SRNL-F1200-2014-00001

February 24, 2014

Subject: Summary of analysis results

To: John Doherty

From: Mark Barnes

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Reviewed by: John Eng Date: 2/24/2014

# Official Use Only

Results for your recently submitted project are summarized below and detailed as an attached PDF file which is organized by page numbers listed below. The document number on the cover of this report is for record only. The document ID references the recipient as the sole owner and contact point.

Sample notes:
Samples were prepared and analyzed to determine inorganic and organic constituents that might be of use in the client's problem identification.

Quantitative results (ICP-ES and ICP-MS) are expressed as microgram of analyte per filter disk, and are not expressed per unit of air that was sampled. GC-MS is not expressed quantitatively because of uncertain capture efficiency of the filter material for those methods. SEM and XRF are qualitative techniques because matrix matched standards were not available.

Techniques employed:
SEM= Scanning Electron Microscopy
ICP-ES= Inductively Coupled Plasma – Emission Spectrometry
ICP-MS= Inductively Coupled Plasma – Mass Spectrometry
XRF= X-Ray Fluorescence
GC-MS= Gas Chromatography – Mass Spectrometry

| Submitted identification table | Physical observation |
|---|---|
| A23021514_2-17-14_0840 | black |
| A23021514_2-17-14_1510 | black |
| A33021414 | white |
| B13021414 | white |
| D11020514 | black with fluffy black solids, < 1 gram, hard to tell density |
| D12020514 | black with fluffy black solids (a little more than D11) |
| D13020514 | black with fluffy black solids (a good bit more than D11 or D12) |

Inorganic summary:

ICP-ES was applied after dissolution in aqua regia. Results for detected analytes are reported in Attachment page 1 (summary). The difference in K and Mg between non-fire samples is shown graphically on page 2. A full detail report showing all measured analytes is on page 3.

A23021514_2-17-14_0840 contained elevated level of Magnesium (relative to other samples)

B13021414 contained elevated level of Potassium (relative to other samples)

Salt was observed on all samples and especially enriched in the D samples.

ICP-MS results are tabulated on page 7-8 as quantitated for the different masses. Interpolation to elemental composition is possible only if the the isotopic distribution is natural or known. Therefore, no interpretation is made.

XRF results showed chlorine and elemental results consistent with ICP-ES and ICP-MS. In order to approximate sample background, a Lexan specimen was analyzed and shown graphically as an overlaid spectrum so that the differences could be noted. Filter media (polyvinyldiene fluoride) caused X-ray scatter and hindered bulk XRF analysis. Lack of availability of matched blank filter reduces certainty for detectability. The XRF results are presented on pages 9-16. XRF data is reported using our internal lab

numbering system, which is tabulated in the GC-MS report on page 4. Please use that cross-talk table to reconcile data ID's. It is noted that ICP results are reported on different AD sample numbers due to the fact that the samples were dissolutions of the originals.

SEM results showed (additionally to ICP results) high concentration of carbon and chlorine (likely as chloride). Scanning electron microscopy (SEM) images with energy dispersive spectroscopy (EDS) show particulate matter and filter fibers, with the brighter areas in backscatter mode tending to be salt-like in composition (Na, Mg, Ca, K, Cl, possibly Al and Si) and darker areas in backscatter mode tending to have high C and Cl compositions and much lower concentration of cations than brighter areas. Filters that appeared almost white (A33 and B13) had appreciably less particulate matter and had a fine network of material that appeared to be salt-like by EDS. The analyst was unable to determine the chemical form of the magnesium, primarily due to its low concentration. During SEM analysis, filter media generated charging on SEM stage and required coating to dissipate charge.

SEM results are shown on the attachment pages 17-88.

Organic summary:

GC-MS A and B samples contained no detectable organics recoverable by methylene chloride extraction and GC-MS. D samples contained measurable amounts of diesel fuel and typical combustion byproducts (e.g. benzo(k)fluoranthene). Organic results are summarized on page 4-6.

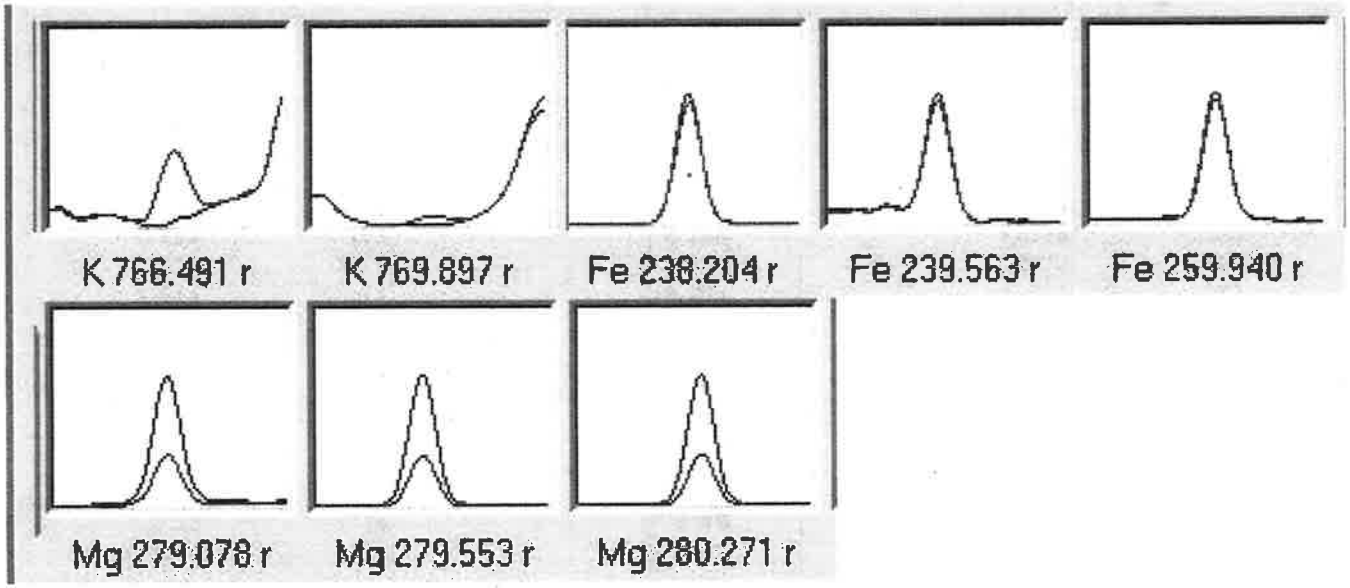
Attachment: Data analysis reports by method

## ICP-OES Results

**Description:** Air sample filter disks
**Travel Copy:** 65453
**Instrument:** Leeman Prodigy ICP-ES
**Reviewer:** John Young
**Comments:**
Results expressed as total ug/sample, from minimum 2x dilution after aqua regia digestion

Method Detection Limit (MDL) = Instrument Detection Limit (IDL) x Dilution Factor.
Uncertainty is the RMS of the method uncertainty and the sample uncertainty.

| USER_SAMPLEID: | A33_021414 | B13_021414 | A23_021514_0840 2_17_14 | A23_021514_1510 2_17_14 | D11_020514 | D12_020514 | D13_020514 |
|---|---|---|---|---|---|---|---|
| SAMPLE_ID: | 300309389 | 300309390 | 300309387 | 300309388 | 300309391 | 300309392 | 300309393 |
| UNITS: | ug/sample | ug/sample | ug/sample | ug/sample | ug/sample | ug/sample | ug/sample |
| **Element** | | | | | | | |
| B | < 29.2 | 39.7 | < 29.2 | < 29.2 | < 29.2 | < 29.2 | < 29.2 |
| Ba | 1.35 | 1.19 | 1.18 | 1.46 | 9.15 | 13.7 | 9.76 |
| Ca | 742 | 758 | 802 | 764 | 1220 | 1460 | 1290 |
| Cd | < 2.1 | < 2.1 | < 2.1 | < 2.1 | 107 | 177 | 124 |
| Fe | 34.7 | 25 | 22.9 | 34.9 | 80.3 | 92.6 | 88.5 |
| K | < 78 | 843 | < 78 | < 78 | 383 | 564 | 442 |
| Mg | 183 | 184 | 465 | 239 | 370 | 462 | 392 |
| Mn | 0.728 | 2.76 | 0.773 | 0.735 | 3.07 | 4.91 | 6.19 |
| Na | 764 | 1100 | 1470 | 1020 | 22400 | 32400 | 26300 |
| P | < 117 | < 117 | < 117 | < 117 | 213 | 302 | 209 |
| Si | 49.2 | 35.6 | 42.8 | 42.5 | 158 | 202 | 162 |
| Sn | < 152 | < 152 | < 152 | < 152 | < 152 | < 152 | < 152 |
| Sr | 3.21 | 3.23 | 3.9 | 3.54 | 11 | 14.6 | 12.3 |
| Zn | 8.79 | 7.69 | 7.74 | 9.5 | 942 | 1520 | 1100 |




**Red- A23_021514_0840 2_17_14 (high alpha (285 kdpm) sample)**
**Green- B13_021414 (1.5 kdpm alpha)**

## ICP-OES Results

**Description:** SMEARS
**Travel Copy:** 65453
**Instrument:** Leeman Prodigy ICP-ES
**Reviewer:** John Young
**Comments:**
Results expressed as total ug/sample, from minimum 2x dilution after aqua regia digestion

Method Detection Limit (MDL) = Instrument Detection Limit (IDL) x Dilution Factor.
Uncertainty is the RMS of the method uncertainty and the sample uncertainty.

| USER_SAMPLEID: | ADS GENERATED BLANK | A33_021414 | B13_021414 | A23_021514_0840 2_17_14 | A23_021514_1510 2_17_14 | D11_020514 | D12_020514 | D13_020514 |
|---|---|---|---|---|---|---|---|---|
| SAMPLE_ID: | 300309386 | 300309389 | 300309390 | 300309387 | 300309388 | 300309391 | 300309392 | 300309393 |
| UNITS: | ug/sample | ug/sample | ug/sample | ug/sample | ug/sample | ug/sample | ug/sample | ug/sample |
| Element | | | | | | | | |
| Ag | < 2.03 (N/A %RSD) | < 2.03 (N/A %RSD) | < 2.03 (N/A %RSD) | < 2.03 (N/A %RSD) | < 2.03 (N/A %RSD) | < 2.03 (N/A %RSD) | < 2.03 (N/A %RSD) | < 2.03 (N/A %RSD) |
| Al | < 11.6 (N/A %RSD) | < 11.6 (N/A %RSD) | < 11.6 (N/A %RSD) | < 11.6 (N/A %RSD) | < 11.6 (N/A %RSD) | < 11.6 (N/A %RSD) | < 11.6 (N/A %RSD) | < 11.6 (N/A %RSD) |
| B | < 29.2 (N/A %RSD) | < 29.2 (N/A %RSD) | 39.7 (10.9 %RSD) | < 29.2 (N/A %RSD) | < 29.2 (N/A %RSD) | < 29.2 (N/A %RSD) | < 29.2 (N/A %RSD) | < 29.2 (N/A %RSD) |
| Ba | < 1.05 (N/A %RSD) | 1.35 (55.1 %RSD) | 1.19 (11.9 %RSD) | 1.18 (69.2 %RSD) | 1.46 (17 %RSD) | 9.15 (10.4 %RSD) | 13.7 (10.1 %RSD) | 9.76 (10.1 %RSD) |
| Be | < 0.15 (N/A %RSD) | < 0.15 (N/A %RSD) | < 0.15 (N/A %RSD) | < 0.15 (N/A %RSD) | < 0.15 (N/A %RSD) | < 0.15 (N/A %RSD) | < 0.15 (N/A %RSD) | < 0.15 (N/A %RSD) |
| Ca | 20.6 (10 %RSD) | 742 (10 %RSD) | 758 (10 %RSD) | 802 (10 %RSD) | 764 (10 %RSD) | 1220 (10 %RSD) | 1460 (10 %RSD) | 1290 (10 %RSD) |
| Cd | < 2.1 (N/A %RSD) | < 2.1 (N/A %RSD) | < 2.1 (N/A %RSD) | < 2.1 (N/A %RSD) | < 2.1 (N/A %RSD) | 107 (10 %RSD) | 177 (10 %RSD) | 124 (10 %RSD) |
| Ce | < 17 (N/A %RSD) | < 17 (N/A %RSD) | < 17 (N/A %RSD) | < 17 (N/A %RSD) | < 17 (N/A %RSD) | < 17 (N/A %RSD) | < 17 (N/A %RSD) | < 17 (N/A %RSD) |
| Co | < 3.59 (N/A %RSD) | < 3.59 (N/A %RSD) | < 3.59 (N/A %RSD) | < 3.59 (N/A %RSD) | < 3.59 (N/A %RSD) | < 3.59 (N/A %RSD) | < 3.59 (N/A %RSD) | < 3.59 (N/A %RSD) |
| Cr | < 2.45 (N/A %RSD) | < 2.45 (N/A %RSD) | < 2.45 (N/A %RSD) | < 2.45 (N/A %RSD) | < 2.45 (N/A %RSD) | < 2.45 (N/A %RSD) | < 2.45 (N/A %RSD) | < 2.45 (N/A %RSD) |
| Cu | < 4.13 (N/A %RSD) | < 4.13 (N/A %RSD) | < 4.13 (N/A %RSD) | < 4.13 (N/A %RSD) | < 4.13 (N/A %RSD) | < 4.13 (N/A %RSD) | < 4.13 (N/A %RSD) | < 4.13 (N/A %RSD) |
| Fe | 33.8 (10.1 %RSD) | 34.7 (10.1 %RSD) | 25 (10.1 %RSD) | 22.9 (10.1 %RSD) | 34.9 (10.1 %RSD) | 80.3 (10 %RSD) | 92.6 (10 %RSD) | 88.5 (10 %RSD) |
| Gd | < 8.58 (N/A %RSD) | < 8.58 (N/A %RSD) | < 8.58 (N/A %RSD) | < 8.58 (N/A %RSD) | < 8.58 (N/A %RSD) | < 8.58 (N/A %RSD) | < 8.58 (N/A %RSD) | < 8.58 (N/A %RSD) |
| K | < 78 (N/A %RSD) | < 78 (N/A %RSD) | 843 (11.3 %RSD) | < 78 (N/A %RSD) | < 78 (N/A %RSD) | 383 (12 %RSD) | 564 (11.2 %RSD) | 442 (11 %RSD) |
| La | < 2.13 (N/A %RSD) | < 2.13 (N/A %RSD) | < 2.13 (N/A %RSD) | < 2.13 (N/A %RSD) | < 2.13 (N/A %RSD) | < 2.13 (N/A %RSD) | < 2.13 (N/A %RSD) | < 2.13 (N/A %RSD) |
| Li | < 9.53 (N/A %RSD) | < 9.53 (N/A %RSD) | < 9.53 (N/A %RSD) | < 9.53 (N/A %RSD) | < 9.53 (N/A %RSD) | < 9.53 (N/A %RSD) | < 9.53 (N/A %RSD) | < 9.53 (N/A %RSD) |
| Mg | < 14.5 (N/A %RSD) | 183 (10.1 %RSD) | 184 (10 %RSD) | 465 (10 %RSD) | 239 (10.1 %RSD) | 370 (10 %RSD) | 462 (10 %RSD) | 392 (10 %RSD) |
| Mn | 1.19 (12.5 %RSD) | 0.728 (10.1 %RSD) | 2.76 (13.8 %RSD) | 0.773 (12.5 %RSD) | 0.735 (10.8 %RSD) | 3.07 (15.2 %RSD) | 4.91 (10.2 %RSD) | 6.19 (10.1 %RSD) |
| Mo | < 22.4 (N/A %RSD) | < 22.4 (N/A %RSD) | < 22.4 (N/A %RSD) | < 22.4 (N/A %RSD) | < 22.4 (N/A %RSD) | < 22.4 (N/A %RSD) | < 22.4 (N/A %RSD) | < 22.4 (N/A %RSD) |
| Na | 58.8 (11.6 %RSD) | 764 (10.2 %RSD) | 1100 (10 %RSD) | 1470 (10.1 %RSD) | 1020 (10.2 %RSD) | 22400 (10 %RSD) | 32400 (10 %RSD) | 26300 (10 %RSD) |
| Ni | < 17.9 (N/A %RSD) | < 17.9 (N/A %RSD) | < 17.9 (N/A %RSD) | < 17.9 (N/A %RSD) | < 17.9 (N/A %RSD) | < 17.9 (N/A %RSD) | < 17.9 (N/A %RSD) | < 17.9 (N/A %RSD) |
| P | < 117 (N/A %RSD) | < 117 (N/A %RSD) | < 117 (N/A %RSD) | < 117 (N/A %RSD) | < 117 (N/A %RSD) | 213 (10.6 %RSD) | 302 (11.5 %RSD) | 209 (12 %RSD) |
| Pb | < 221 (N/A %RSD) | < 221 (N/A %RSD) | < 221 (N/A %RSD) | < 221 (N/A %RSD) | < 221 (N/A %RSD) | < 221 (N/A %RSD) | < 221 (N/A %RSD) | < 221 (N/A %RSD) |
| S | < 2250 (N/A %RSD) | < 2250 (N/A %RSD) | < 2250 (N/A %RSD) | < 2250 (N/A %RSD) | < 2250 (N/A %RSD) | < 2250 (N/A %RSD) | < 2250 (N/A %RSD) | < 2250 (N/A %RSD) |
| Sb | < 43.4 (N/A %RSD) | < 43.4 (N/A %RSD) | < 43.4 (N/A %RSD) | < 43.4 (N/A %RSD) | < 43.4 (N/A %RSD) | 154 (10.1 %RSD) | 277 (11.2 %RSD) | 298 (10.1 %RSD) |
| Si | < 29 (N/A %RSD) | 49.2 (11.3 %RSD) | 35.6 (12.4 %RSD) | 42.8 (10.6 %RSD) | 42.5 (12 %RSD) | 158 (10.1 %RSD) | 202 (10.1 %RSD) | 162 (10.1 %RSD) |
| Sn | < 152 (N/A %RSD) | < 152 (N/A %RSD) | < 152 (N/A %RSD) | < 152 (N/A %RSD) | < 152 (N/A %RSD) | < 152 (N/A %RSD) | < 152 (N/A %RSD) | < 152 (N/A %RSD) |
| Sr | < 0.15 (N/A %RSD) | 3.21 (10 %RSD) | 3.23 (10.1 %RSD) | 3.9 (10 %RSD) | 3.54 (10.1 %RSD) | 11 (10.1 %RSD) | 14.6 (10 %RSD) | 12.3 (10.1 %RSD) |
| Th | < 18.3 (N/A %RSD) | < 18.3 (N/A %RSD) | < 18.3 (N/A %RSD) | < 18.3 (N/A %RSD) | < 18.3 (N/A %RSD) | < 18.3 (N/A %RSD) | < 18.3 (N/A %RSD) | < 18.3 (N/A %RSD) |
| Ti | < 6.3 (N/A %RSD) | < 6.3 (N/A %RSD) | < 6.3 (N/A %RSD) | < 6.3 (N/A %RSD) | < 6.3 (N/A %RSD) | < 6.3 (N/A %RSD) | < 6.3 (N/A %RSD) | < 6.3 (N/A %RSD) |
| U | < 146 (N/A %RSD) | < 146 (N/A %RSD) | < 146 (N/A %RSD) | < 146 (N/A %RSD) | < 146 (N/A %RSD) | < 146 (N/A %RSD) | < 146 (N/A %RSD) | < 146 (N/A %RSD) |
| V | < 1.07 (N/A %RSD) | < 1.07 (N/A %RSD) | < 1.07 (N/A %RSD) | < 1.07 (N/A %RSD) | < 1.07 (N/A %RSD) | < 1.07 (N/A %RSD) | < 1.07 (N/A %RSD) | < 1.07 (N/A %RSD) |
| Zn | 3.1 (11.7 %RSD) | 8.79 (10.9 %RSD) | 7.69 (10.7 %RSD) | 7.74 (11 %RSD) | 9.5 (10.6 %RSD) | 942 (10 %RSD) | 1520 (10 %RSD) | 1100 (10 %RSD) |
| Zr | < 32.9 (N/A %RSD) | < 32.9 (N/A %RSD) | < 32.9 (N/A %RSD) | < 32.9 (N/A %RSD) | < 32.9 (N/A %RSD) | < 32.9 (N/A %RSD) | < 32.9 (N/A %RSD) | < 32.9 (N/A %RSD) |

**WIPP Samples**
**S Crump** to: John Young
Cc: Lynette Connelly

02/24/2014 09:04 AM

Sample ID

| Customer ID | Sample ID | Mass, mg |
|---|---|---|
| A-23...0840 | 300308394 | 0.8 |
| A-23...1510 | 300308395 | 0.3 |
| A33 | 300308396 | 0.5 |
| B13 | 300308397 | 0.4 |
| D11 | 300308398 | 19.3 |
| D12 | 300308399 | 16.7 |
| D13 | 300308400 | 45.8 |

The last three samples in the series, D11, D12, and D13, had the only appreciable quantity of extractable organic material present (extractable masses presented above in the table). These three samples each displayed a large organic constituent in the chromatogram which is composed primarily of unburned diesel fuel mixed with combustion products, such as Benzo[k]fluoranthene (see structure and mass spectrum, below in Figure 2).

The extractable portion of these three samples contained between 40,000 and 65,000 parts per million (ppm) of material detectable by GC/MS. The remainder of extractable material was either non-volatile or too high boiling to be detected in the analysis (the upper temperature limit is 340 °C). The variability of measured organic material on the three filters may be attributed to the small sample size and poor organic capture efficiency of the filters.

Calculations for the organic quantification was completed in the attached spreadsheet.

WIPP Sample Processing 022014.xlsx

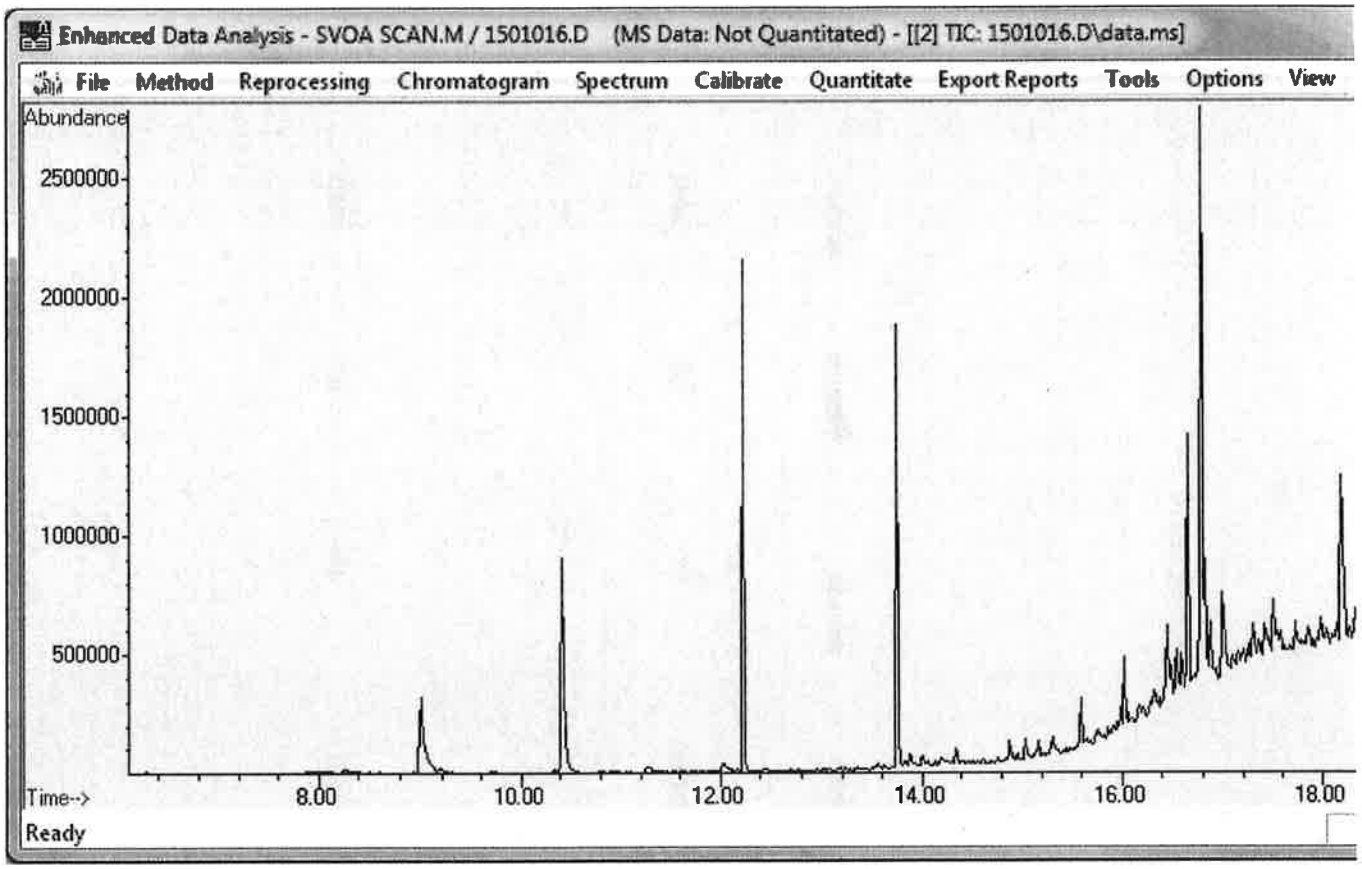



Figure 1. Chromatogram of D1 3 extract analyzed by GC/MS.

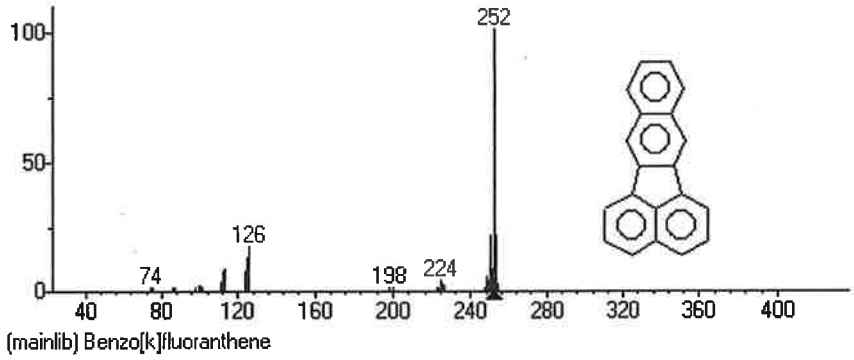



Figure 2. Structure and Mass Spectrum of a typical combustion product, from the NIST Mass Spectral Database.

**WIPP Sample Processing**

| Customer ID | Sample ID | Mass, mg |
|---|---|---|
| A-23...0840 | 300308394 | 0.8 |
| A-23...1510 | 300308395 | 0.3 |
| A33 | 300308396 | 0.5 |
| B13 | 300308397 | 0.4 |
| D11 | 300308398 | 19.3 |
| D12 | 300308399 | 16.7 |
| D13 | 300308400 | 45.8 |

TIC: 1501016.D\data.ms
309400

| Peak # | Ret Time | Type | Width | Area | Start Time | End Time | IS Subtract | Quant, ug | Weight, mg | ug/g, ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8.995 | rBV | 0.198 | 1054348 | 8.961 | 9.159 | | | | |
| 2 | 10.41 | rVB | 0.274 | 1765744 | 10.381 | 10.655 | | | | |
| 3 | 12.227 | rVB | 0.18 | 2247428 | 12.198 | 12.378 | | | | |
| 4 | 13.746 | rBV | 0.146 | 2219531 | 13.717 | 13.863 | | | | |
| 5 | 16.786 | rm | 5.17 | 114112175 | 14.8 | 19.97 | 109673113 | 1977 | 45.8 | 43155 |

TIC: 1401015.D\data.ms
309399

| Peak # | Ret Time | Type | Width | Area | Start Time | End Time | IS Subtract | Quant, ug | Weight, mg | ug/g, ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 7.916 | rBV | 0.175 | 54017 | 7.858 | 8.033 | | | | |
| 2 | 8.993 | rBV | 0.198 | 1171484 | 8.964 | 9.162 | | | | |
| 3 | 9.18 | rVB | 0.25 | 90045 | 9.162 | 9.413 | | | | |
| 4 | 10.408 | rVB | 0.338 | 1811963 | 10.379 | 10.717 | | | | |
| 5 | 12.225 | rVB | 0.163 | 2306772 | 12.196 | 12.359 | | | | |
| 6 | 13.744 | rBV | 0.163 | 2151507 | 13.721 | 13.884 | | | | |
| 7 | 16.783 | rm | 5.997 | 59914391 | 13.989 | 19.986 | 55611377 | 1034 | 16.7 | 61911 |

TIC: 1301014.D\data.ms
309398

| Peak # | Ret Time | Type | Width | Area | Start Time | End Time | IS Subtract | Quant, ug | Weight, mg | ug/g, ppm |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8.265 | rVV | 0.274 | 78843 | 8.207 | 8.481 | | | | |
| 2 | 8.993 | rBV | 0.198 | 1141495 | 8.964 | 9.162 | | | | |
| 3 | 9.185 | rVB | 0.326 | 95345 | 9.162 | 9.488 | | | | |
| 4 | 10.408 | rVB | 0.332 | 1758775 | 10.385 | 10.716 | | | | |
| 5 | 12.224 | rVB | 0.175 | 2208617 | 12.195 | 12.37 | | | | |
| 6 | 13.744 | rBV | 0.163 | 2158485 | 13.715 | 13.878 | | | | |
| 7 | 16.783 | rm | 5.991 | 61813893 | 13.988 | 19.979 | 57496923 | 1066 | 19.3 | 55208 |

## ICP-MS Results

**File Name:** Young 309386-393
**Instrument:** EQS355: Bldg 773A, Rm B057
**Analyst:** Steve Moody
**Comments:** +/-25% uncertainty for mass 126 and 128
**Analysis Date:** 2/20/2014
**Reviewer Name:** Mark Jones

Method Detection Limit (MDL) = Instrument Detection Limit (IDL) x Dilution Factor
Method Uncertanty is +/- 20%
Reported %RSD values reflect variance of replicate measurements.

| m/z | Opening Check Standard (ug/L) | -- | 300309386 ADS GENERATED BLANK 7500 & 1500 X ng/sample | -- | 300309387 A23_021514_0 610 2 17 14 7500 & 1500 X ng/sample | -- | 300309388 A23_021514_1 510 2 17 14 7500 & 1500 X ng/sample | -- | 300309389 A33 021414 7500 & 1500 X ng/sample | -- | 300309390 B13 021414 7500 & 1500 X ng/sample | -- | 300309391 G11 020514 7500 & 1500 X ng/sample | -- | 300309392 D14 020514 7500 & 1500 X ng/sample | -- | 300309393 D13 020514 7500 & 1500 X ng/sample | -- | Closing Check Standard (ug/L) | -- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 59 | 2.44E+01 | (1.25E+00 %RSD) | | | | | | | | | | | | | | | | | 2.53E+01 | (2.22E+00 %RSD) |
| 82 | 2.12E+00 | (2.54E+00 %RSD) | | | | | | | | | | | | | | | | | 2.53E+00 | (7.50E-01 %RSD) |
| 84 | 1.44E-01 | (6.47E+00 %RSD) | | | | | | | | | | | | | | | | | 1.42E-01 | (3.01E+00 %RSD) |
| 85 | 1.75E+01 | (1.38E+00 %RSD) | | | | | | | | | | | 1.17E+02 | (9.00E+00 %RSD) | 2.31E+02 | (1.35E+01 %RSD) | 1.55E+02 | (3.18E+00 %RSD) | 1.78E+01 | (3.34E+00 %RSD) |
| 86 | 2.50E+00 | (5.23E-01 %RSD) | | | 2.87E+02 | (5.03E-01 %RSD) | 3.24E+02 | (2.77E-01 %RSD) | 2.55E+02 | (7.58E-01 %RSD) | 2.51E+02 | (5.55E+00 %RSD) | 1.62E+03 | (2.99E+00 %RSD) | 1.34E+03 | (2.81E+00 %RSD) | 1.14E+03 | (2.71E+00 %RSD) | 2.31E+00 | (7.95E-01 %RSD) |
| 87 | 8.47E+00 | (8.43E-01 %RSD) | | | 2.10E+02 | (7.81E+00 %RSD) | 2.72E+02 | (7.38E+00 %RSD) | 2.25E+02 | (3.24E-01 %RSD) | 2.33E+02 | (1.87E+00 %RSD) | 8.22E+02 | (2.07E+00 %RSD) | 1.11E+03 | (3.39E+00 %RSD) | 8.18E+02 | (3.84E+00 %RSD) | 8.81E+00 | (2.92E+00 %RSD) |
| 88 | 2.64E+01 | (2.34E+00 %RSD) | | | 3.05E+03 | (2.39E+00 %RSD) | 2.48E+03 | (2.27E+00 %RSD) | 2.53E+03 | (6.61E-01 %RSD) | 2.45E+03 | (2.18E+00 %RSD) | 9.55E+03 | (7.43E-01 %RSD) | 1.14E+04 | (1.49E+00 %RSD) | 9.96E+03 | (2.94E+00 %RSD) | 2.12E+01 | (4.17E+00 %RSD) |
| 89 | 2.51E+01 | (2.20E-01 %RSD) | | | | | | | | | | | | | | | 3.74E+01 | (2.15E+01 %RSD) | 2.54E+01 | (1.43E+00 %RSD) |
| 90 | 1.31E+01 | (1.67E+00 %RSD) | | | | | | | | | | | | | | | | | 1.31E+01 | (2.92E+00 %RSD) |
| 91 | 2.92E+00 | (1.49E+00 %RSD) | | | | | | | | | | | | | | | | | 2.92E+00 | (1.77E+00 %RSD) |
| 92 | 3.71E+00 | (1.10E+00 %RSD) | | | | | | | | | | | | | | | | | 8.05E+00 | (2.99E-01 %RSD) |
| 93 | 2.47E+01 | (1.72E+00 %RSD) | | | | | | | | | | | | | | | | | 2.44E+01 | (2.34E+00 %RSD) |
| 94 | 6.59E+00 | (9.89E-01 %RSD) | | | | | | | | | | | | | | | | | 6.62E+00 | (2.57E+00 %RSD) |
| 95 | 3.99E+00 | (7.35E-01 %RSD) | | | | | | | | | | | | | | | | | 3.94E+00 | (2.04E-01 %RSD) |
| 96 | 6.33E+00 | (2.44E+00 %RSD) | | | | | | | | | | | | | | | | | 6.29E+00 | (1.55E+00 %RSD) |
| 97 | 2.35E+00 | (4.53E+00 %RSD) | | | | | | | | | | | | | | | | | 2.38E+00 | (9.56E-01 %RSD) |
| 98 | 6.42E+00 | (3.62E+00 %RSD) | | | | | | | | | | | | | | | | | 6.36E+00 | (1.54E-01 %RSD) |
| 99 | 3.20E+00 | (1.50E+00 %RSD) | | | | | | | | | | | | | | | | | 3.21E+00 | (2.46E+00 %RSD) |
| 100 | 5.57E+00 | (2.77E-01 %RSD) | | | | | | | | | | | | | | | | | 5.54E+00 | (2.99E+00 %RSD) |
| 101 | 4.33E+00 | (1.65E+00 %RSD) | | | | | | | | | | | | | | | | | 4.23E+00 | (4.03E+00 %RSD) |
| 102 | 8.44E+00 | (1.61E-01 %RSD) | | | | | | | | | | | | | | | | | 8.27E+00 | (2.82E+00 %RSD) |
| 103 | 2.54E+01 | (1.01E+00 %RSD) | | | | | | | | | | | | | | | | | 2.51E+01 | (1.75E+00 %RSD) |
| 104 | 7.48E+00 | (3.53E-01 %RSD) | | | | | | | | | | | | | | | | | 7.44E+00 | (3.47E+00 %RSD) |
| 105 | 5.64E+00 | (4.06E+00 %RSD) | | | | | | | | | | | | | | | | | 5.54E+00 | (1.04E+00 %RSD) |
| 106 | 7.13E+00 | (3.78E+00 %RSD) | | | | | | | | | | | 1.03E+03 | (1.09E+01 %RSD) | 1.48E+03 | (1.44E+00 %RSD) | 1.16E+03 | (7.29E+00 %RSD) | 7.31E+00 | (4.16E+00 %RSD) |
| 107 | 1.26E+01 | (1.32E+01 %RSD) | | | | | | | | | | | | | | | | | 1.33E+01 | (1.04E+00 %RSD) |
| 108 | 6.77E+00 | (1.74E+00 %RSD) | | | | | | | | | | | 6.94E+02 | (9.45E+00 %RSD) | 1.11E+03 | (7.87E-01 %RSD) | 8.44E+02 | (3.84E+00 %RSD) | 6.82E+00 | (2.84E-01 %RSD) |
| 109 | 1.17E+01 | (7.64E+00 %RSD) | | | | | | | | | | | | | | | | | 1.28E+01 | (5.52E+00 %RSD) |
| 110 | 6.13E+00 | (3.79E-01 %RSD) | | | 8.35E+01 | (3.42E+00 %RSD) | | | | | | | 1.17E+04 | (1.72E+00 %RSD) | 1.50E+04 | (1.10E+00 %RSD) | 1.34E+04 | (1.33E+00 %RSD) | 6.13E+00 | (1.93E+00 %RSD) |
| 111 | 3.23E+00 | (1.49E+00 %RSD) | | | 7.97E+01 | (2.21E+01 %RSD) | | | | | | | 1.39E+04 | (2.35E+00 %RSD) | 2.10E+04 | (5.93E+00 %RSD) | 1.65E+04 | (3.04E+00 %RSD) | 3.21E+00 | (6.43E-01 %RSD) |
| 112 | 6.16E+00 | (4.66E+00 %RSD) | | | 1.16E+02 | (2.24E+01 %RSD) | 4.44E+01 | (4.32E+01 %RSD) | | | | | 2.51E+04 | (1.27E+00 %RSD) | 4.15E+04 | (4.54E+00 %RSD) | 3.00E+04 | (7.16E-01 %RSD) | 6.25E+00 | (3.76E+00 %RSD) |
| 113 | 4.27E+00 | (1.24E+00 %RSD) | | | | | | | | | | | 1.78E+04 | (4.48E+00 %RSD) | 2.84E+04 | (1.66E+00 %RSD) | 2.16E+04 | (2.40E+00 %RSD) | 4.38E+00 | (1.10E-02 %RSD) |
| 114 | 7.33E+00 | (1.31E+00 %RSD) | | | 1.30E+02 | (5.41E+00 %RSD) | 5.64E+01 | (4.56E+01 %RSD) | | | | | 3.04E+04 | (7.57E-01 %RSD) | 5.09E+04 | (1.49E+00 %RSD) | 3.93E+04 | (6.49E-01 %RSD) | 7.41E+00 | (1.23E+00 %RSD) |
| 116 | 5.39E+00 | (6.68E-01 %RSD) | | | | | 7.83E+01 | (3.71E-01 %RSD) | | | | | 7.93E+03 | (2.64E-01 %RSD) | 1.30E+04 | (2.30E+00 %RSD) | 5.27E+03 | (1.43E+00 %RSD) | 5.35E+00 | (1.15E-01 %RSD) |
| 117 | 1.90E+00 | (1.05E+00 %RSD) | | | | | 3.91E+01 | (4.74E+01 %RSD) | 2.58E+01 | (6.26E+00 %RSD) | | | 7.95E+02 | (3.65E-01 %RSD) | 1.24E+03 | (6.36E+00 %RSD) | 5.47E+02 | (6.31E+00 %RSD) | 1.52E+00 | (8.22E+00 %RSD) |
| 118 | 4.05E+00 | (9.45E-01 %RSD) | | | 2.33E+01 | (4.24E+01 %RSD) | 9.11E+01 | (3.36E-01 %RSD) | 6.46E+01 | (2.83E+01 %RSD) | 3.22E+01 | (3.75E+01 %RSD) | 2.51E+03 | (4.00E-01 %RSD) | 4.04E+03 | (3.00E+00 %RSD) | 2.83E+03 | (3.83E+00 %RSD) | 6.05E+00 | (1.27E+00 %RSD) |
| 119 | 2.27E+00 | (1.65E+00 %RSD) | | | | | 3.57E+01 | (8.55E+00 %RSD) | 2.25E+01 | (1.59E+00 %RSD) | | | 9.73E+02 | (3.61E+00 %RSD) | 1.43E+03 | (1.74E+00 %RSD) | 9.76E+02 | (1.82E-02 %RSD) | 7.18E+00 | (2.80E+00 %RSD) |
| 120 | 8.24E+00 | (1.56E+00 %RSD) | | | | | | | | | | | 3.37E+03 | (9.49E-01 %RSD) | 5.40E+03 | (2.66E+00 %RSD) | 3.75E+03 | (5.70E-02 %RSD) | 8.14E+00 | (3.30E+00 %RSD) |
| 121 | 1.41E+01 | (1.34E+00 %RSD) | | | 1.83E+03 | (6.80E+00 %RSD) | 9.19E+02 | (2.80E+00 %RSD) | | | | | 9.81E+04 | (8.97E-01 %RSD) | 1.74E+05 | (2.29E+00 %RSD) | 1.70E+05 | (1.83E+00 %RSD) | 1.39E+01 | (2.72E+00 %RSD) |
| 122 | 1.84E+00 | (6.61E-01 %RSD) | | | | | | | | | | | 7.55E+02 | (2.81E+00 %RSD) | 1.15E+03 | (1.44E+00 %RSD) | 7.11E+02 | (3.37E-01 %RSD) | 1.77E+00 | (1.41E+00 %RSD) |
| 123 | 1.10E+01 | (9.17E-01 %RSD) | | | 1.51E+03 | (2.42E+00 %RSD) | 6.30E+02 | (1.30E+01 %RSD) | | | | | 7.54E+04 | (1.32E-01 %RSD) | 1.34E+05 | (2.94E-01 %RSD) | 1.28E+05 | (2.13E+00 %RSD) | 1.07E+01 | (2.17E+00 %RSD) |
| 124 | 2.75E+00 | (2.08E+00 %RSD) | | | | | | | | | | | 1.61E+03 | (2.08E+00 %RSD) | 1.60E+02 | (2.03E+00 %RSD) | 1.07E+03 | (4.51E+00 %RSD) | 2.94E+00 | (4.93E-01 %RSD) |
| 125 | 1.52E+00 | (1.14E+01 %RSD) | | | | | | | | | | | | | | | | | 1.47E+00 | (1.01E+01 %RSD) |
| 126 | 4.00E+00 | (8.68E+00 %RSD) | | | | | | | | | | | | | | | | | 2.77E+00 | (7.13E+00 %RSD) |
| 128 | 6.10E+00 | (1.43E+01 %RSD) | | | | | | | | | | | | | | | | | 6.23E+00 | (1.24E+01 %RSD) |
| 130 | 7.30E+00 | (1.14E+01 %RSD) | | | | | | | | | | | | | | | | | 6.99E+00 | (6.24E+00 %RSD) |
| 133 | 2.52E+01 | (8.61E-01 %RSD) | | | | | | | 3.55E+02 | (1.07E+00 %RSD) | 2.71E+02 | (2.13E+00 %RSD) | | | | | 4.27E+04 | (1.73E+01 %RSD) | 2.48E+01 | (2.44E+00 %RSD) |
| 134 | 5.81E-01 | (1.21E+00 %RSD) | | | | | | | | | | | 1.72E+02 | (2.08E+01 %RSD) | 2.80E+02 | (3.34E+00 %RSD) | 1.77E+02 | (6.23E+00 %RSD) | 5.69E-01 | (2.14E+00 %RSD) |
| 135 | 1.74E+00 | (3.28E-01 %RSD) | | | 6.48E+01 | (5.81E+00 %RSD) | 7.92E+01 | (1.92E+01 %RSD) | 7.67E+01 | (2.05E+00 %RSD) | 5.70E+01 | (7.29E-01 %RSD) | 3.66E+02 | (2.26E+00 %RSD) | 4.48E+02 | (4.79E-01 %RSD) | 6.01E+02 | (1.75E+00 %RSD) | 1.59E+00 | (1.11E+00 %RSD) |
| 136 | 1.98E+00 | (1.74E+00 %RSD) | | | | | | | | | | | 6.57E+02 | (5.89E-01 %RSD) | 9.51E+02 | (1.87E+00 %RSD) | 6.83E+02 | (4.45E+00 %RSD) | 1.99E+00 | (3.41E+00 %RSD) |
| 137 | 2.80E+00 | (2.76E+00 %RSD) | | | 1.24E+02 | (1.04E+00 %RSD) | 1.42E+02 | (1.30E+00 %RSD) | 1.32E+02 | (4.04E+00 %RSD) | 1.27E+02 | (2.95E+00 %RSD) | 1.62E+03 | (4.13E-01 %RSD) | 1.52E+03 | (2.83E+00 %RSD) | 1.01E+03 | (1.90E+00 %RSD) | 2.80E+00 | (1.34E+00 %RSD) |
| 138 | 1.60E+01 | (1.72E+00 %RSD) | | | 7.46E+02 | (3.25E-01 %RSD) | 9.95E+02 | (4.31E+00 %RSD) | 8.80E+02 | (3.25E+00 %RSD) | 7.44E+02 | (6.21E+00 %RSD) | 6.21E+03 | (4.62E-01 %RSD) | 9.09E+03 | (7.50E-01 %RSD) | 6.64E+03 | (4.52E+00 %RSD) | 1.65E+01 | (2.54E+00 %RSD) |
| 139 | 2.50E+01 | (8.03E-01 %RSD) | | | | | | | | | | | 8.05E+01 | (1.65E+01 %RSD) | 8.38E+01 | (4.64E-01 %RSD) | 1.50E+02 | (1.00E+01 %RSD) | 2.52E+01 | (7.49E-01 %RSD) |
| 140 | 2.14E+01 | (3.11E-01 %RSD) | 1.10E+03 | (6.92E+00 %RSD) | | | | | | | | | 9.88E+01 | (9.40E+00 %RSD) | 1.47E+02 | (7.71E-01 %RSD) | 3.09E+03 | (2.73E+00 %RSD) | 2.29E+01 | (1.28E+00 %RSD) |
| 141 | 2.49E+01 | (9.81E-01 %RSD) | | | | | | | | | | | | | | | 1.53E+01 | (5.90E-01 %RSD) | 2.30E+01 | (1.61E+00 %RSD) |
| 142 | 9.46E+00 | (7.27E-01 %RSD) | 1.27E+02 | (1.11E+01 %RSD) | | | | | | | | | 2.27E+01 | (4.99E+00 %RSD) | 3.04E+01 | (4.31E+01 %RSD) | 4.50E+02 | (2.93E+00 %RSD) | 9.24E+00 | (4.88E-01 %RSD) |
| 143 | 3.01E+00 | (1.57E+00 %RSD) | | | | | | | | | | | | | | | 2.58E+01 | (2.49E+01 %RSD) | 3.10E+00 | (3.98E+00 %RSD) |
| 144 | 4.70E+00 | (1.76E+00 %RSD) | | | | | | | | | | | | | | | 5.74E+01 | (1.21E+01 %RSD) | 4.90E+00 | (2.21E+00 %RSD) |
| 145 | 3.07E+00 | (1.53E+00 %RSD) | | | | | | | | | | | | | | | 1.77E+01 | (1.34E+01 %RSD) | 2.06E+00 | (3.55E+00 %RSD) |
| 146 | 4.33E+00 | (2.78E+00 %RSD) | | | | | | | | | | | | | | | 5.11E+01 | (2.41E+01 %RSD) | 4.36E+00 | (3.33E-01 %RSD) |
| 147 | 3.27E+00 | (1.37E-01 %RSD) | | | | | | | | | | | | | | | | | 3.80E+00 | (9.96E-01 %RSD) |
| 148 | 4.25E+00 | (2.50E-02 %RSD) | | | | | | | | | | | | | | | | | 4.23E+00 | (3.40E+00 %RSD) |
| 149 | 3.48E+00 | (1.82E+00 %RSD) | | | | | | | | | | | | | | | | | 3.55E+00 | (2.74E+00 %RSD) |
| 150 | 3.20E+00 | (7.48E-01 %RSD) | | | | | | | | | | | | | | | | | 3.30E+00 | (2.50E+00 %RSD) |
| 151 | 1.17E+01 | (6.10E-02 %RSD) | | | | | | | | | | | | | | | | | 1.20E+01 | (2.21E+00 %RSD) |
| 152 | 6.65E+00 | (1.22E+00 %RSD) | | | | | | | | | | | | | | | | | 6.97E+00 | (1.14E+00 %RSD) |
| 153 | 1.31E+01 | (4.23E+00 %RSD) | | | | | | | | | | | | | | | | | 1.31E+01 | (3.41E+00 %RSD) |
| 154 | 6.17E+00 | (9.05E-01 %RSD) | | | | | | | | | | | | | | | | | 6.27E+00 | (3.83E+00 %RSD) |
| 155 | 3.70E+00 | (2.87E+00 %RSD) | | | | | | | | | | | | | | | | | 3.78E+00 | (3.70E+00 %RSD) |
| 156 | 5.13E+00 | (2.54E+00 %RSD) | | | | | | | | | | | | | | | | | 5.27E+00 | (5.24E+00 %RSD) |
| 157 | 3.95E+00 | (1.62E-01 %RSD) | | | | | | | | | | | | | | | | | 4.00E+00 | (1.94E+00 %RSD) |
| 158 | 6.20E+00 | (7.44E-01 %RSD) | | | | | | | | | | | | | | | | | 6.32E+00 | (1.93E+00 %RSD) |
| 159 | 2.48E+01 | (4.37E+00 %RSD) | | | | | | | | | | | | | | | | | 2.53E+01 | (3.50E+00 %RSD) |
| 160 | 6.01E+00 | (1.88E+00 %RSD) | | | | | | | | | | | | | | | | | 6.11E+00 | (7.77E-01 %RSD) |
| 161 | 4.94E+00 | (6.54E-01 %RSD) | | | | | | | | | | | | | | | | | 4.79E+00 | (4.54E+00 %RSD) |
| 162 | 6.32E+00 | (6.55E-01 %RSD) | | | | | | | | | | | | | | | | | 6.37E+00 | (1.04E+00 %RSD) |
| 163 | 6.14E+00 | (3.48E-01 %RSD) | | | | | | | | | | | | | | | | | 6.24E+00 | (3.68E-01 %RSD) |
| 164 | 7.43E+00 | (1.27E+00 %RSD) | | | | | | | | | | | | | | | | | 7.41E+00 | (3.06E+00 %RSD) |
| 165 | 2.49E+01 | (6.30E-01 %RSD) | | | | | | | | | | | | | | | | | 2.48E+01 | (1.79E+00 %RSD) |
| 166 | 8.45E+00 | (8.33E-01 %RSD) | | | | | | | | | | | | | | | | | 8.63E+00 | (4.01E-01 %RSD) |
| 167 | 5.76E+00 | (6.88E-01 %RSD) | | | | | | | | | | | | | | | | | 5.69E+00 | (2.24E-01 %RSD) |
| 168 | 6.55E+00 | (2.10E+00 %RSD) | | | | | | | | | | | | | | | | | 6.73E+00 | (8.87E-01 %RSD) |
| 169 | 2.51E+01 | (8.61E-01 %RSD) | | | | | | | | | | | | | | | | | 2.55E+01 | (1.93E+00 %RSD) |
| 170 | 4.57E+00 | (6.97E-01 %RSD) | | | | | | | | | | | | | | | | | 1.64E+00 | (2.48E+02 %RSD) |
| 171 | 3.59E+00 | (3.47E+00 %RSD) | | | | | | | | | | | | | | | | | 3.63E+00 | (2.09E+00 %RSD) |
| 172 | 5.46E+00 | (1.47E+00 %RSD) | | | | | | | | | | | | | | | | | 5.42E+00 | (4.92E+02 %RSD) |
| 173 | 3.81E+00 | (2.87E-01 %RSD) | | | | | | | | | | | | | | | | | 4.22E+00 | (4.16E+00 %RSD) |
| 174 | 7.85E+00 | (2.32E-01 %RSD) | | | | | | | | | | | | | | | | | 8.03E+00 | (2.18E-01 %RSD) |

