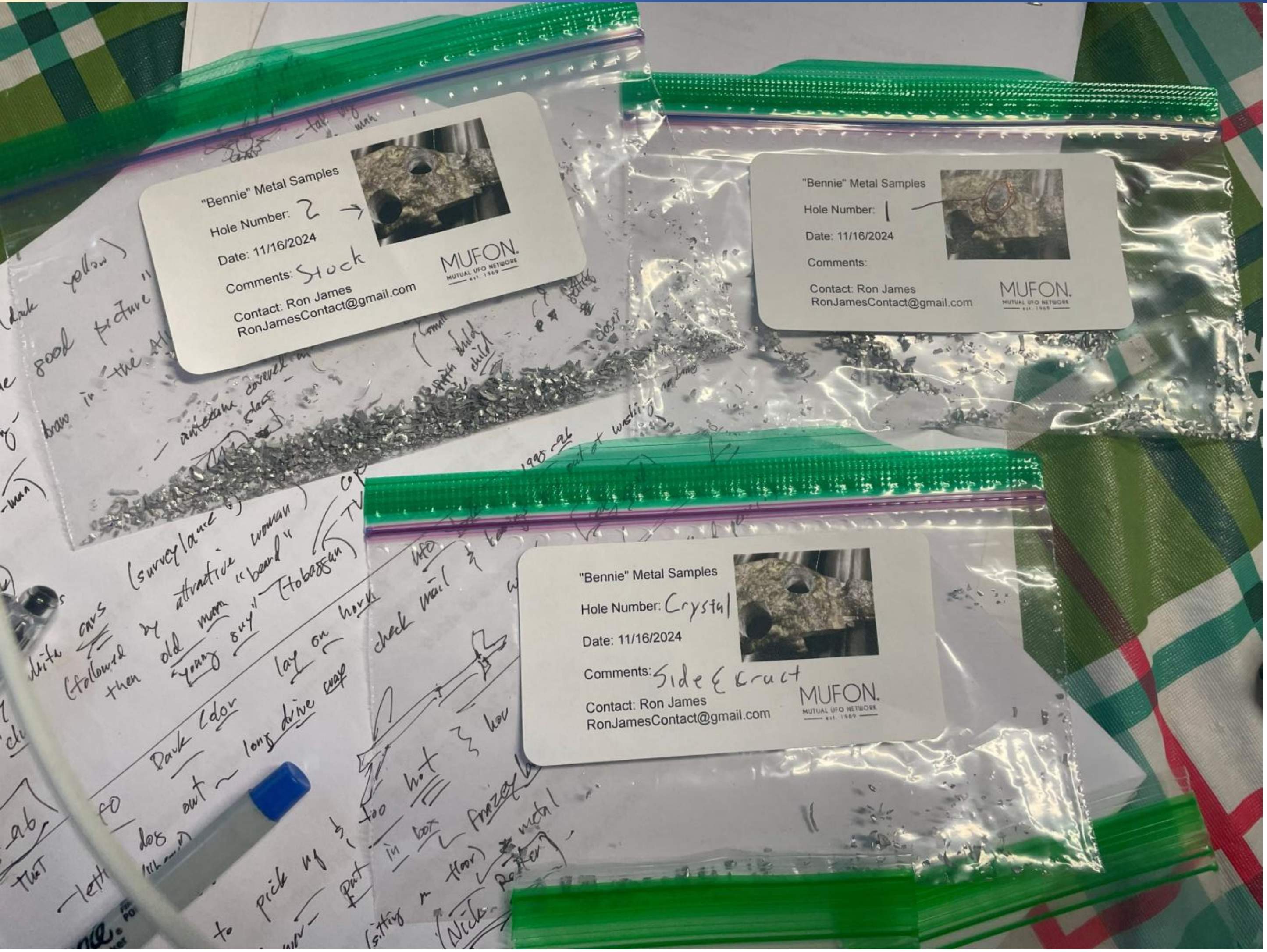
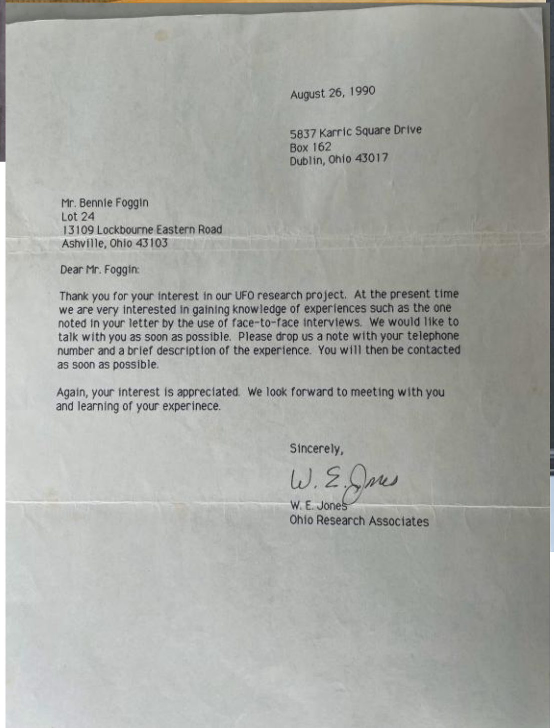
Foggin Object (cutting from edge)

Foggin Object (cutting from edge)

Foggin Object (cutting from edge)



Foggin Object (cutting from edge)



August 26, 1990

5837 Karric Square Drive
Box 162
Dublin, Ohio 43017

Mr. Bennie Foggin
Lot 24
13109 Lockbourne Eastern Road
Ashville, Ohio 43103

Dear Mr. Foggin:

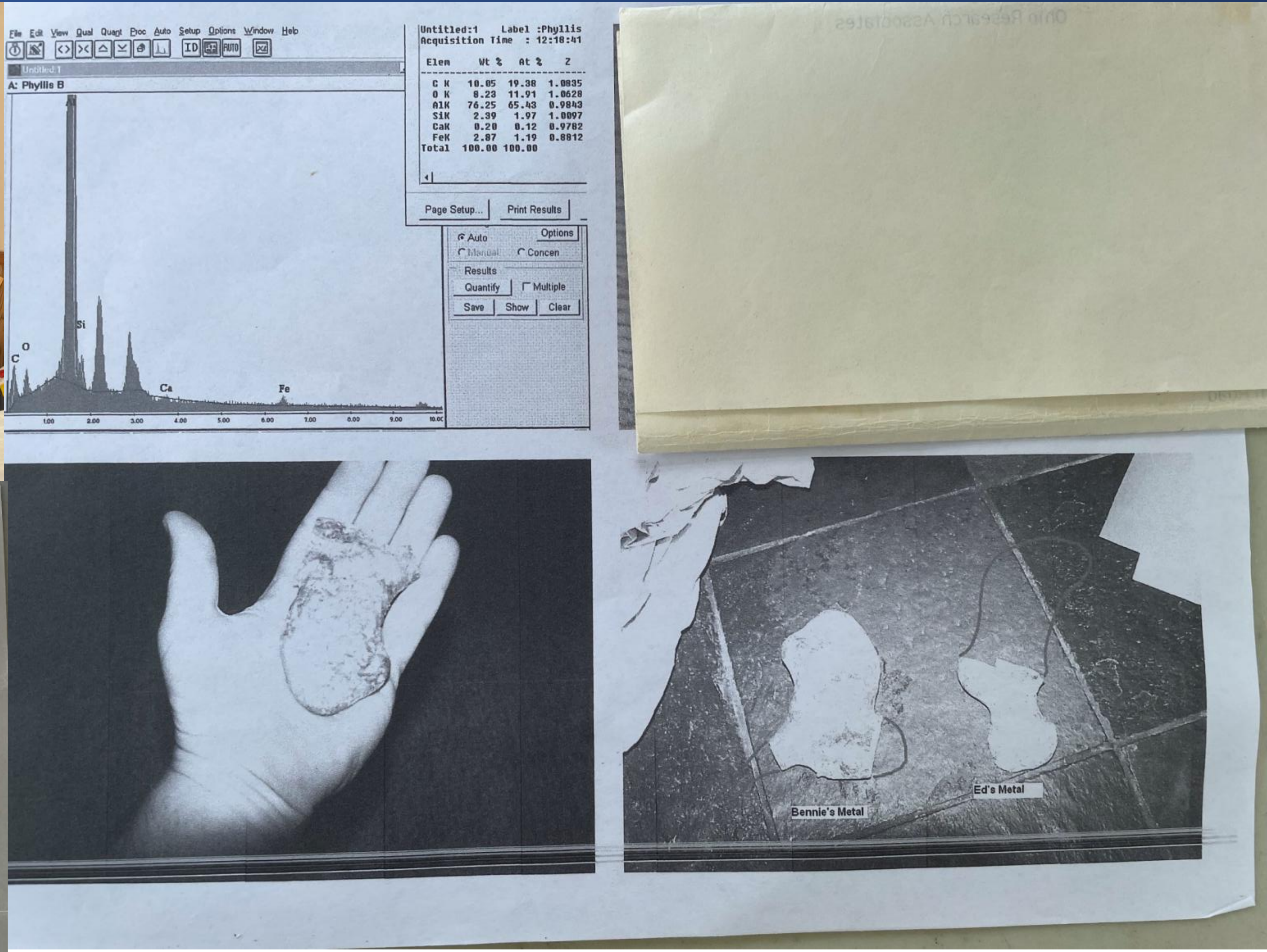
Thank you for your interest in our UFO research project. At the present time we are very interested in gaining knowledge of experiences such as the one noted in your letter by the use of face-to-face interviews. We would like to talk with you as soon as possible. Please drop us a note with your telephone number and a brief description of the experience. You will then be contacted as soon as possible.

Again, your interest is appreciated. We look forward to meeting with you and learning of your experinece.

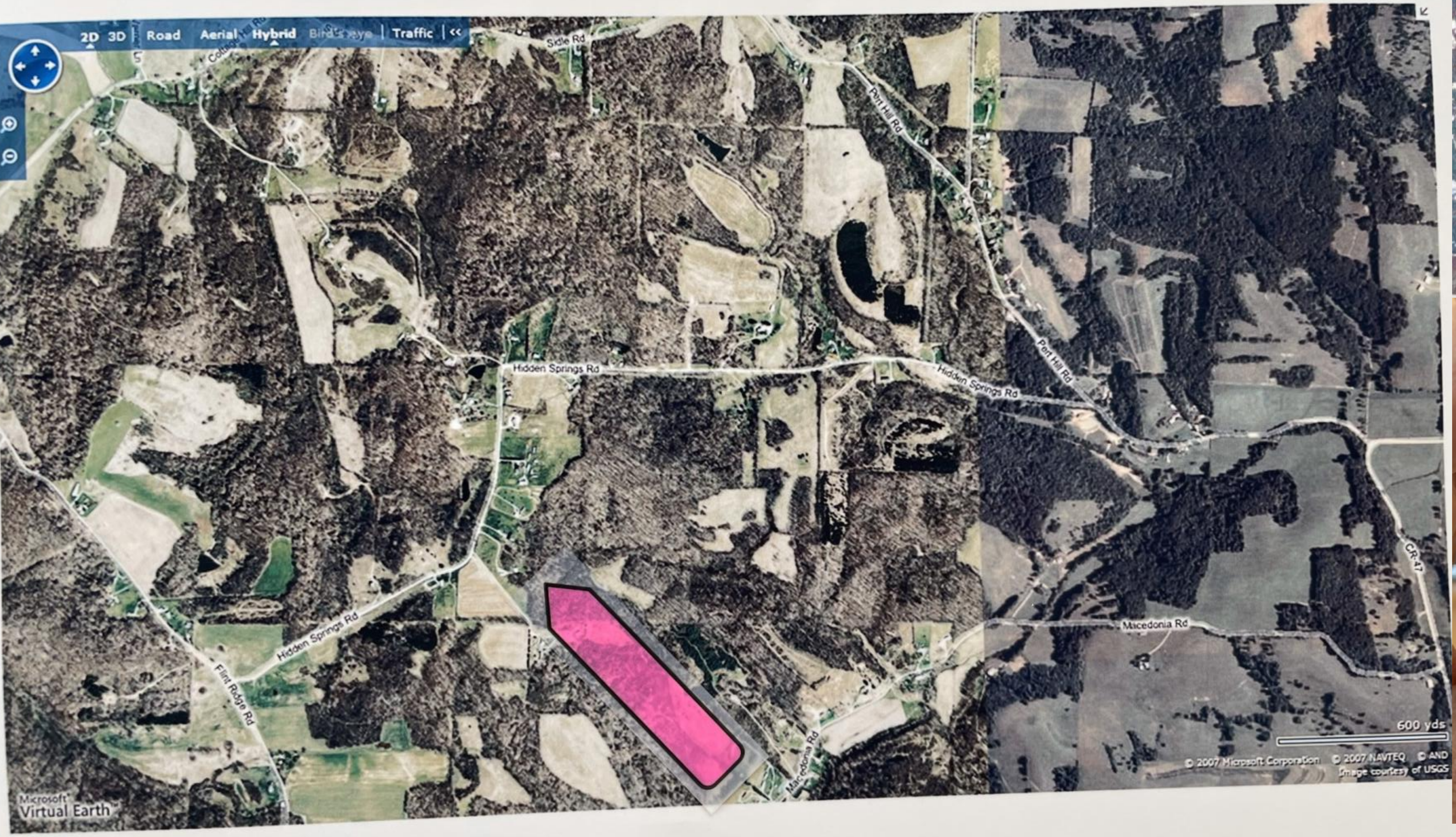
Sincerely,

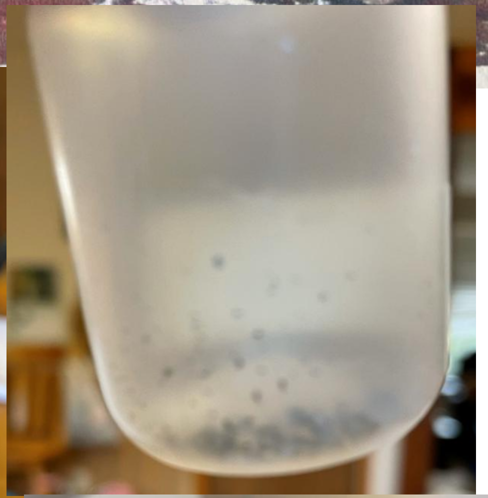
W. E. Jones

W. E. Jones
Ohio Research Associates



Foggin Object (cutting from edge)





Foggin Object (cutting from edge)

bfoggin

From: "Nick Reiter" <avalonbiker@yahoo.com>
Date: Monday, February 04, 2013 9:24 AM
To: "bfoggin" <bfoggin@columbus.rr.com>
Subject: Art's results in an email form

OK, Ben, you should be able to see everything here as it appears in the report. Don't know why the attached original document didn't go through.

Talk to you tonight...

N

ICP and ICP-MS Services

ANALYTICAL REPORT

Prepared for: Nick Reiter Date Reported: February 1, 2013

Comparison of "Exova" results to ICP and ICP-MS Services results

All results are reported in parts per million (ug of element per g of sample)

Element	Exova	ICP and ICP-MS Services
Lithium		
Beryllium	0.23	0.24
Boron	<10.	5.
Sodium	<50.	See ICP Emission Report
Magnesium	3,100.	2,500.
Aluminum	Major (>100,000)	Major (>100,000)
Silicon	<2,000.	See ICP Emission Report
Phosphorus	<8.	See ICP Emission Report
Potassium	<50.	See ICP Emission Report
Calcium	<50.	See ICP Emission Report
Scandium	Internal Standard	0.4
Titanium	310.	310.
Vanadium	57.	65.
Chromium	240.	260.
Iron	9,700.	See ICP Emission Report
Manganese	1,900.	2,100.

Cobalt	6.6	7.0
Nickel	270.	250.
Copper	4,200.	2,900.
Zinc	2,000.	1,500.
Gallium	31.	90.
Germanium	0.96	0.55
Arsenic	<0.4	0.4
Selenium	<6.	<1.
Bromine	<50.	<10.
Rubidium	<0.02	0.07

Results continue on the following page.

Element	Exova	ICP and ICP-MS Services
Strontium	0.17	2.2
Yttrium	1.2	0.9
Zirconium	24.	20.
Niobium	0.81	0.45
Molybdenum	5.3	7.8
Ruthenium	<0.02	<0.01
Rhodium	<0.04	
Palladium	<0.1	<0.01
Silver	5.3	3.3
Cadmium	4.7	4.5
Indium	Internal Standard	0.03
Tin	29.	26.
Antimony	6.0	5.5
Tellurium	<0.1	<0.05
Iodine	<30.	<10.
Cesium	<0.02	<0.01
Barium	0.35	7.
Lanthanum	3.4	2.5
Cerium	7.7	7.0
Praseodymium	0.57	0.73
Neodymium	2.3	2.3
Samarium	0.31	0.29
Europium	<0.02	<0.01
Gadolinium	0.52	0.35
Terbium	Internal Standard	0.05
Dysprosium	0.39	0.26
Holmium	0.07	0.05
Erbium	0.19	0.12
Thulium	<0.02	0.01
Ytterbium	<0.08	0.01
Lutetium	<0.4	0.01
Hafnium	0.98	0.57
Tantalum	<0.06	0.01
Tungsten	4.8	9.1
Rhenium	<0.3	<0.01
Osmium	<0.3	<0.01

Iridium	<0.08	<0.01
Platinum	<0.1	<0.01
Gold	<1.	<0.01
Mercury	<0.2	0.04
Thallium	<0.8	0.24
Lead	400.	300.
Bismuth	12.	7.3
Thorium	0.69	0.41
Uranium	0.97	0.84

ICP and ICP-MS Services

ANALYTICAL REPORT
SAMPLE SUBMITTED 8-16-12

Prepared for: Mr. Nick Reiter

All results reported in parts per million (ppi

Element	Concentration
Ca	600
Fe	11,000
K	100
Na	100

All results reported in parts per million (ppm)

1. ICP-OES elemental analysis
2. ICP-MS elemental analysis
3. Isotope abundance analysis

Element	Sample submitted in August, 2012	Sample submitted in March, 2013
Ca	640.	230.
Fe	10,400.	11,700.
K	40.	120.
Na	20.	70.
P	45.	10.
S	90.	32.
Si	29,000.	7,900.

Element	Sample submitted in August of 2012, ppm	Sample submitted in March of 2013, ppm	Ratio of 2013 sample to 2012 sample
Magnesium	2,500.	2,000.	0.80
Titanium	310.	240.	0.77
Vanadium	65.	65.	1.00
Manganese	2,100.	2,200.	1.05
Nickel	250.	215.	0.86
Copper	2,900.	2,560.	0.88
Zinc	1,500.	1,330.	0.89
Lead	300.	260.	0.87

All results are reported as percent abundances.

Isotopic Abundance	Terrestrial Sample	Foggins sample	Accepted Value
Ni-58	68.45 ± 0.18	68.01 ± 0.14	68.27
Ni-60	26.02 ± 0.09	26.23 ± 0.10	26.10
Ni-61	1.12 ± 0.005	1.14 ± 0.007	1.13
Ni-62	3.52 ± 0.07	3.68 ± 0.02	3.59
Sr-84	0.56 ± 0.002	0.43 ± 0.06	0.56
Sr-86	9.85 ± 0.02	9.78 ± 0.18	9.86
Sr-87	6.99 ± 0.03	6.94 ± 0.37	7.00
Sr-88	82.60 ± 0.04	82.83 ± 0.40	82.58

Foggin Object (cutting from edge)

Microstructural Analysis of Samples Received from Bennie Foggin

R.Olson, L. Martins, M. Topolski

Project Notes

We received samples of aluminum from Bennie Foggin labelled "Ohio Ed's metal sample" (hereafter labelled SM006) and "Rendlesham Forest Sample" (hereafter labelled SM007). The Ed's metal sample was a small chunk less than about 1 cubic centimeter. The Rendlesham sample was a collection of relatively fine shavings with size on the order of 1-mm. We have no knowledge of the history of Ed's metal specimen. We were well aware of the Rendlesham story given its significant media exposure over the last couple of decades, but have no knowledge of this particular sample or how it was collected.

Specimen Notes

Samples were mounted in epoxy, initially ground using SiC paper to reveal a cross-section of the microstructure, then polished using water-based diamond suspensions and a Buehler automatic polishing wheel. Samples were then cleaned using ethanol in an ultrasonic bath and coated with a conductive coating of Au-Pd to prepare for analysis via Scanning Electron Microscopy and Energy Dispersive Spectroscopy. Samples were analysed using a Tescan Vega 3 SEM equipped with an Oxford XMax-N EDS. All images were captured in backscatter mode.

Results and Discussion

The analytical results for all spectra are included in two summary tables below. The first is provided in weight percent, the second in atomic percent. The first seven spectra (1-7) pertain to Ed's metal analyses, and the final ten spectra (8-17) pertain to the Rendlesham analyses.

