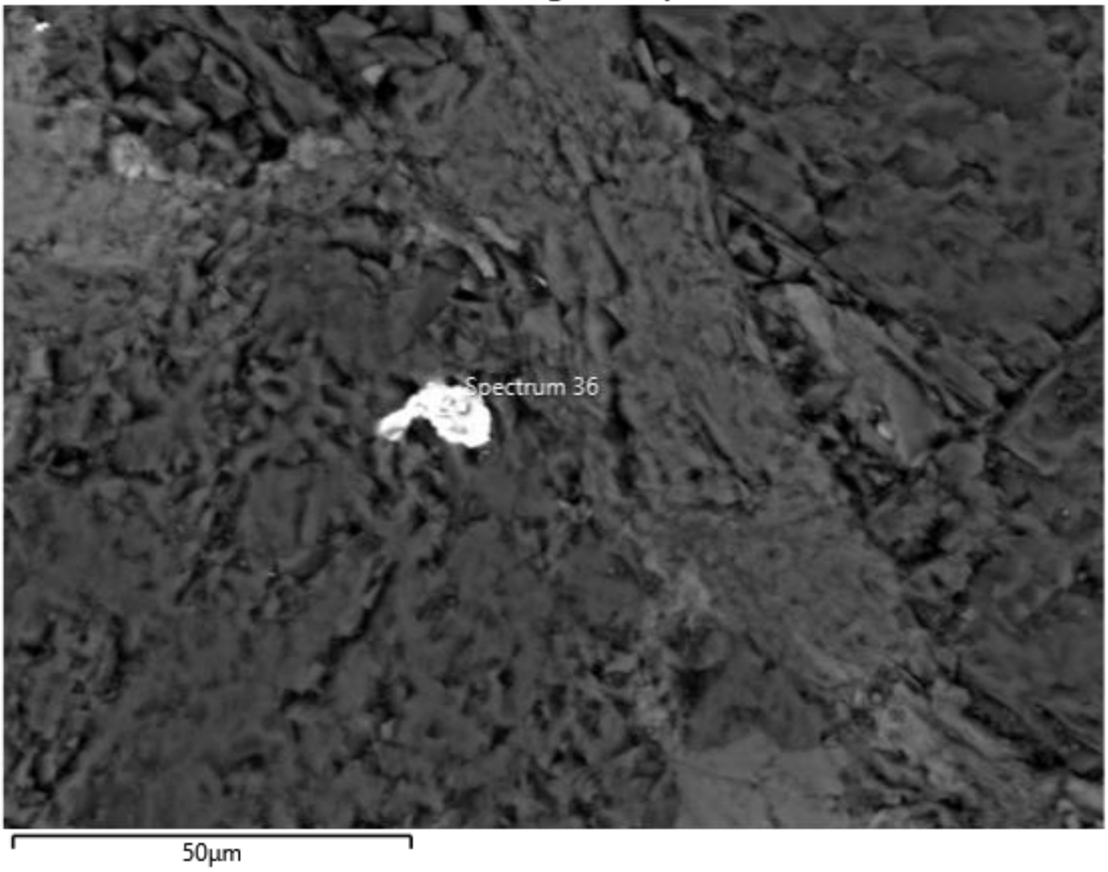


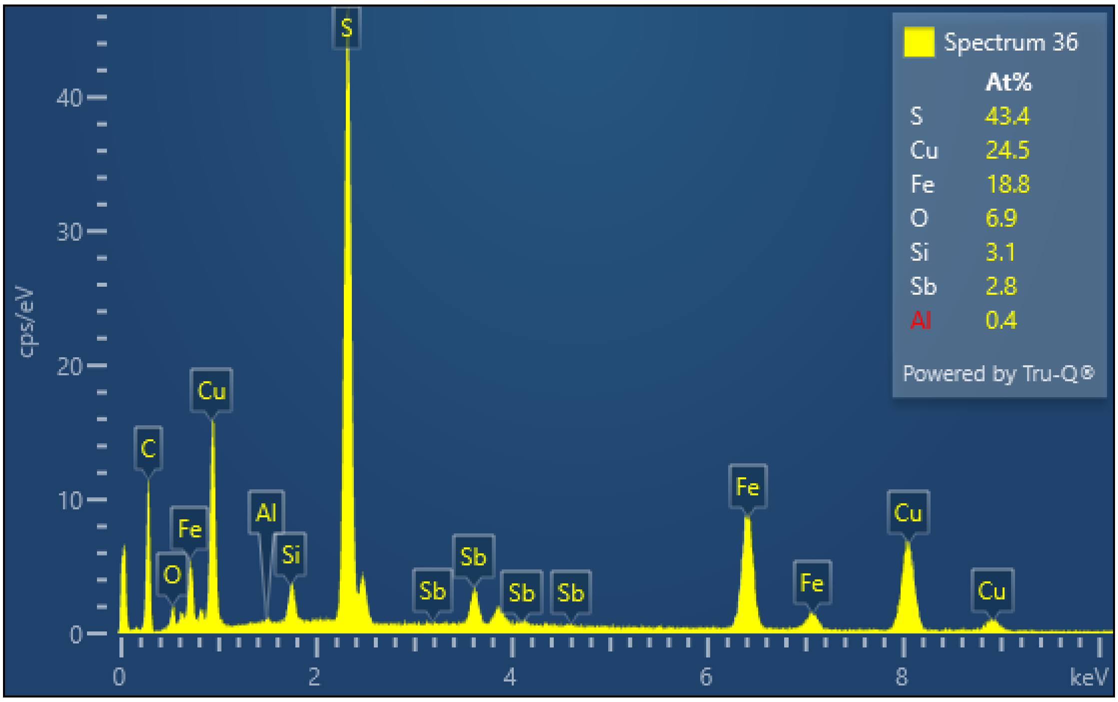
Electron Image 17 (Input1)