**ICP-MS Results**

File Name: Young 200356-363

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 175 | 2.36E+01 | (8.87E-01 %RSD) | | | | | | | | | | | | | | | | | 2.41E+01 | (1.35E+00 %RSD) |
| 176 | 5.09E+00 | (1.99E+00 %RSD) | | | | | | | | | | | | | | | | | 5.09E+00 | (1.49E+00 %RSD) |
| 177 | 4.80E+00 | (4.41E+00 %RSD) | | | | | | | | | | | | | | | | | 4.94E+00 | (3.33E-01 %RSD) |
| 178 | 6.81E+00 | (2.32E+00 %RSD) | | | | | | | | | | | | | | | | | 6.91E+00 | (1.07E+00 %RSD) |
| 179 | 3.39E+00 | (3.14E-01 %RSD) | | | | | | | | | | | | | | | | | 3.31E+00 | (2.79E+00 %RSD) |
| 180 | 8.74E+00 | (8.20E-01 %RSD) | | | | | | | | | | | | | | | | | 8.40E+00 | (1.95E+00 %RSD) |
| 181 | 2.22E+01 | (1.06E+00 %RSD) | | | | | | | | | | | | | | | | | 2.59E+01 | (1.22E+00 %RSD) |
| 182 | 2.15E+00 | (4.03E+00 %RSD) | | | | | | | | | | | | | | | | | 5.88E+00 | (1.25E+00 %RSD) |
| 183 | 3.53E+00 | (1.29E+00 %RSD) | | | | | | | | | | | | | | | | | 3.34E+00 | (4.36E+00 %RSD) |
| 184 | 7.42E+00 | (3.09E+00 %RSD) | | | | | | | | | | | | | | | | | 7.11E+00 | (2.70E+00 %RSD) |
| 185 | 8.12E+00 | (2.41E+00 %RSD) | | | | | | | | | | | | | | | | | 8.25E+00 | (3.02E+00 %RSD) |
| 186 | 7.01E+00 | (5.20E+00 %RSD) | | | | | | | | | | | | | | | | | 7.58E+00 | (2.76E+00 %RSD) |
| 187 | 1.52E+01 | (1.42E+00 %RSD) | | | | | | | | | | | | | | | | | 1.59E+01 | (2.75E-01 %RSD) |
| 192 | 9.37E+00 | (1.90E-01 %RSD) | | | | | | | | | | | | | | | | | 8.30E+00 | (1.11E+00 %RSD) |
| 193 | 1.57E+01 | (1.39E+00 %RSD) | | | | | | | | | | | | | | | | | 1.57E+01 | (4.69E+00 %RSD) |
| 194 | 8.22E+00 | (3.44E-01 %RSD) | | | | | | | | | | | | | | | | | 8.12E+00 | (2.18E+00 %RSD) |
| 195 | 8.43E+00 | (1.27E+00 %RSD) | | | | | | | | | | | | | | | | | 8.47E+00 | (2.24E+00 %RSD) |
| 196 | 4.25E+00 | (1.03E+00 %RSD) | | | | | | | | | | | | | | | | | 4.49E+00 | (1.53E+00 %RSD) |
| 197 | -2.00E+01 | (9.97E-01 %RSD) | | | | | 1.02E+05 | (1.64E+00 %RSD) | 9.62E+04 | (1.42E+00 %RSD) | 9.72E+04 | (2.05E+00 %RSD) | 9.77E+04 | (1.02E+00 %RSD) | 9.73E+04 | (1.31E+00 %RSD) | 4.11E+04 | (2.32E+00 %RSD) | 2.24E+01 | (2.52E+00 %RSD) |
| 198 | 1.79E+00 | (2.23E+00 %RSD) | | | | | | | | | | | | | | | | | 1.80E+00 | (1.43E+00 %RSD) |
| 203 | 7.21E+00 | (1.87E+00 %RSD) | | | | | | | | | | | | | | | | | 7.19E+00 | (2.26E+00 %RSD) |
| 204 | 3.44E-01 | (9.26E-01 %RSD) | | | 1.02E+03 | (9.76E+00 %RSD) | 2.81E+02 | (1.78E+01 %RSD) | | | | | 1.99E+03 | (7.35E+00 %RSD) | 3.48E+03 | (7.91E+00 %RSD) | 2.39E+03 | (7.33E+00 %RSD) | 3.81E-01 | (2.40E+00 %RSD) |
| 205 | 1.77E+01 | (9.72E-01 %RSD) | | | | | | | | | | | | | | | | | 1.82E+01 | (1.82E+00 %RSD) |
| 206 | 5.81E+00 | (1.11E+00 %RSD) | | | 1.67E+04 | (8.33E-01 %RSD) | 4.98E+03 | (1.77E+00 %RSD) | 1.54E+02 | (1.14E+01 %RSD) | 1.73E+02 | (3.99E+00 %RSD) | 5.49E+04 | (4.22E+00 %RSD) | 6.21E+04 | (2.17E-01 %RSD) | 4.22E+04 | (5.20E+00 %RSD) | 5.93E+00 | (4.11E+00 %RSD) |
| 207 | 5.34E+00 | (1.56E+00 %RSD) | | | 1.40E+04 | (2.41E+00 %RSD) | 4.53E+03 | (1.87E+00 %RSD) | 1.33E+02 | (1.88E+01 %RSD) | 1.66E+02 | (1.02E+01 %RSD) | 3.24E+04 | (8.10E-01 %RSD) | 5.28E+04 | (3.08E-01 %RSD) | 3.57E+04 | (4.43E+00 %RSD) | 5.42E+00 | (4.16E+00 %RSD) |
| 208 | 1.25E+01 | (1.17E+00 %RSD) | | | 3.53E+04 | (2.52E+00 %RSD) | 1.06E+04 | (1.75E+00 %RSD) | 3.08E+02 | (1.69E+01 %RSD) | 3.76E+02 | (7.75E+00 %RSD) | 7.75E+04 | (2.97E+00 %RSD) | 1.26E+05 | (2.12E-01 %RSD) | 8.75E+04 | (1.46E+00 %RSD) | 1.21E+01 | (2.84E-01 %RSD) |
| 229 | | | | | | | | | | | | | | | | | | | | |
| 230 | | | | | | | | | | | | | | | | | | | | |
| 232 | 2.53E+01 | (2.32E+00 %RSD) | | | | | | | | | | | | | | | | | 2.51E+01 | (2.43E+00 %RSD) |
| 233 | | | | | | | | | | | | | | | | | | | | |
| 234 | | | | | | | | | | | | | | | | | | | | |
| 235 | 1.87E-01 | (9.69E+00 %RSD) | | | | | | | | | | | | | | | | | 2.01E-01 | (9.49E+00 %RSD) |
| 236 | | | | | | | | | | | | | | | | | | | | |
| 237 | | | | | | | | | | | | | | | | | | | | |
| 238 | 3.40E+01 | (3.92E-01 %RSD) | | | 2.47E+02 | (2.06E-01 %RSD) | | | | | | | | | | | | | 3.49E+01 | (2.02E-01 %RSD) |
| 239 | | | | | 6.50E+01 | (2.20E-01 %RSD) | 2.50E+01 | (2.00E+01 %RSD) | | | | | | | | | | | | |
| 240 | | | | | | | | | | | | | | | | | | | | |
| 241 | | | | | 4.15E+01 | (2.40E+00 %RSD) | | | | | | | | | | | | | | |
| 242 | | | | | | | | | | | | | | | | | | | | |
| 243 | | | | | | | | | | | | | | | | | | | | |
| 244 | | | | | | | | | | | | | | | | | | | | |

Filter samples were analyzed by X-ray Fluorescence to determine their elemental composition. Analysis conditions were:

X-ray source

1. Ag transmission target, no filter
2. 40kV electron beam voltage
3. 15 microamp electron beam current
4. 45 degree excitation angle of incidence
5. 4mm diameter beam spot size

X-ray detector

1. Gain = 50
2. Beam shaping 9.4 microseconds
3. 30% dead-time (approximate)
4. 1800 seconds acquisition time
5. 45 degree observation angle of incidence

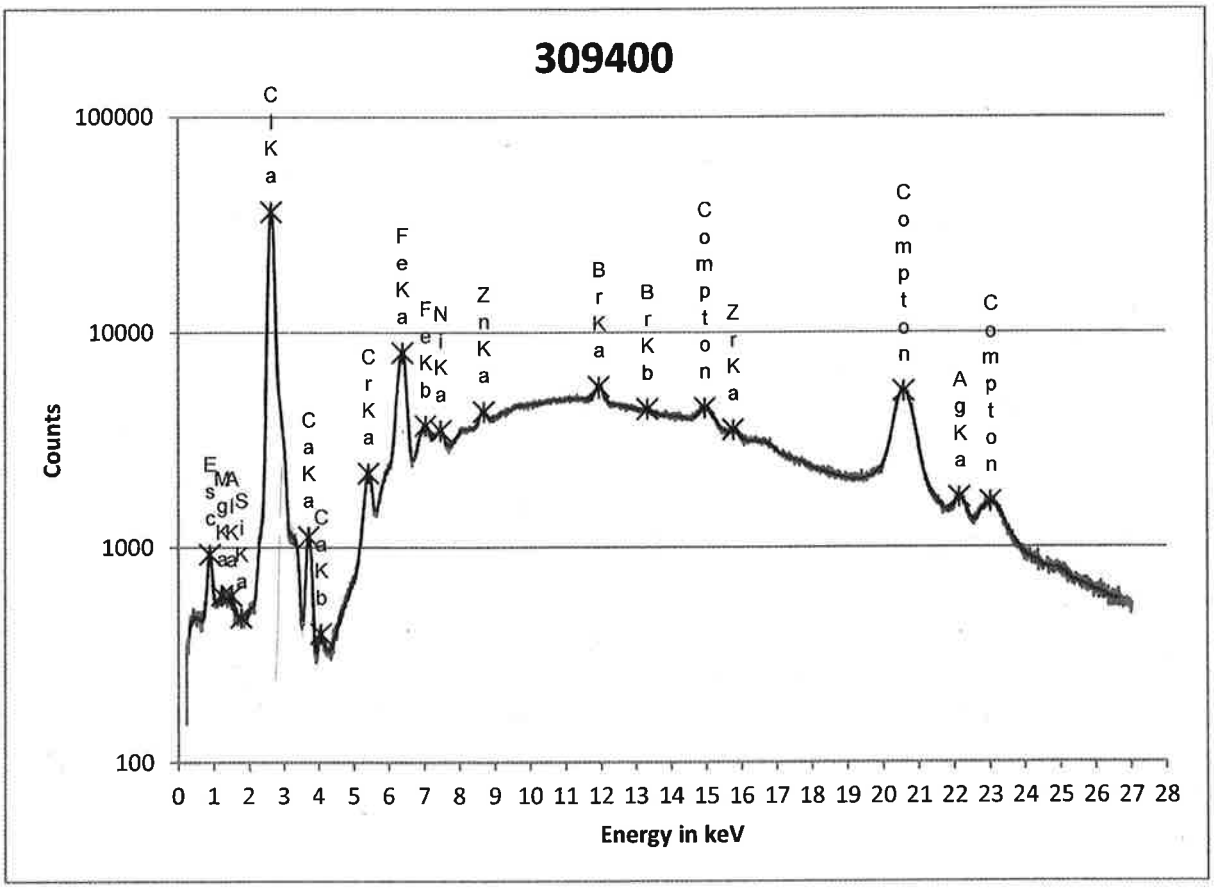
Sample preparation

1. Sample analyzed in "as is" condition.
2. Filter paper placed on polycarbonate slide.
3. Analysis conducted in air.

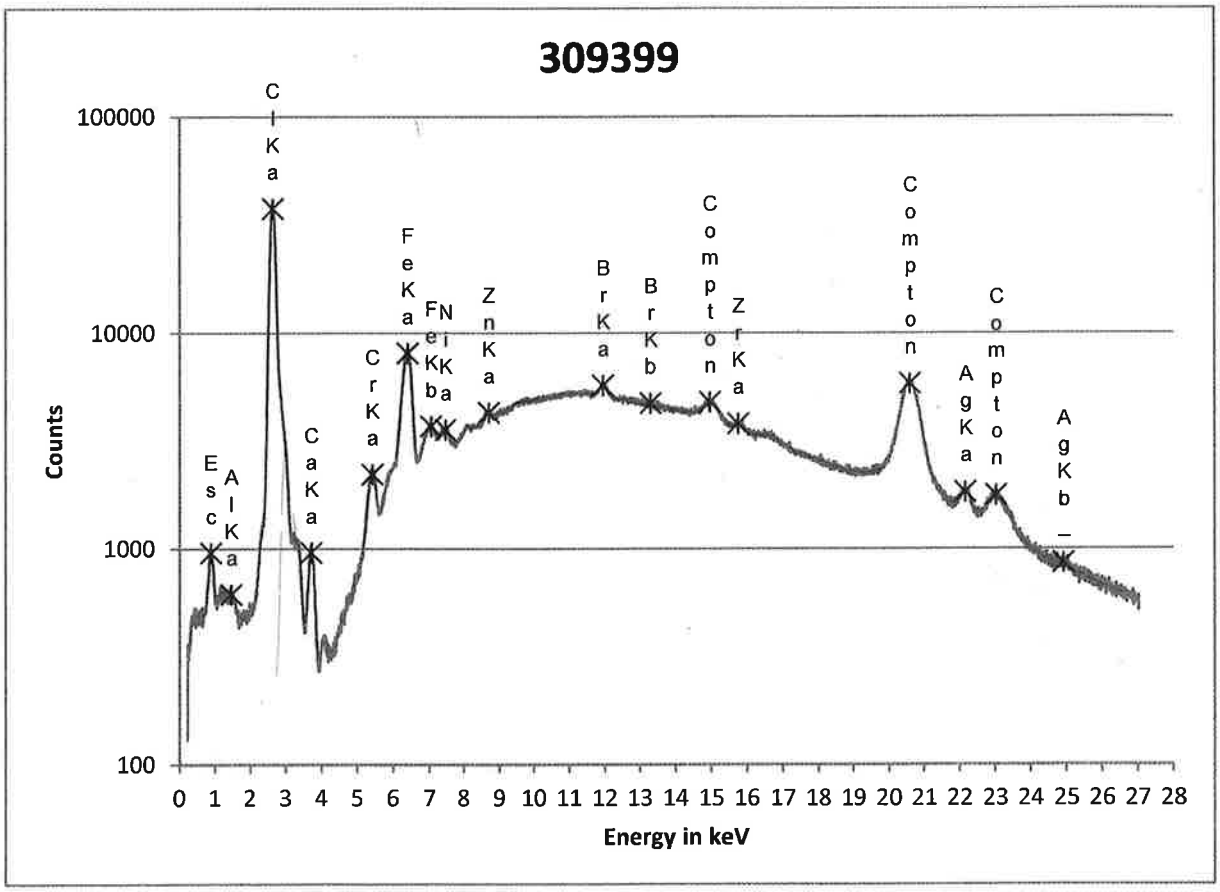
In the following graphs:

1. Peaks are labeled with their elemental abbreviations and x-ray line.
2. The x-axis is x-ray energy in keV
3. The y-axis is counts (x-rays detected)
4. The grey trace is raw data
5. The red trace is smoothed data using an adaptive Gaussian filter
6. The blue trace is smoothed blank data scaled to compensate for dead-time difference.

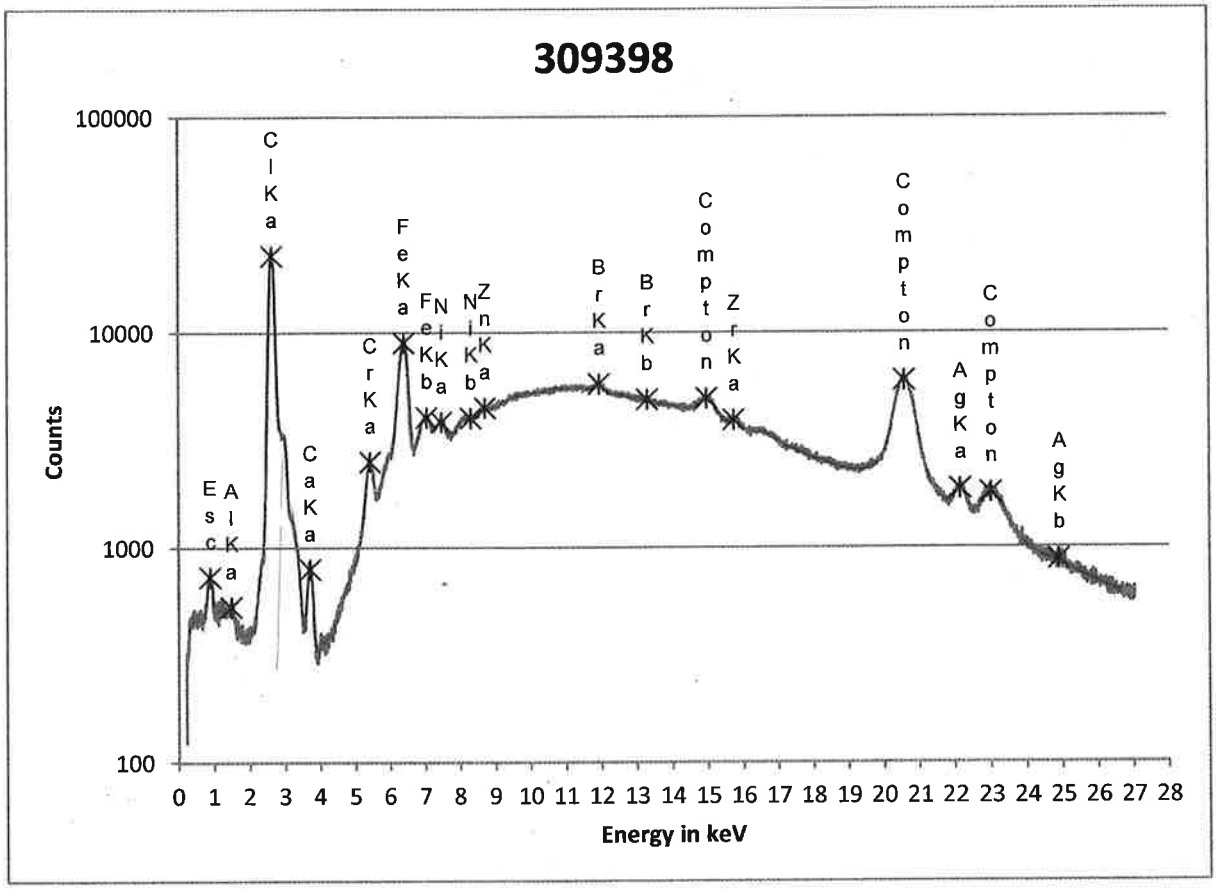
Sample# 309400:
Elements detected above the blank: Cl, Ca, Zn, Br
Elements observed in the blank Ar, Cr, Fe, Ni, Zr, and Ag
Compton scattering is observed from Ag and Zr.
X-ray lines from elements whose atomic number is less than 12 (Mg) are not observable due to strong absorption in air.



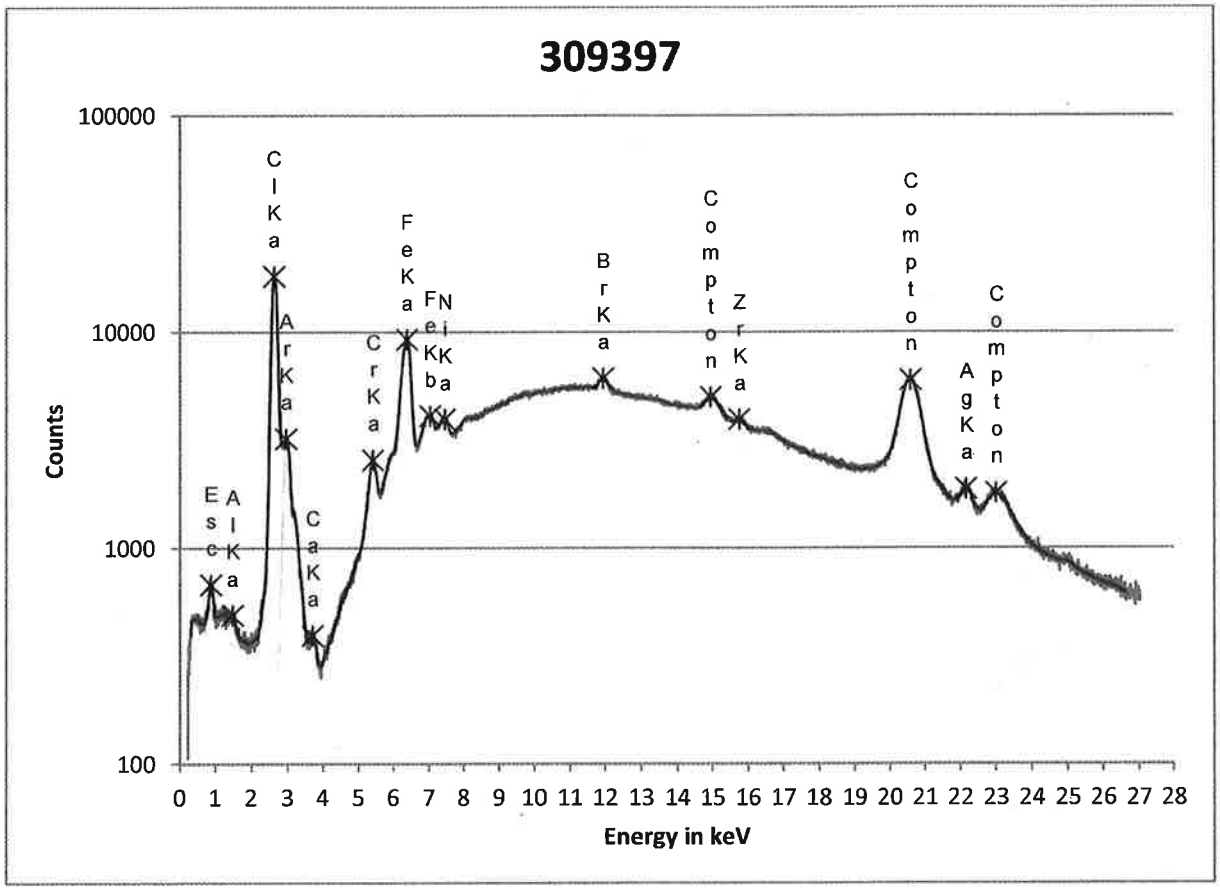
Sample# 309399:
Elements detected above the blank: Cl, Ca, Zn, Br
Elements observed in the blank Ar, Cr, Fe, Ni, Zr, and Ag
Compton scattering is observed from Ag and Zr.
X-ray lines from elements whose atomic number is less than 12 (Mg) are not observable due to strong absorption in air.



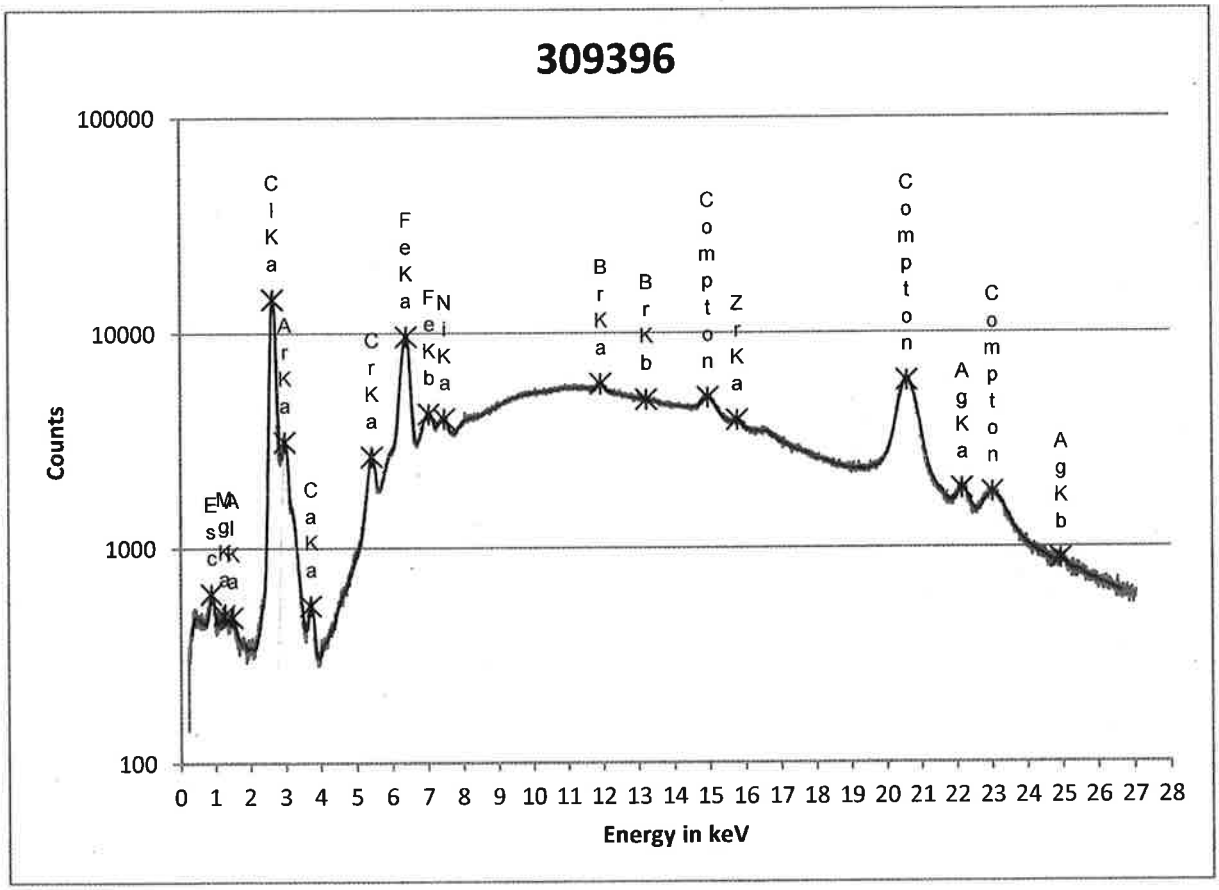
Sample# 309398:
Elements detected above the blank: Cl, Ca, Zn, Br
Elements observed in the blank Ar, Cr, Fe, Ni, Zr, and Ag
Compton scattering is observed from Ag and Zr.
X-ray lines from elements whose atomic number is less than 12 (Mg) are not observable due to strong absorption in air.



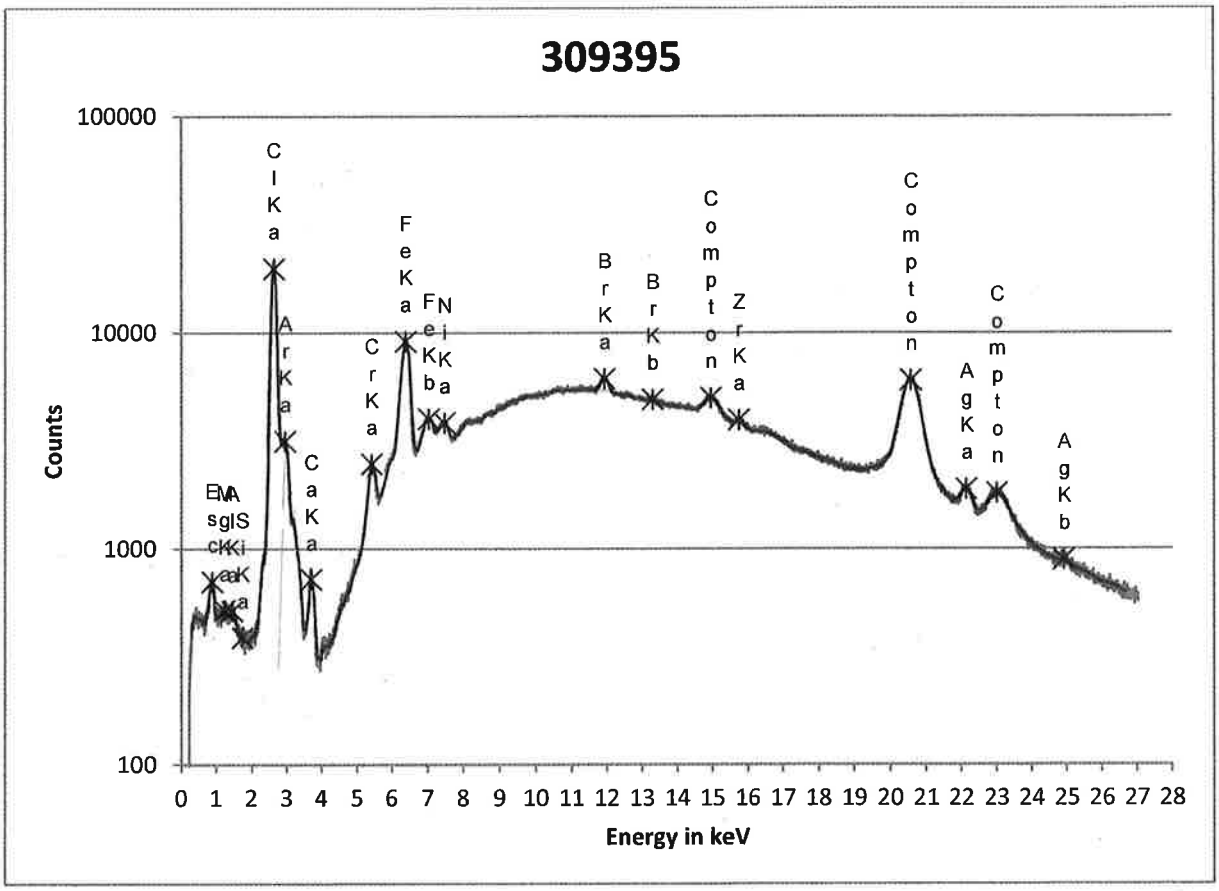
Sample# 309397:
Elements detected above the blank: Cl, Ca, Br
Elements observed in the blank Ar, Cr, Fe, Ni, Zr, and Ag
Compton scattering is observed from Ag and Zr.
X-ray lines from elements whose atomic number is less than 12 (Mg) are not observable due to strong absorption in air.



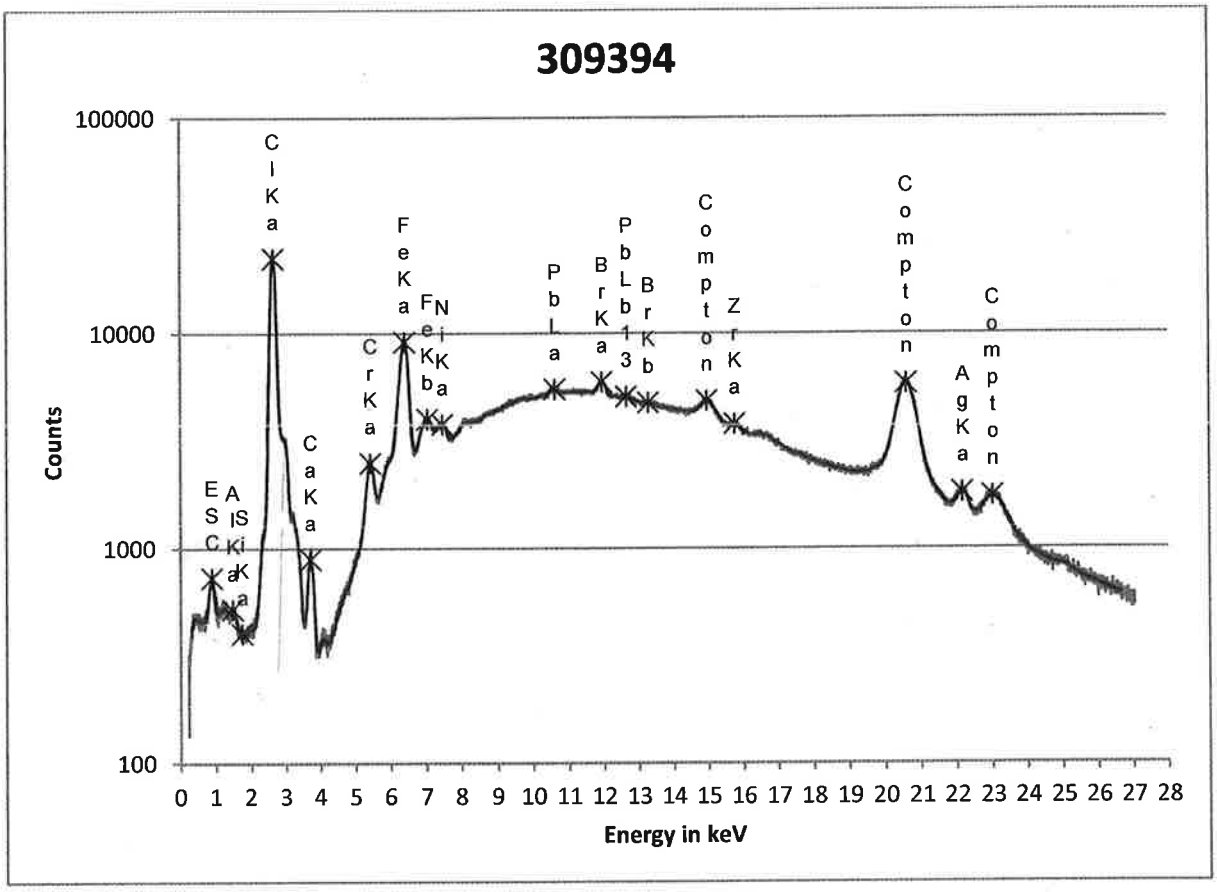
Sample# 309396:
Elements detected above the blank: Cl, Ca, Br
Elements observed in the blank Ar, Cr, Fe, Ni, Zr, and Ag
Compton scattering is observed from Ag and Zr.
X-ray lines from elements whose atomic number is less than 12 (Mg) are not observable due to strong absorption in air.

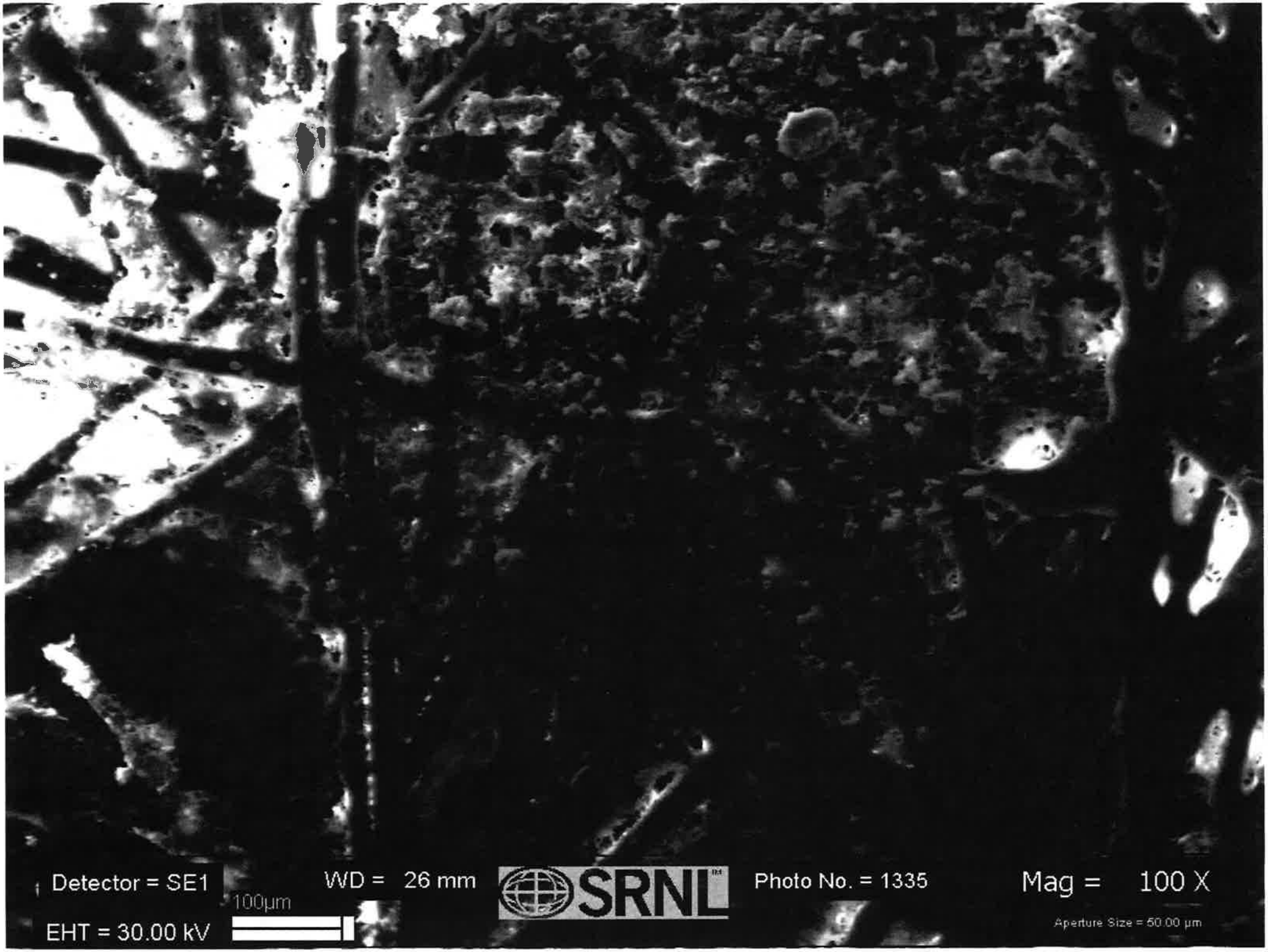


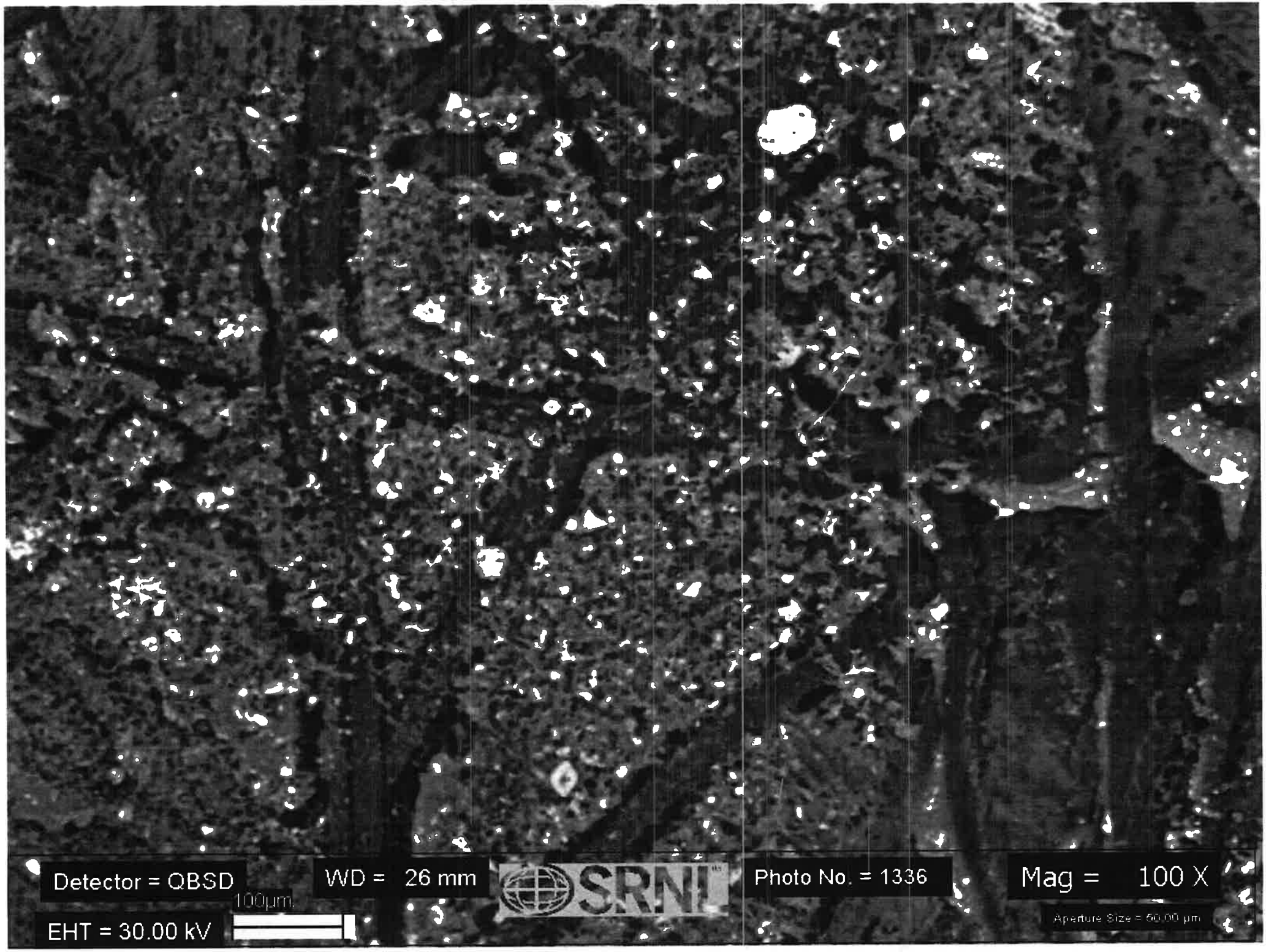
Sample# 309395:
Elements detected above the blank: Cl, Ca, Br
Elements observed in the blank Ar, Cr, Fe, Ni, Zr, and Ag
Compton scattering is observed from Ag and Zr.
X-ray lines from elements whose atomic number is less than 12 (Mg) are not observable due to strong absorption in air.