Ed's metal

Figure 1 shows a low magnification image of the surface prepared for analysis. Sites A and B were analyzed in detail. Figure 2 is a close-up of site A, where a large section of the alloy was scanned by EDS to obtain an estimate of the average composition. This material has a fairly simple composition. The relatively low amount of silicon is likely the result of impurity, not an intentional addition. It is difficult to process aluminum (Al) with silicon (Si) and iron (Fe) contents below about 0.4 wt%. We did not see Fe at this level in spectrum 1, but did pick up a precipitate in spectrum 3 with a high Fe content, so it could be we simply did not pick up the trace Fe in spectrum 1. The magnesium (Mg) concentration of 0.35 wt% is likely an intentional addition. Mg is a very common additive in Al alloy. A small amount of oxygen (O) was pick up, likely trace amounts of oxides in the alloy resulting from processing issues. The only other element we detected at this level was silver (Ag), which is a very unusual component. Historically, Ag is associated with copper (Cu) based alloys of Al. Al-Cu alloys were highly used in WWII

for aircraft, but it was discovered they suffered from stress corrosion. Ag was then used to enhance the stress corrosion resistance of these alloys. It also improves high temperature properties. We do not know what role silver might play in non-Cu bearing alloys. At a level of 1.06 wt %, this was likely added to the metal.

Figure 3 is a close-up on one of the main precipitates we observed. It also shows the location of an EDS scan of the Al matrix, plus location of where we analysed the precipitate. Note the Ag is found in the matrix material again at a level of 1.30 wt%, so it is homogenized with the Al. This suggests the Ag was added at the melt stage. In conventional Al making processes, this would be a relatively expensive step, so it is likely an intentional addition. The Mg is again present at 0.36 wt%. The precipitate shows high level of Si and Fe, likely there due to trace levels of these elements in the alloy.

Figure 4 is another analysis from site B with a different type of precipitate. Spectrum 4 again shows the Mg, but we did not pick up the Ag. There is a small amount of porosity present here and we see evidence of some type of oxide containing mostly Al with Na, Mg, Si, Cl and Ca, likely an aluminum oxide impurity that caused the porosity.

Figure 5 shows a couple other precipitates at site B. Spectrum 6 has a high oxygen content, likely an oxide impurity. Spectrum 7 has high Si and Fe content similar to precipitate observed in Figure 3, but picked up a little Ag.

Overall, we can say this specimen is not composed of a common aluminum alloy. The Ag and Mg appear to be intentionally added, whereas the Si and Fe contents are likely at impurity levels. There is also the evidence of some oxide impurities likely introduced during processing.

Rendlesham Forest

Figure 6 is a low magnification image of the cross-section of two as-received shavings. Some porosity is present, but we do not know if these were a result of mechanical and/or thermal stresses induced during the formation of these shavings, or were present in an original component from which these shavings originated. Subsequent images represent images taken from Sites A and B.

Figure 7 is a higher magnification image of Site A. The enclosed area in Figure 7 represents the area used to measure the average composition of the alloy. The Si content is relatively high at 19.47%, suggesting this alloy might have been used for casting. The Fe content is at a typical level for trace impurity. Mg and Cu levels are likely due to addition, but could be impurities.

Figure 8 is a higher magnification image of Site A revealing details of precipitates. Spectrum 9 shows results of the Al matrix, low level of Mg at 0.22 wt% and Si at 1.37 wt%. Spectrum 10 shows results of bright precipitate containing high levels of Si and Fe, but also smaller amounts of Mn and Cr. Another interesting feature of this microstructure is the slightly lighter regions dispersed through the metal matrix, as indicated by the spot denoted Spectrum 12. These are regions of Si metal contained within the Al metal matrix. It appears these regions also contain a lot of porosity, likely a result of how the silicon solidifies within the aluminum matrix as the material cools.

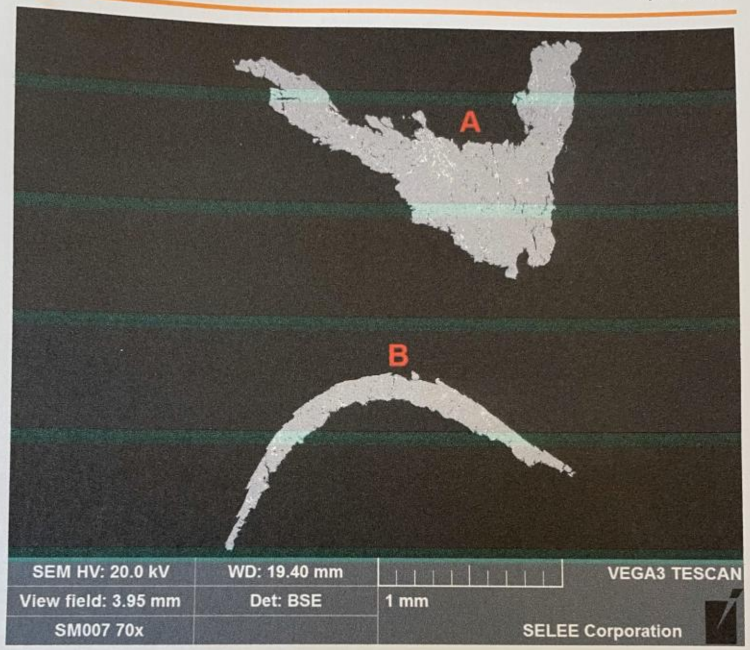


Figure 6: Low magnification image of Rendlesham Forest shavings. Subsequent images where obtained at sites A or B.

Foggin Object (cutting from edge)

SM007 - Site A+

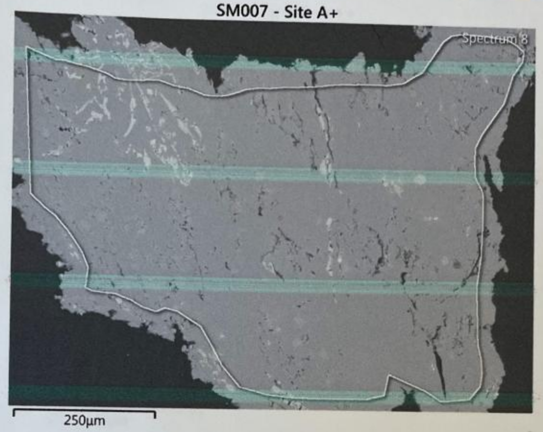


Figure 7: Higher magnification image of Site A.

Summary of Energy Dispersive Spectroscopy Results - %WEIGHT

Spc Label	O	Na	Mg	Al	Si	S	Cl	Ca	V	Cr	Mn	Fe	Cu	Ag
Spc 8	1.09	-	0.19	78.30	19.47	-	-	-	-	-	-	0.47	0.47	-

Summary of Energy Dispersive Spectroscopy Results - %ATOMIC

Spc Label	O	Na	Mg	Al	Si	S	Cl	Ca	V	Cr	Mn	Fe	Cu	Ag
Spc 8	1.85	-	0.21	78.71	18.80	-	-	-	-	-	-	0.23	0.20	-

SELEE METALLURGICAL SERVICES

SM007 - Site A++++

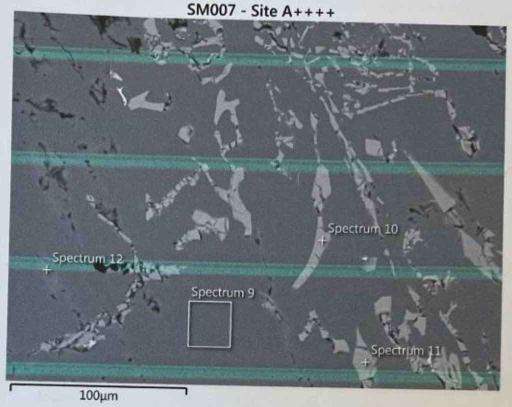


Figure 8: Higher magnification image at Site A.

Summary of Energy Dispersive Spectroscopy Results - %WEIGHT

Spc Label	O	Na	Mg	Al	Si	S	Cl	Ca	V	Cr	Mn	Fe	Cu
Spc 9	0.56	-	0.22	97.85	1.37	-	-	-	-	-	-	-	-
Spc 10	-	-	-	58.11	10.20	-	-	-	0.20	1.13	6.91	22.39	1.05
Spc 11	-	-	-	58.89	9.30	-	-	-	-	1.17	6.56	22.76	1.32
Spc 12	0.60	-	-	1.00	98.40	-	-	-	-	-	-	-	-

Summary of Energy Dispersive Spectroscopy Results - %ATOMIC

Spc Label	O	Na	Mg	Al	Si	S	Cl	Ca	V	Cr	Mn	Fe	Cu
Spc 9	0.95	-	0.24	97.50	1.31	-	-	-	-	-	-	-	-
Spc 10	-	-	-	69.79	11.77	-	-	-	0.13	0.71	4.08	12.99	0.54
Spc 11	-	-	-	70.77	10.74	-	-	-	-	0.73	3.87	13.21	0.67
Spc 12	1.04	-	-	1.04	97.92	-	-	-	-	-	-	-	-

SELEE METALLURGIC SERVICES

SM007 - Site B++++

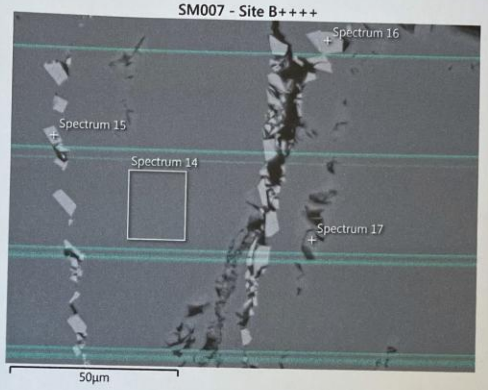


Figure 10: Higher magnification image of site B.

Summary of Energy Dispersive Spectroscopy Results - %WEIGHT

Spc Label	O	Na	Mg	Al	Si	S	Cl	Ca	V	Cr	Mn	Fe	Cu	Ag
Spc 14	0.55	-	0.20	96.84	0.97	-	-	-	-	-	-	-	-	1.44
Spc 15	-	-	-	57.81	16.47	-	-	-	-	-	1.88	23.84	-	-
Spc 16	-	-	-	55.87	17.00	-	-	-	-	-	2.48	24.65	-	-
Spc 17	0.77	-	-	8.16	91.07	-	-	-	-	-	-	-	-	-

Summary of Energy Dispersive Spectroscopy Results - %ATOMIC

Spc Label	O	Na	Mg	Al	Si	S	Cl	Ca	V	Cr	Mn	Fe	Cu	Ag
Spc 14	0.93	-	0.22	97.54	0.94	-	-	-	-	-	-	-	-	0.36
Spc 15	-	-	-	67.16	18.38	-	-	-	-	-	1.07	13.38	-	-
Spc 16	-	-	-	65.48	19.14	-	-	-	-	-	1.43	13.95	-	-
Spc 17	1.34	-	-	8.42	90.24	-	-	-	-	-	-	-	-	-

SELEE METALLURGICAL SERVICES

Foggin Object (cutting from edge)

7/19/2015

Figure 9 shows a close up of Site B, where we again see high concentration of Si and small amounts of Fe and Cu, similar to results found in Figure 7. But here we also see evidence of Ag again? This is confirmed in Spectrum 14 shown in Figure 10. The composition of the brighter precipitates (Spectra 15 and 16) show similar high concentration of Si and Fe with smaller amount of Fe. The composition of lighter regions represented by Spectrum 17 confirms silicon metal within aluminum matrix.

Overall we can also say this metal alloy does not represent a common aluminum alloy. The high silicon content suggests this material was used to generate a casting, as high silicon is often used to accomplish this (4000 series alloys). None we know of use Ag in any capacity.

Regarding the use of Ag, we did uncover an Apr 2010 article on the web entitled "Al-Cu-Mg-Ag Alloys" discussing research interest in this system for use in aerospace applications.

www.totalmateria.com/page.aspx?ID=CheckArticle&site+ktn&NM=240

Although Ed's metal and Rendlesham samples are quite different, the fact we are picking up Ag in both samples, an unusual component, begs the questions,

Is Ed's metal and Rendlesham connected in some way?

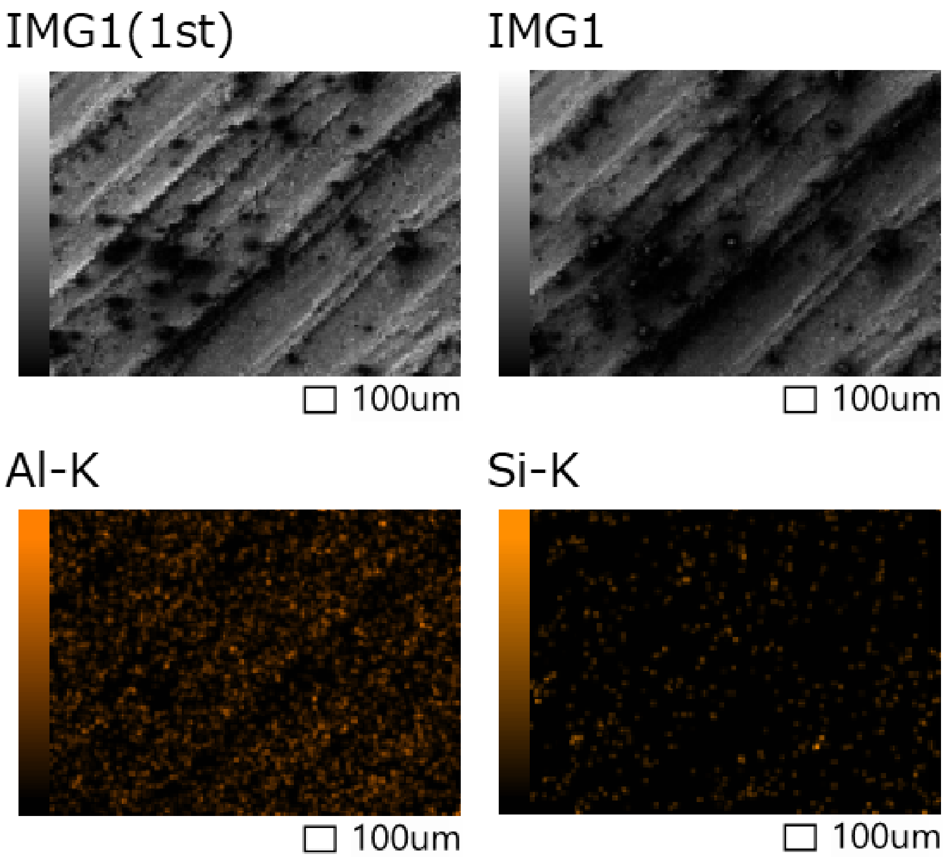
Is there a possibility for Ag contamination?

We do not think Ag contamination was a possibility in our lab, and took a very close look at Ag peaks in the spectra, so are fairly sure about the results.

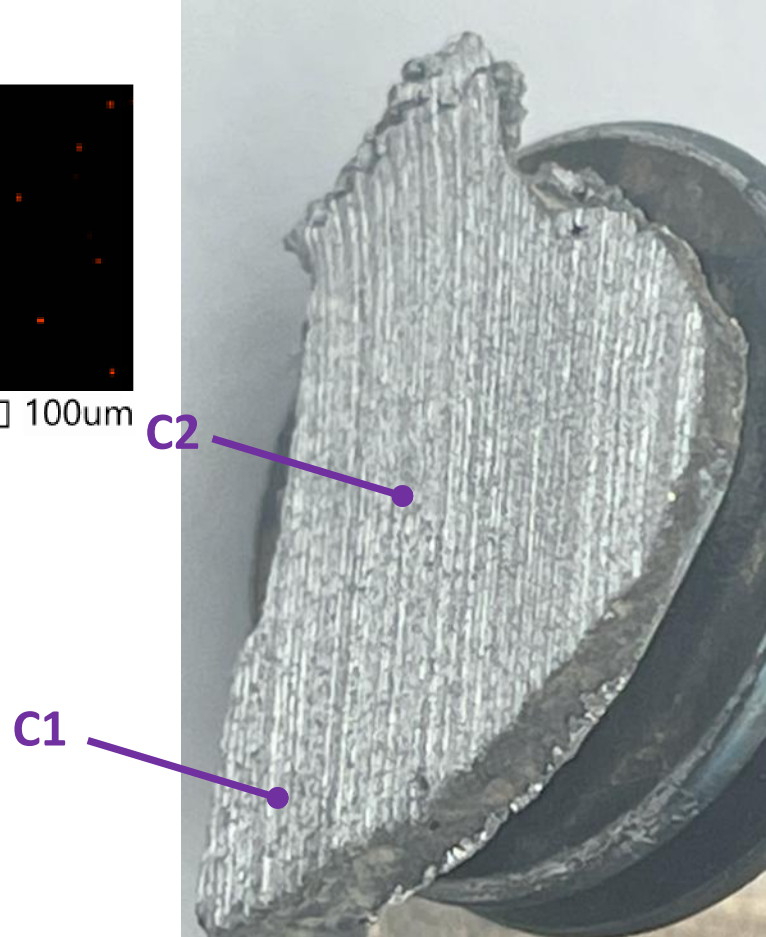
SELEE METALLURGICAL SERVICES

It was only after Kim was done that I told her a little bit about the metal and Benny. I didn't go into the photo stories at all. She had sensed early on that most of what I was showing her was UFO related (although Kim has also known me for 12 years, and knows what I am into!"

Cut Surface Spot #C1 (EDS map)

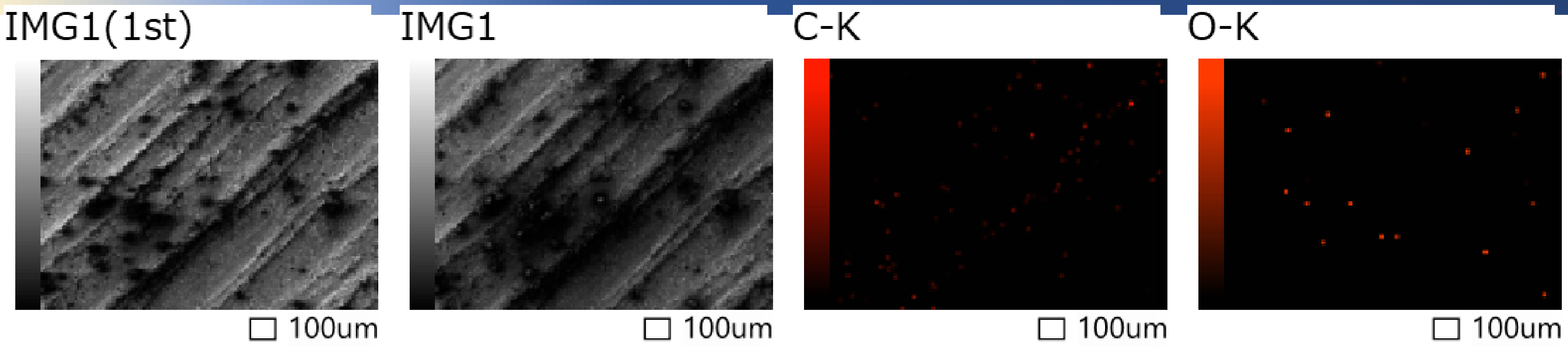


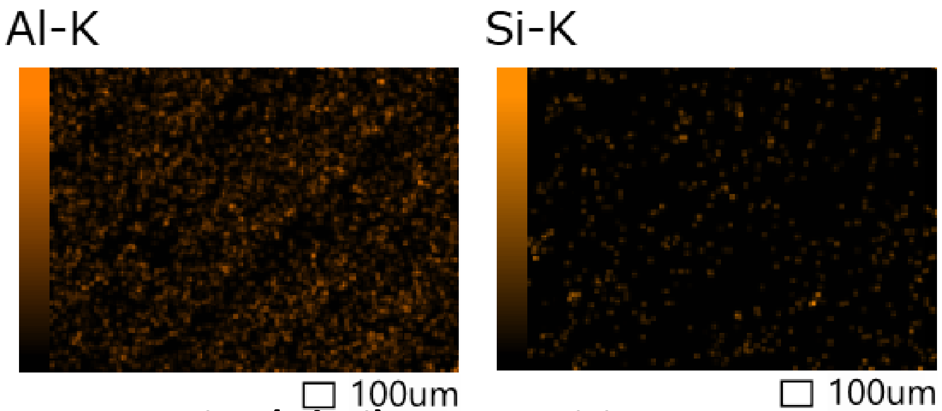
Element	Line	Mass%	Atom%
C	K	5.52±0.04	10.83±0.08
O	K	11.86±0.14	17.46±0.20
Al	K	70.74±0.81	61.75±0.71
Si	K	11.88±0.54	9.96±0.45
Total		100.00	100.00



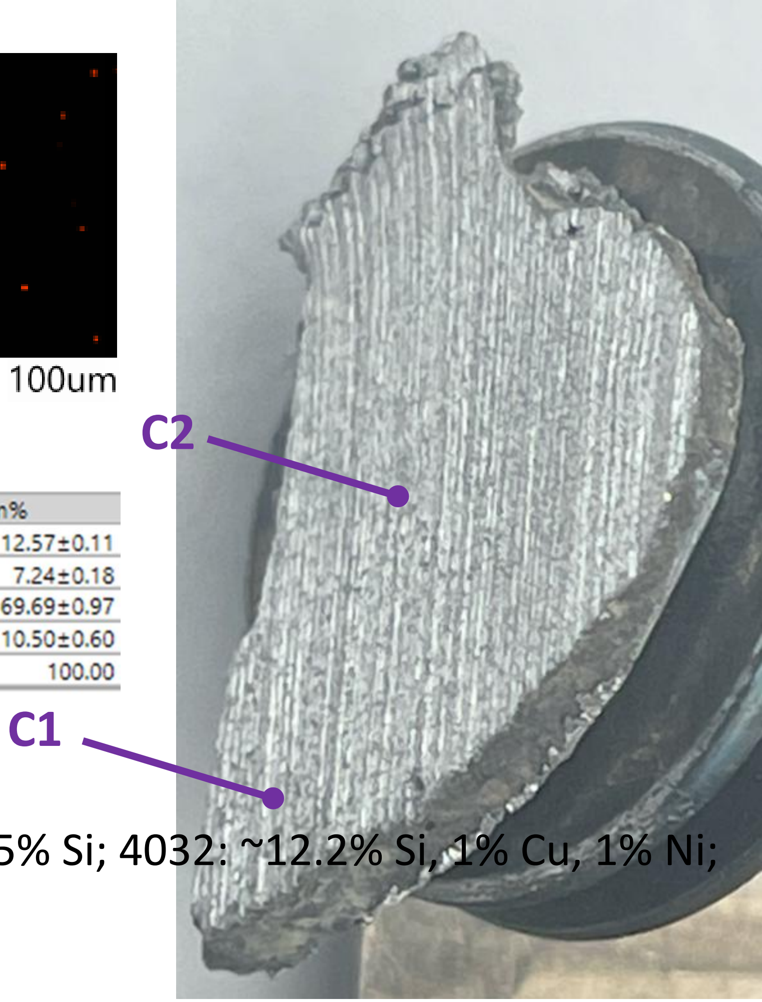
- Cut surface: Cut (inside surface, but exposed to environment for some time).
- High Al (70.74 wt%): Consistent with an aluminum alloy or aluminum matrix material (Al >50 wt%).
- High O (11.86 wt%, 17.46 at%): Suggests an oxide layer (e.g., Al_2O_3, common on Al surfaces) or oxide inclusions, as bulk alloys lack significant O.
- C (5.52 wt%, 10.83 at%): Indicates carbon contamination (e.g., hydrocarbons from SEM chamber, sample handling) or a carbon-containing composite (e.g., Al with carbon fibers or graphite).
- Si (11.88 wt%): Matches 4xxx series (Al-Si, 5–12% Si) or high-Si casting alloys, used for wear resistance and castability.