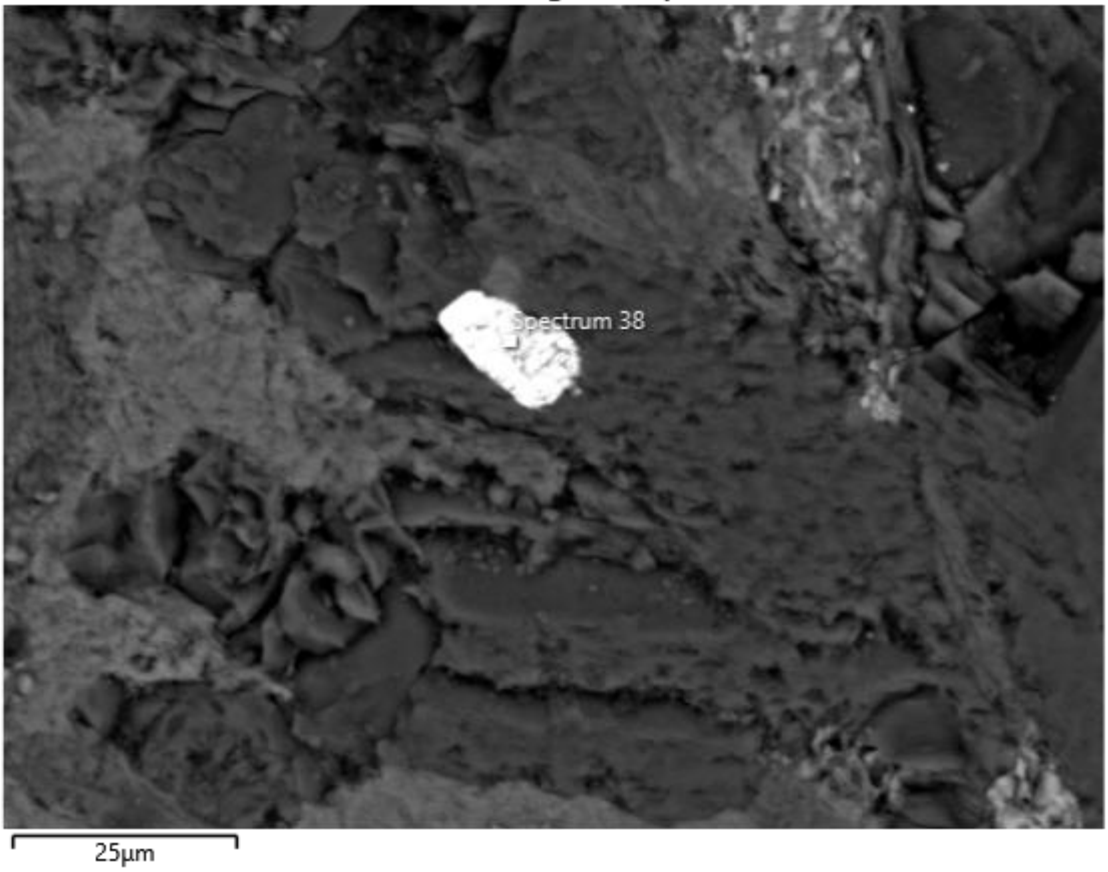


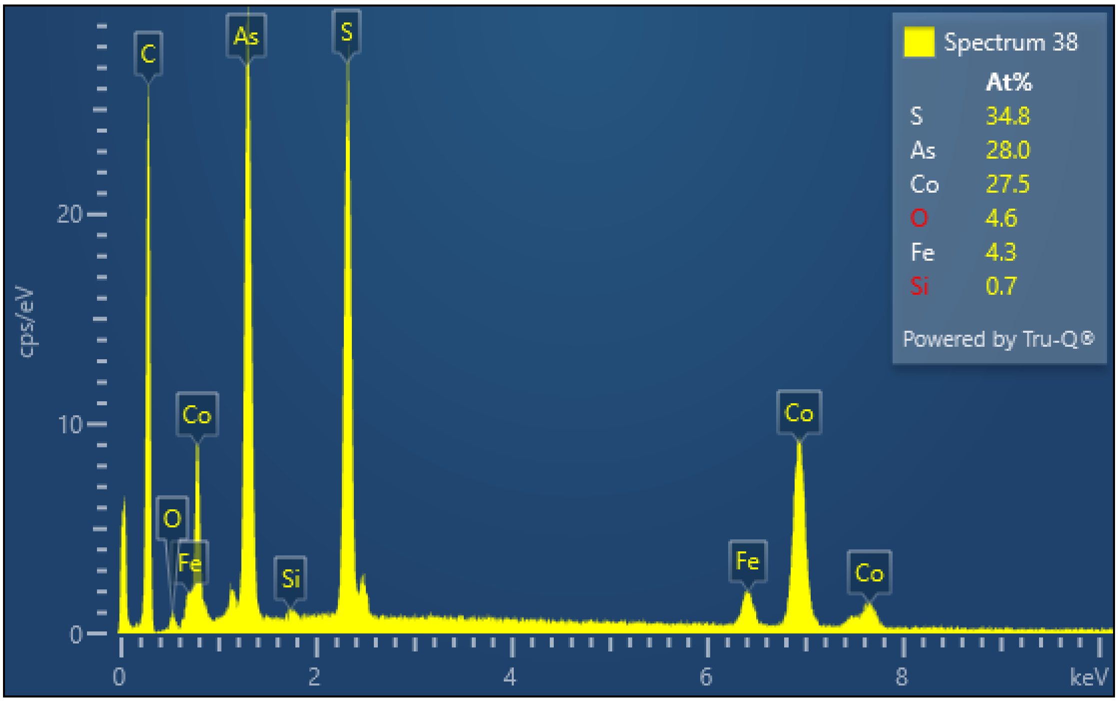
Electron Image 18 (Input1)