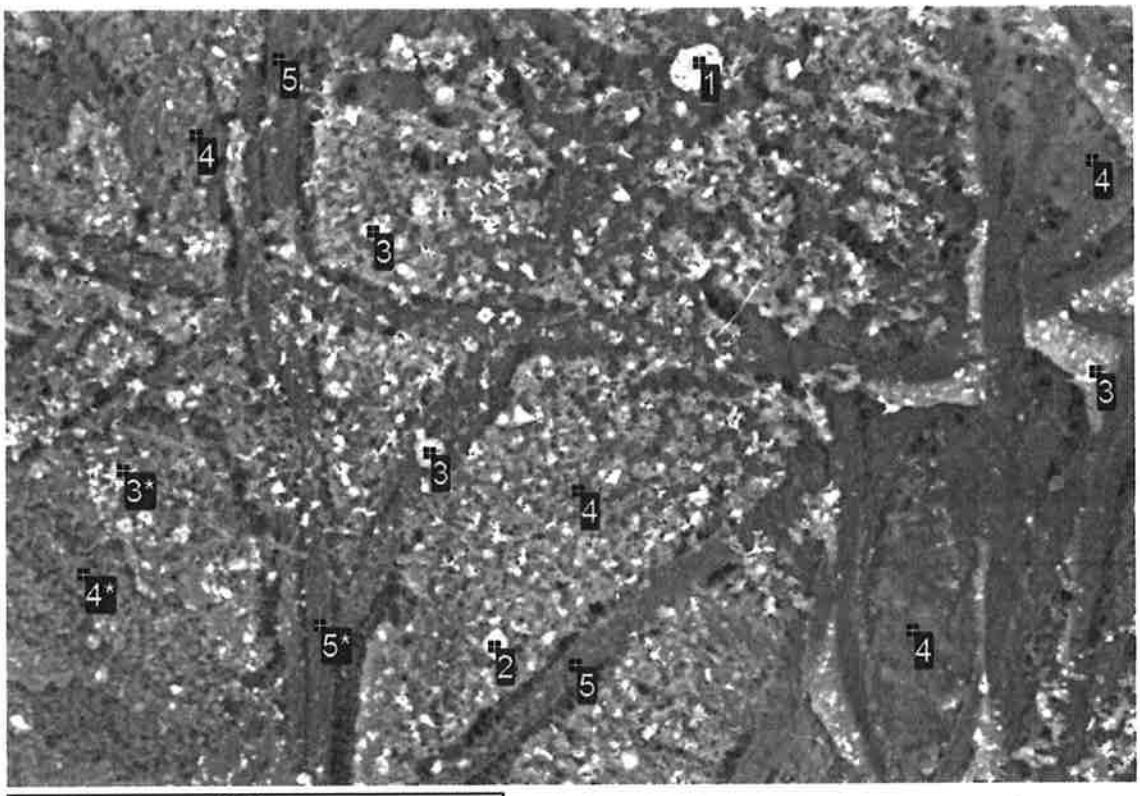
Sample# 309394:
Elements detected above the blank: Cl, Ca, Pb, Br
Elements observed in the blank Ar, Cr, Fe, Ni, Zr, and Ag
Compton scattering is observed from Ag and Zr.
X-ray lines from elements whose atomic number is less than 12 (Mg) are not observable due to strong absorption in air.




Detector = SE1
EHT = 30.00 kV
100µm
WD = 26 mm
SRNL
Photo No. = 1335
Mag = 100 X
Aperture Size = 50.00 µm

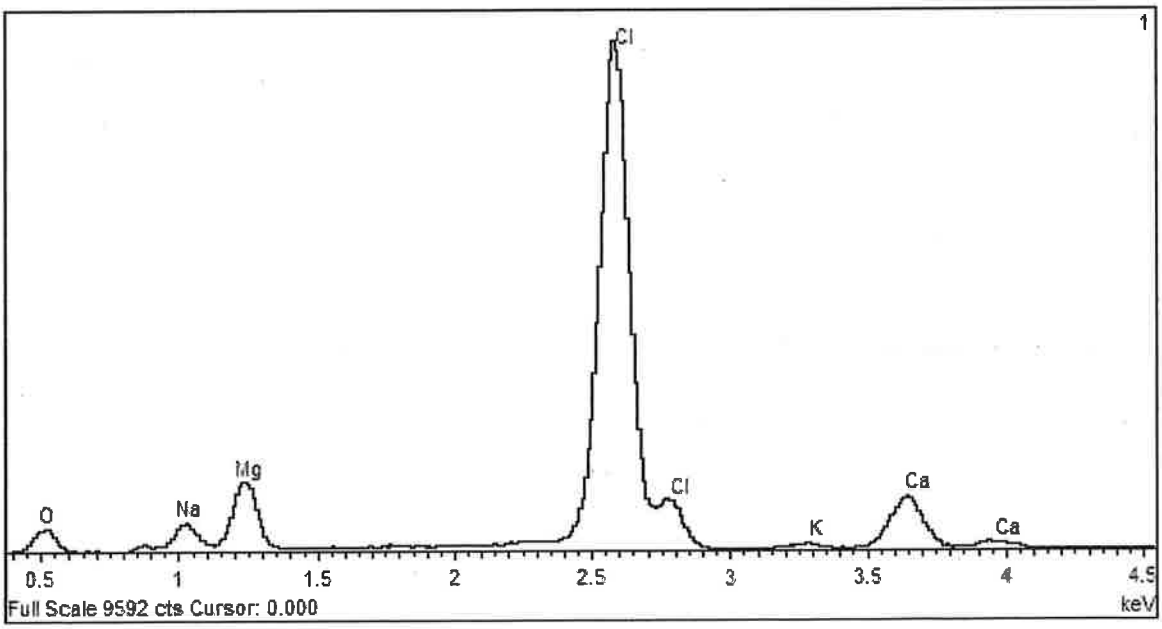

Detector = QBSD
WD = 26 mm
SRNI
Photo No. = 1336
Mag = 100 X
100µm
EHT = 30.00 kV
Aperture Size = 50.00 µm

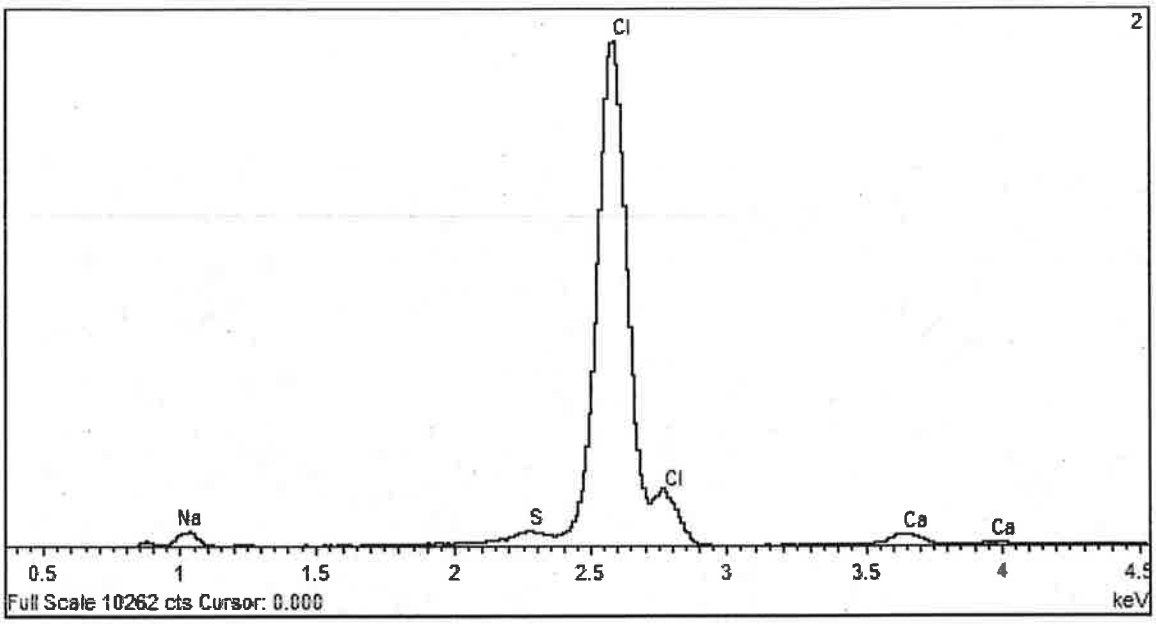
# A23_021514_0840 300309394

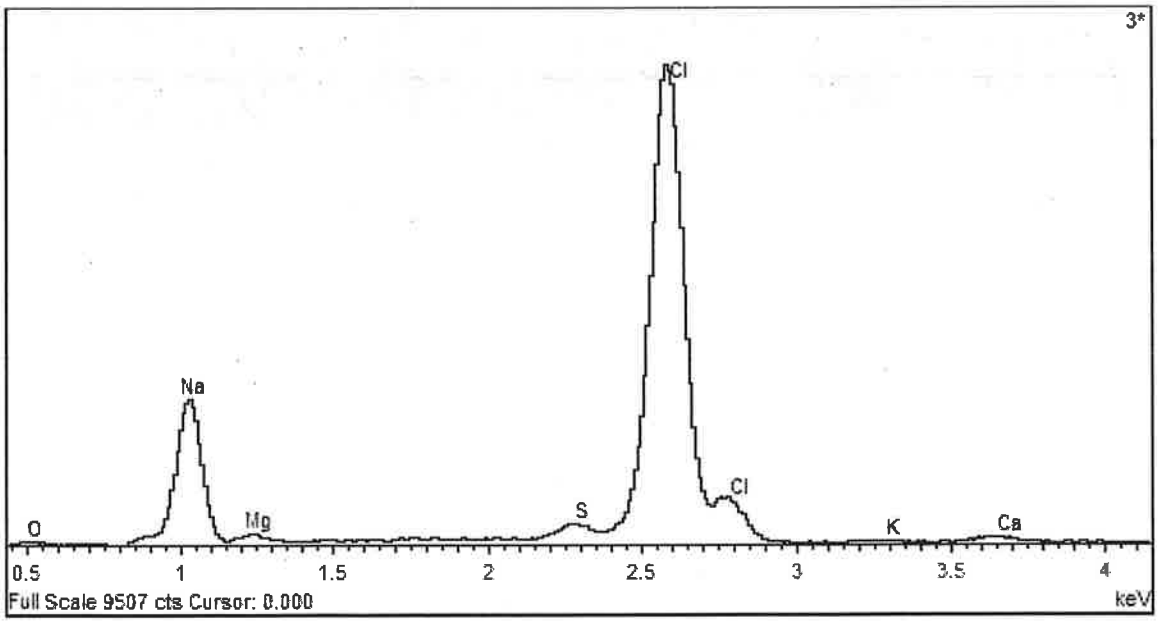


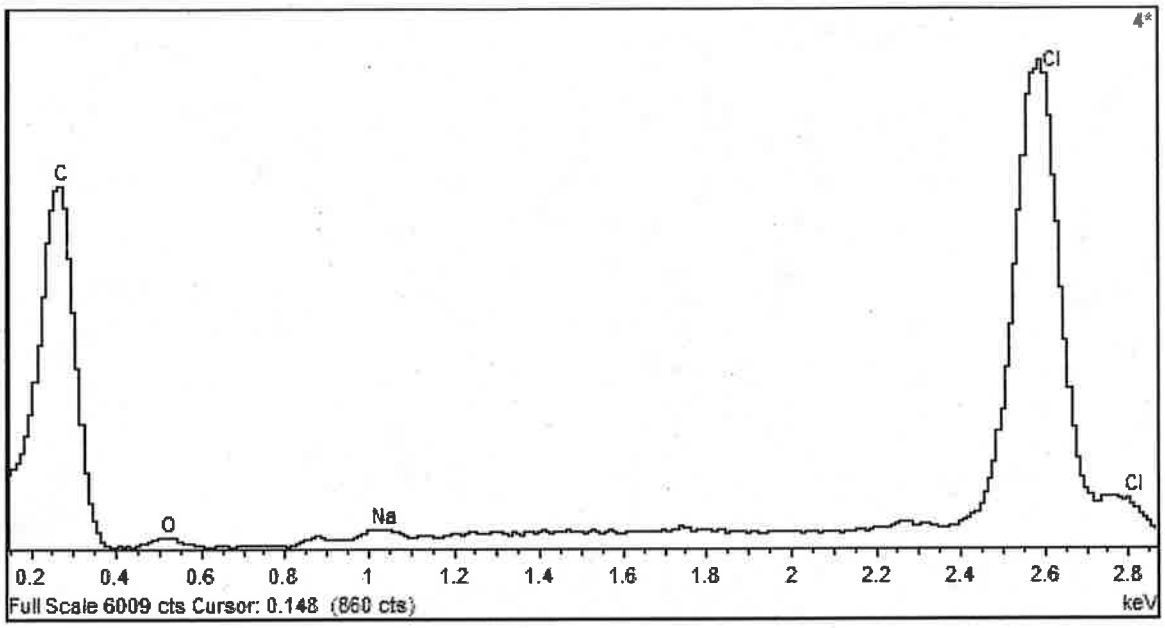

500µm

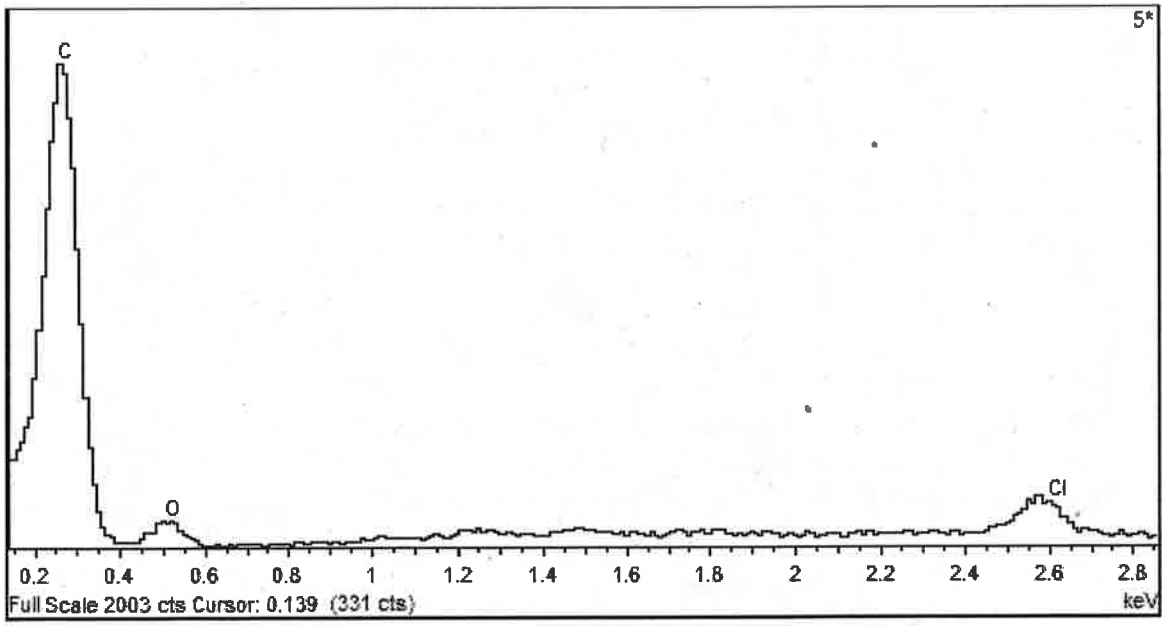
A23_1 PHOTO-1336

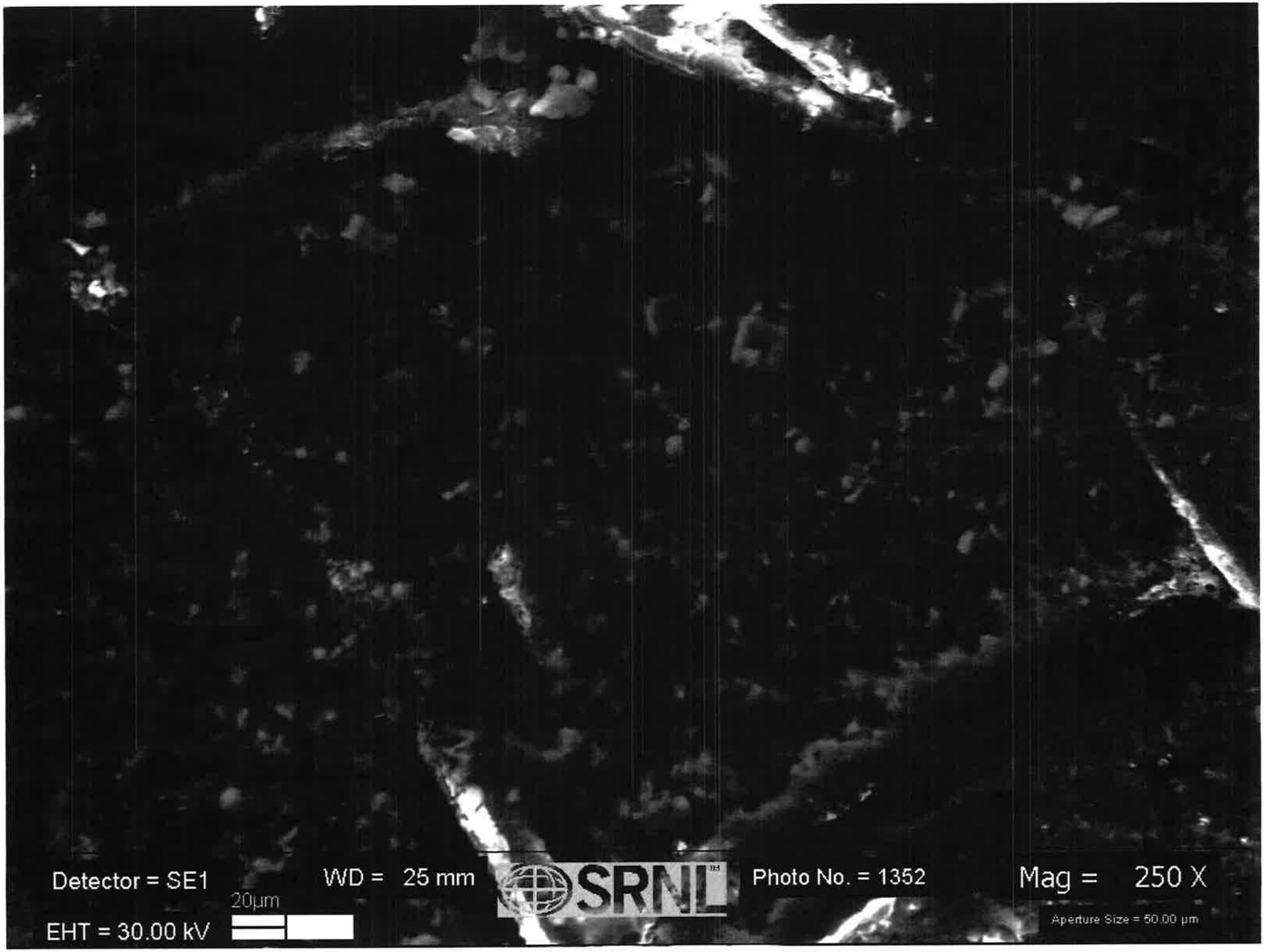


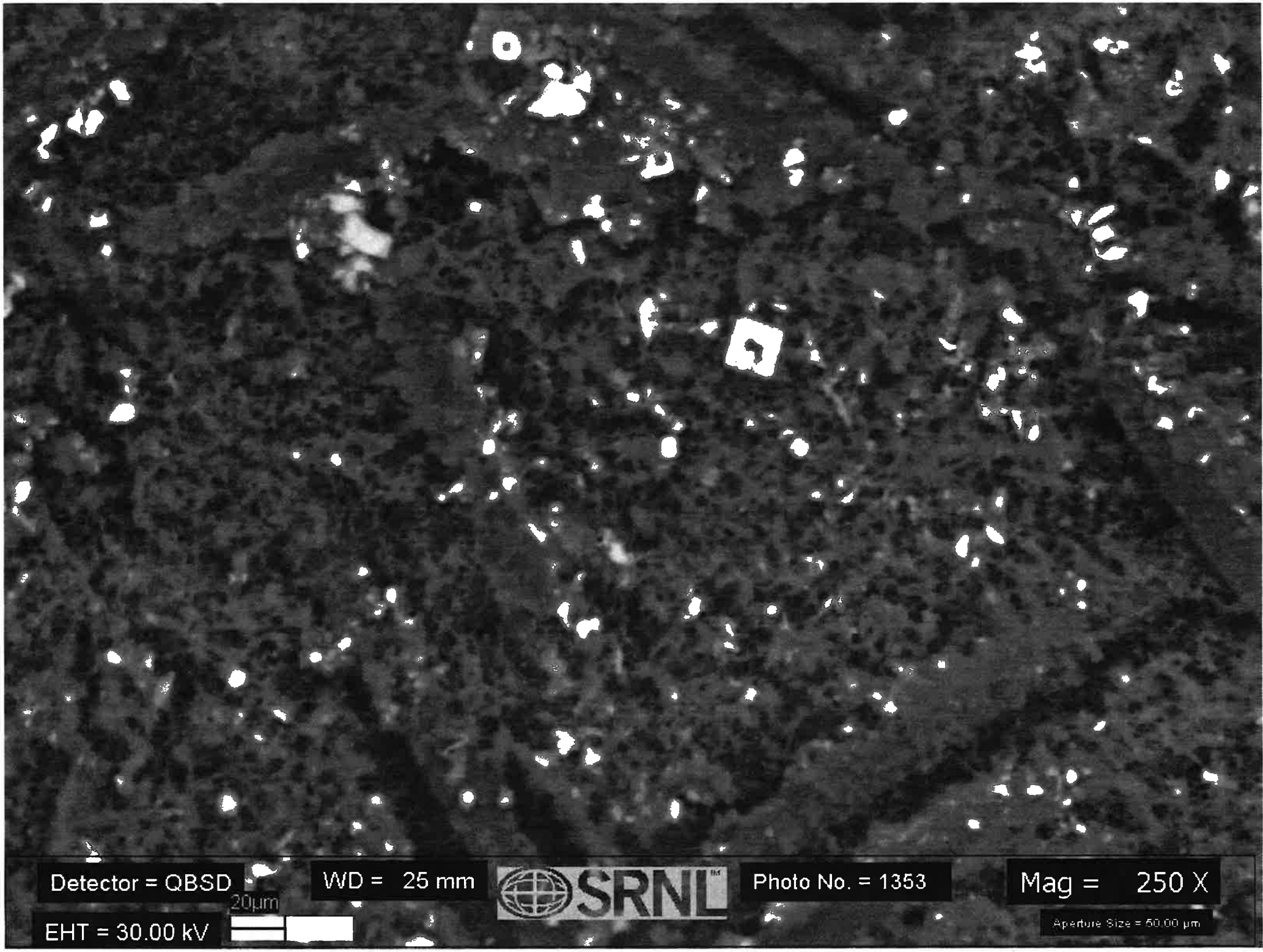

2
Cl
Cl
Na
S
Ca
Ca
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Full Scale 10262 cts Cursor: 0.000
keV


3*
Cl
Na
Cl
O
Mg
S
K
Ca
0.5
1
1.5
2
2.5
3
3.5
4
Full Scale 9507 cts Cursor: 0.000
keV

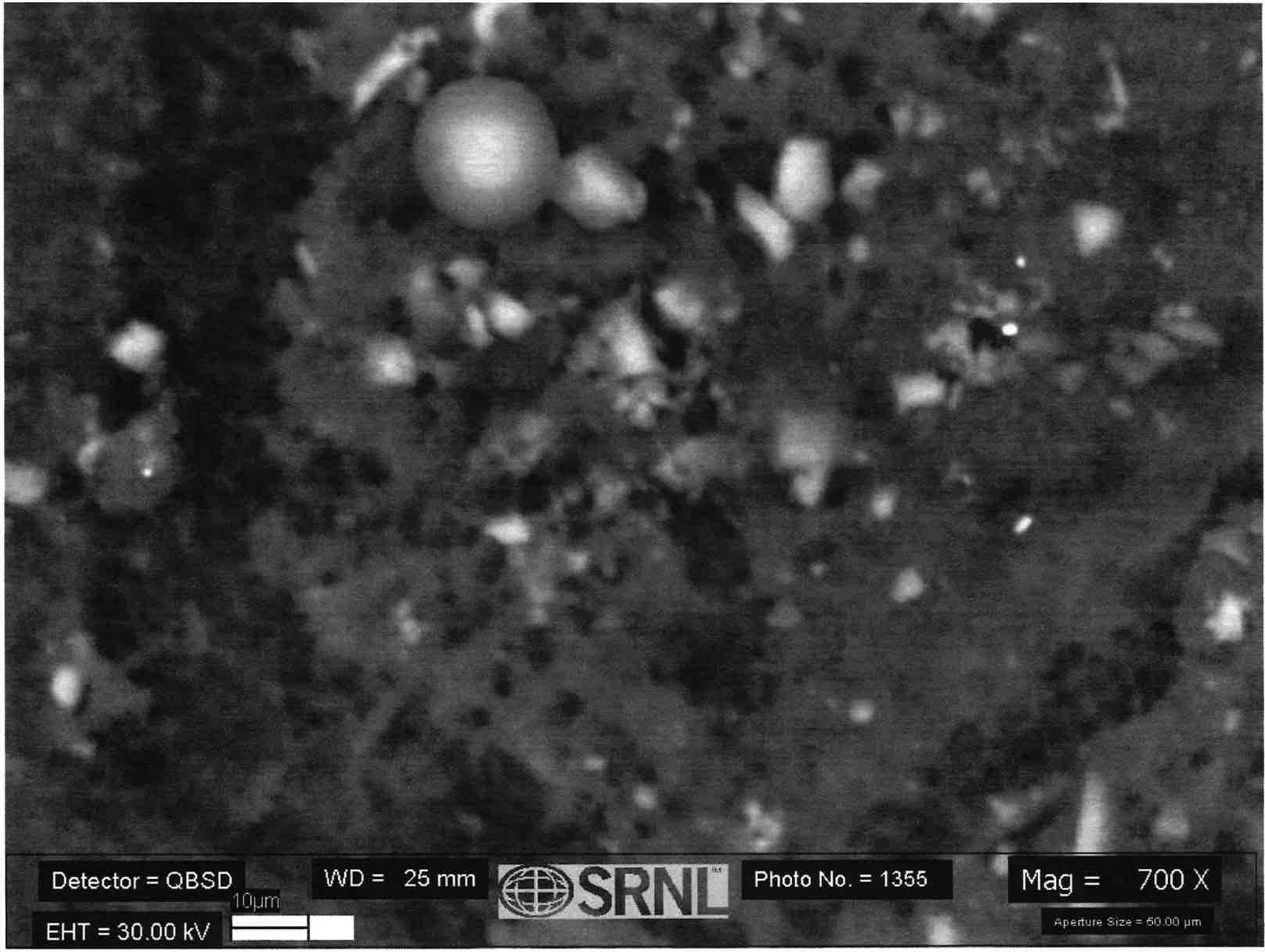

4*
C
O
Na
Cl
Cl
0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 2.6 2.8
Full Scale 6009 cts Cursor: 0.148 (860 cts)
keV


5*
C
O
Cl
0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 2.6 2.8
Full Scale 2003 cts Cursor: 0.139 (331 cts)
keV

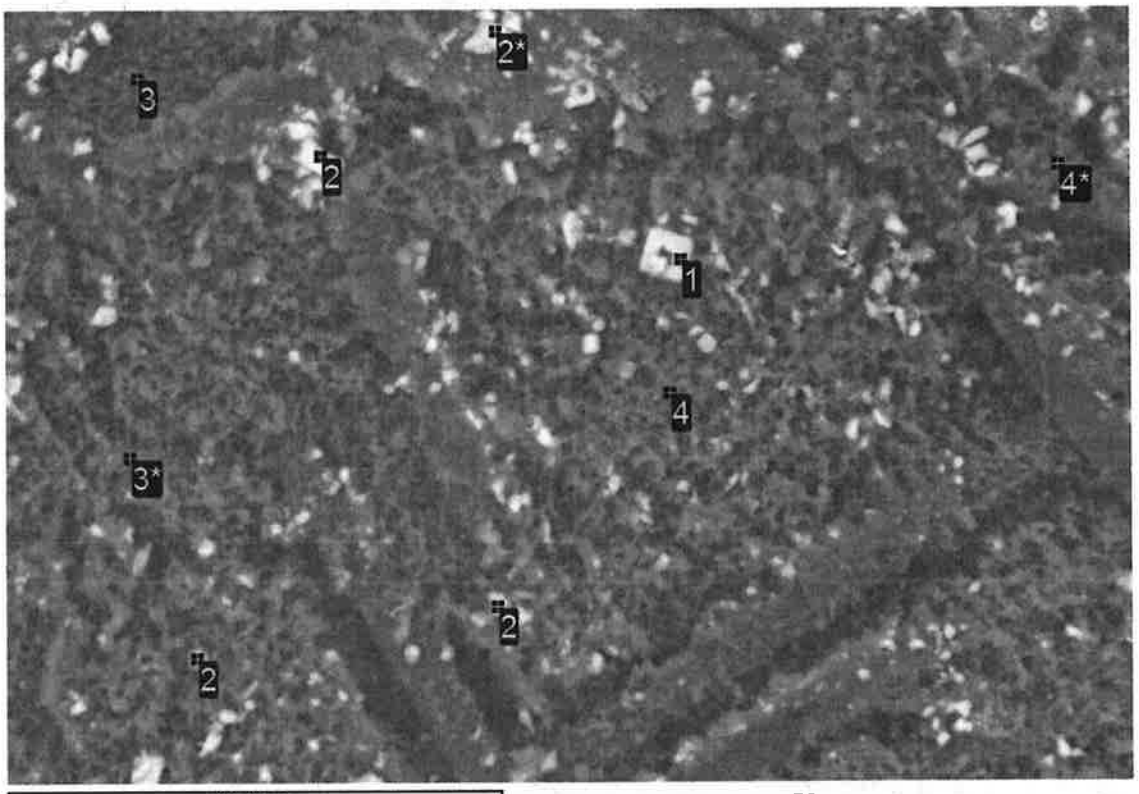

Detector = SE1
WD = 25 mm
SRNL
Photo No. = 1352
Mag = 250 X
20µm
EHT = 30.00 kV
Aperture Size = 50.00 µm


Detector = QBSD
WD = 25 mm
SRNL
Photo No. = 1353
Mag = 250 X
20µm
EHT = 30.00 kV
Aperture Size = 50.00 µm

Detector = SE1
EHT = 30.00 kV
10µm
WD = 25 mm
SRNL
Photo No. = 1354
Mag = 700 X
Aperture Size = 50.00 µm

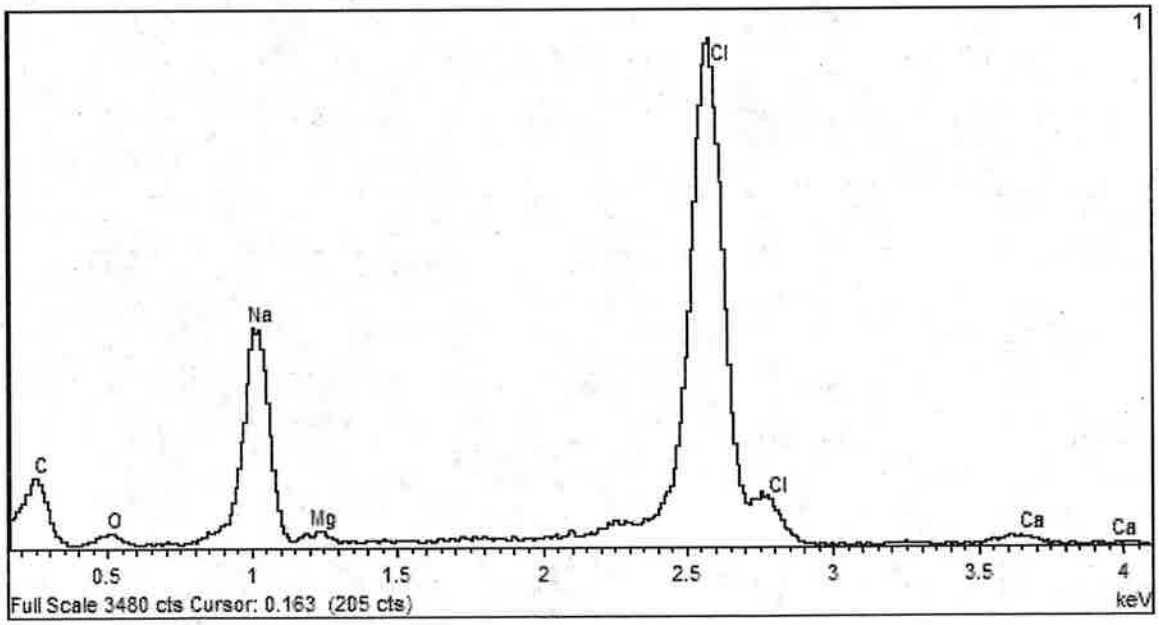

Detector = QBSD
WD = 25 mm
SRNL
Photo No. = 1355
Mag = 700 X
10µm
EHT = 30.00 kV
Aperture Size = 60.00 µm

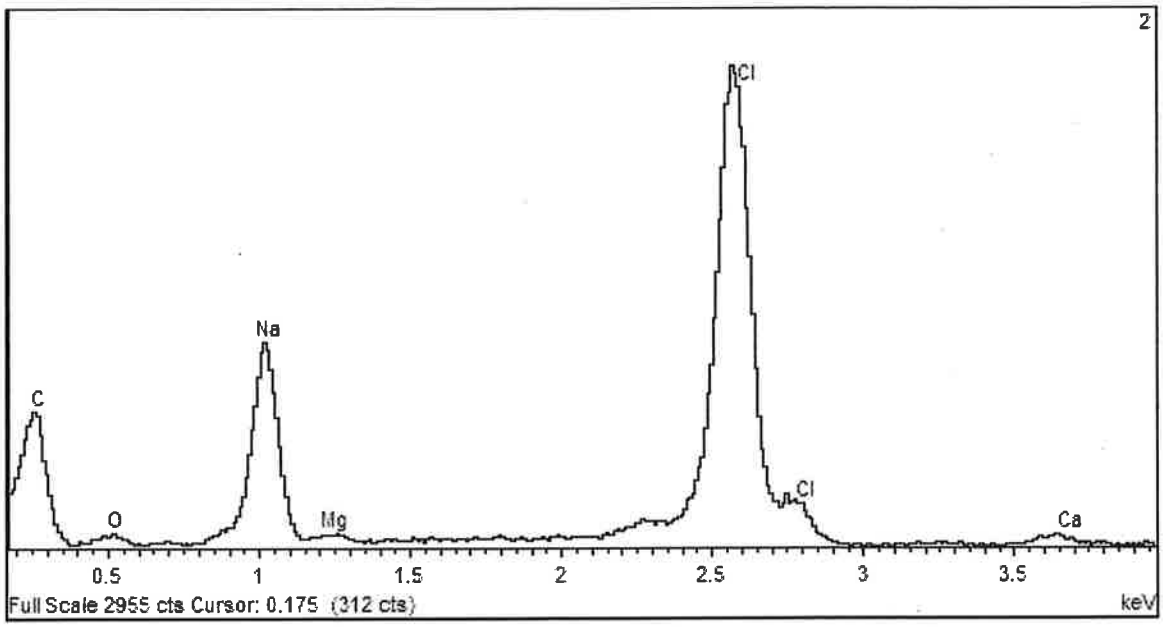
# A23_021514_1510 300309395

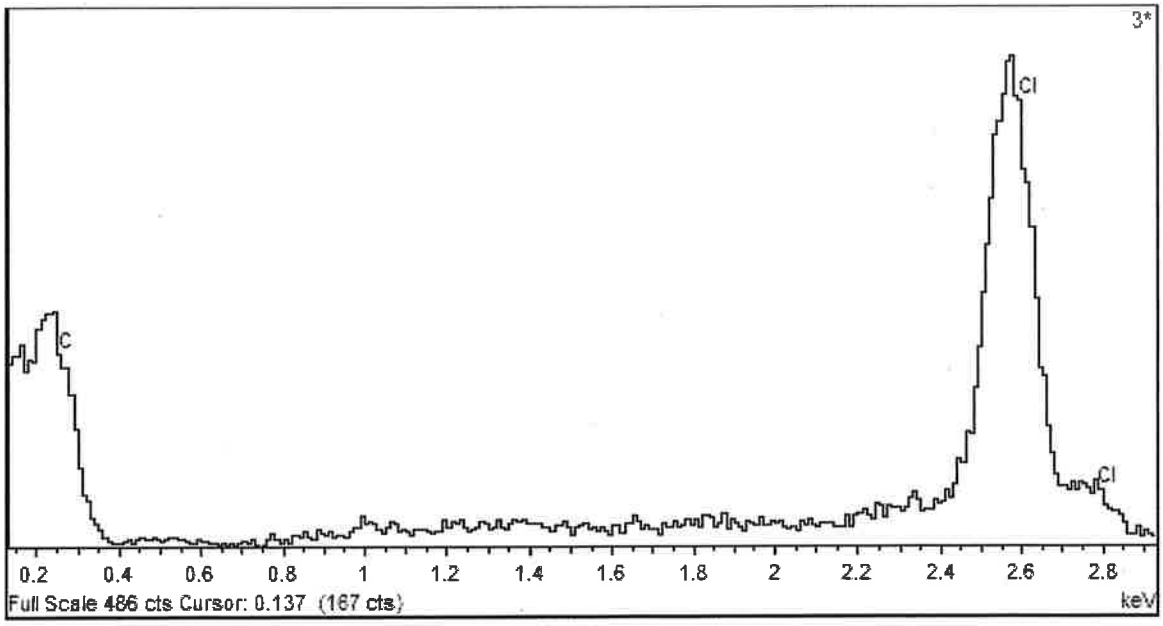


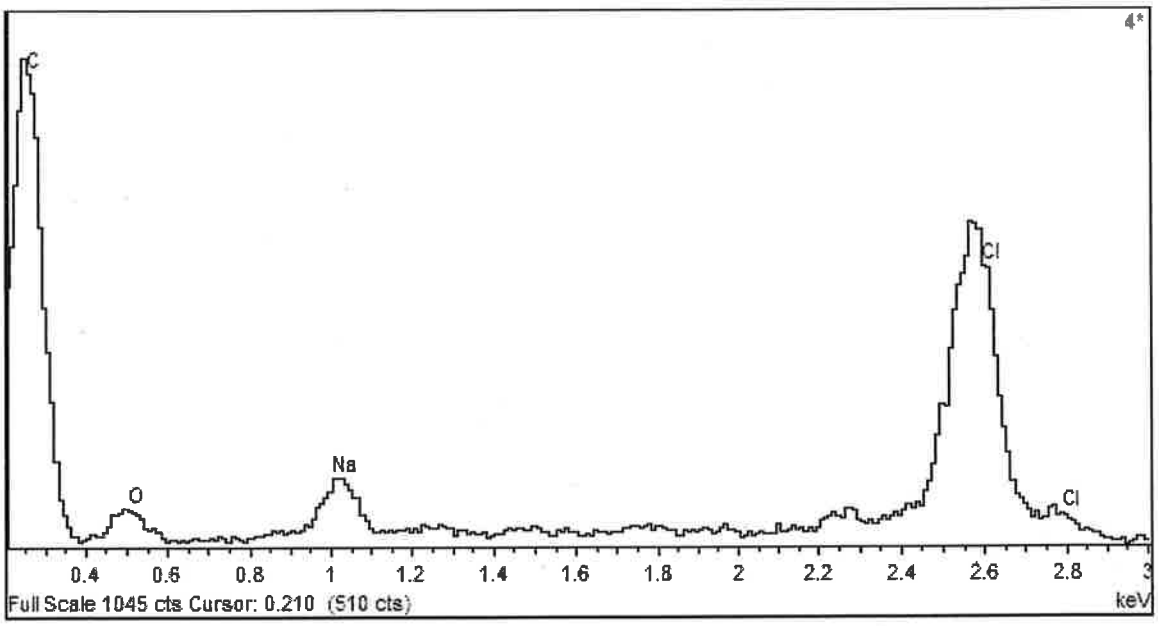

200µm

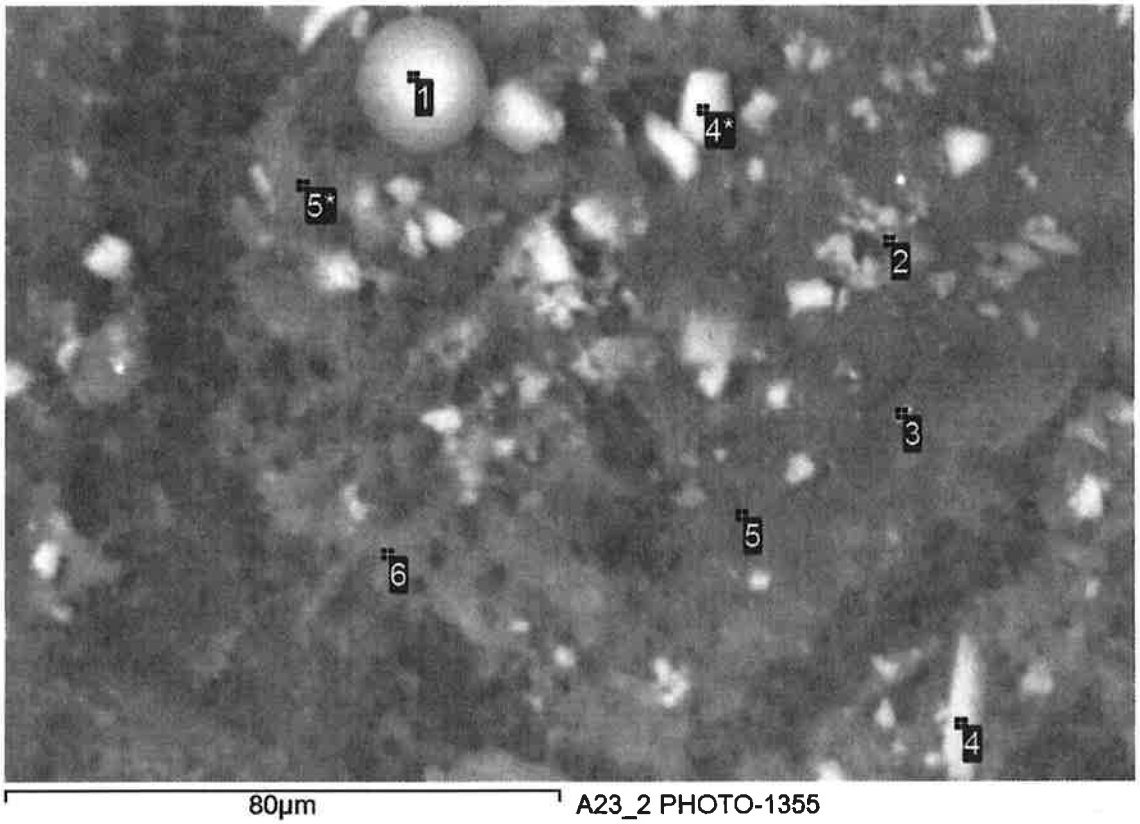
A23_2 PHOTO-1353

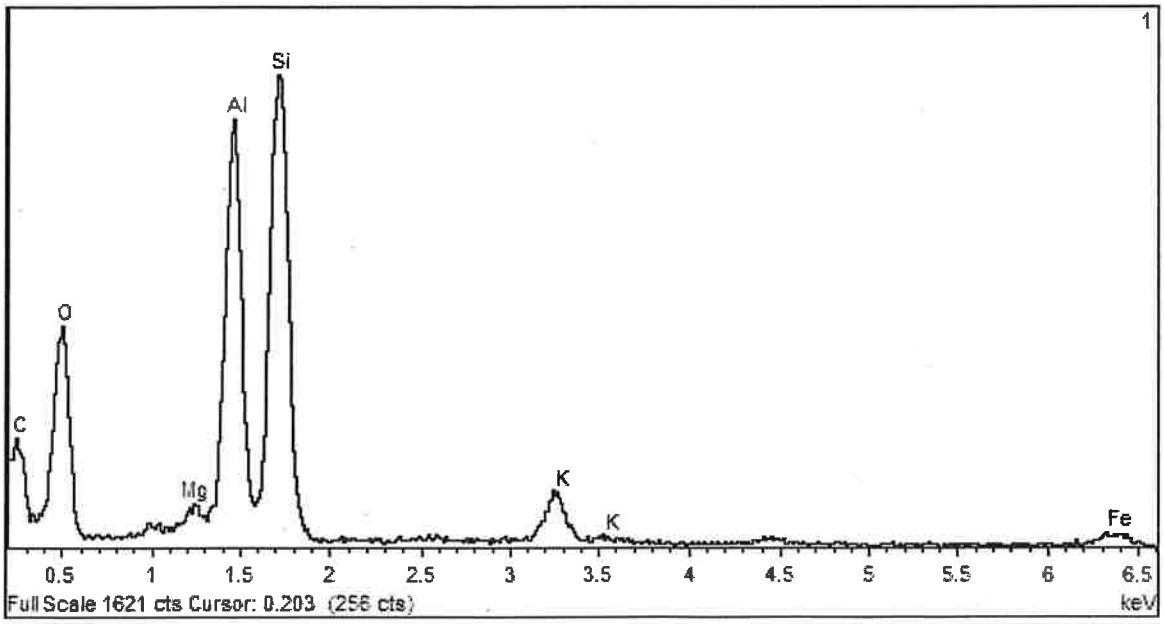


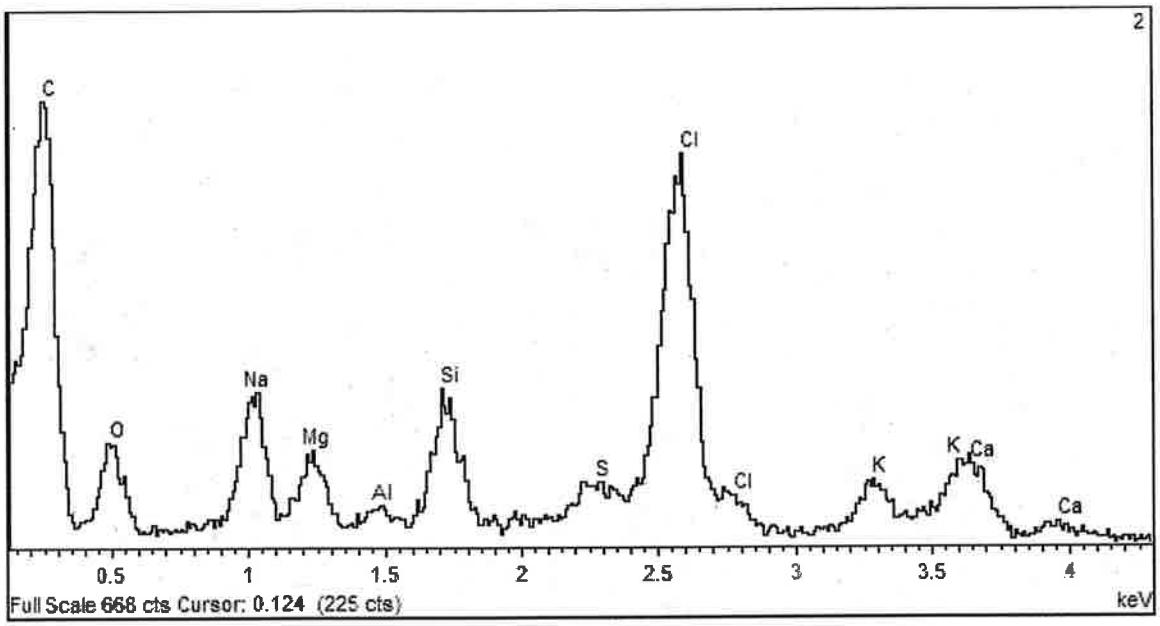

2
Cl
Na
C
O
Mg
Cl
Ca
0.5
1
1.5
2
2.5
3
3.5
Full Scale 2955 cts Cursor: 0.175 (312 cts)
keV

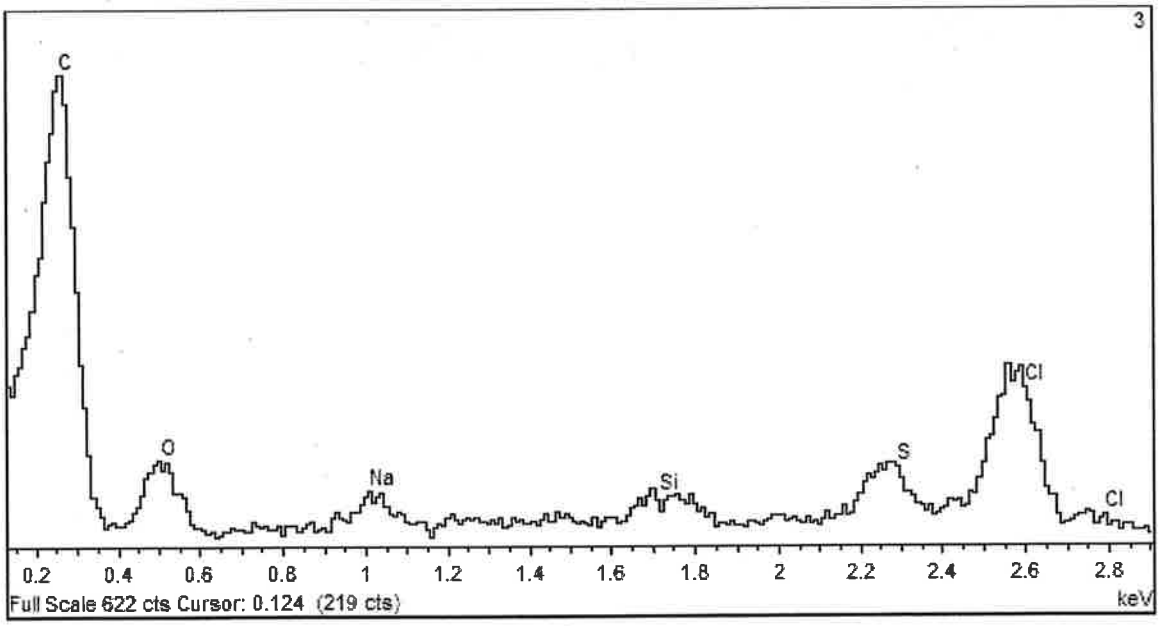

3*
Cl
C
Cl
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 486 cts Cursor: 0.137 (167 cts)
keV