Cut Surface Spot #C2 (EDS map)





Element	Line	Mass%	Atom%
C	K	6.18±0.05	12.57±0.11
O	K	4.74±0.12	7.24±0.18
Al	K	77.00±1.07	69.69±0.97
Si	K	12.07±0.70	10.50±0.60
Total		99.99	100.00



- **4xxx Series (Al-Si)**: **Composition**: 5–12 wt% Si, balance Al, minor Mg, Cu, Ni (e.g., 4043: ~5% Si; 4032: ~12.2% Si, 1% Cu, 1% Ni; 4047: ~12% Si).
- **Si**: 11.88 wt% aligns well with 4032 (~12.2% Si) or 4047 (~12% Si)
- **Al**: 70.74 wt% is lower than 4xxx (~85–95% Al), but oxide and carbon reduce Al wt%.
- **O**: 11.86 wt% suggests Al_2O_3 (Al:O = 2:3 atomic, ~52.93 wt% Al, 47.07 wt% O). If ~11.86 wt% O is from Al_2O_3, it consumes ~13.33 wt% Al, leaving ~57.41 wt% Al for the alloy, still low.
- **C**: 5.52 wt% is not in 4xxx alloys; likely surface contamination (e.g., hydrocarbons) or a composite.

•**Verdict**: **4032** or **4047** with an **Al_2O_3 layer** and **carbon contamination** is the closest match.

Discussion of cut surface:

- **Best Candidates (Grok's verdict):**

A390 (Casting Alloy, Oxidized): Composition: ~17% Si, 4–5% Cu, 0.5% Mg (negligible here), balance Al (~78% Al).Adjusted: With ~12 wt% O from Al_2O_3 (consuming ~13 wt% Al) and ~5 wt% C contamination, it approaches your composition (Al ~70%, Si ~12%).

4032 (4xxx Series, Oxidized): Composition: ~12.2% Si, 1% Cu, 1% Ni, balance Al (~85% Al).Adjusted: Al_2O_3 and C reduce Al wt%, aligning with ~70% Al, 12% Si.Uses: Forgings, welding rods.

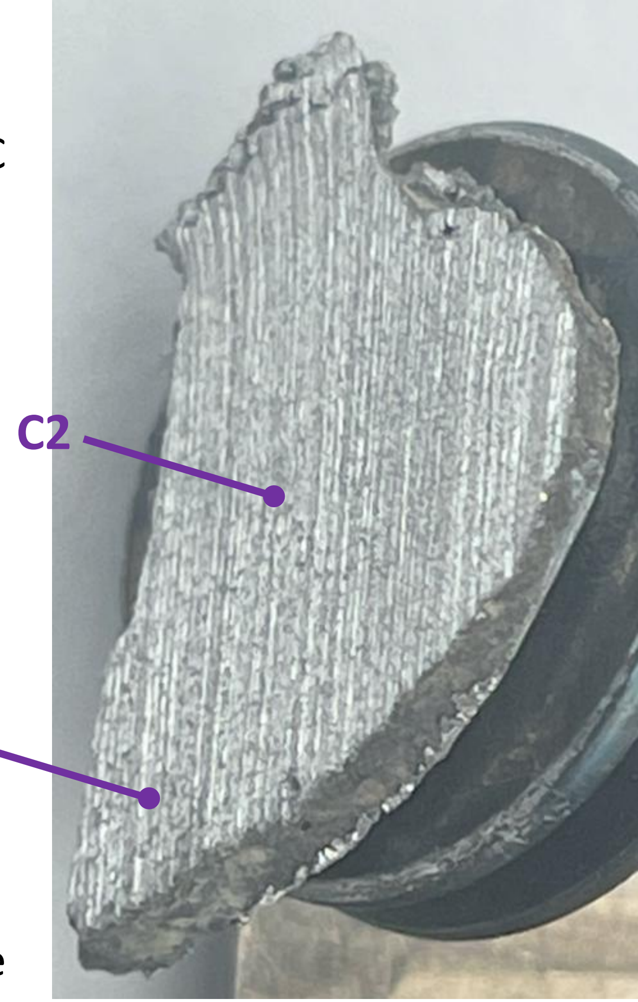
Al-SiC Composite: Composition: Al matrix (e.g., 6061 or 4xxx) with 10–20% SiC (Si:C = 70:30 wt%).Adjusted: SiC contributes Si (~8–14%) and C (~3–6%), plus Al_2O_3, matching your composition.Uses: Aerospace, automotive, lightweight high-strength parts.

Most Likely: A390 with Al_2O_3 and carbon contamination, or an Al-SiC composite, given high Si, O, and C.

Relevance to any Extraterrestrial origin (not Grok):

Al-SiC or Al-Si-C alloy is most interesting possibility from a novel material perspective. We use nanostructures, in particular carbon (graphene nanoplates, carbon nanotubes) for conductivity, electromagnetic absorption, radiation shielding. It is hard to image those with an SEM if they are indeed sub 10 nm.

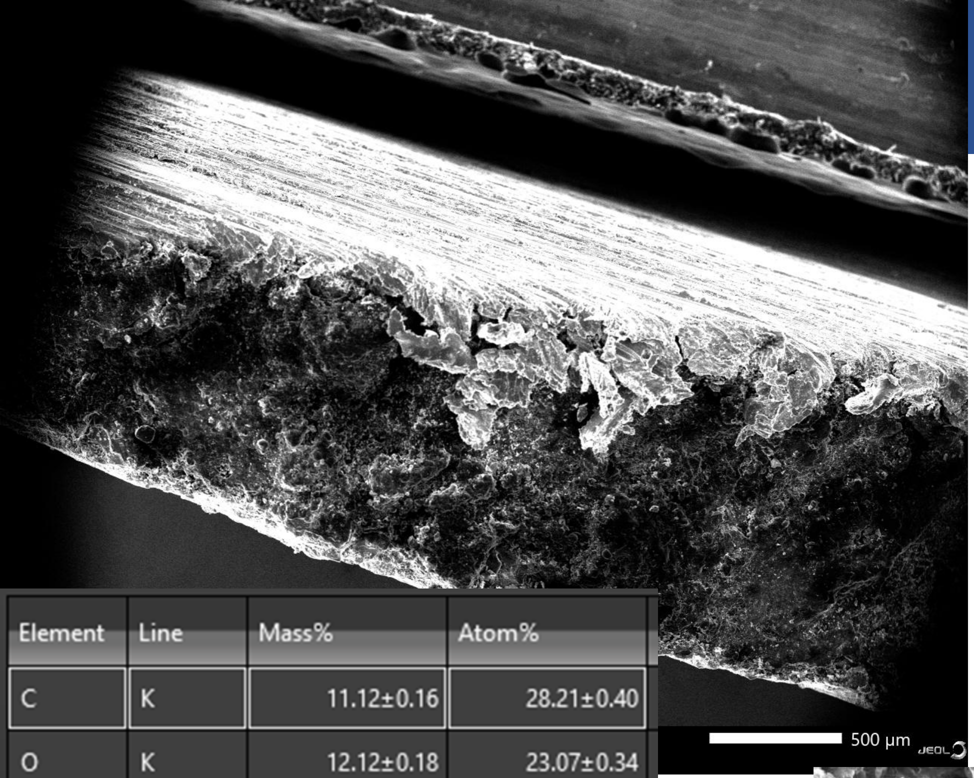
The next step is to polish the cut surface so that the microstructure is better reveals (not the rough cut surface from the diamond saw).

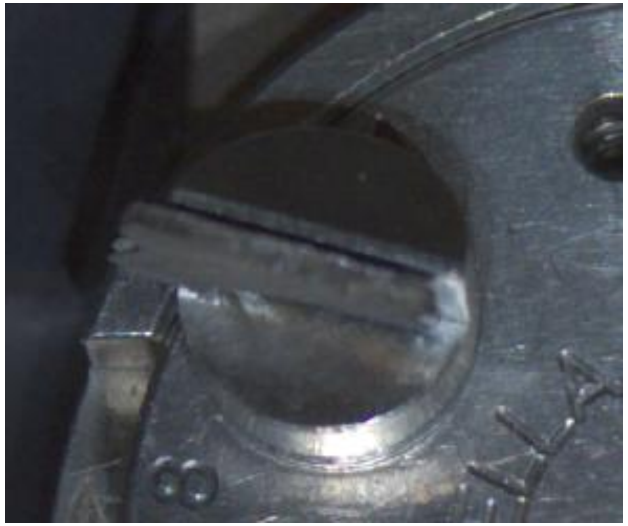


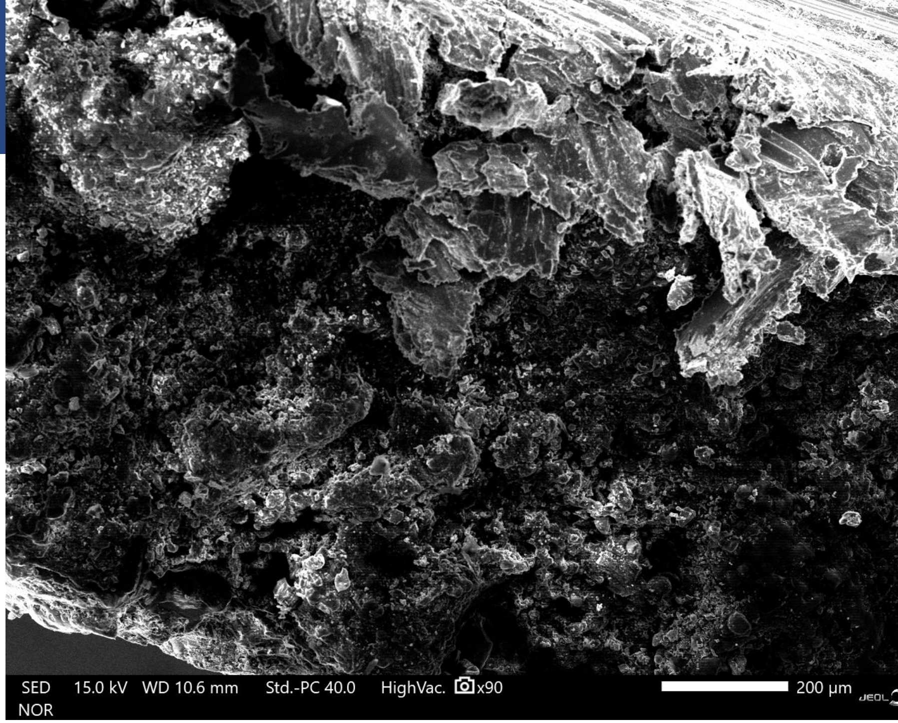
Next: Top (exposed surface). It is a different color, etc.

Spot #S1

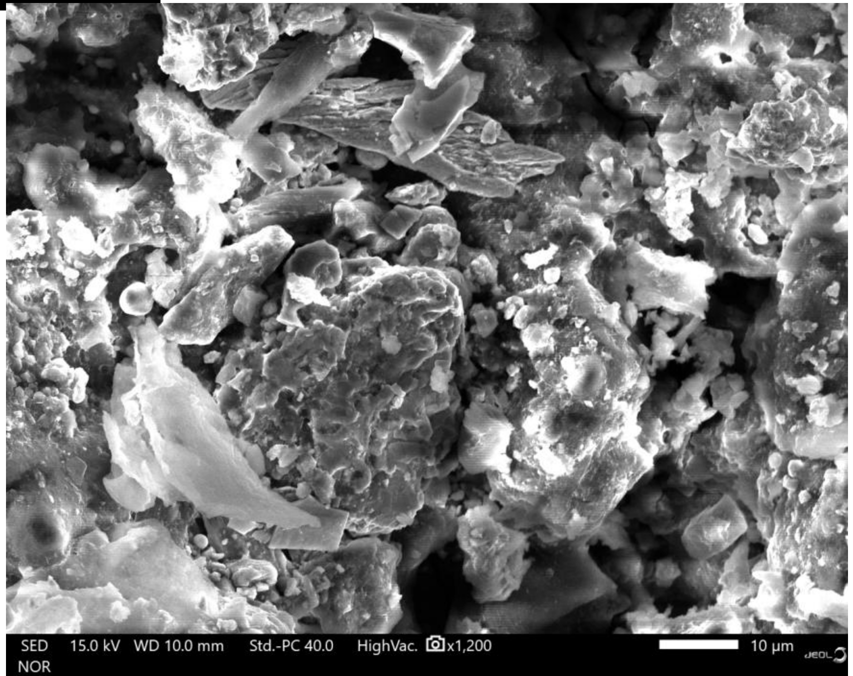
- Spot heavy in Fe content.

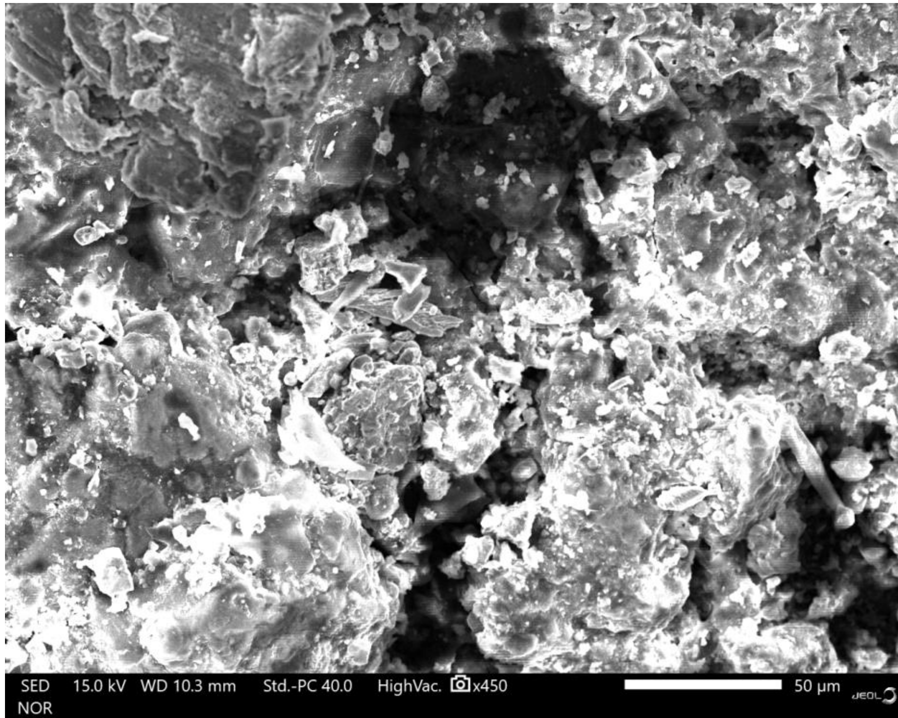




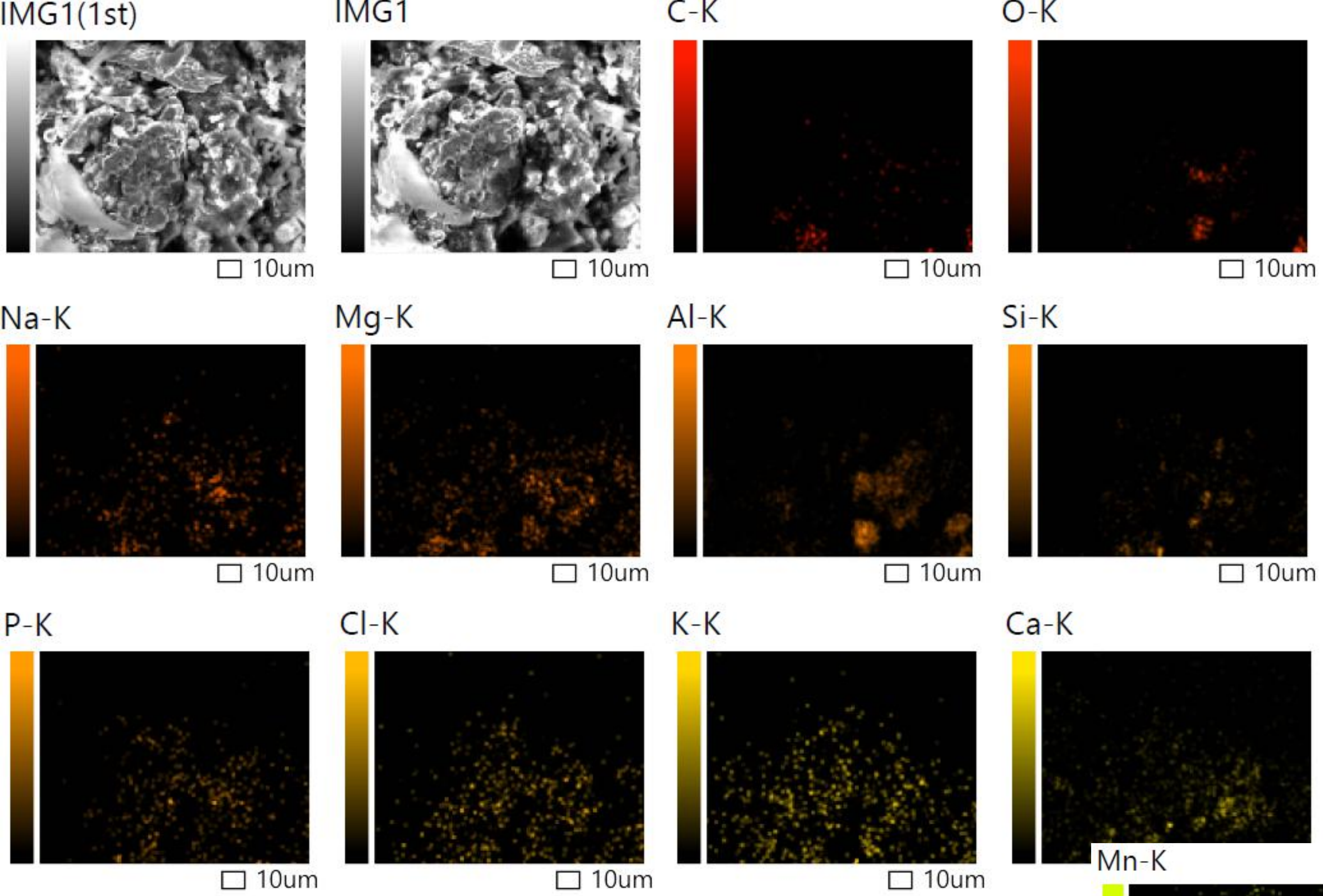


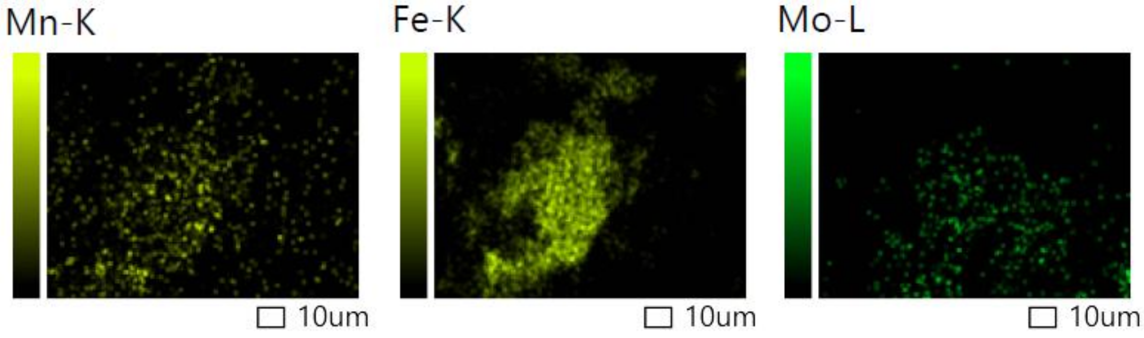
Element	Line	Mass%	Atom%
C	K	11.12±0.16	28.21±0.40
O	K	12.12±0.18	23.07±0.34
Na	K	0.56±0.05	0.74±0.07
Mg	K	1.08±0.06	1.36±0.07
Al	K	7.63±0.13	8.61±0.15
Si	K	1.12±0.05	1.21±0.06
P	K	0.15±0.02	0.14±0.02
Cl	K	0.20±0.02	0.17±0.02
K	K	0.33±0.04	0.25±0.03
Ca	K ▼	2.50±0.09	1.90±0.07
Mn	K ▼	0.93±0.10	0.52±0.06
Fe	K ▼	61.57±0.69	33.58±0.37