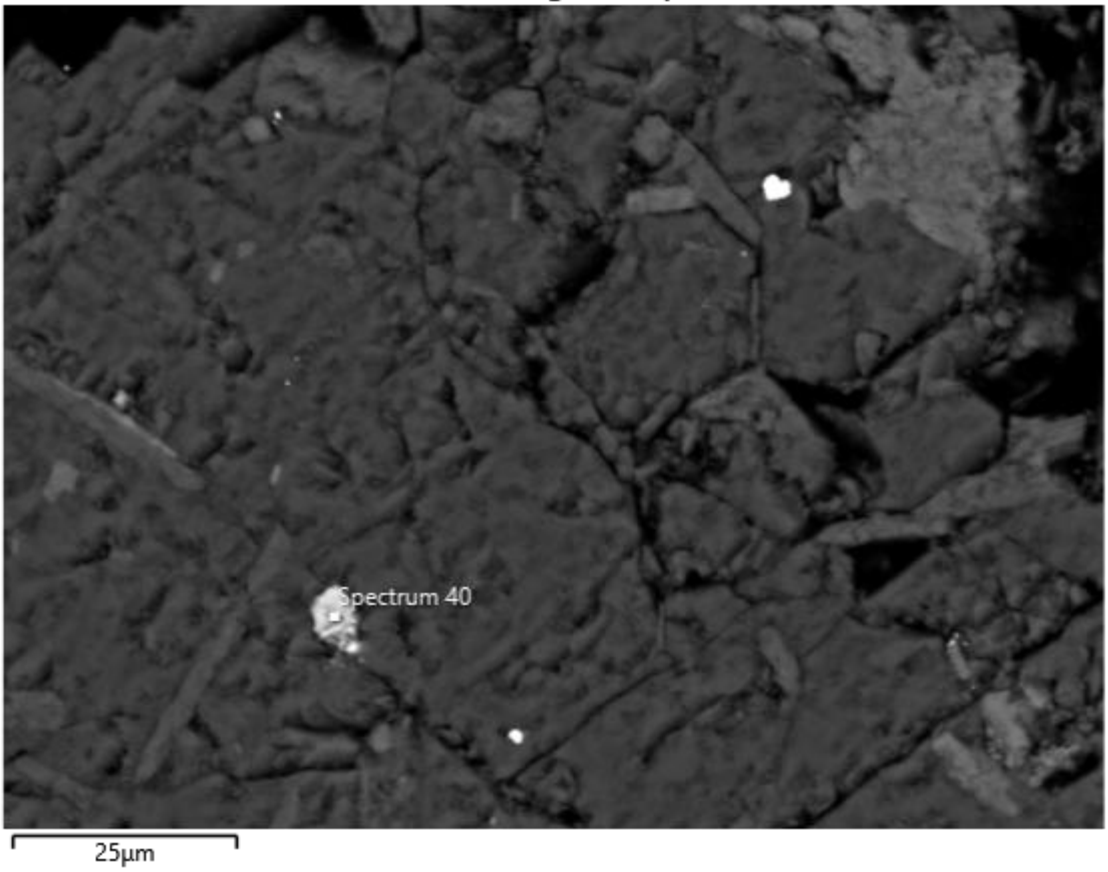


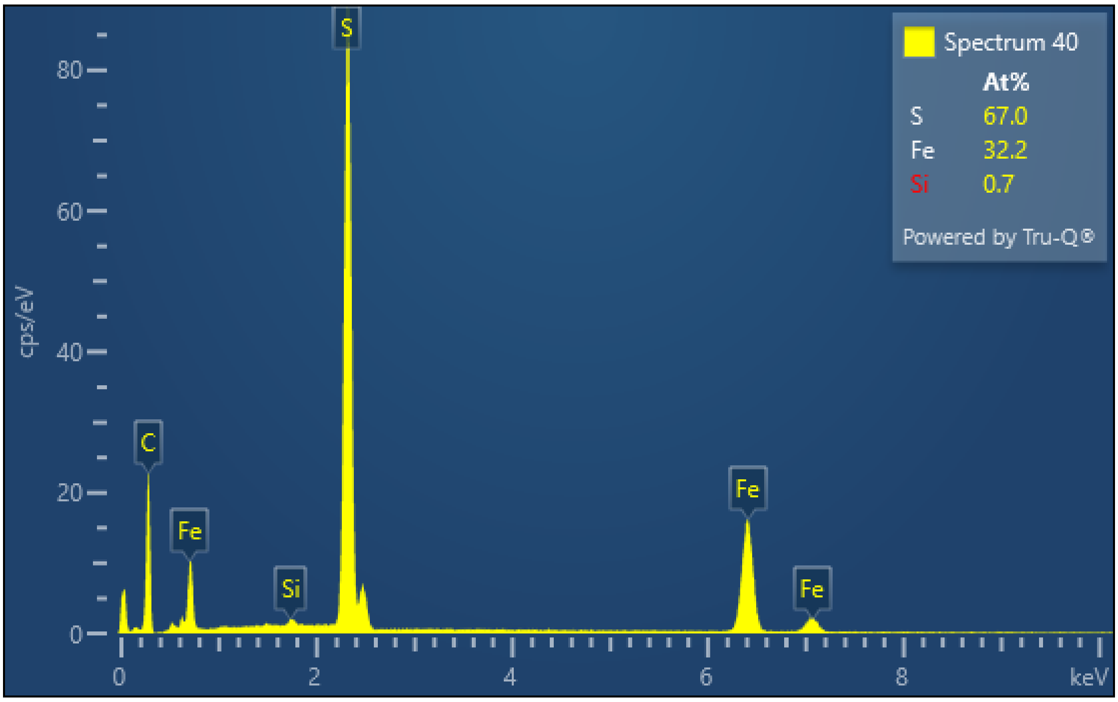
Electron Image 19 (Input1)