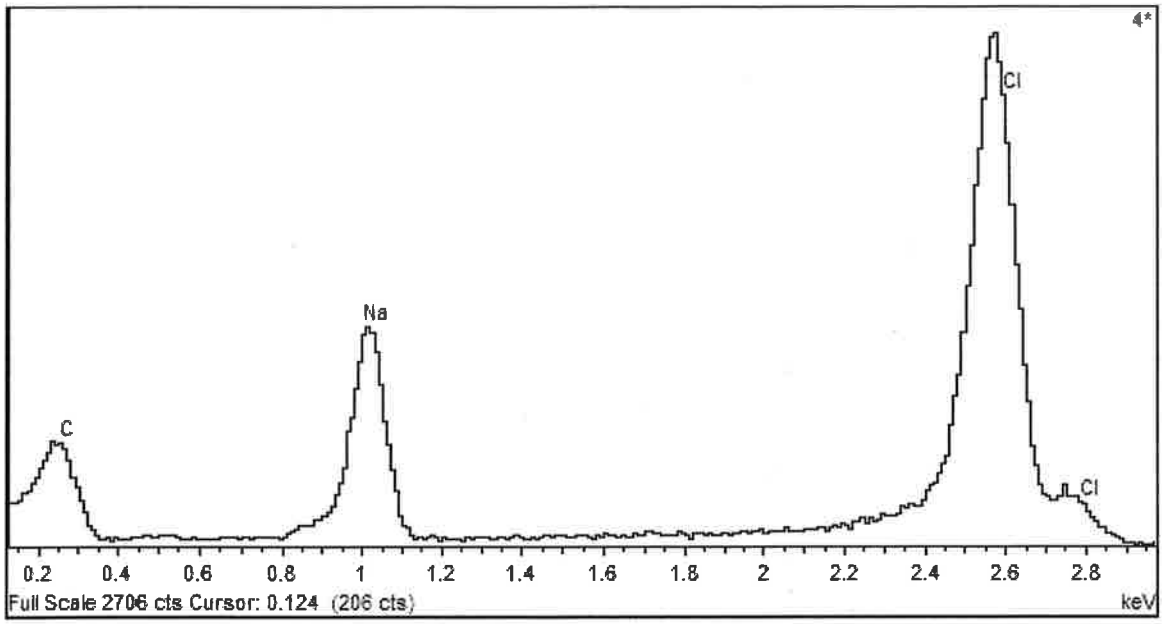

4*
C
O
Na
Cl
Cl
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
keV
Full Scale 1045 cts Cursor: 0.210 (510 cts)

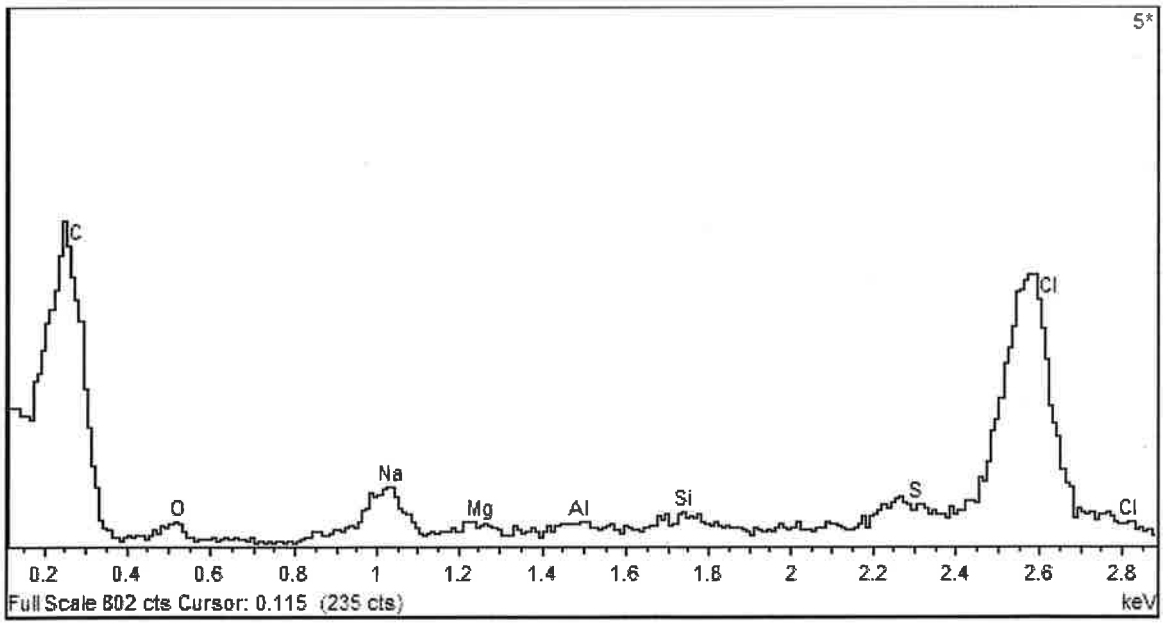

1
4*
5*
2
3
5
6
4
80µm
A23_2 PHOTO-1355

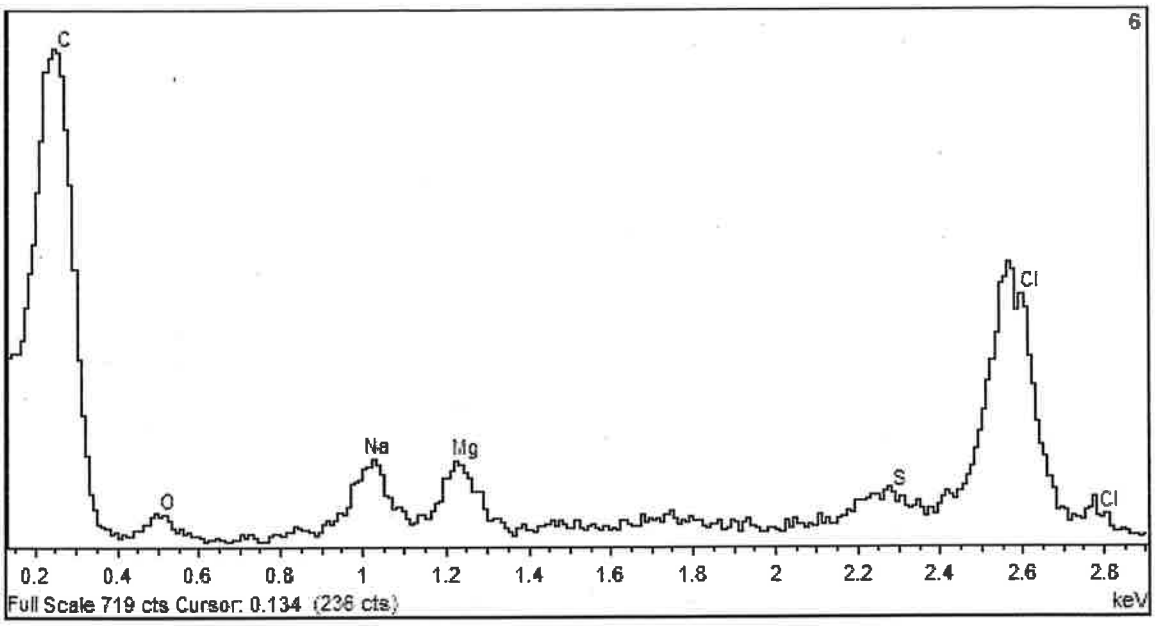

1
Si
Al
O
C
Mg
K
K
Fe
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
keV
Full Scale 1621 cts Cursor: 0.203 (256 cts)

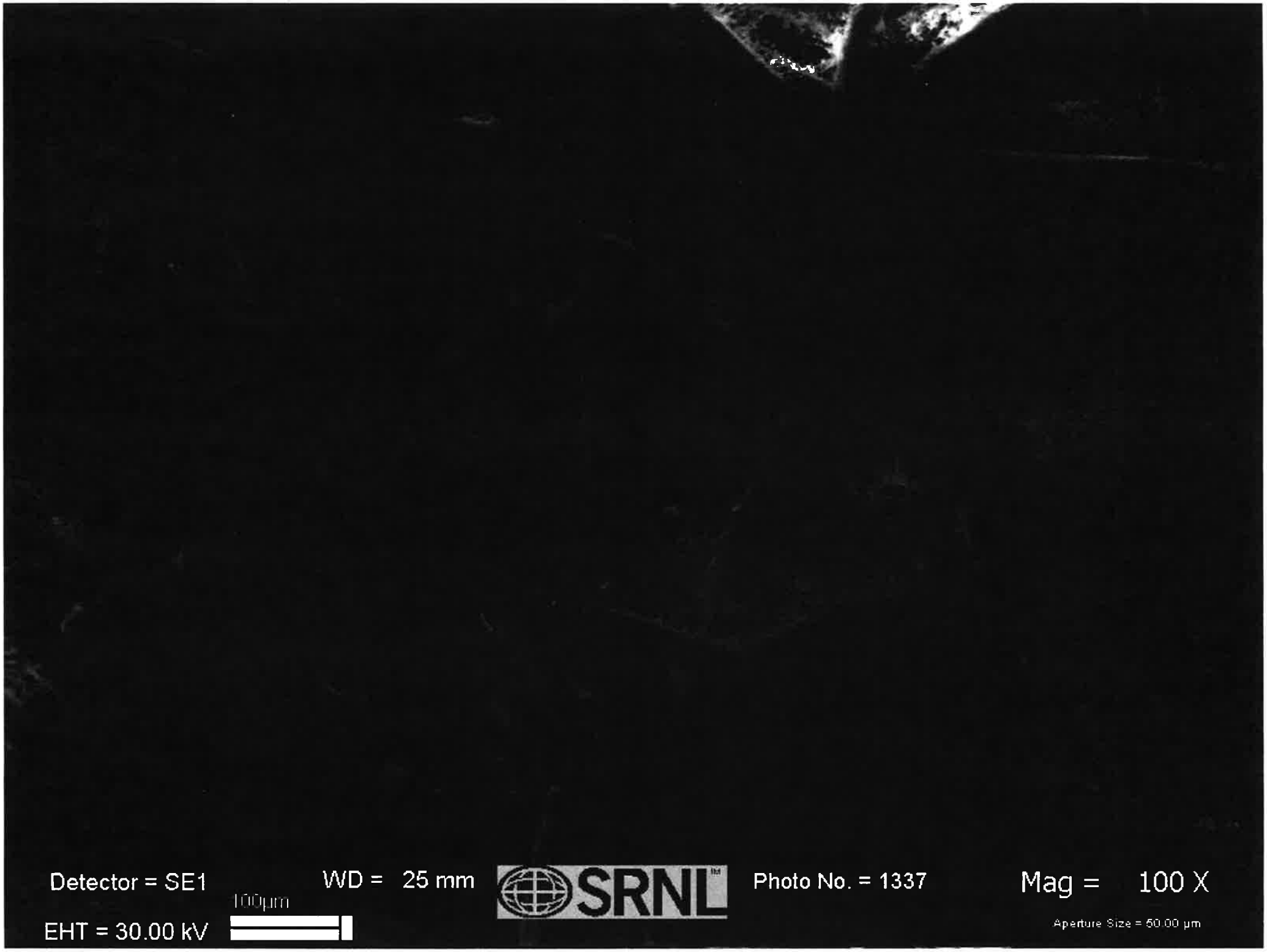

2
C
O
Na
Mg
Al
Si
S
Cl
Cl
K
K
Ca
Ca
0.5
1
1.5
2
2.5
3
3.5
4
Full Scale 668 cts Cursor: 0.124 (225 cts)
keV


3
C
O
Na
Si
S
Cl
Cl
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 622 cts Cursor: 0.124 (219 cts)
keV


4*
Cl
Na
C
Cl
0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 2.6 2.8
Full Scale 2706 cts Cursor: 0.124 (206 cts)
keV


5*
C
Cl
Na
O
Mg
Al
Si
S
Cl
0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 2.6 2.8
Full Scale 802 cts Cursor: 0.115 (235 cts)
keV

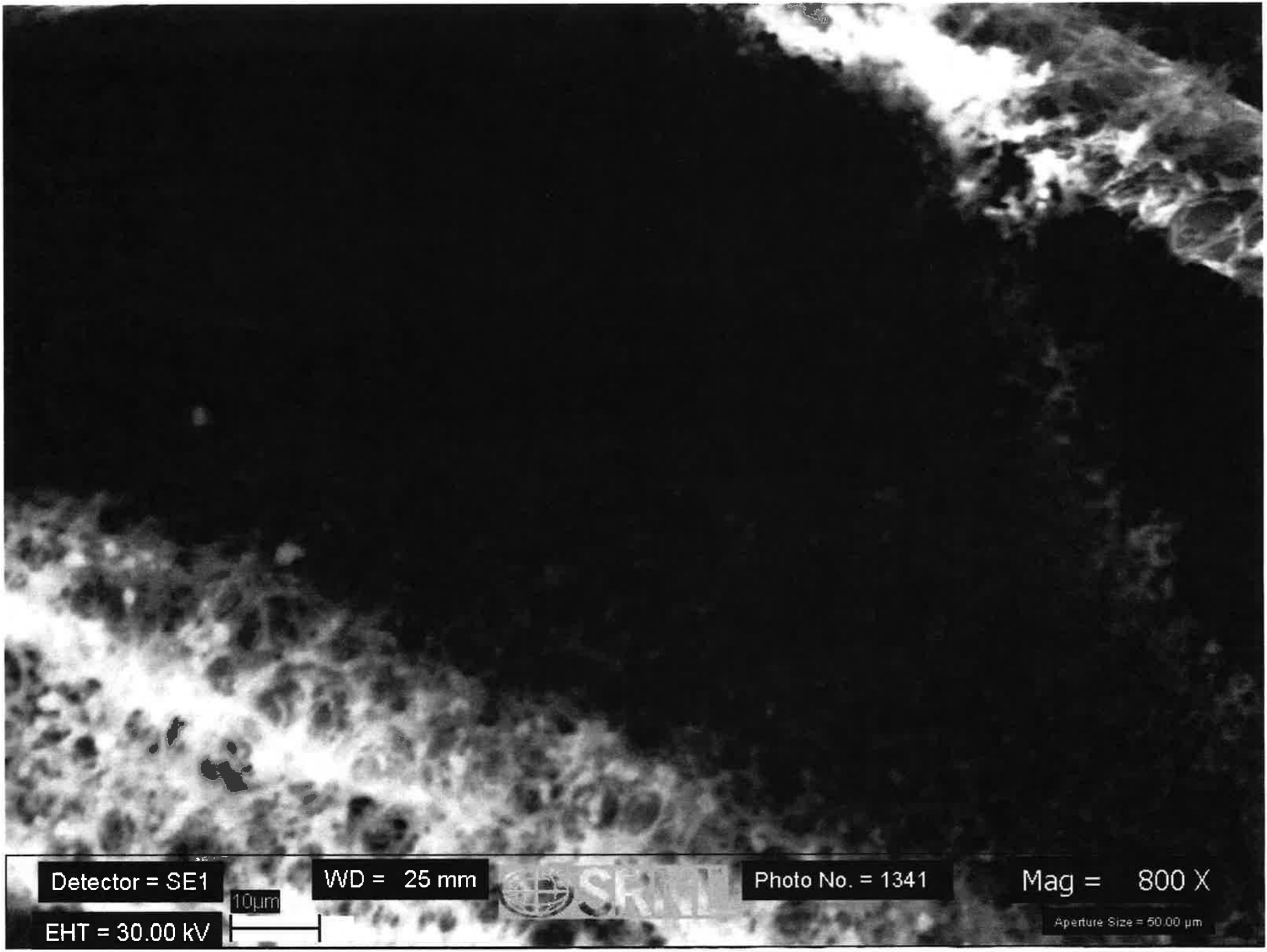

6
C
O
Na
Mg
S
Cl
Cl
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
keV
Full Scale 719 cts Cursor: 0.134 (236 cts)

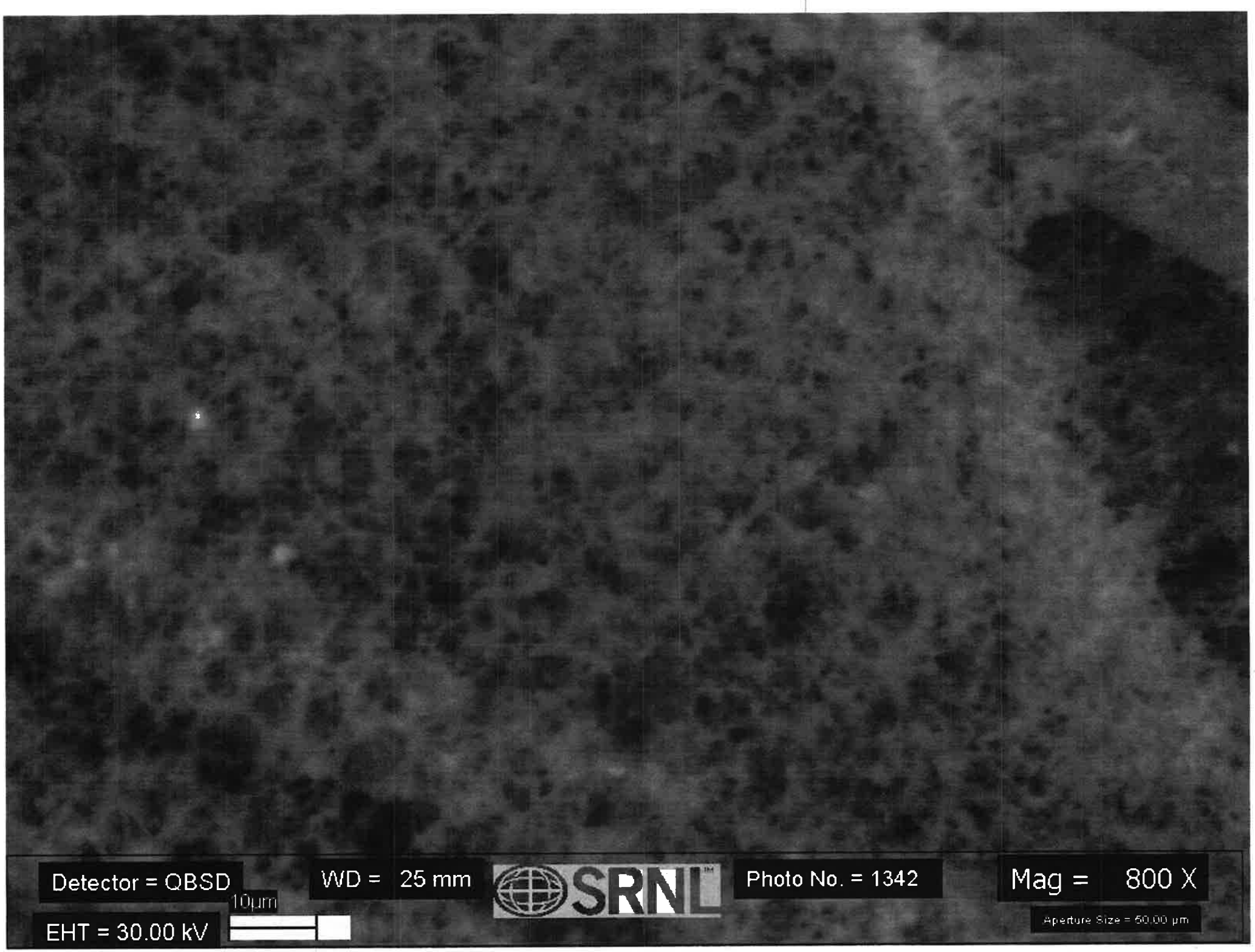

Detector = SE1
WD = 25 mm
Photo No. = 1337
Mag = 100 X
100µm
EHT = 30.00 kV
Aperture Size = 50.00 µm

Detector = QBSD
WD = 25 mm
SRNL
Photo No. = 1338
Mag = 100 X
100µm
EHT = 30.00 kV
Aperture Size = 50.00 µm

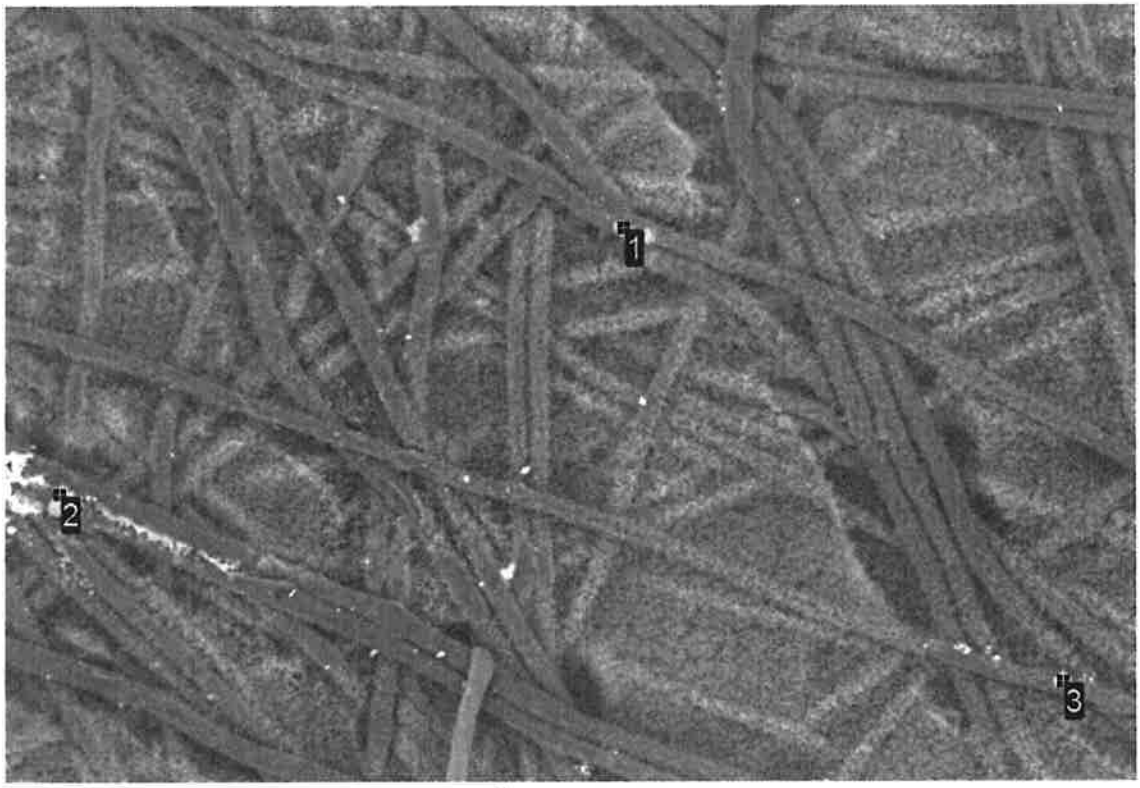
Detector = QBSD
WD = 25 mm
SRNL
Photo No. = 1339
Mag = 100 X
100µm
EHT = 30.00 kV
Aperture Size = 50.00 µm

Detector = SE1
EHT = 30.00 kV
100µm
WD = 25 mm
SRNL
Photo No. = 1340
Mag = 100 X
Aperture Size = 50.00 µm

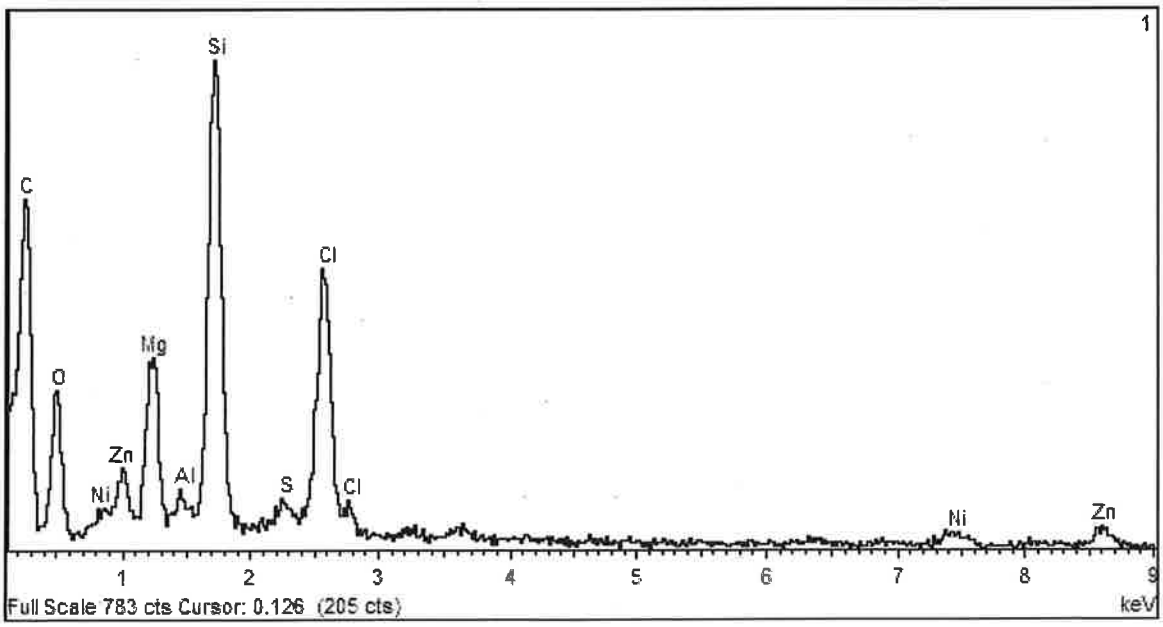

Detector = SE1
EHT = 30.00 kV
10µm
WD = 25 mm
Photo No. = 1341
Mag = 800 X
Aperture Size = 50.00 µm

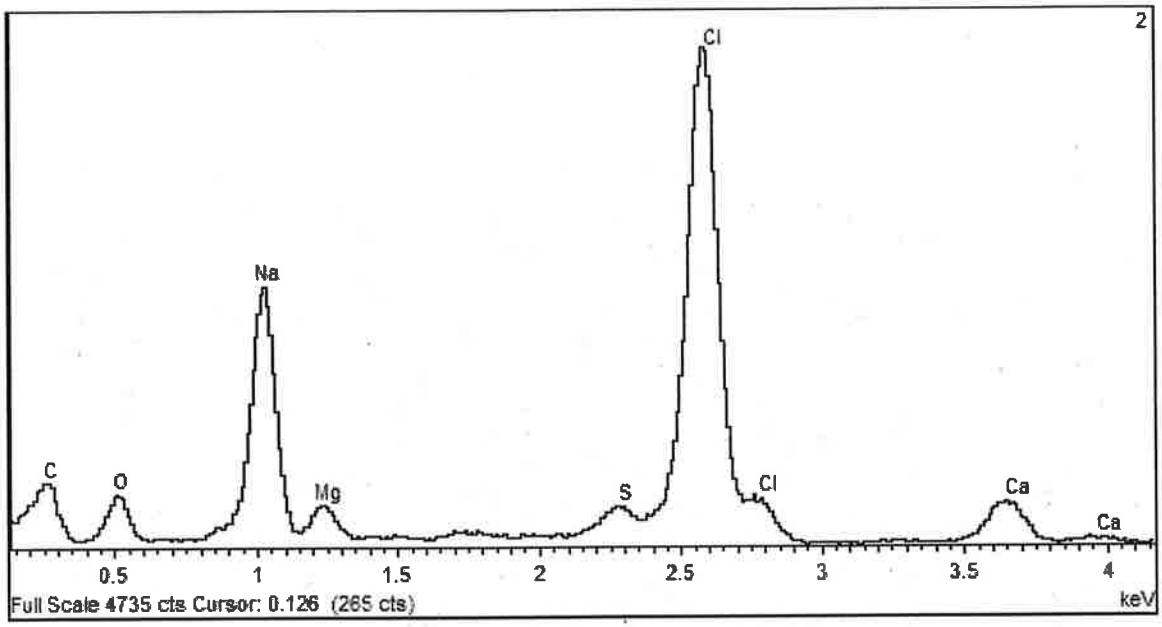

Detector = QBSD
EHT = 30.00 kV
10µm
WD = 25 mm
SRNL
Photo No. = 1342
Mag = 800 X
Aperture Size = 50.00 µm

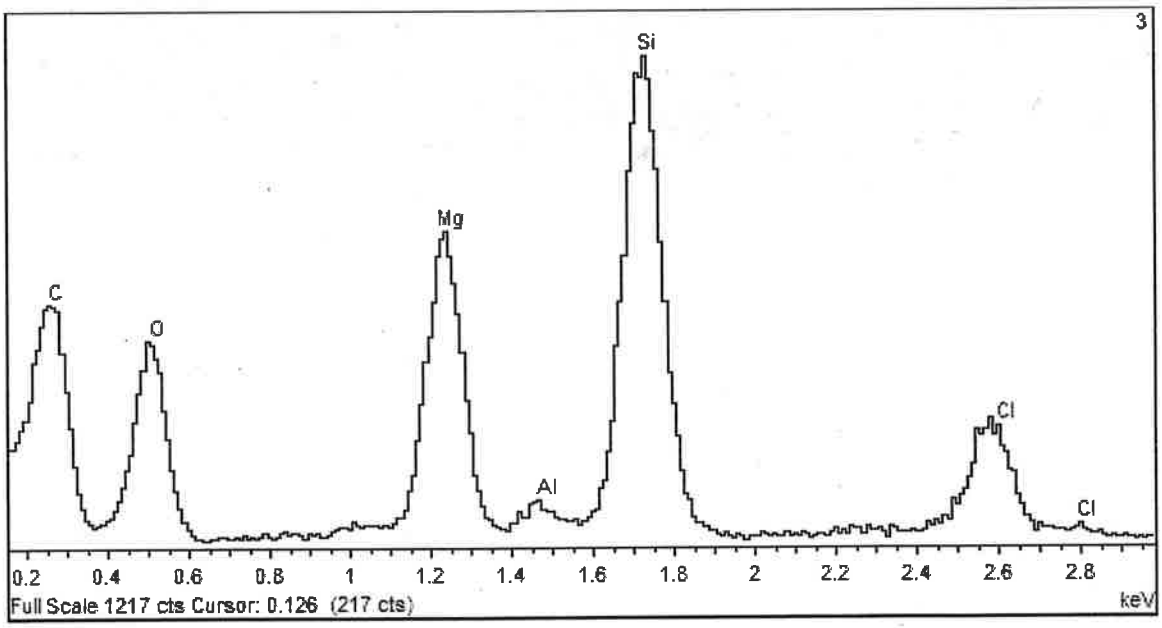
# A33_021414 300309396

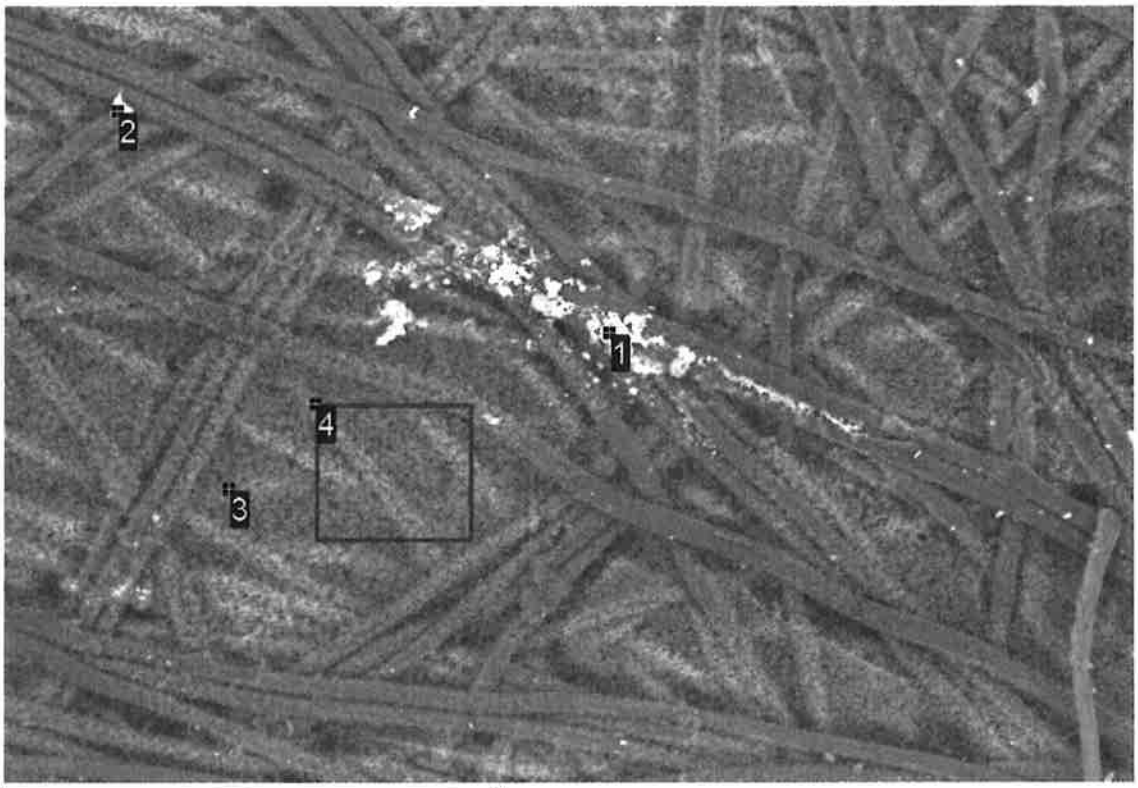



500µm A33 PHOTO-1338



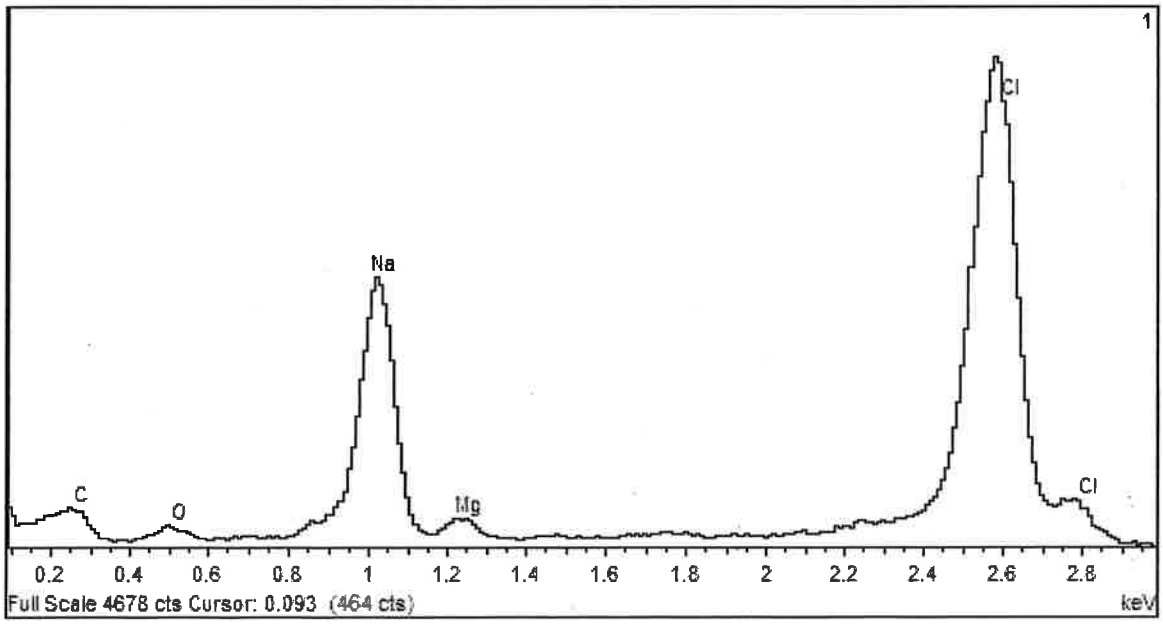

2
Cl
Na
C
O
Mg
S
Cl
Ca
Ca
0.5
1
1.5
2
2.5
3
3.5
4
Full Scale 4735 cts Cursor: 0.126 (265 cts)
keV

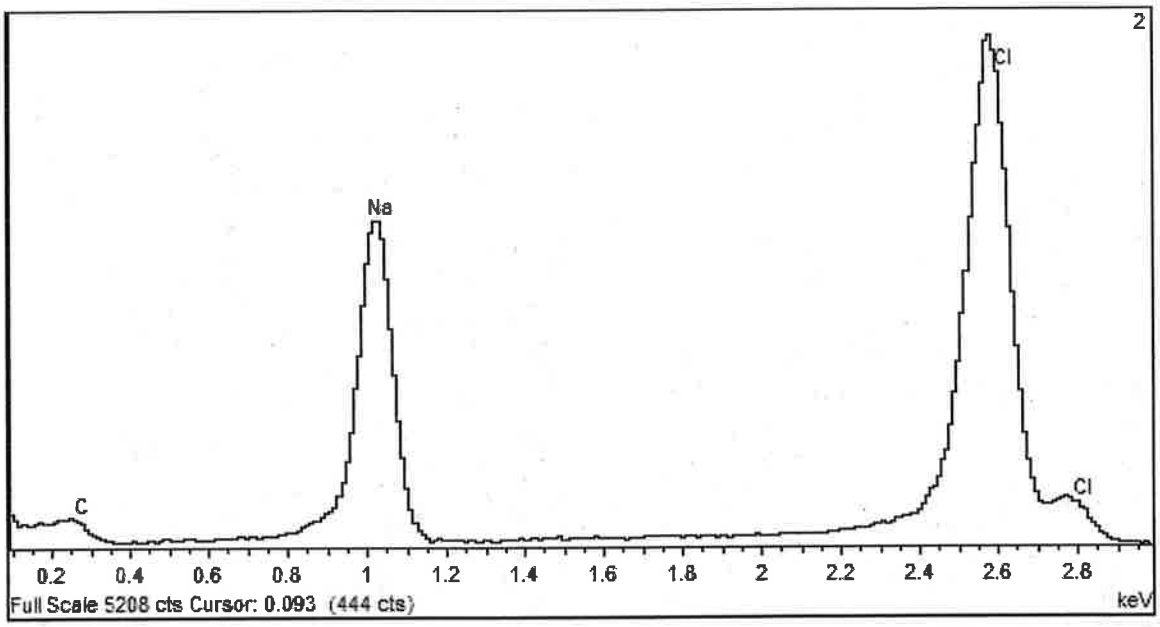

3
Si
Mg
C
O
Cl
Al
Cl
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 1217 cts Cursor: 0.126 (217 cts)
keV

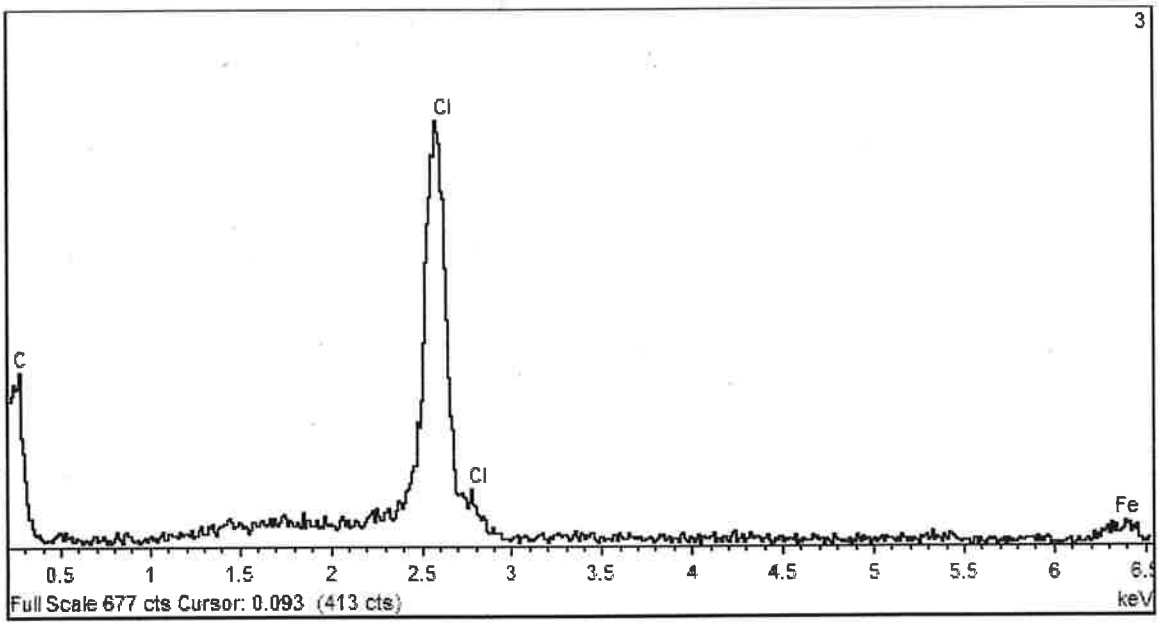


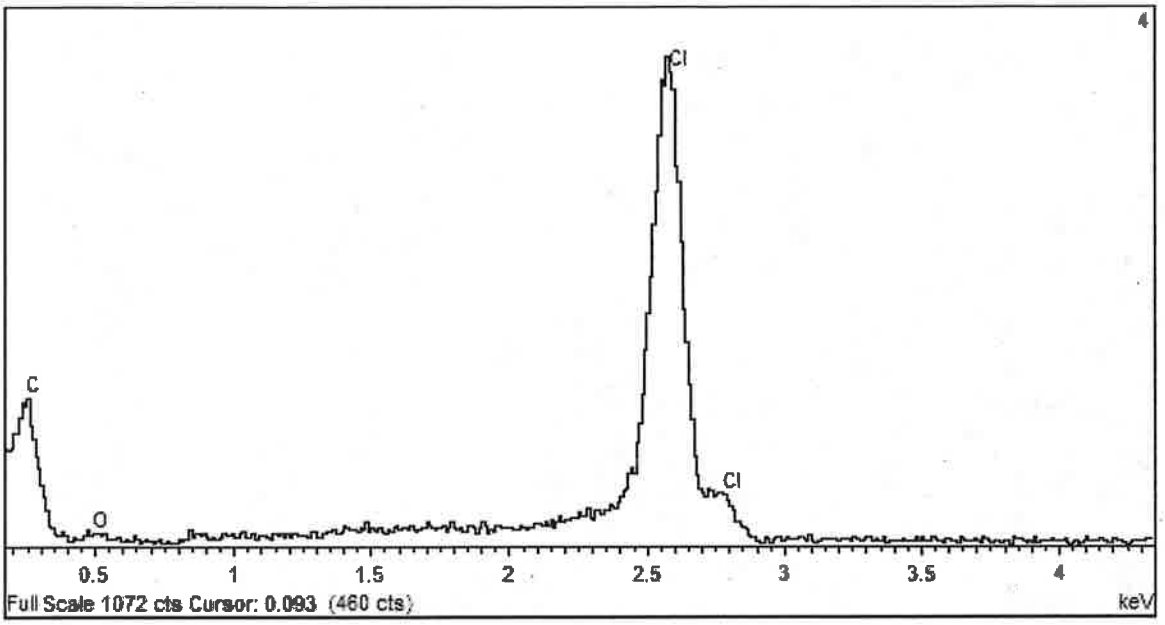

500µm

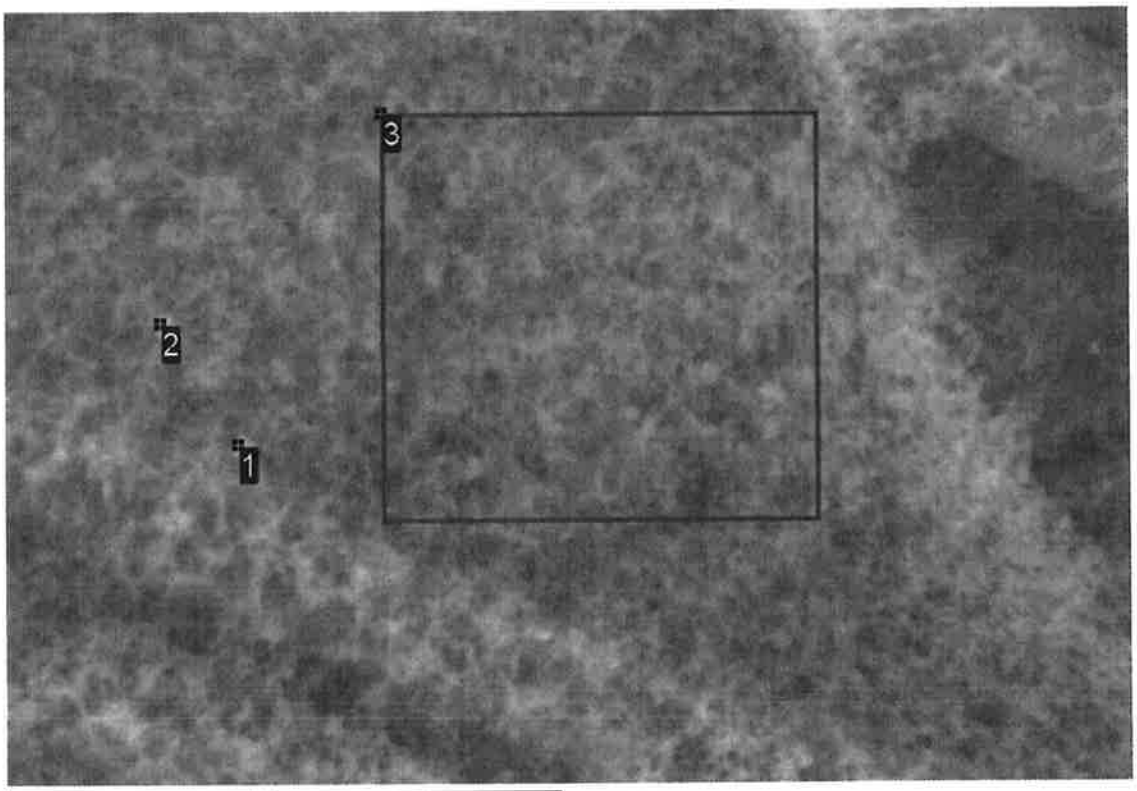
A33 PHOTO-1339



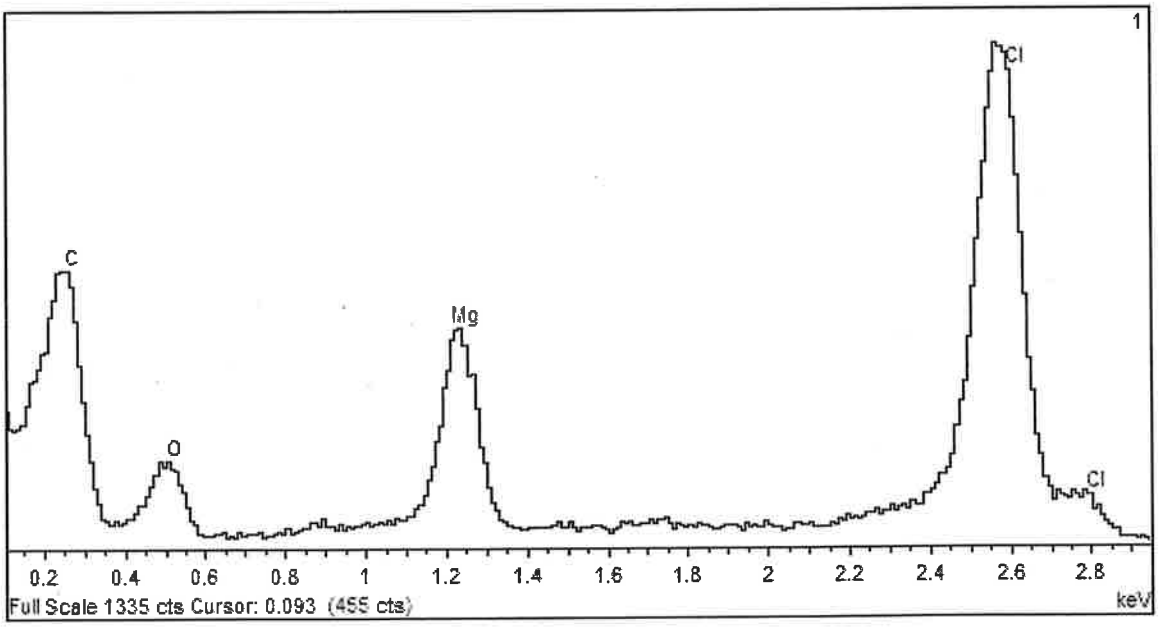

2
Cl
Na
C
Cl
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 5208 cts Cursor: 0.093 (444 cts)
keV

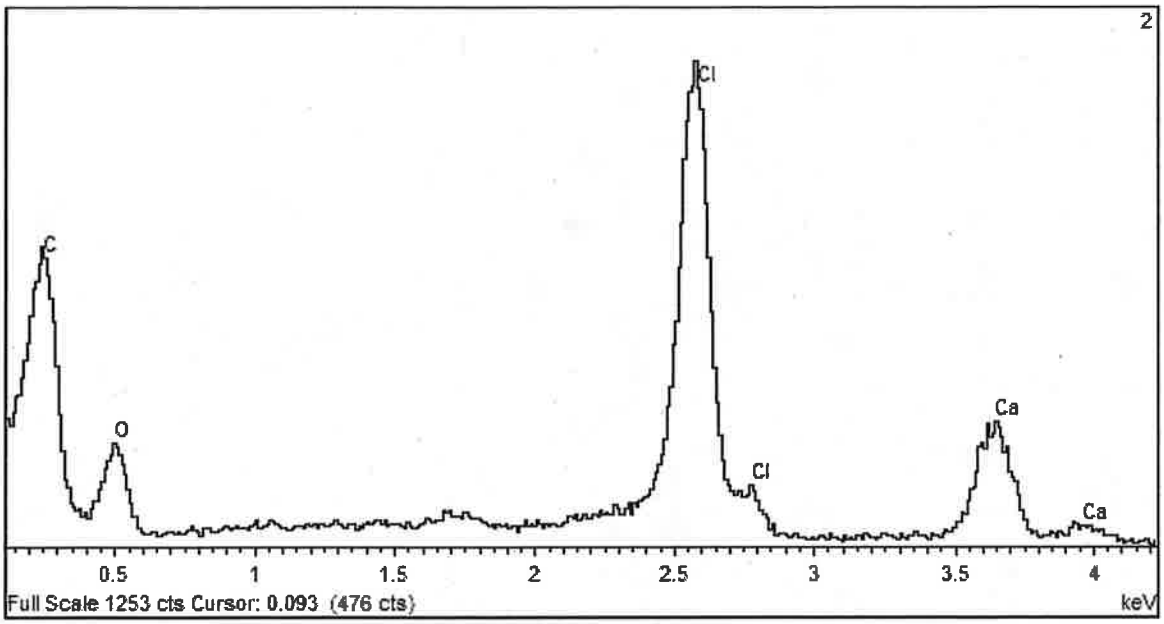

3
Cl
C
Cl
Fe
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
Full Scale 677 cts Cursor: 0.093 (413 cts)
keV

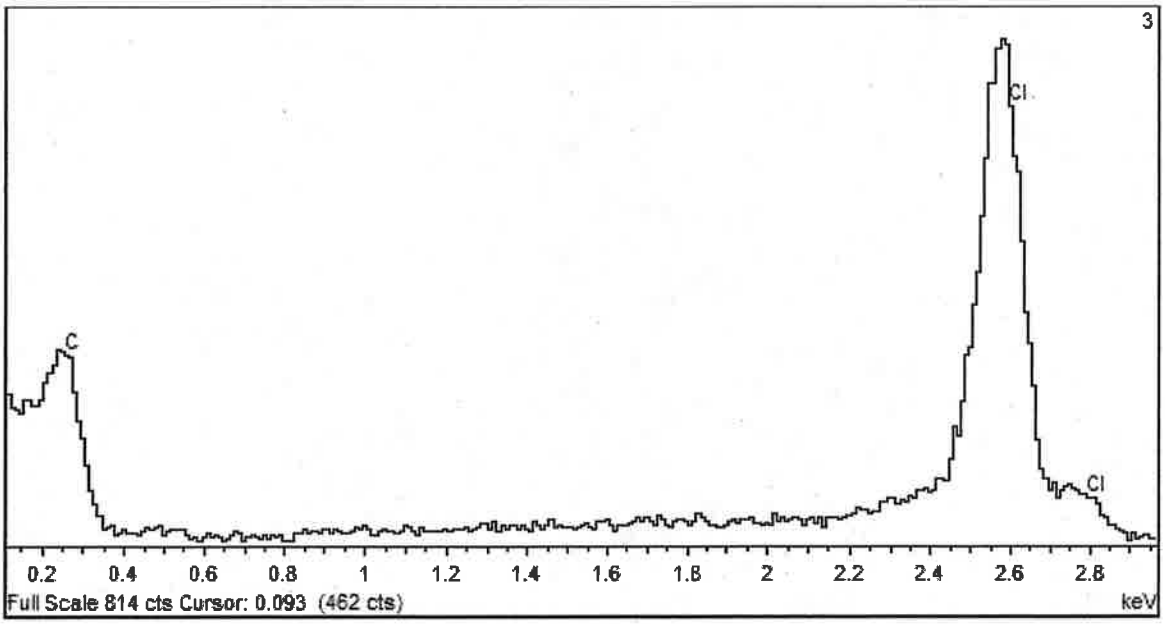

4
Cl
C
Cl
O
0.5
1
1.5
2
2.5
3
3.5
4
Full Scale 1072 cts Cursor: 0.093 (460 cts)
keV



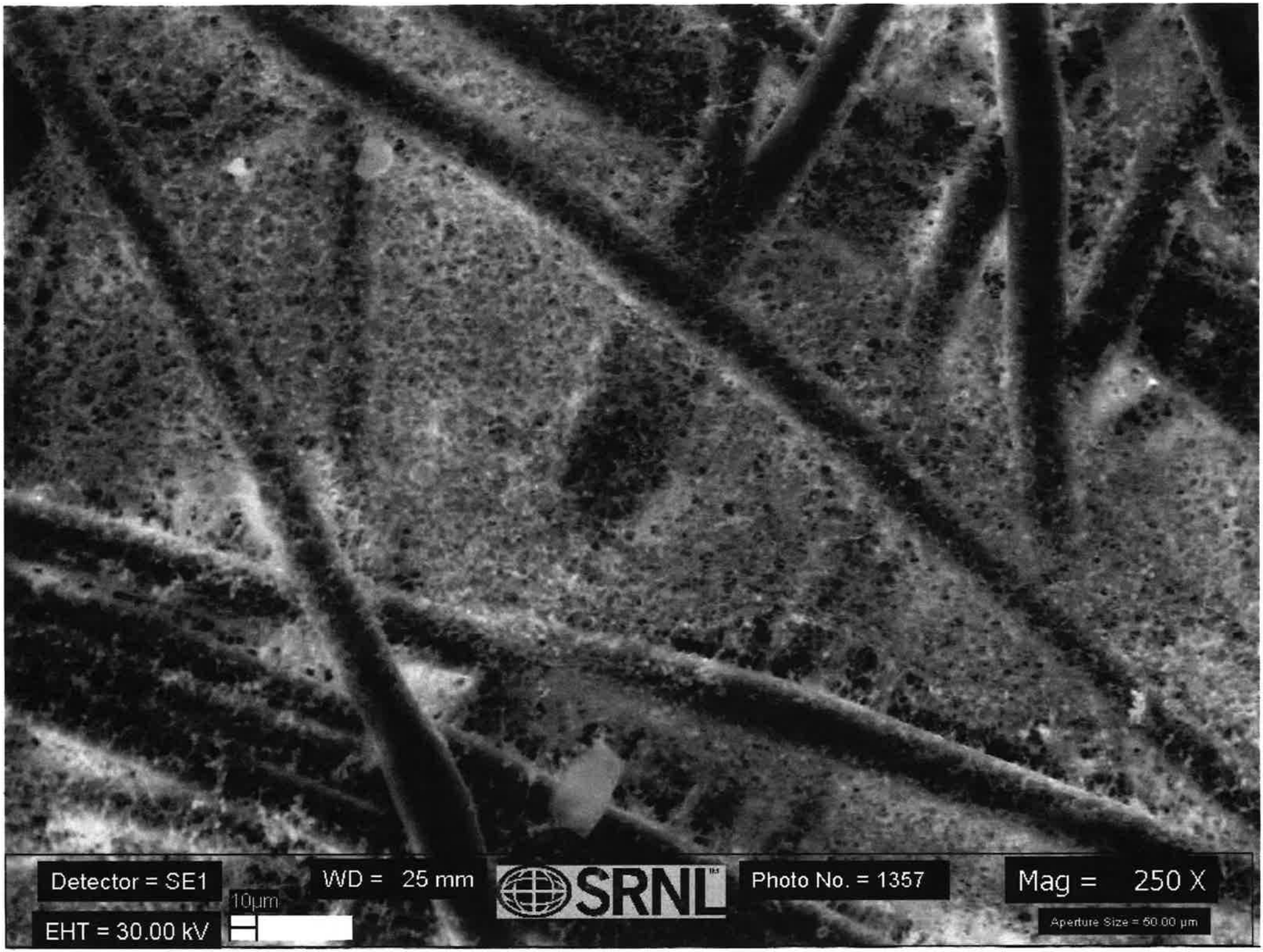

70µm A33 PHOTO-1342

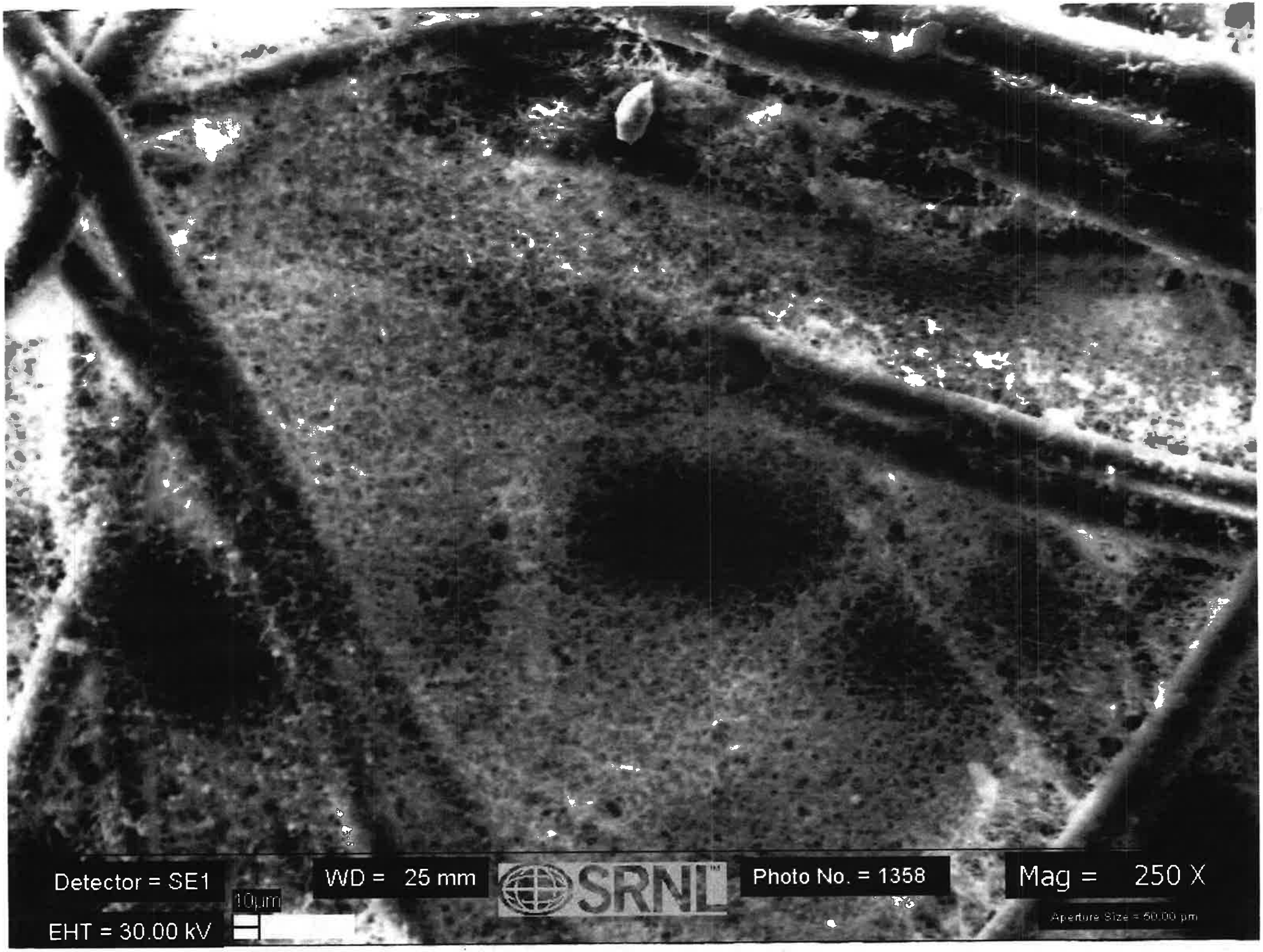



2
Cl
C
O
Cl
Ca
Ca
0.5
1
1.5
2
2.5
3
3.5
4
Full Scale 1253 cts Cursor: 0.093 (476 cts)
keV


3
Cl
C
Cl
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 814 cts Cursor: 0.093 (462 cts)
keV

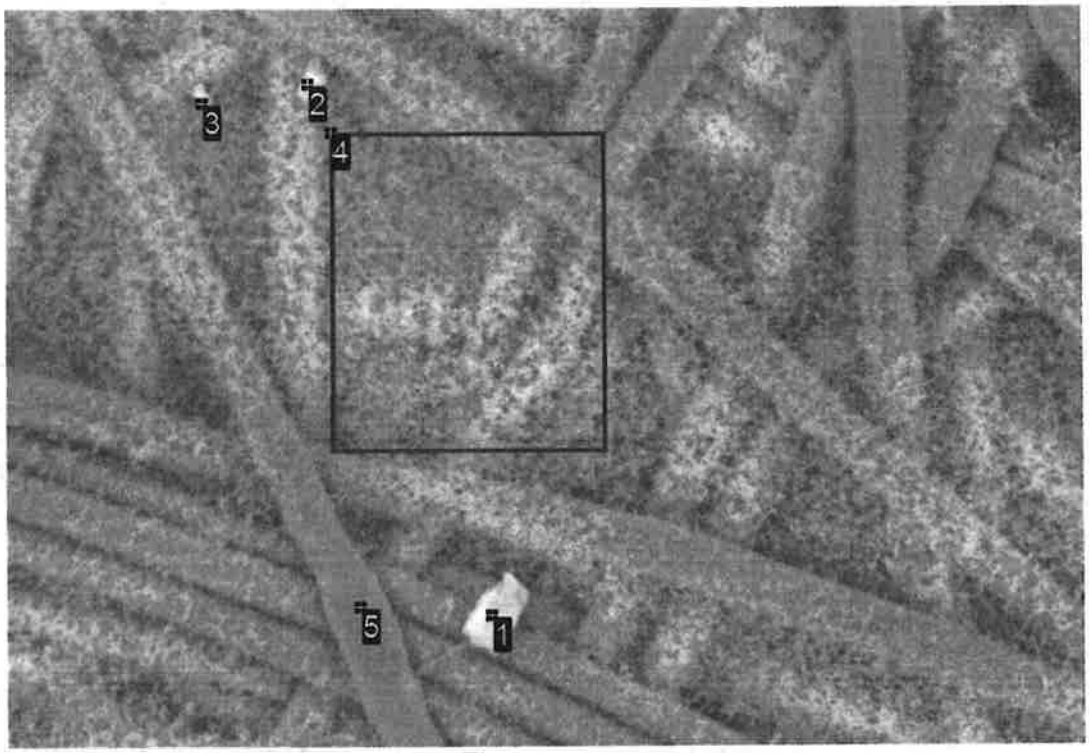
Detector = QBSD
WD = 25 mm
SRNL
Photo No. = 1356
Mag = 250 X
10µm
EHT = 30.00 kV
Aperture Size = 50.00 µm


Detector = SE1
EHT = 30.00 kV
10µm
WD = 25 mm
SRNL
Photo No. = 1357
Mag = 250 X
Aperture Size = 60.00 µm


Detector = SE1
EHT = 30.00 kV
10µm
WD = 25 mm
SRNL
Photo No. = 1358
Mag = 250 X
Aperture Size = 50.00 µm

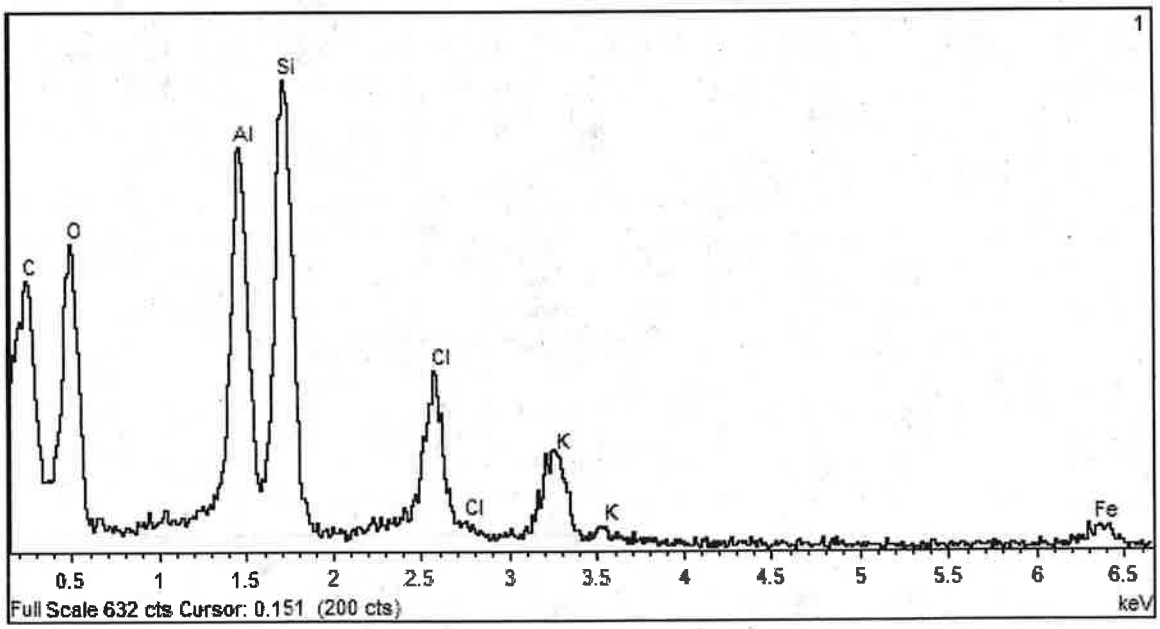
Detector = QBSD
WD = 25 mm
SRNL
Photo No. = 1359
Mag = 250 X
10µm
EHT = 30.00 kV
Aperture Size = 50.00 µm

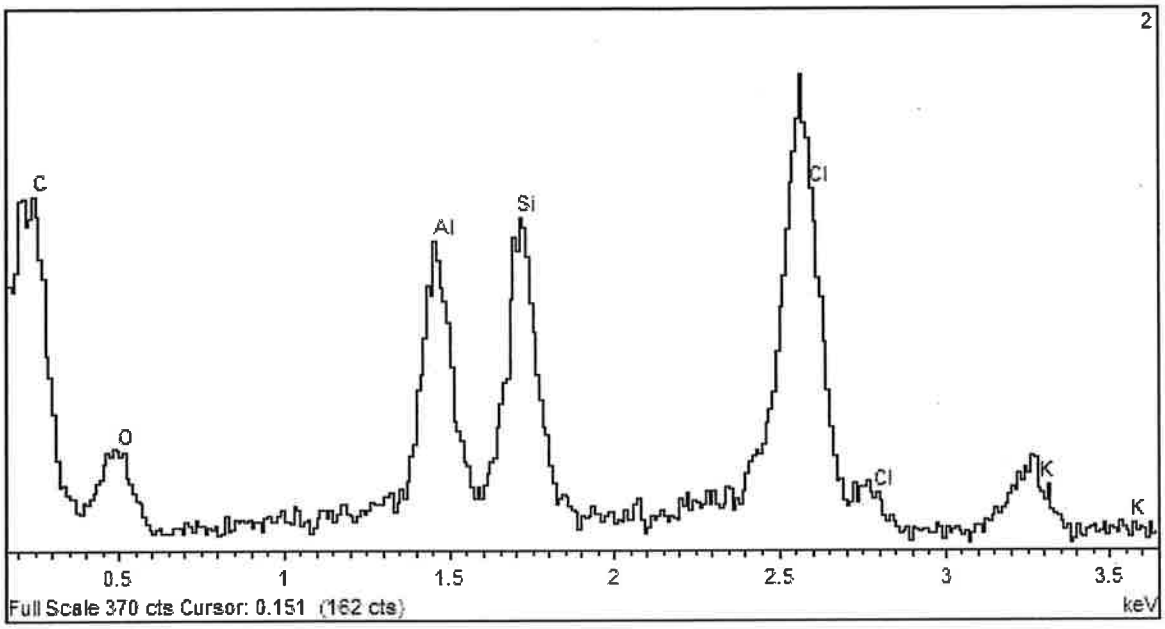
# B13_021414 300309397

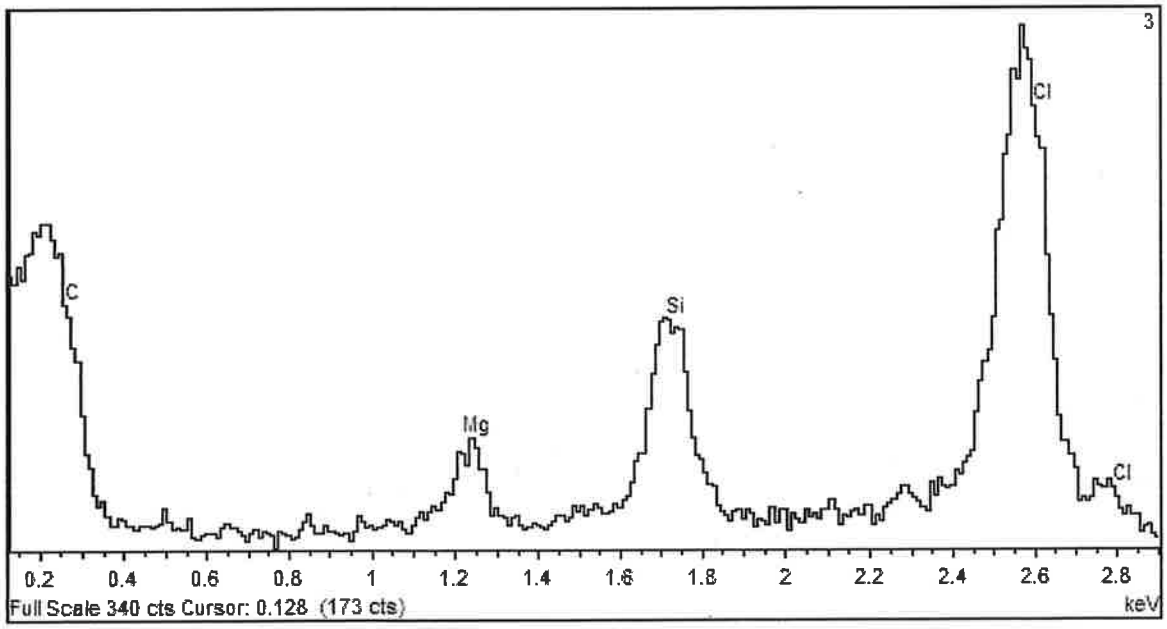


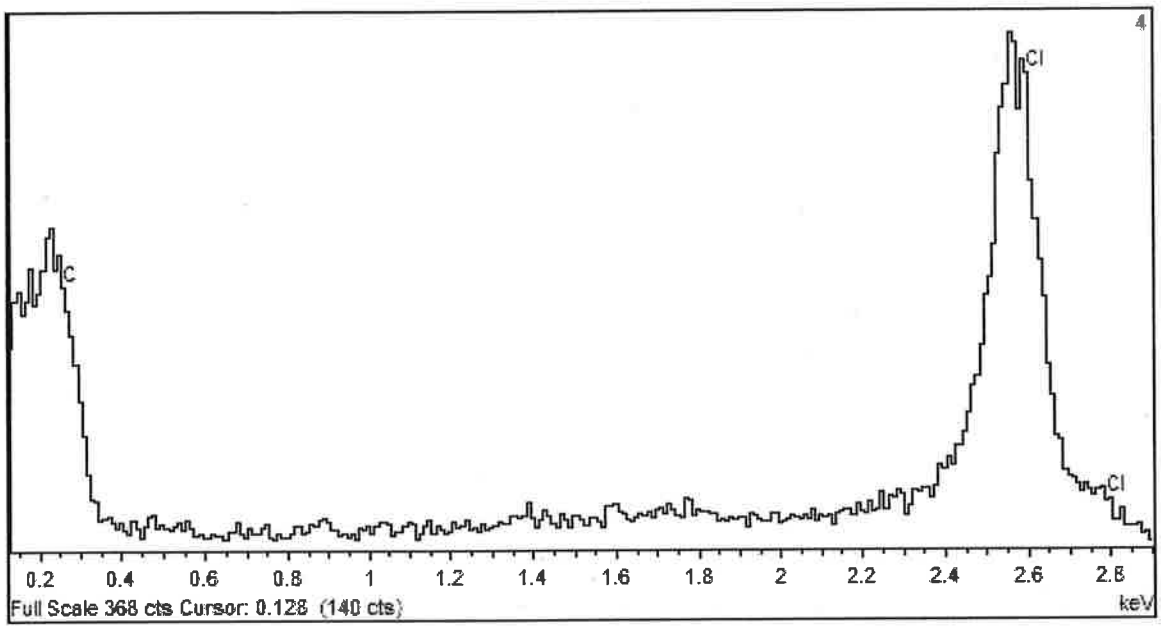

200µm

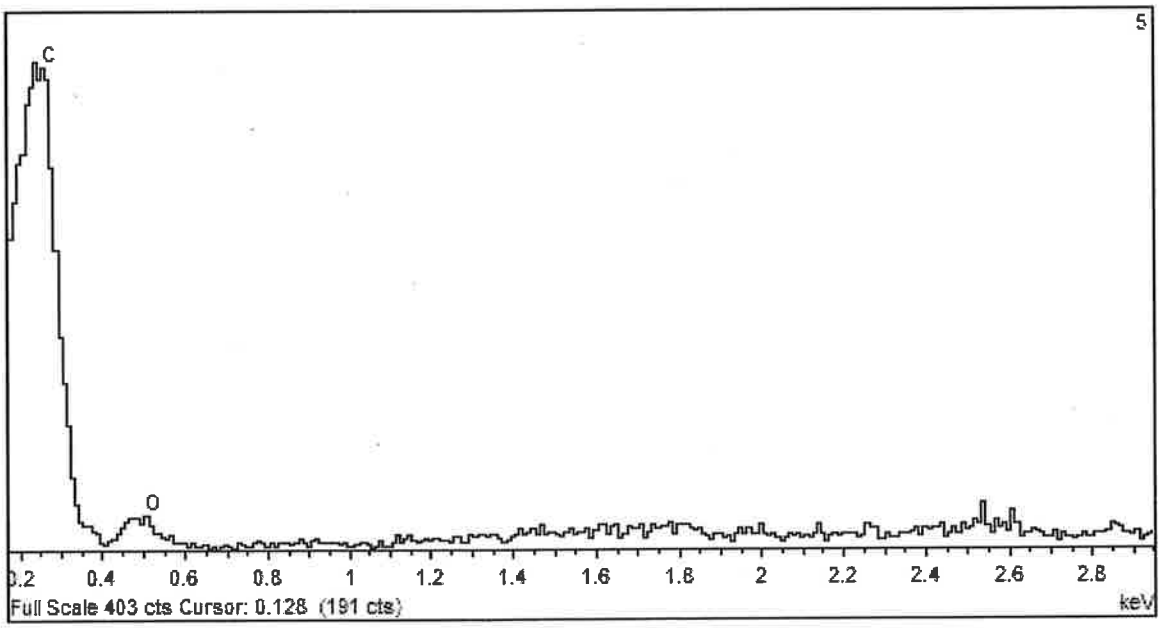
B13 PHOTO-1356

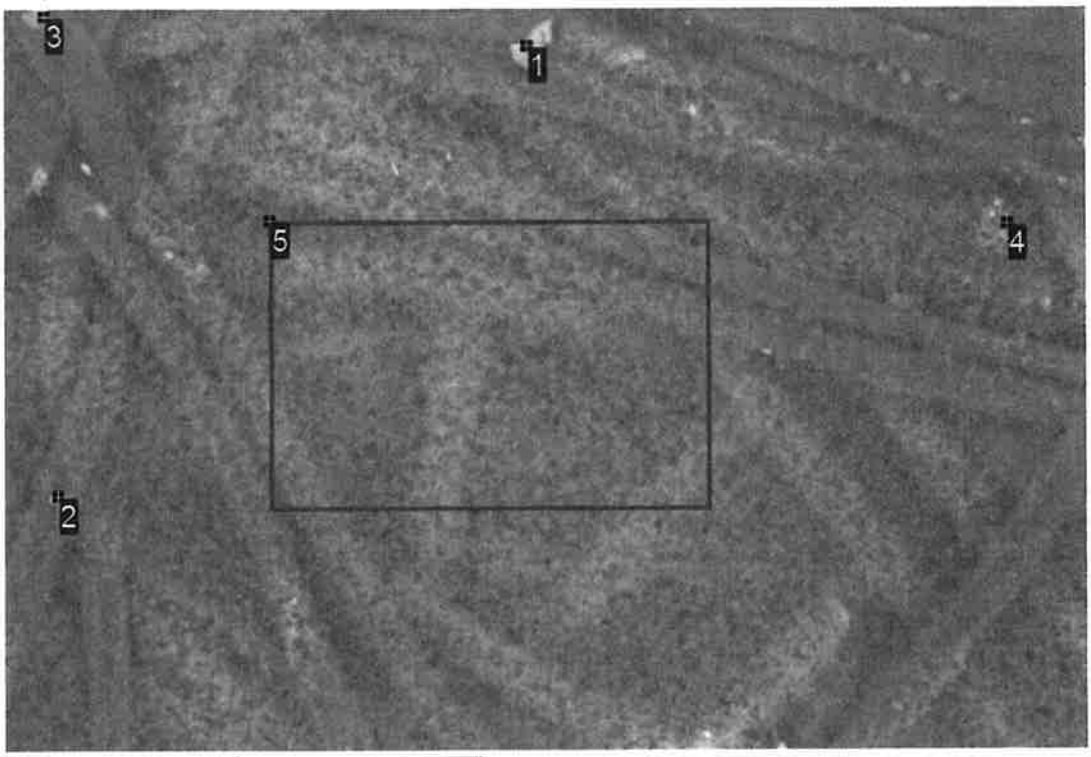



2
C
O
Al
Si
Cl
Cl
K
K
0.5
1
1.5
2
2.5
3
3.5
Full Scale 370 cts Cursor: 0.151 (162 cts)
keV

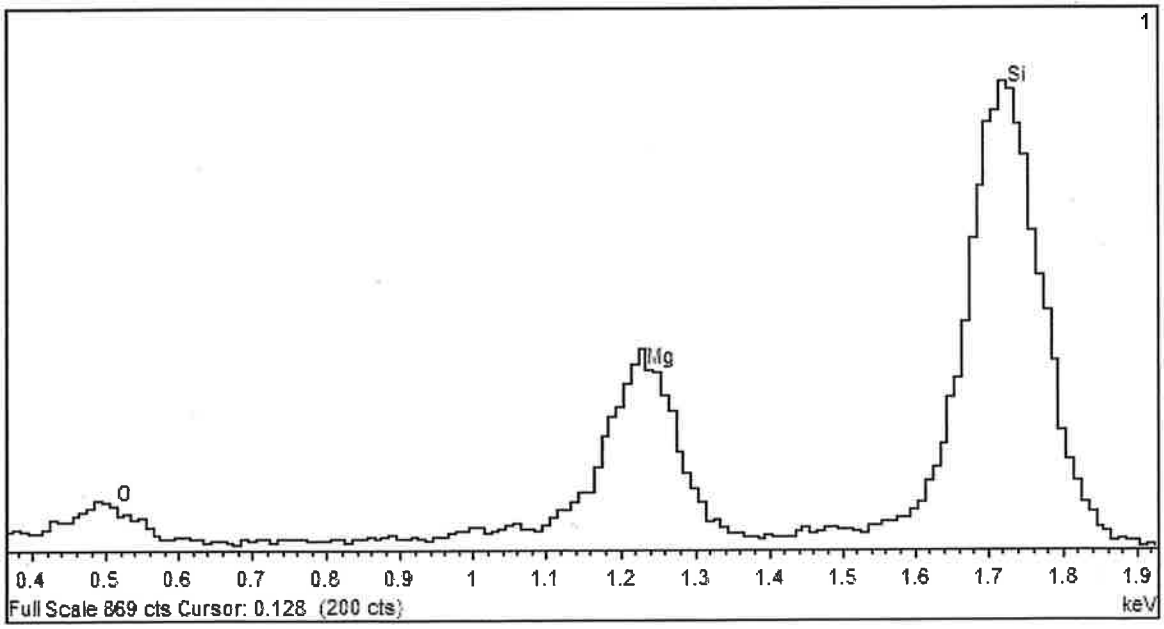

3
C
Mg
Si
Cl
Cl
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 340 cts Cursor: 0.128 (173 cts)
keV

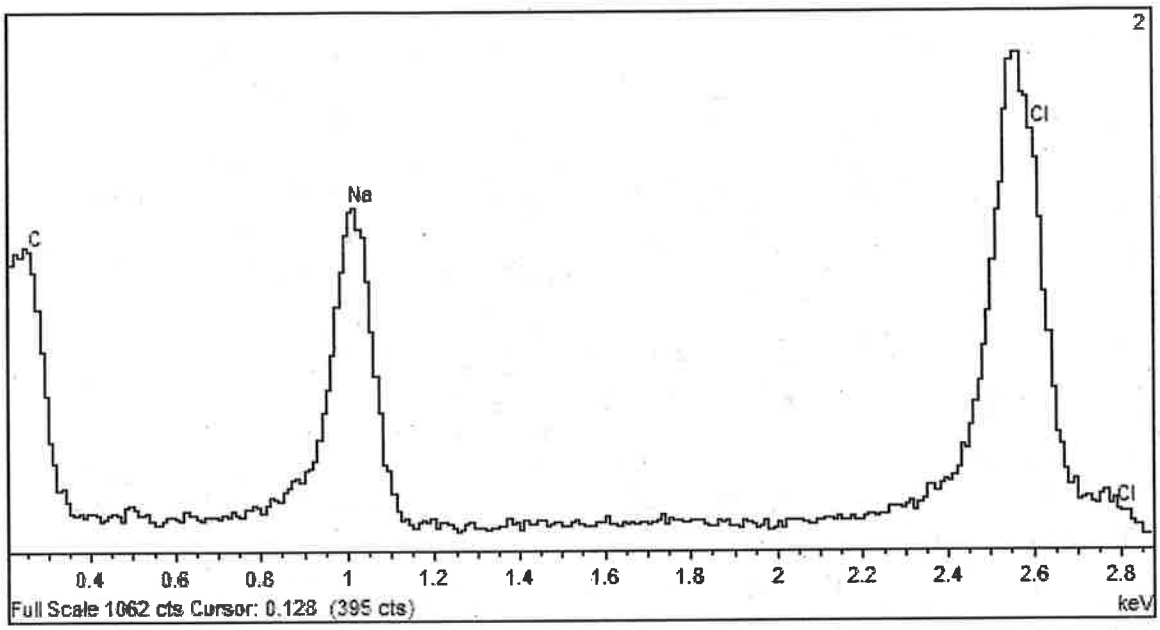

4
Cl
C
Cl
0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 2.6 2.8
Full Scale 368 cts Cursor: 0.128 (140 cts)
keV

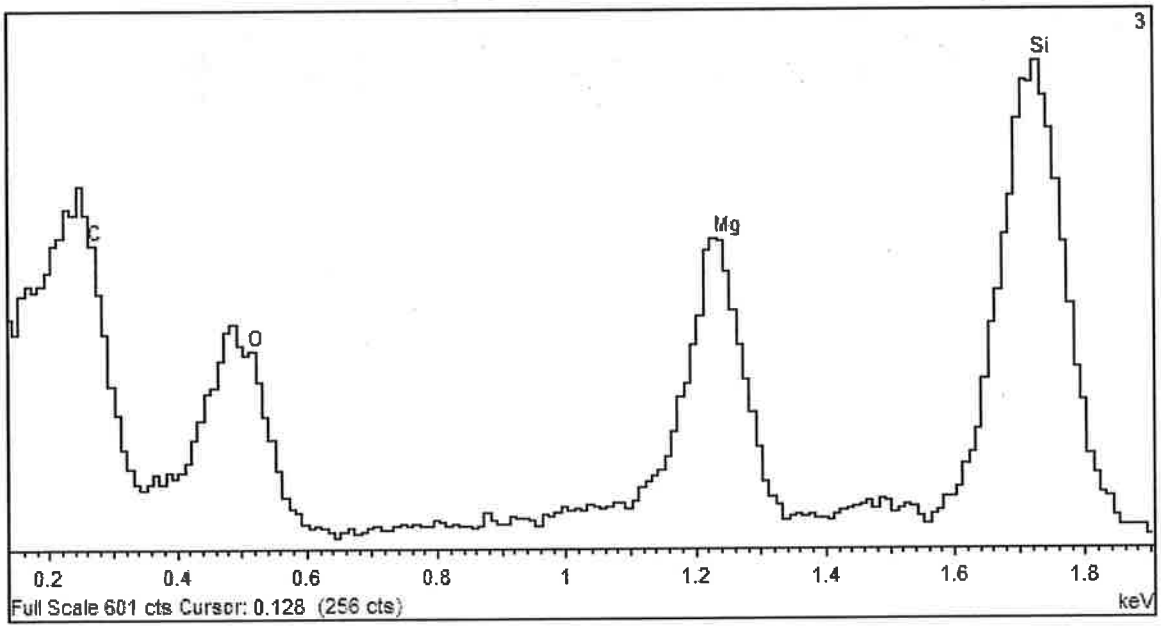

5
C
O
0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 2.6 2.8
Full Scale 403 cts Cursor: 0.128 (191 cts)
keV

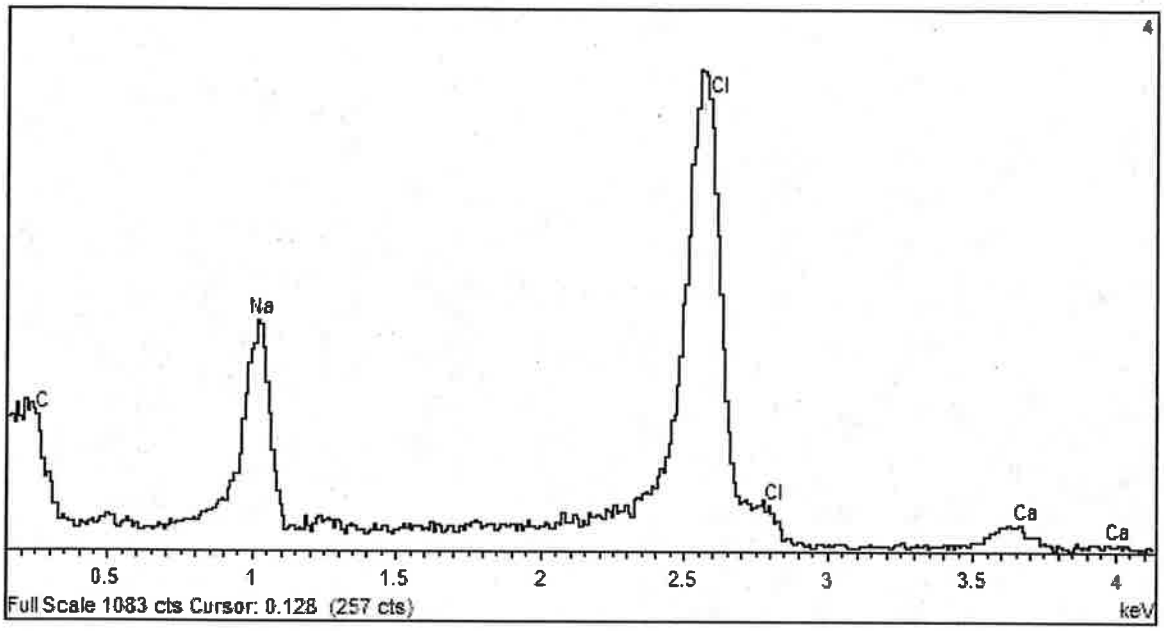


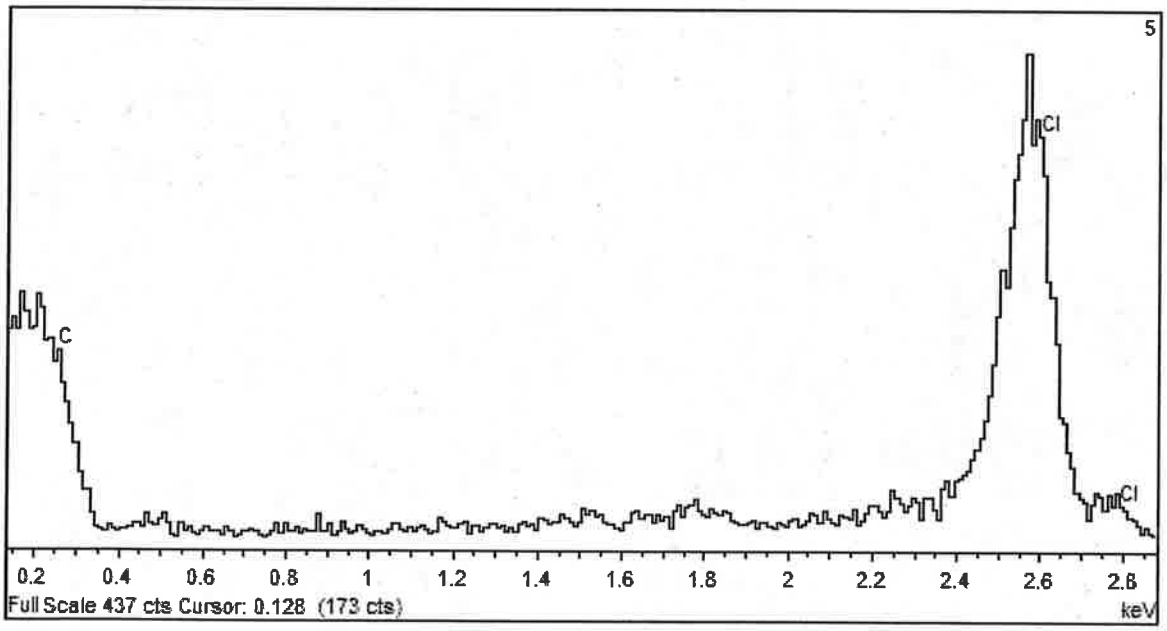

B13 PHOTO-1359

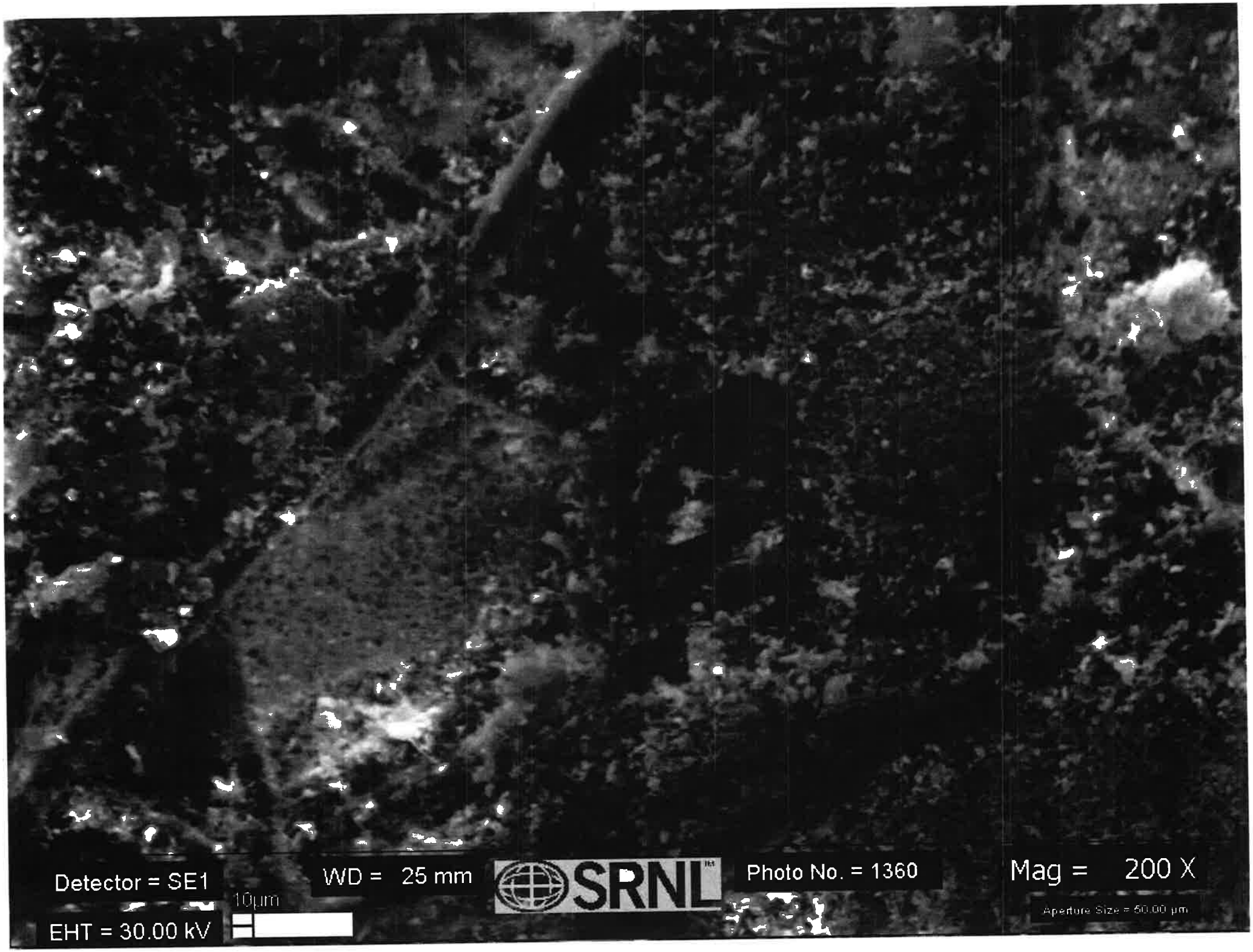


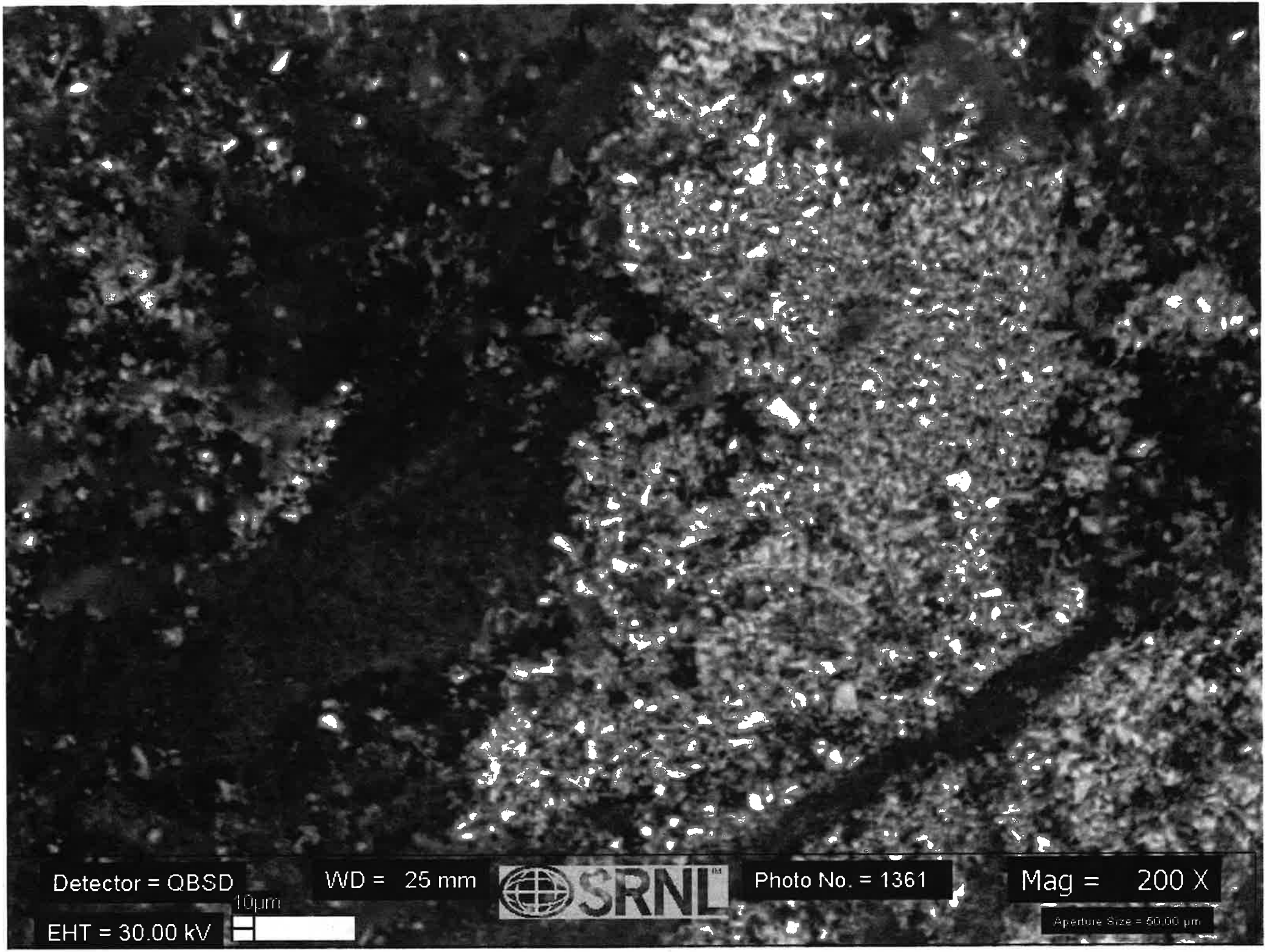

2
C
Na
Cl
Cl
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
keV
Full Scale 1062 cts Cursor: 0.128 (395 cts)

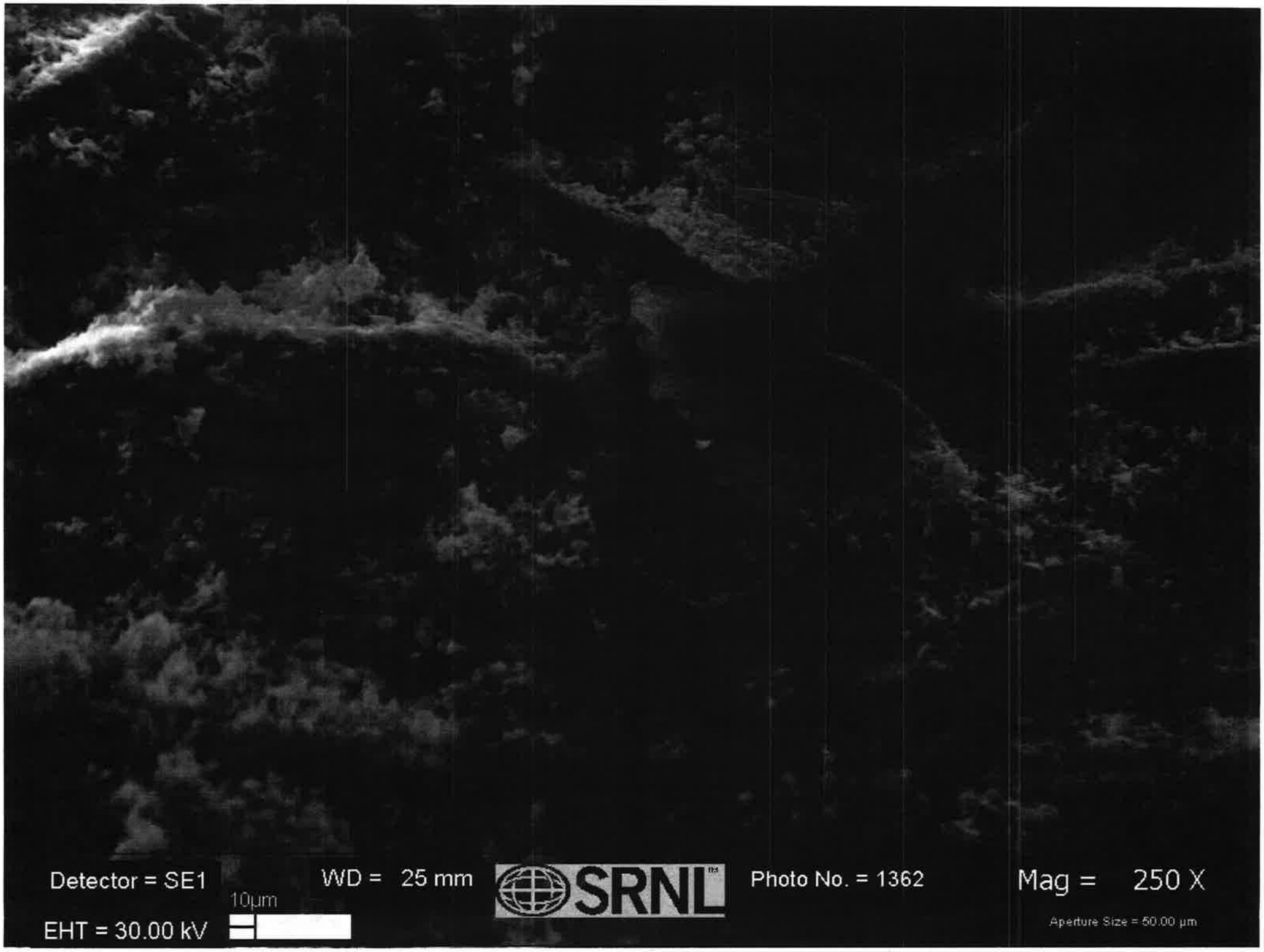

3
Si
C
Mg
O
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
keV
Full Scale 601 cts Cursor: 0.128 (256 cts)

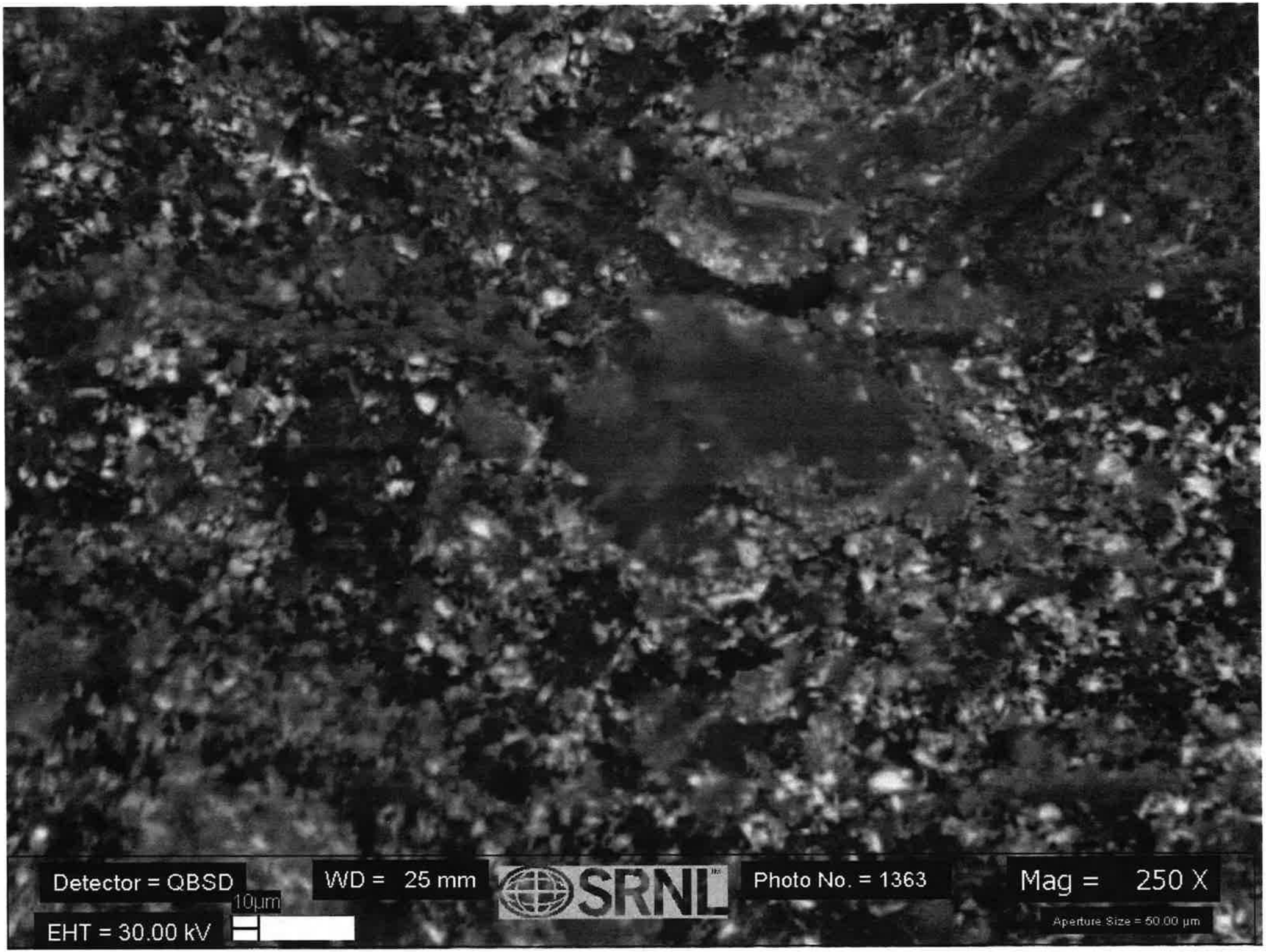

4
Cl
Na
C
Cl
Ca
Ca
0.5
1
1.5
2
2.5
3
3.5
4
Full Scale 1083 cts Cursor: 0.128 (257 cts)
keV

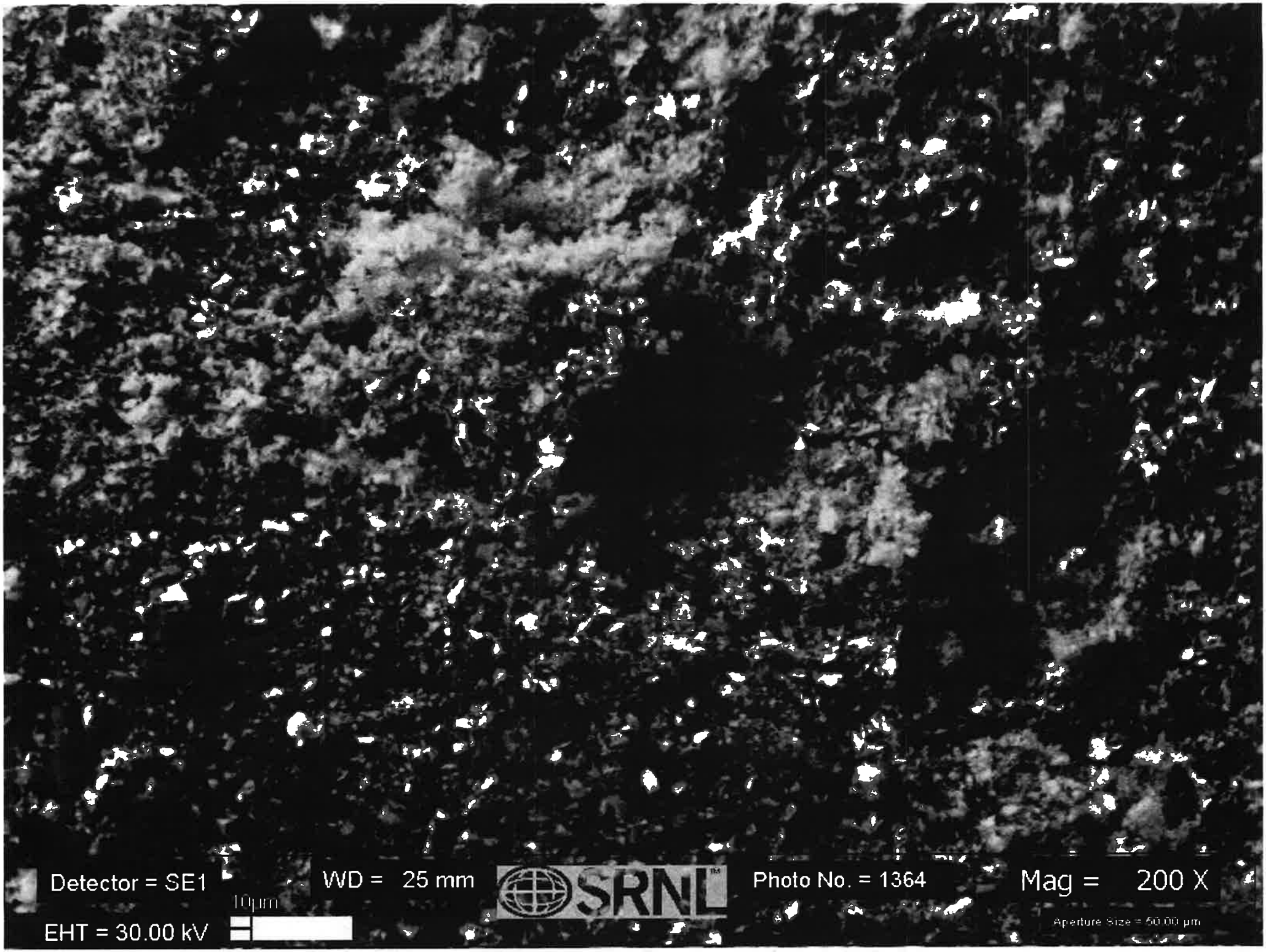

5
Cl
C
Cl
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 437 cts Cursor: 0.128 (173 cts)
keV

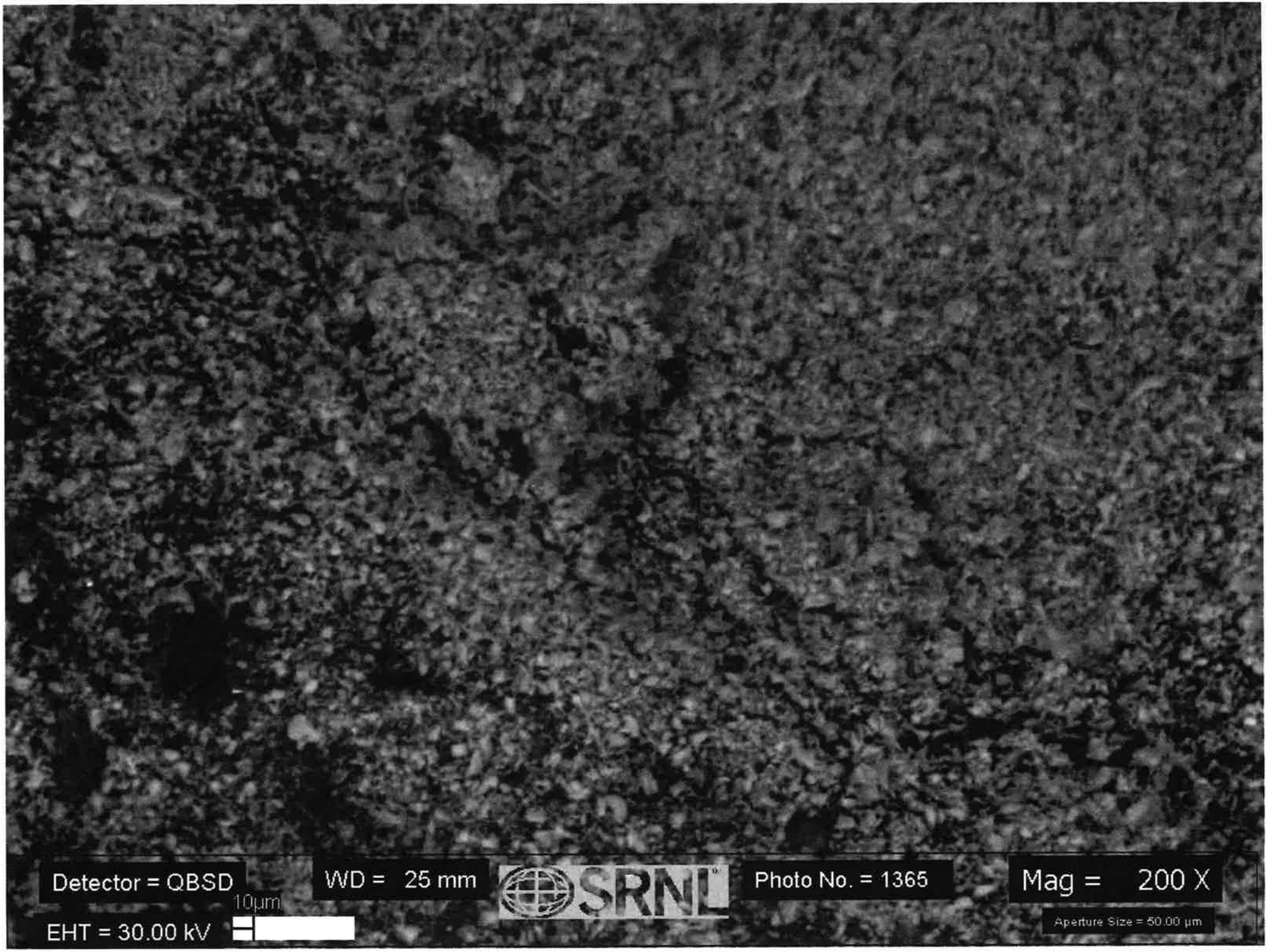

Detector = SE1
EHT = 30.00 kV
10µm
WD = 25 mm
SRNL
Photo No. = 1360
Mag = 200 X
Aperture Size = 50.00 µm


Detector = QBSD
WD = 25 mm
SRNL
Photo No. = 1361
Mag = 200 X
10µm
EHT = 30.00 kV
Aperture Size = 50.00 µm

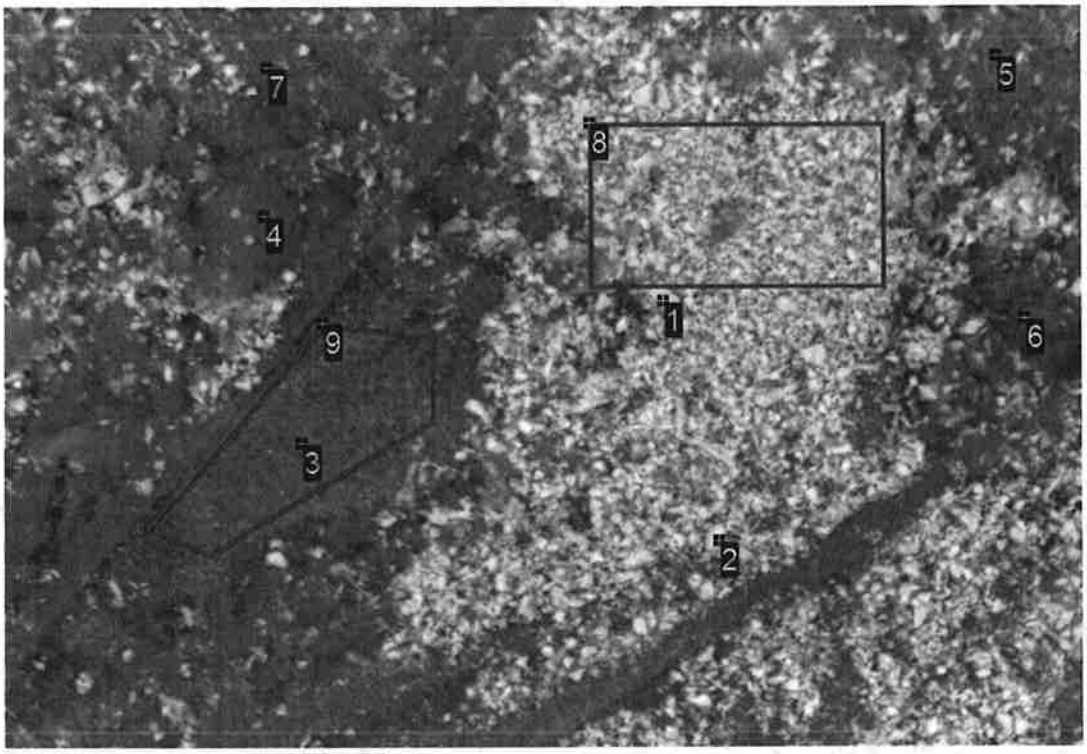

Detector = SE1
WD = 25 mm
SRNL
Photo No. = 1362
Mag = 250 X
10µm
EHT = 30.00 kV
Aperture Size = 50.00 µm


Detector = QBSD
WD = 25 mm
SRNL
Photo No. = 1363
Mag = 250 X
10µm
EHT = 30.00 kV
Aperture Size = 50.00 µm


Detector = SE1
WD = 25 mm
Photo No. = 1364
Mag = 200 X
10µm
EHT = 30.00 kV
Aperture Size = 60.00 µm

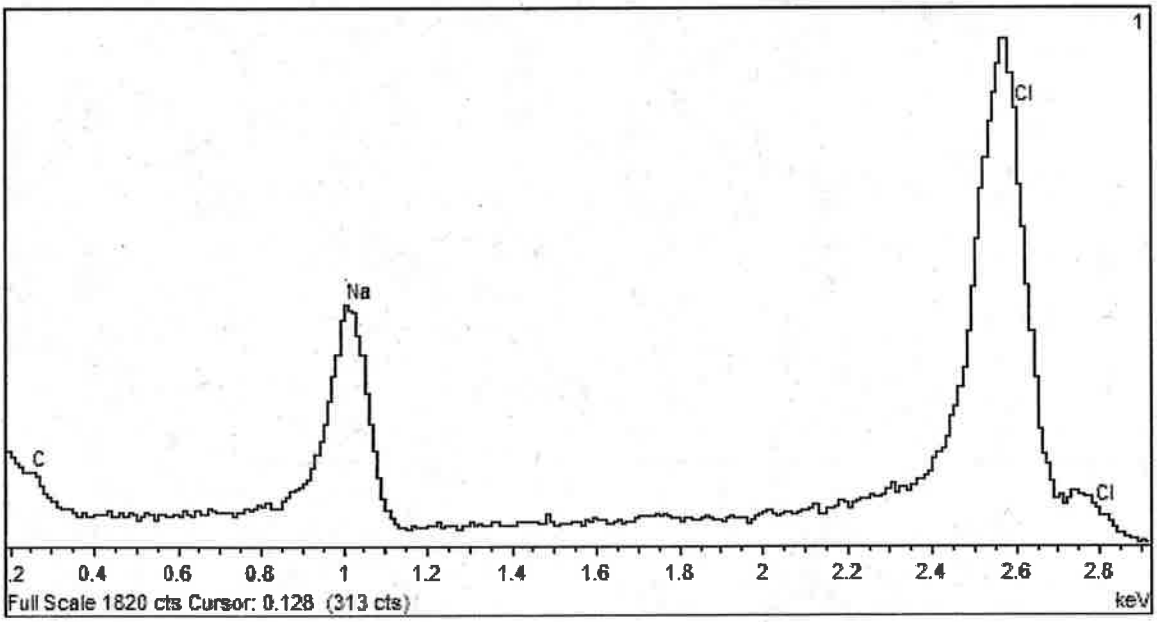

Detector = QBSD
WD = 25 mm
SRNL
Photo No. = 1365
Mag = 200 X
10µm
EHT = 30.00 kV
Aperture Size = 50.00 µm

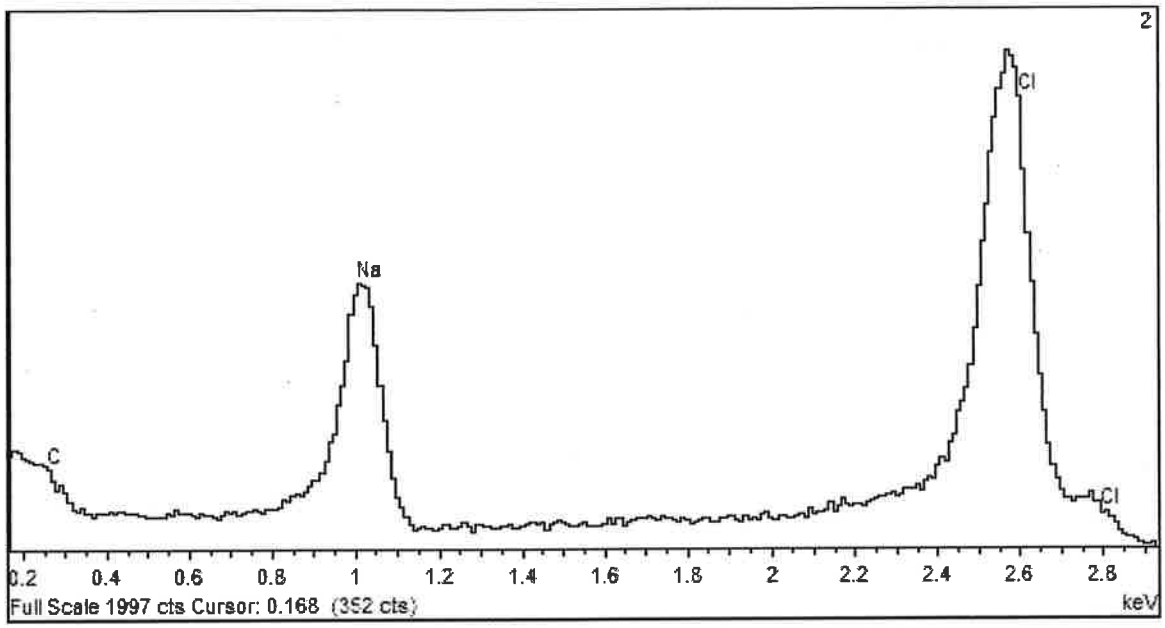
# D11_020514 300309398

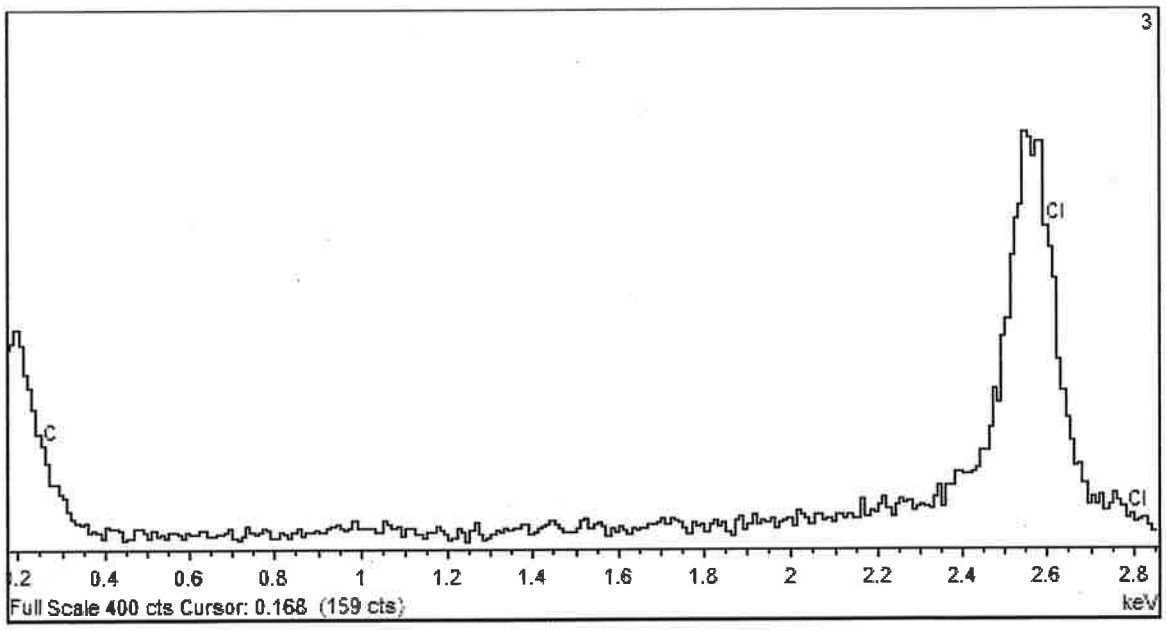


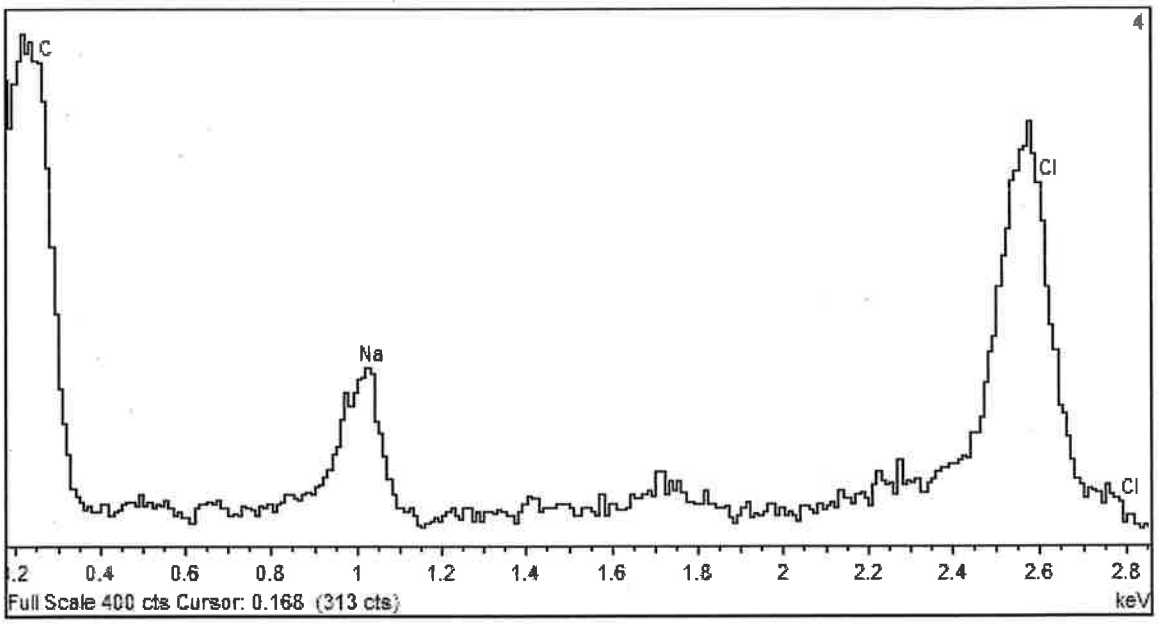

200µm

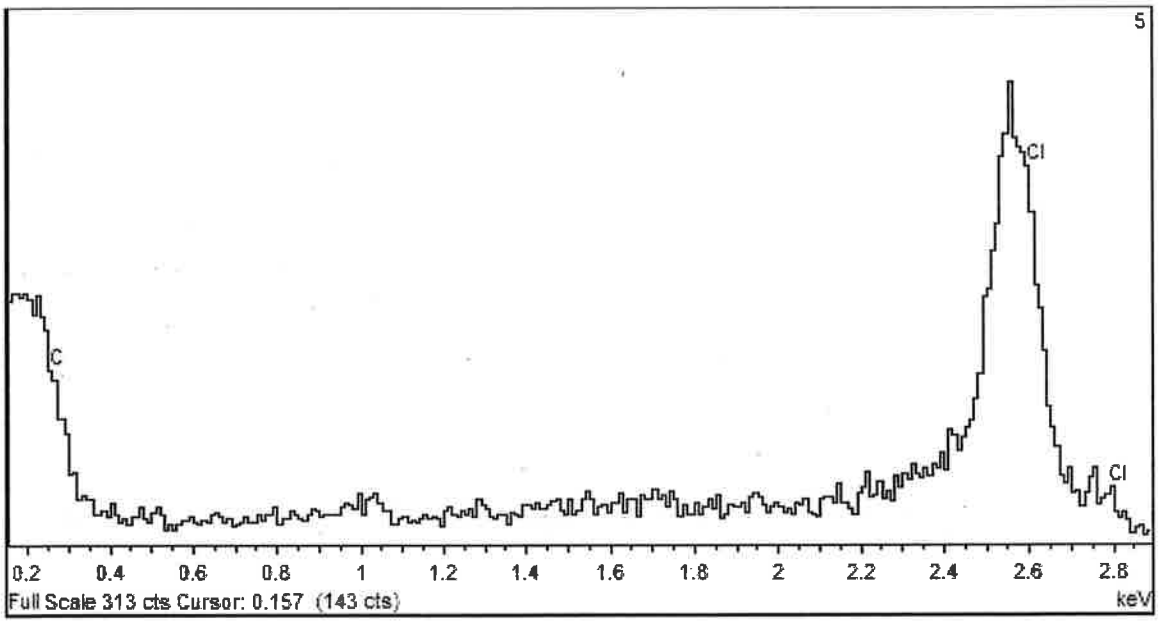
D11 PHOTO-1361

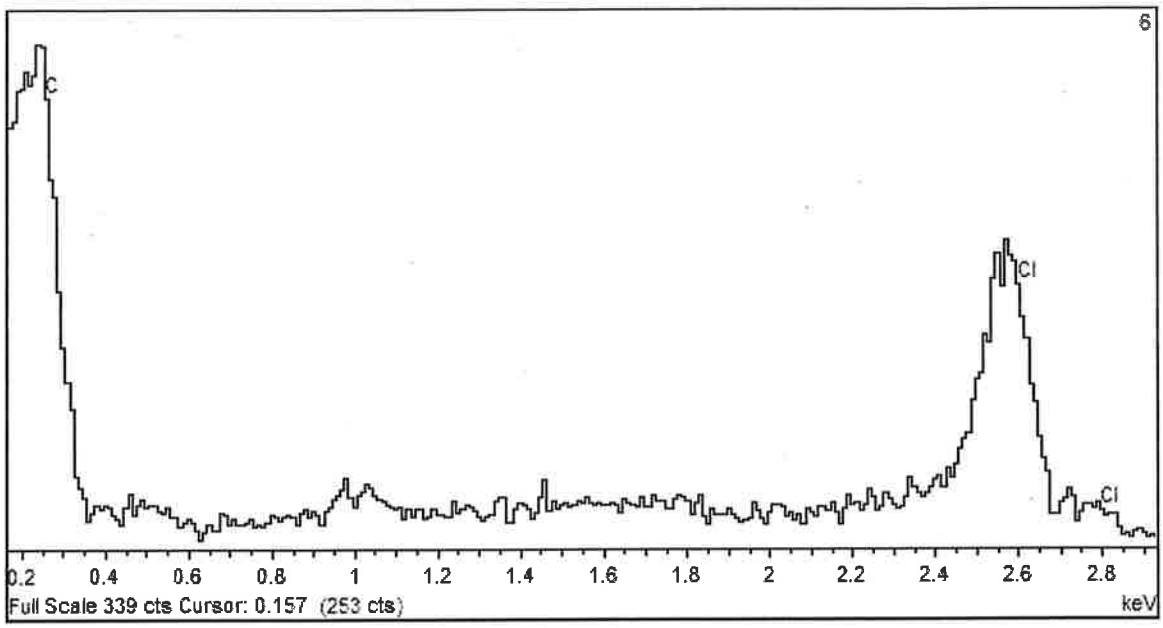


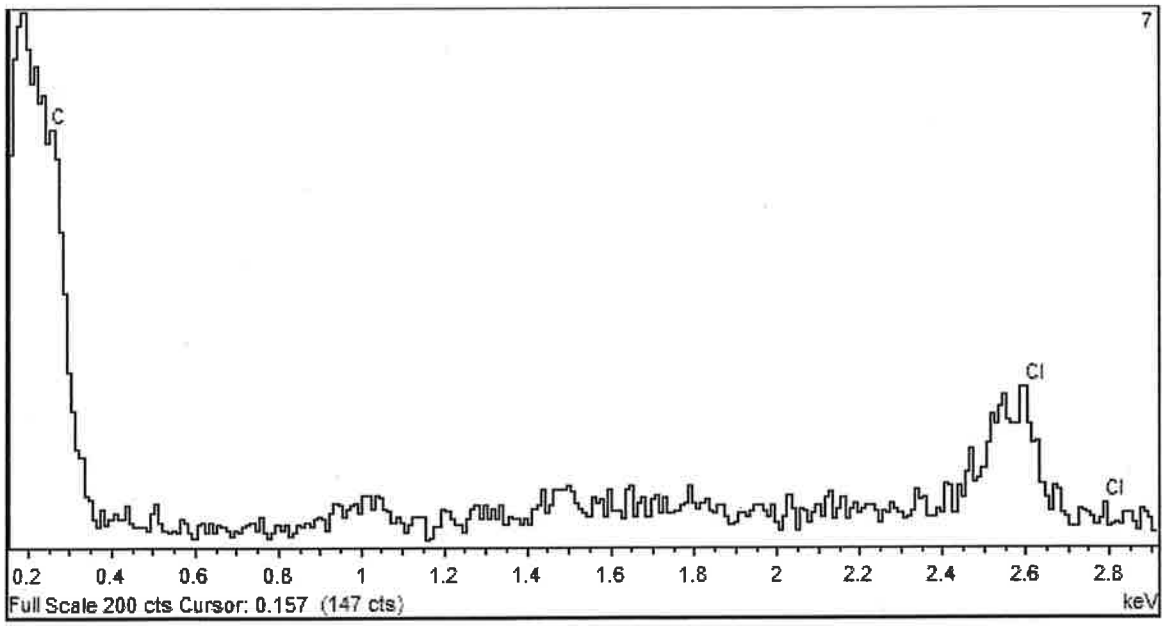

2
Cl
Na
C
Cl
0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 2.6 2.8
Full Scale 1997 cts Cursor: 0.168 (352 cts)
keV

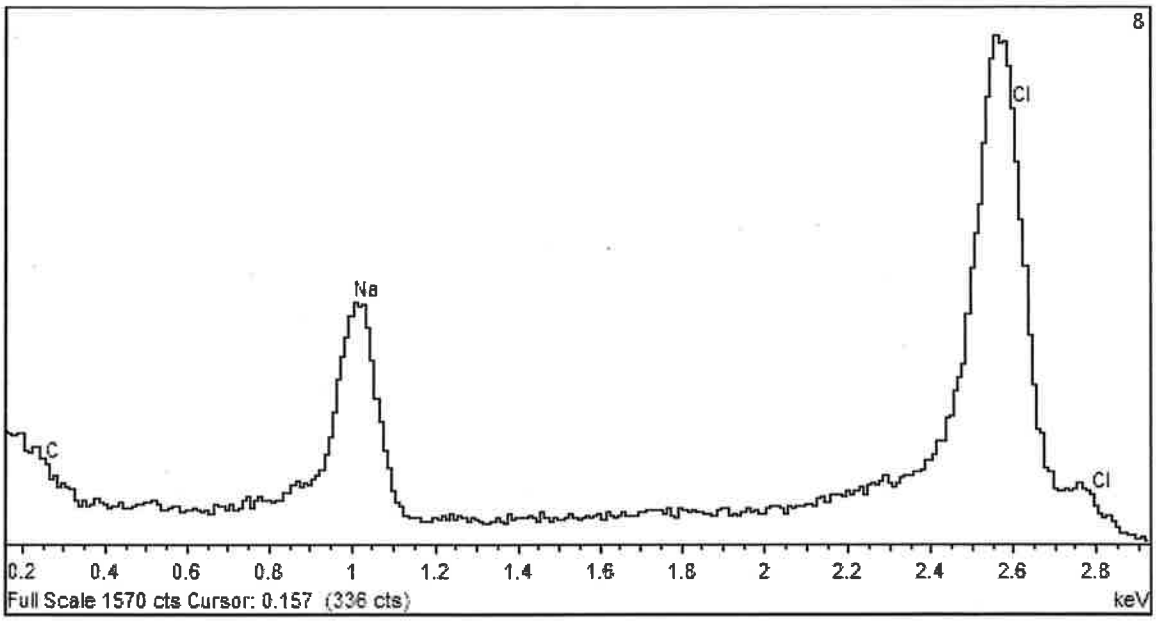

3
Cl
C
Cl
0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 2.6 2.8
Full Scale 400 cts Cursor: 0.168 (159 cts)
keV

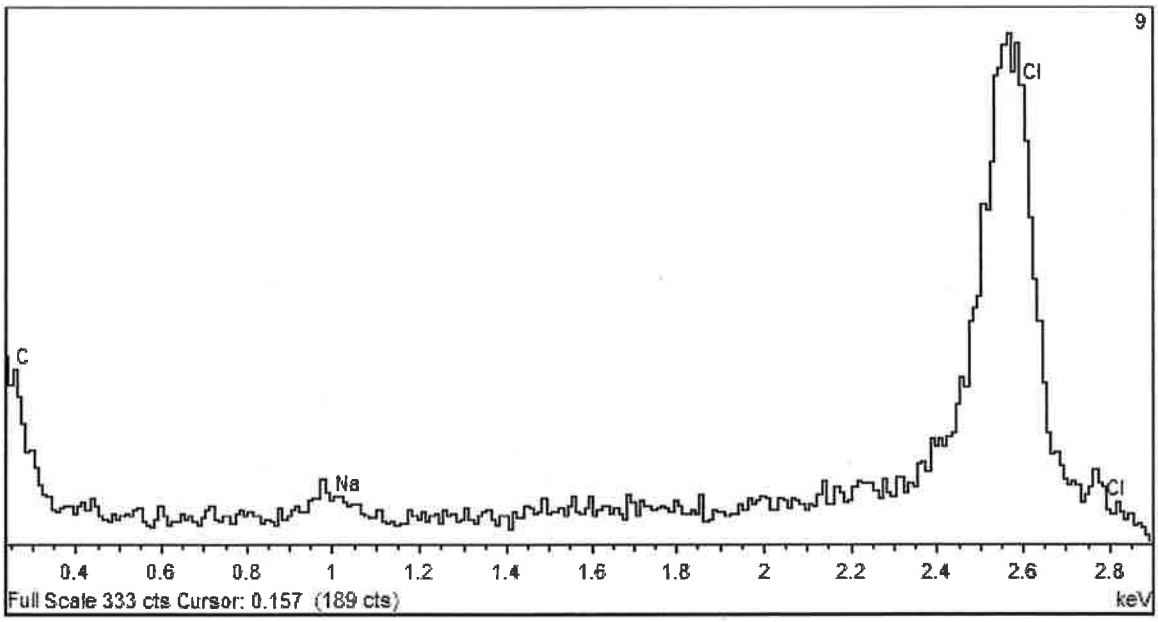

4
C
Na
Cl
Cl
.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 400 cts Cursor: 0.168 (313 cts)
keV

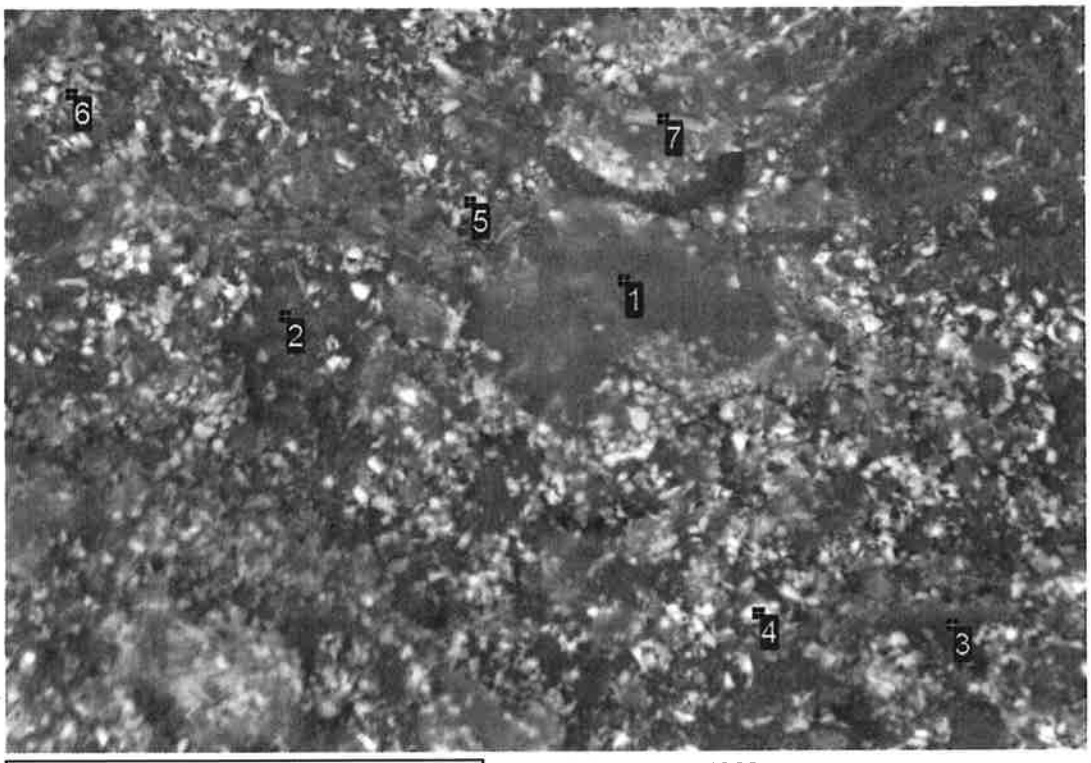

5
Cl
C
Cl
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 313 cts Cursor: 0.157 (143 cts)
keV


6
C
Cl
Cl
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 339 cts Cursor: 0.157 (253 cts)
keV


7
C
Cl
Cl
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 200 cts Cursor: 0.157 (147 cts)
keV

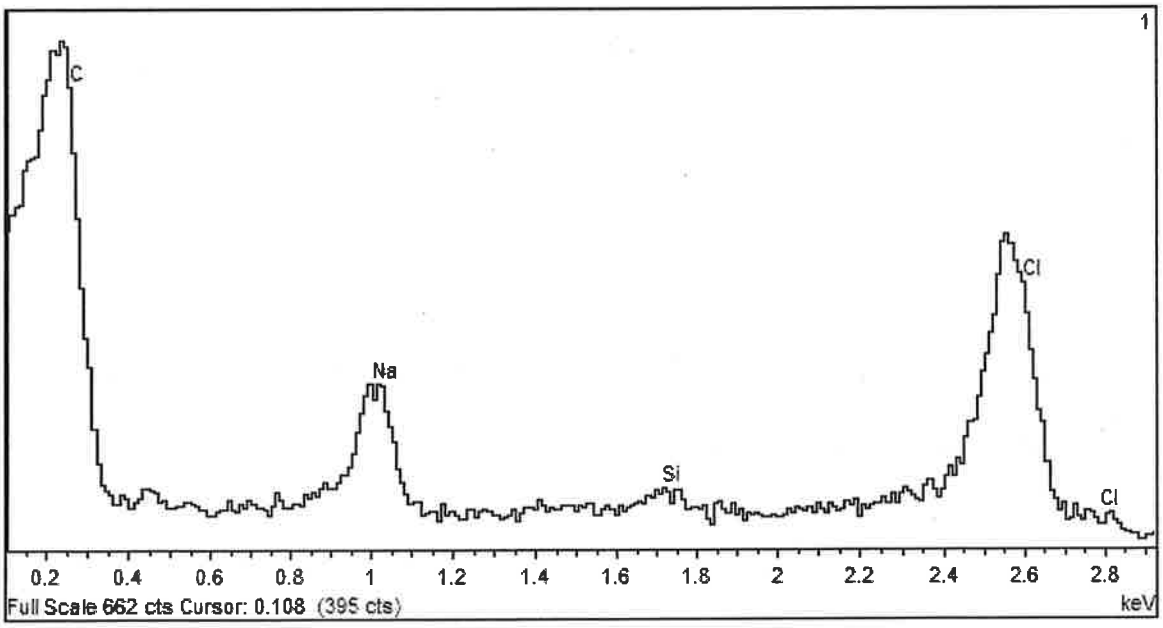

8
Cl
Na
C
Cl
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 1570 cts Cursor: 0.157 (336 cts)
keV

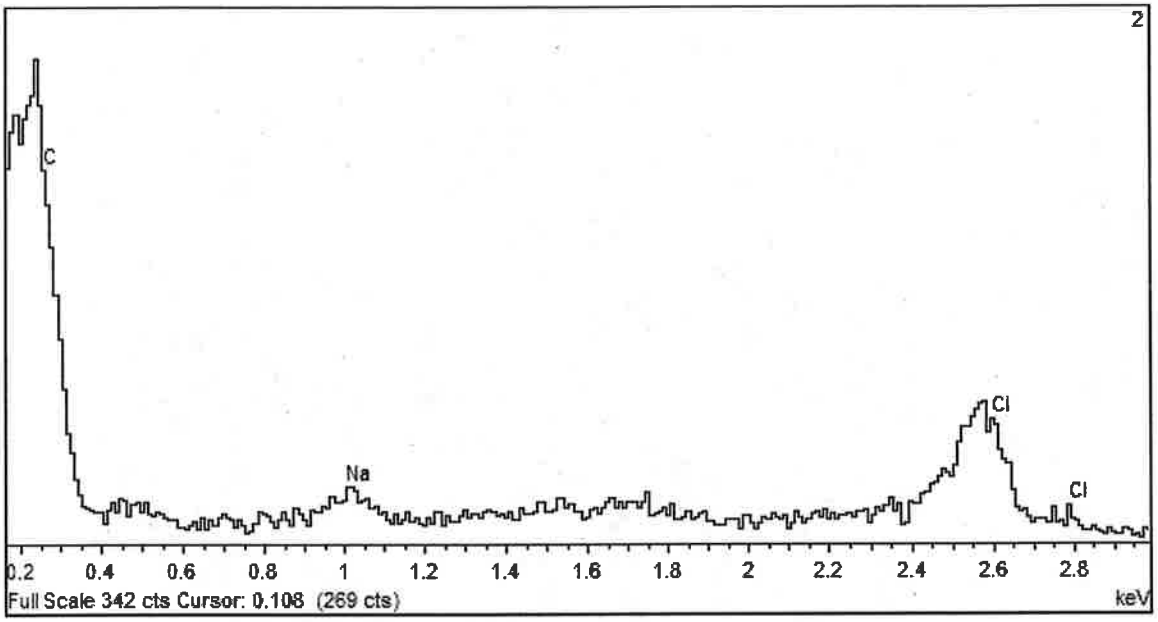

9
Cl
C
Na
Cl
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 333 cts Cursor: 0.157 (189 cts)
keV

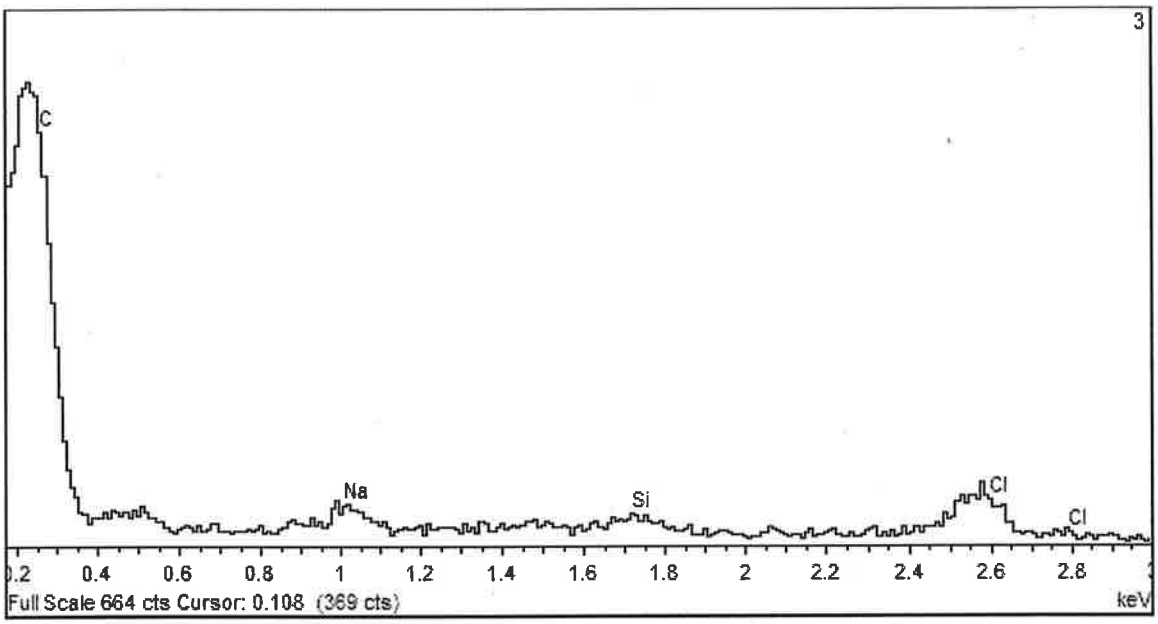


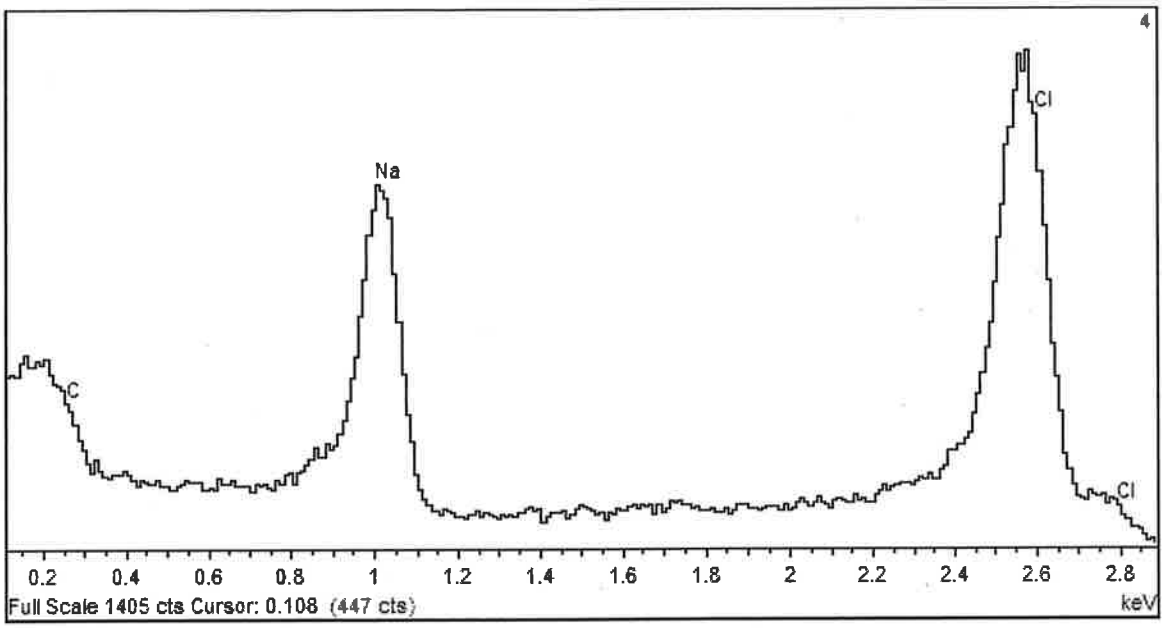

200µm

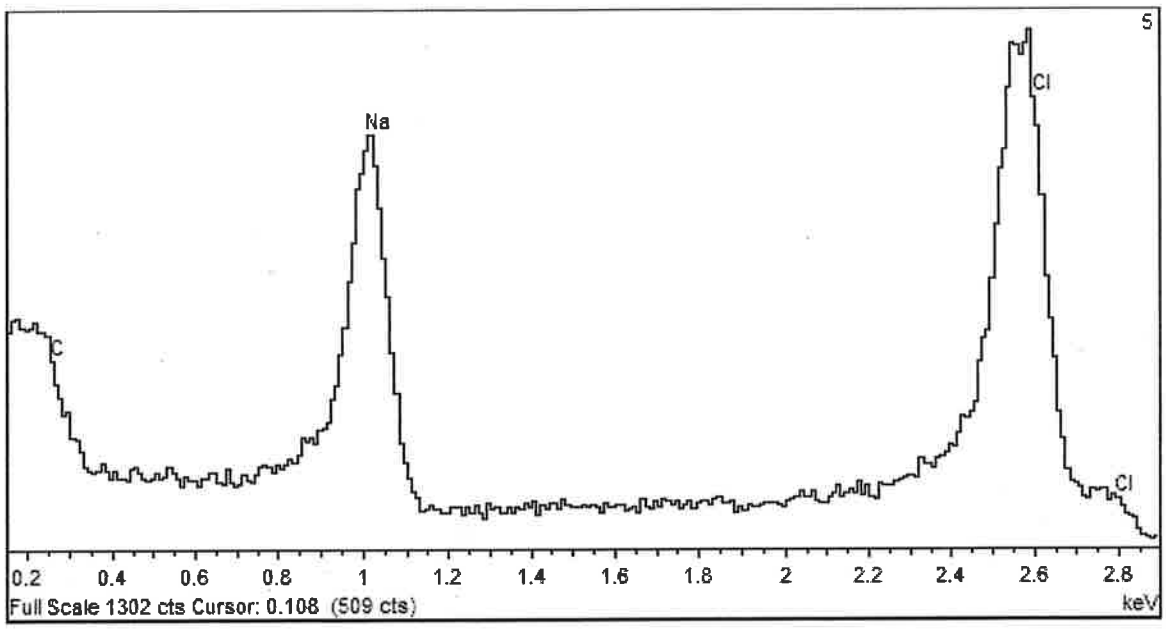
D11 PHOTO-1363

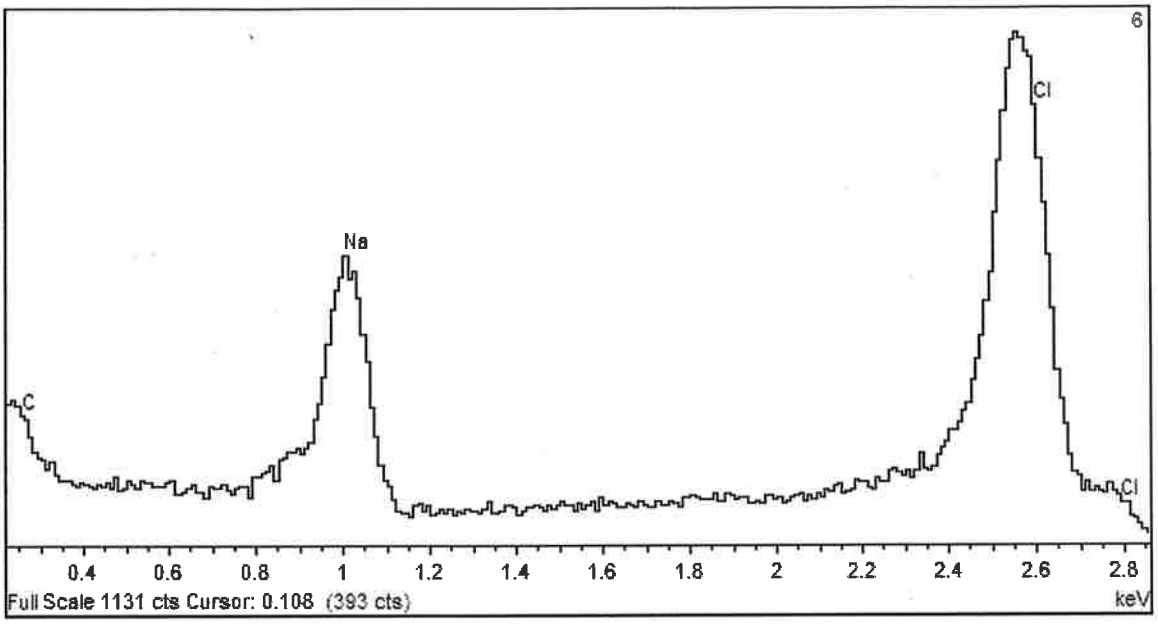


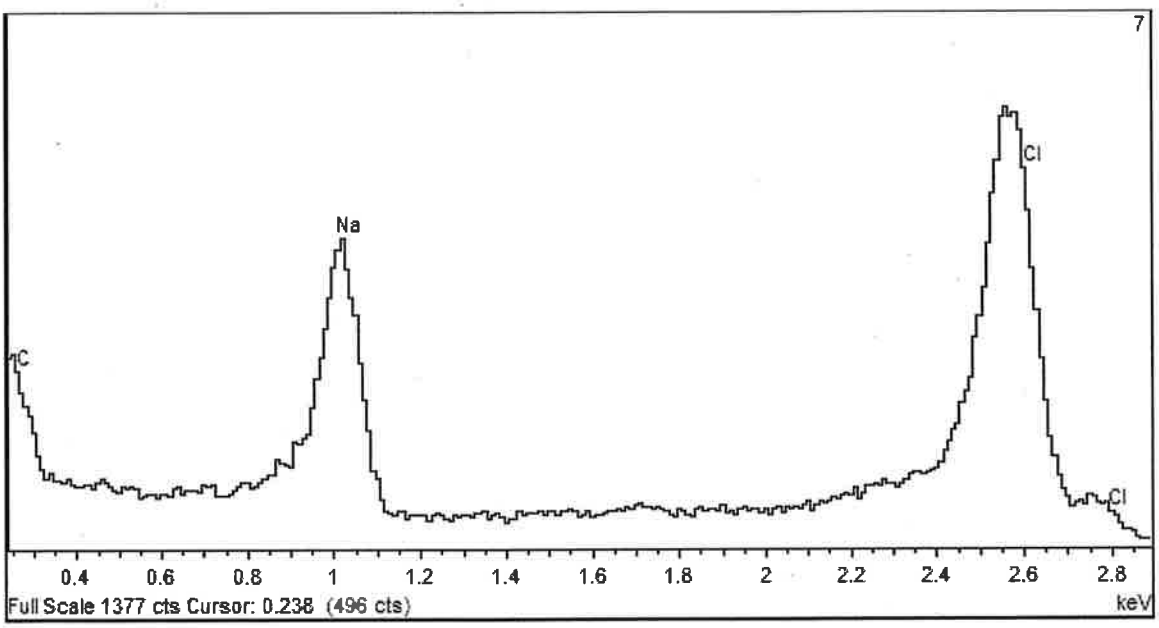

2
C
Na
Cl
Cl
0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 2.6 2.8
Full Scale 342 cts Cursor: 0.108 (269 cts)
keV

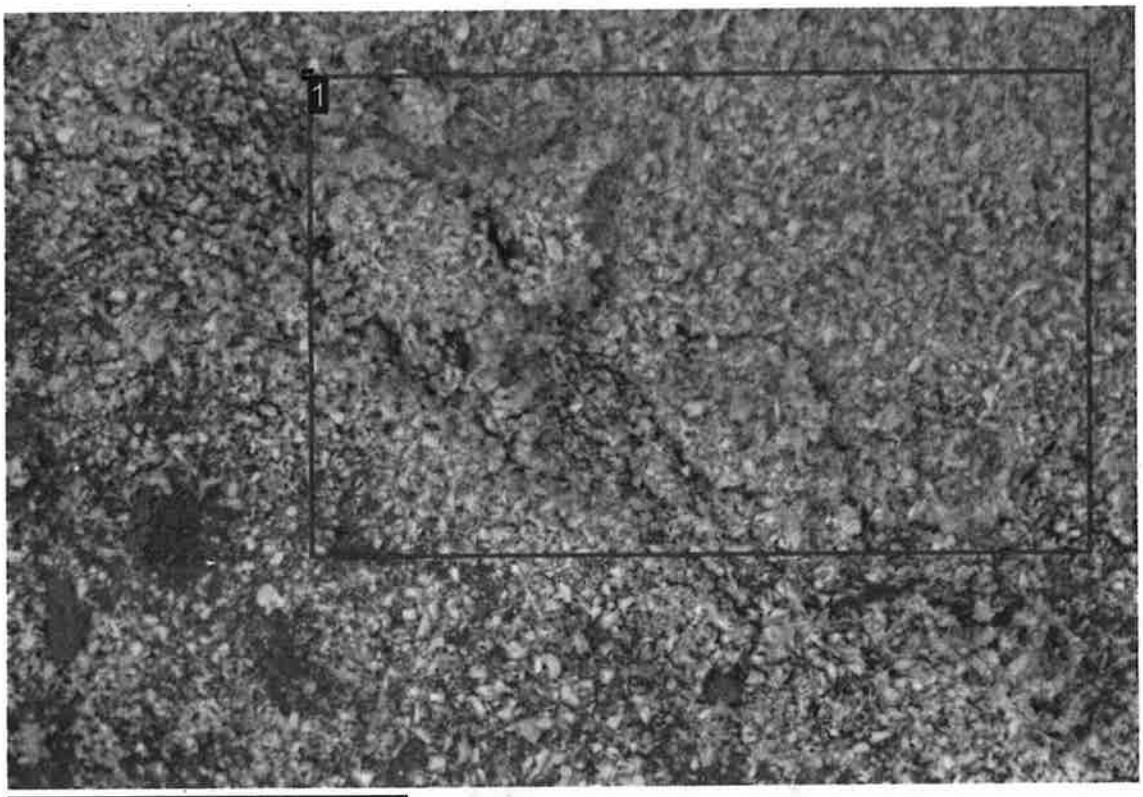

3
C
Na
Si
Cl
Cl
0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 2.6 2.8
Full Scale 664 cts Cursor: 0.108 (369 cts)
keV


4
Na
Cl
C
Cl
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 1405 cts Cursor: 0.108 (447 cts)
keV


5
Na
Cl
C
Cl
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 1302 cts Cursor: 0.108 (509 cts)
keV

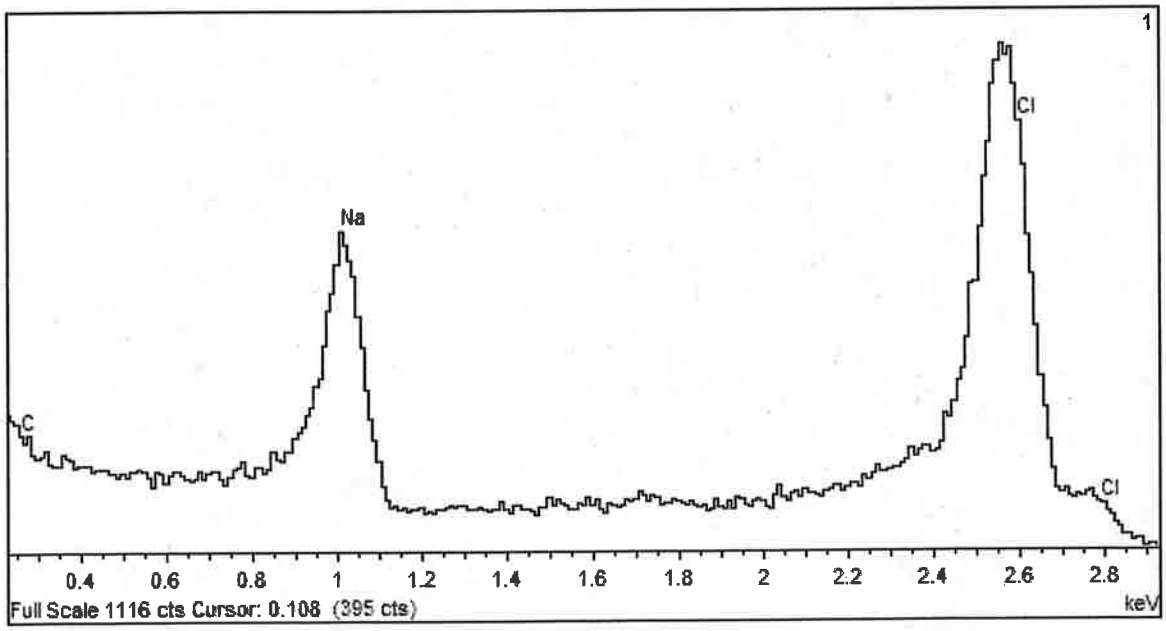

6
Cl
Na
C
Cl
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 1131 cts Cursor: 0.108 (393 cts)
keV

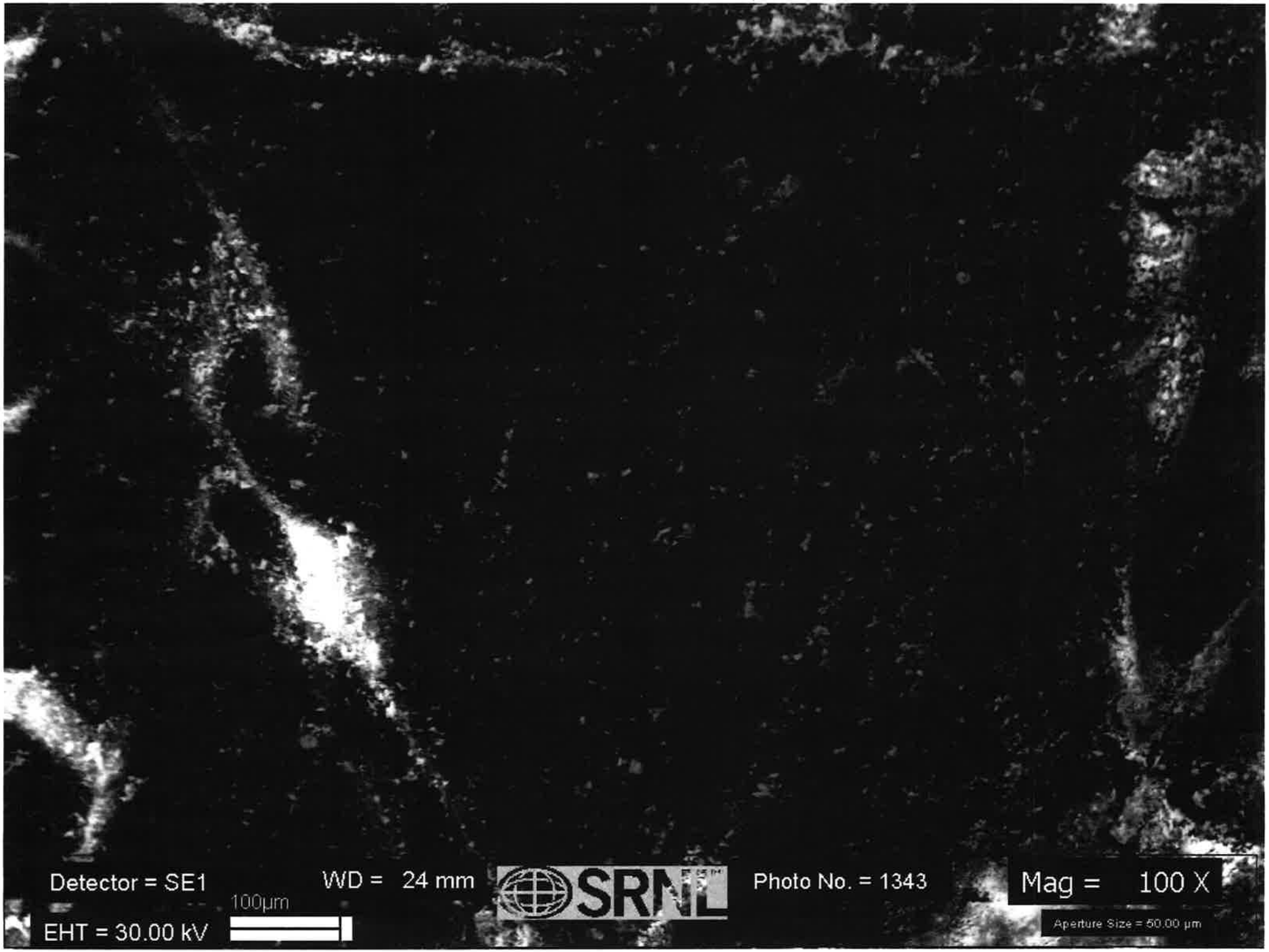

7
Cl
Na
C
Cl
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 1377 cts Cursor: 0.238 (496 cts)
keV

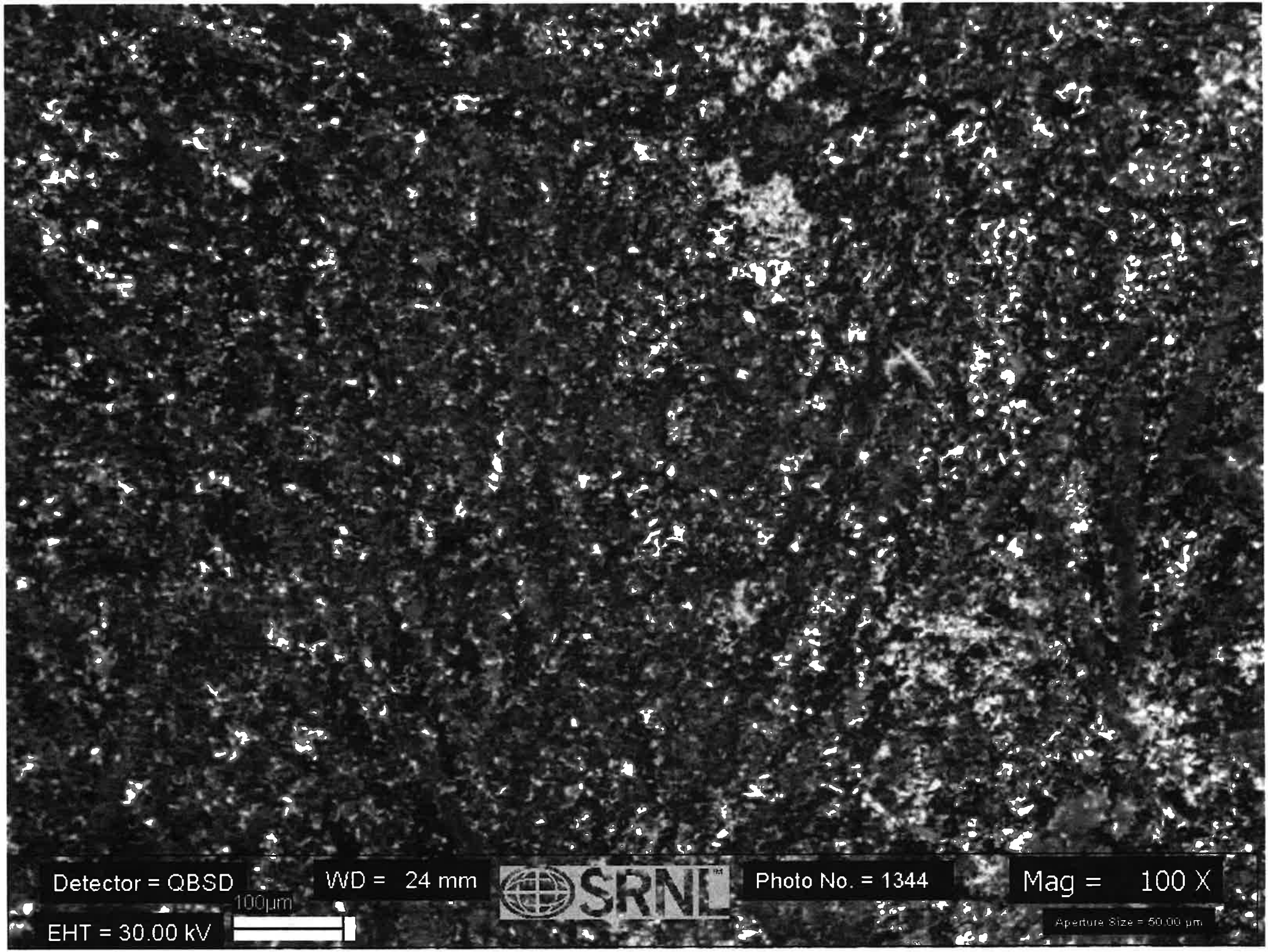


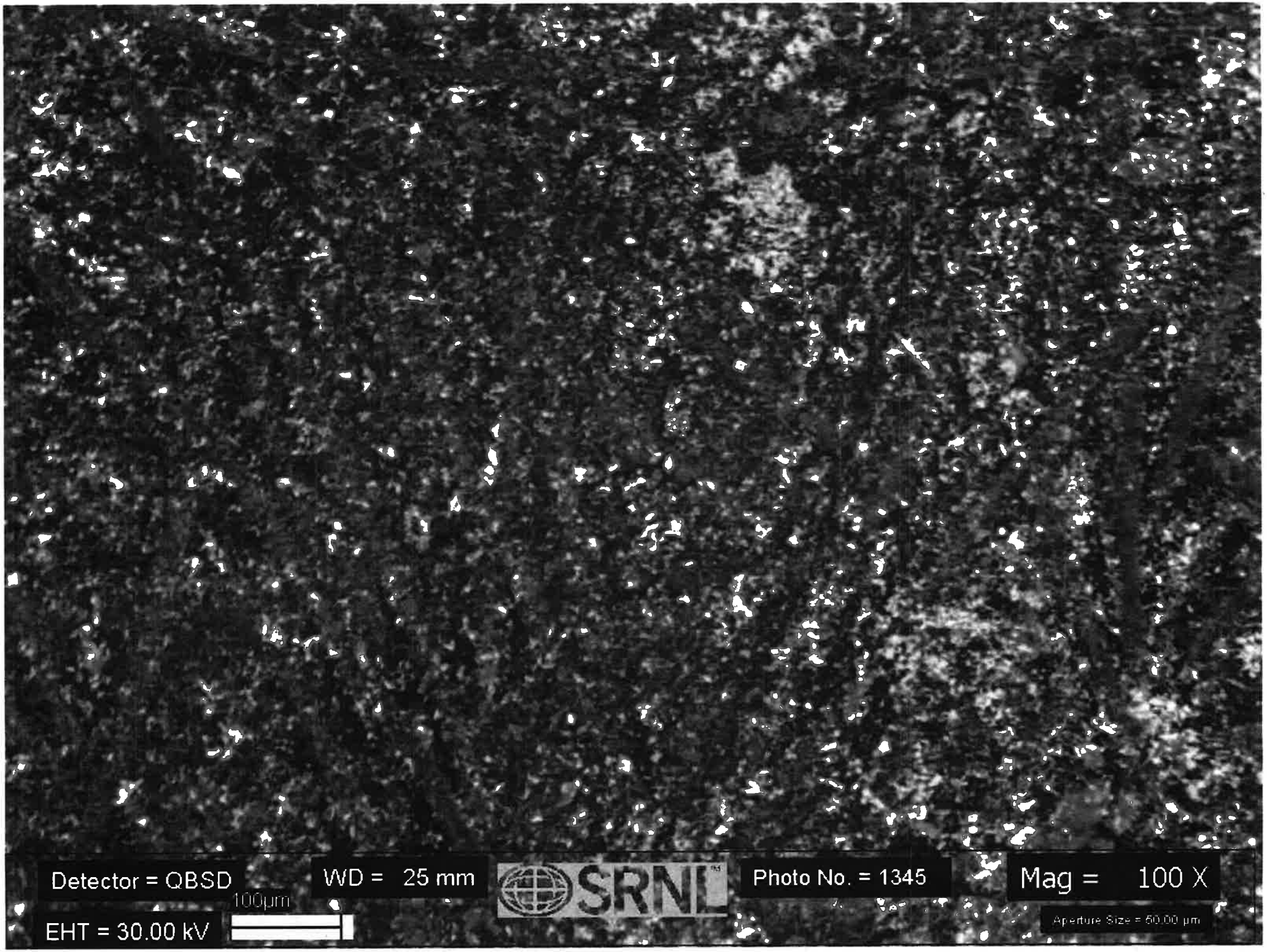

200µm

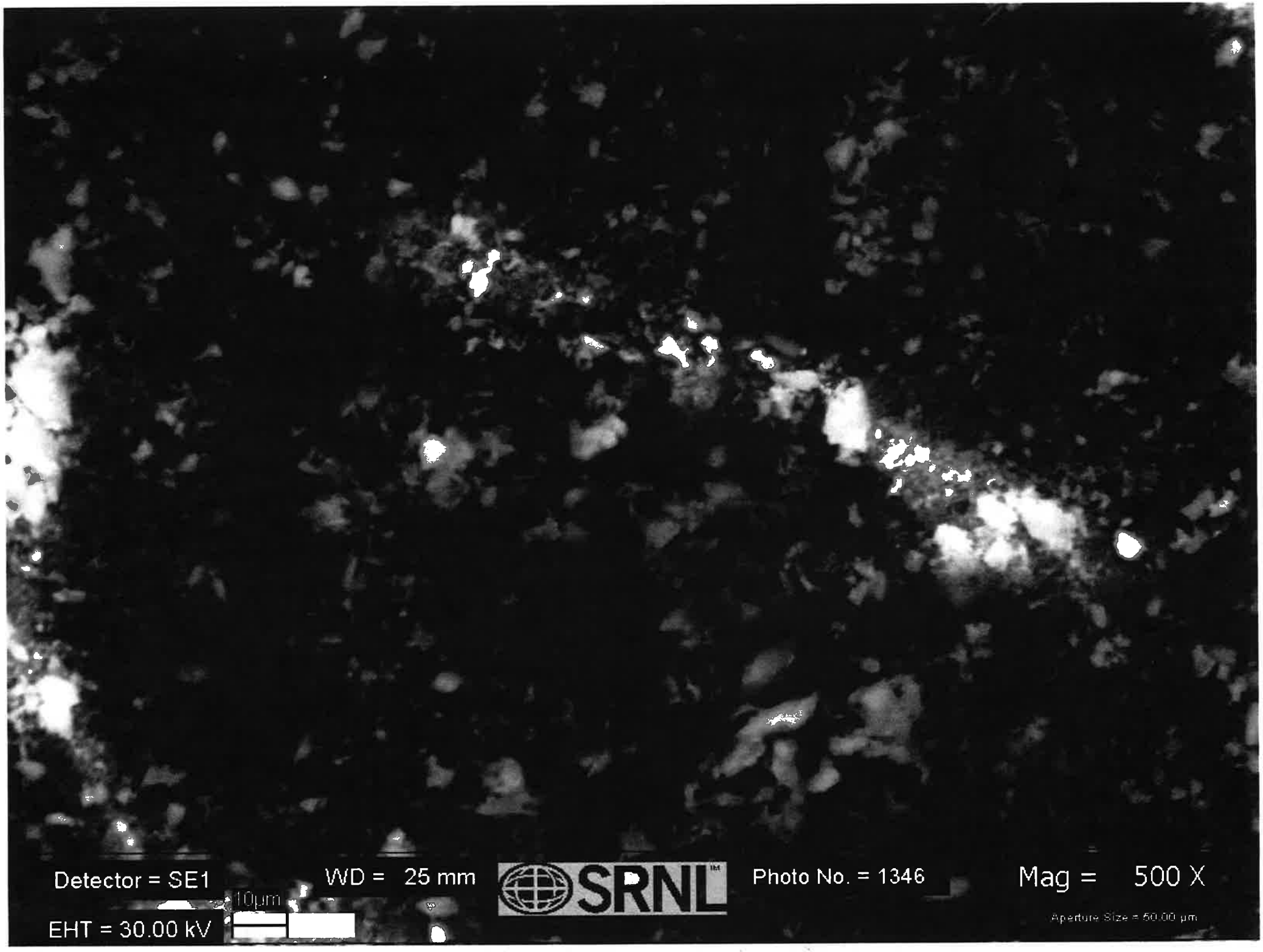
D11 PHOTO-1365

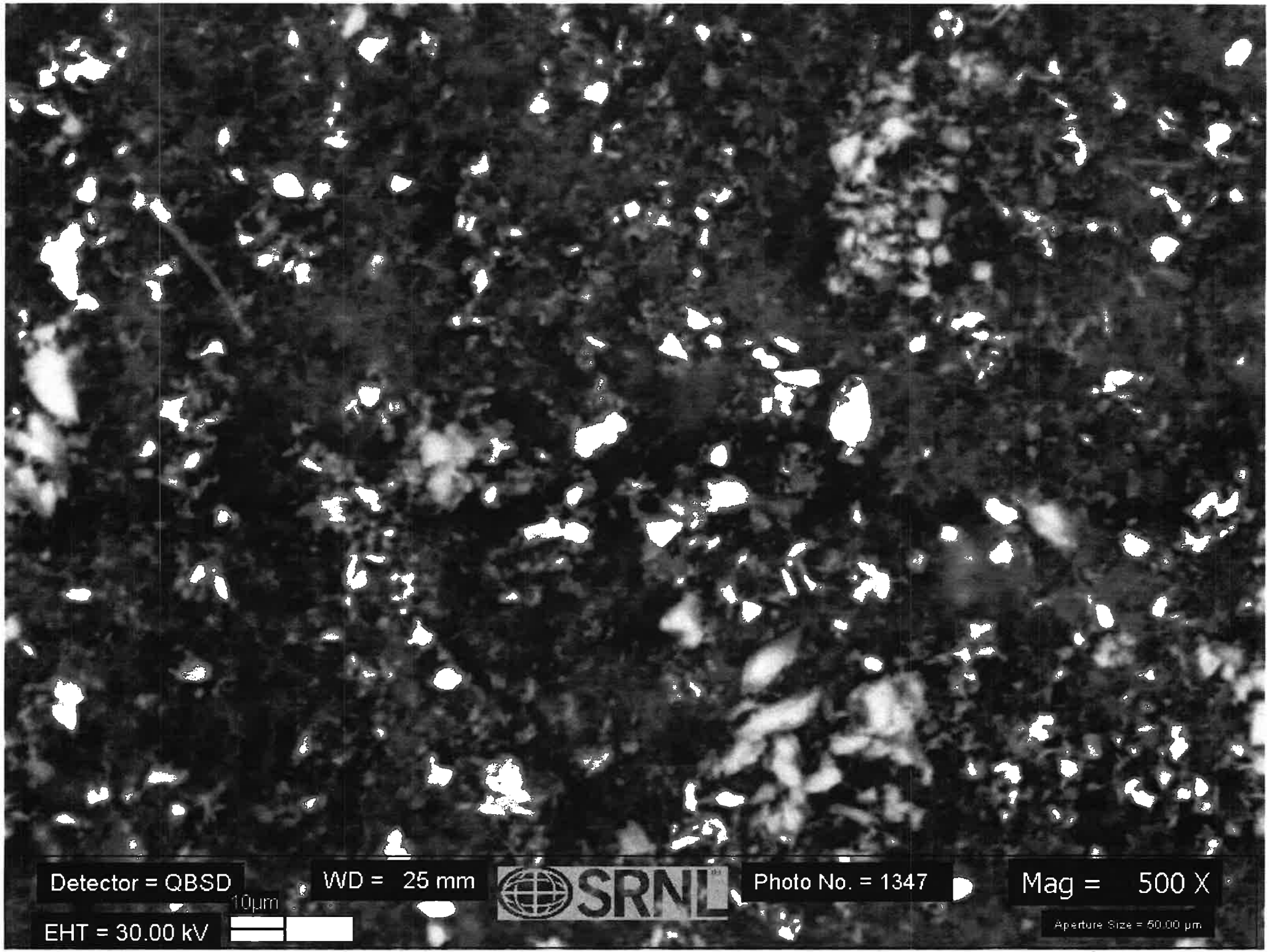



Detector = SE1
WD = 24 mm
SRNL
Photo No. = 1343
Mag = 100 X
100µm
EHT = 30.00 kV
Aperture Size = 50.00 µm

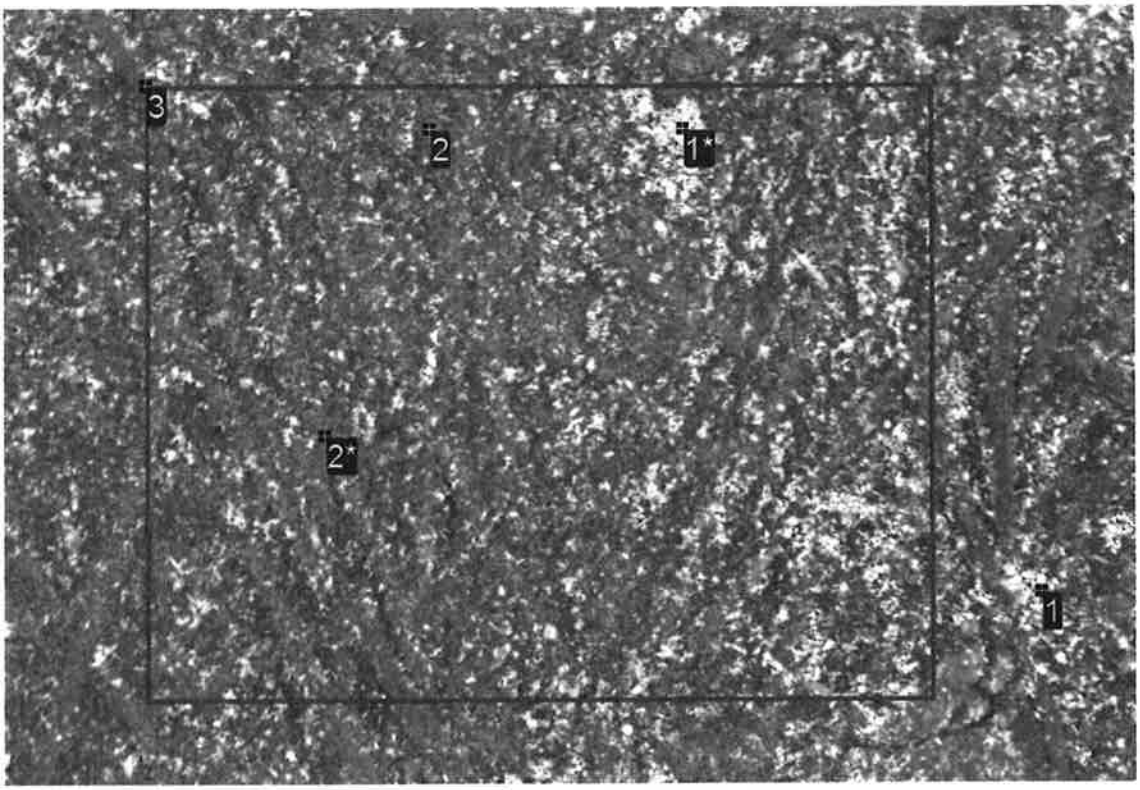

Detector = QBSD
WD = 24 mm
SRNL
Photo No. = 1344
Mag = 100 X
100µm
EHT = 30.00 kV
Aperture Size = 50.00 µm


Detector = QBSD
WD = 25 mm
SRNL
Photo No. = 1345
Mag = 100 X
100µm
EHT = 30.00 kV
Aperture Size = 60.00 µm

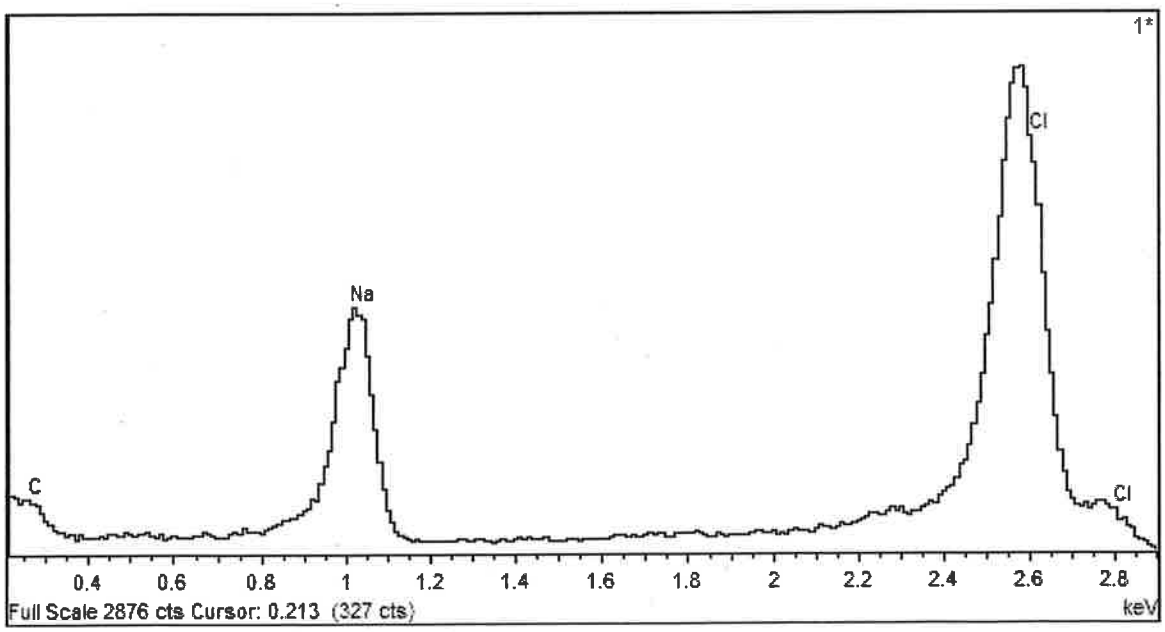

Detector = SE1
WD = 25 mm
SRNL
Photo No. = 1346
Mag = 500 X
10µm
EHT = 30.00 kV
Aperture Size = 50.00 µm

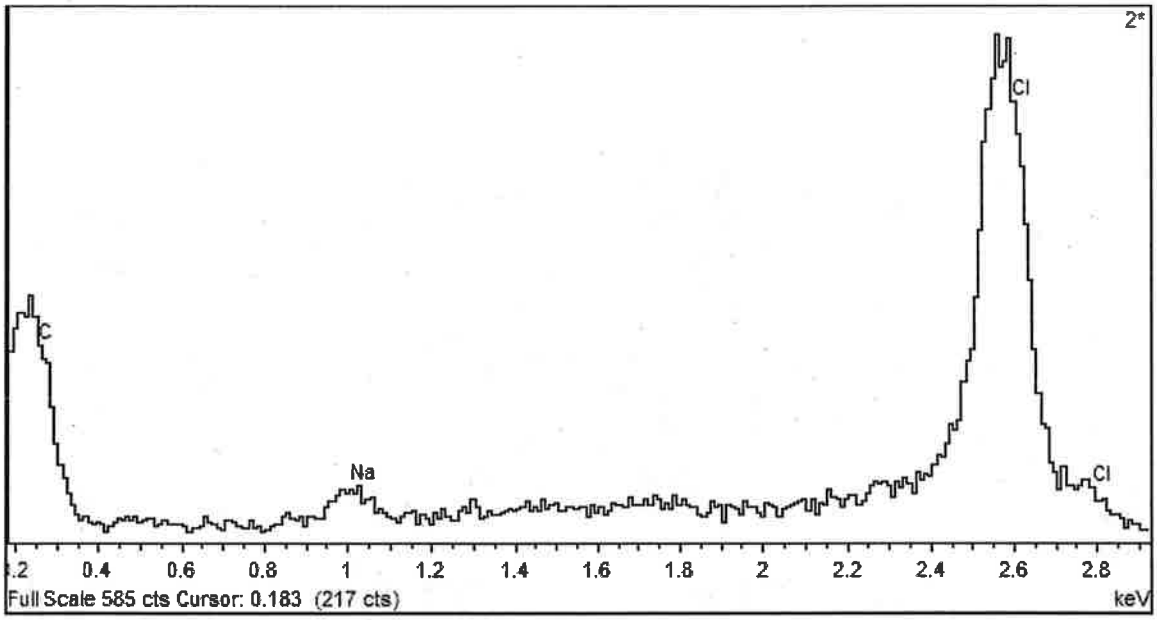

Detector = QBSD
WD = 25 mm
SRNL
Photo No. = 1347
Mag = 500 X
10µm
EHT = 30.00 kV
Aperture Size = 50.00 µm

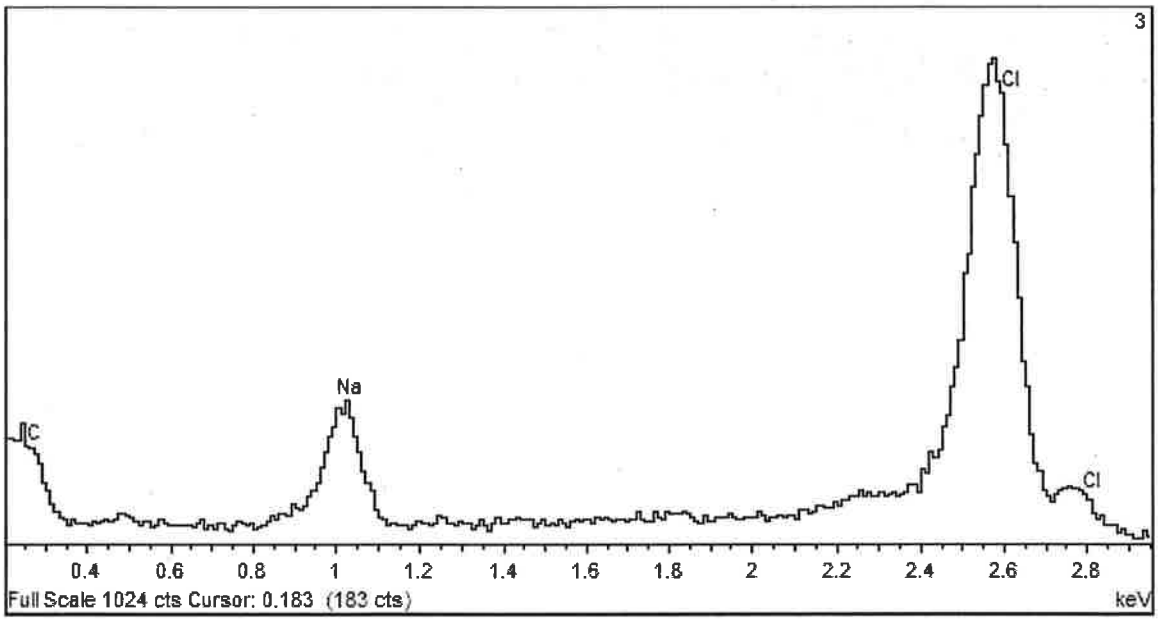
# D12_020514 300309399

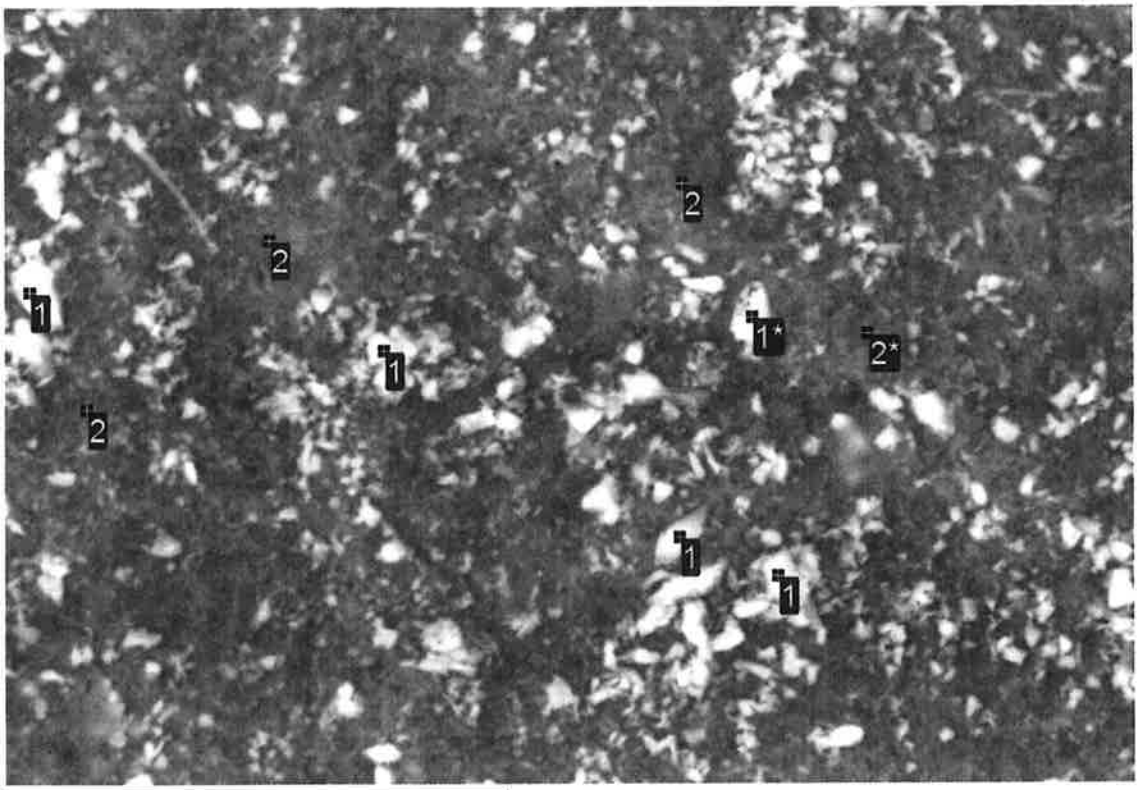



500µm D12 PHOTO-1344

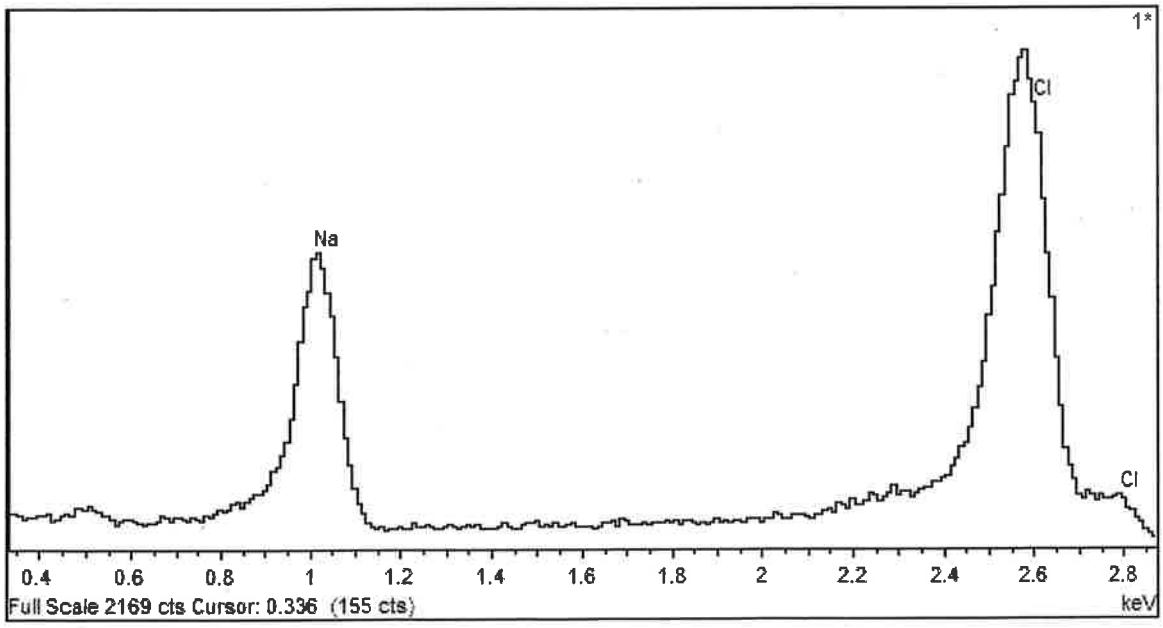


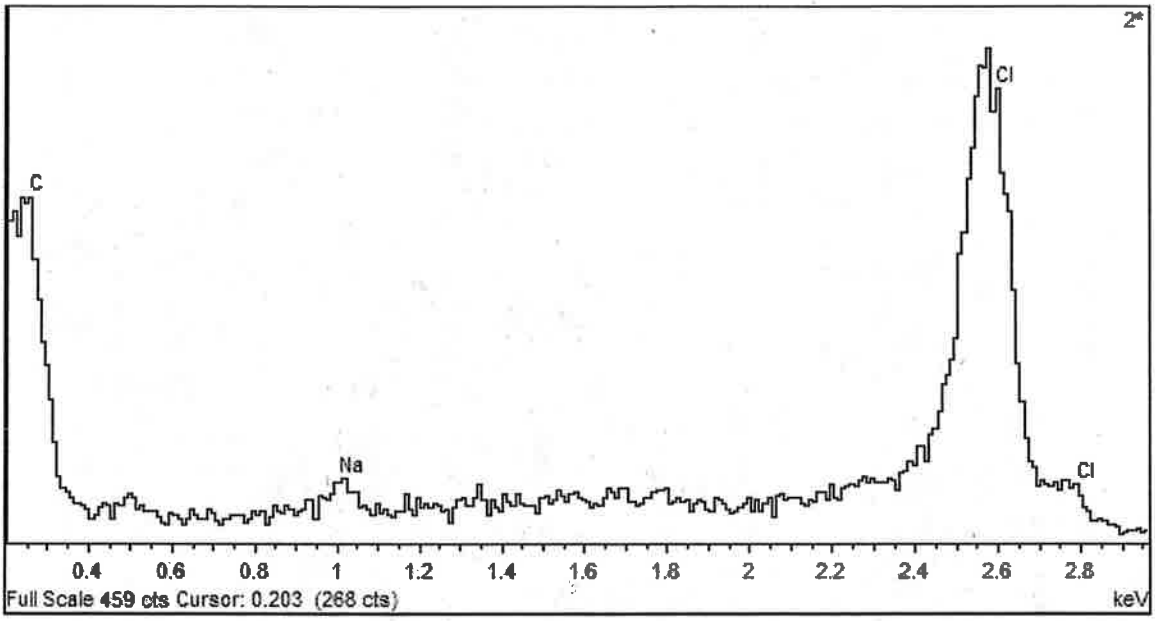

2*
Cl
C
Na
Cl
.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 2.6 2.8
Full Scale 585 cts Cursor: 0.183 (217 cts)
keV


3
Cl
Na
C
Cl
0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 2.6 2.8
Full Scale 1024 cts Cursor: 0.183 (183 cts)
keV

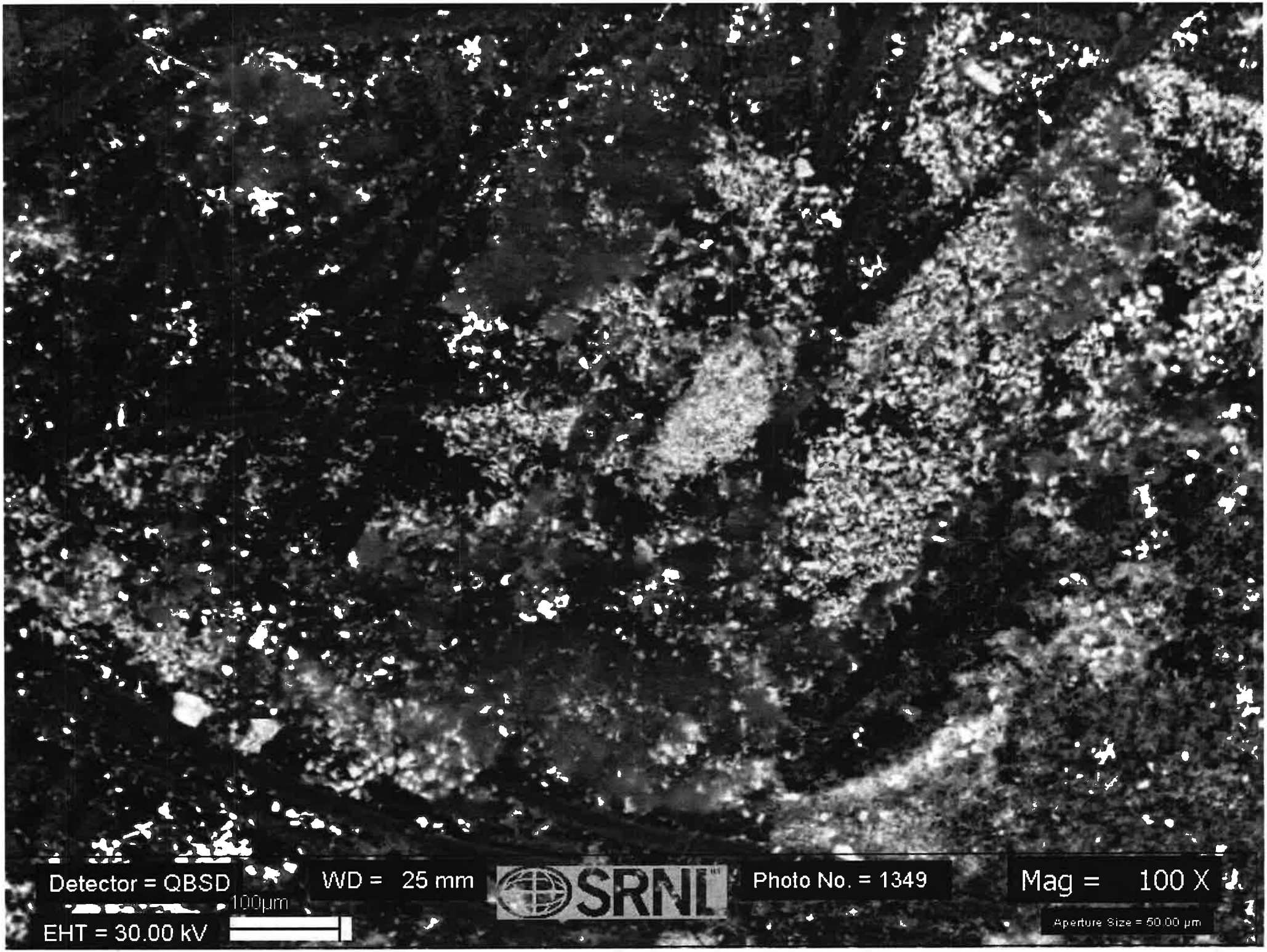


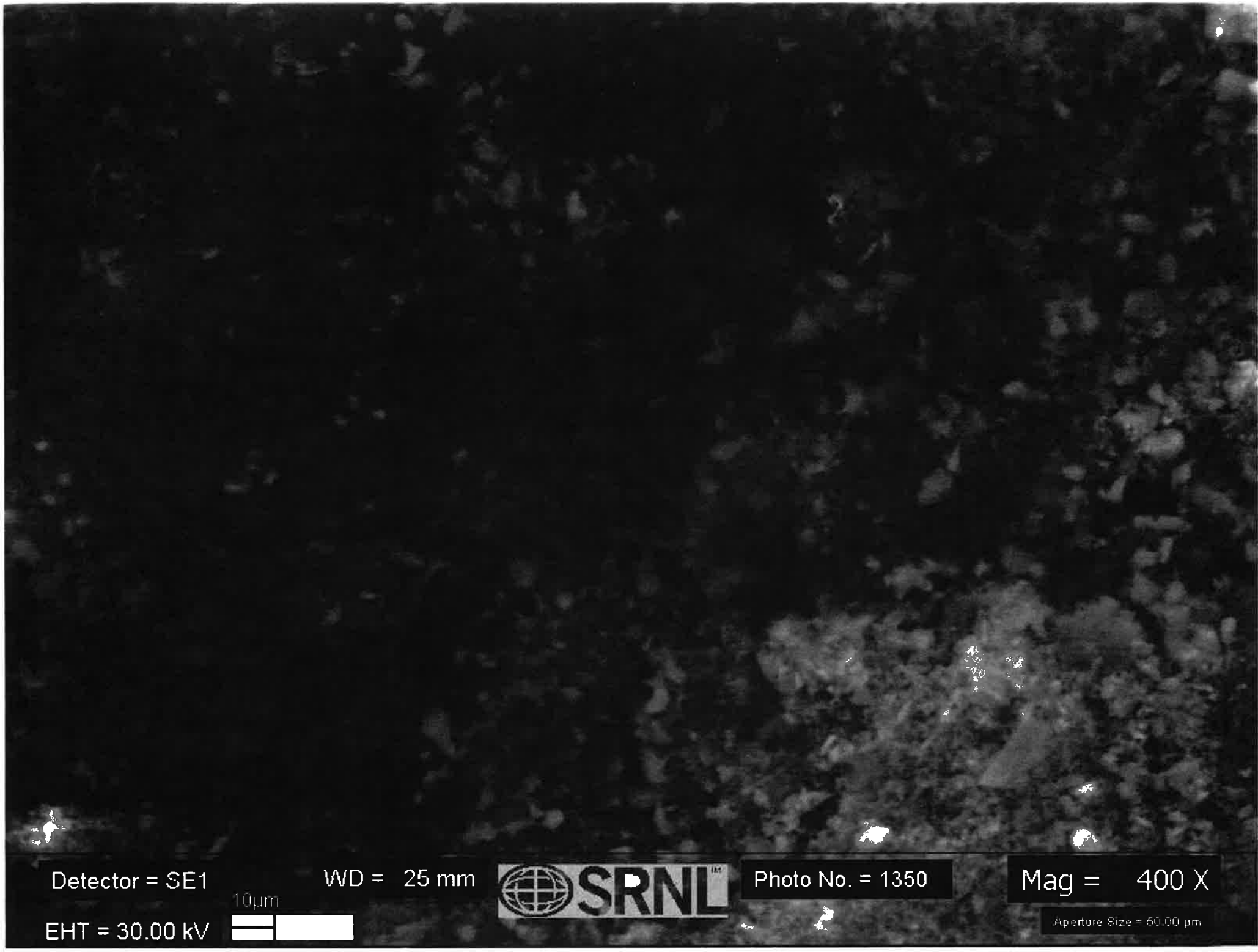

100µm D12 PHOTO-1347

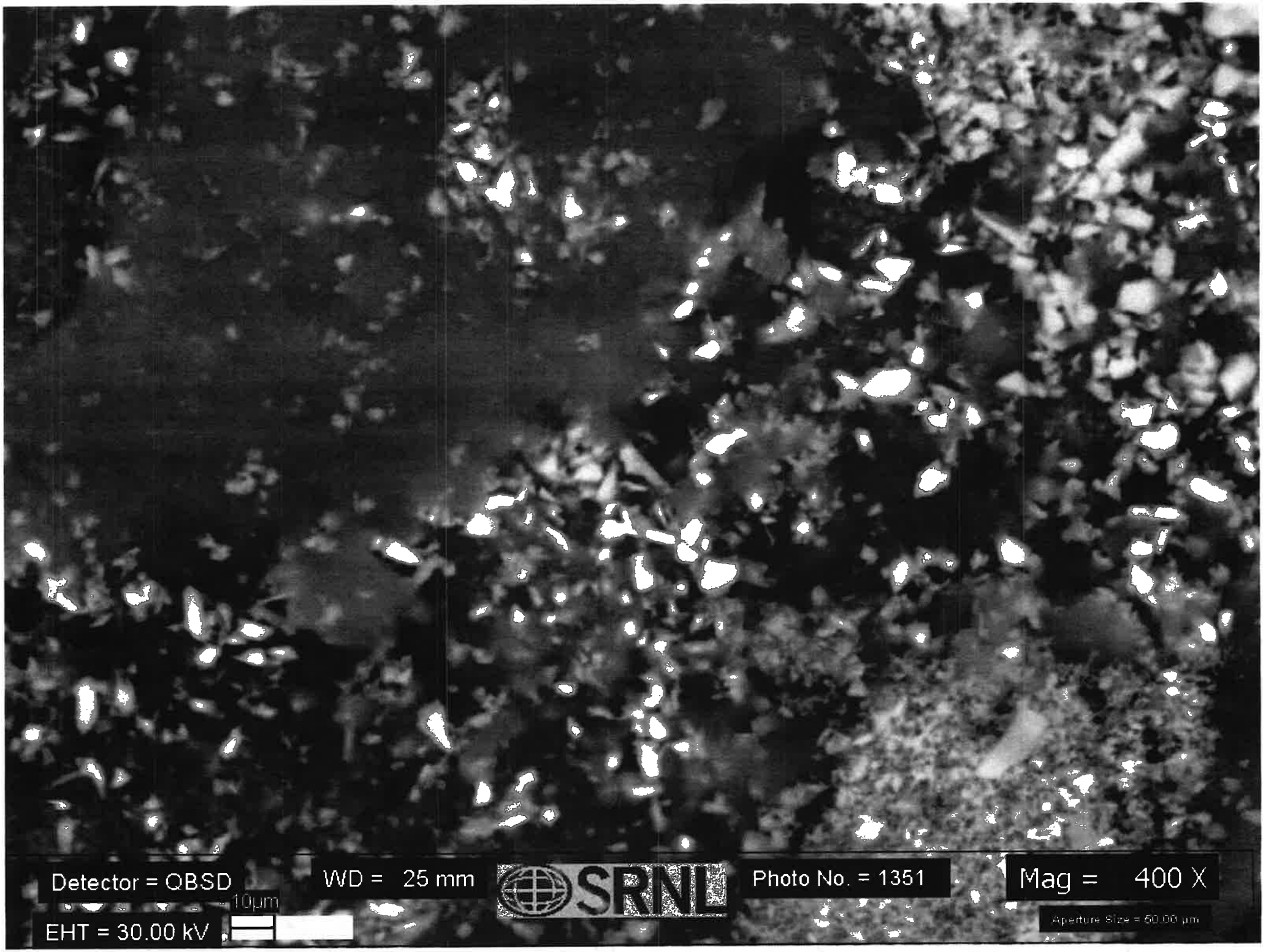



2*
C
Na
Cl
Cl
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 459 cts Cursor: 0.203 (268 cts)
keV

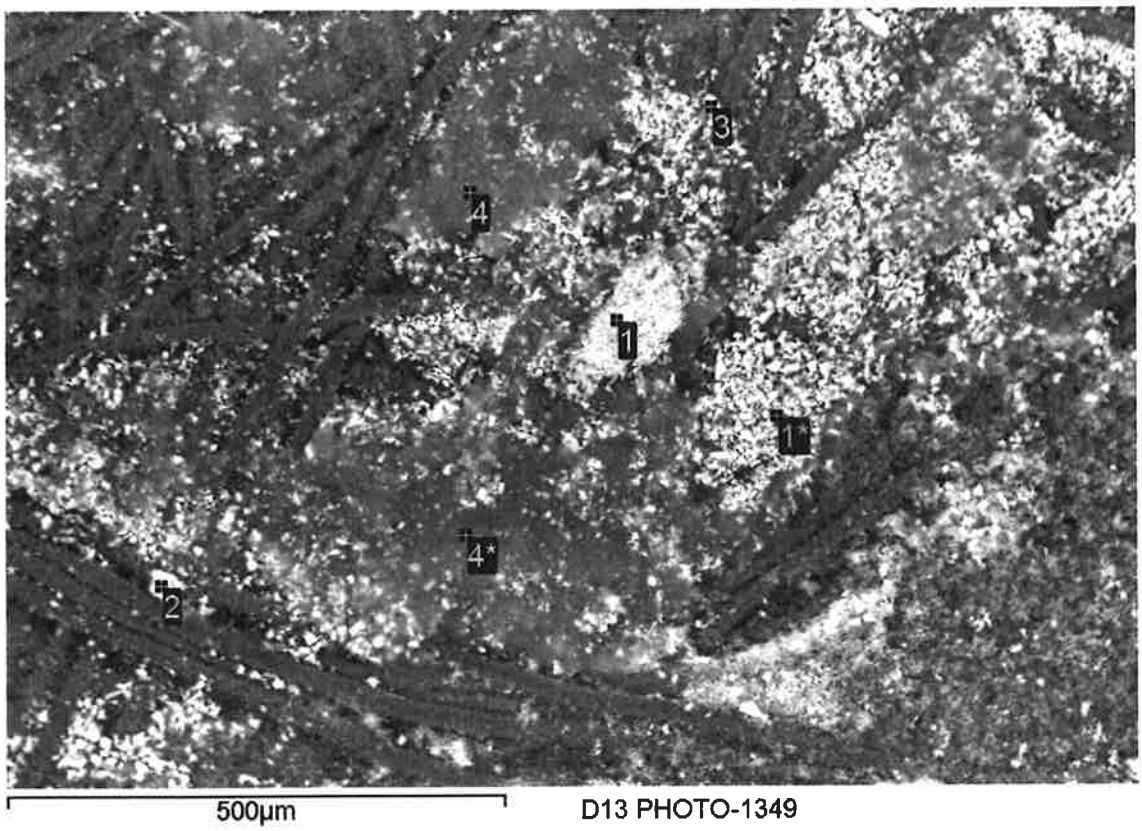
Detector = SE1
EHT = 30.00 kV
100µm
WD = 25 mm
SRNL
Photo No. = 1348
Mag = 100 X
Aperture Size = 50.00 µm

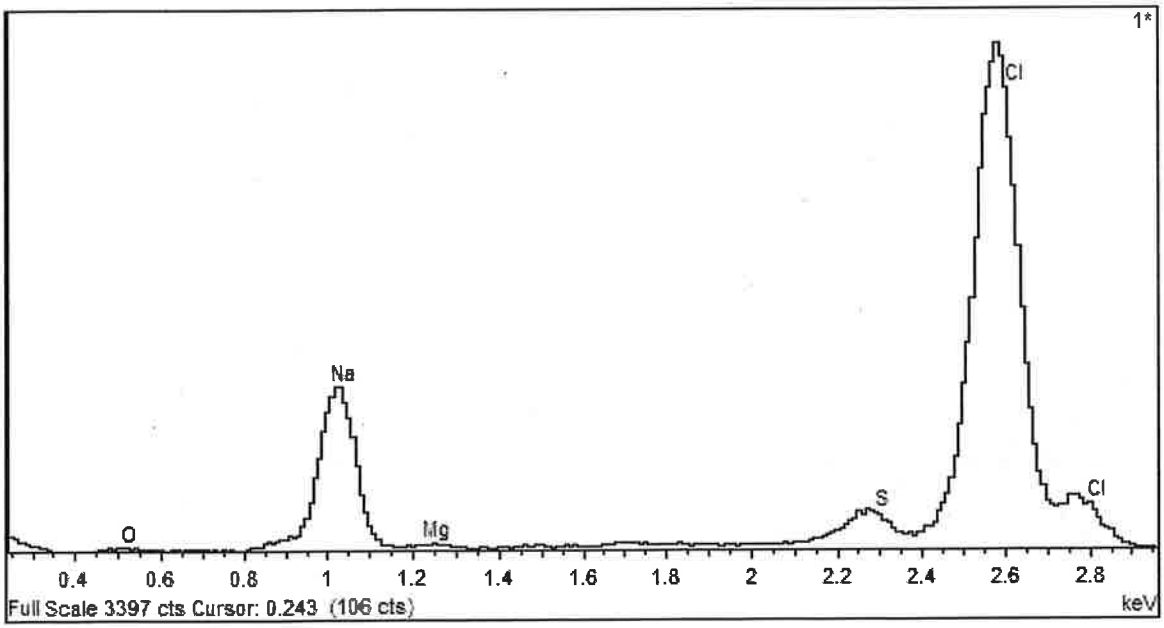

Detector = QBSD
WD = 25 mm
SRNL
Photo No. = 1349
Mag = 100 X
100µm
EHT = 30.00 kV
Aperture Size = 50.00 µm

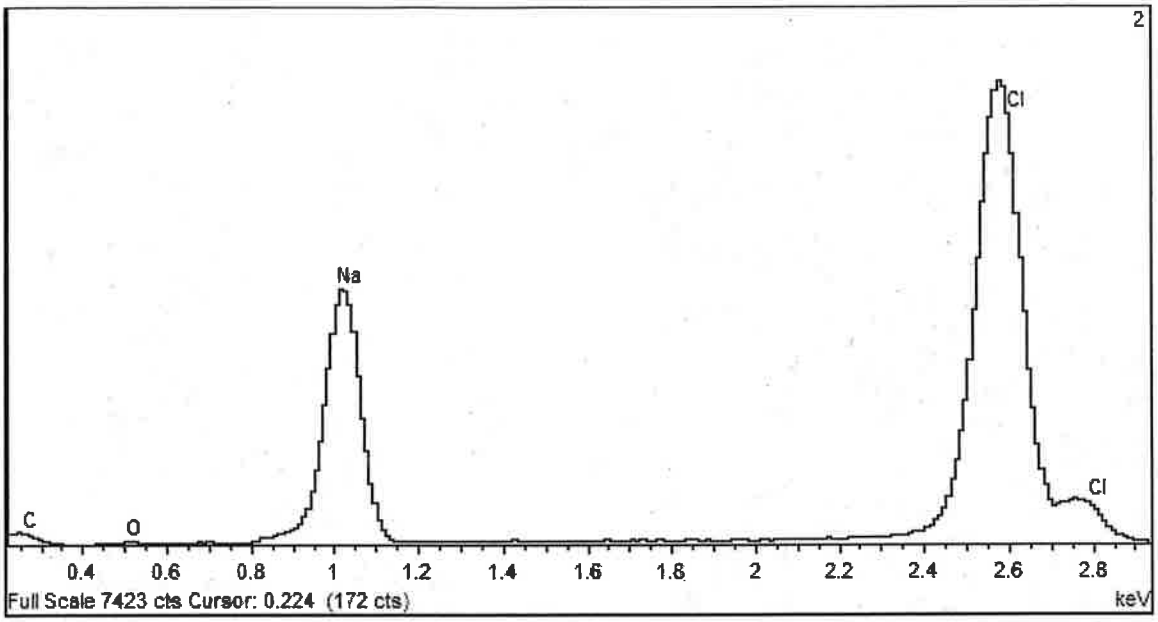

Detector = SE1
WD = 25 mm
SRNL
Photo No. = 1350
Mag = 400 X
10µm
EHT = 30.00 kV
Aperture Size = 50.00 µm

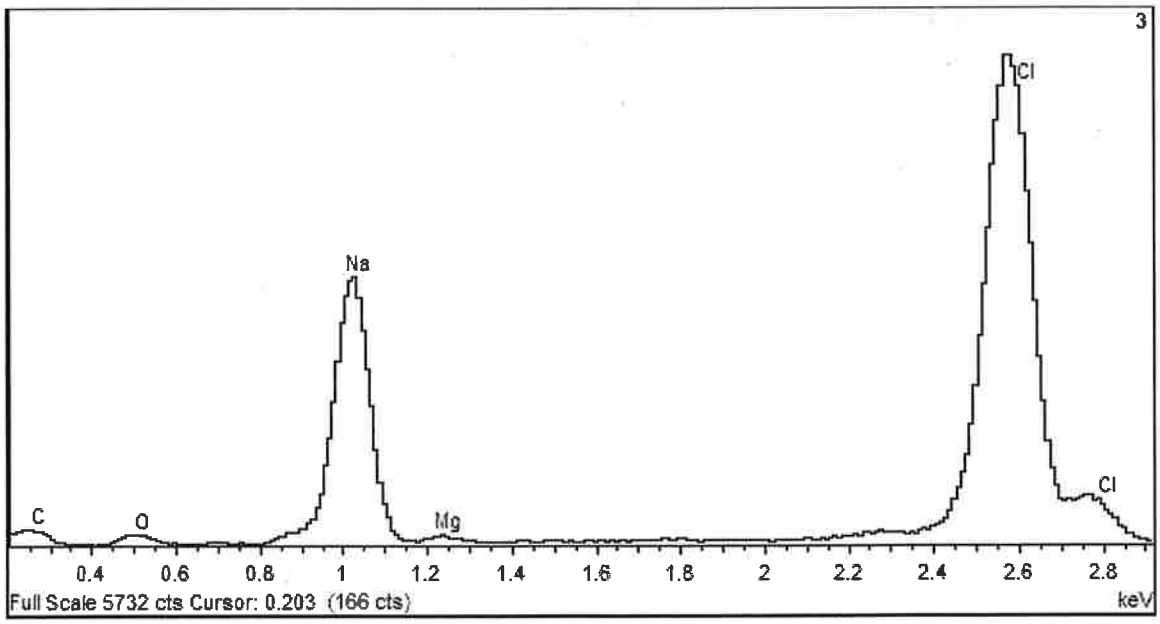

Detector = QBSD
EHT = 30.00 kV
10µm
WD = 25 mm
SRNL
Photo No. = 1351
Mag = 400 X
Aperture Size = 50.00 µm

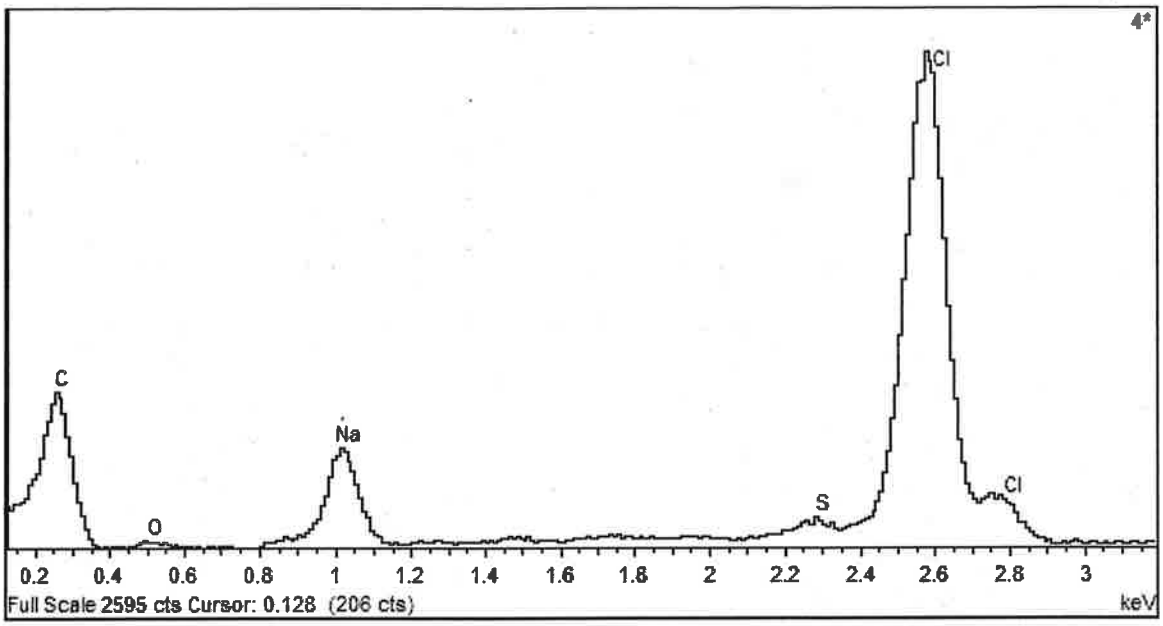
# D13_020514 300309400

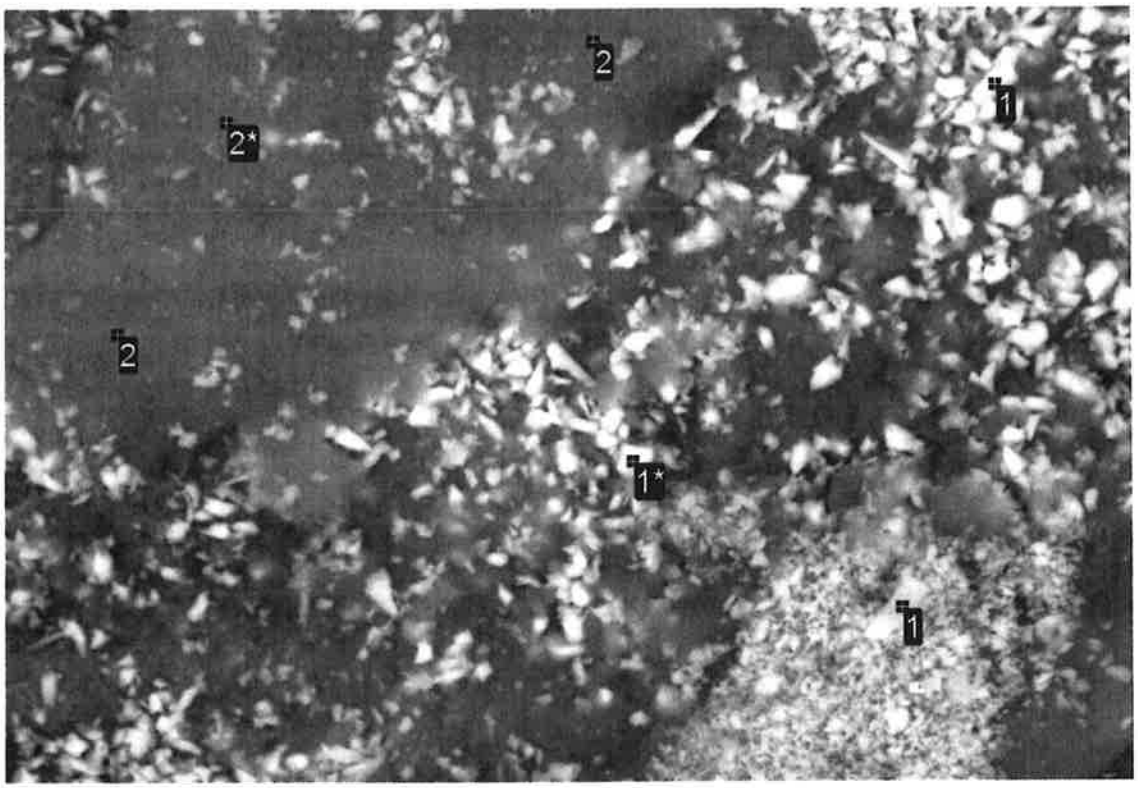



2
Cl
Na
Cl
C
O
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 7423 cts Cursor: 0.224 (172 cts)
keV

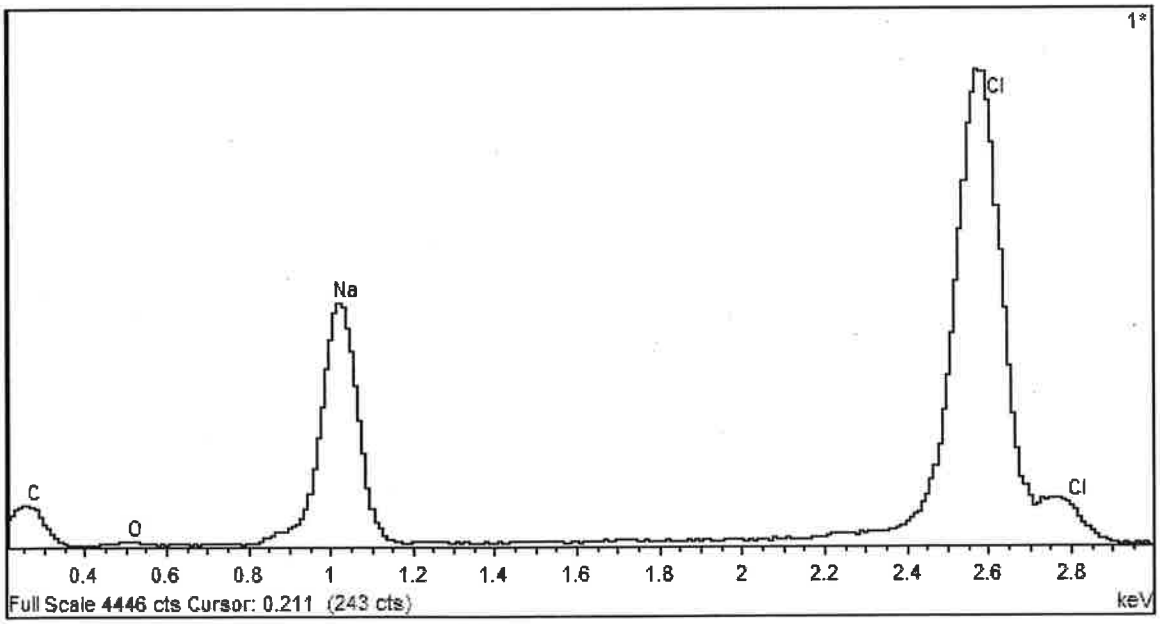

3
Cl
Na
Cl
C
O
Mg
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 5732 cts Cursor: 0.203 (166 cts)
keV

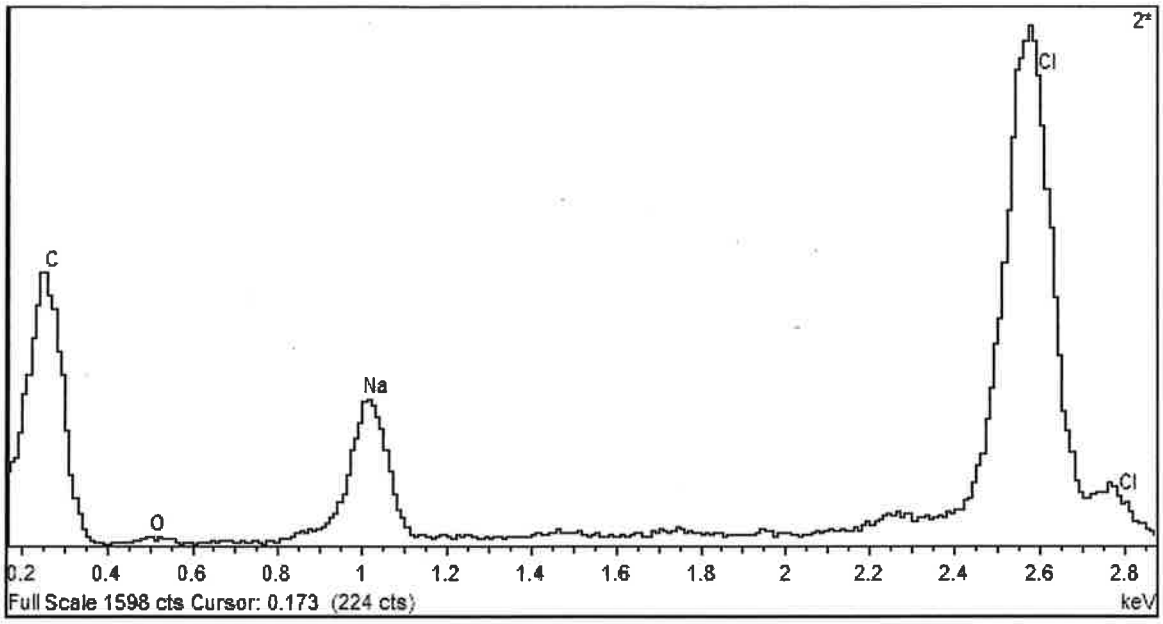

4*
Cl
C
Na
S
Cl
O
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
Full Scale 2595 cts Cursor: 0.128 (206 cts)
keV




100µm

D13 PHOTO-1351




2*
Cl
C
Na
Cl
O
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
Full Scale 1598 cts Cursor: 0.173 (224 cts)
keV