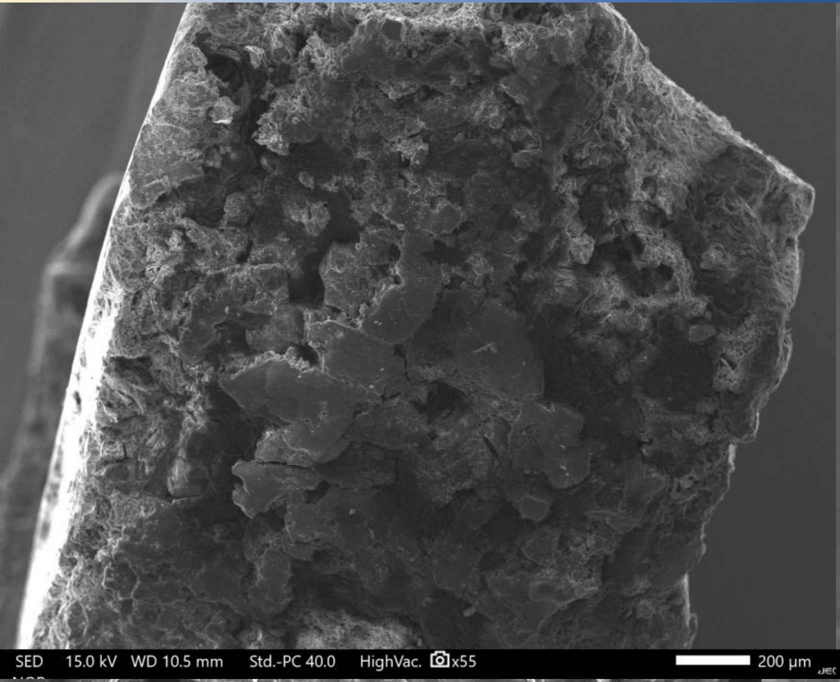
Spot #S1

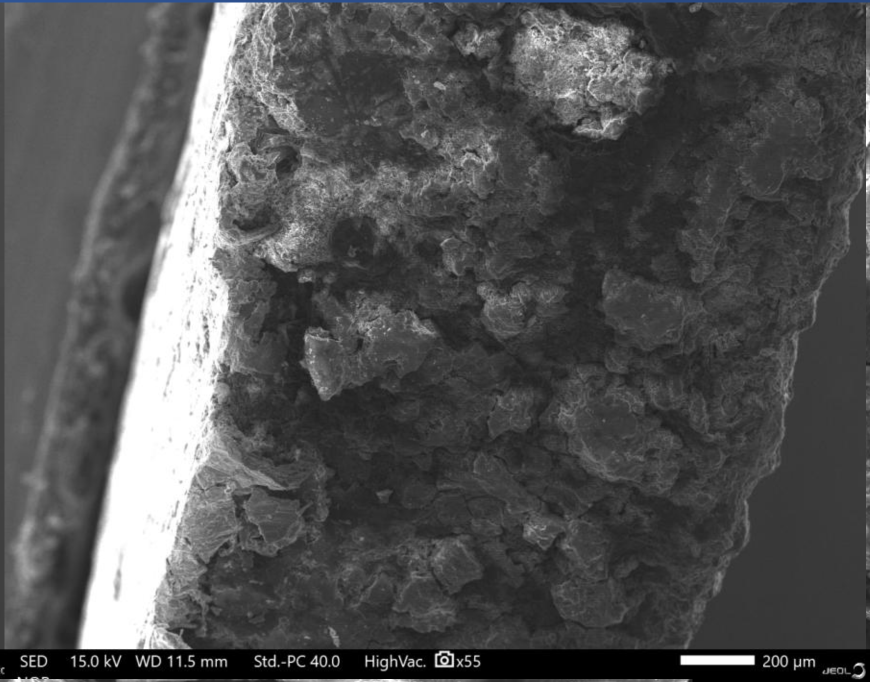


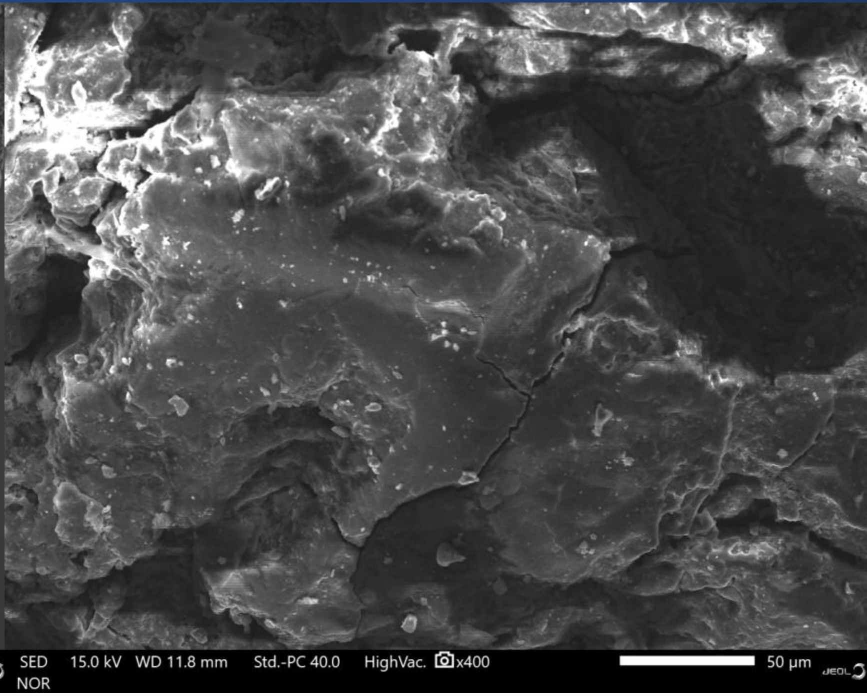


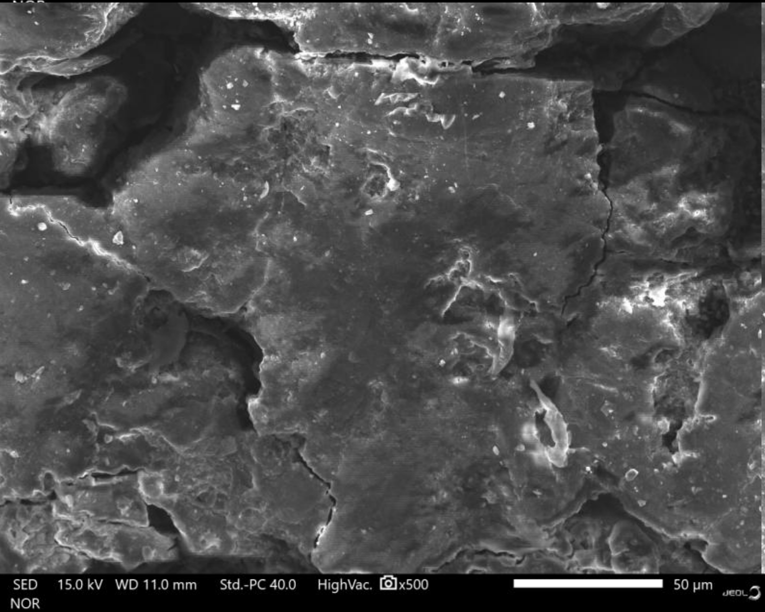
- Spot heavy in Fe content.

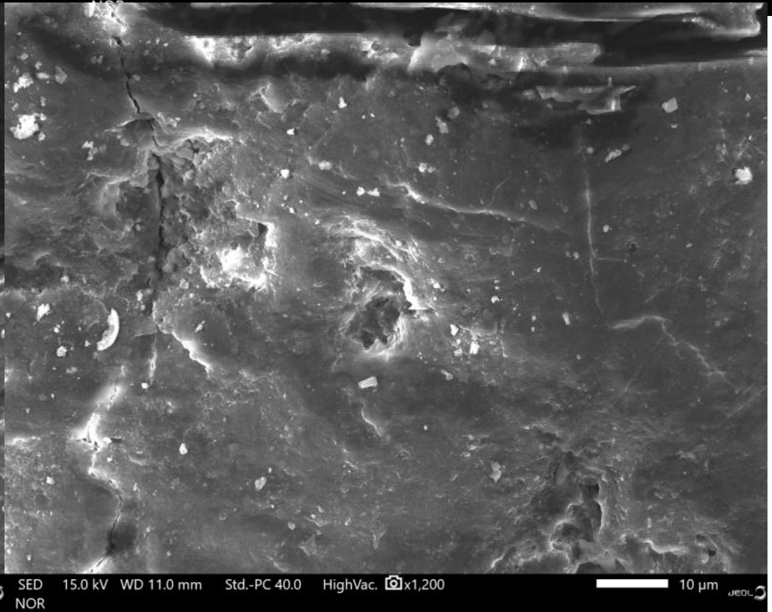
Spot #S2


SED 15.0 kV WD 10.5 mm Std.-PC 40.0 HighVac. x55
200 μm

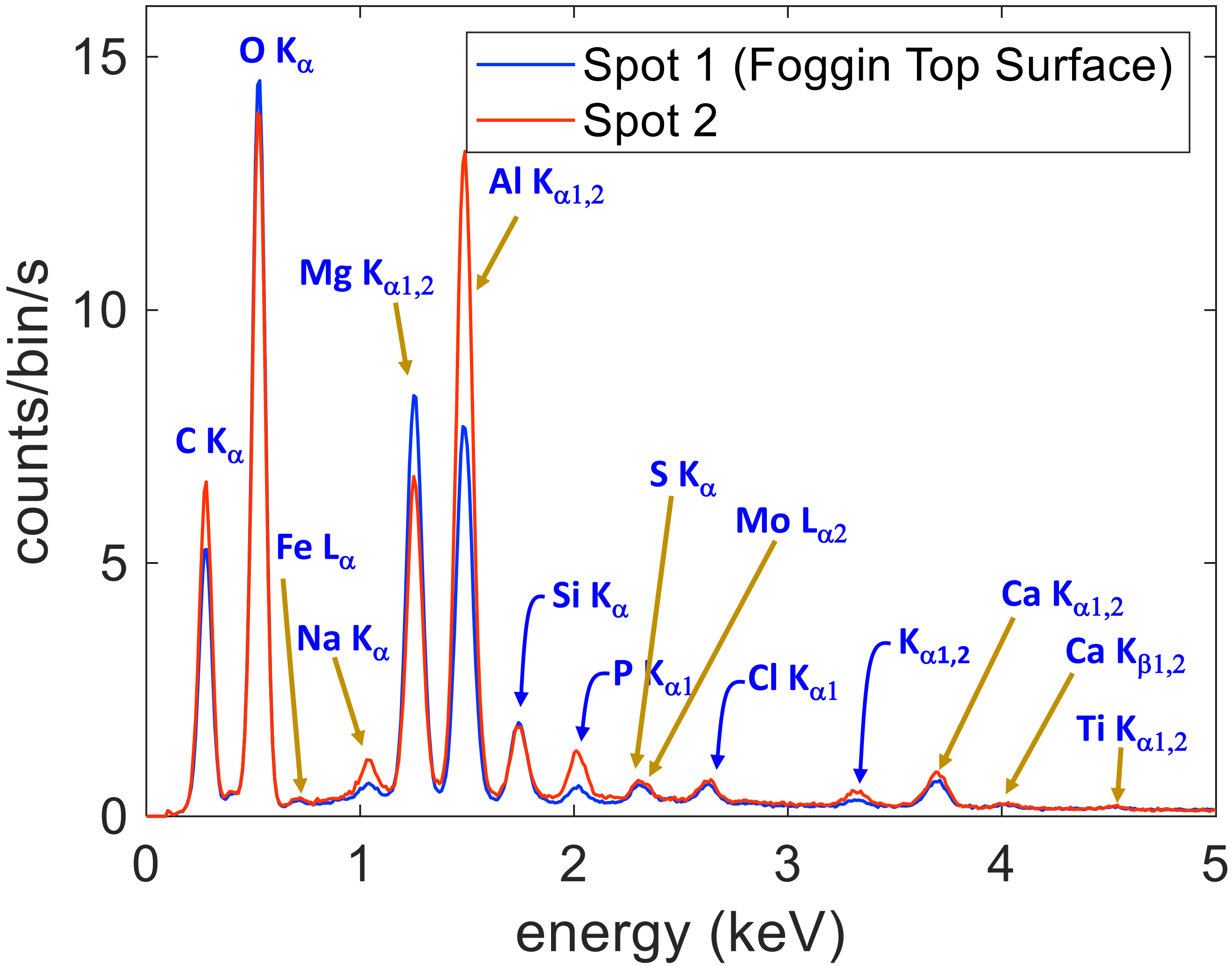

SED 15.0 kV WD 11.5 mm Std.-PC 40.0 HighVac. x55
200 μm

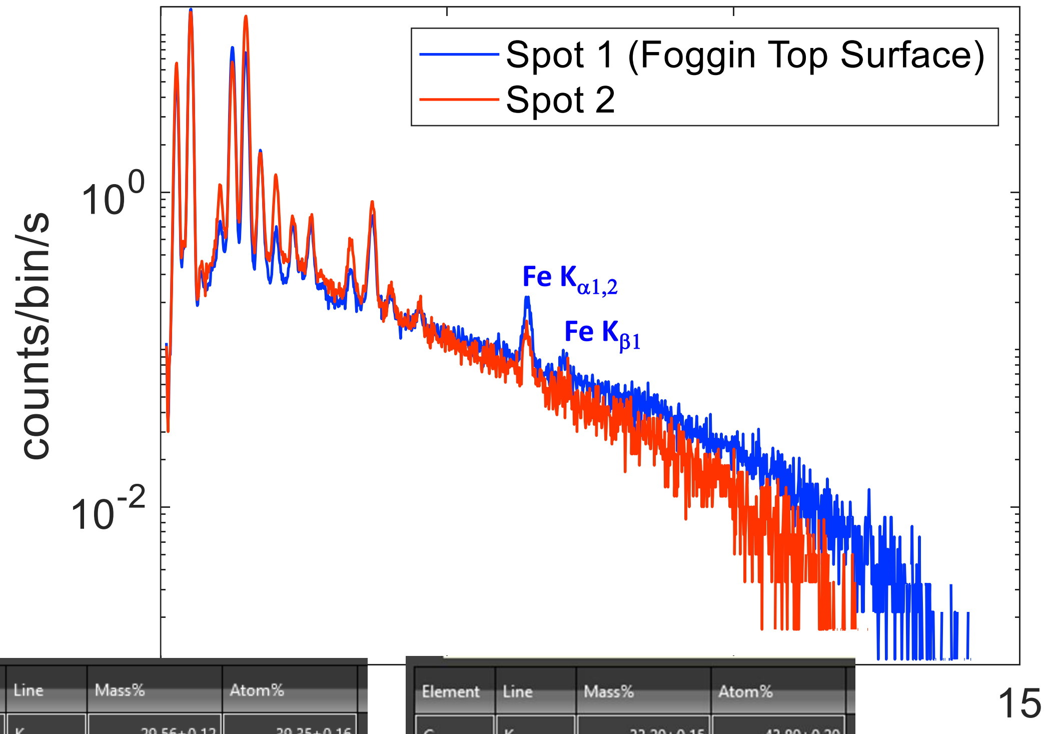

SED 15.0 kV WD 11.8 mm Std.-PC 40.0 HighVac. x400
NOR
50 μm


SED 15.0 kV WD 11.0 mm Std.-PC 40.0 HighVac. x500
NOR
50 μm


SED 15.0 kV WD 11.0 mm Std.-PC 40.0 HighVac. x1,200
NOR
10 μm

SEM EDS spectrum of Foggin Top Surface



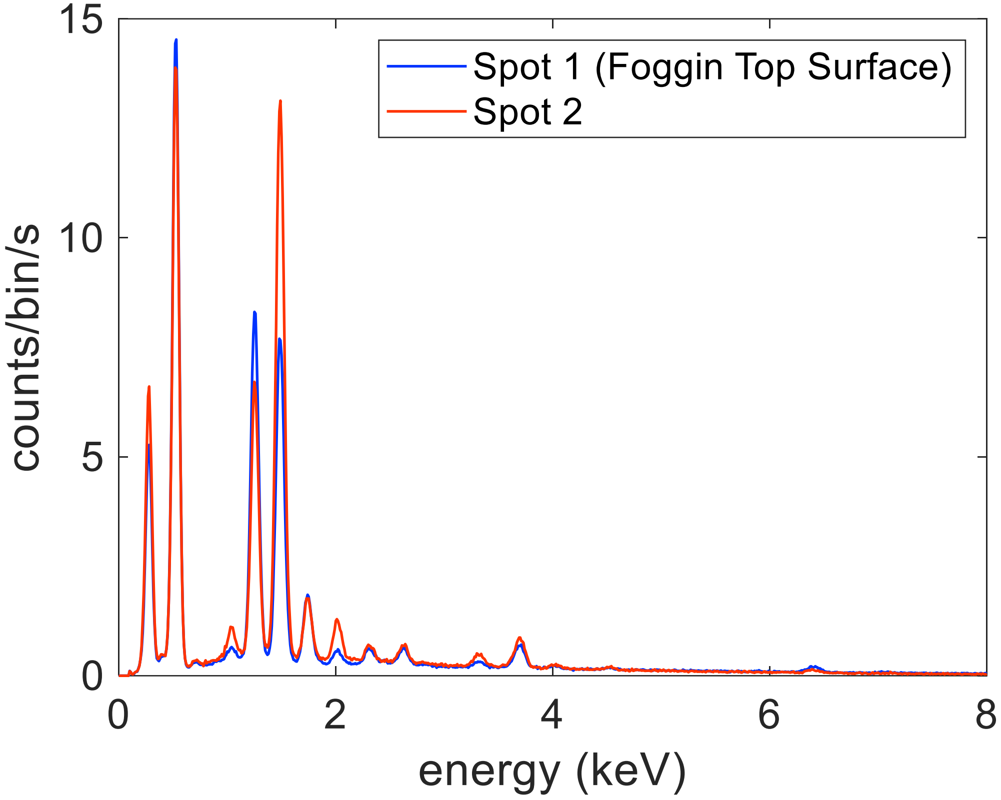


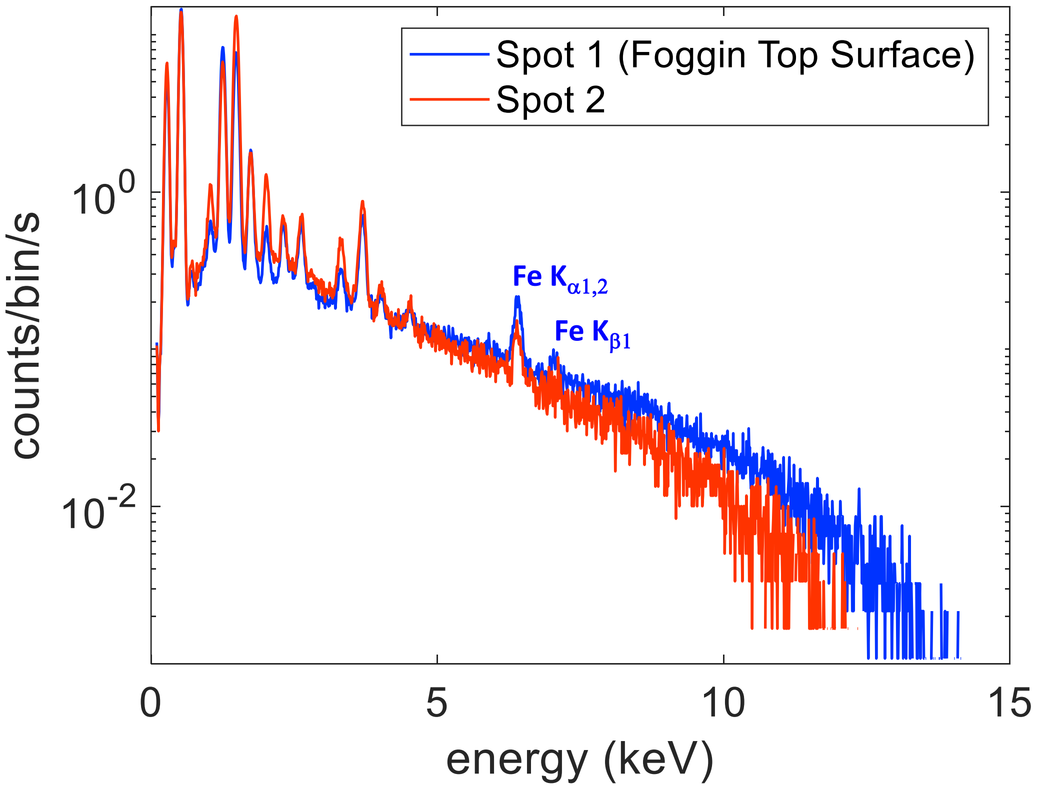
Element	Line	Mass%	Atom%
C	K	29.56±0.12	39.35±0.16
O	K	47.65±0.20	47.62±0.20
Na	K	0.37±0.02	0.26±0.01
Mg	K	8.17±0.06	5.37±0.04
Al	K	8.20±0.06	4.86±0.04
Si	K	1.84±0.03	1.05±0.02
S	K	0.33±0.02	0.17±0.01
Cl	K	0.59±0.02	0.27±0.01
K	K	0.28±0.02	0.11±0.01
Ca	K ▼	1.31±0.03	0.52±0.01
Fe	K ▼	1.17±0.05	0.33±0.02
Mo	L	0.53±0.06	0.09±0.01

Element	Line	Mass%	Atom%
C	K	33.20±0.15	43.80±0.20
O	K	43.02±0.23	42.61±0.23
Na	K	0.70±0.03	0.48±0.02
Mg	K	5.36±0.06	3.49±0.04
Al	K	11.54±0.08	6.78±0.05
Si	K	1.41±0.03	0.80±0.02
P	K	1.20±0.03	0.61±0.01
S	K	0.48±0.02	0.24±0.01
Cl	K	0.58±0.02	0.26±0.01
K	K	0.50±0.02	0.20±0.01
Ca	K ▼	1.46±0.04	0.58±0.02
Fe	K ▼	0.58±0.04	0.16±0.01

- Cross-sectional cut suggests Al alloy (see below), but top surface is very mixed composition. Al content is relatively low.