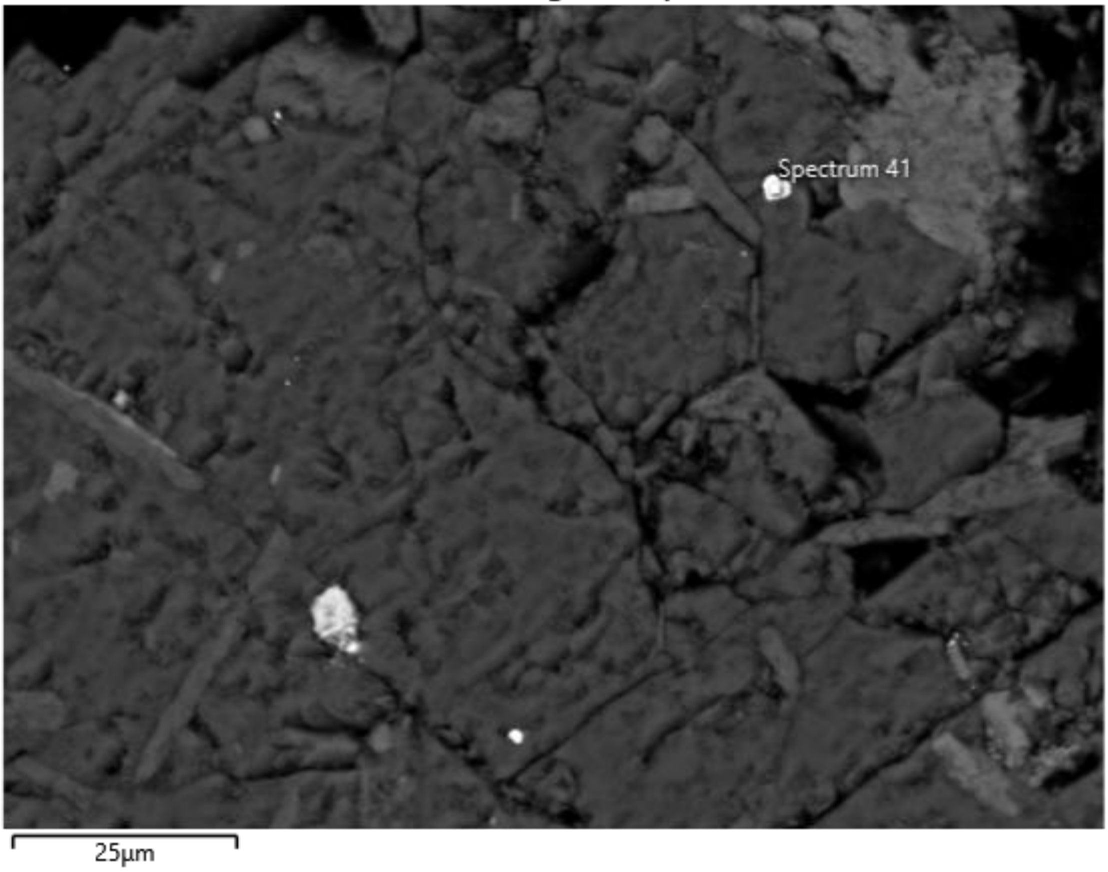


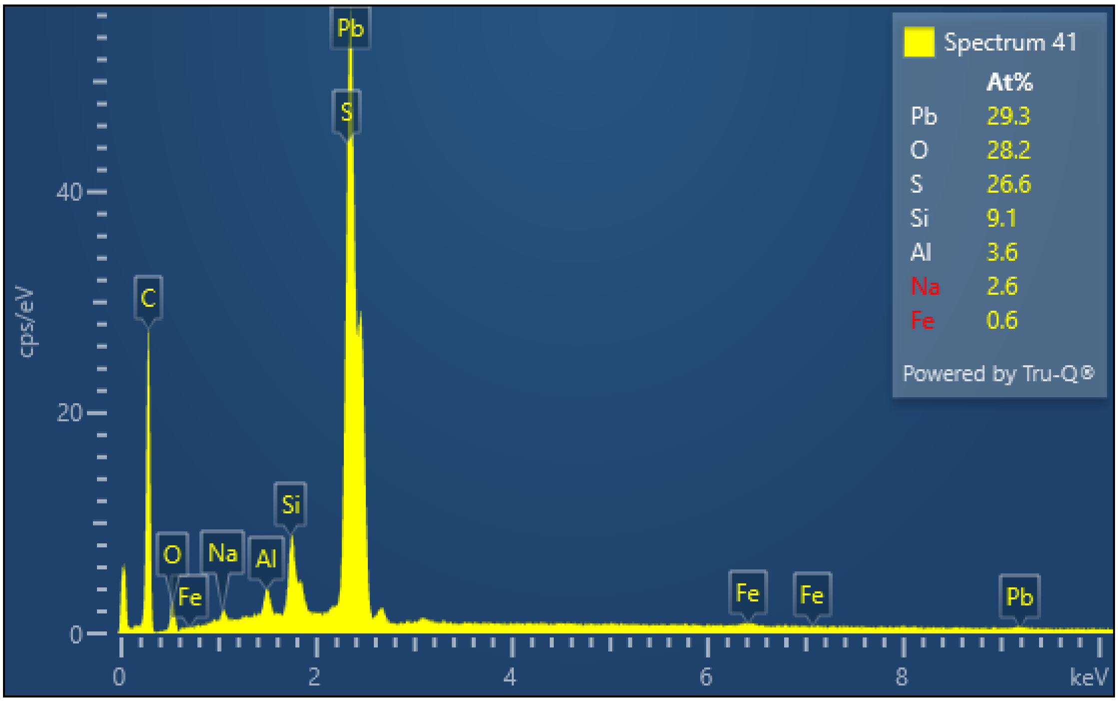
Electron Image 21 (Input1)





Electron Image 21 (Input1)





microanalysis australia

5 Alvan Street
Mount Lawley
WA 6050

Client:	Mine Waste Management NZ	**Date received:**	27/11/2024
Client address:	5 Sir William Pickering Drive BURNSIDE NZ 8053	**Date analysed:**	19/12/2024
Job number:	24_2171	**Date reported:**	23/12/2024
Lab ID:	24_2171_007		
Client ID:	**MG54047**		
Analysis:	Scanning electron microscopy (SEM) with elemental analysis by energy dispersive spectroscopy (EDS)		
Revision number:	0		
Comments:	None		

Sample preparation

The sample was supplied to Microanalysis Australia as a bulk drill core sample.

The sample was mounted in epoxy resin and polished to a flat surface before being carbon coated. Non-conducting samples require coating prior to SEM analysis to prevent charging whilst being analysed by the electron beam.

Analysis

The sample was analysed using a Carl Zeiss EVO50 scanning electron microscope (SEM) fitted with an Oxford INCA X-Max energy dispersive spectrometer (EDS).

EDS is a semi-quantitative technique (at best) on well prepared, optically flat samples. Factors such as sample unevenness may adversely bias elemental concentration interpretation. EDS has a spatial resolution of ~5 µm meaning spectra from particles less than this size may contain elemental concentrations biased by their surroundings. Analysis was conducted at 20 KeV unless otherwise stated.

No calibration standards (standardless quant) were used in the EDS detector standardization prior to analysis.

Summary

All images were acquired using backscatter electrons (BSE) unless otherwise specified. For BSE, image contrast is directly proportional to average atomic number i.e. the brighter the area, the higher the atomic number.

The mineralogy of particles identified has been summarised in the following table (**Table 1: Mineralogy summary of particles observed**) and have been listed in order of abundance i.e. major, minor or trace quantities of particles.

Analyst: Damon Blakey, *B.Sc. (Forensic Biology and Toxicology)*

Reported: Damon Blakey, *B.Sc. (Forensic Biology and Toxicology)*

Approved: Rick Hughes, B.Sc.(Hons)Physics, MAIP

Table 1: Mineralogy summary of sulfur-based particles observed

Compound/phase relative abundance[2]	Size range (µm)	Observed morphology	Observed composition (elements present)				Assumed compound/phase	Compound/phase confidence[1] (Likely/possible)
			Major	Minor	Trace	Varying		
Major	<5 - ~40	Angular, subangular, and aggregated particulate	S, Fe, Cu	-	-	O, Si	Copper-iron sulfide (chalcopyrite)	Likely
Minor	<5 - ~40	Irregular particulate	Pb, S	-	-	O (minor to major) Se, Ca, Si, Fe, Cu (trace to minor)	Lead sulfate (anglesite)	Possible

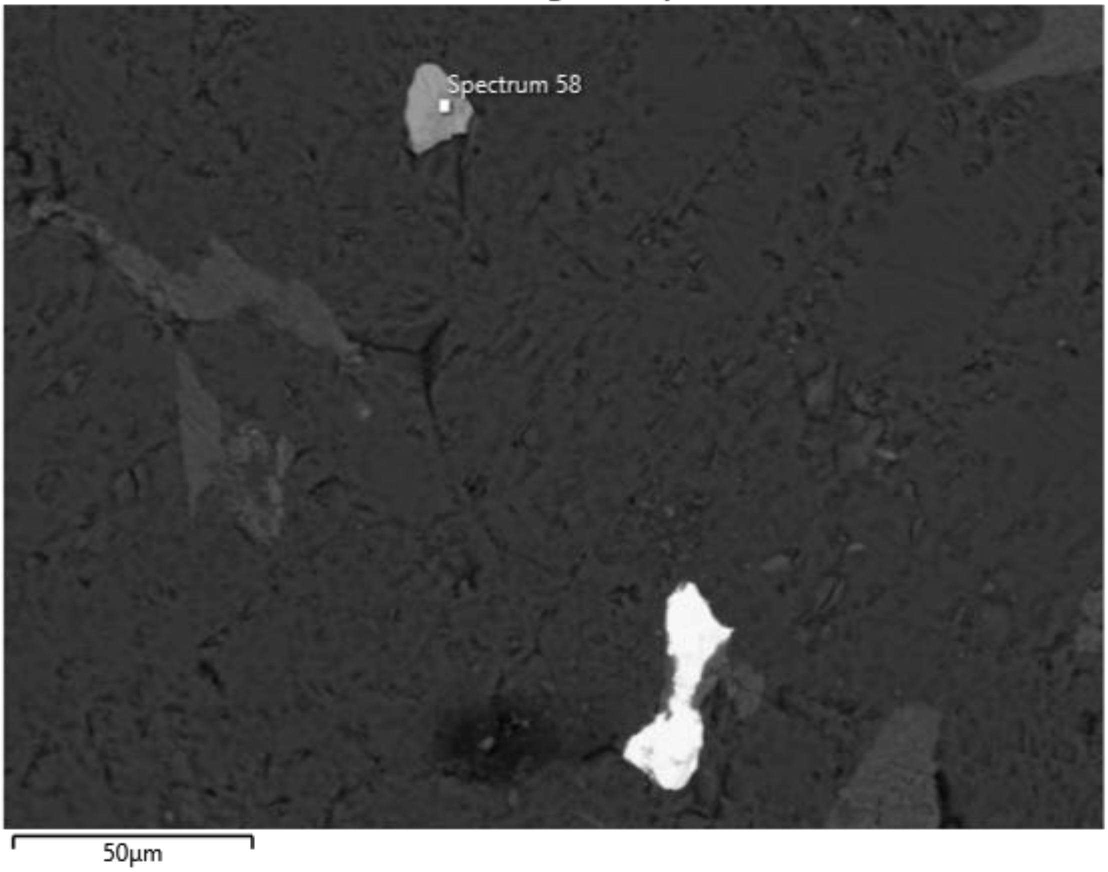
[1] indicates whether multiple options may be possible with similar stoichiometries. Confirmation by other techniques such as XRD or FTIR may be necessary for increased confidence. *Most of the sulfur-based minerals are surrounded by oxygen-containing minerals such as silica, iron oxides, and various aluminosilicates. The oxygen from the surrounding materials may interfere with the sulfur-containing particles, allowing oxygen to show as a trace or minor phase in the analysis of the sulfur particles. Most of the time this will be from the surrounding materials, however we assign a 'possible' confidence as to not rule out the possibility of partial oxidation of the sulfur mineral present.*