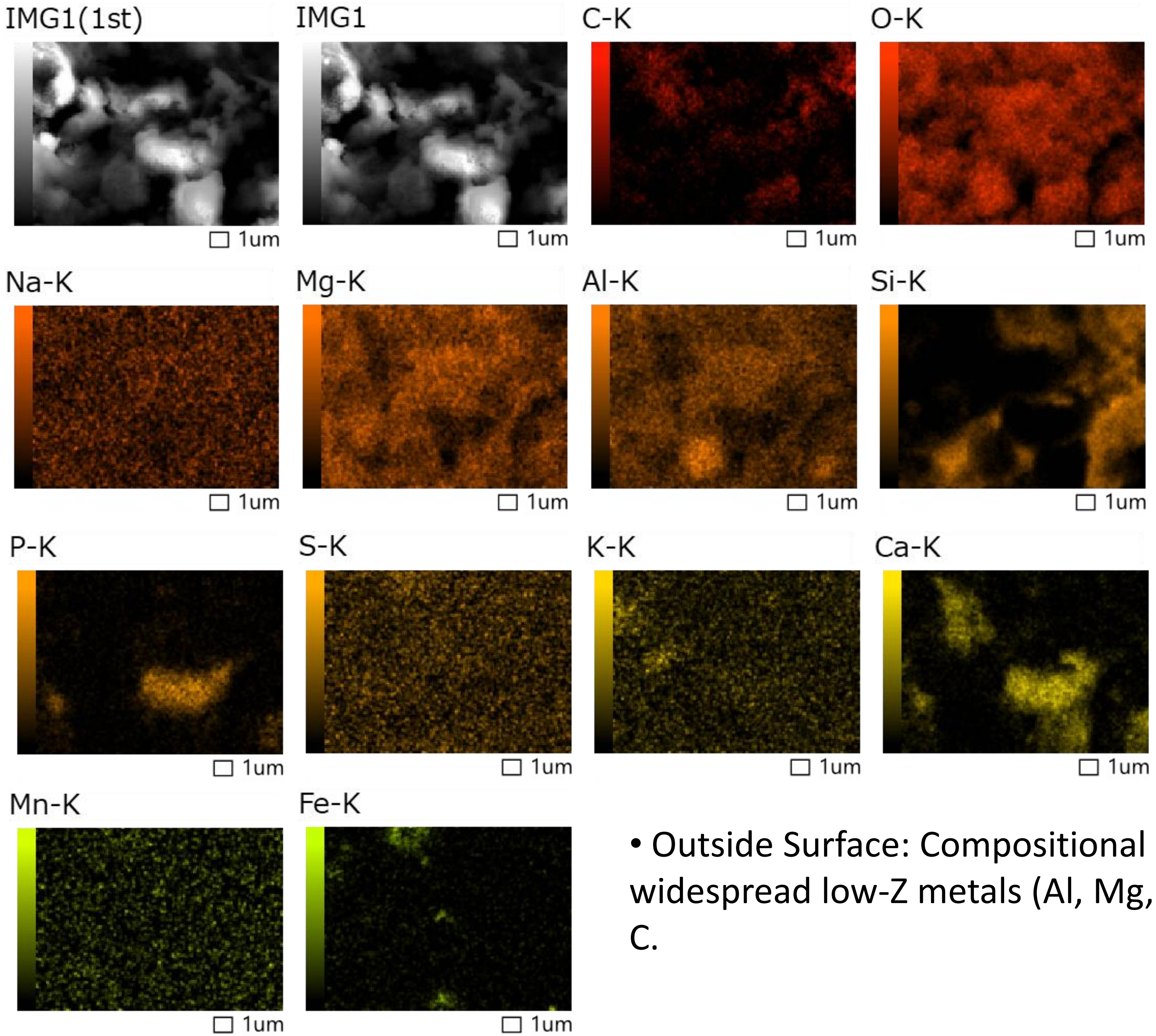
SEM EDS spectrum of Foggin Top Surface





- The top surface is a brown encrustation.
- Unknown if due to handling (over the 4 decades), environmental or from the original sample.

Spot #S3: SEM EDS composition



- Outside Surface: Compositional map shows widespread organics (O, S) and widespread low-Z metals (Al, Mg, Na) along with localized concentrations of P, Fe, Ca, K, C.

EDS Chemical Composition: Spot #S3

Element	Line	Mass%	Atom%
K	K	0.16±0.00	0.07±0.00
Ca	K	3.58±0.02	1.56±0.01
Mn	K	0.10±0.01	0.03±0.00
Fe	K	0.53±0.01	0.17±0.00

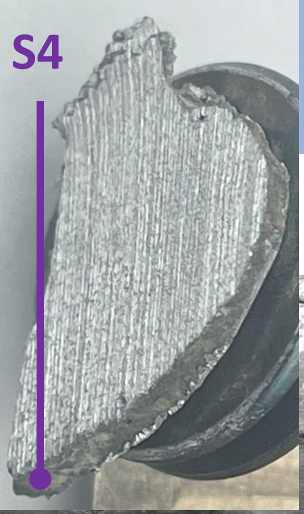
Element	Line	Mass%	Atom%
Mg	K	6.77±0.02	4.86±0.01
Al	K	5.87±0.02	3.80±0.01
Si	K	14.70±0.03	9.14±0.02
P	K	1.28±0.01	0.72±0.01
S	K	0.32±0.00	0.18±0.00

Element	Line	Mass%	Atom%
C	K	18.88±0.04	27.44±0.06
O	K	47.47±0.07	51.79±0.07
Na	K	0.33±0.01	0.25±0.00
Mg	K	6.77±0.02	4.86±0.01
Al	K	5.87±0.02	3.80±0.01
Si	K	14.70±0.03	9.14±0.02

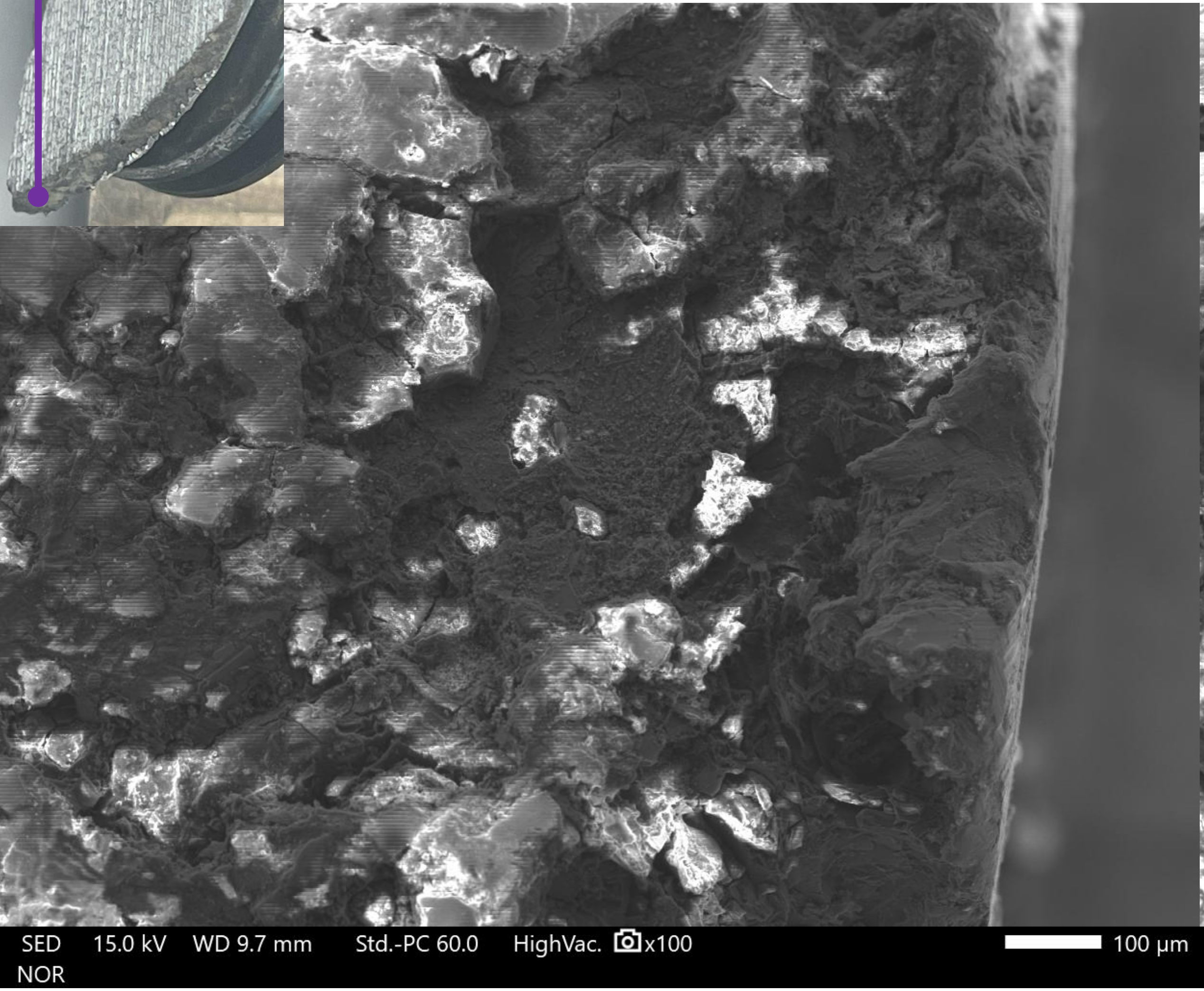
Spc 015 Fitting ratio 0.0041

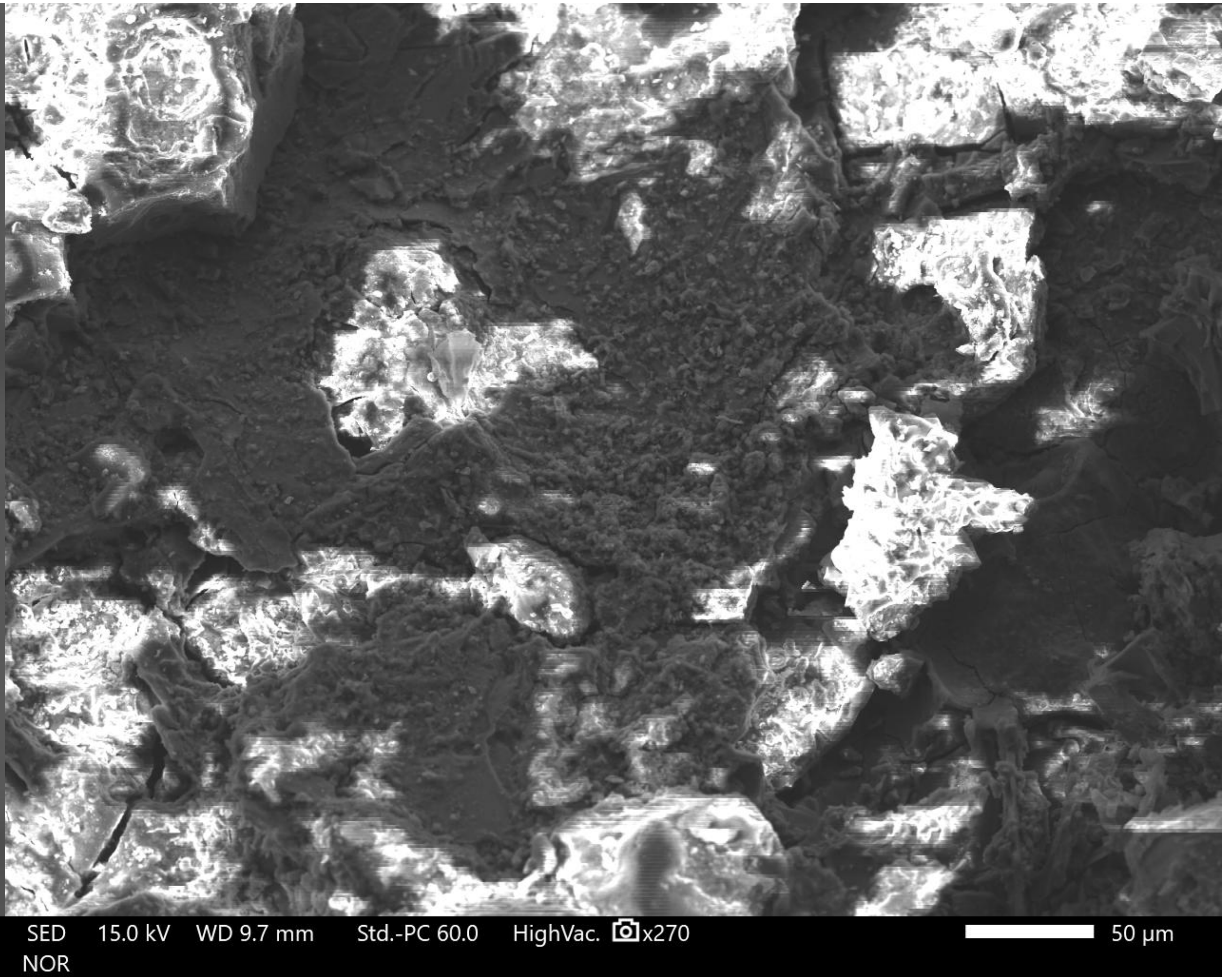
- Top (outside surface).
- Substantial organic content (O: 51.79 %, C 27.44 %), perhaps due to handling, oxidation, etc.
- Substantial Si content at this spot.

• Magnesium is a common alloying element in the 5xxx series (Al-Mg) and some 7xxx series (Al-Zn-Mg), valued for corrosion resistance, workability, and strength, but typically in small amounts (5xxx series: 0.5–6% Mg, 7xxx series: < 2.5 % Mg), because phase separation results for Mg:Al ~ 1:1, as found here. Similarly for Magnesium alloys (with Al), Composition: 2–10% Al(e.g. **AZ31**: ~3% Al, 1% Zn, balance Mg., **AZ91**: ~9% Al, 1% Zn, balance Mg.



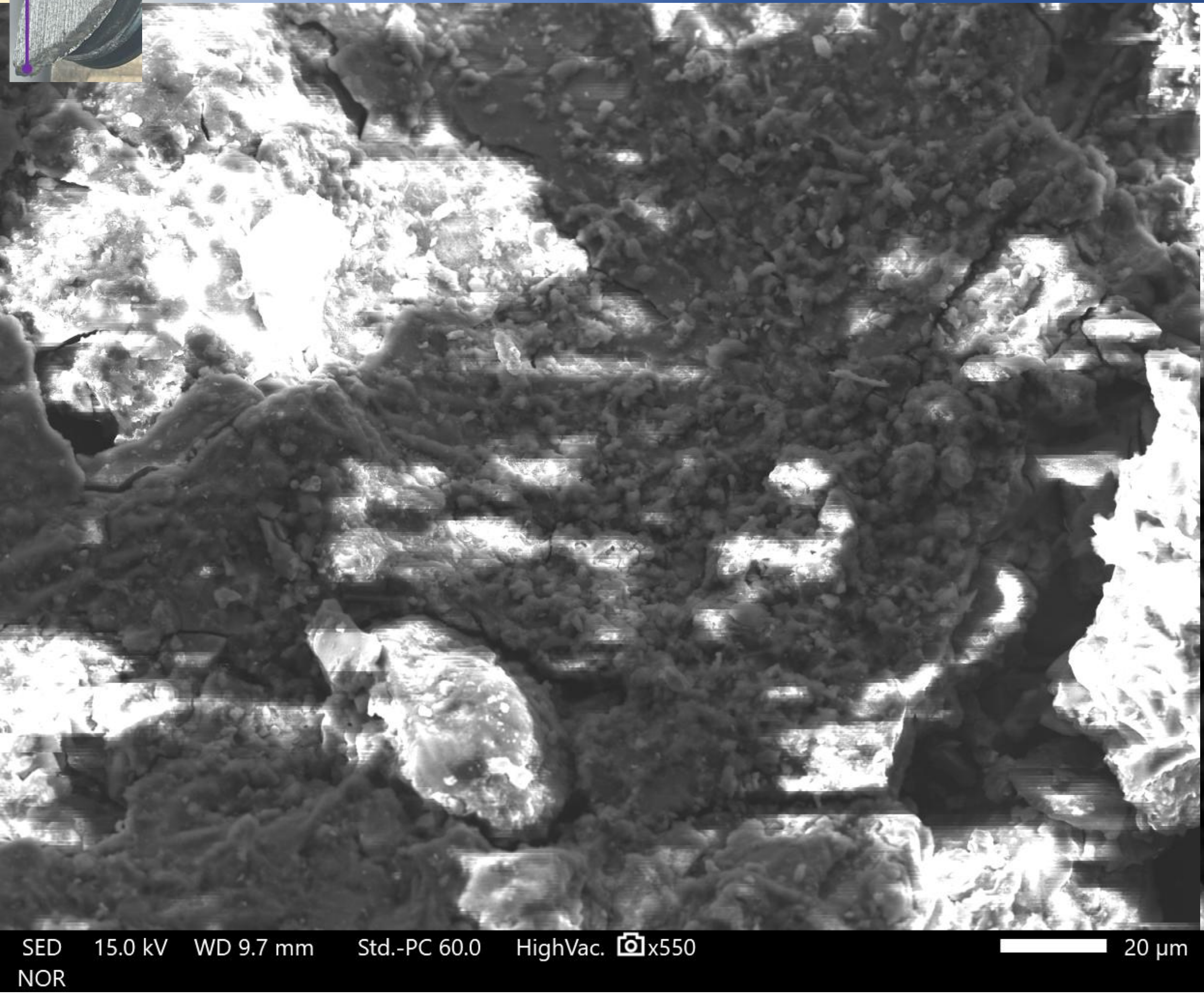
Top Surface Spot #S4 (EDS map)

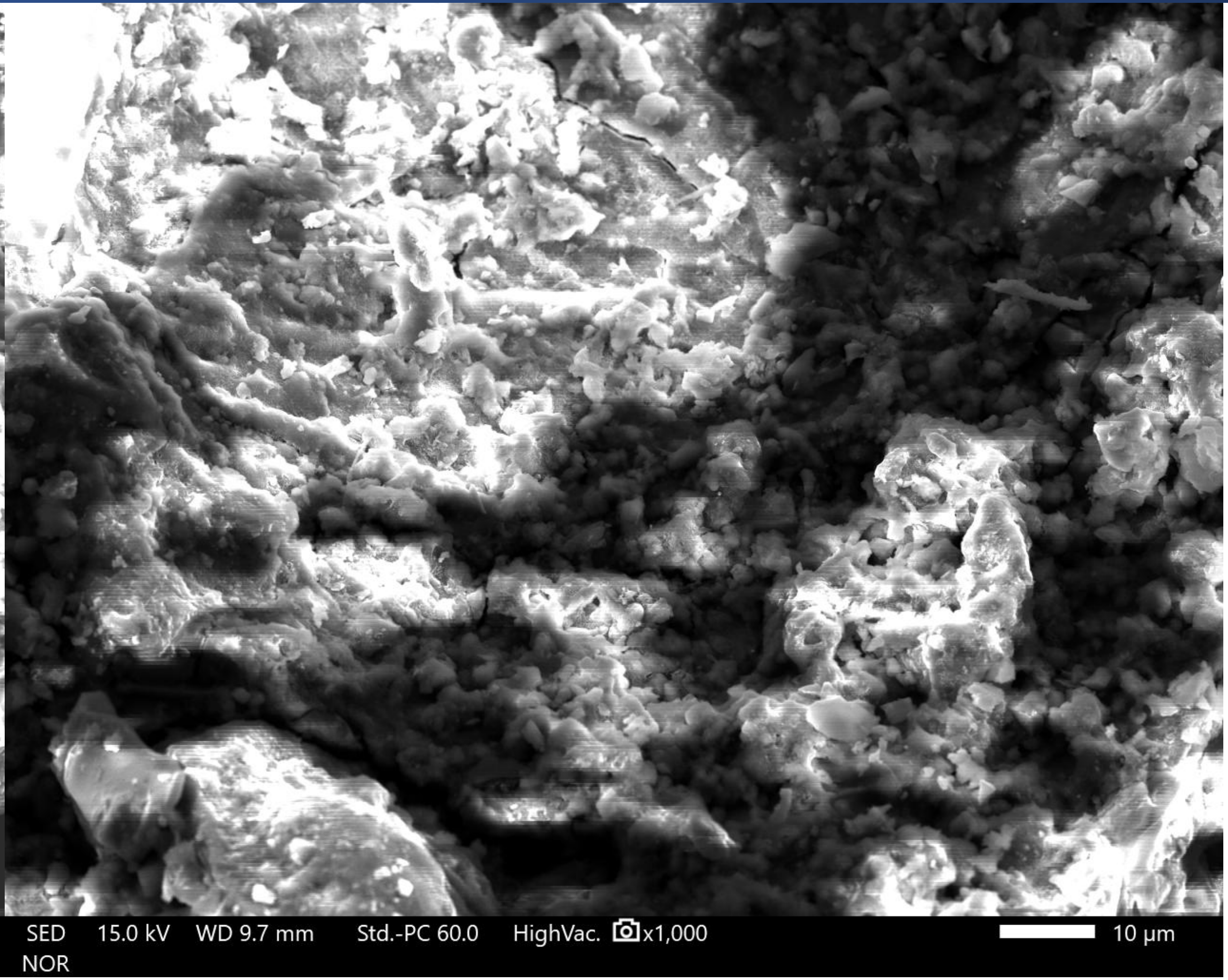




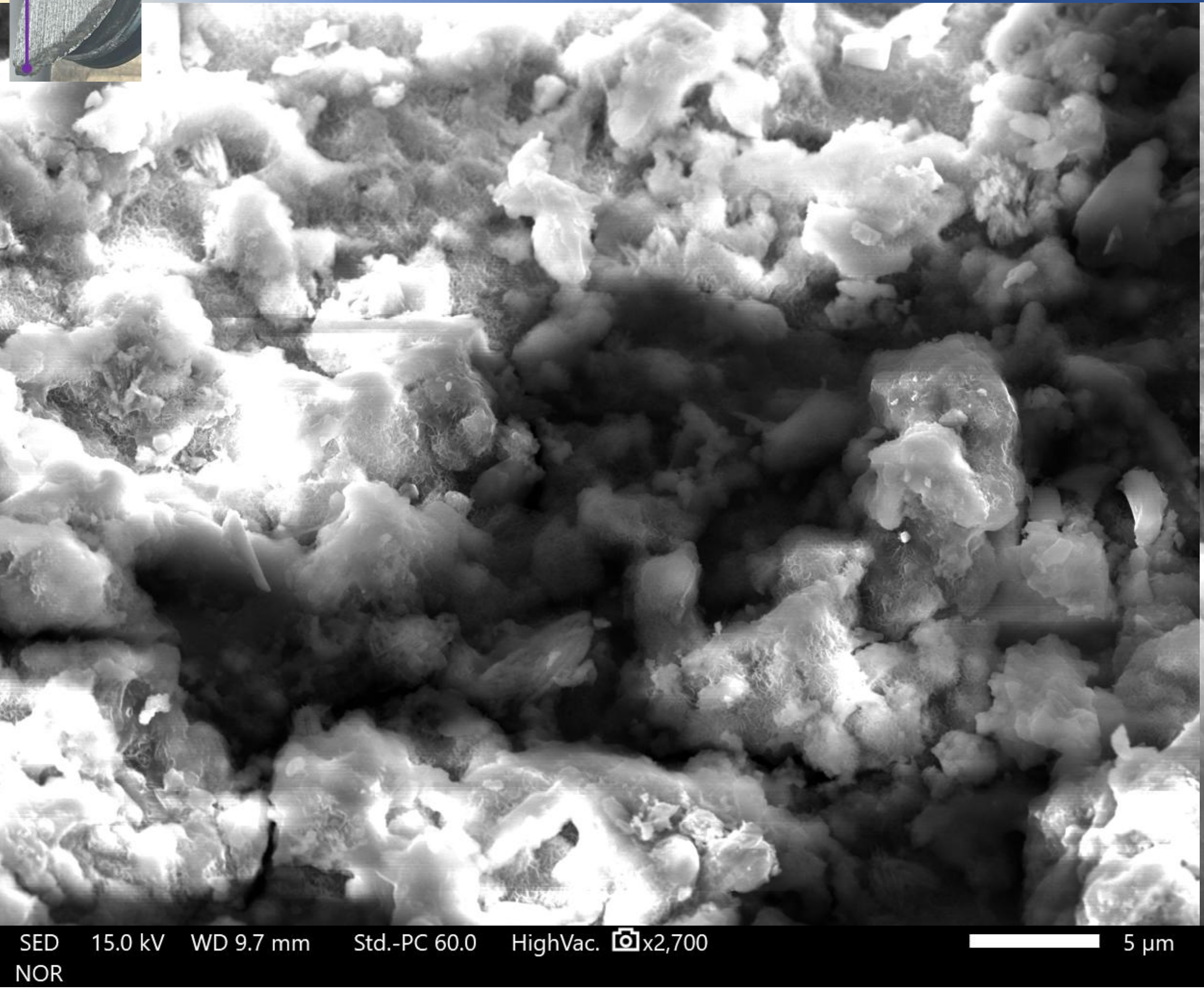
- Next few slides show zooming in on one spot in the dark sections.

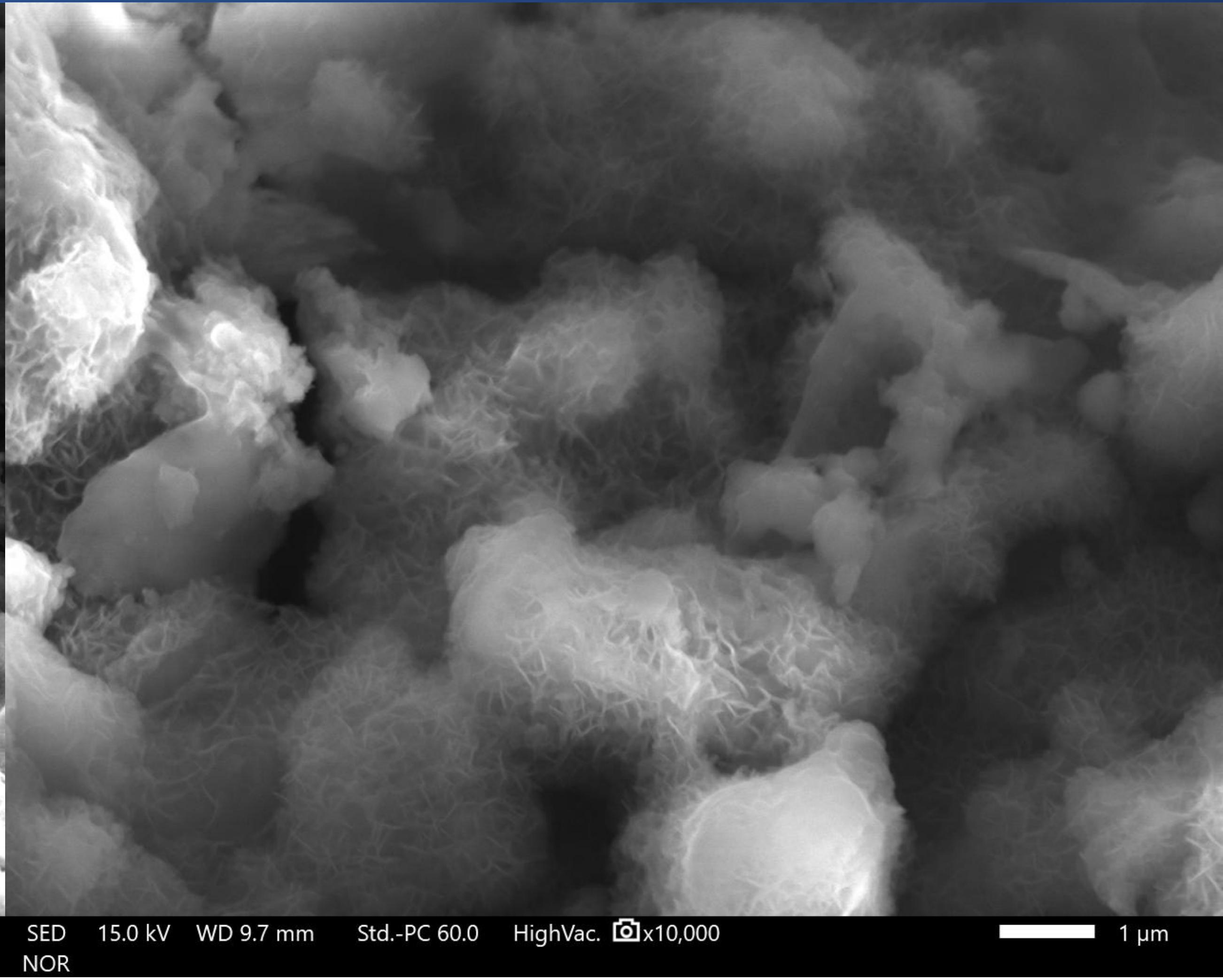
Top Surface Spot #S4 (EDS map)





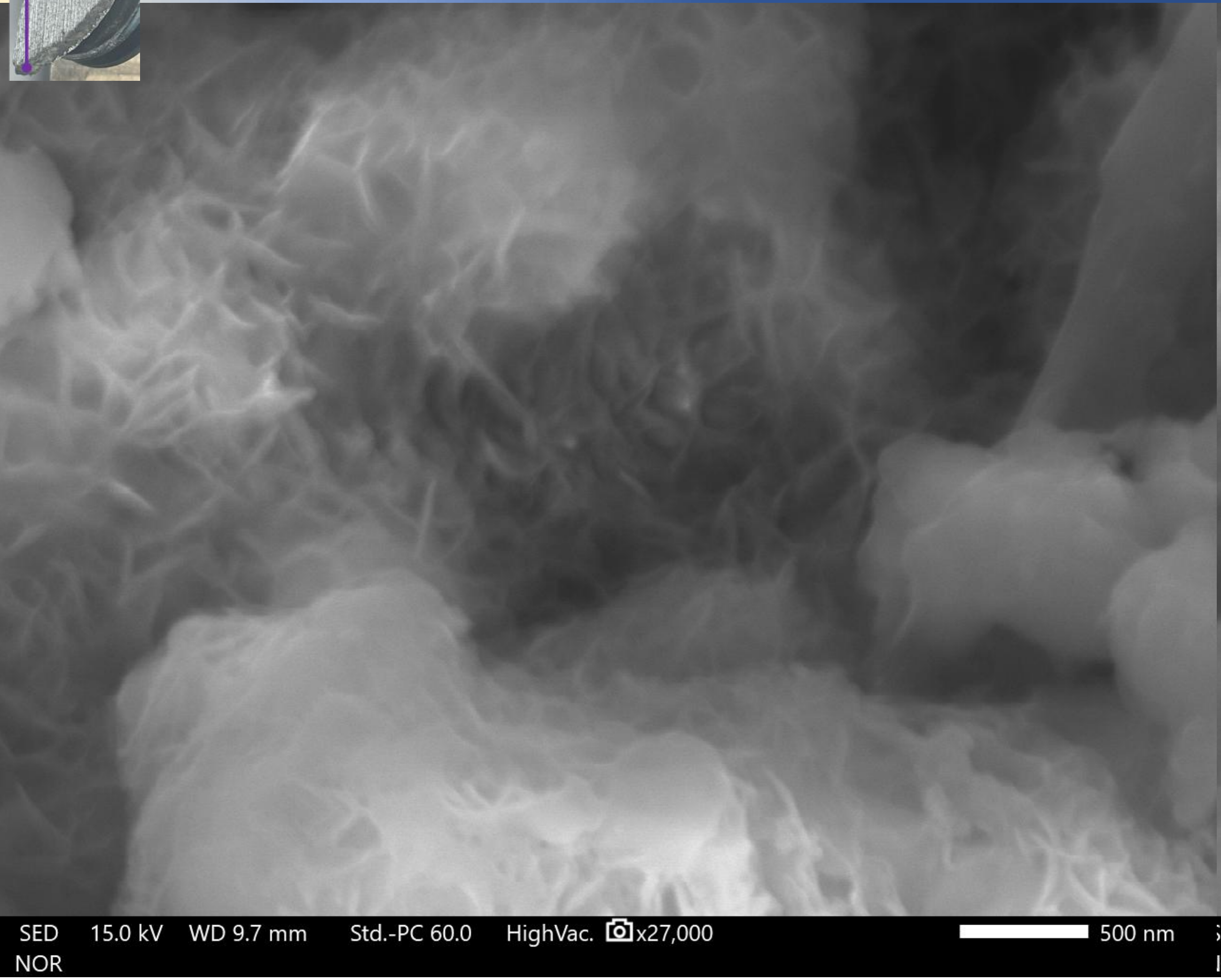
Top Surface Spot #S4 (EDS map)

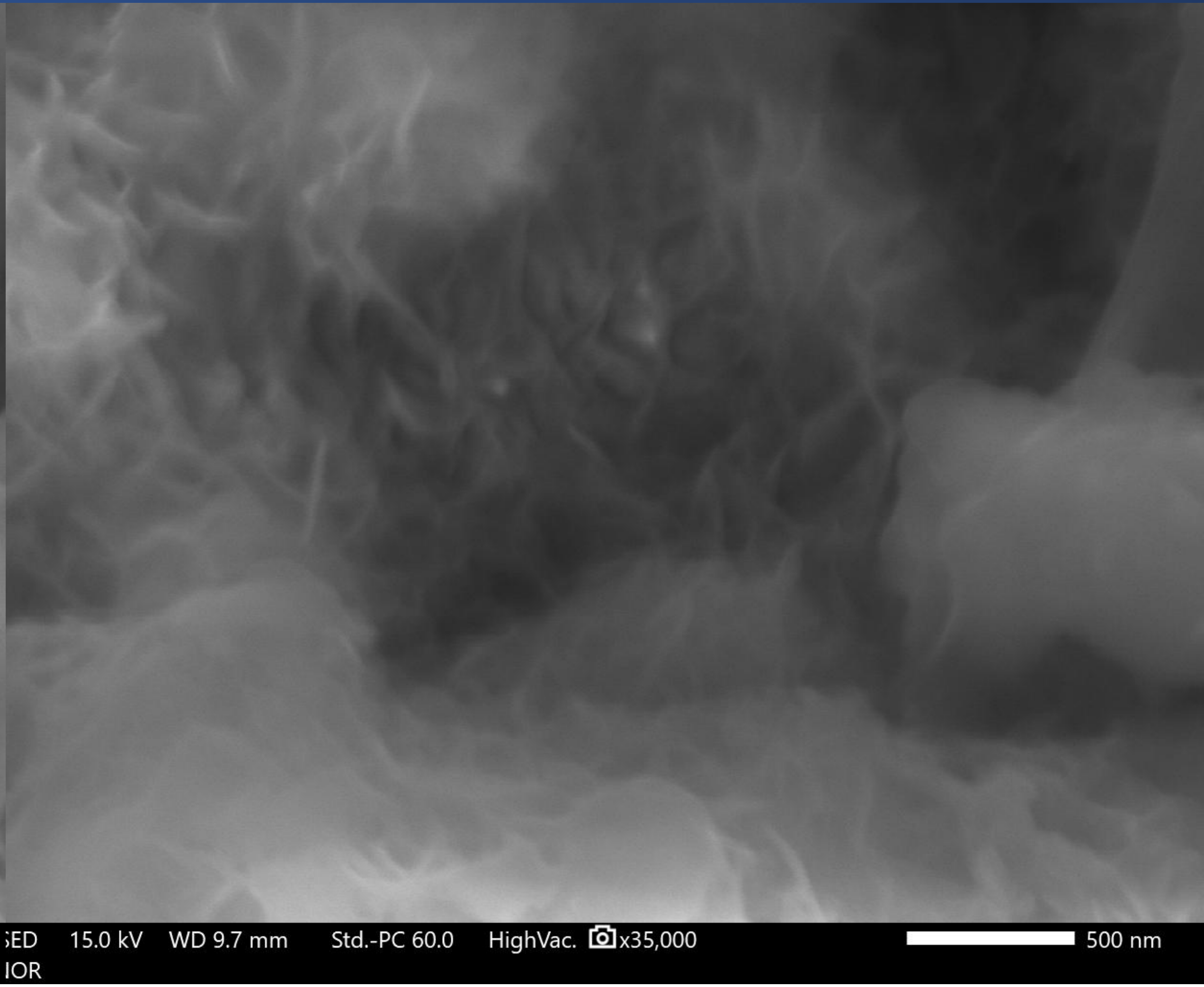




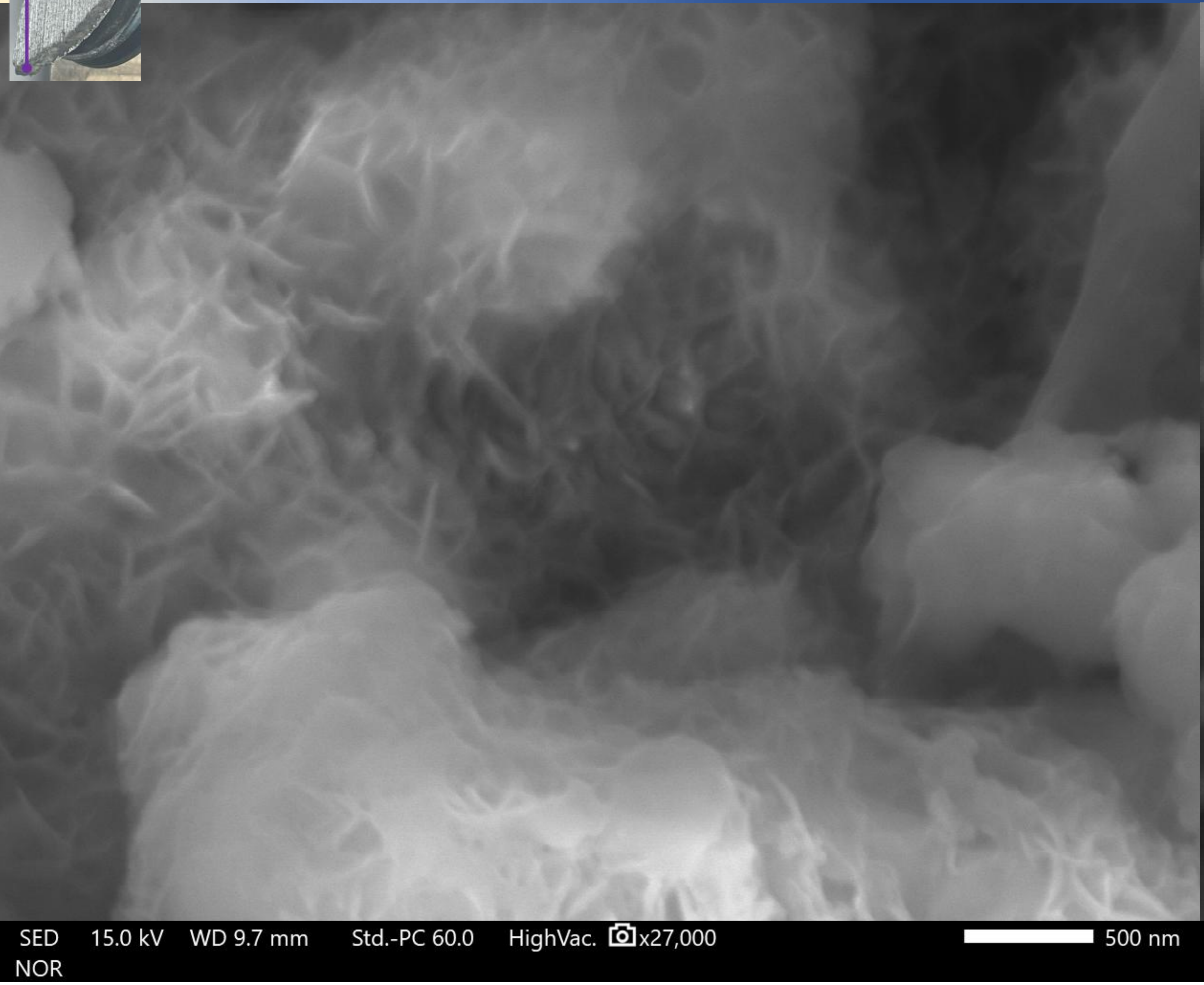
- Dendritic structures on the right (and next few slides are interesting, although may just be expected product of emergence from molten state.