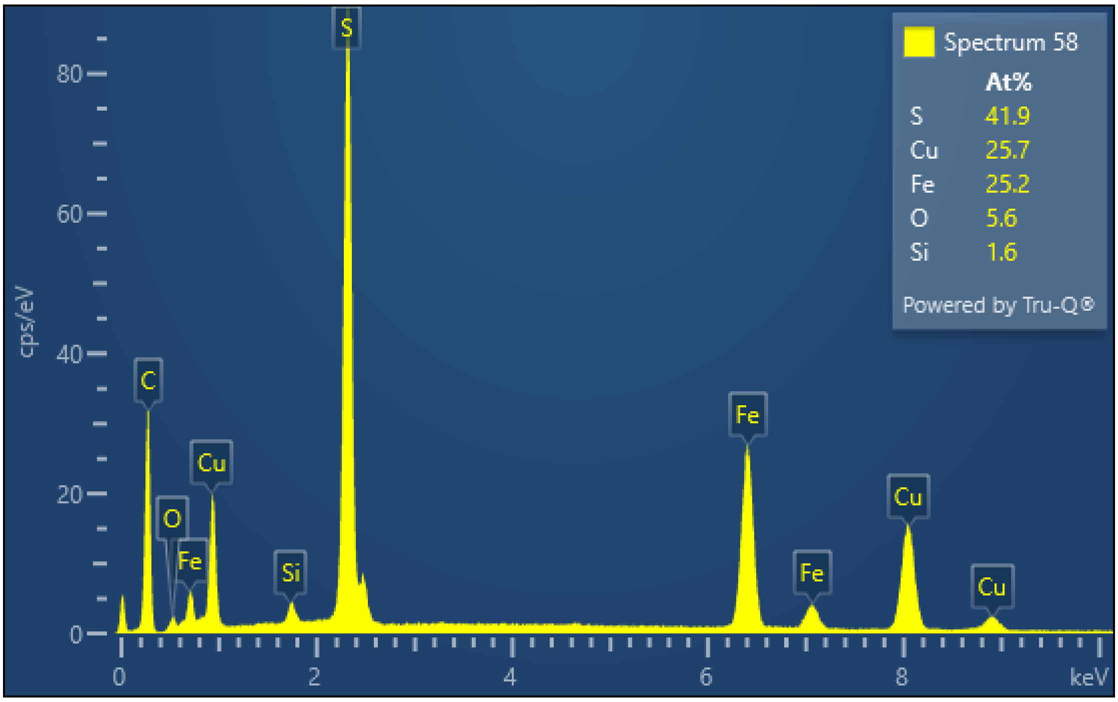
[2] The interpreted compound abundance qualifiers (major, minor, trace) are based on the following categories and are presented by number (count) of observed particles as opposed to wt% or ppm as would be reported by ICP/XRF. **All sulfur-based phases within the sample are trace. This is an abundance relative only to each other type of sulfur-based mineral present.**

Qualifier	*Approximate* range, number %
Major	> ~30
Minor	~1 to ~30
Trace	< ~1

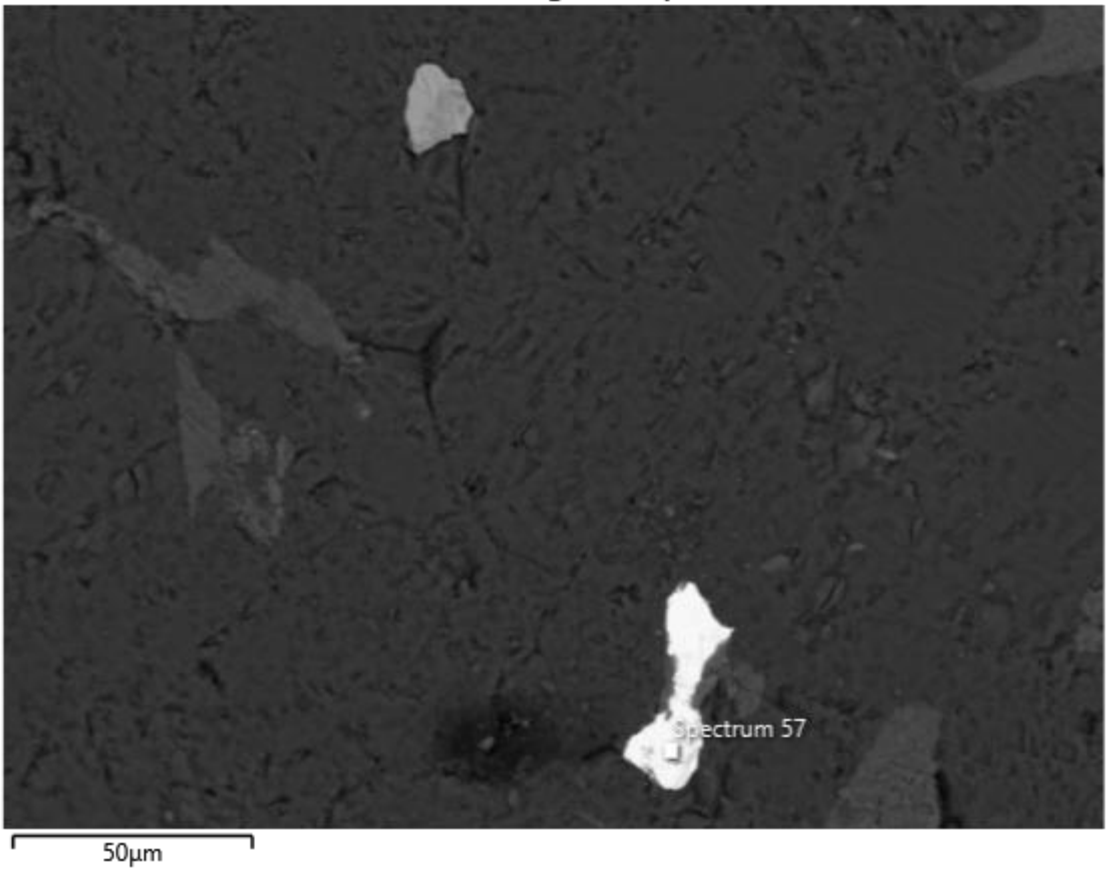
The range (above) is stated as '*Approximate*' as the technique is more a qualitative measure of relative abundance as opposed to a quantitative absolute abundance. The abundance is stated as number percent as no calculations have been made to transform geometric sizes into particle volumes, nor density values used to calculate weight fractions that would enable weight percentages to be quoted.

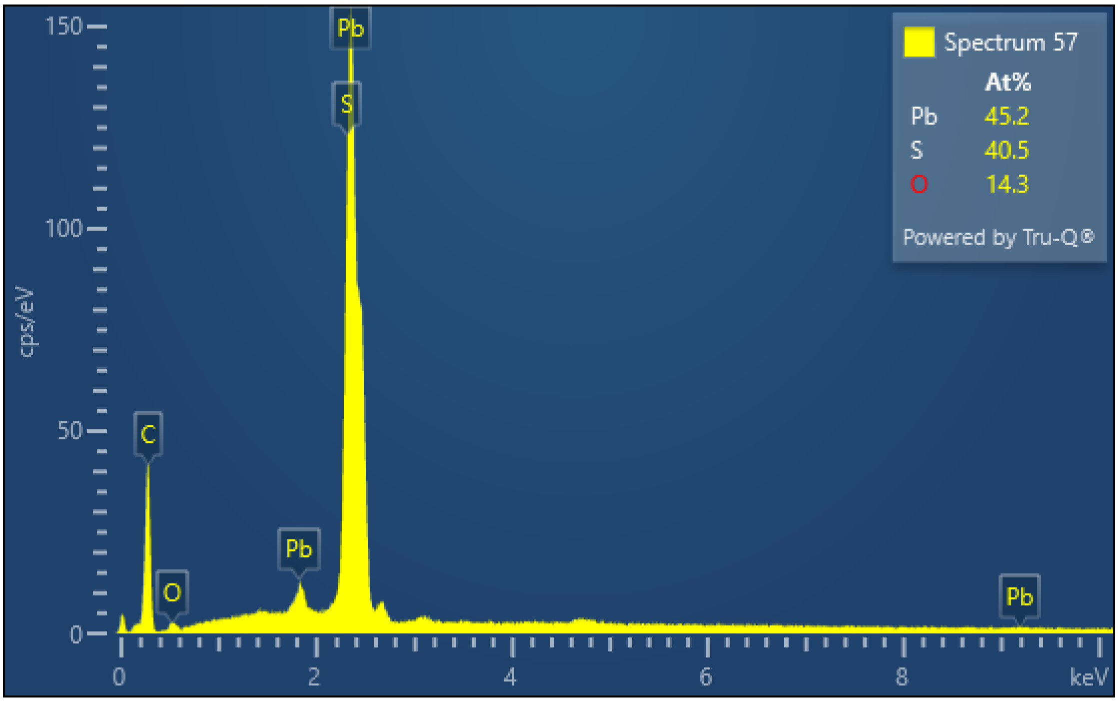
Electron Image 31 (Input1)



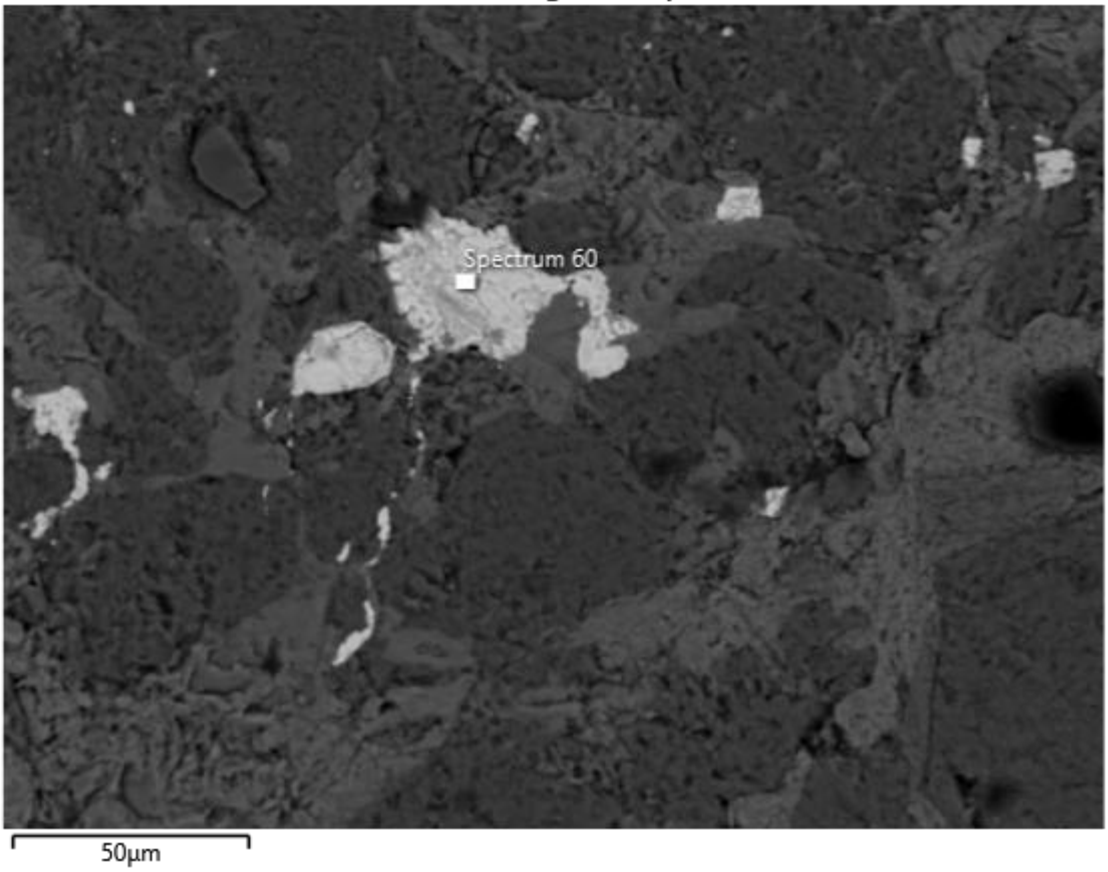


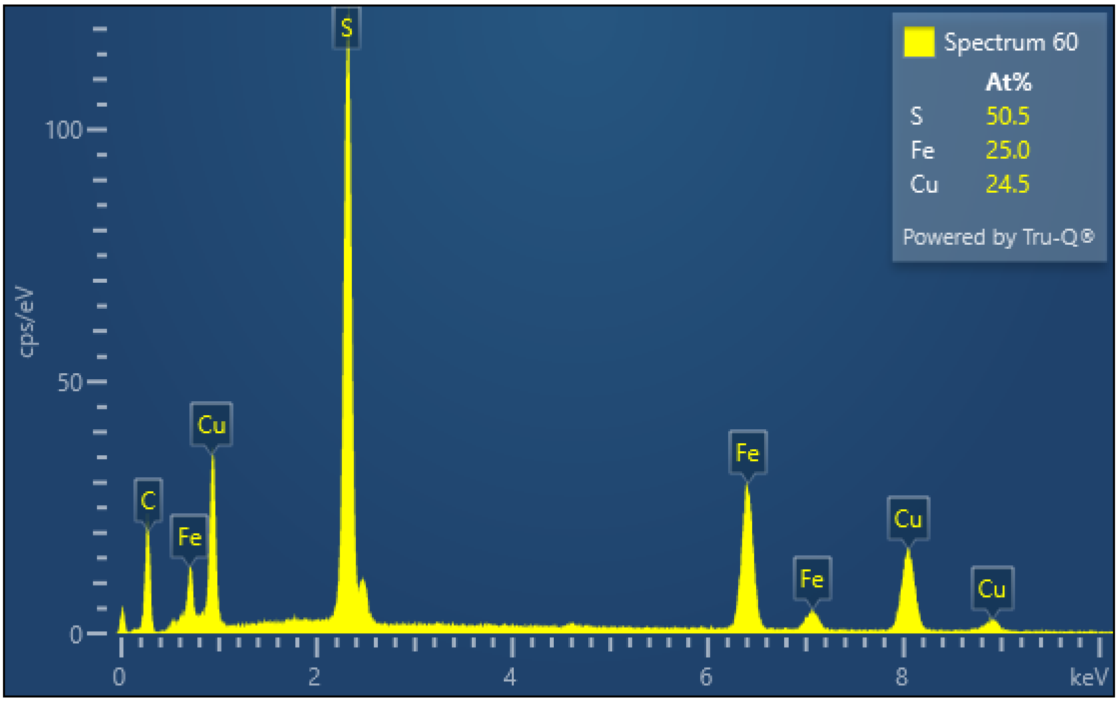
Electron Image 31 (Input1)



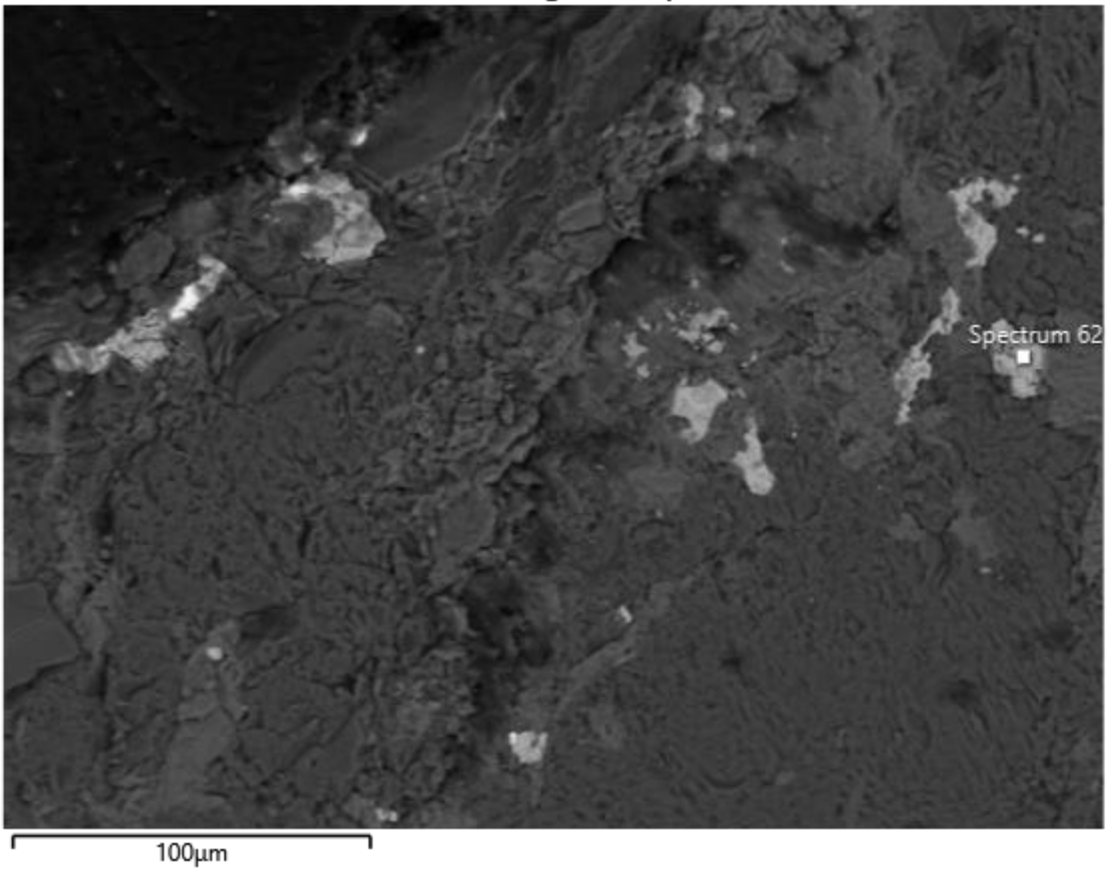


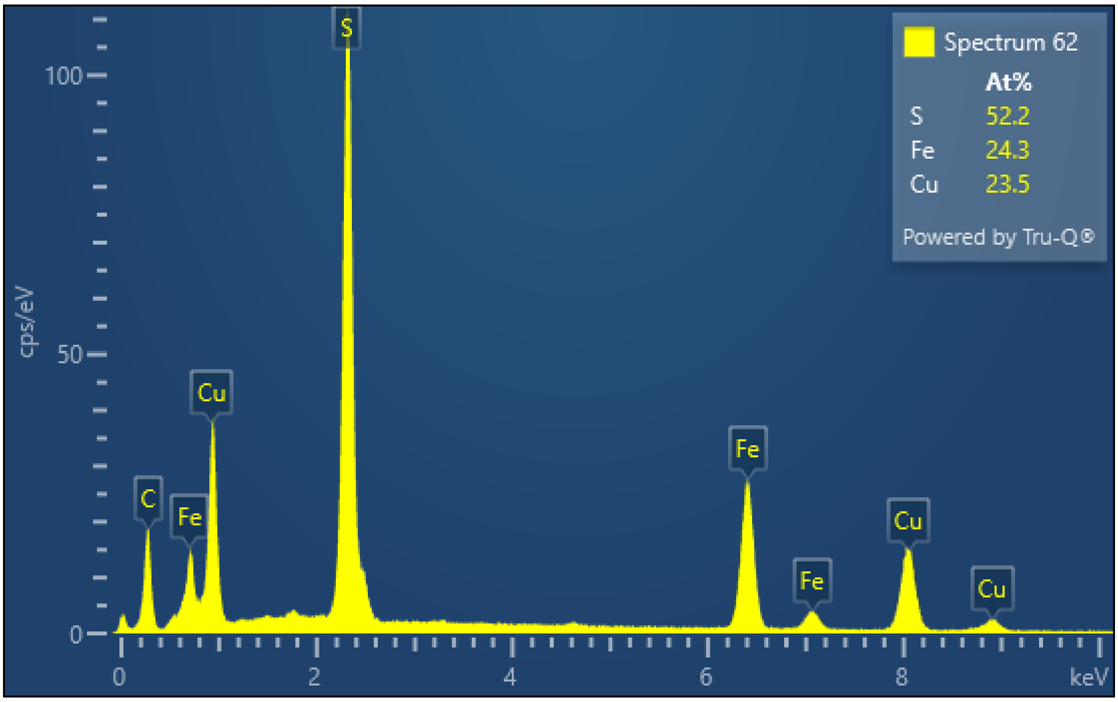
Electron Image 33 (Input1)



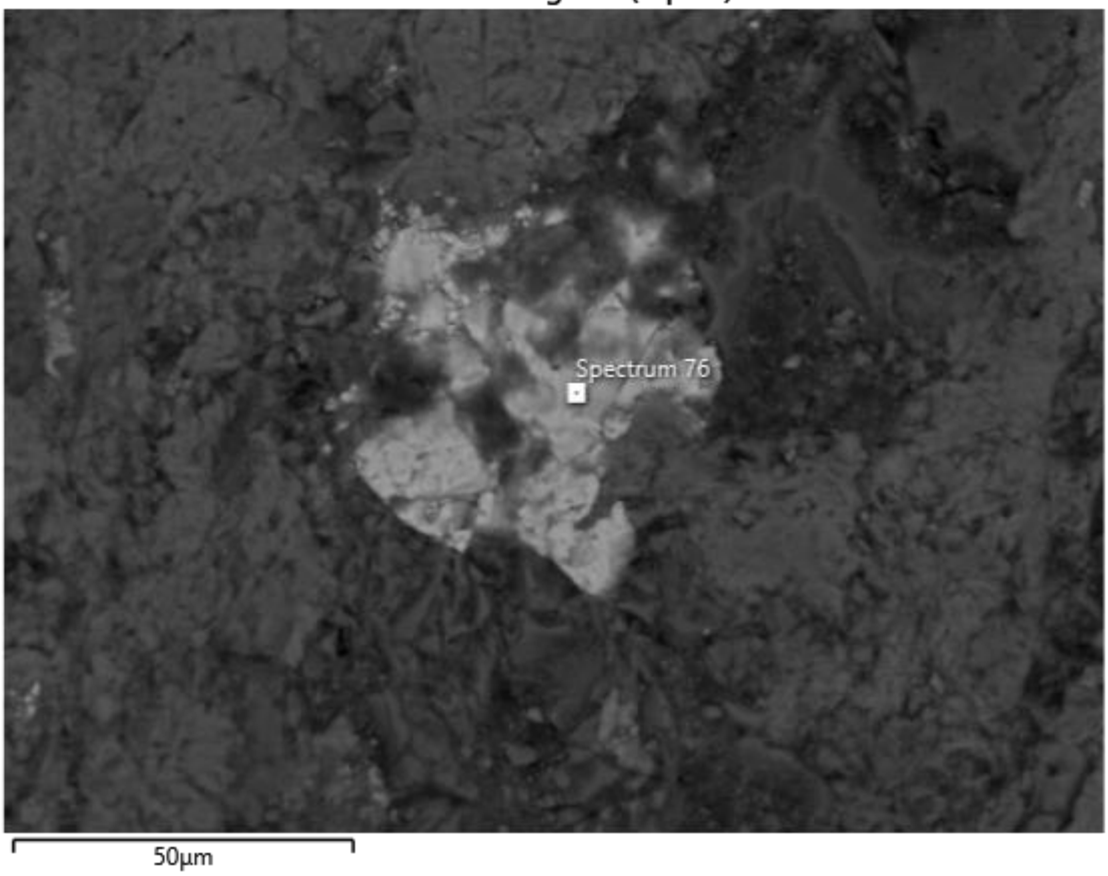


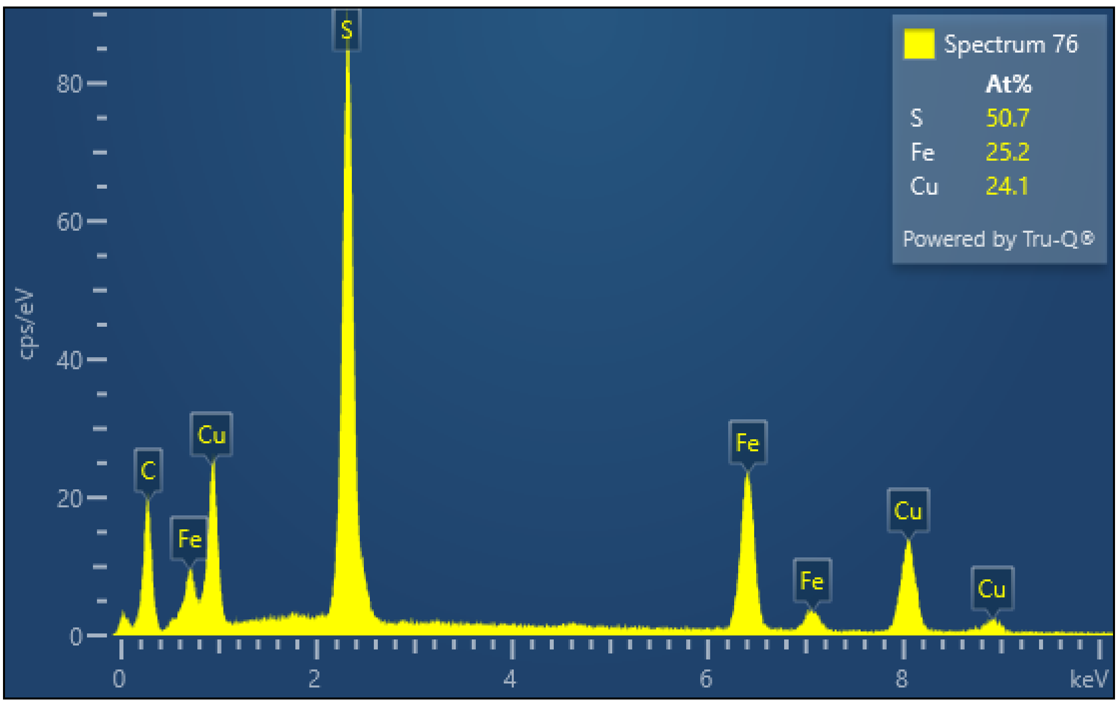
Electron Image 34 (Input1)





Electron Image 37 (Input1)





Electron Image 38 (Input1)