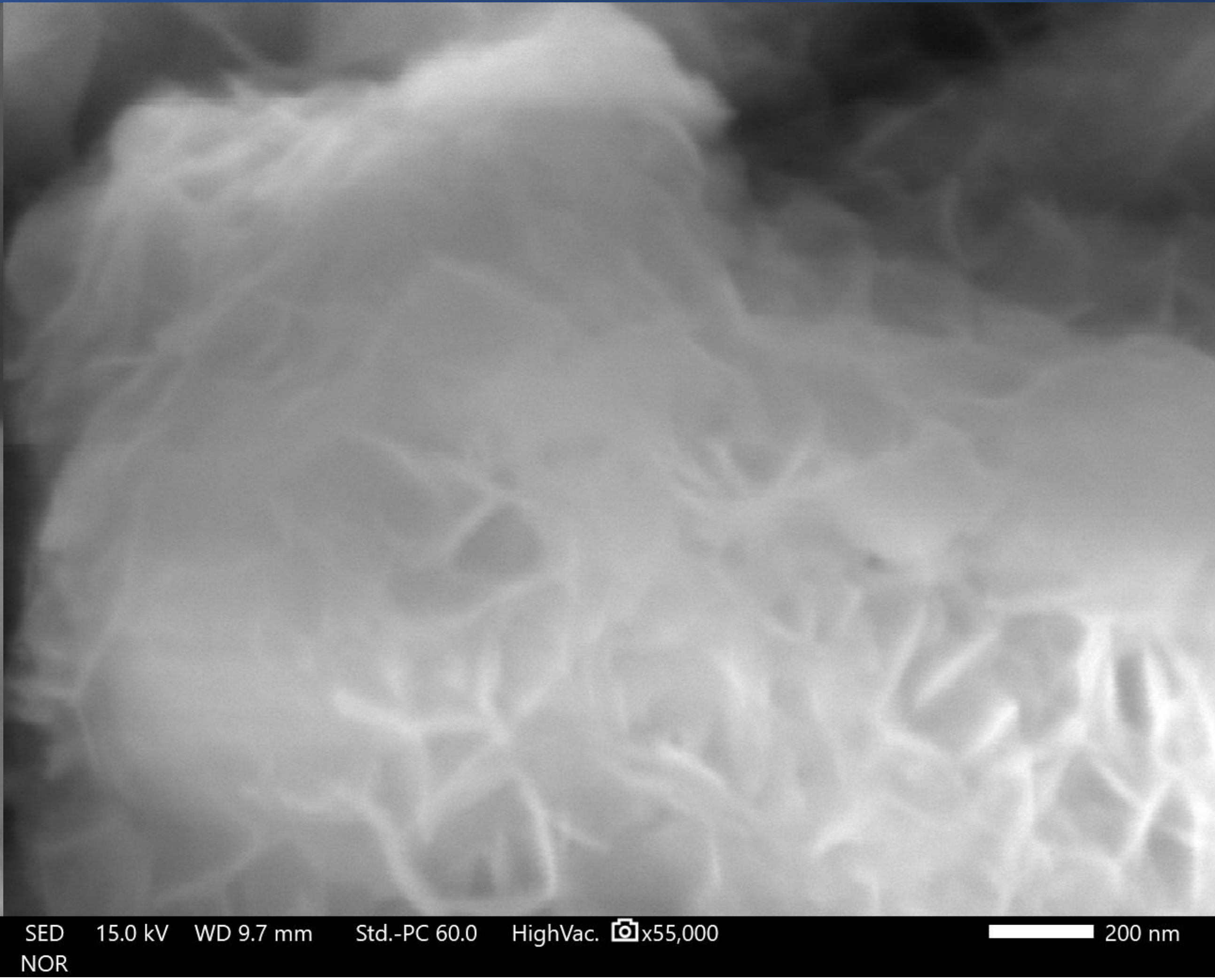
Top Surface Spot #S4 (EDS map)



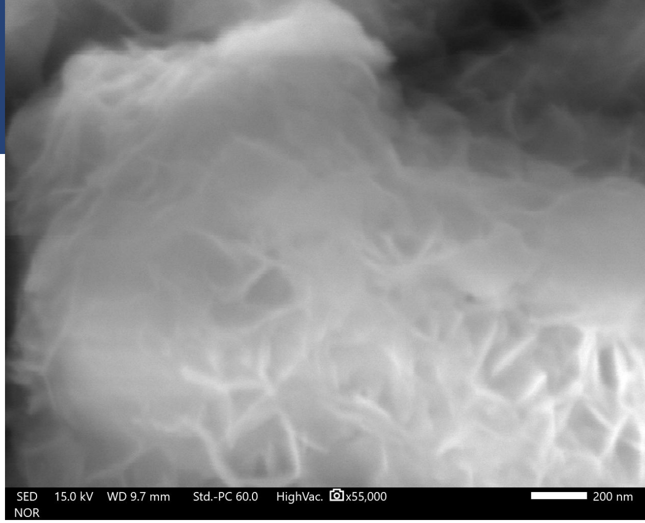


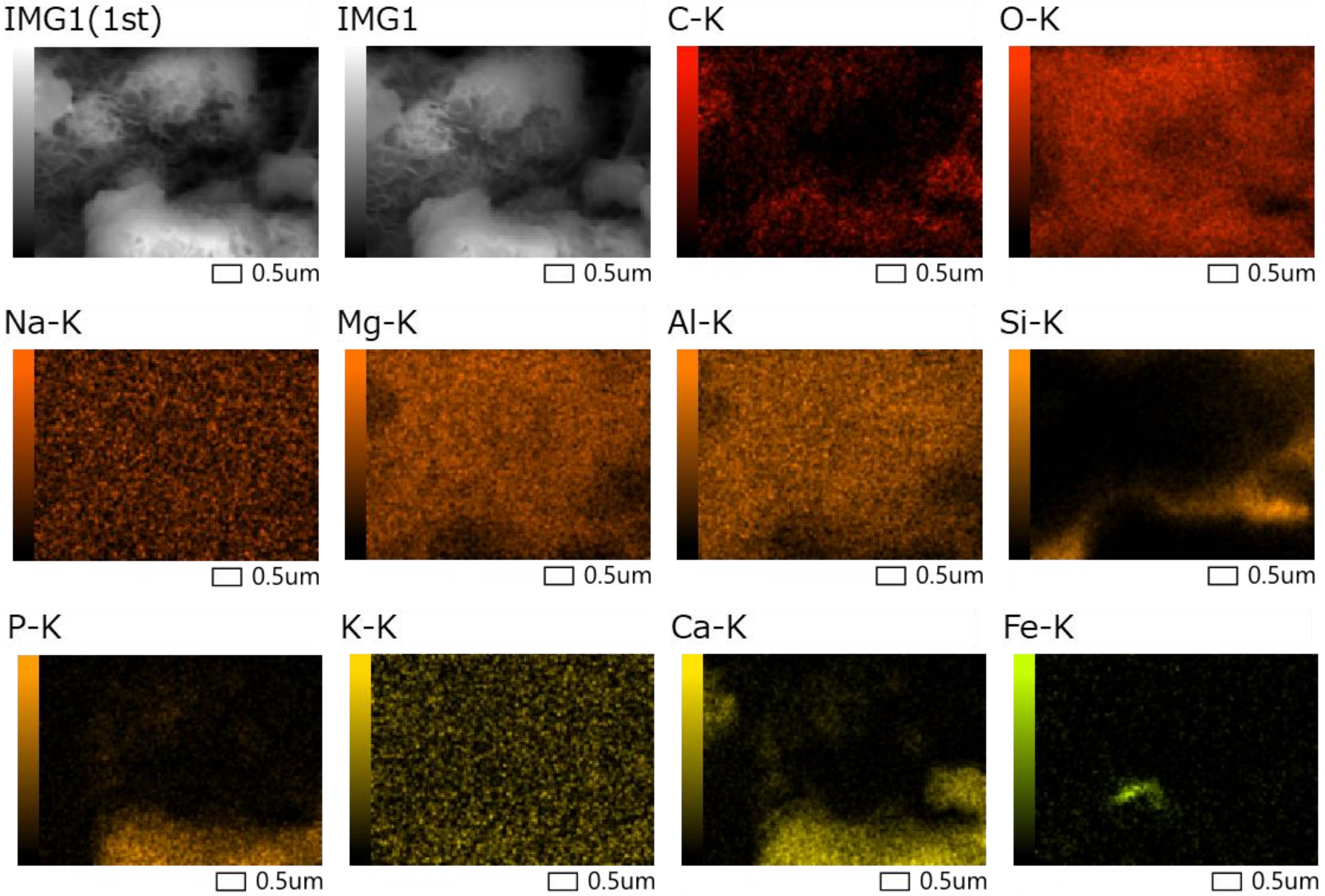
Top Surface Spot #S5 (EDS map)

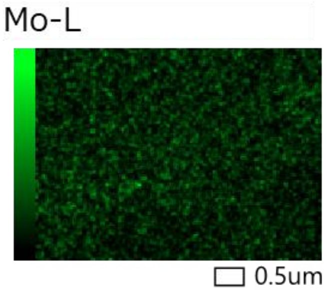




Top Surface Spot #S5 (EDS map)







Element	Line	Mass%	Atom%
C	K	28.61±0.06	38.72±0.08
O	K	45.34±0.09	46.07±0.09
Na	K	0.49±0.01	0.35±0.01
Mg	K	4.50±0.02	3.01±0.01
Al	K	11.60±0.03	6.99±0.02
Si	K	5.86±0.02	3.39±0.01

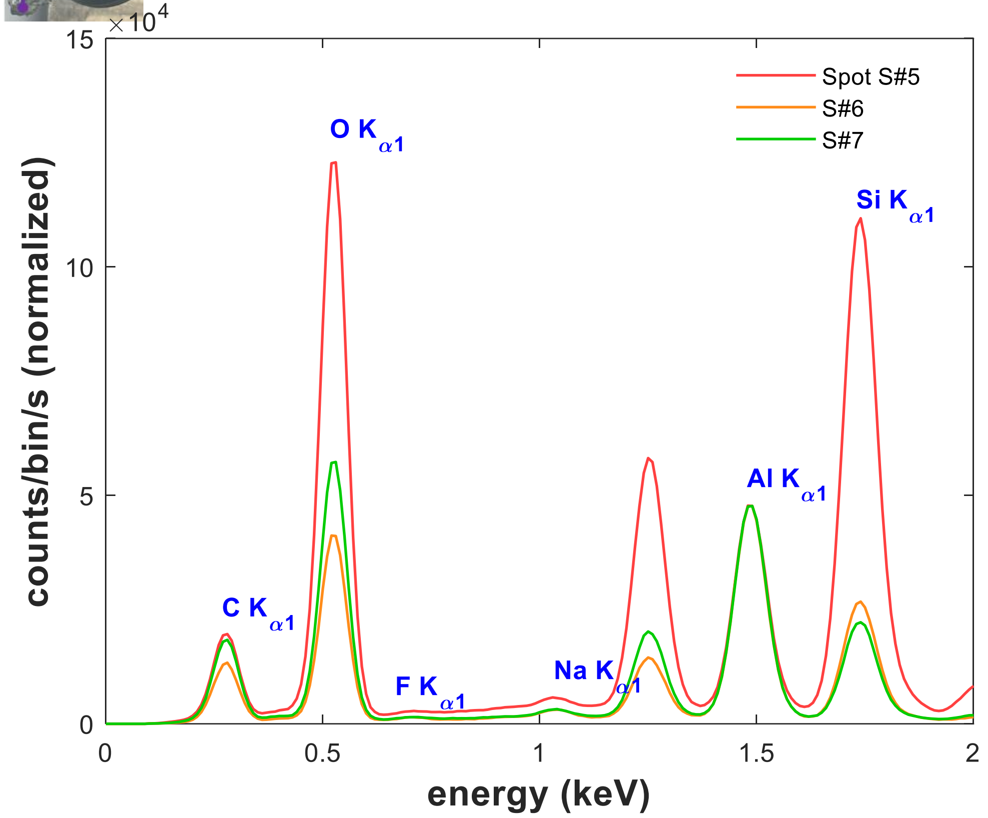
Element	Line	Mass%	Atom%
Si	K	5.86±0.02	3.39±0.01
P	K	0.41±0.01	0.21±0.00
S	K	0.39±0.01	0.20±0.00
Cl	K	0.38±0.01	0.18±0.00
K	K	0.23±0.01	0.10±0.00
Ca	K	1.30±0.01	0.53±0.01

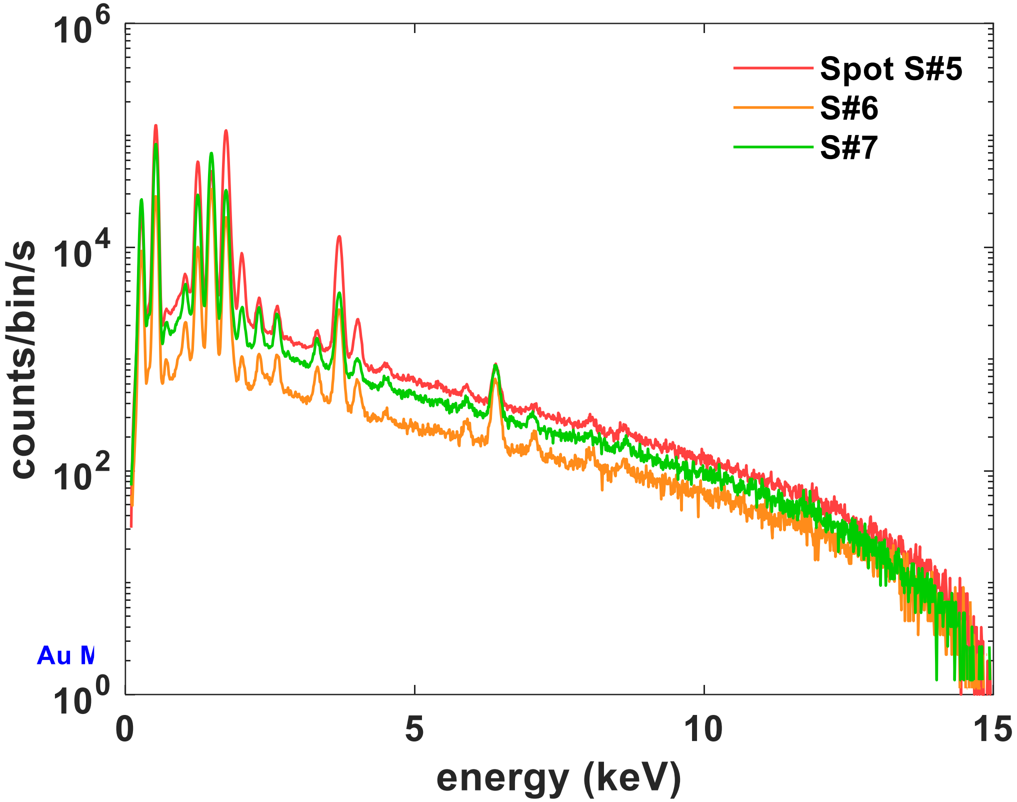
Spc_017

Element	Line	Mass%	Atom%
Cl	K	0.38±0.01	0.18±0.00
K	K	0.23±0.01	0.10±0.00
Ca	K	1.30±0.01	0.53±0.01
Fe	K	0.88±0.02	0.26±0.01
Total		99.99	100.01

Element Weight % (339.1)
Role Aluminum (Al) Balance (~77–82%) Base metal, matrix Silicon (Si) 11.0–13.0% Improves fluidity, wear resistance, reduces thermal expansion
Copper (Cu) 3.0–4.0% Enhances strength, reduces corrosion resistance
Iron (Fe) 0.6–1.2% Reduces die sticking, affects ductility
Magnesium (Mg) 0.5–1.5% Improves strength, heat treatability
Manganese (Mn) 0.5% max Improves Fe-Al intermetallic phase, strength
Zinc (Zn) 1.0% max Solution strengthening, minor effect
Nickel (Ni) 0.5–1.5% Enhances high-temperature strength
Tin (Sn) 0.15% max Minor, affects fluidity Others (each) 0.05% max Trace impurities Others (total) 0.15% max Trace impurities

Top Surface Spot #S5 (EDS map)





Element	Line	Mass%	Atom%
C	K	28.61±0.06	38.72±0.08
O	K	45.34±0.09	46.07±0.09
Na	K	0.49±0.01	0.35±0.01
Mg	K	4.50±0.02	3.01±0.01
Al	K	11.60±0.03	6.99±0.02
Si	K	5.86±0.02	3.39±0.01

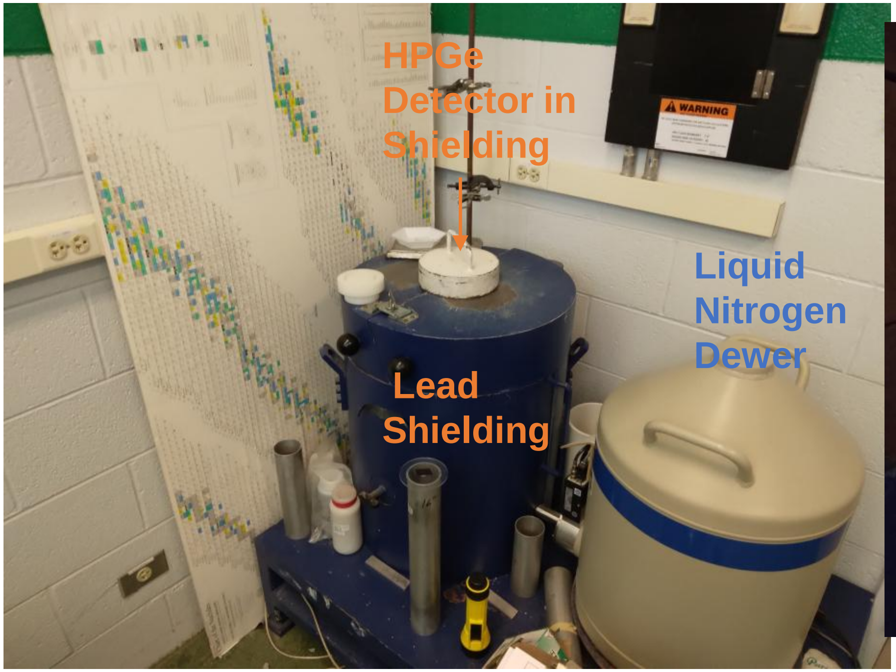
Element	Line	Mass%	Atom%
Si	K	5.86±0.02	3.39±0.01
P	K	0.41±0.01	0.21±0.00
S	K	0.39±0.01	0.20±0.00
Cl	K	0.38±0.01	0.18±0.00
K	K	0.23±0.01	0.10±0.00
Ca	K	1.30±0.01	0.53±0.01

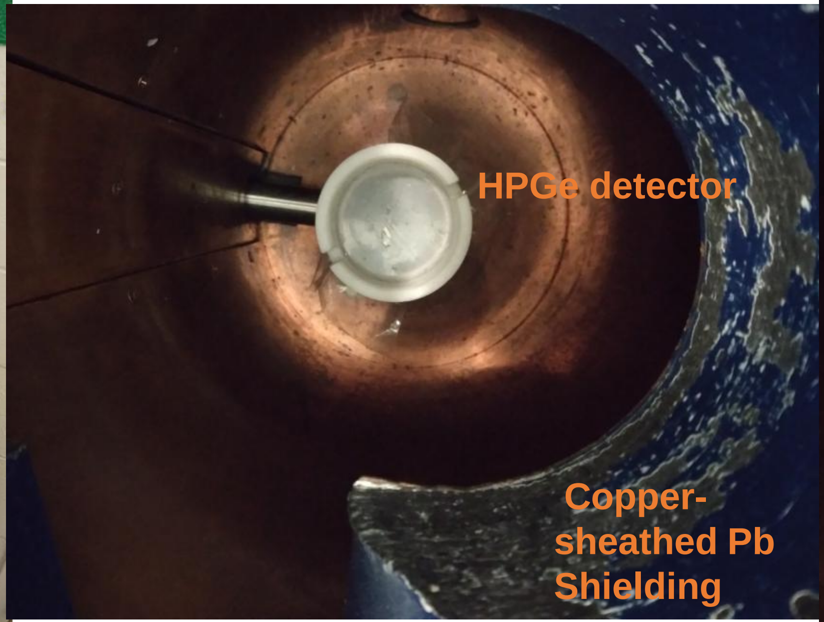
Spc_017

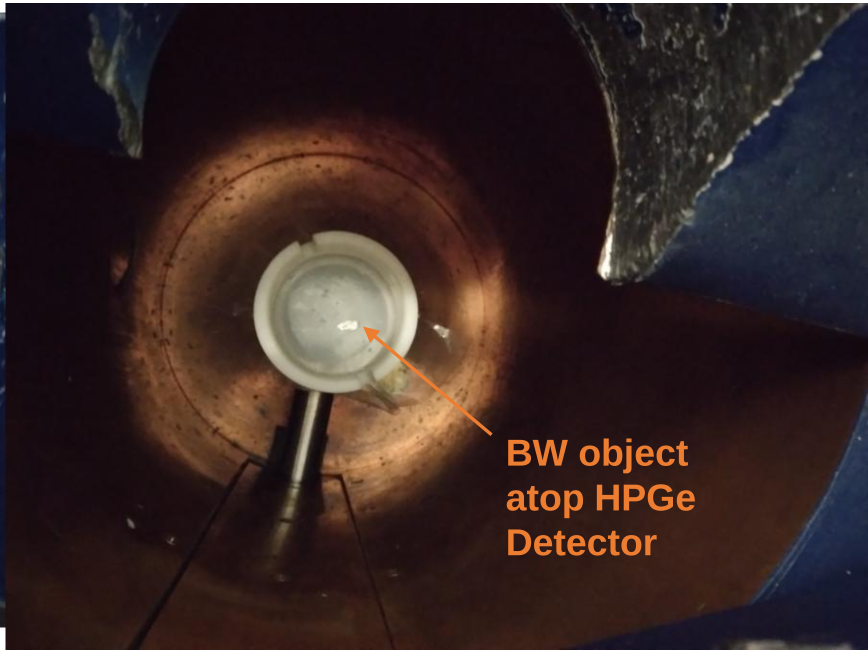
Element	Line	Mass%	Atom%
Cl	K	0.38±0.01	0.18±0.00
K	K	0.23±0.01	0.10±0.00
Ca	K	1.30±0.01	0.53±0.01
Fe	K	0.88±0.02	0.26±0.01
Total		99.99	100.01

- EDS spectra normalized to Al peak counts.
- Similar to other spots, dominated (on atomic basis) by hydrocarbonds (C, O).
- Al, Si, and Mg are prevalent.
- Rod-like, dendritic structures overlap the Mg, O, and Al maps, not the C maps.

Foggin Object (Section cutting): Gamma-Ray Experimental Setup

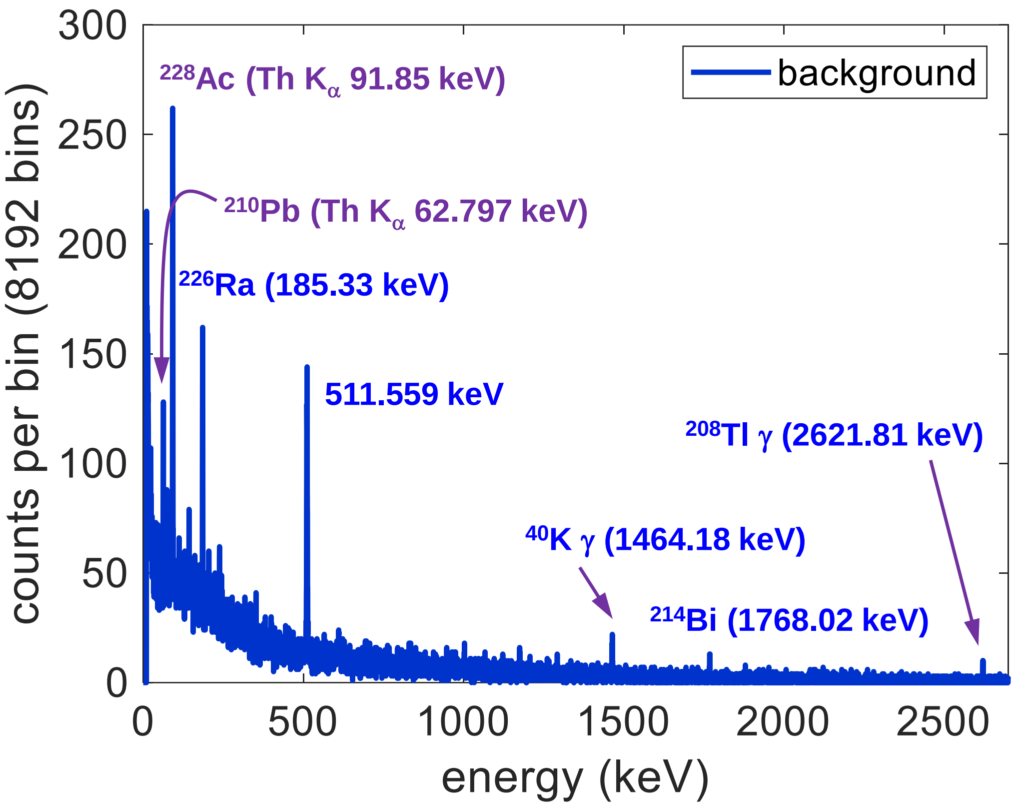


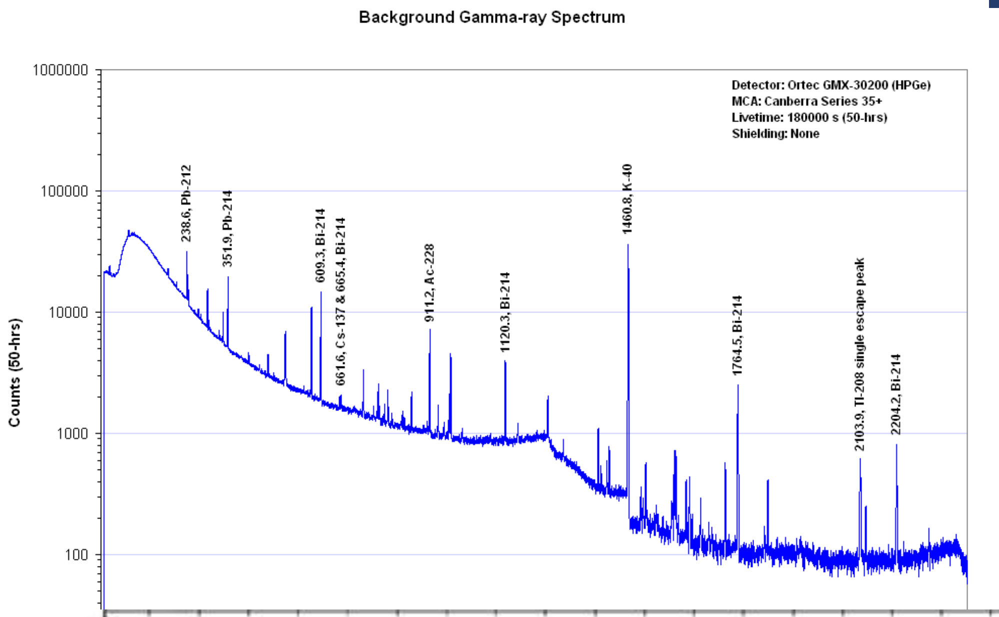


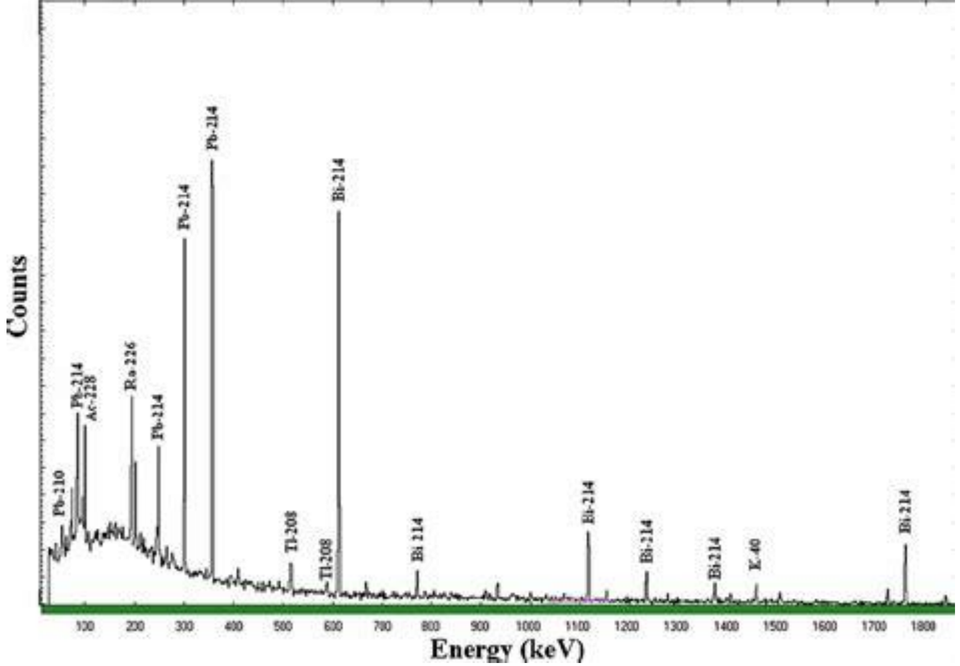


1) The above setup is used for counting activated solids and other radioactive sources.
2) The lead enclosure includes a copper sheathing to block the photons produced in the lead.
3) There is always radiation background (from the surrounding cinderblock walls, etc.), the challenge is to observe other sources in the presence of that background.
4) The high-purity germanium detector (3” x 1”) is cooled to liquid nitrogen temperatures in order to achieve high-resolution.
5) As shown in the right-hand picture, the target under study (the little cutting from the Bob White Object) can be placed on top of the HPGe detector within the shielding. Thus, even samples with low radioactivity can be counted.
6) The setup is connected to electronics that produces the a histogram of the number of gamma-ray emissions at each energy.
7) The following results were derived from this setup.

Foggin (edge-cut): Radiation Response (2)

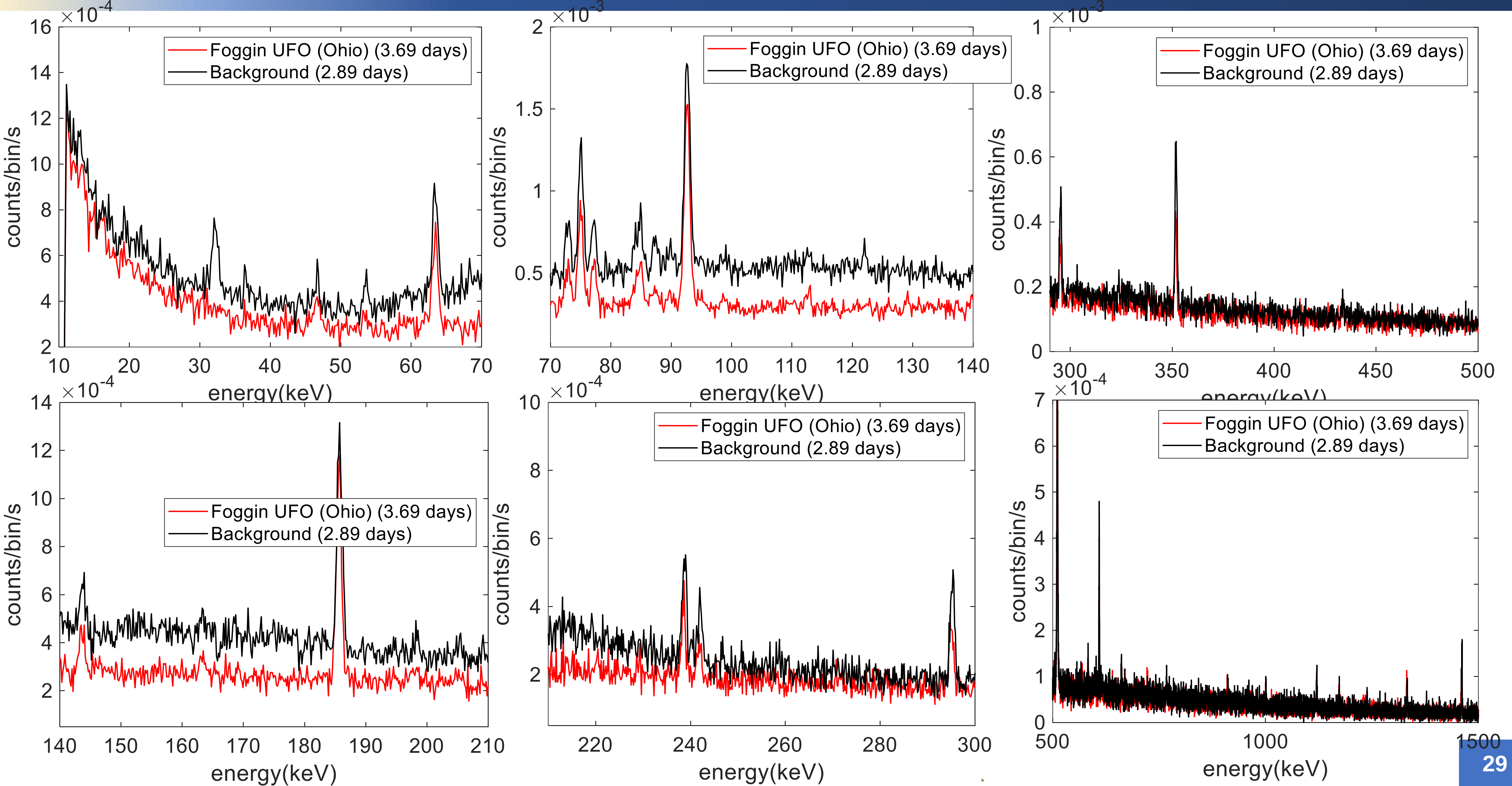




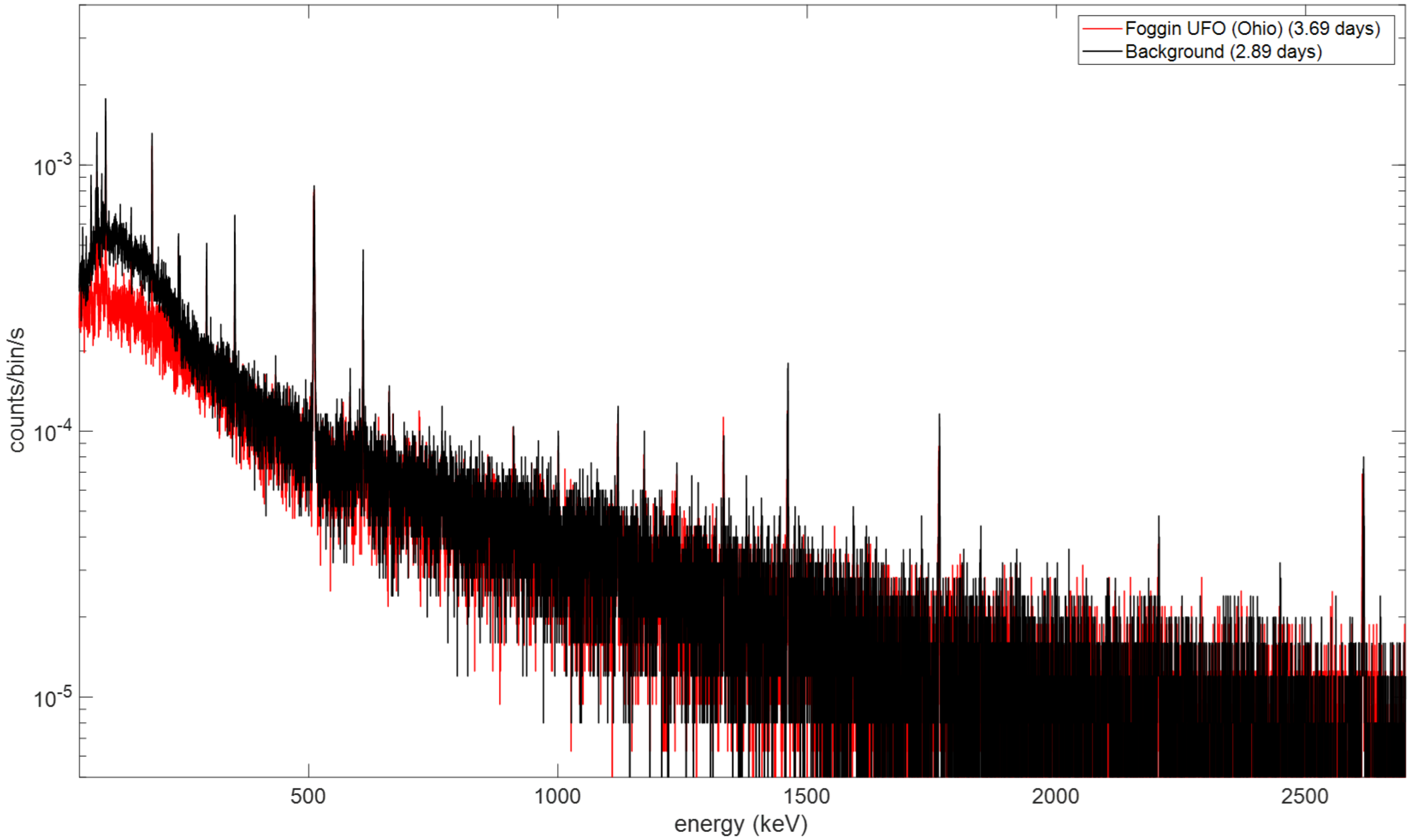


1) Above is a 24 hour background spectrum derived from a high-purity germanium detector (HPGe), in which the peak ID is used for calibration.
2) If radioactive, the goal of putting a sample in the chamber is that some peak will become more prominent, or more promisingly, some additional peak is evident from which one can determine the emitting isotope.
3) The right are example background spectra from various sources.

Foggin (end tip cutting): Radiation Response 3.69 days comparison



Foggin Object (end tip cutting): Radiation



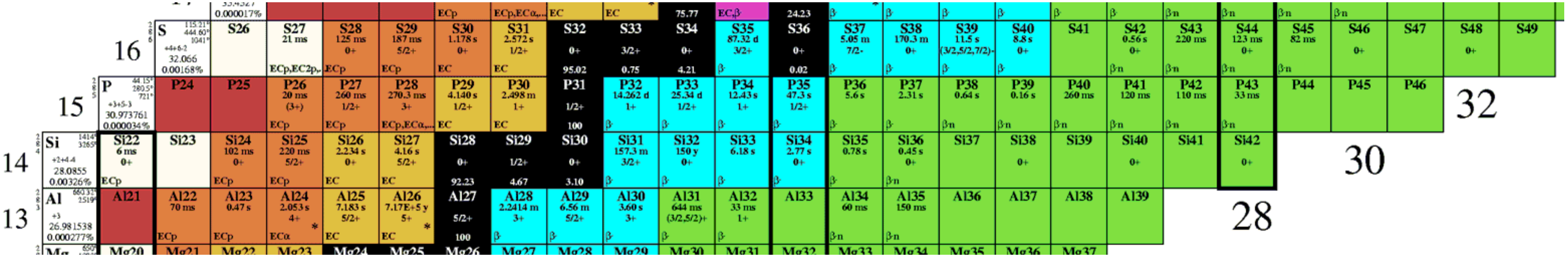
1) Doesn’t really look any different. Differences are likely due to statistical counting fluctuations (across 8190 channels, will have some disparity in the peaks due to uncertainty in counts/channel. Background higher just because blocked less than when sample and holder in well.
2) **Prelim Conclusion: No anomalies here. Object is not emitting gamma-rays.**

Foggin Object (end tip cutting): Gamma-ray Preliminary conclusions

1) There are no gamma-rays emitted by the end-cut piece that aren't in the background. Note that there can be some differences between background and Foggin Object ("BW object") but these are expected when the counts per channel are low.

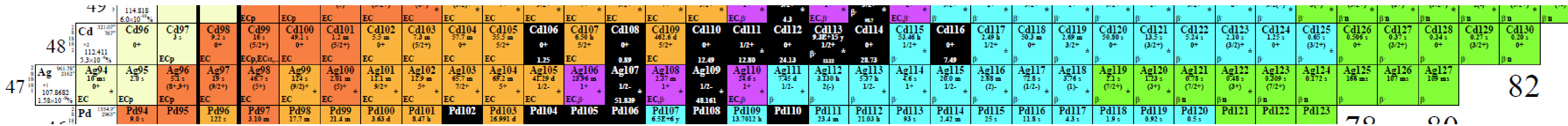
(the fractional uncertainty (count variation in a particular channel) is the square root of (the number of counts in channel) so, for example, if there are 100 counts in each channel, then the standard deviation is 10. This means that if one channel has 90 counts and next door has 110 counts, this does not mean that the 110 count channel is evidence of a gamma-ray emission, it is expected because the number of counts per channel is random (with known statistics). Thus, there can be some peaks in the "background" that aren't in "BW object" and vice-versa, but these occur only for limited channel numbers and are not indicative.)

2) If the object was activated at some point (radioactive isotopes of Aluminum, Silicon, Silver, etc. were created), one can look at the half-lives of these isotopes to see if one expects gamma-rays 40 years later. For aluminum, the half-lives are all very short (look under the "13" for Aluminum); specifically, 2.24 m, 6.56 m, 3.60 s, 644 ms, 33 ms. Furthermore, they decay via beta decay (shooting out an electron rather than a photon). Thus, even if initially radioactive, don't expect it to be now via aluminum.



3) Silicon also has mainly short-lived isotopes that decay via beta emission, with the exception of ^{32}Si, which has a 150 year half life. One can try to observe beta (or other charged particle emissions).

Foggin Object (end tip cutting): Gamma-ray Preliminary conclusions



4) Silver (Ag, row 47) also has isotopes that are short-lived if activated from stable isotopes Ag-107 and Ag-109 (stable isotopes colored black in the boxes). Thus, from the two main constituents of the Foggin end piece (Al, Si), one doesn't expect gamma-ray emission, and none is observed.

5) Perhaps impurities could produce radioactive isotopes, but none are evident in the spectra. We are currently looking for charge-particle emissions (beta, alpha) with a silicon-PIN detector (good charged-particle detector) in the setup: