VOLUME TWO: APPENDICES

0 Master Table of Painting Typology And Colourants Pages 1-3

I Çatalhöyük Paintings Image Database Pages 1-103

II Techniques for Materials Analysis Pages 1-22

III Lists of Pigment Samples – Çatalhöyük Samples, University Of Oxford Museum Of Natural History Samples, Kremer Pigmente Samples Pages 1-6

IV GIS Maps Of Chronological Levels From Xii-0 With Annotations Of Findspots For Paintings And Rare Pigments Pages 1-15

V List of Relevant Sites and Their Longitude and Latitude Co-Ordinates Pages 1-2

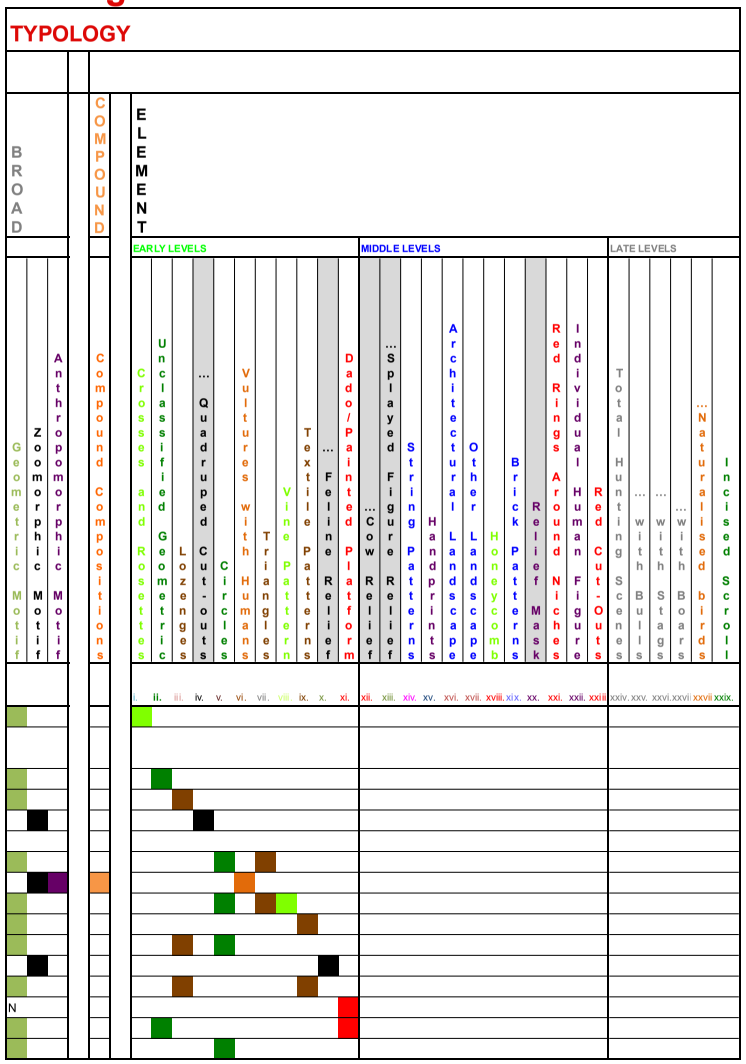
VI Results from Fourier-Transform Infrared Spectroscopy Pages 1-23, X-Ray Fluorescence Results 24-34

VII Results of The Survey Of 164 Archaeological Samples In The On-Site Archive Of Çatalhöyük Pages 1-4

VIII Results of Scanning Electron Microscopy

Appendix 0
Master Summary Tables of Çatalhöyük Paintings and Colourants

Master SummaryTable of Çatalhöyük Paintings and Colourants



Early Levels XII-VIII

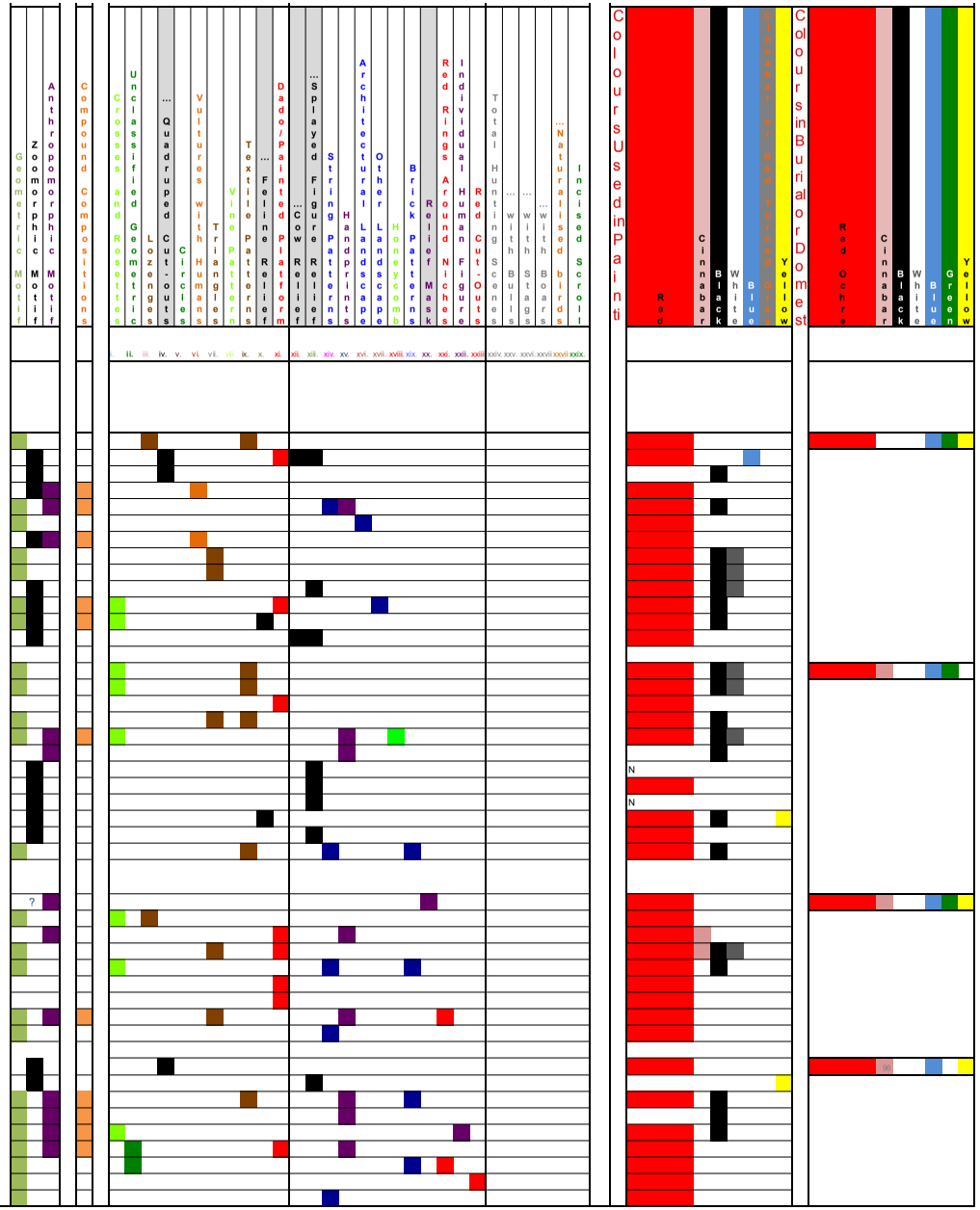
	ID	BLDG number	Wall Orientation
South I. X	1	below 1	none
7,035-6,920 cal BC**			
South K. IX	2		2 N
6,950-6,550 cal BC	3		2 E
	4		8 N
South L. VIII	5		2 NW
6,710-6,550 cal BC	6		8 E
	7		14 N
	8		14 E
	9		25 NE
	10		27 W
	11		27 W
	12		31 NE
	13		31 E
	14		31 W

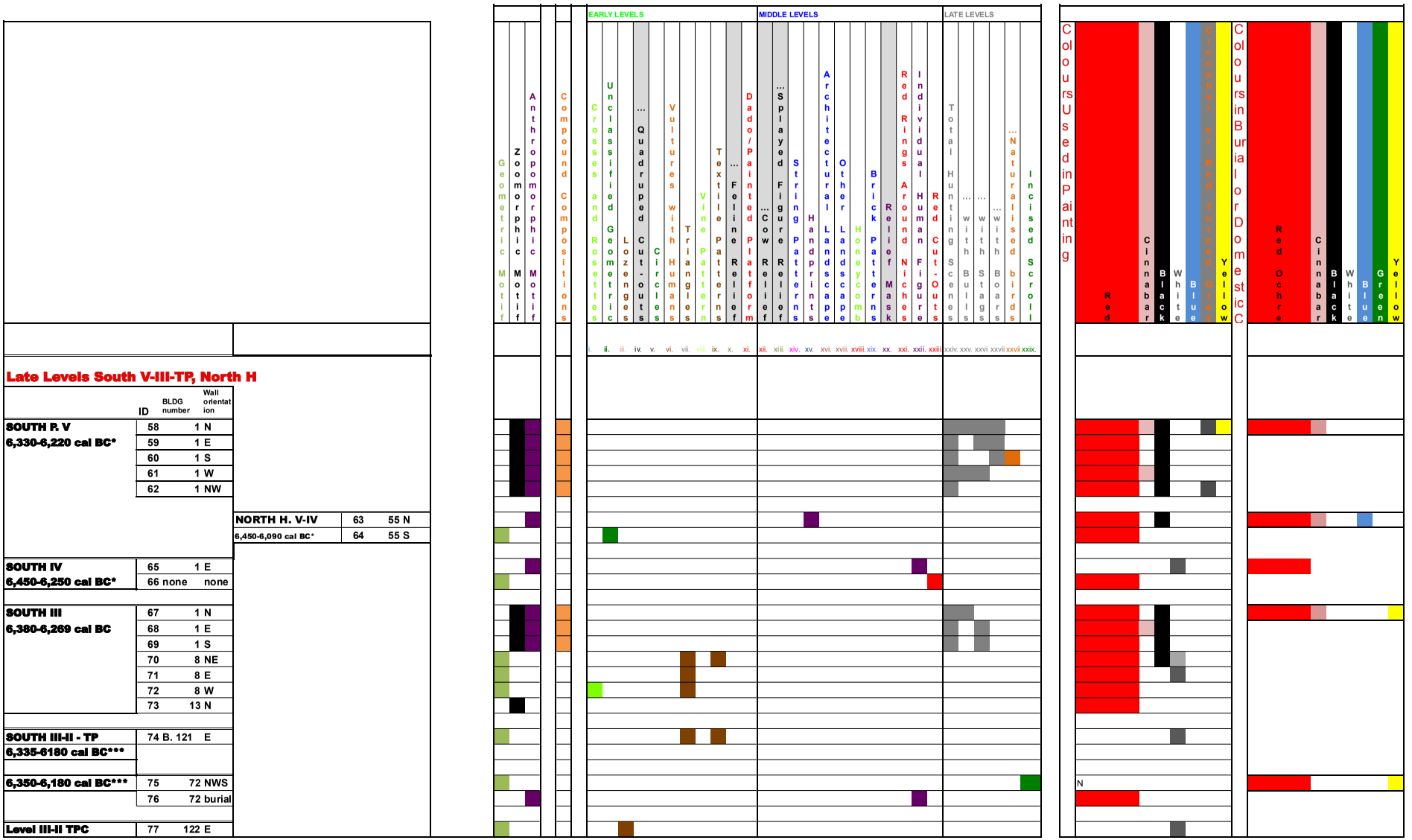
Middle Levels South VII-VI, North G

	ID	BLDG number	Wall orientation
South M.VII	15		1 E
6,610-6,500 cal BC*	16		1 SW
	17		8 N
	18		8 E
	19		8 NW
	20		14 N
	21		21 N
	22		21 N
	23		21 W
	24		23 E
	25		44 N
	26		44 E
	27		none N
SOUTH N. VIB	28		1 N
6,490-6,380 cal BC*	29		1 E
	30		3 none
	31		5 none
	32		8 E
	33		15 N
	34		31 E
	35		31 S
	36		31 W
	37		44 N
	38		45 none
	39		50 E

	ID	BLDG number	Wall orientation
NORTH G. VIB	40	132	E floor
6,490-6,380 cal BC*	41	119	NE
	42	49	N
	43	49	W
	44	49	NW
	45	52	NE
	46	59	N
	47	77	N
	48	77	E

SOUTH O. VIA	49	VIA-B.8	N
6,490-6,380 cal BC*	50	VIA-B.8	W
	51	50	E
	52	63	E
	53	66	E
	54	80	NE
	55	80	E
	56	96	N
	57	96	E



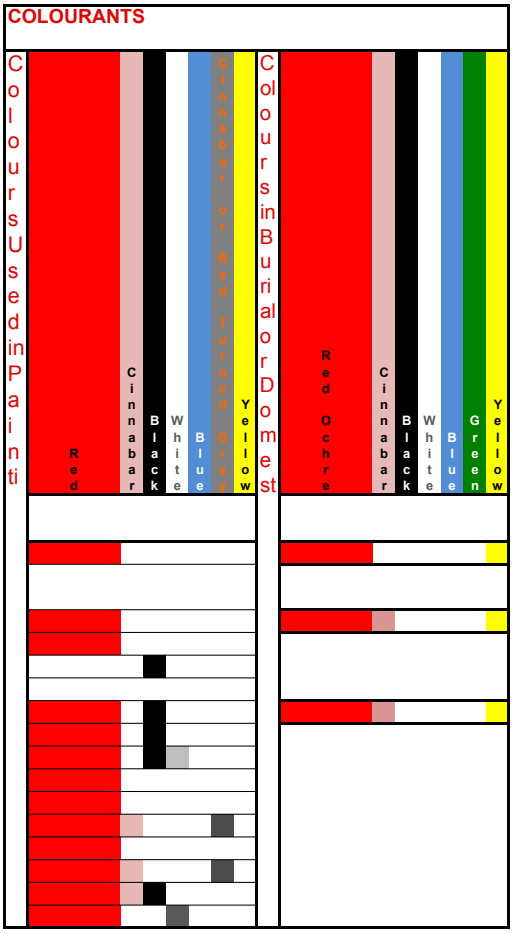


Below each level is a date range for that level from the radiocarbon dating program reported by Cessford (2005).
More detailed dates for each building, if available, are to the right of the building field.
Sources:
***Chronology from, Cessford 2005, Hodder, Chapter 1, Fig. 1.5 CH vol. 9 In press**
****Chronology from Bayliss, A. 2015.**
***** Chronology from Marciniak and Czerniak Antiquity,TP Areas correspond to Levels 0-II. Dates for building 72 selected from the start or end of the 68% probability range within the 95% probability range of dates for the building.**

Master SummaryTable of Çatalhöyük Colourants

Early Levels XII-VIII

	ID	BLDG number	Wall Orientation
South I. X	1	below 1	none
7,035-6,920 cal BC**			
South K. IX	2		2 N
6,950-6,550 cal BC	3		2 E
	4		8 N
South L. VIII	5		2 NW
6,710-6,550 cal BC	6		8 E
	7		14 N
	8		14 E
	9		25 NE
	10		27 W
	11		27 W
	12		31 NE
	13		31 E
	14		31 W



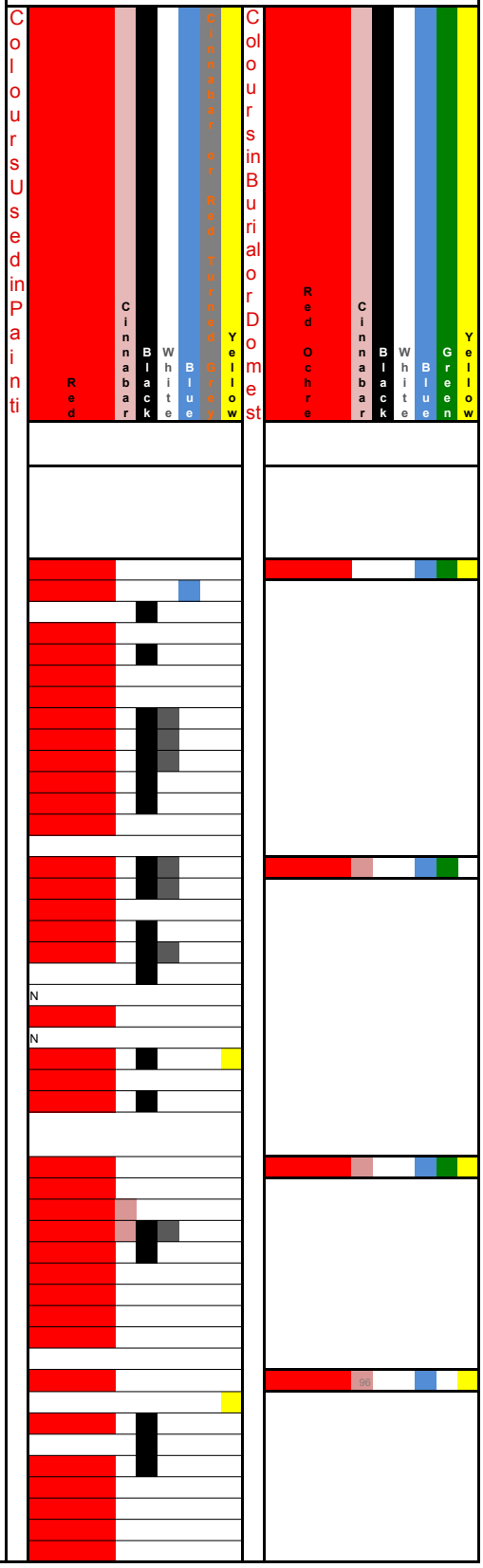
Middle Levels South VII-VI, North G

	ID	BLDG number	Wall orientation
South M.VII	15	1	E
6,610-6,500 cal BC*	16	1	SW
	17	8	N
	18	8	E
	19	8	NW
	20	14	N
	21	21	N
	22	21	N
	23	21	W
	24	23	E
	25	44	N
	26	44	E
	27	none	N
SOUTH N. VIB	28	1	N
6,490-6,380 cal BC*	29	1	E
	30	3	none
	31	5	none
	32	8	E
	33	15	N
	34	31	E
	35	31	S
	36	31	W
	37	44	N
	38	45	none
	39	50	E

	ID	BLDG number	Wall orientation
NORTH G. VIB	40	132	E floor
6,490-6,380 cal BC*	41	119	NE
	42	49	N
	43	49	W
	44	49	NW
	45	52	NE
	46	59	N
	47	77	N
	48	77	E

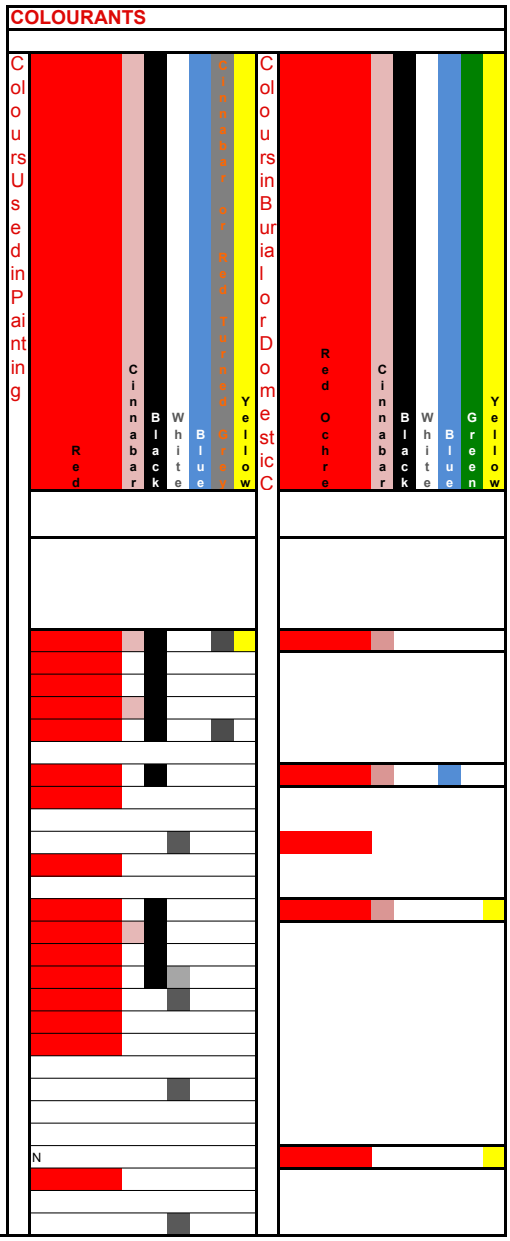
SOUTH O. VIA	49	VIA-B.8	N
6,490-6,380 cal BC*	50	VIA-B.8	W
	51	50	E
	52	63	E
	53	66	E
	54	80	NE
	55	80	E
	56	96	N
	57	96	E

COLOURANTS



Late Levels South V-III-TP, North H

	ID	BLDG number	Wall orientation
SOUTH P. V	58	1	N
6,330-6,220 cal BC*	59	1	E
	60	1	S
	61	1	W
	62	1	NW
NORTH H. V-IV	63	55	N
6,450-6,090 cal BC*	64	55	S
SOUTH IV	65	1	E
6,450-6,250 cal BC*	66	none	none
SOUTH III	67	1	N
6,380-6,269 cal BC	68	1	E
	69	1	S
	70	8	NE
	71	8	E
	72	8	W
	73	13	N
SOUTH III-II - TP	74	B. 121	E
6,335-6180 cal BC***			
6,350-6,180 cal BC***	75	72	NWS
	76	72	burial
Level III-II TPC	77	122	E



Below each level is a date range for that level from the radiocarbon dating program reported by Cessford (2005).
More detailed dates for each building, if available, are to the right of the building field.
Sources:
***Chronology from, Cessford 2005, Hodder, Chapter 1, Fig. 1.5 CH vol. 9 In press**
****Chronology from Bayliss, A. 2015.**
***** Chronology from Marciniak and Czerniak Antiquity,TP Areas correspond to Levels 0-II. Dates for building 72 selected from the start or end of the 68% probability range within the 95% range of dates for the building.**

Appendix I Çatalhöyük Paintings Image Database



Catalogue ID 1
Description: Detail of four-point cross in red
Context: below XI.1
Wall orientation: N
Dimension: ~20 cm.
Excavation phase: Mellaart
References: Photo taken by Todd in August 1963 in series just after VII.14; *AS* XIV p. 61; Rosettes in orange decorating a doorjamb of VII. 1 reported in *AS* XIV p. 56
Photograph Source: Todd 64_21



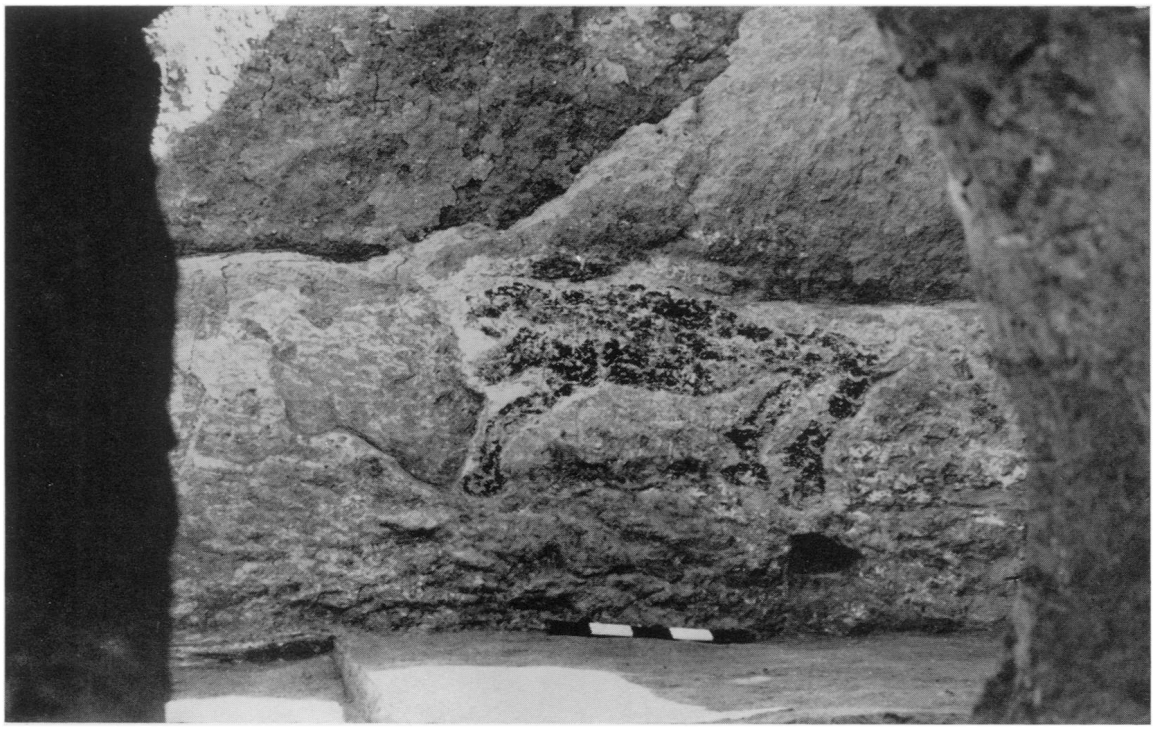
Catalogue ID 2
Description: Rectangular design in red
Context: IX.2
Wall orientation: N
Excavation phase: Çatalhöyük Research Project
Photograph Source: Archive Report 2005 Figure 119





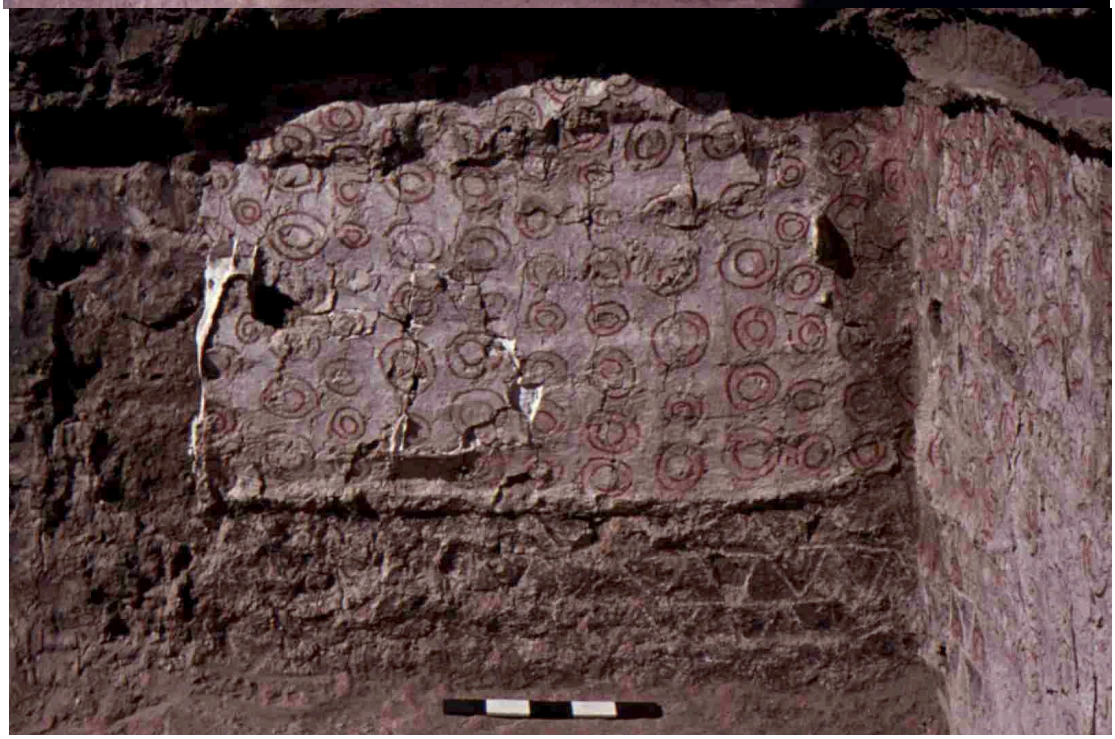
a

Catalogue ID 3
Description: Concentric lozenges in red
Context: IX.2
Wall orientation: E
Excavation phase: Çatalhöyük Research Project
References: Archive Report 1999 (exposed) and 2003 (excavated)
Photograph Source: in situ Archive Report 2003 Figure 37; (a) Konya Museum Author's Own.



Catalogue ID 4
Description: Black animal torso with three full legs and partial fourth leg in sunken relief
Context: IX.8
Wall orientation: N
Excavation phase: Mellaart
References: Mellaart 1967 black and white photograph Pl. 11.
Photograph Source: *AS* XIV Pl. XIV *(b)*





a
Catalogue ID 5
Description: Room view (a) Rows of two concentric circles repeating over two full walls with rows of triangles below
Context: VIII.2
Wall orientation: NW is probable
References: Mellaart 1967 p. 151. Todd 1976 p. 35; Hirsh colour Pl. III (4)
Excavation phase: Mellaart
Photograph Source: Todd 64_26; (a) Todd 64_28



b
Catalogue ID 5
Description: Corner view (b) Rows of two concentric circles repeating over two full walls with rows of triangles below
Context: VIII.2
Wall orientation: NW is probable
References: Mellaart 1967 p. 151. Todd 1976 p. 35; Hirsh colour Pl. III (4)
Excavation phase: Mellaart
Photograph Source: Hirsh 1989 Pl. III (4)



a
Catalogue ID 6
Description: Human figures, one headless in red with outstretched arms and weapons with two, black birds (vultures) on either side
Context: VIII.8
Wall orientation: E
Excavation phase: Mellaart
References: *AS* XIV, p. 70 and black and white reconstruction Pl. XIV *(a)*; Mellaart 1967 reproduction in black and white Pl. 46.
Photograph Source: Hirsh colour reproduction Pl. XIII *(1)*; (a) Hirsh colour Pl. XIII *(2)*



Catalogue ID 7
Description: Room view of Catalogue ID 7, 8, and 9.
Context: VIII.14
Wall orientation: N
Excavation phase: Mellaart
References: *AS* XVI black and white photograph Pl. XLII *(a)*
Photograph Source: Hirsh 1989 Plate I colour *(9)* detail; (a) Hirsh 1989 colour Pl. 1 *(9)*



a
Catalogue ID 7
Description: (a) Detail of a raised relief with a vine-type design framed in horizontal registers painted red in recessed areas.
Context: VIII.14
Wall orientation: N
Excavation phase: Mellaart
References: *AS* XVI black and white photograph Pl. XLII *(a)*
Photograph Source: Hirsh 1989 Plate I colour *(9)* detail; (a) Hirsh 1989 colour Pl. 1 *(9)*



b
Catalogue ID 7
Description: Detail Incised circle and ovoid shapes in first phase of decoration on North wall
Context: VIII.14
Wall orientation: N
Excavation phase: Mellaart
References: *AS* XVI Pl. XLII *(a)*
Photograph Source: (b) *AS* XVI Pl. XLIII *(a)*



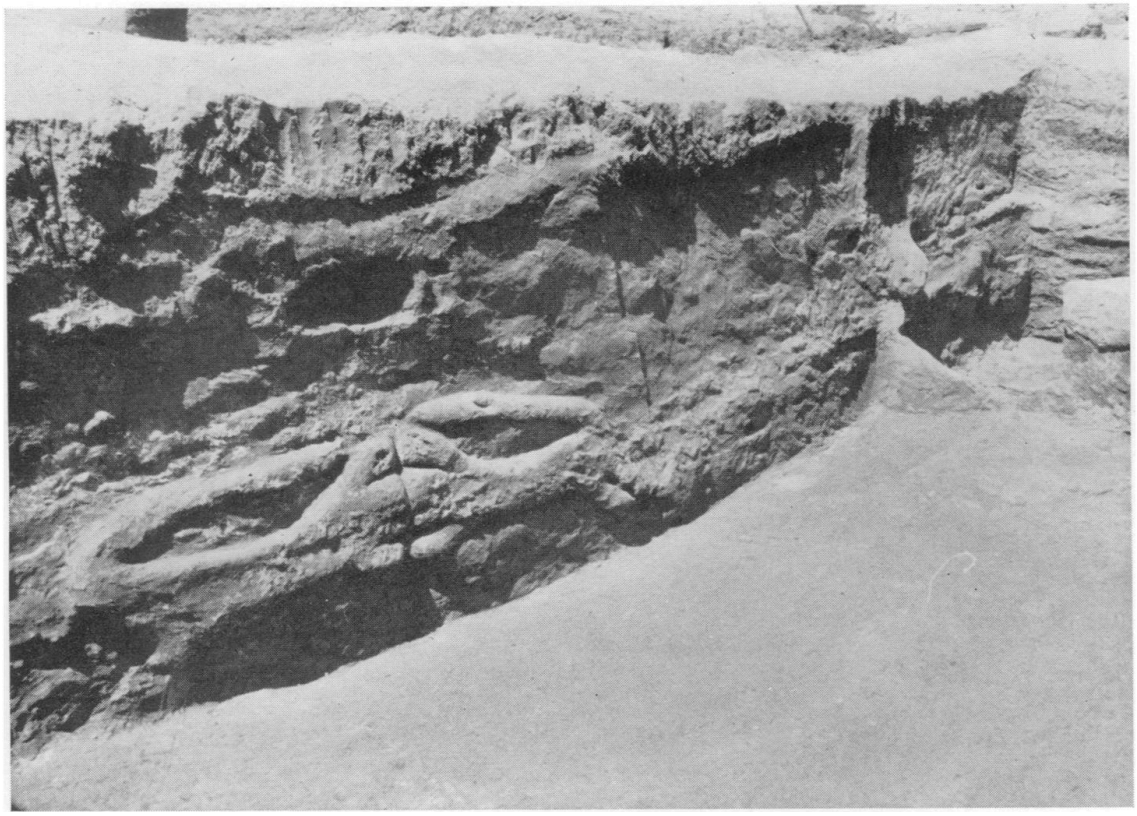
c
Catalogue ID 7
Description: (c) Rectangles in checkerboard-like design in black
Context: VIII.14
Wall orientation: N
Excavation phase: Mellaart
References: Hirsh Plate V *(1)*
Photograph Source: *AS* XVI Pl. Plate XLII *(b)*



Catalogue ID 8
Description: Diagonal lines with vine-like pattern in red covering full wall
Context: VIII.14
Wall orientation: E
Excavation phase: Mellaart
References: *AS* XVI Pl. Plate XLIII *(b)*
Photograph Source: Hirsh Plate I *(9)*



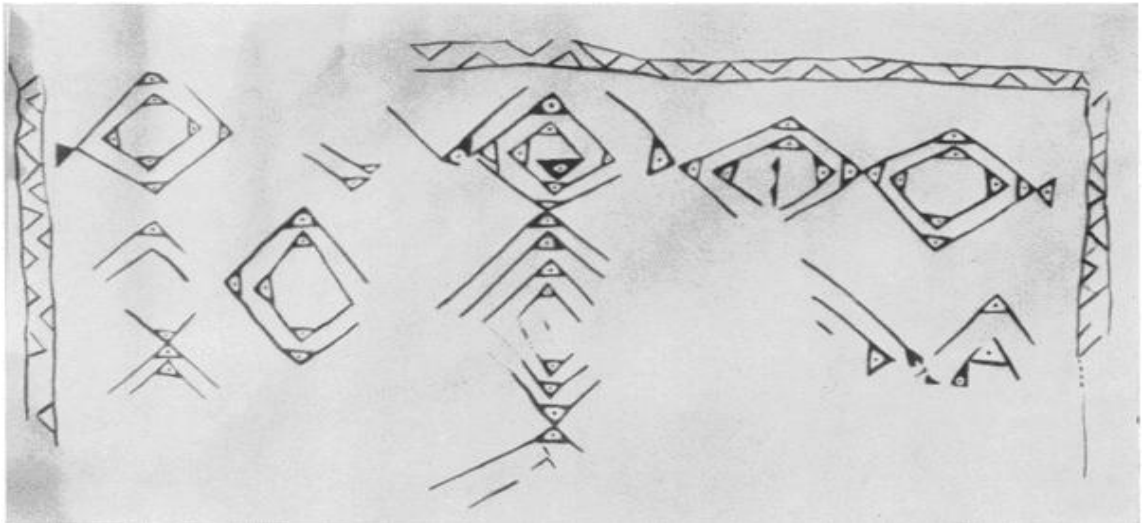
Catalogue ID 9
Description: Circles and lozenge shapes covering North and East walls in repeating design
Context: VIII.25
Wall orientation: N-E
Excavation phase: Mellaart
Photograph Source: *AS XVI Pl. XLIV (a)*





a
Catalogue ID 10
Description: Room view (a) Raised relief two facing quadrupeds with heads and front legs touching. Spots on the heads lines around tails in red.
Context: VIII.27
Wall orientation: W
Dimensions: 2 m. sq.
Excavation phase: Mellaart
References: Mellaart 1967 and Hodder 2006 Figure 35; Todd 1976 p. 56
Photograph Source: Hirsh Plate XII *(1);* (a) *AS* XVI Pl. XLV *(b)*





a
Catalogue ID 11
Description: Framed design with concentric lozenges in red
Context: VIII.27
Wall orientation: W
Excavation phase: Mellaart
References: AS XVI Pl. XLIV *(a)*
Photograph Source: Todd 76_03; (a) *AS* XVI Pl. XLIV *(a)*



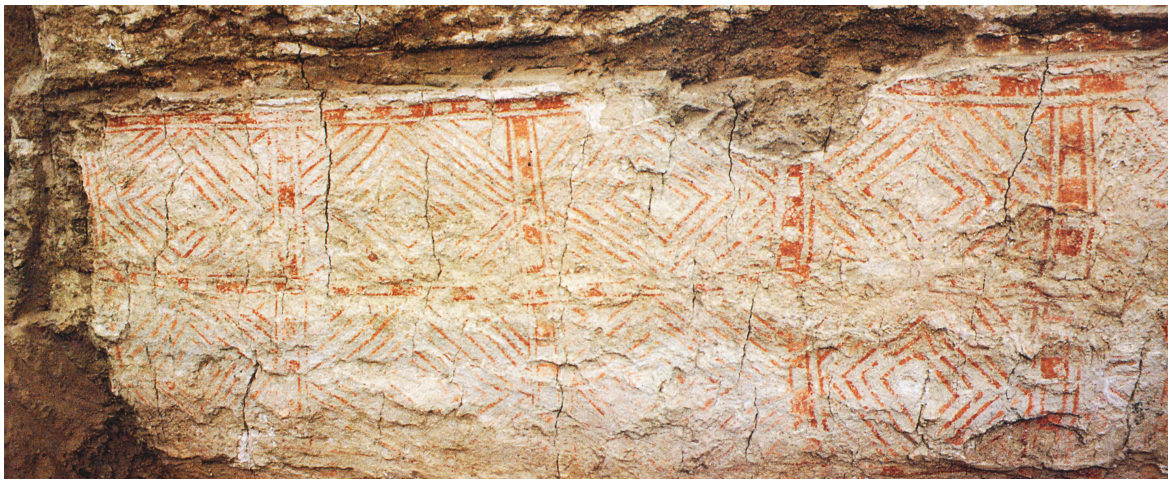
Catalogue ID 12
Description: Room view of the "Red Shrine" seen here from the east with painted floors, platforms, walls
Context: VIII.31
Wall orientation: NE
Excavation phase: Mellaart
References: Mellaart 1966b: Pl. XLVIb; Matthews 2005: 129 This is only building after level X which is not using "calcareous silty clays, mined from soft lime deposits, which occur naturally within 5 km of site".
Photograph Source: *AS* XVI Pl. XLVI *(b)*



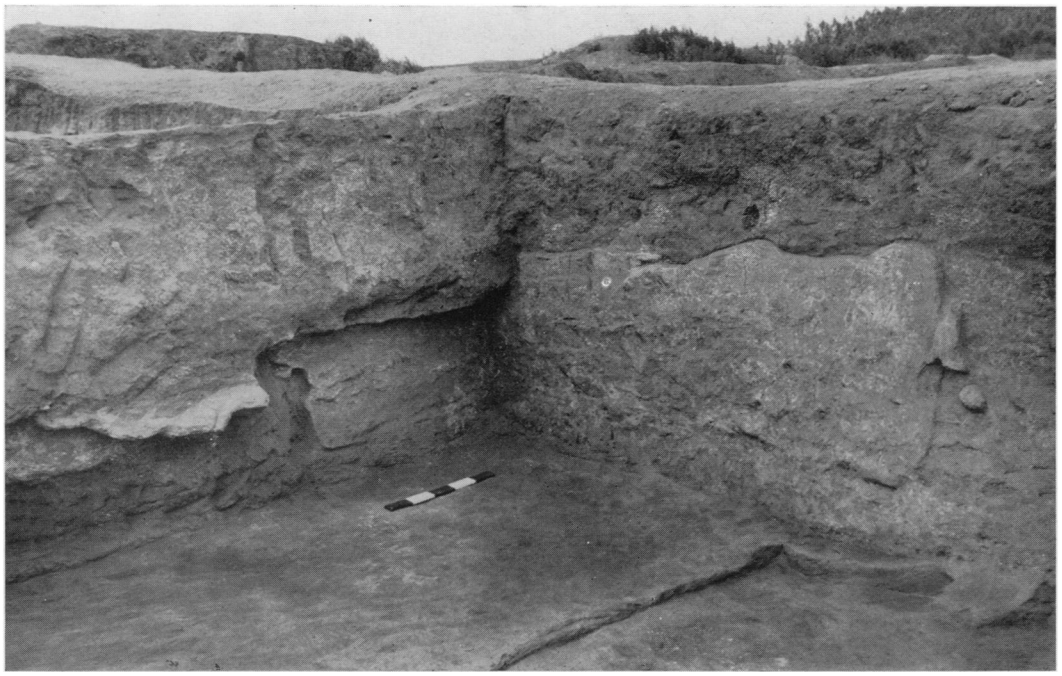
a
Catalogue ID 13
Description: Room view with painted platform in "orange" ("Red Shrine" also seen in Catalogue ID 52) (a) Platform edge in the "Red Shrine" with curved and diagonal lines separated in vertical registers.
Context: VIII.31
Wall orientation: E
Excavation phase: Mellaart
Photograph Source: *AS* XVI Pl. XLIX (a); (a) *AS* XVI Pl. XLVIII (a)
References: XRF performed by Zararsiz et al. 2008, 449, Figures 4a-c



a
Catalogue ID 14
Description: Three circles in row each with a red centre with white circles
Context: VIII.31
Wall orientation: W
Excavation phase: Mellaart
Photograph Source: Todd 76_01; (a) *AS* XVI Pl. XLVII *(a)*



Catalogue ID 15
Description: Concentric lozenges within framed, red squares a border of red stripes, full wall
Context: VII.1
Wall orientation: E
Excavation phase: Mellaart
References: *AS* XIV Pl. XI (b)
Photograph Source: Hirsh Plate VI (1)



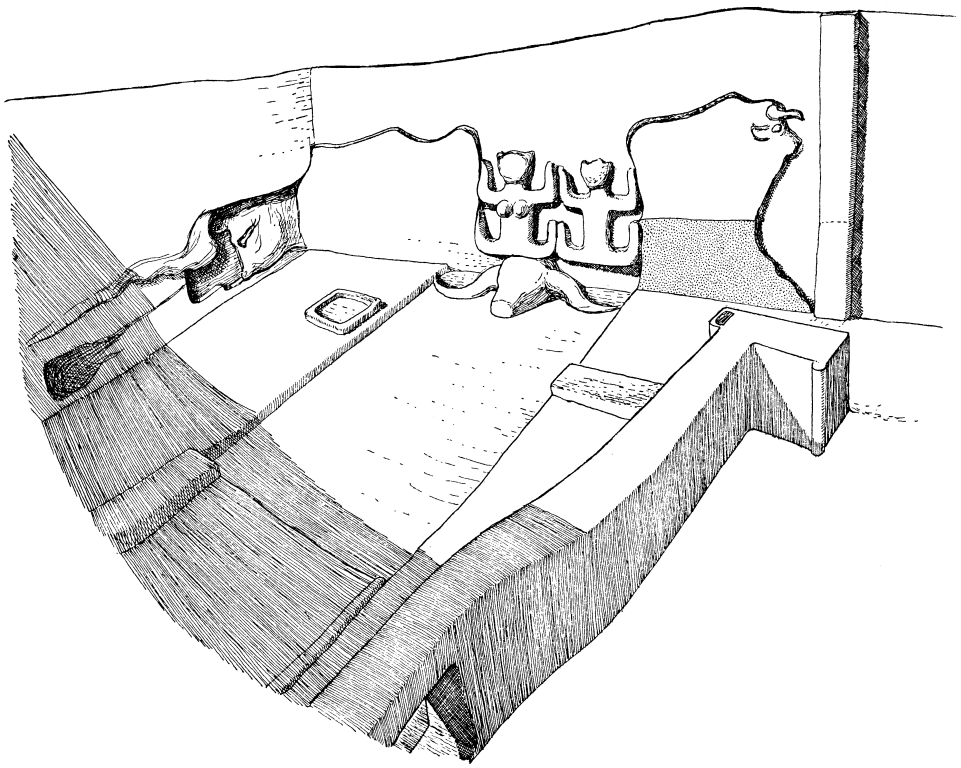


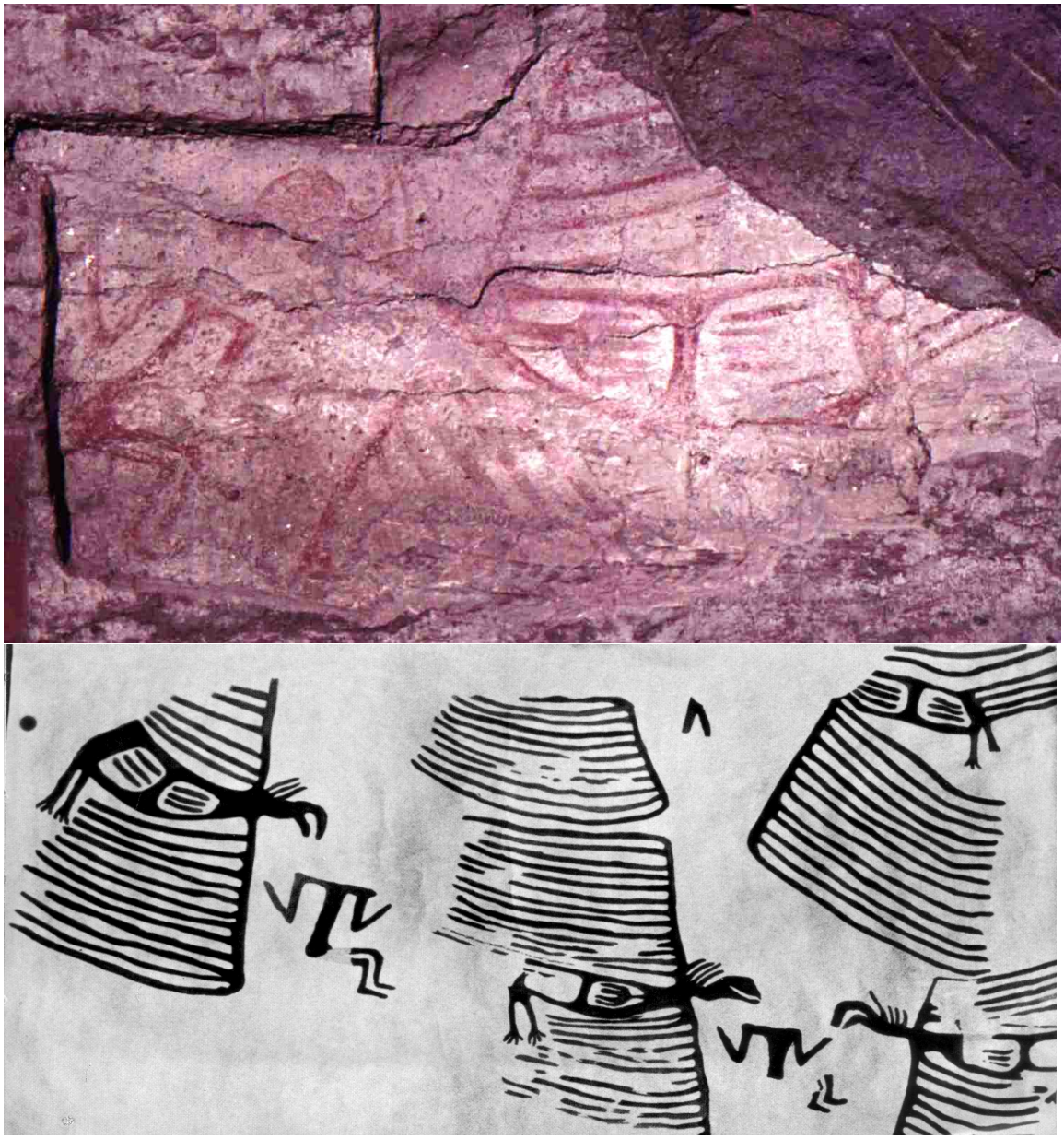
FIG. 14. Restored view of west wall of Shrine VII, 1.

a
Catalogue ID 16
Description: Engraving of bull with horn on western wall, and (a) Reconstruction with two splayed figure reliefs in the centre of the south wall next to the cut out of a cow painted in blue over a flat red dado base
Context: VII.1
Wall orientation: S and W
Excavation phase: Mellaart
References: *AS* XIV Pl. III (*a),* p. 55

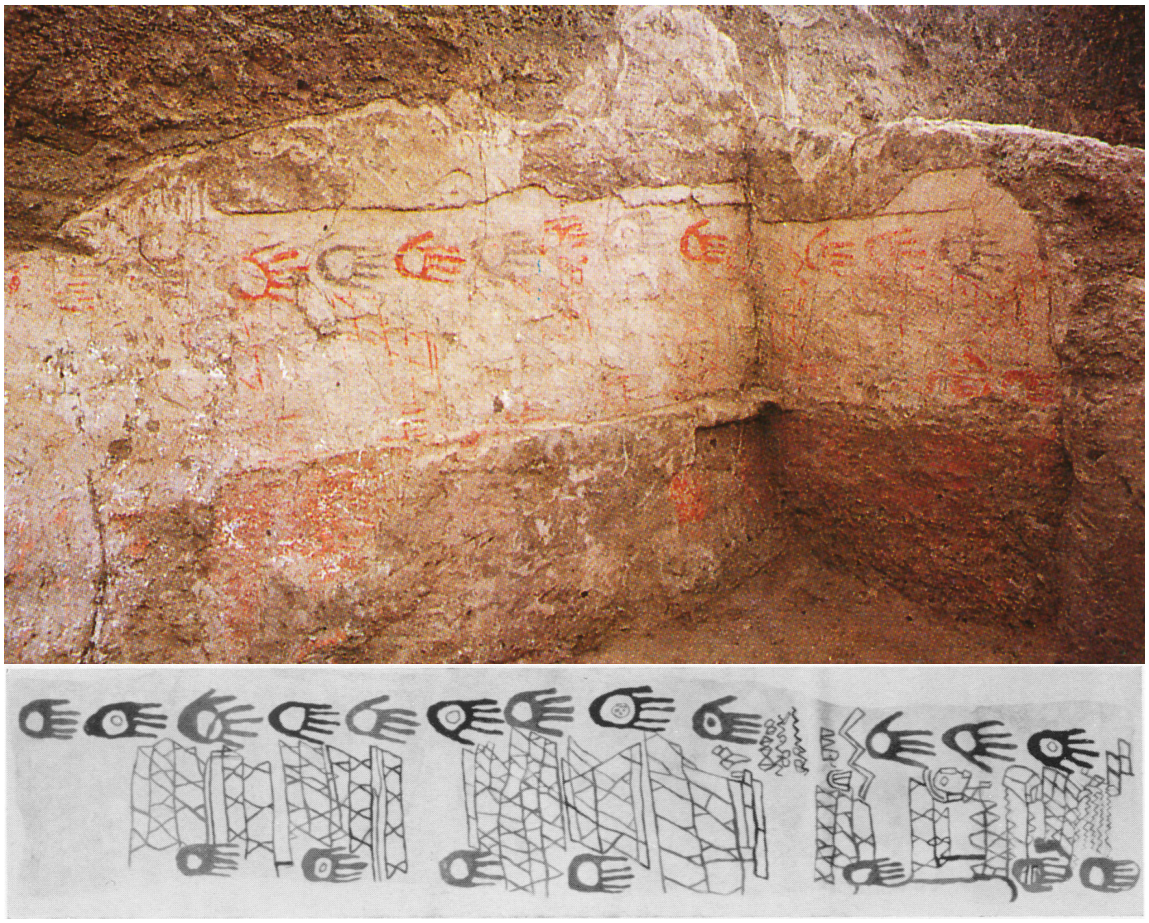
Photograph Source: *AS* XIV Pl. XI (a), reconstruction *AS* XIV Figure 14



Catalogue ID 17
Description: Black animal torso cut-out
Context: VII.8
Wall orientation: N
Excavation phase: Mellaart
References: Mellaart *AS* XIV Pl. VII *(a)*
Photograph Source: Mellaart 1967 black and white photograph Pl. 12.



a
Catalogue ID 18
Description: Four birds (vultures) with two, headless human figures, detail in red and reproduction
Context: VII.8
Wall orientation: E
Excavation phase: Mellaart
References: *AS* XIV Pl. VIII (a) photo (b) reconstruction; Mellaart 1967 reconstruction black and white Pl. 49 and photographs Pl. 48.
Photograph Source: Todd 63_16; (a) *AS* XIV Pl. VII (b) reconstruction

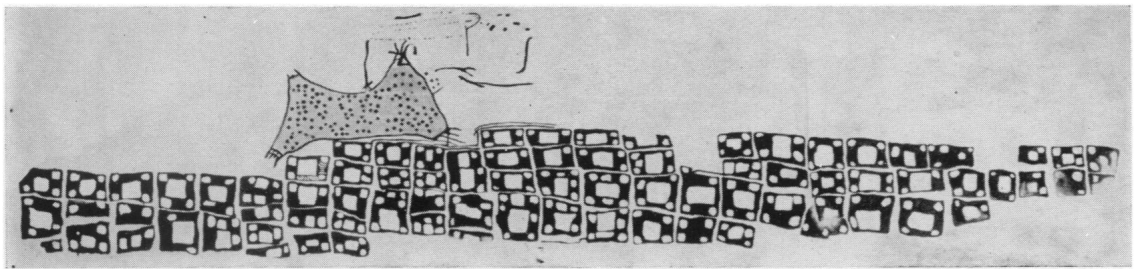


a
Catalogue ID 19
Description: Two Rows of alternating red and black handprints with strings between, corner view. Seven hands are red, five black. Left hands are black, right hands in red; the negative space in the palm is filled with at least one dot.
(a) Reconstruction of Two Rows of alternating red and black handprints with strings
Context: VII.8
Wall orientation: N-W
Excavation phase: Mellaart
References: *AS* XIV Pl. VI *(b)* photo and *(c)* reconstruction; Mellaart 1967 black and white photograph Pl. 44 and reproduction Pl. 43.
Photograph Source: Hirsh Plate III *(3);* (a) *AS* XIV Pl. VI *(c)*





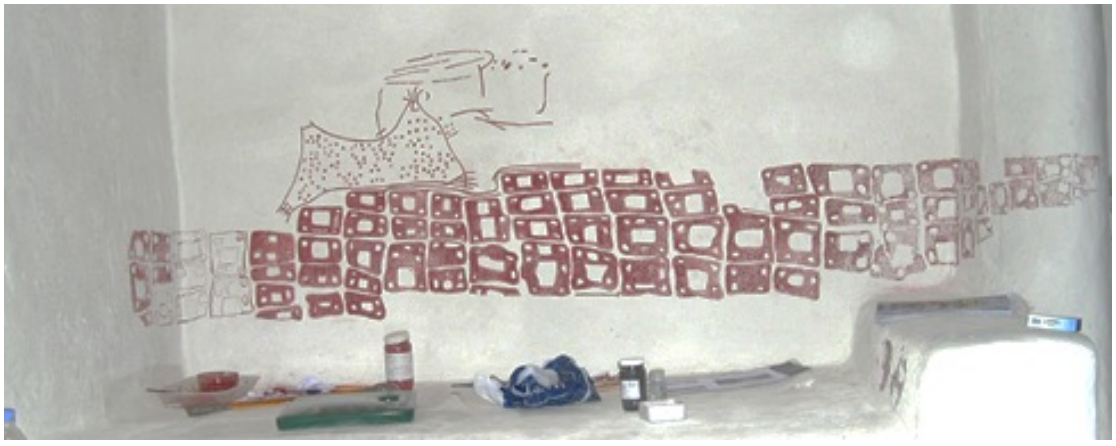
a
Catalogue ID 20
Description: "Volcano/City Plan" in red showing irregular relief
(a) Corner room view of "Volcano/City Plan" in red
Context: VII.14
Wall orientation: N
Excavation phase: Mellaart
References: *AS* XIV Pl. V *(b)*; *AS* XIV Pl. VI *(a)* reconstruction reconstruction by Grace Huxtable; Mellaart 1967 black and white Pl. 60; Todd 1976 black and white photograph Figure 19.
Photograph Source: Todd 64_19; (a) Todd 64_20



b



c



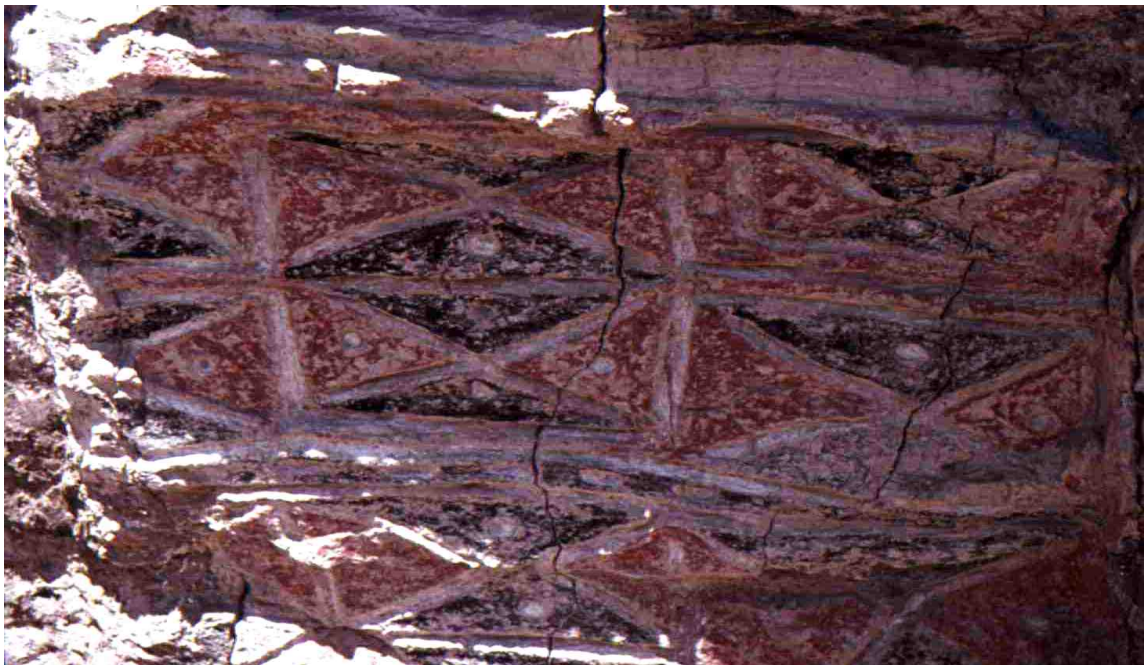
d

Catalogue ID 20
Description: (b) and (c) "Volcano/City Plan" reconstruction
Context: VII.14
Wall orientation: N
Excavation phase: Mellaart
References: *AS* XIV Pl. VI *(a)*; Mellaart 1967 reconstruction Pl. 60; Todd 1976 black and white reproduction Figure 18.
Photograph Source: (b) *AS* XIV Pl. VI*;* (c) Boardman 2006. Pl. 11; (d) Replica painting inside the Neolithic house 2005, working shot, author's own.





a
Catalogue ID 21
Description: Headless human with two birds (vultures) in red, (a) reproduction
And colour photograph in red
Context: VII.21
Wall orientation: N
Excavation phase: Mellaart
References: *AS* XIV Pl. XII *(a)* photo *(b)* reconstruction.
Photograph Source: Hirsh Pl. reproduction XIII *(4);* (a) Hirsh colour Pl. XIII *(3)*



Catalogue ID 22
Description: Incised red and black triangles with white lines and dots in triangle centres
Context: VII.21
Wall orientation: N
Excavation phase: Mellaart
References: Mellaart 1967 black and white photograph Pl. 30.
Photograph Source: Hirsh Plate I (9)



Catalogue ID 23
Description: Incised red and black triangles with white dashed line to frame design and white dots in triangle centres
Context: VII.21
Wall orientation: W
Excavation phase: Mellaart
References: Hirsh Pl. V*(1);* Mellaart 1967 colour Pl. VIII
Photograph Source: Todd 62_11





a
Catalogue ID 24
Description: Relief of "splayed" figure with two concentric circles in the centre in red, white and black
Context: VII.23
Wall orientation: E
Excavation phase: Mellaart
References: Hodder, I. 2006, LT, Figure 18; *AS* XIV Pl. XIII *(a)* photo and *(b)* reconstruction. Mellaart 1967 colour Pl. VII; Todd 1976 Figure 22.
Photograph Source: Front view Hirsh Plate X (1); raking view from Mellaart 1967 colour Pl. VII



Catalogue ID 25
Description: Pair of raised reliefs of quadrupeds in profile with sculptural heads and red dado below
Context: VII.44
Wall orientation: N
Excavation phase: Mellaart
References: Hodder, I. 2006. Figure 106 shows in situ photo of full room view from above. *AS* XVI Pl. XXXVIII *(a-c)* Of the six painted layers on this relief, layers three, four and six are documented in reconstructions. Todd 1976 p. 57 and Figure 28. French p. 1
Photograph Source: *AS* XVI Pl. XXXIX *(a)*



a
Catalogue ID 25
Description: (a) Raised relief of Quadrupeds showing the first painted layer, sixth from topmost layer with black "lip" patters with red on heads and paws (b) Detail of quadruped and finger dots in red below the back paws of the leopard figure on photo right
Context: VII.44
Wall orientation: N
Excavation phase: Mellaart
References: Hodder, I. 2006. Figure 106 shows in situ photo of full room view from above. Pl. 10 on page 153 shows detail in colour of the dots and red quadruped with horns below leopard on PL. Figure 58 p.142 shows closer detail in b/w. (a) Hodder, I. 2006, LT. Figure 2. Todd 1976 p. 57 and Figure 27.
Photograph Source: (a) *AS* XVI Pl. XXXIX *(b)*

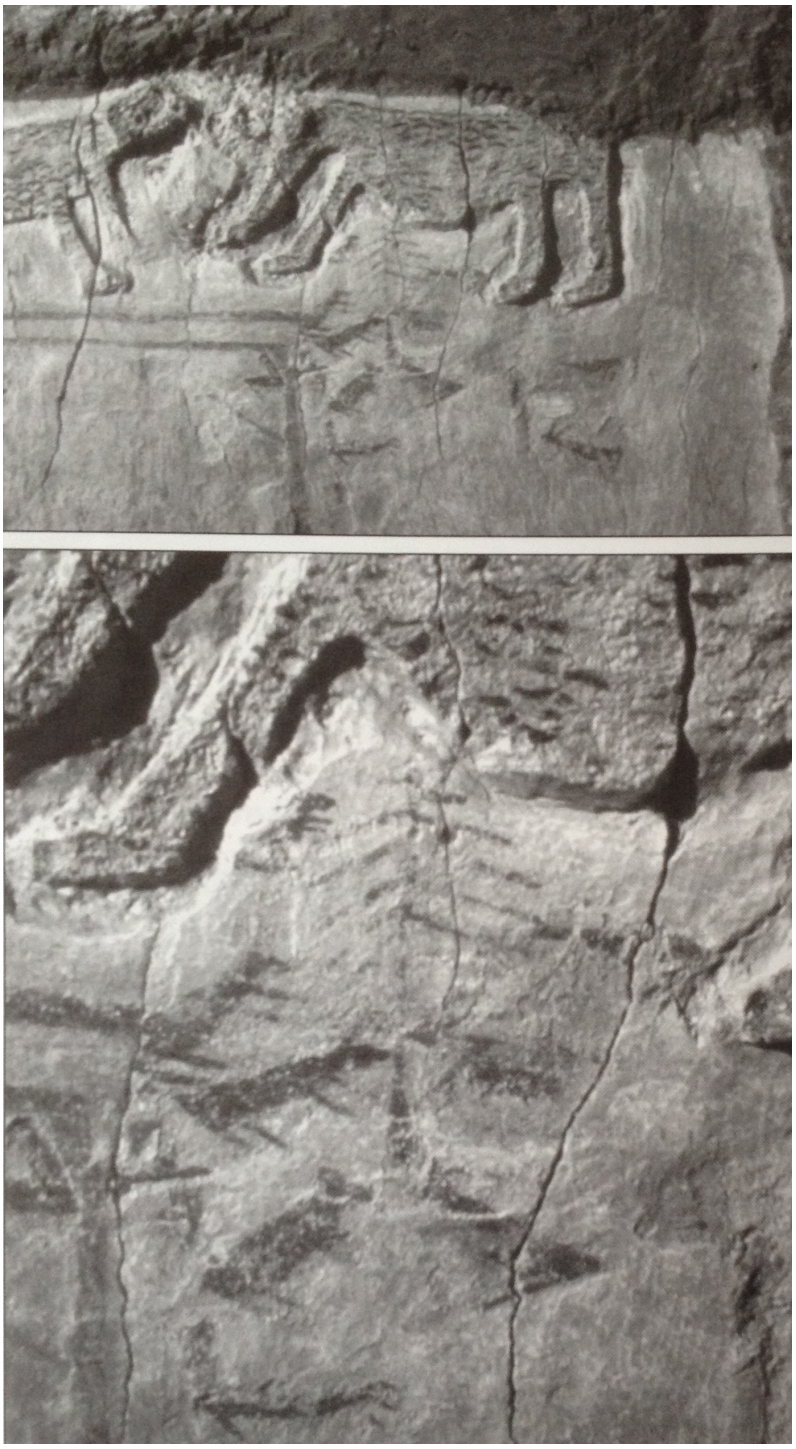


b



c

Catalogue ID 25
Description: (b) and (c) Details of black circles with rosettes formed in negative space
Context: VII.44
Wall orientation: N
Excavation phase: Mellaart
References: Mellaart, J. 1967 Table VI. *AS* XIV. Pl. (a) photo, *(b-c)* reconstructions. Todd 1976: 57.
Photograph Source: (b) Todd 64_14; (c) Todd 64_15



d
Catalogue ID 25
Description: (d) Tree with branches angled downward from trunk with Quadrupeds below and left of the tree.
Context: VII.44
Wall orientation: N
Excavation phase: Mellaart
References: Russell and Meece 2005 report 9-10 goats around the tree, p. 212.
Photograph Source: (d) Mellaart 1966, Pl. XXXV-XXXVI



e
Catalogue ID 25
Description: (e) Room view of tree design.
Context: VII.44
Wall orientation: N (alcove)
Excavation phase: Mellaart
References: Todd, I. p. 61; *AS* XVI Pl. XXXVI *(a);* Finger dots along north and east walls labelled "animal tracks" in AS XVI Pl. XXXVI *(b)*. (c) *AS* XVI Pl. Plate XXXV *(b)* detail of horned quadruped from north wall of alcove.
Photograph Source: (e) Todd 76_07



f
Catalogue ID 25
Description: (f) Tree design with red lines forming trunk and branches angled upward from trunk and leaves formed by finger dots. Five horned animals to the right and left of tree trunk.
Context: VII.44
Wall orientation: N (alcove)
Excavation phase: Mellaart
Photograph Source: Todd 76_10

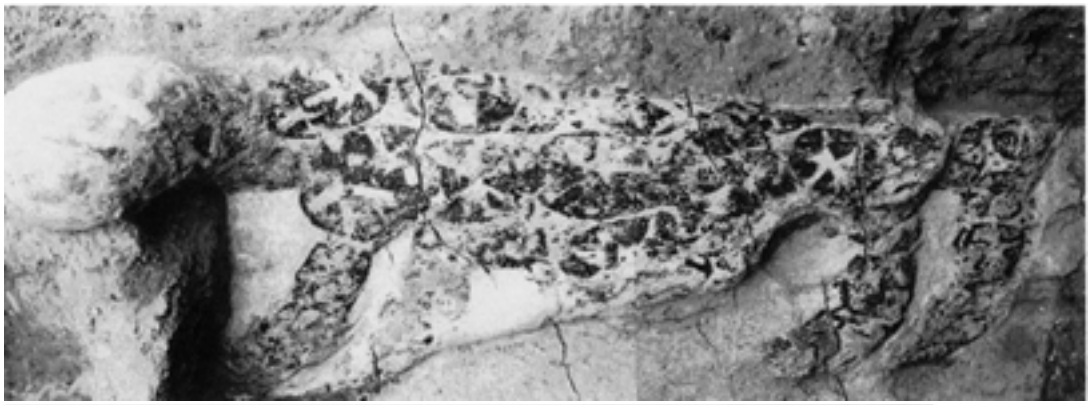


g



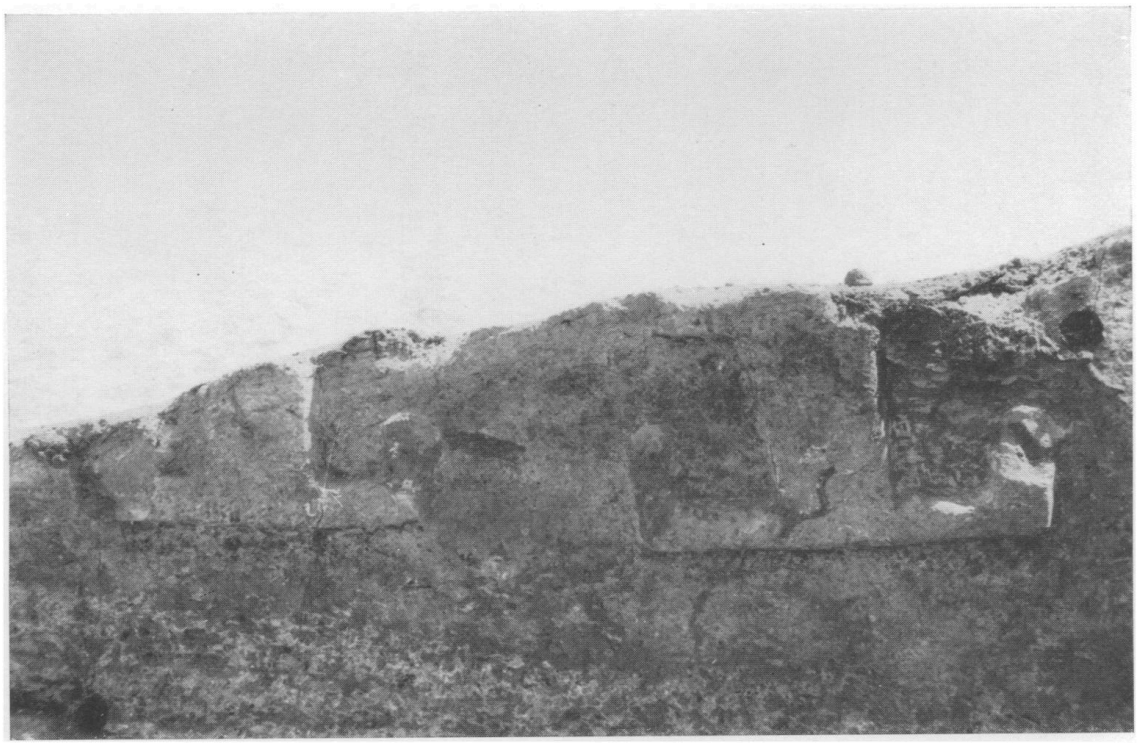
h

Catalogue ID 25
Description: (g) Detail of horned animal and finger dots for leaves in Tree design (h) Detail of horned animal in tree design
Context: VII.44
Wall orientation: N (alcove)
Excavation phase: Mellaart
Photograph Source: (g) Todd 76_09; (h) Todd 76_05





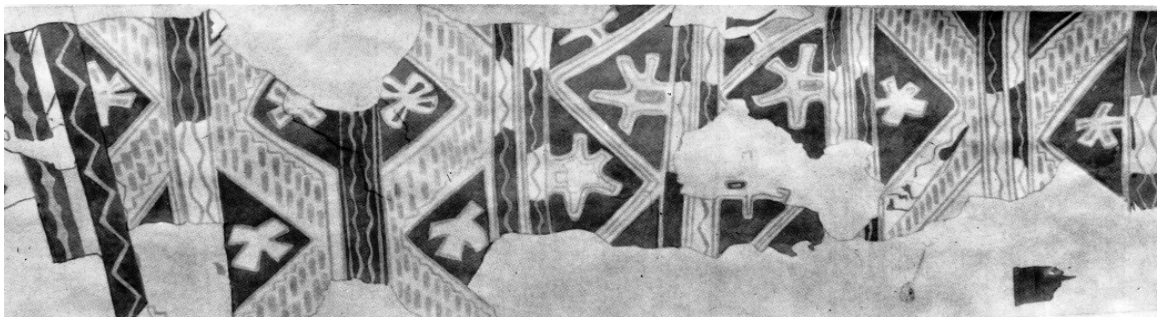
a
Catalogue ID 26
Description: Raised relief of single quadruped (Leopard) with a pattern of black circles with rosettes formed in negative space (a) Detail of the sculptural, painted head
Context: VII.44
Wall orientation: E
References: Hodder, I. 2006. Figure 106 shows in situ photo of full room view from above. Pl. 10 on page 153 shows detail in colour of the dots and red quadruped with horns below leopard on PL. Figure 58 p.142 shows closer detail in b/w. (a) Hodder, I. 2006, LT. Figure 2. Todd 1976: 57.
Photograph Source: *AS* XVI Pl. XXXVII *(a)*: (a) *AS* XVI Pl. XL *(a)*



Catalogue ID 27
Description: Pair of truncated, splayed figures
Context: VII undocumented building
Wall orientation: N
Excavation phase: Mellaart
References: Limbs of figures are painted red, *AS* XII p. 49.
Photograph Source: Mellaart *AS* XII Pl. III(b).



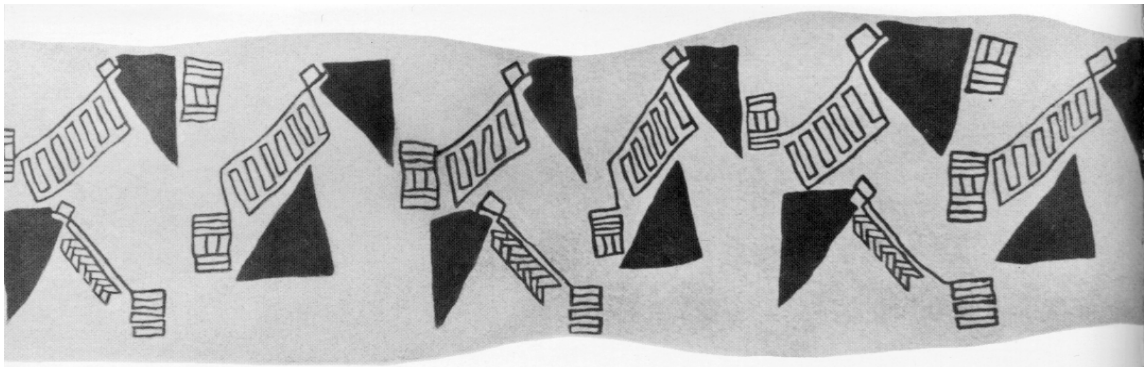
Catalogue ID 28
Description: Design in Horizontal registers separated by diagonal sections including rosette and cross motifs with skull-like elements in lower registers (reproduction)
(a) Upper section only (reproduction)
Context: VIB.1
Wall orientation: N
Excavation phase: Mellaart
References: Mellaart 1967 reproduction black and white Pl. 8 and Pl. 29.
Photograph Source: *AS* XIII Pl. XXVI *(a)*



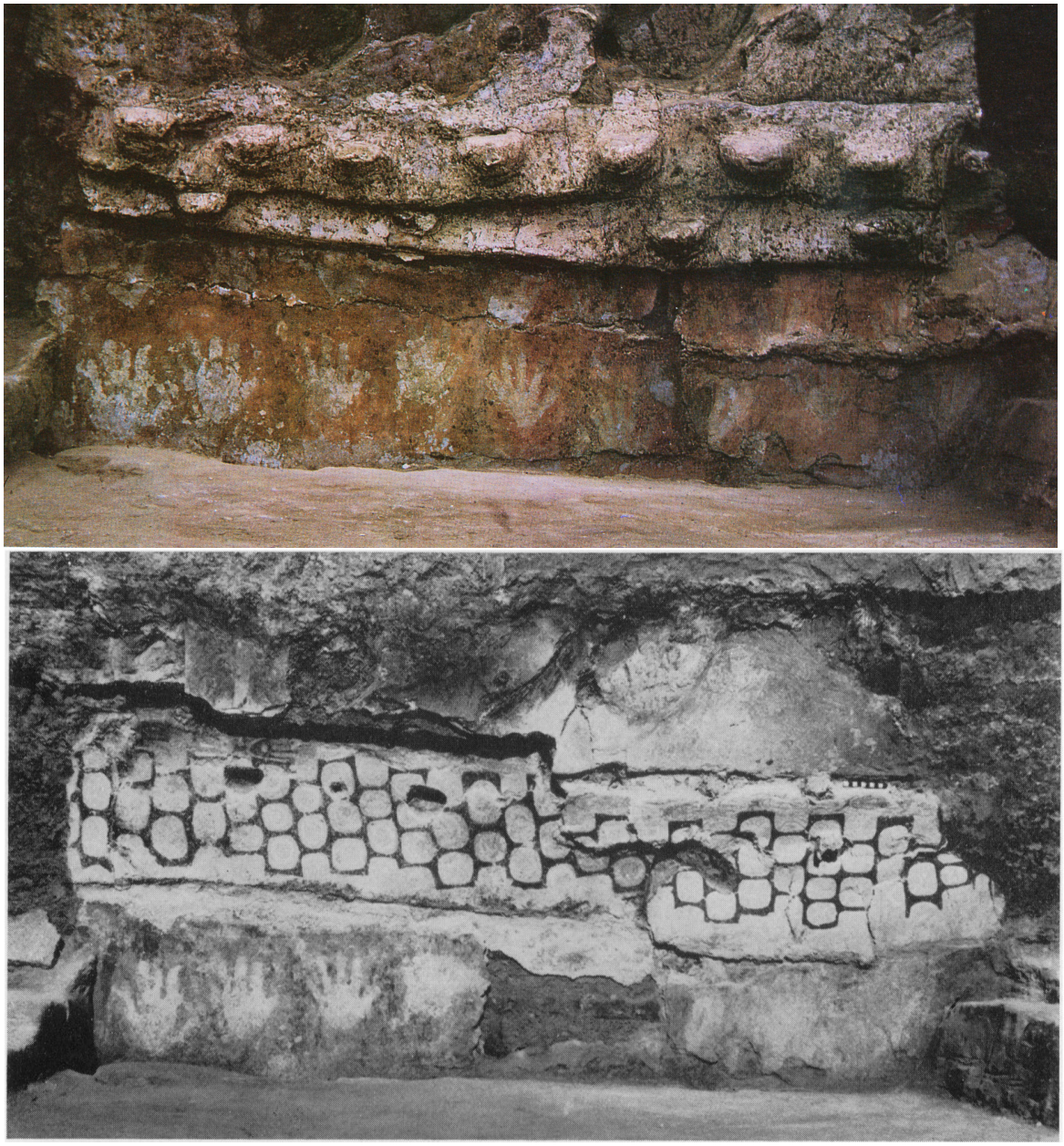
Catalogue ID 29
Description: Design in Horizontal registers with diagonal lines and five-point stars (reproduction)
Context: VIB.1
Dimensions: 1.8 meters long
Wall orientation: E
Excavation phase: Mellaart
References: Mellaart 1967, Figure 44, Pl. 29. P. 153.
Photograph Source: *AS* XII Pl. XI *(b)*



Catalogue ID 30
Description: Red dado over platform, room view
Context: VI.3
Wall orientation: Undocumented
Excavation phase: Mellaart
Photograph Source: *AS* XII Pl. IV *(c)*



Catalogue ID 31
Description: Triangles and diagonal lines (reproduction)
Context: VIB.5
Wall orientation: Undocumented
Excavation phase: Mellaart
References: Mellaart 1967 reproduction black and white Pl. 5.
Photograph Source: *AS* XIII Pl. VIII *(a)*



a
Catalogue ID 32
Description: Two rows of negative handprints below plastered boar jaw installations; (a) Two rows of negative handprint below "honeycomb" design in first phase of painting under boar jaw installations, full wall
Context: VIB.8
Wall orientation: E
Excavation phase: Mellaart
References: AS XIII Pl. X (a-b) photo; AS XIII P. XI (a) restoration. AS XIII Pls. XII (a-c) restorations. Mellaart 1967 Pl 27 black and white.
Photograph Source: Hirsh colour Pl. III (1); (a) *AS* XII Pl. XI *(b)*



b



c

Catalogue ID 32
Description: b) Full wall of the honeycomb-like design above rows of negative handprints in red and white, left wall section; (c) Detail of right wall section of "honeycomb" design in red and white.
Context: VIB.8
Wall orientation: E
Excavation phase: Mellaart
References: *AS* XIII Pl. X (a-b) photo; *AS* XIII P. XI (a) restoration. *AS* XIII Pls. XII (a-c) restorations; Mellaart 1967 black and white photograph Pl. 42, reproduction black and white Pl. 43
Photograph Source: (b) Todd 56_40; (c) Todd 56_



d
Catalogue ID 32
Description: d) Drawing of late painting phase with crosses and stylised flower and insect motifs
Context: VIB.8
Wall orientation: E
Excavation phase: Mellaart
References: Mellaart 1967 Copy of a later painting phase.
Photograph Source: (d) Mellaart 1967 reproduction black and white Figure 46



a
Catalogue ID 33
Description: Six rows of schematic handprints in faded black, full wall Colour is blue-black (French pers. comm.) Wall edges visible in b/w. Excavation reports fifty-seven children's hands. (a) Six rows of schematic handprints in faded black, room view
Context: VIB.15
Wall orientation: N
Excavation phase: Mellaart
Photograph Source: Hirsh Pl. III (2); Pl. III *(a);* (a) *AS* XIII Pl. XVIII *(b)*



Catalogue ID 34
Description: Splayed figure with head with a trail on left
Context: VIB.31
Wall orientation: E
Excavation phase: Mellaart
Photograph Source: *AS* XIV Pl. III *(c)*



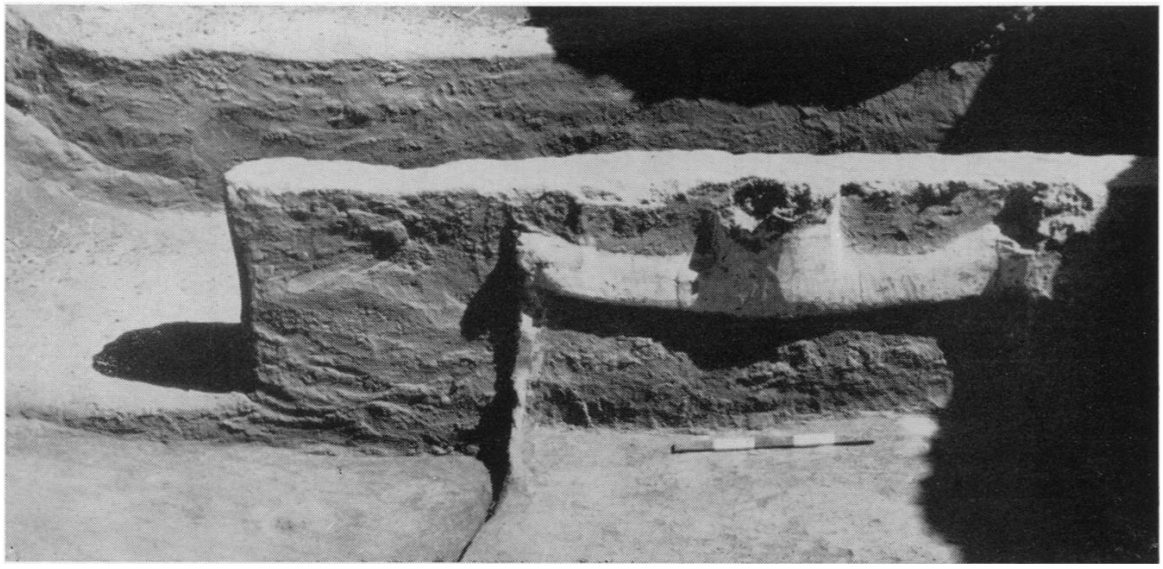
Catalogue ID 35
Description: Splayed figure with red posts over a red dado panel.
Context: VIB.31
Wall orientation: S
Excavation phase: Mellaart
References: AS XIV p. 45 as the "Boar's Head Shrine"; Mellaart 1967 black and white photograph Pl. 24. Toes of the figure reported to have the same outline of red like the feet and tails of the leopards in VI.44.
Photograph Source: *AS* XIV Pl. IV *(a)*



Catalogue ID 36
Description: Splayed figure with short limbs
Context: VIB.31
Wall orientation: W
Excavation phase: Mellaart
Photograph Source: *AS* XIV Pl. IV *(b)*



Catalogue ID 37
Description: Leopards in raised relief on North wall directly above the same subject in Level VII
Context: VI.44
Wall orientation: N
Excavation phase: Mellaart
Dimension: L. 6 feet
References: *AS* XIV. Pl. II (a) photo, *(b-c)* reconstructions. Mellaart 1967 colour Pl. VI black and white photograph Pl. 19-20, reproduction black and white Pl. 18
Photograph Source: Todd 75_27

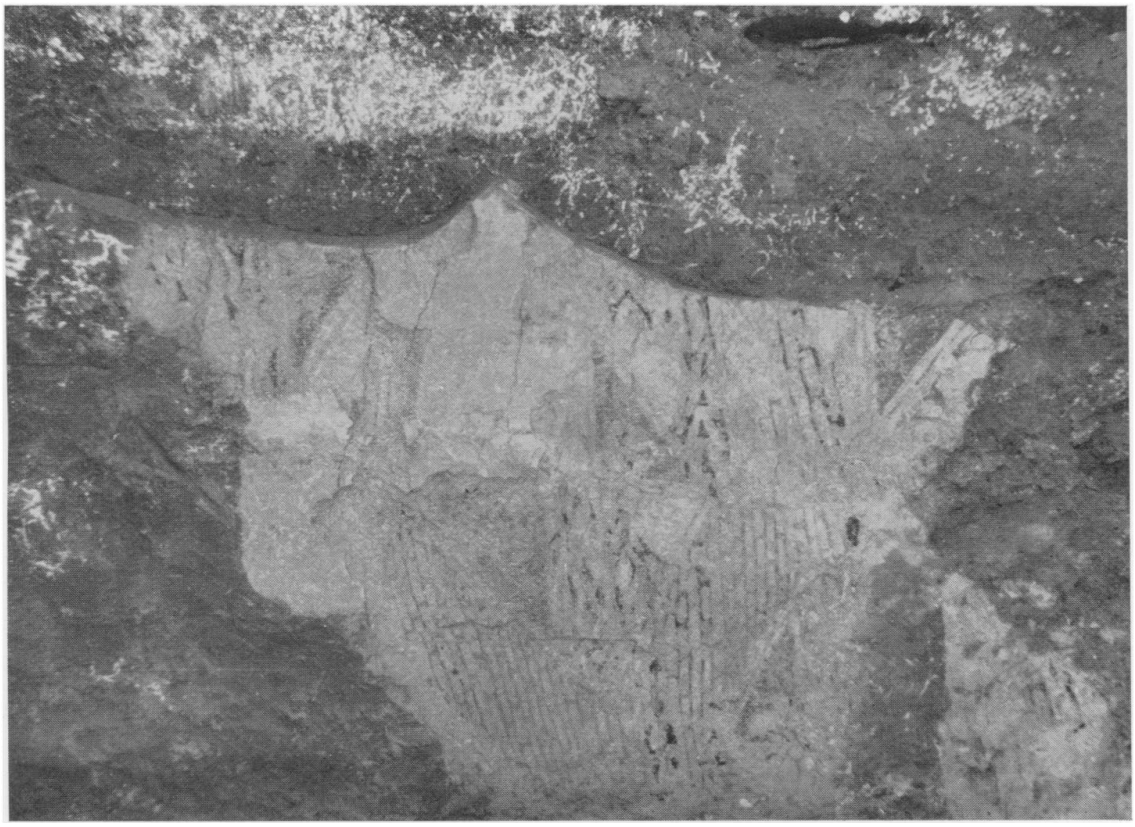


Catalogue ID 38
Description: Truncated, Splayed figure
Context: VIB.45
Wall orientation: none stated
Excavation phase: Mellaart
References: Mellaart 1967 black and white photograph Pl. 25. Red outline on paws indicating blood, similar to that on neighbouring leopard relief.
Photograph Source: *AS* XIV Pl. III *(a)*





a
Catalogue ID 39
Description: Remains of a black textile-like pattern, corner view (a) Red string diagonal lines, detail
Context: VIB.50
Wall orientation: E
Excavation phase: Mellaart
References: AS XVI Pl. XXXIV (a) and (b); Mellaart 1967 plates 37-8, Figure 45, p. 154.
Photograph Source: Todd 76_04; (a) *AS* XVI Pl. XXXIV *(b)*



b
Catalogue ID 39
Description: (b) Remains of diagonal lines with rectangles in brick-like design, detail
Context: VIB.50
Wall orientation: N
Excavation phase: Mellaart
Photograph Source: *AS* XVI Pl. XXXIII (b)





a
Catalogue ID 40
Description: Painted relief of face mask with obsidian eyes
Context: North Area B. 132
Wall orientation: Deposited SE corner of building
Dimensions: H. 40cm X W. 25cm X D. 15cm.
Excavation phase: Çatalhöyük Research Project
References: Archive Report 2015 p. 8-11, p. 284-287, Fig. 1.2, Fig. 28.2-28.9

Photograph Source: Çatalhöyük Research Project; Archive Report 2015 Fig. 28.1; (a) Fig. 28.9 eye detail



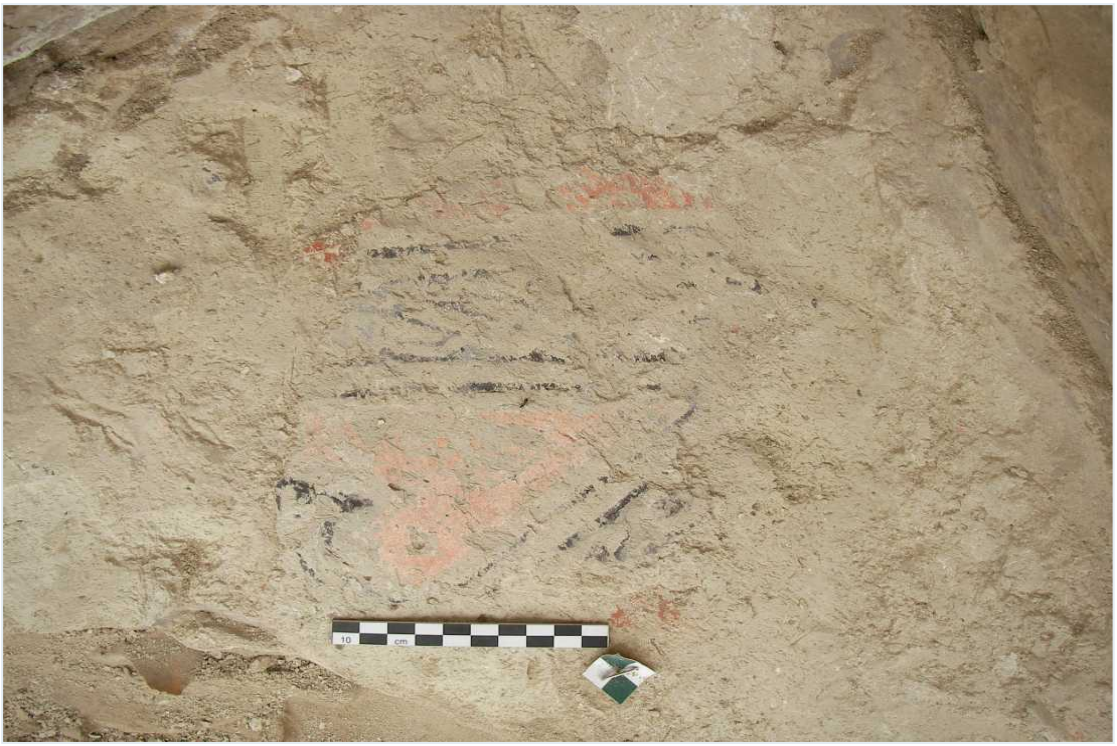
Catalogue ID 41
Description: Concentric Lozenges incised in red
Context: North Area unassigned level G or F, B. 119
Wall orientation: NE corner
Dimension: W. ~1.5 m
Excavation phase: Çatalhöyük Research Project
Photograph Source: Portfolio of ÇRP 15030166490_622018a669_h.jpg

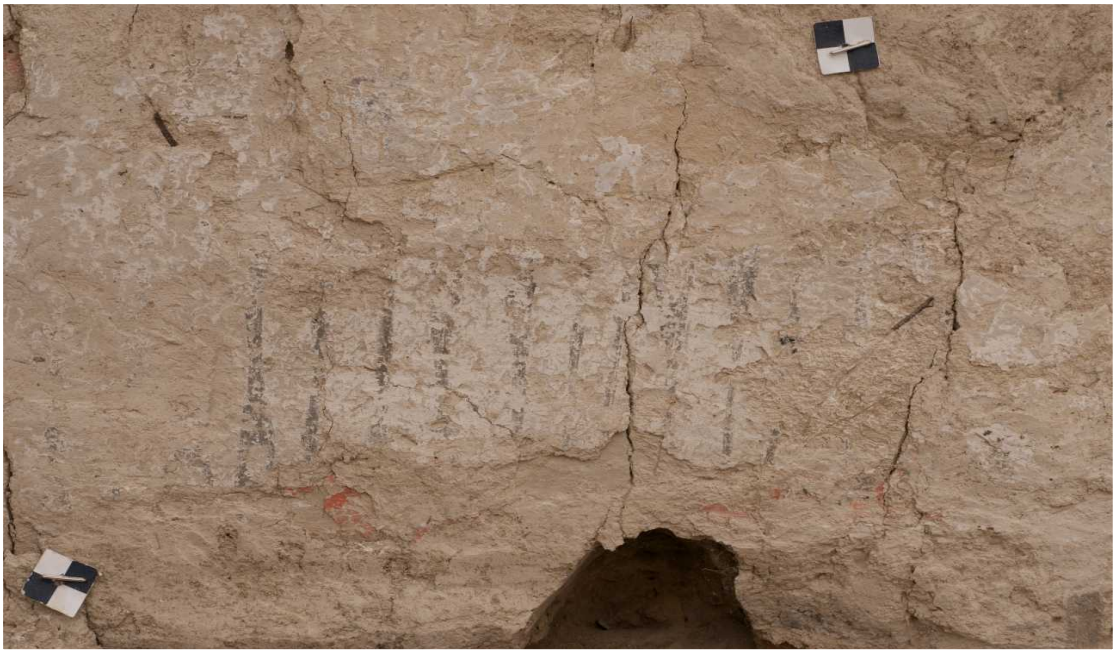


Catalogue ID 42
Description: Schematic handprints in red along platform
Context: North Area B. 49
Wall orientation: N platform
Dimension: 14.7 m sq.
Excavation phase: Çatalhöyük Research Project
References: Archive Report 2008. Eddisford D. p. 33; Figure 18
Photograph Source: Archive Report 2008 Figure 18



Catalogue ID 43
Description: Black and white horizontal and diagonal lines outlining red triangles
Context: North Area B. 49
Wall orientation: W
Dimension: 14.7 m.
Excavation phase: Çatalhöyük Research Project
References: Archive Report 2008 Figure 4, Eddisford, D. p. 32-35.
Photograph Source: Archive Report 2008 Figure 4





a
Catalogue ID 44
Description: Black lines with red (a) Black parallel lines
Context: North Area B. 49
Wall orientation: NW platform
Excavation phase: Çatalhöyük Research Project
Photograph Source: (a) Çatalhöyük Research Project (b) Archive Report 2008 Figure 19



b
Catalogue ID 44
Description: Black four point shapes with “brick” pattern inside linked with rosette
Context: North Area B. 49
Wall orientation: NW platform
Excavation phase: Çatalhöyük Research Project
Photograph Source: (b) Archive Report 2008 Figure 19



Catalogue ID 45
Description: Red platform
Context: North Area B. 52
Wall orientation: N-E
Dimension: ~1.3 m. sq.
Excavation phase: Çatalhöyük Research Project
References: Catalhoyuk.tumblr.com
Photograph Source: ÇRP, Jason P. Quinlan, 2 July 2013



Catalogue ID 46
Description: Red dado
Context: North Area B. 59
Wall orientation: N
Dimension: 56 m. sq.
Excavation phase: Çatalhöyük Research Project
References: Archive Report 2007, House, M. p. 80-96
Photograph Source: Çatalhöyük Archive Report 2006 Figure 6





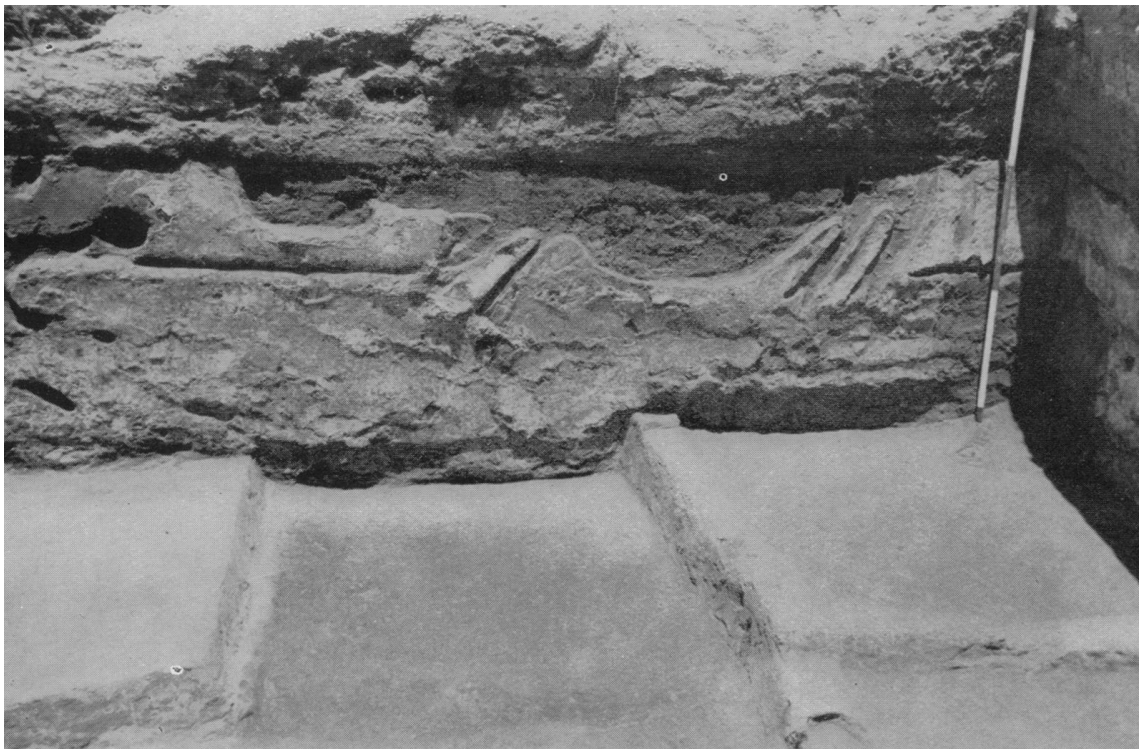
a
Catalogue ID 47
Description: Red painted niche under bucrania (a) Two positive handprints in red
Context: North Area B. 77
Wall orientation: N
Dimension: 27 m. sq.
Excavation phase: Çatalhöyük Research Project
Photograph Source: (a) Archive Report 2010 Figure 32 (b) Archive Report 2010 House Figure 7



b
Catalogue ID 47
Description: (b) Detail of incised platform design in horizontal registers of crosses, scrolls, and triangles in red
Context: North Area B. 77
Wall orientation: N
Dimension: L. 27 cm.; H. 20 cm.
Excavation phase: Çatalhöyük Research Project
Photograph Source: Archive Report 2010 Figure 36



Catalogue ID 48
Description: Detail of red string design
Context: North Area B. 77
Wall orientation: E
Dimension: 27 cm.
Excavation phase: Çatalhöyük Research Project
Photograph Source: Archive Report 2010 Figure 33



Catalogue ID 49
Description: Sunken relief of quadruped painted red
Context: VIA and VIB.8
Wall orientation: N
Dimension: L. of figure 3 m
Excavation phase: Mellaart
References: *AS* XIII p. 67, Mellaart 1967 Pl. 14
Photograph Source: Mellaart *AS* XII Pl. IX(b).



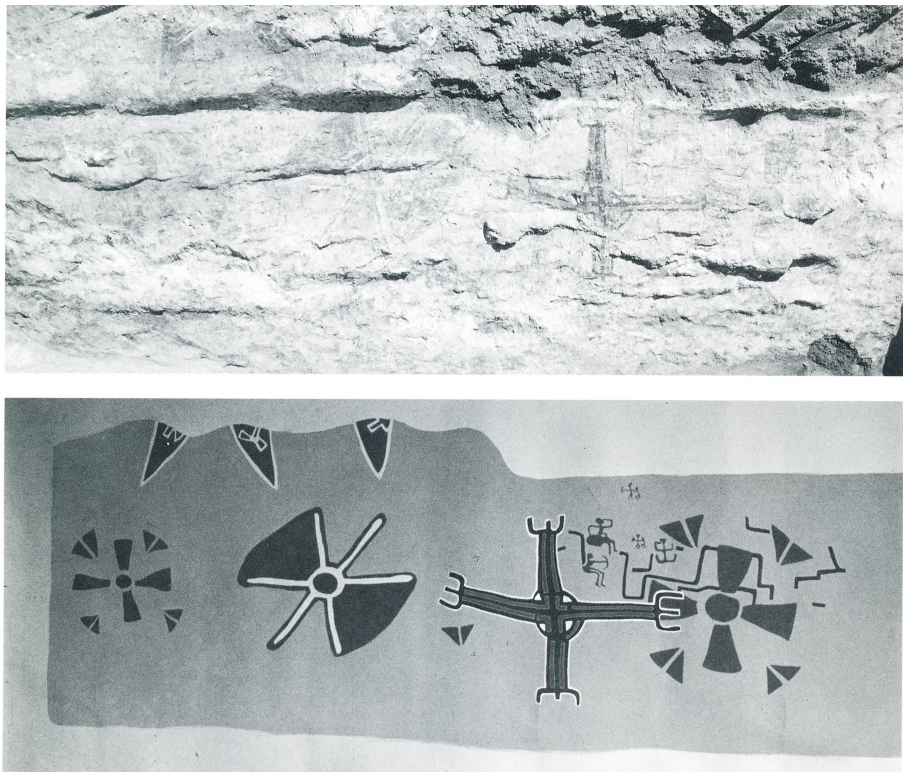
Catalogue ID 50
Description: Splayed figure
Context: VIA.8
Wall orientation: W
Dimension: H. of figure 1.10 m
Excavation phase: Mellaart
References: *AS* XIII p. 61, 67, reconstruction Fig. 8; One phase of the relief painted in a 'saffron yellow' colour Mellaart *AS* XIII, 67, Fig. 8.
Photograph Source: *AS* XIII P. IX(a)



a
Catalogue ID 51
Description: Red framed design in two horizontal registers with centre motif of four-point stars with diagonal brick-like pattern in black and red, full wall
(a) Red and black framed design (reproduction)
Context: VIA.50
Wall orientation: E
Excavation phase: Mellaart
References: *AS* XIV Pl. I (b) with description of a sole handprint in lower left of wall p. 42. Figure 4; Mellaart 1967 black and white photograph detail Pl. 37 and black and white reproduction Pl. 38.
Photograph Source: Hirsh Pl. III (6) colour photo; (a) Hirsh Pl. III (7) colour reconstruction



a
Catalogue ID 52
Description: Handprint detail
Context: VIA.63
Wall orientation: E
Excavation phase: Mellaart
References: Mellaart 1967 Pl. 7, AS XIII Pl. VII(b). Documented as painted in red.
Photograph Source: Mellaart 1967 Pl. 7; (a) *AS* XIII Pl. VII (b)



a



b

Catalogue ID 53
Description: (a) Crosses and replica drawing of crosses; (b) Detail of a human
Context: VIA.66
Wall orientation: E
Excavation phase: Mellaart
Location: Ankara Museum
References: (a) Hirsh 1989 colour Pl. (IV); Mellaart 1967 black and white reproduction of crosses with human figure Pl. 40; (b) Mellaart 1967 black and white photograph of human detail Pl. 39
Photograph Source: (a) Hirsh 1989 Pl. (IV); (b) Mellaart 1967 Pl. 39





a
Catalogue ID 54
Description: Checkerboard painted Platform edge, (a) Handprint on platform surface
Context: Area B. 80
Wall orientation: NE platform edge, (a) platform surface
Dimension: 1.5m
Excavation phase: Çatalhöyük Research Project
References: Archive Report 2015 p.59-65, 68.
Photograph Source: Çatalhöyük Research Project; Archive Report 2015 Fig. 3.18;(a) Fig. 3.17





a
Catalogue ID 55
Description: Horizontal registers with diagonal lines in brick-like patterns with a red ring around a niche (a) detail of painted area to the left with curved lines and shapes
Context: South O.VIA.80
Wall orientation: E
Excavation phase: Çatalhöyük Research Project
Photograph Source: Author's own.

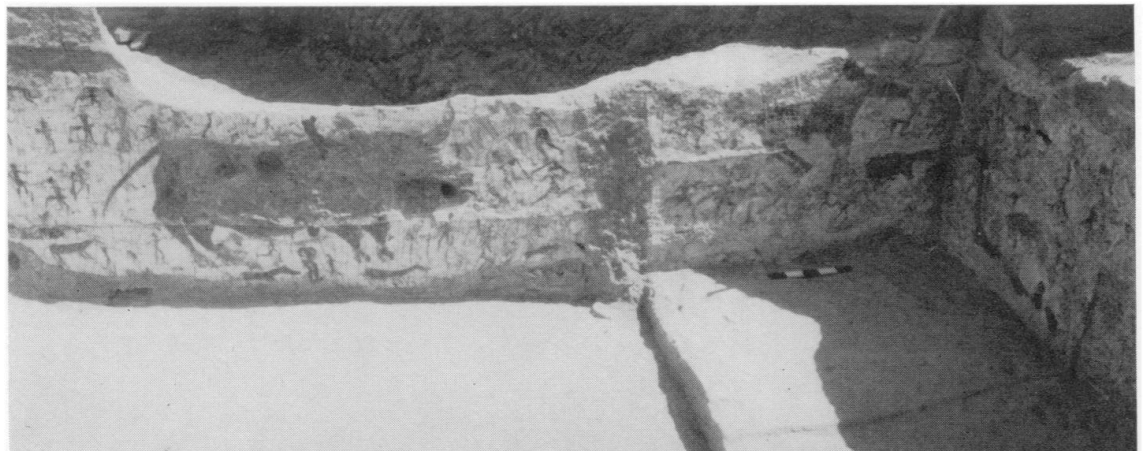


Catalogue ID 56
Description: Diagonal sunk relief (cut-out) line in red
Context: South Area B. 96
Wall orientation: N
Dimension: ~0.75 m
Excavation phase: Çatalhöyük Research Project
Photograph Source: Portfolio of ÇRP 20120623_jpq_8068.jpg



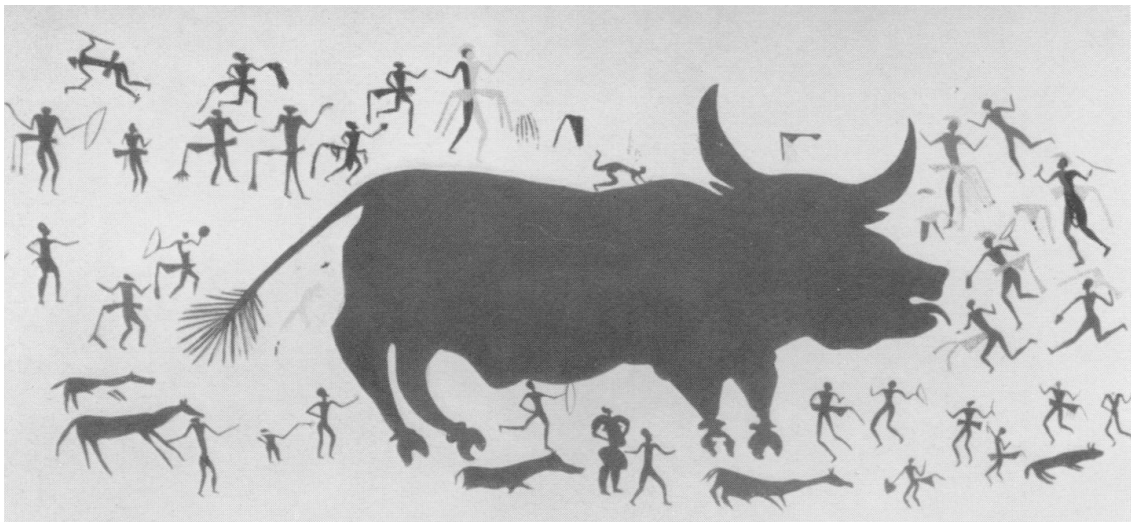


a
Catalogue ID 57
Description: Red string diagonal lines
Context: South Area VIA.O B. 96, sp. 370
Wall orientation: E
Dimension: ~1m long
Excavation phase: Çatalhöyük Research Project
Photograph Source: Portfolio of ÇRP 15030172248_800b9e9dff_n.jpg; (a) 15213681141_c523943583_n.jpg





a
Catalogue ID 58
Description: Large Bull with quadrupeds and human figures, room view (a) "Hunting Shrine" painting with a large bull centre figure with horns and hooves in profile facing right painted in red with black burrowing holes through animal's upper back. The bull has human figures in red and black on all sides. Three other animals visible below and to the left.
Context: V.1
Wall orientation: N
Excavation phase: Mellaart
Photograph Source: *AS* XVI Pl. LIV *(a)* reconstruction; (a) Hirsh II (10)



b



c

Catalogue ID 58
Description: (b) Reproduction of painting in the room termed by Mellaart as the "Hunting Shrine" (c) Detail of Two human figures, one headless
Context: V.1
Wall orientation: N
Excavation phase: Mellaart
Photograph Source: (b) *AS* XVI Pl. LI (a); (c) *AS* XVI Pl. LVI (b)



d
Catalogue ID 58
Description: (d) Large horned animal, boar, with human figures (reproduction)
Context: V.I
Wall orientation: N
Excavation phase: Mellaart
Photograph Source: (d) *AS* XVI Pl. LIX *(b)*

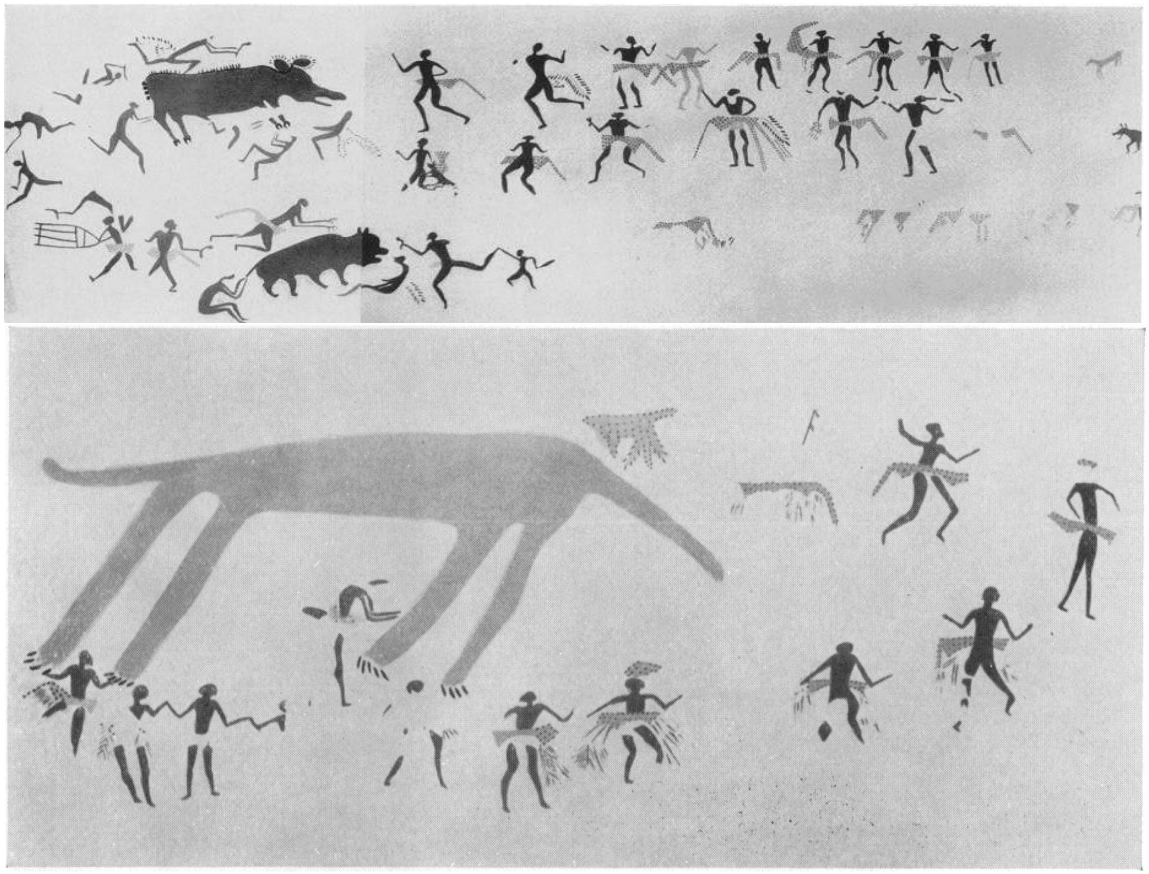


e



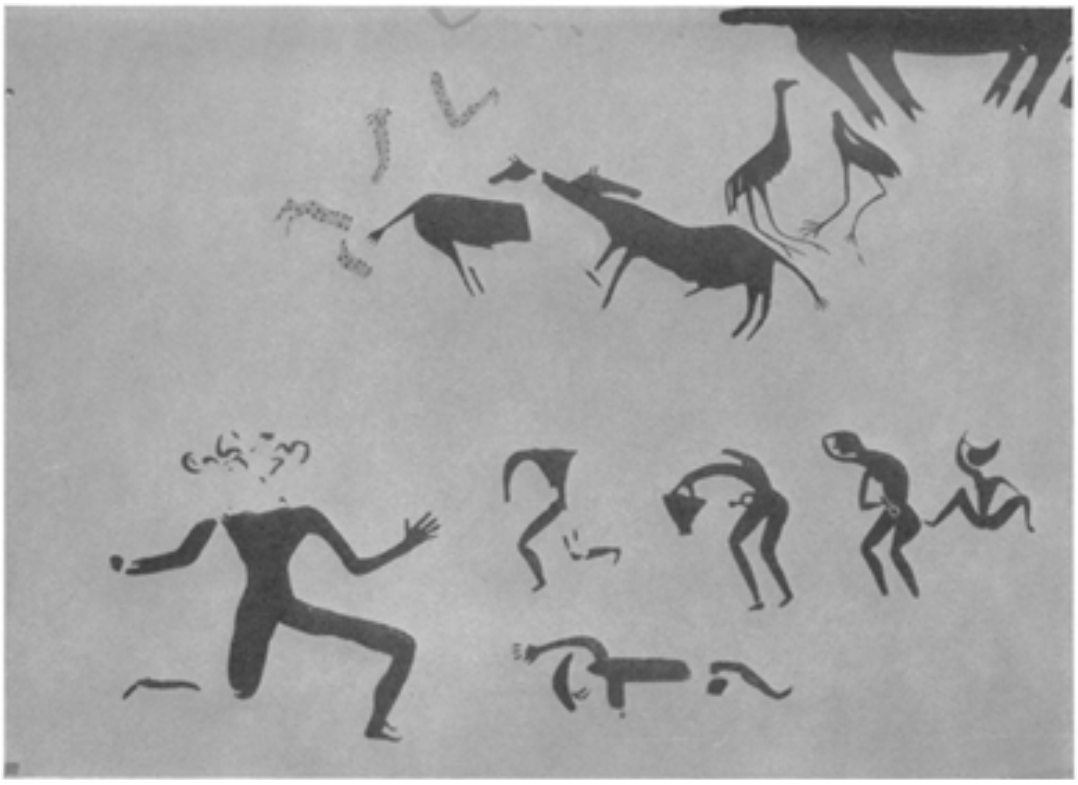
f

Catalogue ID 58
Description: (e) Quadrupeds and humans, right wall section (f) Quadrupeds and human figures, corner view
Context: V.I
Wall orientation: N
Excavation phase: Mellaart
Photograph Source: (e) *AS* XVI Pl. LIX *(a);* (f) Detail N-E corner *AS* XVI Pl. LI *(b)*



a
Catalogue ID 59
Description: Quadrupeds with humans, North and centre section of the wall (reproduction) (a) Lower half of quadruped incised with human figures, South section of the wall (reproduction)
Context: V.1
Wall orientation: E
Location: Ankara Museum
Photograph Source: *AS* XVI Pl. LXI *(a);* (a) reconstruction of "lion" *AS* XVI Pl. LXI *(b)*

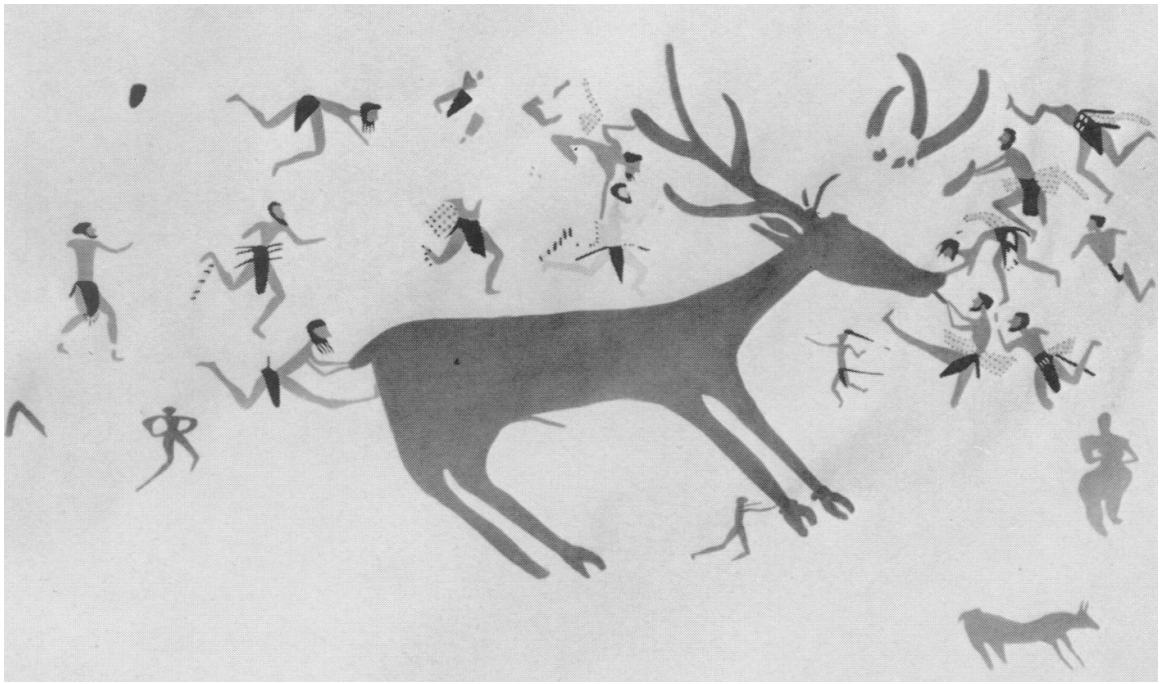


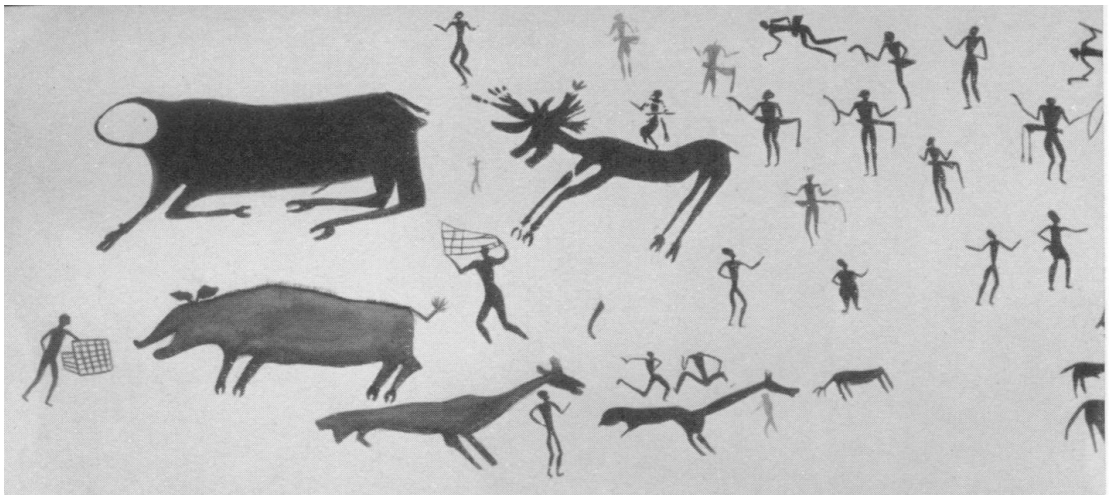


a
Catalogue ID 60
Description: Humans with animals, detail of red quadrupeds and black birds (a) Humans under animals black birds and red quadrupeds (reproduction)
Context: V.I
Wall orientation: S
Excavation phase: Mellaart
Photograph Source: (a) Museum of Ankara; (b) *AS* XVI Pl. LXII *(b)*



b
Catalogue ID 60
Description: (b) Detail of black birds, black and white photo
Context: V.I
Wall orientation: S
Excavation phase: Mellaart
Photograph Source: *AS* XVI Pl. LXII *(a)*





a
Catalogue ID 61
Description: Large quadruped with antlers as a centre figure surrounded by human figures and one, smaller animal figure (reproduction) referred to by Mellaart as the "Red Deer Stag"; (a) Five animals, quadrupeds, one with antlers with human figures (reproduction)
Context: V.1
Wall orientation: W
Excavation phase: Mellaart
Photograph Source: *AS* XVI Pl. LII *(b)* reconstruction; (a) *AS* XVI Pl. LIII *(a)*



b



c

Catalogue ID 61
Description: Details of Shrine V.I (a) Three red quadrupeds with red and black human figures, one with net. (b) Corner view with painted figures on walls and floor of Shrine V.I
Context: V.1
Wall orientation: W
Excavation phase: Mellaart
Photograph Source: (b) Ankara Museum; (c) *AS* XVI Pl. LIII *(a)*

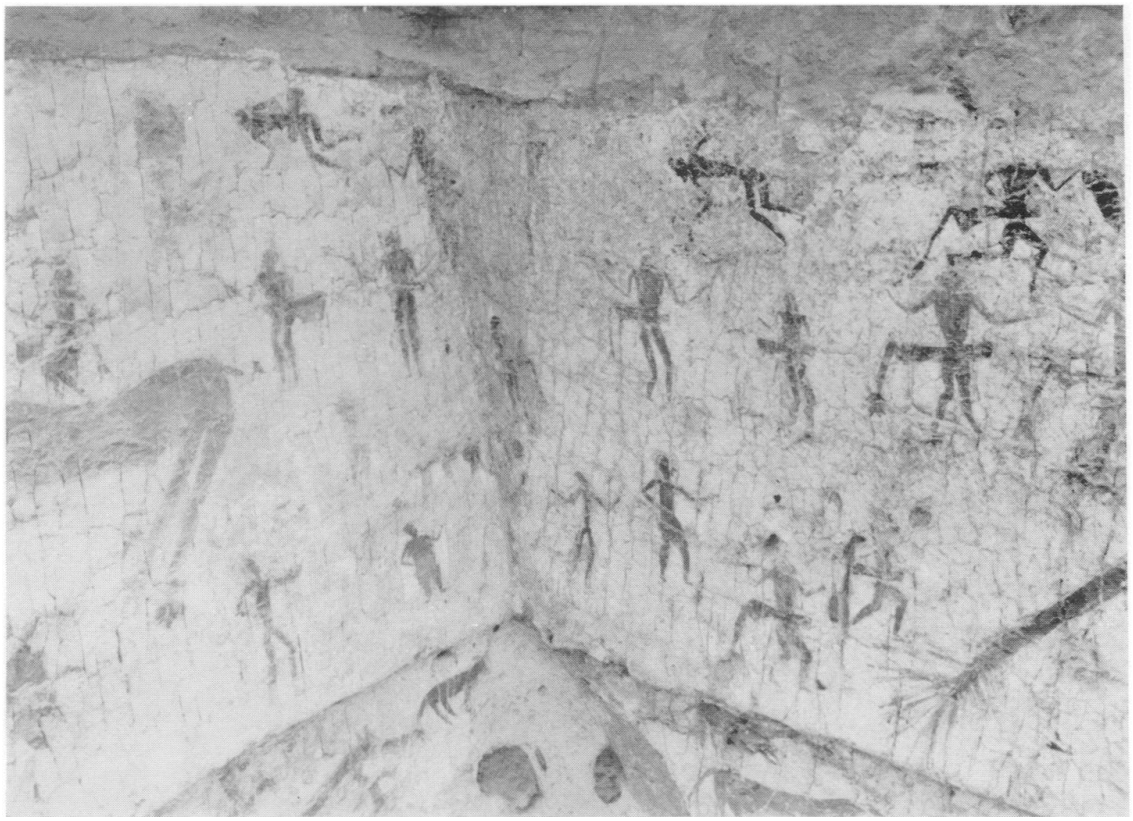


d



e

Catalogue ID 61
Description: (c) Detail of horned animal with antlers
(d) Detail of human figure in black hands on tail of animal
Context: V.1
Wall orientation: W
Excavation phase: Mellaart
Photograph Source: (d) Ankara Museum; (e) *AS* XVI Pl. LII *(a)*



Catalogue ID 62
Description: Corner view of Hunting Shrine showing human and animal figures on walls and floors
Context: V.1
Wall orientation: NW corner
Excavation phase: Mellaart
Photograph Source: (b) *AS* XVI Pl. LV *(a)*

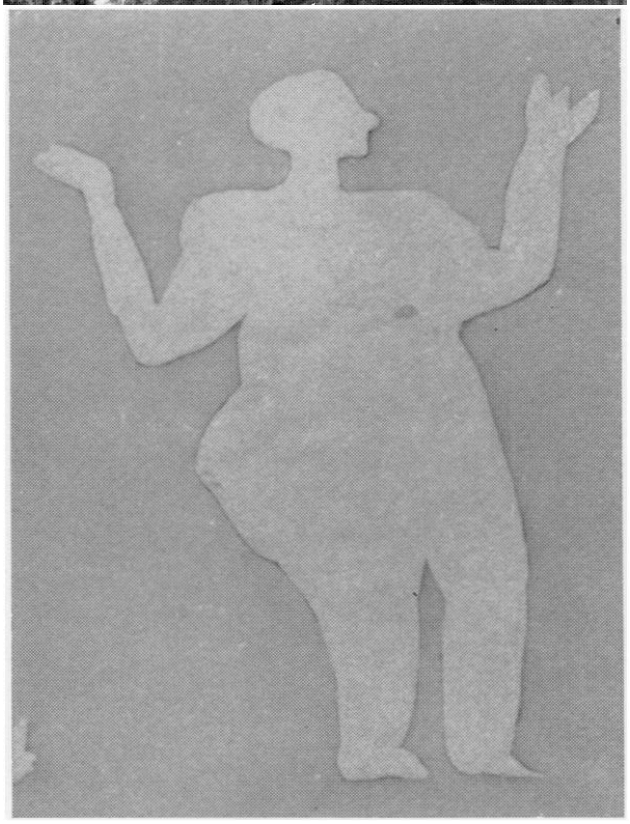


Catalogue ID 63
Description: Positive red handprints with black shape
Context: North Area B. 55
Wall orientation: N
Excavation phase: Çatalhöyük Research Project
Archive Report 2005, Yeomans L. p. 36; Archive Report 2008; Çamurcuoğlu, D. p. 256 Figure 176
Photograph Source: Archive Report 2008 Figure 176



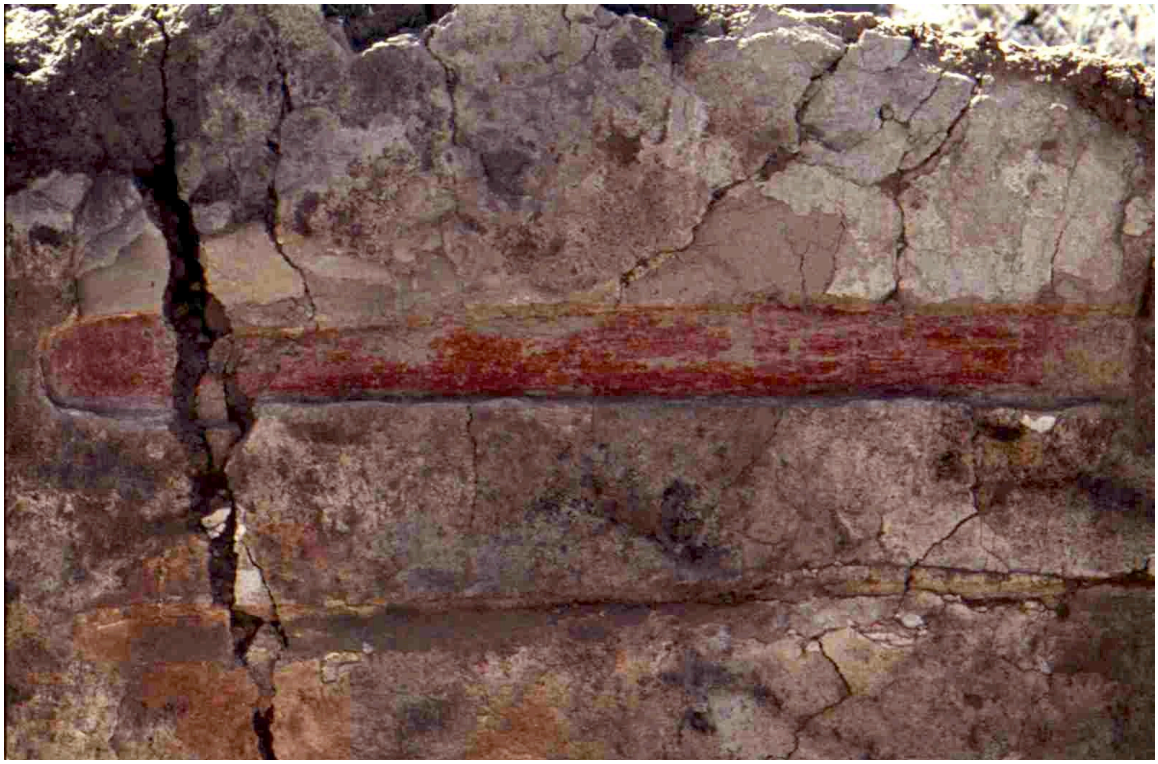
Catalogue ID 64
Description: Red horizontal design
Context: North Area B. 55
Wall orientation: S
Dimension: ~30 cm. sq.
Excavation phase: Çatalhöyük Research Project
References: Archive Report 2005, Yeomans, L. p. 36.
Photograph Source: Çatalhöyük Research Project; Archive Report 2005 p. 36



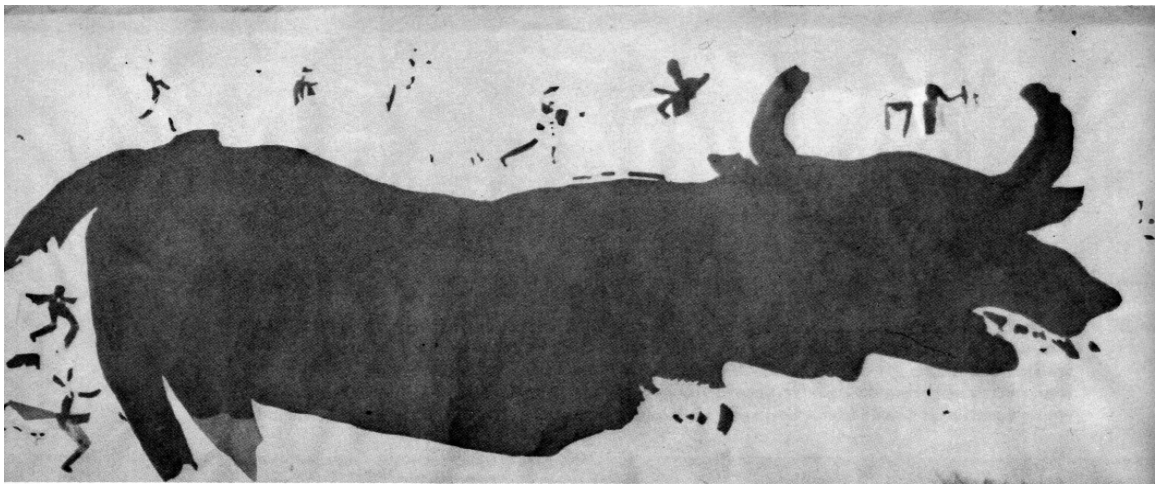


a
Catalogue ID 65
Description: Detail of voluminous, human figure in white
Context: IV.1
Wall orientation: E
Dimension: 0.13 m
Excavation phase: Mellaart
References: AS XII p. 60; Mellaart 1967 black and white Pl. 53.

Photograph Source: *AS* XII Pl. XIII *(a)* photo; (a) *AS* XII Pl. XIII *(b)* reconstruction



Catalogue ID 66
Description: Horizontal sunk relief line in red
Context: South Area, level not stated, most likely IV, documentation in photograph only
Wall orientation: Undocumented
Excavation phase: Mellaart
References: Photo taken after A.III.1 stag and hunter taken August 1962 in Level VI area
Photograph Source: Todd 55_29



Catalogue ID 67
Description: Red bull with Human Figures (reproduction)
Context: III.1
Wall orientation: N
Dimension: L. of bull 2.05 m; L. of scene 5.5 m
Excavation phase: Mellaart
References: *AS* XII p. 57 Figure 11 (reconstruction of building); Mellaart 1967 black and white Pl. 64.
Photograph Source: *AS* XII Pl. XV (a) reconstruction





a



b

Catalogue ID 68
Description: Two horned Stags with human figures (reproduction), (a) Detail of a Human figure in red (b) Detail of human figure in red, headless, holding bow
Context: III.1
Wall orientation: E
Dimension: L. 1 m.; H. 0.65 m.
Excavation phase: Mellaart
References: Mellaart 1967 black and white Pl. 61; (b) Mellaart 1967, p.61, colour Pl. 63 and XIII; Hirsh 1989 Pl. I (2). Cover art for Hodder 2006.
Photograph Source: *AS* XII Pl. XIV *(b)* reconstruction; (a) *AS* XII colour Pl. XVIII; (b) Todd 54_16





a
Catalogue ID 69
Description: Horned Animals with Human Figures (Reproduction), (a) Detail of Horned Animals
Context: III.1
Wall orientation: Antechamber S
Dimension: 3.75 sq. m.
Excavation phase: Mellaart
References: *AS* XII Pl. XVII *(a);* Mellaart 1967 reproduction Pl. 54, black and white Pl. 55.
Photograph Source: *AS* XII Pl. XVI *(a)* reconstruction; (a) *AS* XII Pl. XVII *(b)*



a
Catalogue ID 70
Description: NE corner view with (a) Red triangles and white diagonal lines, full wall view
Context: III.8
Wall orientation: NE corner
Excavation phase: Mellaart
References: *AS* XIII p. 48, Pl. IV (b) reconstruction Pl. IV *(c)* photo; Mellaart 1967 reproduction black and white p. 31.
Photograph Source: Mellaart 1967 Pl. 32; (a) Todd 54_31

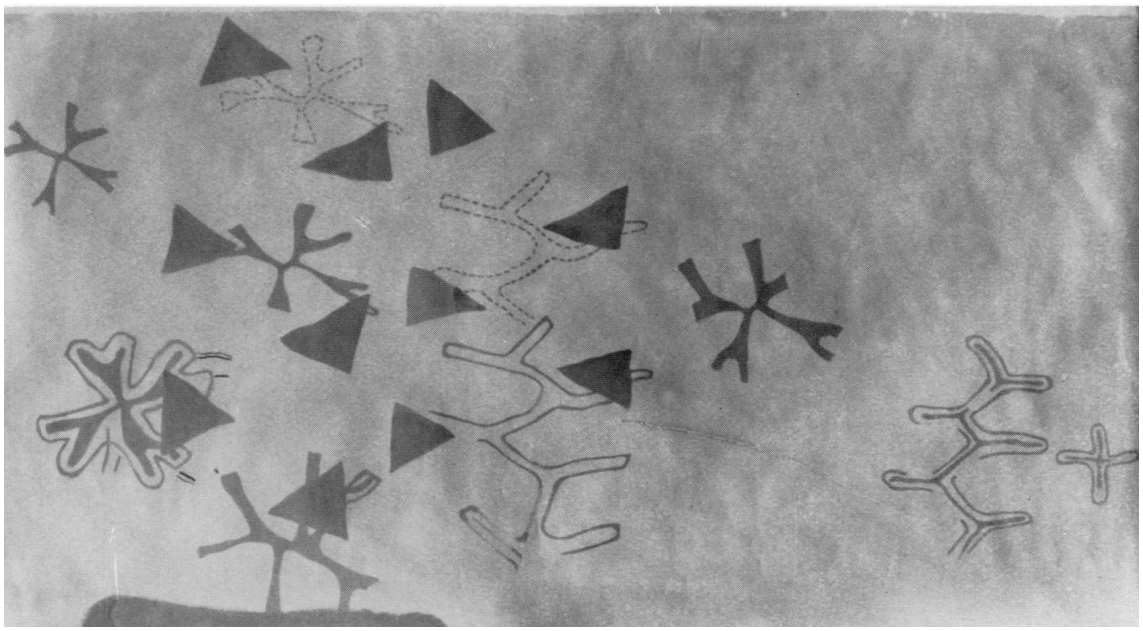


b



c

Catalogue ID 70
Description: (b) Detail of Red triangles and white diagonal lines (c) Detail of Red triangles and white diagonal lines
Context: III.8
Wall orientation: NE
Excavation phase: Mellaart
References: *AS* XIII P. IV (b) reconstruction Pl. IV *(c)* photo
Photograph Source: (b) Todd 53_29; (c) Todd 53_30



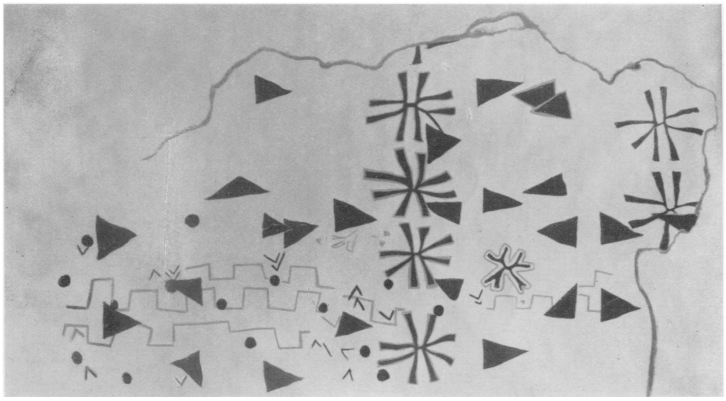
Catalogue ID 71
Description: Red triangles
Context: III.8
Wall orientation: E
Excavation phase: Mellaart
References: *AS* XIII p.48
Photograph Source: *AS* XIII Pl. III (a)



Catalogue ID 72
Description: Triangles and Eight point rosettes, full wall view.
Context: III.8
Wall orientation: W
Excavation phase: Mellaart
References: *AS* XIII P. IV (a) reconstruction; Mellaart 1967 black and white photograph Pl. 34, p.155.
Photograph Source: Todd 54_25



a



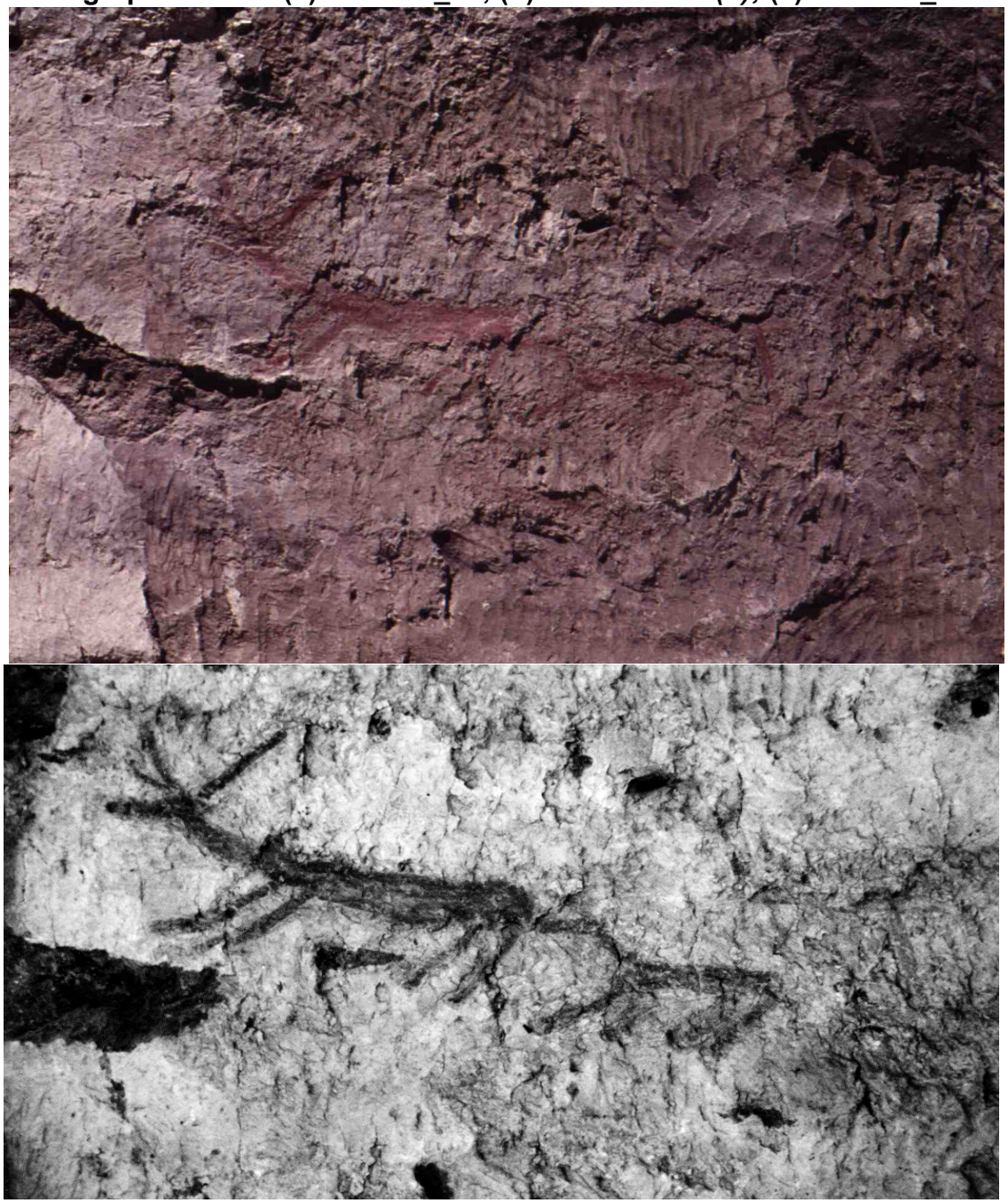
b



c

Catalogue ID 72
Description: (a) Triangles and Eight point rosettes, left section of West wall (b) Triangles and Eight point rosettes (reproduction), (c) Detail of Eight point rosette
Context: III.8
Wall orientation: W
Dimension (a) ~20 m. sq.
Excavation phase: Mellaart

References: *AS* XIII P. IV (b) reconstruction Mellaart 1967 black and white reproduction Pl. 33.
Photograph Source: (a) Todd 54_22; (b) *AS* XIII Pl. III *(b);* (c) Todd 53_20



a
Catalogue ID 73
Description: Detail of Two horned quadrupeds, adult and young in red
Context: III.13
Wall orientation: N
Dimension: ~12.5cm.
Excavation phase: Mellaart
References: Mellaart 1967 colour Pl. XI and reconstruction black and white Pl. 57.
Photograph Source: Todd 54_33; Mellaart 1967 black and white Pl. 56.



Catalogue ID 74
Description: Diagonal and vertical textile-like pattern, in white on buff plaster
Context: Level III-0, TP Area B. 121
Wall orientation: E
Dimension: ~1.2 m
Excavation phase: Çatalhöyük Research Project
Photograph Source: Portfolio of ÇRP 20130802_cons_0178





a
Catalogue ID 75
Description: Incised scroll pattern in plaster around burial tomb
Context: Level III-0, TPC Area B. 72, sp. 327
Wall orientation: W, wrapping around to S and N
Dimension: 1.1 m W wall, partial coverage of N-S walls 1.9 m
Excavation phase: Çatalhöyük Research Project
Photograph Source: Portfolio of ÇRP 971096441_bfbe43bbf_m.jpg; (a) 20070723_AL_021.jpg, (b) 2007073_AL_025.jpg



b
Catalogue ID 75
Description: detail of Incised scroll pattern in plaster around burial tomb
Context: Level III-0, TPC Area B. 72, sp. 327
Wall orientation: W, wrapping around to S and N
Dimension: 1.1 m W wall, partial coverage of N-S walls 1.9 m
Excavation phase: Çatalhöyük Research Project
Photograph Source: Portfolio of ÇRP (b) 2007073_AL_025.jpg



Catalogue ID 76
Description: Red figure on fragment in burial chamber
Context: Level III-0, TP.O
Wall orientation: B. 72
Dimension: ~25 cm
Excavation phase: Çatalhöyük Research Project
References: Marciniak, A. and Czerniak, L. P. 76-78
Photograph Source: Archive Report 2008. Marciniak, A. and L. Czerniak.
Figure 57



a
Catalogue ID 77
Description: Horizontal lozenges in black and white
Context: Level III-II, TPC B. 122, Space 562
Wall orientation: E
Dimension: L. 5.1m, H. 3.7m
Excavation phase: Çatalhöyük Research Project
References: Archive Report 2015 p. 76
Photograph Source: Çatalhöyük Research Project; Archive Report 2015 Figure 4.6 (a) Fig. 4.

APPENDIX II Techniques for Materials Analysis

Optical and Polarised Light Microscopy

a) How OM/PLM works

The technique of optical microscopy uses magnifying eyepiece lenses and objectives that combine to allow for the examination of samples at magnifications ranging from 2.5 – 1000x, depending on the instrument. A sample is illuminated with either transmitted or reflected light that passes upwards through the vertical illuminator through lenses and apertures to the eyepiece for observation (Bradbury and Bracegirdle 1998). The field of view can be observed by eye or be recorded with a camera.

Optical and polarised light microscopy is the most commonly applied analytical technique for the identification of pigments (Eastaugh 2004a). It allows for the observation of crystalline structures in mineral pigments. In transmitted light, one can observe pigment colour, opacity, grain size, surface, shape, roundness, and degree of dispersion in the sample matrix. Inclusions and other relationships between particles and constituents in the sample can also been seen with this method (Eastaugh 2004a).

Polarised light microscopy is possible with microscopes fitted with a polariser. The polariser is a filter which forces the transmitted light travelling in every direction, to vibrate into a single direction along one plane. Two polarisers, one above and one

below the observed sample are set at right angles. When both polarisers are inserted in the field of view, they refract the light and split it into two rays of light, which vibrate perpendicular to one another. The crystalline material between the two polarisers allows for the observance of diagnostic interference colours, or polarisation colours. Some of the features of individual grains that can be observed with polarised light microscopy are birefringence (the difference between the two refractive indices (RI) of a crystal) and pleochroism, refractive index, iso- or anisotropism. To observe interference colours, the standard thickness in thin sections is 30 micrometers. Pigment particles, however, are usually smaller and irregular in depth and, as such, exhibit lower order colours on the Michel-Levy Chart (Eastaugh 2004a). Mineralogical texts describe the standard interference colours for crystals to match to samples in order to characterise minerals (Deer et al. 1992).

Feller and Bayard (1986) provide a basic overview of procedures for the observation of pigments. The encyclopedic and illustrated resource for the examination of pigments using this technique is the *Pigment Compendium: Optical Microscopy of Historical Pigments* by Eastaugh et al. (2004a).

b) OM/PLM equipment

Particles were examined with ***optical microscopy*** *(OM) and* ***polarised light microscopy*** *(PLM) up to 500x magnification with binocular microscopy with the Leica DM 2500P microscope at RLAHA.*

c) Sample prep for OM/PLM

Temporary slides to view grains were prepared with glycerine on a glass slide with a slide cover. The mounting medium for permanent slides was prepared as recommended in the *Pigment Compendium* (Eastaugh et al. 2004a), with Cargille Meltmount media, halogenated diphenyl oxide, and natural hydrocarbons, with a 1.66 refractive index (RI).

In cases where a polished sample surface is needed for analysis, cross sections were made with the Easy Sections© kit. This protocol is in common usage in the sampling of polychrome surfaces in museum collections. The sample is placed into a mould and the 2-part epoxy resin is poured over the sample. The epoxy composition is a resin, made of methyl methacrylate 65 to 75%, hydroxyethyltoluidine <0.5%, and a hardener, made of dibenzoylperoxide 5% in phthalate plasticizer. Visibility of the sample is enhanced as the mould and epoxy share the same RI.

To cut cross sections, the Isomet low speed copper blade saw by Buehler was used. Polishing of cross sections was done with abrasive papers and Micromesh© polishing cloths.

d) Standards used for OM/PLM

The reference specimens used for OM/PLM of red pigments are powdered red ochre, cinnabar from commercial suppliers Kremer Pigmente, hematite, cinnabar, realgar, and orpiment from the Oxford University Natural History Museum, and mineral cinnabar from the RLAHA collection. Reference specimens for yellow colours were powdered jarosite from Kremer Pigmente, and mineral jarosite and goethite from the

OUMNH. For blue pigments, powdered samples of azurite, lapis lazuli, and chrysocolla from Kremer Pigmente and mineral specimens of azurite from OUNMH were used. For green, powdered malachite and atacamite from Kremer Pigmente and mineral malachite from OUMNH were examined. For white or colourless constituents, powders of quartz, gypsum, and bone ash from Kremer Pigmente were used as reference specimens.

e) Databases and Resources used for interpretation of OM/PLM

The primary resource for interpretation with this method is the reference volume *The Pigment Compendium* (Eastaugh et al. 2004a). Additional comparative images are used from the Artists' Pigment series (vol. 1 Roy 1986; vol. 2 Feller 1993; vol. 3 Fitzhugh 1997; vol. 4 Berrie 2004). Also utilised is the materials database for the Forbes Collection on the Conservation and Art Materials Encyclopedia Online (CAMEO www.cameo.mfa.org).

f) Particle Size Classification System

Pigment particle sizes for all colourants at Çatalhöyük were reported by Çamurcuoğlu as 0.005mm–0.3mm (2012, 253). She labels this a 'fine' particle size. It is not clear from her work how she defines 'fine'; whether the classification system she is using is for pigments as classified by Feller and Bayard (1996) or some other geological classification system for micro-artefacts, such as the classification system for '*archaeosediment'* by Rapp and Hill (2006, 30). It is also unclear whether the fine

particle size would be expected to differ between iron-based pigments and copper-based pigments.

The *Pigment Compendium* (Eastaugh et al. 2004a) provides particle size classifications derived from optical microscopy standards from Feller and Bayard (1996) used in classifying pigment specimens. When terms are used to describe particle sizes in the course of this study, this standard, seen in Table 5, is used.

Table 5 Feller and Bayard's (1996) particle size classification for pigments.

Absolute particle size (μm)	Relative Particle Size
>40	Very coarse
10-40	Coarse
10-3	Large
3-1	Medium
1.0-0.3	Fine
<0.3	Very fine

2.2.2 X-ray Fluorescence

a) How XRF technique works

X-rays come from wavelengths between 10^{-9} and 10^{-15} m in the electromagnetic spectrum. Relative to the visible part of the spectrum, X-rays are shorter in wavelength than the optical region (400-750 nm). In XRF, samples are irradiated from an X-ray tube with a metal anode, such as molybdenum (Mo) or rhodium (Rh). When a primary beam of electrons strikes the anode, it emits lines that are characteristic of the anode. Electrons will also be emitted from the solid sample in a continuous X-ray spectrum. The X-ray energies from the anode and solid sample have an output up to the accelerating voltage applied to the sample, or the keV (Pollard 2008).

The grounds for identification and characterisation of the chemistry of a sample are the line spectra of the elements. Interpretation of line spectra requires that the emission lines from the anode are recognized and discounted, including Rayleigh or Compton scattering (Pollard and Heron 2008). Emission line charts show the characteristic principal energy levels for each element present in the sample.

As a non-destructive surface technique, XRF is useful in the analysis of cultural material. The portable, handheld units make XRF accessible to bring instruments to collections or out in the field; for this they are increasingly popular in the study of archaeological and cultural artefacts (Shugar and Mass 2013). In the study of pigments, increasing use is found for XRF in the chemical analysis of pigment in situ on easel and wall paintings (Artoli 2010). The main caveat of analysing a painted surface with XRF is that results may contain emission lines from not only the pigmented layer, but the substrate ground layers as well (McGlinchey 2013).

For this analysis, two XRF instruments with differing spatial resolution are used. The Bruker ARTAX has spot size <100 μm and high spatial resolution for individual grains in pigment samples. The Bruker TRACer III-V handheld unit has a spot size of several millimeters and low spatial resolution for bulk analysis of powders.

b) <u>XRF equipment and software</u>

At RLAHA, the Bruker TRACer III-V handheld unit was used for the XRF bulk analysis of selected samples. This unit has an X-ray tube as an excitation source, with a Rhodium (Rh) target, and a high-resolution, Peltier cooled, silicon PIN diode detector.

Settings for non-vacuum were used, with filters appropriate to the elements to be detected. For screening higher Z elements, such as Hg or As, the red filter (0.001" Cu, 0.001' Ti, 0.012' Al) was used.

A Bruker ARTAX μ-X-ray fluorescence at Art Access and Research (AA&R) was used for all samples. It is a portable instrument with an open system for uneven objects, such as the samples being analysed here. The microspot size of primary X-radiation is <100μm using a polycapillary lens. This lens type increases the fluorescence intensity by a factor of over 1000 compared with a pinhole collimator. Analysis capability ranges from elements Na (11) to U (92) with spatial resolution down to 70 μm. The excitation source is an X-ray tube with a Mo target. The detector type is a Peltier cooled silicon drift detector. *Samples were run for 300 seconds each at 50 keV.*

c) Sample prep for XRF

Qualitative results for *Bruker ARTAX μ-XRF* at Art Access and Research (AA&R) were obtained on the surface of solid or powdered pigment samples. Samples of rocks and powders were run on the bulk of the sample. Readings were taken from the surface of painted plasters. During μ-XRF two to ten readings of each sample were collected. The high sensitivity of this instrument will give results for the azurite samples, below the 1-5% by weight sensitivity by the bulk XRD. Sixty-six samples were analysed.

Film used during handheld XRF at RLAHA was MYLAR® Polyester film, from Chemplex ® Industries, Inc. Typical impurities listed on the label are Ca, P, Sb, Fe, and Zn. As this film was used during the HgS screening, impurities of the film did not

interfere with relevant results. Testing with the XRF at RLAHA confirmed the radio transparency of this film.

d) Standards used for XRF

The reference specimens used for red pigments were powdered red ochre, cinnabar from commercial suppliers Kremer Pigmente, and hematite, cinnabar, and mineral cinnabar from the RLAHA collection, and OUMNH specimens of cinnabar, realgar, and orpiment. Reference specimens for yellow colours were powdered jarosite from Kremer Pigmente. For blue pigments, powdered samples of azurite, lapis lazuli, chrysocolla from Kremer Pigmente were used. For green, powdered malachite and atacamite from Kremer Pigmente and mineral malachite from OUMNH were examined. For white or colourless constituents, powders of quartz, gypsum, and bone ash from Kremer Pigmente were used as reference specimens.

Specific information pertaining to the screening of Hg for mineral cinnabar.

Detection limits of the elements Hg and S for the Bruker Tracer III-V instrument were tested with a mixture of Kremer Pigmente cinnabar and calcite in four concentrations: 0.5%, 1%, 3%, and 5%. All showed positive results for the expected Hg and S peaks.

e) Databases and Resources Used for the Interpretation of XRF Results

Resources for interpretation are from comparisons with reference specimens. Additional comparative images and EDS spectra are used from the Artists' Pigment series (vol. 1 Roy 1986; vol. 2 Feller 1993; vol. 3 Fitzhugh 1997; vol. 4 Berrie 2004). For each pigment in the Artists' Pigment series, reference information is given for X-

ray spectrometry, including the main emission lines for identification. Additional confirmation was provided from emission line reference charts for K-level and L-level emission lines in keV for each element (http://www.med.harvard.edu/jpnm/physics/refs/xrayemis.html).

f) How Data was Normalised for XRF

The goal of using the XRF spectroscopy is to identify compositional groupings. In combination with the archaeological data of samples, giving chronological and spatial distribution, this study aims to find distinguishing differences within the broad class of similar materials; in this case, earth pigments. Samples were first grouped by type such as rock, cake, powder, or painted surface. This first separation of samples by type allowed for a more logical cross-comparison of results. It would be misleading to compare a parent rock with a painted surface, for example. The rock will be higher in concentration and depth than that of pigmented material. Unlike a rock, the painted plasters have a layer structure that can contribute peaks from the mud plaster substrate to the spectra.

Distinctions regarding sample chemistry are by groupings of major and minor elements. Groups with similar trace elements are discussed. Variations between subgroups of archaeologically relevant and related samples are discussed. For instance, the subgroup of samples of painted fragments from building 80 and 96 are discussed. Also, a subgrouping of the composition of three sample types, a rock, a cake, and pigmented plaster from the late levels will be discussed.

Normalising XRF data for heterogeneous samples

Data is qualitative from the μ-XRF. μ-XRF data was processed in order to 1) normalise peak values for each element and 2) facilitate the comparison between samples. To be able to compare relative amounts of primary, secondary, and trace elements, the values for the peak intensities for each sample were normalised. Peak numerical values for each element were normalized to that of the primary element of the sample: in the case of ochres, iron (Fe), or for copper pigments, copper (Cu). The value of the peak intensity for the primary element is divided by itself, and then multiplied by 100 to obtain a standardised value of 100 for all samples. The same equation is then applied to the other peak values for the same sample. The values for secondary and trace elements are also divided by the value of the Fe peak for that sample, and then multiplied by 100. This treatment of the numerical values standardized the value for the primary element and allowed for cross-sample comparison for all other peaks.

2.2.3 Fourier Transform Infrared Spectroscopy

a) How FT-IR works

FT-IR spectroscopy uses heat arising from low-energy transitions between molecular vibrational and rotational energy states. Infrared radiation (IR) is in the region just below that of visible light (400 – 750 nm) in the electromagnetic spectrum. IR is measured in wave numbers, or the number of waves per centimeter. The range of 1,500-500 cm^{-1}, known as the 'fingerprint region', is the most useful segment of the IR spectrum for the characterisation of a sample. Peaks in this area give information on the types of chemical bonds present. IR is a useful tool for identifying functional groups.

As different substances can have similar types of chemical bonds and resulting IR spectra, this technique is not a precise tool to characterise samples, but is used most effectively when coupled with other techniques (Pollard and Heron 2008). FT-IR and the other infrared spectroscopic technique, Raman, are capable of non-destructive analysis on samples viewed down a microscope. The capabilities of IR techniques to leave the object of investigation intact, lend themselves to the study of museum objects, especially of pigments on painted surfaces (Burgio 2014; Bell et al. 1997). For example, Donais and George (2012) report the efficacy of an infrared technique in combination with XRF in their characterisation of pigments from Roman fresco fragments.

b) Equipment for FT-IR

At AA&R laboratory, the FT-IR spectrometer is a Bruker vertex 70, equipped with a mid-infrared source and KVR beam potassium (KBr) beamsplitter, a HENE laser and a deuterated triglycine sulfate detector, with scan capabilities from 600-4000 cm^{-1} At RLAHA, FT-IR is an Agilent Technologies Cary 600 Series spectrometer with scan capabilities from 400-4000 wn.

The spectrometer is equipped with Pike GladiATR accessory. The ATR element is a diamond. Infrared spectra were collected between 4000 and 600 with a default sample scan of 64 sample scans for the background and samples. Resolution was 4 cm^{-1}. Background scans were run prior to each sample measurement. Selected samples had 128 or 256 sample scans run to clarify results.

c) FT-IR Sample preparation

Samples of colourants were applied in powdered form directly to the diamond ATR element. A stainless steel scalpel is used to remove a sample from the bulk of material. Qualitative results for all samples are obtained with Fourier transform infrared spectroscopy.

d) Standards used for FT-IR

The reference specimens used for FT-IR of red pigments are powdered red ochre from commercial suppliers Kremer Pigmente. Reference specimens for yellow colours were powdered jarosite from Kremer Pigmente. For blue pigments, powdered samples of azurite, lapis lazuli, and chrysocolla from Kremer Pigmente were used. For green, powdered malachite and atacamite from Kremer Pigmente. For white or colourless

constituents, powders of calcite, quartz, gypsum, and bone ash from Kremer Pigmente were used as reference specimens.

e) Databases and Resources used for interpretation of FT-IR results

Resources for interpretation are from comparison with reference specimens. Infrared and Raman Users Group (IRUG) database were used for interpretation and comparison of results (www.irug.org). Additional comparative images and infrared spectra are used from the Artists' Pigment series (vol. 1 Roy 1986; vol. 2 Feller 1993; vol. 3 Fitzhugh 1997; vol. 4 Berrie 2004) and Forbes Collection on the CAMEO database (http://cameo.mfa.org) (See Appendix I for results for azurite and cinnabar). For approximate ranges of common bond vibrations in organic molecules, the Infrared correlation chart in Pollard and Heron (2008, Figure 2.19) is used.

f) How FT-IR data was processed

Results from the scans are compared to those in the above-mentioned reference libraries.

2.2.4 Scanning Electron Microscopy

a) How SEM works

SEM is effective both as a form of microscopy and as an analytical technique. The imaging is of a higher resolution at far higher magnifications than optical microscopy. SEM images can yield topographic or compositional information from the sample's surface in either secondary or backscattered images. Secondary images reflect the top few atomic layers of a sample, revealing its topography. Backscattered images

show compositional differences of the sample by reflecting the relative atomic weight across the surface (Pollard and Heron 2008).

As a tool for analysis, it uses much the same principle as XRF. SEM uses an electron beam to stimulate X-ray emission in samples by creating an inner shell vacancy. Unlike XRF, the electron beam of SEM is more analytically sensitive, as it does not produce the spectral artefacts and increased background signal from the scattering of the primary X-ray beam as in the XRF technique. Electron beams are emitted from a heated cathode in an electron gun; the beam can then be focused on the sample via sets of magnetic lenses. After the beam strikes the sample, electrons from the sample are read by one of two types of detector, either wavelength dispersive (WD) or energy-dispersive (ED) (Pollard and Heron 2008).

Together with the optical capability of the instrument, the operator can view the precise location of the beam on the sample while simultaneously analysing the chemistry of the area with the electron beam. Analysis is possible on a single spot or a raster over larger areas.

b) SEM Equipment

A JEOL JSM-5910 scanning electron microscope (SEM) for higher magnification imaging and EDS is used for elemental analysis, with INCA software for processing data. SEM is used for select samples to image at high magnifications and gain elemental data for individual grains. Qualitative data is gained from unprepared stub mounts and polished sections. The beam current ranged from 10-20 keV.

c) Sample preparation for SEM

For qualitative analysis of powders on the SEM, stub mounts were prepared by removing powder from the sample with a sharp, clean scalpel and placing them on the adhesive carbon tab of a cylinder stub. Samples were carbon coated using the Bio Rad SEM coating system with carbon fibre number 428 from Agar Scientific.

Cross sections were prepared in epoxy blocks with the same method described for OM/PLM. With samples embedded in epoxy blocks, additional conductivity to the sample holder is added with copper tape when required.

d) Standards used for SEM

The reference specimens used for OM/PLM of red pigments were powdered red ochre, cinnabar from commercial suppliers Kremer Pigmente and hematite, cinnabar, and mineral cinnabar from RLAHA collection. Reference specimens for yellow colours were powdered jarosite from Kremer Pigmente. For blue pigments, powdered samples of azurite, chrysocolla from Kremer Pigmente. For green, powdered malachite and atacamite from Kremer Pigmente are used.

e) Databases and Resources for SEM interpretation

Resources for interpretation are from comparison with reference specimens. Additional comparative images and EDS spectra were used from the Artists' Pigment series (vol. 1 Roy 1986; vol. 2 Feller 1993; vol. 3 Fitzhugh 1997; vol. 4 Berrie 2004) and Forbes Collection on the CAMEO database (http://cameo.mfa.org) (See Appendix I for results for azurite and cinnabar).

2.2.5 X-ray Diffraction

a) How XRD works

XRD involves a rotating anode or sealed tube X-ray source, a 2-circle automated diffractometer to orient a sample to the incident beam and detector bands to detect the diffracted signal. The diffraction peaks in the spectrum are used for identification and characteristic of each crystalline phase. The interpretation of XRD results is based on Bragg's Law[1] that gives the angles for coherent and incoherent scattering of a crystalline structure. The peak profile shape, the integrated intensity, and angular position of the diffraction signal are all vital to the interpretation of results (Artioli 2010).

Due to its sensitivity to crystallographic structure types, XRD is one of the most often used techniques for pigment identification (Artioli 2010).

b) XRD equipment

*Bulk analysis with X-ray diffraction (*XRD*) was used on four blue samples to confirm the mineralogical identification (see Figure 15) and determine accessory minerals up to the detection limit >1% by weight.* The instrument used was a Panalytical X'pert Pro diffractometer with a Medipix2 detector and Cu radiation. Data was collected over the region 10 to 20 degrees 2-theta with a step size of 0.013 degrees and a time per step of 200 seconds. *Dr. Keith Rogers at Cranfield University provided instrument access and operation.*

[1] Bragg's Law $2d \sin\theta = n\lambda$, where d is the distance between lattice planes in the crystal, θ is the half of the diffraction angle between the incident and diffracted beams, and λ is the wavelength of the incoming radiation. (Artioli 2010, 51)

c) Sample prep for XRD

Samples are prepared by pulverising powders in glazed crucibles.

d) Standards used for XRD

The reference specimens to investigate the copper based pigments were powdered samples of azurite, chrysocolla, and malachite from Kremer Pigmente.

e) Databases and Resources for XRD interpretation

The database used at Cranfield University for the comparison of data was the International Centre for Diffraction Data's PDF-2. Additional comparative images and EDS spectra are used from the Artists' Pigment series (vol. 1 Roy 1986; vol. 2 Feller 1993; vol. 3 Fitzhugh 1997; vol. 4 Berrie 2004) and Forbes Collection on the CAMEO database (http://cameo.mfa.org) (See Appendix I for results for azurite).

Online Reference Resources Consulted For Comparative Results In Materials Analysis

Two online databases were also utilised for comparison in characterising archaeological samples in this study. The first is CAMEO, developed by the Museum of Fine Arts, Boston, as a database for artist's materials. It contains over information for over 10,000 materials used in the production or conservation of architectural, artistic, archaeological, and fine art objects. Within CAMEO are the digitized results of analysis of The Forbes Pigment Collection. This bulk of this collection, assembled by

the late Edward Waldo Forbes, former director of the Fogg Art Museum at Harvard University, is housed now in two locations: the Straus Center for Conservation at Harvard University, the Institute of Fine Arts Conservation Center at New York University. Several laboratories around the world contain subsets of the collection. Within CAMEO is the database of results of analysis of over 3,000 colourant with techniques such as SEM, FT-IR, PLM, XRF and XRD. Institutions that house the collections submit results of analysis in order to collect the information in a central resource that is readily accessible to researchers. For a list of contributing institutions, see: http://cameo.mfa.org/wiki/Forbes_Pigment_Database (accessed 21.12.2017)

Pigments that were referenced from CAMEO for comparison with archaeological results in this study: dolomite, linarite, and additional examples of iron oxides.

Additional reference spectrum from http://rruff.info/azurite/display=default/R050497 were consulted for XRD and IR results for azurite, chrysocolla, linarite, and malachite.

The other online resource which was used to compare results was the peer-reviewed database IRUG- Infrared and Raman Users Group http://www.irug.org. The IRUG database contains high quality comparative results for spectral data to study architecture, works of art, and archaeological materials with a dedicated section for artist's pigments. The following spectra were accessed:

Micas
http://www.irug.org/search-spectral-database?spectra_front_form_filter%5Bkeyword%5D%5Btext%5D=mica&spectra_front_form_filter%5Bdata_type%5D=&spectra_front_form_filter%5Bmaterial_class%5D=

Haematite
http://www.irug.org/search-spectral-database?spectra_front_form_filter%5Bkeyword%5D%5Btext%5D=hematite&spectra_front_form_filter%5Bdata_type%5D=&spectra_front_form_filter%5Bmaterial_class%5D=

Ilmentite ($Fe+2TiO_3$) and titanium
http://www.irug.org/search-spectral-database?spectra_front_form_filter%5Bkeyword%5D%5Btext%5D=titanium+oxide&spectra_front_form_filter%5Bdata_type%5D=&spectra_front_form_filter%5Bmaterial_class%5D=

Quartz
http://www.irug.org/jcamp-details?id=415

Gypsum $CaSO_4$
http://www.irug.org/jcamp-details?id=1413

Goethite
http://www.irug.org/search-spectral-database?spectra_front_form_filter%5Bkeyword%5D%5Btext%5D=goethite&spectra_front_form_filter%5Bdata_type%5D=&spectra_front_form_filter%5Bmaterial_class%5D=

Dolomite CaMg(CO3)2
http://www.irug.org/jcamp-details?id=494

Optical Microscopy of Pigments Reference Table

Chemical formulas and descriptive terminology for the microscopic observations of particle shapes and characteristics used here derive from the *Pigment Compendium: Optical Microscopy of Historical Pigments* (Eastaugh et al. 2004a) and the Forbes Pigment Database, Conservation & Art Materials Encyclopaedia Online (CAMEO) (www.cameo.mfa.org). The following table lists pigments known to occur in archaeological contexts.

	Formula	Mohs	Density	Refractive Index	Notes CAMEO
Black/Brown					
Charcoal black	C			RI=opaque	Particles small, elongated and splintery. Contains 80-98% Carbon with ash and moisture.
Animal/Bone black	C, $(Ca_{10}(PO_4)_6(OH)_2$, $CaCo_3$		2.29	RI= 1.65-1.70	10% carbon with 84% calcium hydroxyapatite, and calcium carbonate. Irregular particles. Particles vary in colour brown to black, irregular shape. Excellent lightfastness
Burnt Umber- a mixture of Manganese	MnO (oxide hydroxide manganite),		3.64	RI= 2.2-2.3	All phases are opaque black or weakly translucent particles. When crushed, they produce subangular anhedral particles. Surface textures may be observed and have irregular fracture surfaces. The pigment known as wad is an earth pigment composed of one or more of the

oxide and iron oxide	Mn_2O_3 Manganese dioxide, pyrolusite), Mn_3O_4 (Manganese sesquioxide, hausmannite)				manganese oxide minerals, plus other phases such as iron oxides (goethite, hematite and magnetite). Pyrolusite particles are fibrous and elongate particles are typical; striated fibrous surfaces may also be observed. Hausmannite has subangular particles brown-black in colour.
White					
Calcium Carbonate	$CaCO_3$		2.7-2.95	RI=1.510; 1.645	Particle size= 0.1-1.0 micrometers. Insoluble in water. May fluoresce medium purple in UV light. Reacts with acids to form carbon dioxide.
Calcium Sulfate	$CaSO_4$			RI=1.21; 1.52; 1.53	Particle size=0.2 micrometers
Calcinated bone white	$Ca_3(PO_4)_2$				Bone ash contains Calcium hydroxyapatite, magnesium phosphate, calcium carbonate, and calcium fluoride.
Huntite (magnesium calcium carbonate)	$Mg_3Ca(CO_3)_4$			RI= 1.625	Similar to calcite under microscope. Moderate birefringence with strong interference colours.
Kaolinite	$Al_2Si_2O_5(OH)_4$	2.0-2.5	2.6-2.63	RI=1.558; 1.565; 1.564	Insoluble in water, cold acids and alkalis. Monoclinic system with hexagonal, plate-like crystals 0.1-1.0 micrometers. Perfect cleavage in one direction. Plastic when wet. Brittle when dry. Fracture, earthy/friable; luster is dull to pearly. Streak is white.

Red	Formula	Mohs	Density	Refractive Index	Notes CAMEO
Hematite	α-Fe_2O_3	5.5-6.5	4.2-5.3	RI=2.78; 3.01	Hexagonal crystal systems with granular crystals. No cleavage planes. Fracture is uneven to splintery. Luster is metallic. Streak is dark to cherry red.
Cinnabar	HgS	2.0-2.5	8.10-8.176	RI=3.146; 2.819	Found in volcanic regions in veins near volcanoes, hot springs. Soluble in aqua regia. Unaffected by alkalis. Hexagonal crystal system. Perfect cleavage in three directions, 60 and 120-degree angles. Ground cinnabar has uneven sized fractured particles and may contain quartz. Trans light colour is cherry red. Streak is scarlet. Fracture is subconchoidal to uneven. Luster is adamantine to dull. Darkens in UV light. Highly toxic.
Realgar	α-As_4S_4	1.5-2.0	3.56-3.59	RI=2.5, 2.684; 2.704	Isotropic crystals with good cleavage in one direction. Burns with blue flame. Darkens with heat. Changes to red crystalline form at 170C. Soluble in alkaline sulfide solutions and nitric acid. Insoluble in water and hydrochloric acid. Fracture=conchoidal. Luster=resinous to adamantine. Streak= orange-yellow. Pigment particles are pleochroic with high birefringence and straight extinction. Turns black in contact with copper and lead containing pigments.
Yellow					
Goethite	α-FeO(OH)	5.0-5.5	4.28		Soluble in mineral acids. Insoluble in water and ethanol. Orthorhombic crystals in prisms; fibrous structure. Perfect cleavage in one direction. Uneven fracture. Luster adamantine to dull. Yellow streak.
Jarosite	$KFe_3(SO_4)_2(OH)_6$				

Orpiment	As_2S_3	1.5-2.0	3.43	RI= 2.40; 3.02; 2.81	Decomposes slowly in water; soluble in acids and alkalis. Unstable mixed with alkaline pigments in buon fresco or lime white. Orpiment and realgar lose colour exposed to light orpiment oxidizes to form translucent or white oxides of arsenic. Monoclinic with poorly formed crystals. The mineral variety shows large crystalline tabular particles with striations and a waxy appearance. Cleavage is good in one direction. Luster is pearly to resinous. Streak is lemon yellow. Strongly anisotropic. Small, elongated, yellow particles (4-20 microns) exhibit high birefringence and straight extinction. Turns black in contact with copper and lead pigments. Toxic.
Green	Formula	Mohs	Density	Refractive Index	Notes CAMEO
Malachite	$CuCO_3.Cu(OH)_2$	3.5-4.0	3.77-3.80	1.730; 1.838; 1.758	Insoluble in water, ethanol. Decomposes in acids with bubbles of carbon dioxide. Decomposes with warm alkalis. Stable in light. Perfect cleavage in one direction. Streak- Green. Brittle mineral, conchoidal fractures with splinters. Pigment particle are coarse and irregular.
Atacamite	$Cu_2Cl(OH)_3$	3.0-3.5	3.76-3.78	RI=1.831	Atacamite, a copper oxychloride, occurs naturally in oxidation zones of copper deposits and ranges in colour from a muted green to emeralds or blackish green. It is known to occur as a chloride corrosion product on copper and bronze artefacts. Its presence indicates bronze disease. It is found as a green pigment in Asia, Russia, Persia, and Europe.
Celadonite	$K(Mg,Fe_2+)(Fe_3+,Al)(Si_4O_{10}(OH)_2$	2.0-2.5	2.5-2.7	RI=1.62	Mica type mineral found in Chinese and Indian paintings.

Green Earth	$K(Mg,Fe)(Fe_3+,Al)(Si_4O_{10})(OH)_2$		2.5-2.7	RI=1.62	Turns warm, brown (burnt green earth) when heated to 500 degrees C. Slightly soluble in acids. Siliceous, iron-rich clays ground from celadonite or glauconite with montmorillonite, chlorite and cronstedtite have been used.
Blue	Formula	Mohs	Density	Refractive Index	Notes CAMEO
Lapis Lazuli (lazurite)	$(Na,Ca)_4(Al,SiO_4)_3(SO_4,S,Cl)$	5.0-5.5	2.7-2.9	RI=1.5-1.67	Inclusions of calcite, sodalite and pyrite. Decomposes in hydrochloric acid with precipitation of silica, evolution of hydrogen sulfide, which is accompanied by a characteristic smell likened to rotten eggs, and effervescence of calcite inclusions. Isometric with compact masses. Poor cleavage. Fracture uneven. Luster_ dull to greasy. Streak-pale blue. If piece is dyed, can be detected with an acetone swab.
Azurite (basic copper carbonate)	$2CuCO_3$-$Cu(OH)_2$	3.5-4.0	3.77-3.80	1.730; 1.838; 1.758	Insoluble in water, ethanol. Decomposes in acids with bubbles of carbon dioxide. Blackens with warm alkalis, hydrogen sulfide or sulfur fumes. Strong birefringence. High refracting. Irregular particles. Pleochroic from pale to deep blue. Monoclinic tabular crystals. Good cleavage two directions. Conchoidal fracture. Vitreous to dull luster. Blue streak.

Chrysocolla	$CuSiO_3.nH_2O$	2-4	2.0-2.8	1.575; 1.598; 1.597	A sky blue mineral composed of hydrated copper silicate. Chrysocolla is a secondary copper ore that has also been used as a gemstone and blue-green to green colour when ground to a pigment. It is stable in light but decomposed by acids, alkalis, and heat. It has been gathered or mined as a semi-precious stone since 3000 BCE. It has been found as a pigment in wall paintings in Kizil in Turkistan and Twelfth Dynasty Egyptian tombs (Gettens and Stout 1966).

Appendix III

List of Pigment Samples Exported from Çatalhöyük to RLAHA

RLAHA Sample No.	Unit No.	CRP Sample No.	Flot	Material	Area
1	5349	10		mineral	South
2	12540	3		mineral	South
3	12867	3		mineral	South
4	5153 (subsample s.5)	8		mineral	South
5	4225	8		mineral	South
6	5575	3		clay	South
7	19306	1		mineral	South
8	18536	3		mineral	South
9	18544	4		mineral	South

10	1525 (subsample s.2)	8		mineral	South
11	18488 (subsample s.2)	3	9035	mineral	South
12	17048	3		mineral	South
13	19808	3		mineral	South
14	17339	12		mineral	South
15	4671 (subsample s.2)	6	2733	mineral	South
16	13365	4		mineral	South
17	19223	8		mineral	South
18	4194	1		mineral	South
19	4464	13		mineral	South
20	4464	14		mineral	South
21	14009	1		mineral	South
22	4620 (subsample s.1)	4		mineral	South
23	4407 (subsample s.1)	4		mineral	South
24	3290	5		mineral	South
25	4947	6		mineral	South

26	5228	2	3287	mineral	South
27	5214	2		mineral	South
28	4407 (subsample s.1)	4		mineral	South
29	18918	10		paint and plaster	South
30	19700 (subsample s.4)	6		paint and plaster	South
31	19700	5		mineral	South
32	19306			mineral	South
33	15839	39		mineral	TP
34	12456	24		mineral	IST
35	12546	25		mineral	IST
36	12456	25		mineral	IST
37	11862	9		plaster	IST
38	12487 (subsample s.7)	7	6849	mineral	IST
39	1993	8		mineral	North

40	17532	5		mineral	North
41	7597	4		mineral	North
42	7575	7		mineral	North
43	20450	7		mineral	North
44	19447	14		mineral	North
45	16308 (subsample s.3)	4		mineral	North
46	17485 F. 4024 (subsample s.3)	1		plaster	North
47	19457	1		mineral	North
48	6250	8		mineral	North
49	18508	7		mineral	North
50	18508	8		mineral	North
51	18552			mineral	North
52	18508	10		mineral	North
53	18545			mineral	North
54	18508	9		mineral	North

List of Minerals Sampled from the University of Oxford Museum of Natural History

Samples from OUMNH			
Accession number	Mineral		Location
Red Sulphides			
23358	cinnabar and quartz		nonlocalised poss. Almaden
5059	cinnabar		Almaden, Spain
19788	realgar		unlocalised
19880	realgar and cinnabar?		Eugenia mine, Paladihena Asturias, Spain
22698	cinnabar (earthy)		Coldstone quarry, Yorkshire, UK
24851	orpiment and realgar		Nevada, USA
21519	cinnabar		Sinatoa, Mexico
480	cinnabar (fibrous)		Idrija, Austria
18548	cinnabar		Bavarian Pallatinate, Germany
482	cinnabar		Moschellandsberg, Bavaria
22631	cinnabar		Monte Amiata, Tuscany Italy

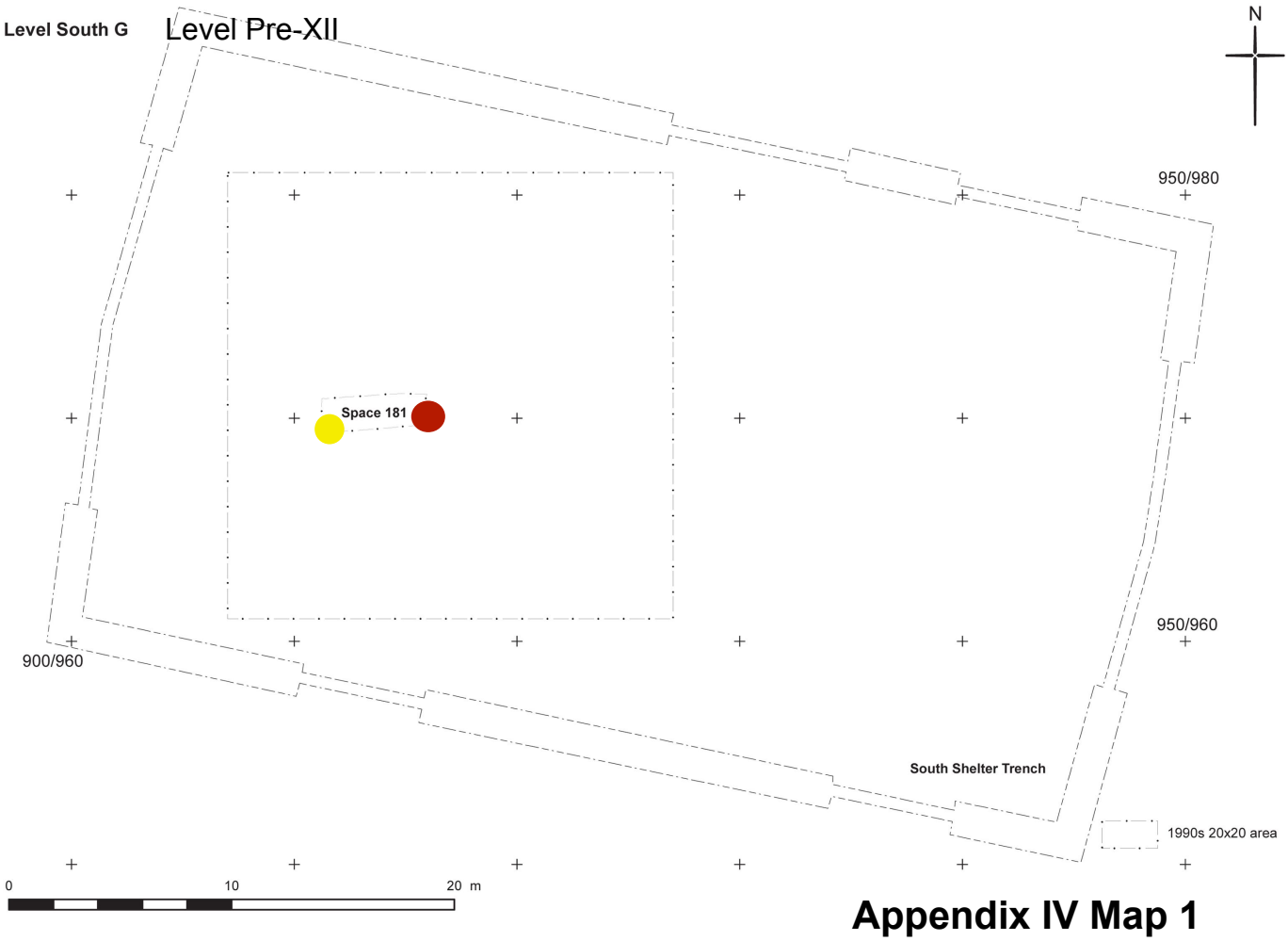
26698	cinnabar (earthy)		Coldstone quarry, Yorkshire, UK
Red iron oxides			
28246	hematite 'red ochre'		Ireland
12868	hematite, pseudomorphous?		unlocalised
5421	hematite, specular		unlocalised
Yellow Iron Oxides			
19528	jarosite with Goethite		Chuquicamata, Chile
22066	Jarosite with earthy iron oxide		Mealbank quarry, Ingleton, Yorks
28263	goethite ‘yellow ochre’		Headington, Oxfordshire
11470	Chalcanthite with jarosite with plumbo		Copiapo, Chile
Green and Blue			

6628	chessylite (azurite)		Chessy, N. Lyons, France
16976	Chessylite (azurite)		Chessy, N. Lyons, France
27789	Malachite with Azurite		Laurium, Attica, Central Greece
11470	Chalcanthite with jarosite with plumbo		Copiapo, Chile
1638	Chessylite, steatite		Barnaul, Siberia
30948	Malachite with Azurite		Laurium, Attica, Central Greece
30933	Malachite with minor quartz, iron oxide		Laurium, Attica, Central Greece
	Linarite		
	Vivianite		
19241	Riebeckite		
6018	Manganite on Barytes		
5308	Pyrolusite		
11470	chalcanthite		

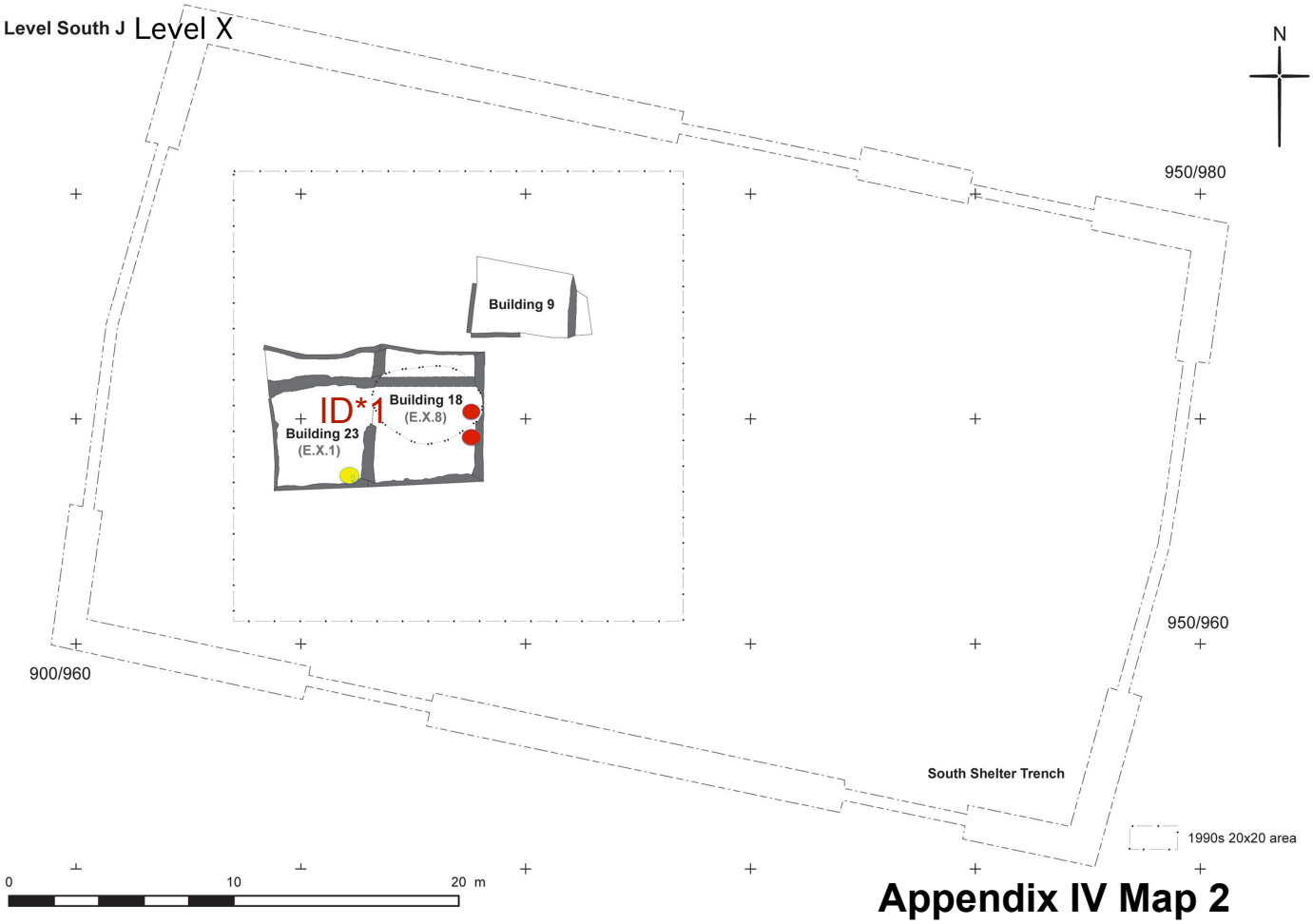
Appendix IV

GIS Maps for each Level

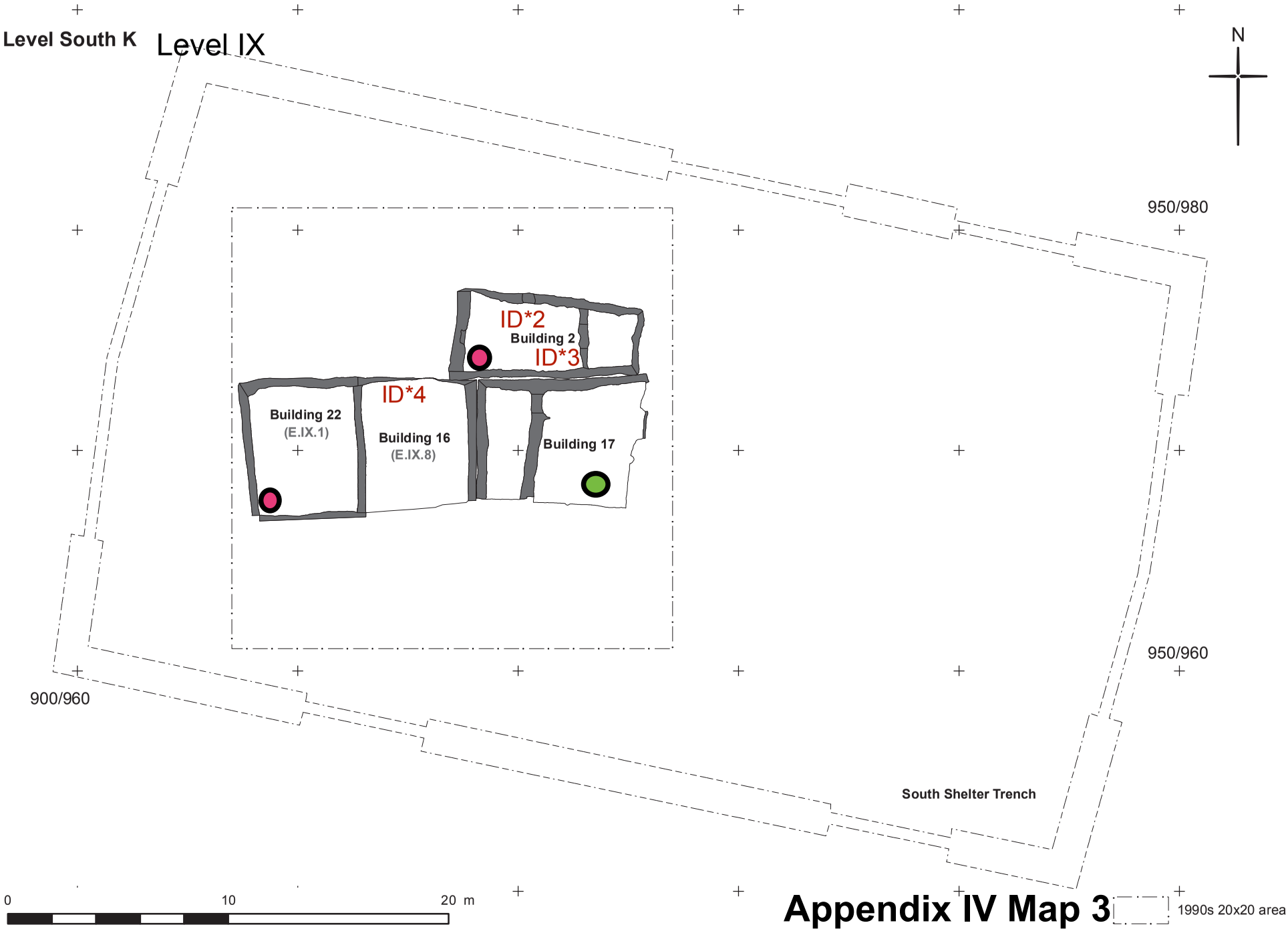
Map 1 Level Pre-XII, South G
Map 2 Level X, South J
Map 3 Level IX, South K
Map 4 Level VIII, South L
Map 5 Level VIII, IX North F
Map 6 Level VII, South M
Map 7 Level VIB, South N
Map 8 Level VIA, VIB, VII, North G
Map 9 Level VIA, South O
Map 10 Level V, South P
Map 11 Level IV-V, North H
Map 12 Level III-IV, North I
Map 13 Level IV, South Q
Map 14 Level III, II, I, 0, South R, S, and T



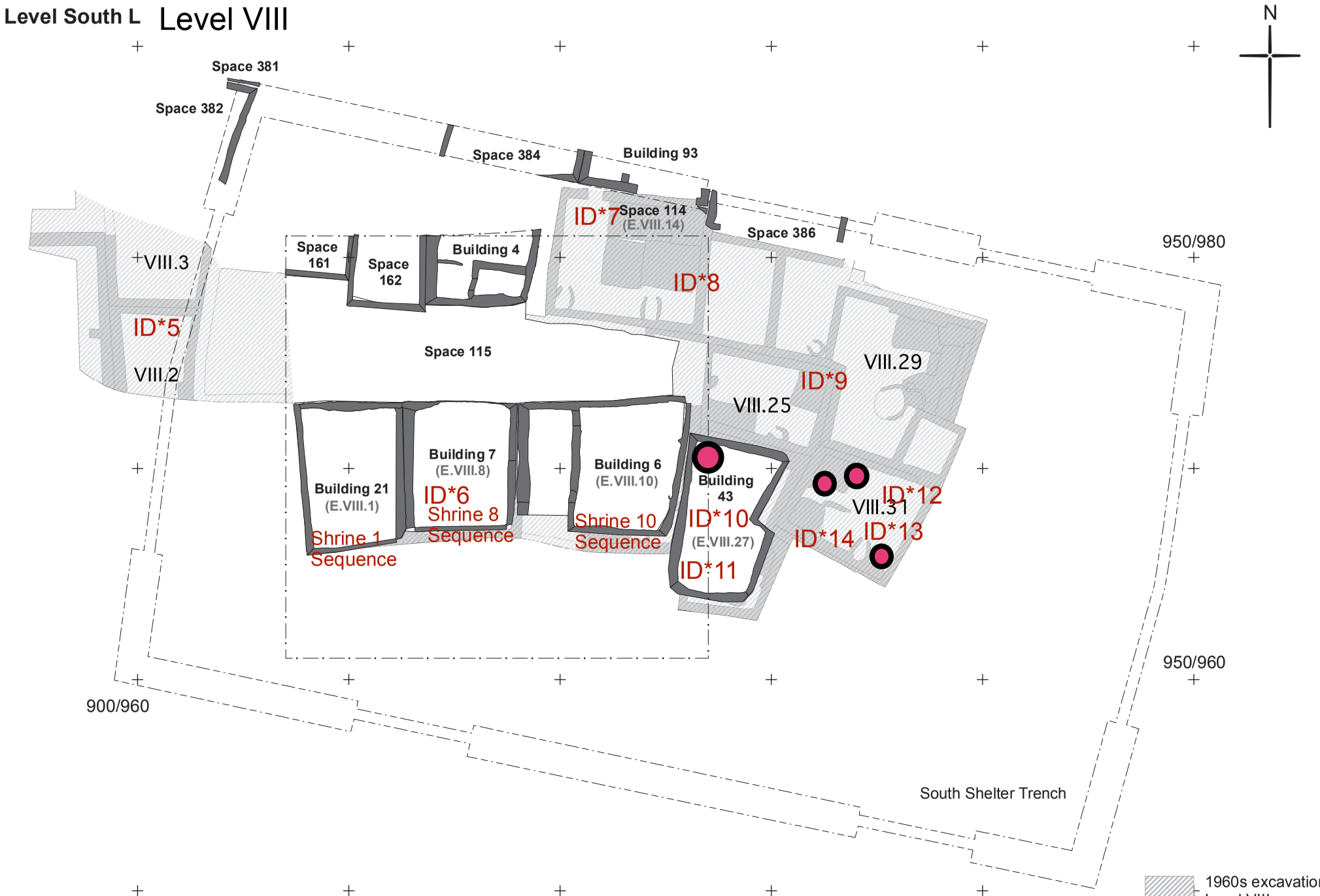
Appendix IV Map 1



Appendix IV Map 2



Appendix IV Map 3

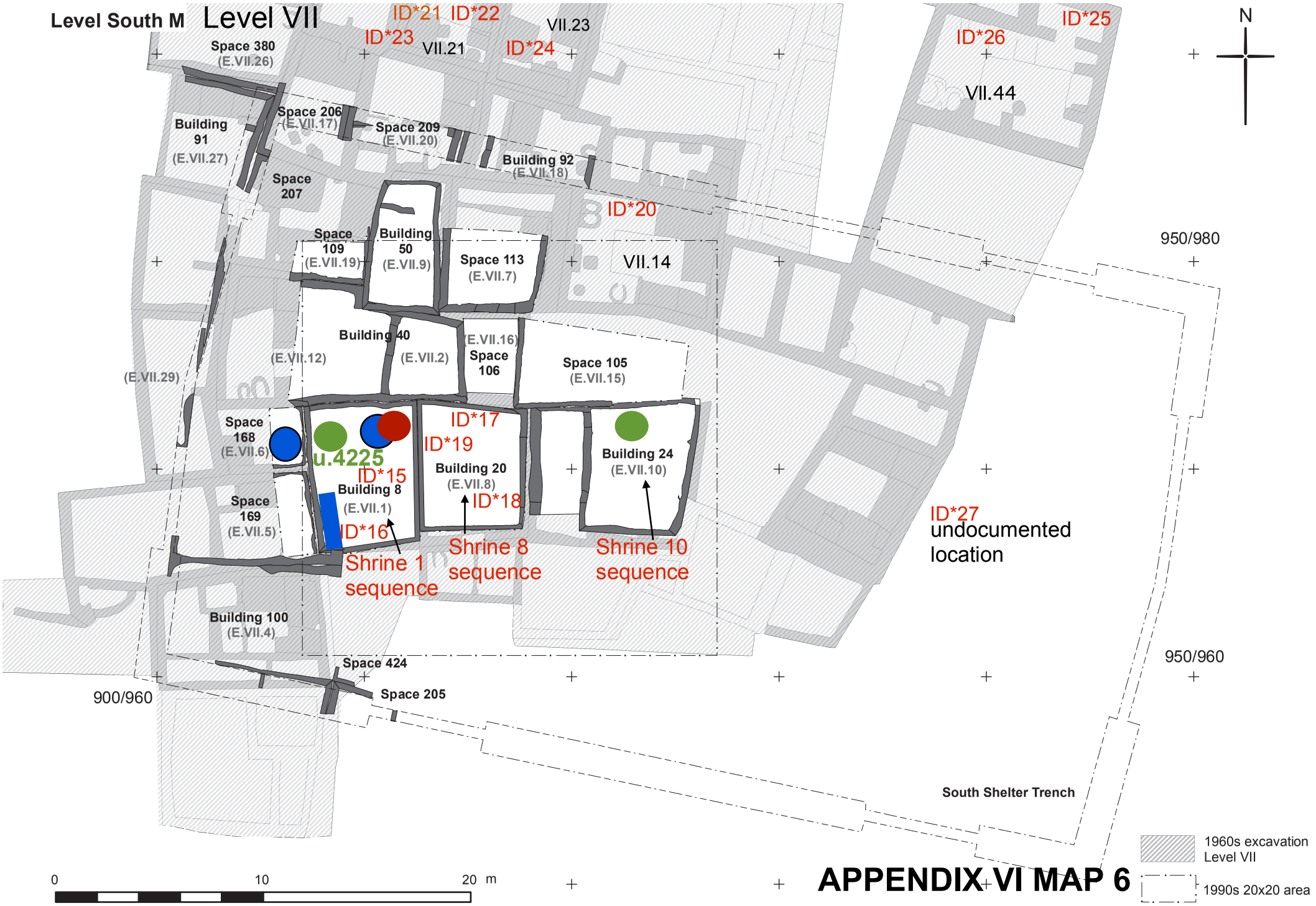


Appendix IV Map 4

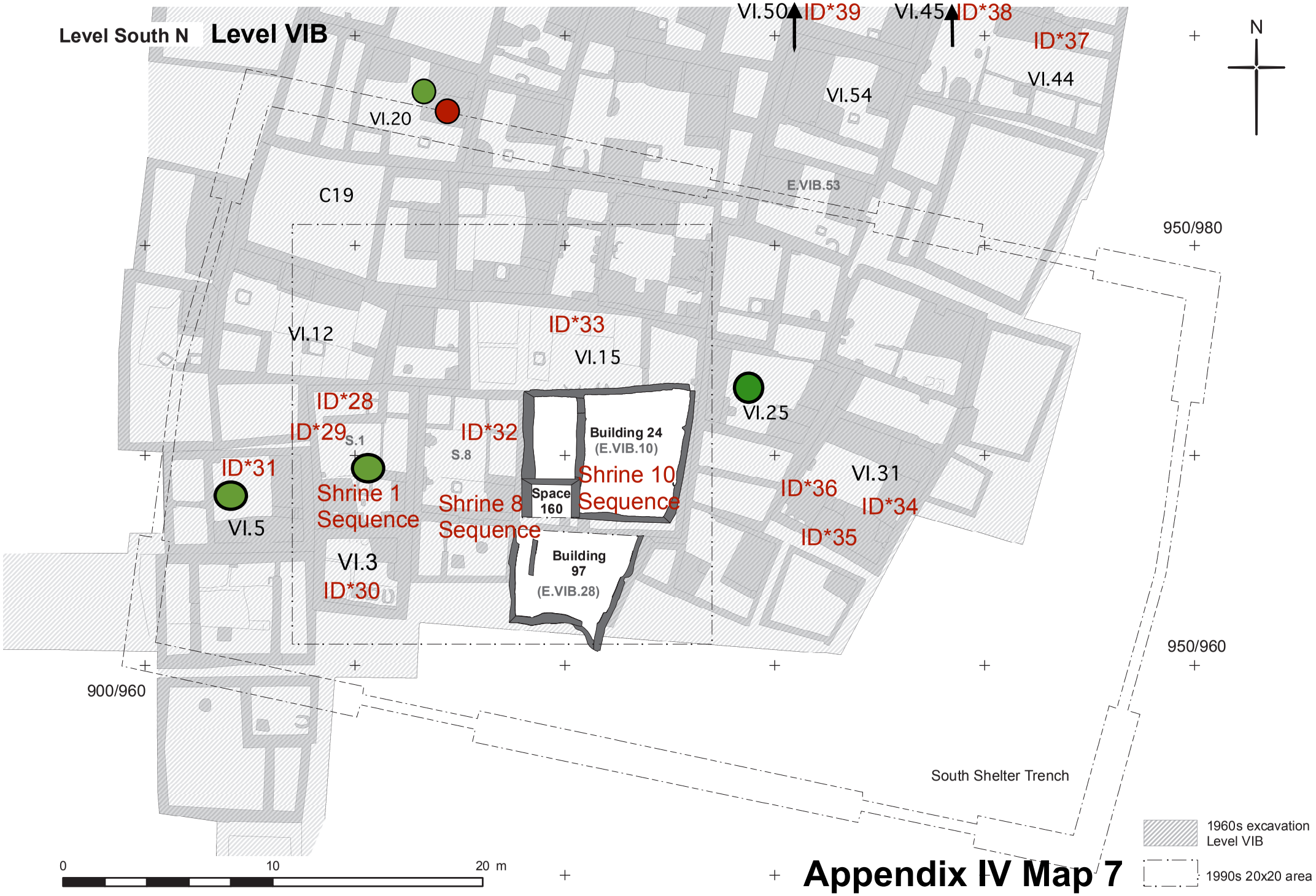
Level 4040 F Level VIII, IX



Appendix IV Map 5

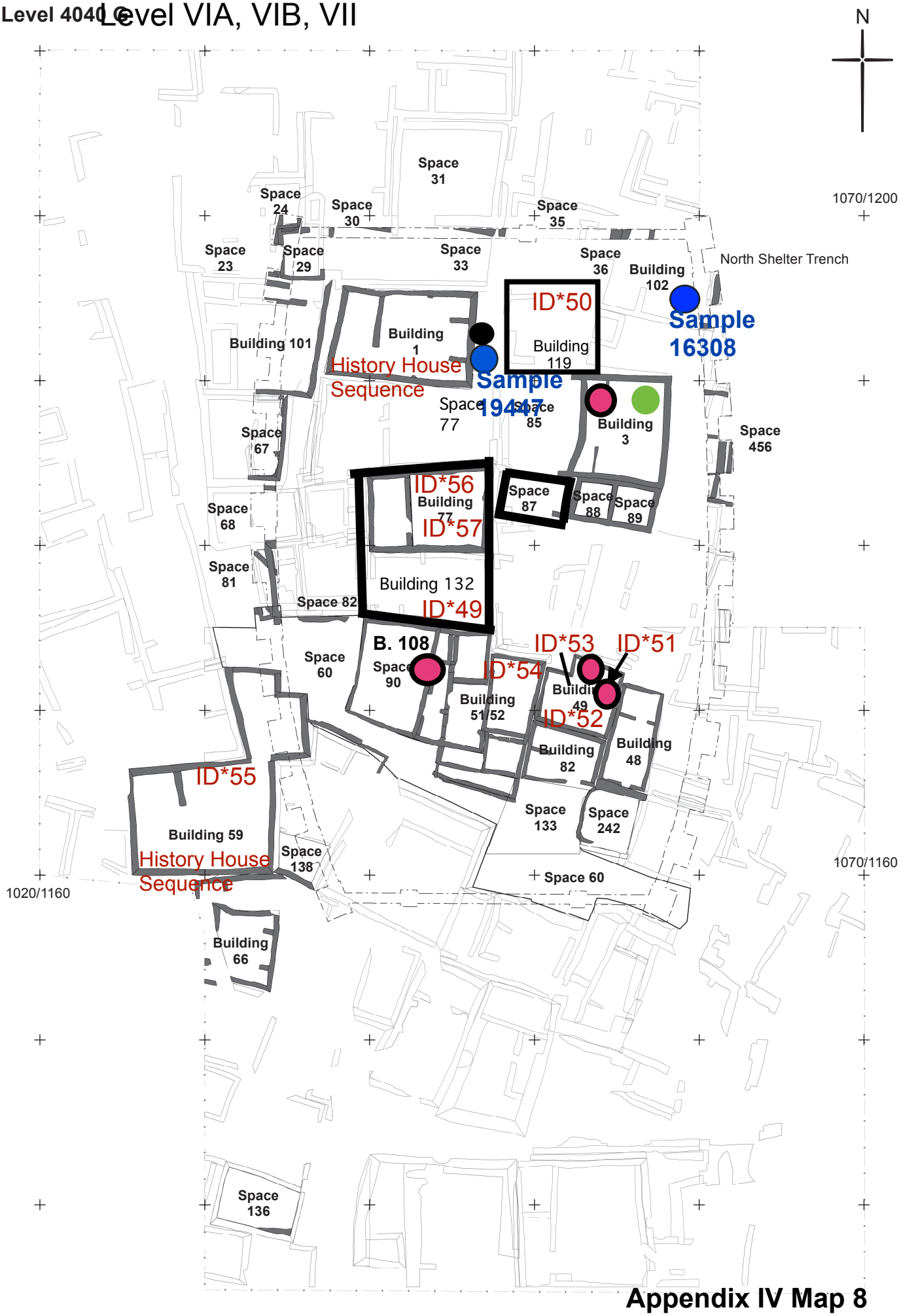


APPENDIX VI MAP 6

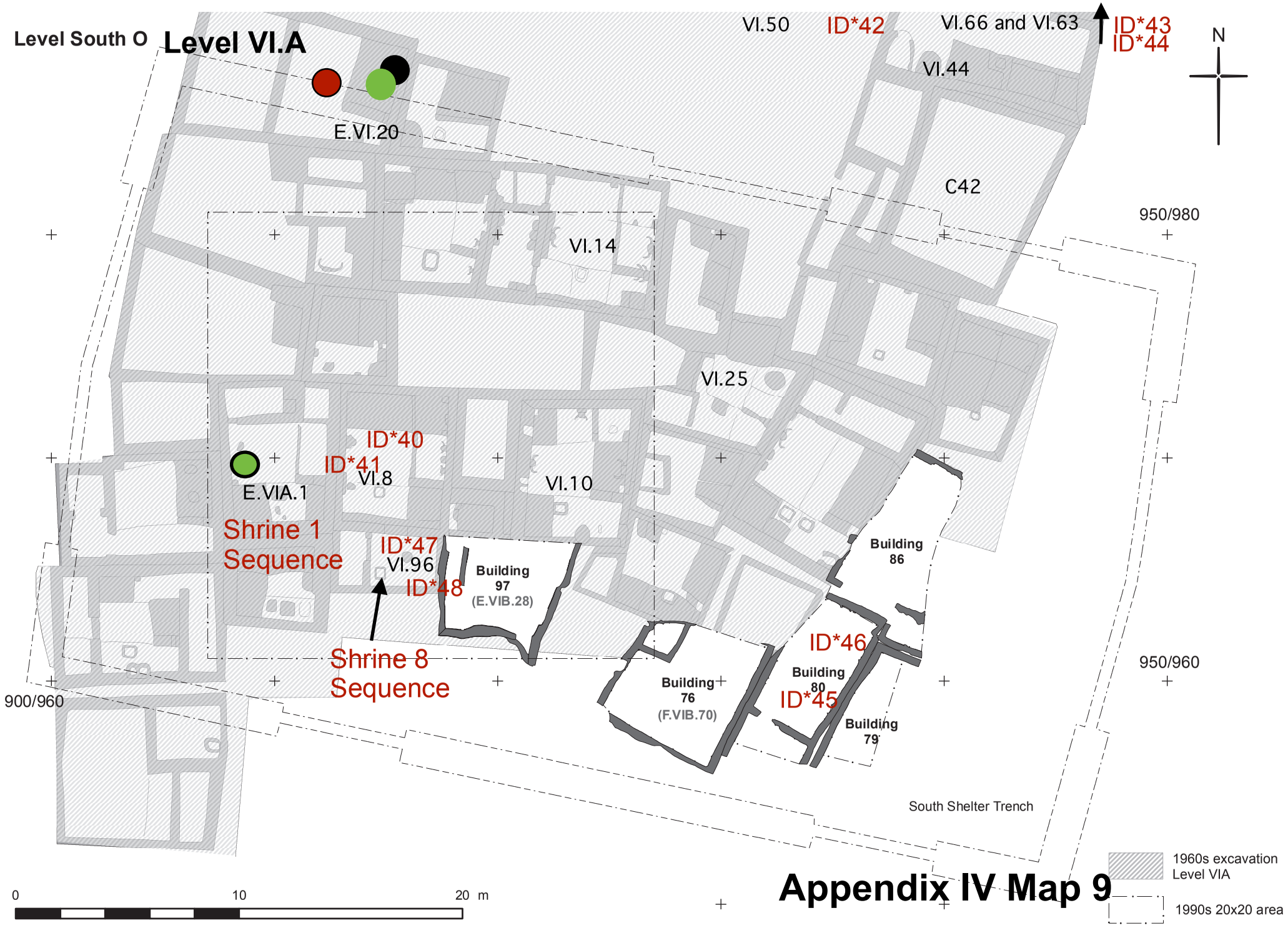


Appendix IV Map 7

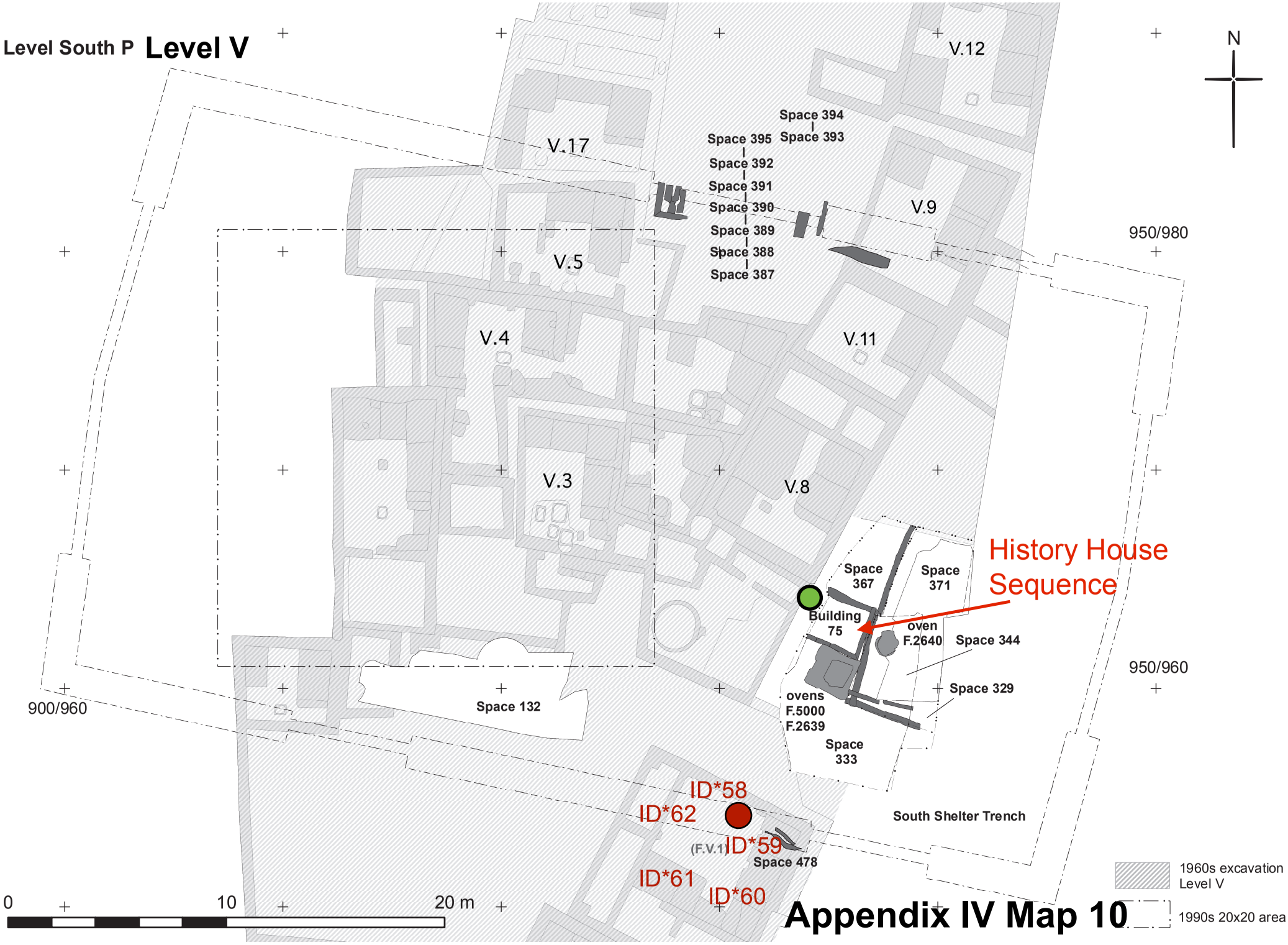
Level 4040 Level VIA, VIB, VII



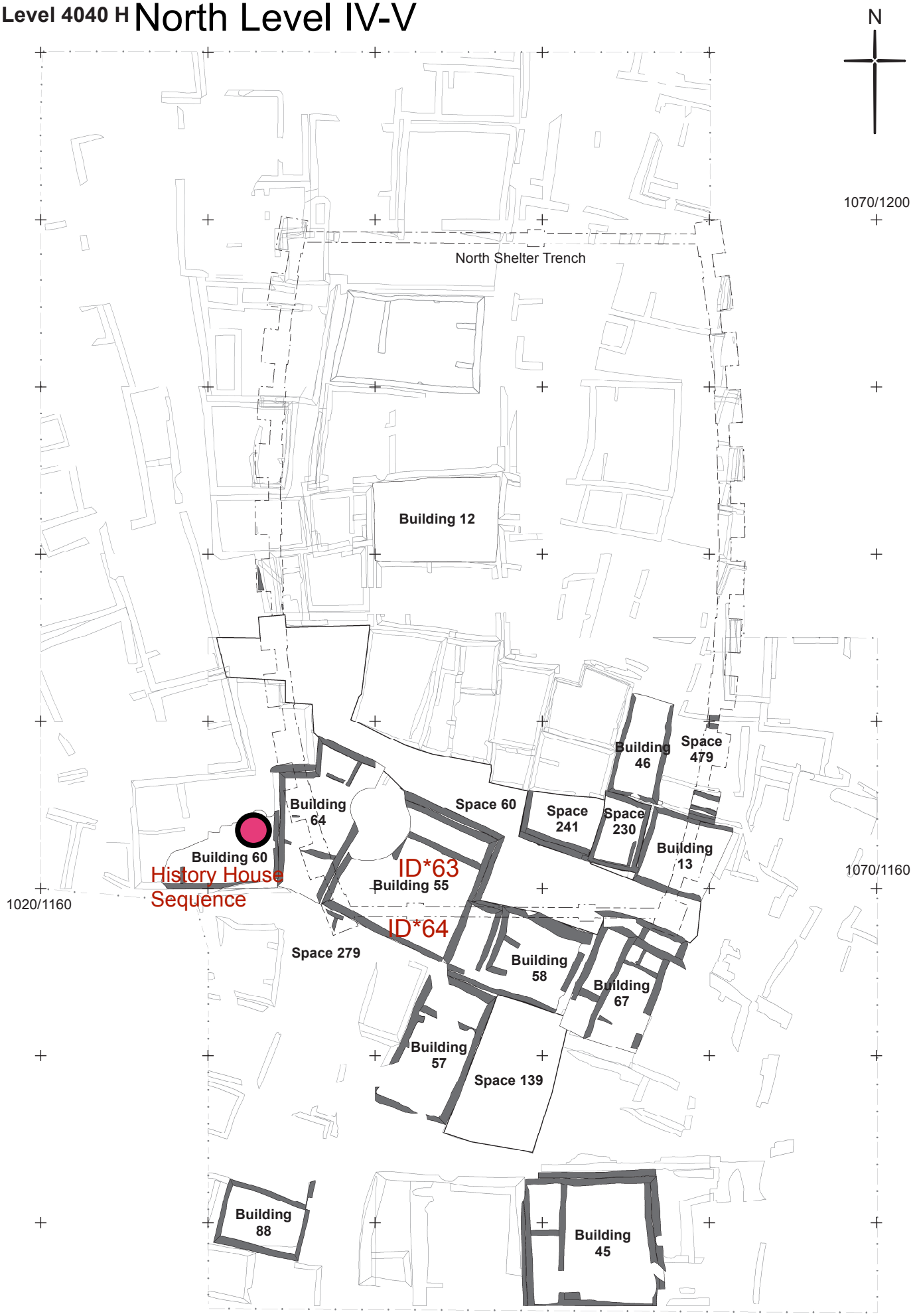
Appendix IV Map 8



Appendix IV Map 9

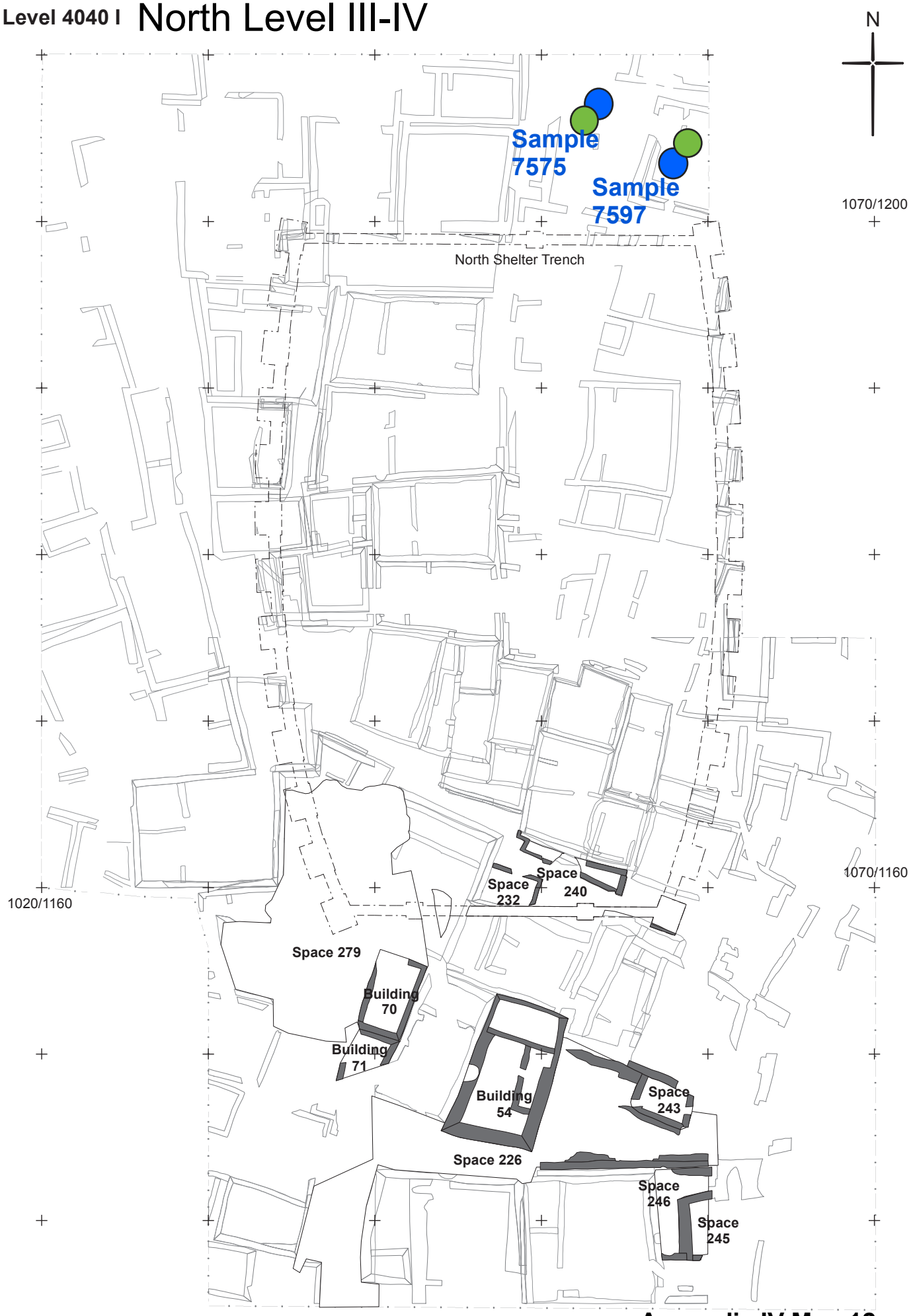

Level South P
Level V
N
V.12
V.17
Space 394
Space 393
Space 395
Space 392
Space 391
Space 390
Space 389
Space 388
Space 387
V.9
950/980
V.5
V.4
V.11
V.3
V.8
History House
Sequence
Space
367
Space
371
Building
75
oven
F.2640
Space 344
950/960
Space 329
ovens
F.5000
F.2639
Space
333
900/960
Space 132
ID*58
ID*62
South Shelter Trench
(F.V.1)
ID*59
Space 478
ID*61
ID*60
0
10
20 m
1960s excavation
Level V
1990s 20x20 area
Appendix IV Map 10

Level 4040 H North Level IV-V

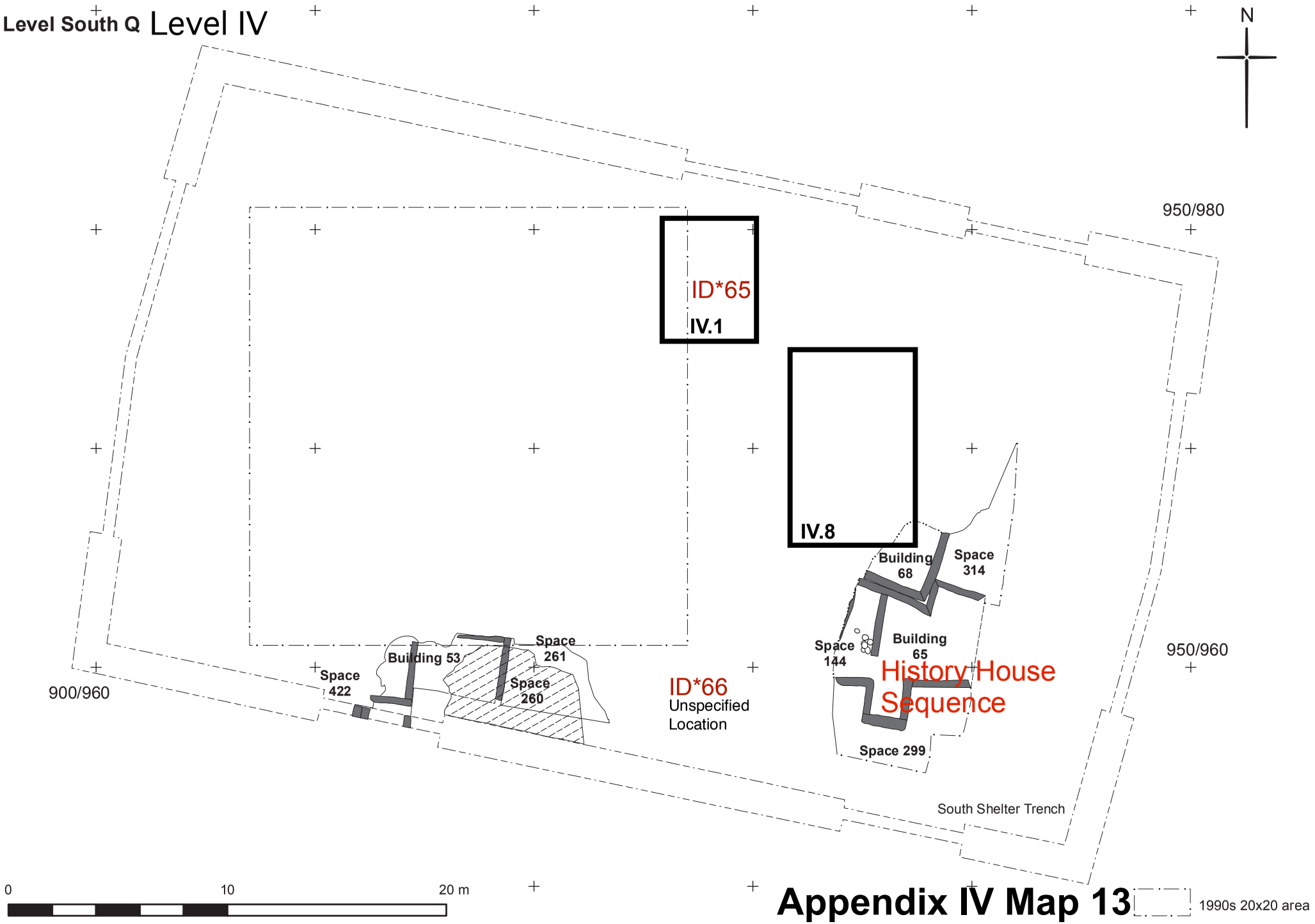


Appendix IV Map 11

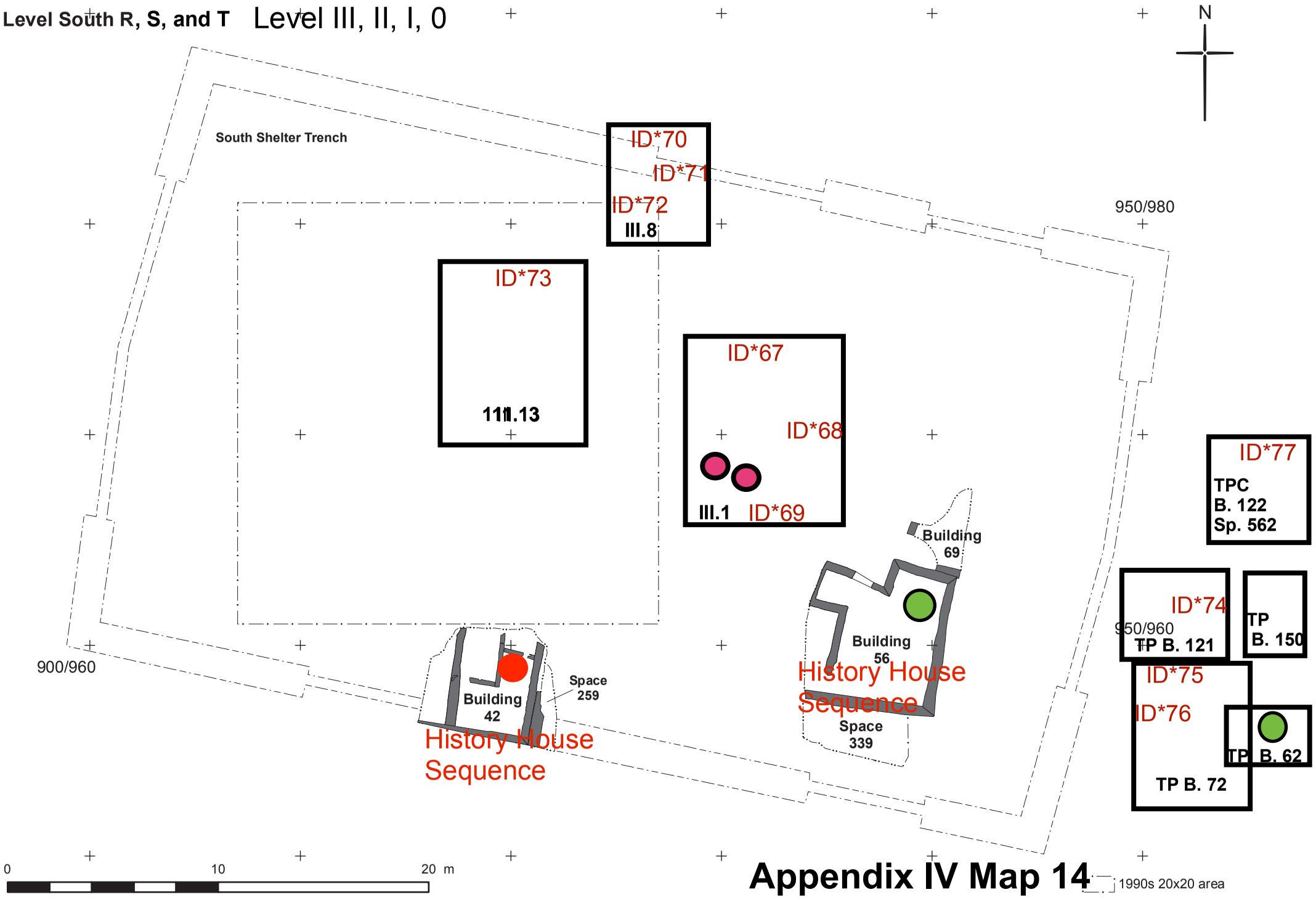
Level 4040 I North Level III-IV



Appendix IV Map 12



Appendix IV Map 13


Level South R, S, and T
Level III, II, I, 0
N
South Shelter Trench
ID*70
ID*71
ID*72
III.8
950/980
ID*73
III.13
ID*67
ID*68
III.1
ID*69
Building
69
ID*77
TPC
B. 122
Sp. 562
ID*74
950/960
TP B. 121
TP
B. 150
ID*75
ID*76
TP B. 72
TP B. 62
900/960
Building
42
Space
259
History House
Sequence
Building
56
History House
Sequence
Space
339
0
10
20 m
Appendix IV Map 14
1990s 20x20 area

Appendix V List of Relevant Sites and their Longitude and Latitude Co-ordinates

SITE	LATITUDE	LONGITUDE
Çatalhöyük East	37.666492°N	32.826918°E
Çatalhöyük West	37.666018°N	32.823328°E
Aşıki Höyük	38.349419°N	34.229645°E
Pınarbaşı A	41.6°N	33.11667°E
Canhasan	37.2667°N	33.3167°E
Süberde / Görüklük Tepe	37.35°N	31.93333°E
Musular	38.347406°N	34.226648°E
Erbaba	37.704725°N	31.746312°E
Hacılar	38.64972°N	35.45028°E
Bademağacı	37.211944°N	30.474444°E
Oküzini	37.078968°N	30.578646°E
Yümük Tepe /Mersin / ancient name Zephyrium	36.801389°N	34.603889°E
Fikirtepe	40.986944°N	29.036667°E
Alaca Höyük	40.233333°N	34.6833333°E
Tepecik-Çiftlik	38.171944°N	34.493611°E
Hoca Çeşme	40.759907°N	26.146621°E
Ilıpınar	38.690000°N	26.916667°E
Menteşe/Yenisehir	37.416667°N	28.433333°E
Pendik / Temenye	40.890843°N	29.253302°E
Köşk Höyük	37.847803°N	34.611841°E
Boncuklu	39.333333°N	27.516667°E
Göbekli Tepe	37.223300°N	38.922400°E
Jerico	31.8500N	35.4667E
‘Ain Ghazal	31.5833 N	36.3333 E

Beisamoun / Mallaha	33.09009 N	35.58172 E
Tell Abu Hureyra	35.8667 N	38.400 E
Samarra	34.21064 N	43.87729 E
Choga Mami	33.883333 N	45.450000 E

Compiled from available data at:

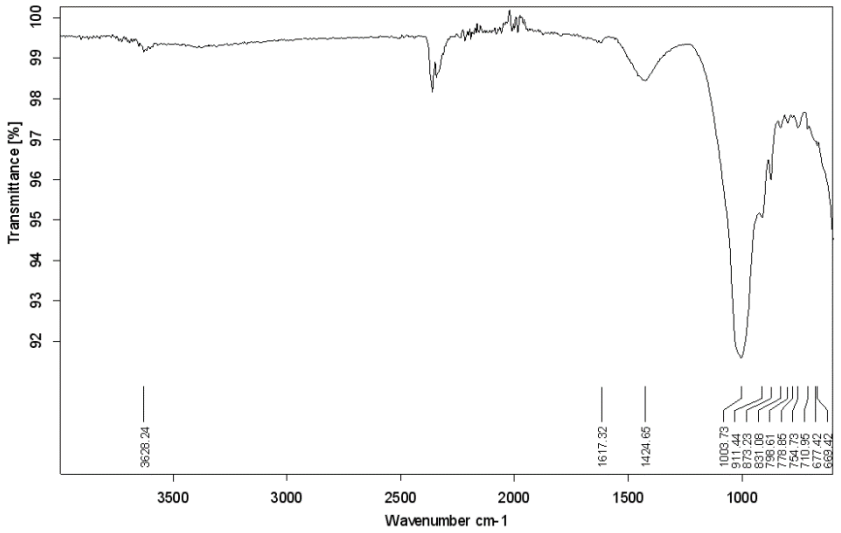
- http://www.archatlas.org/Home.php
- http://tayproject.org/Neosearcheng.html

APPENDIX VI Results from Fourier-Transform Infrared Spectroscopy

Page 1-19: Archaeolgical samples from Çatalhöyük in order of unit number

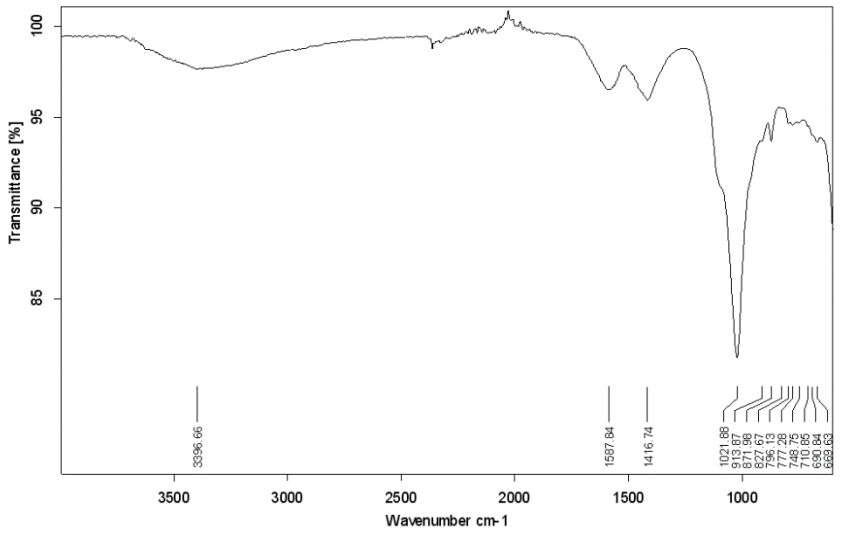
Page 20-22: Reference powdered pigment and accessory mineral samples from Kremer Pigmente GmbH & Co., supplier of high quality artist's materials for museum conservation and restoration: http://www.kremer-pigmente.com/en.

Page 23 Readings from packing materials



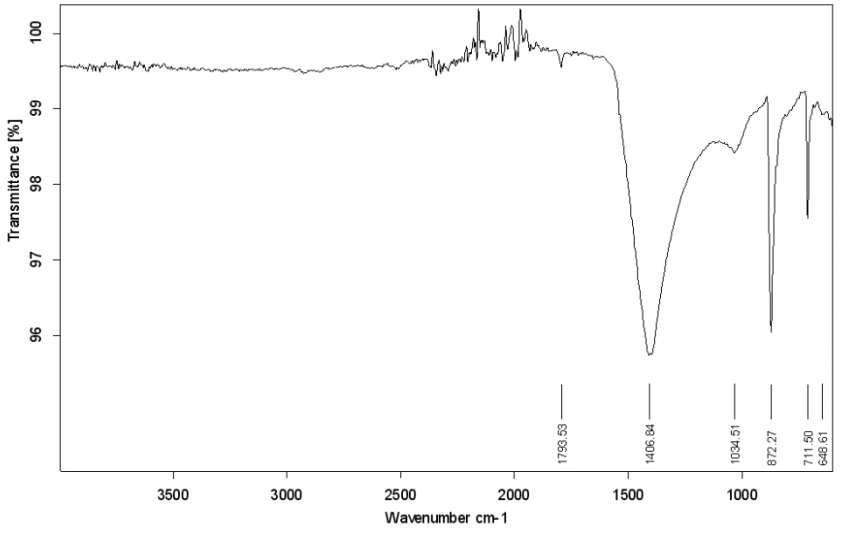
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\1525s8PK.0	red contains soil PWD	Instrument type and / or accessory	05/09/2013

Page 1/1



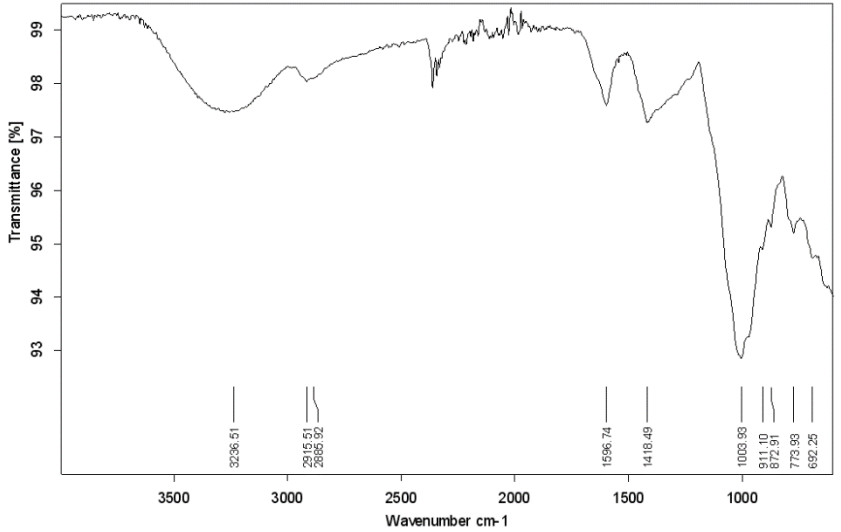
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\1993s8 PWDPK.0	yellow PWD	Instrument type and / or accessory	04/09/2013

Page 1/1



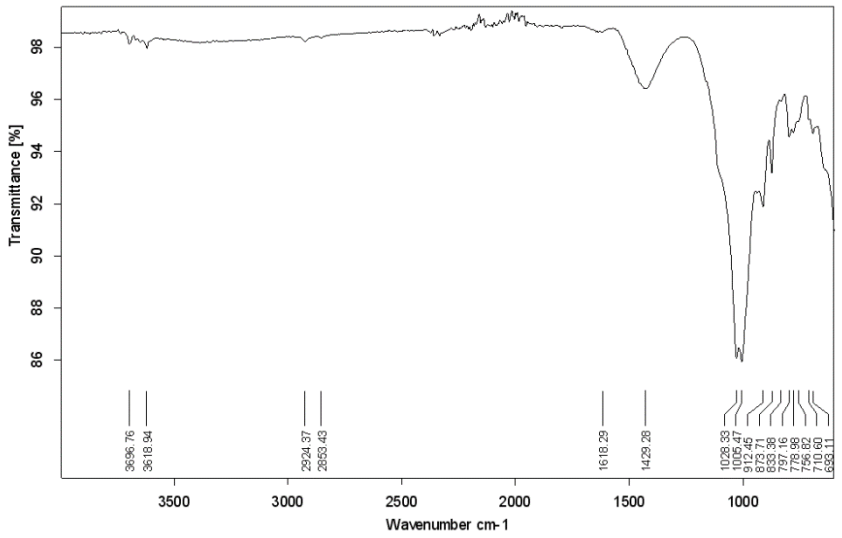
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\3290s1 PWDPK.0	red PWD	Instrument type and / or accessory	04/09/2013

Page 1/1



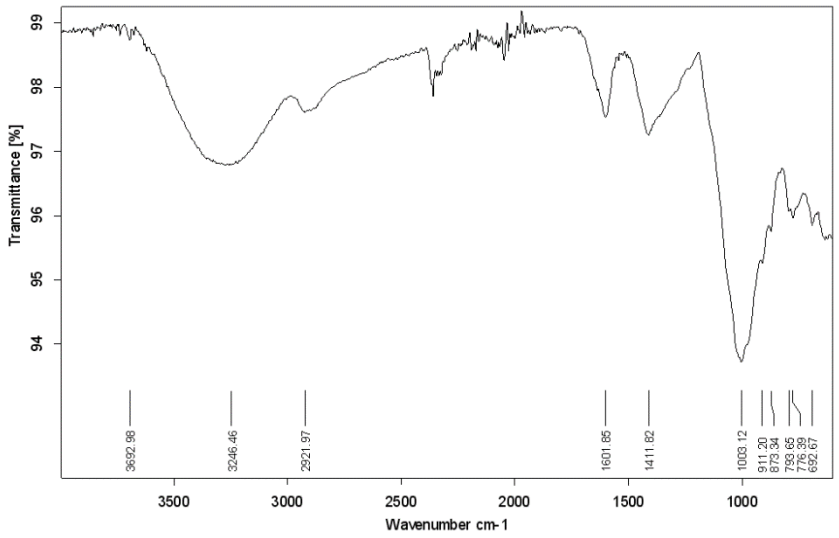
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\3464s1PK.0	red particles west area PWD	Instrument type and / or accessory	05/09/2013

Page 1/1



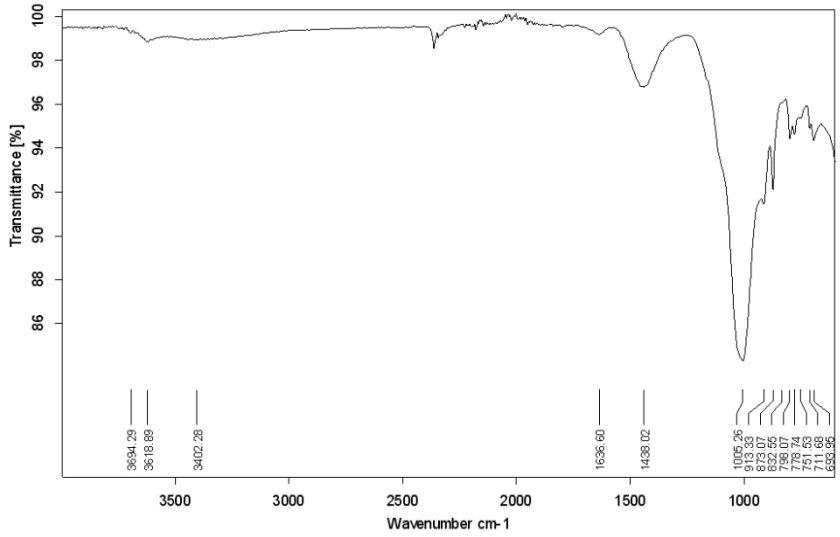
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\3476s1.0 red powder west area PWD Instrument type and / or accessory 05/09/2013

Page 1/1



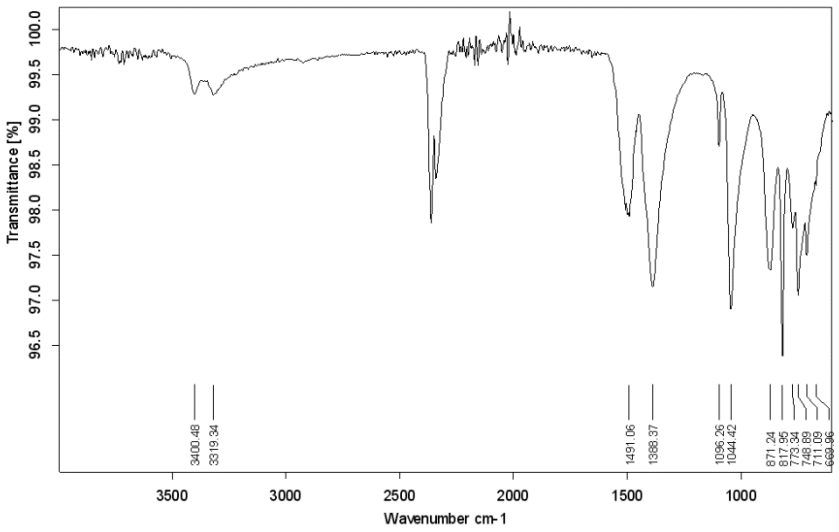
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\3476s2.0 red particle west areaPWD Instrument type and / or accessory 05/09/2013

Page 1/1



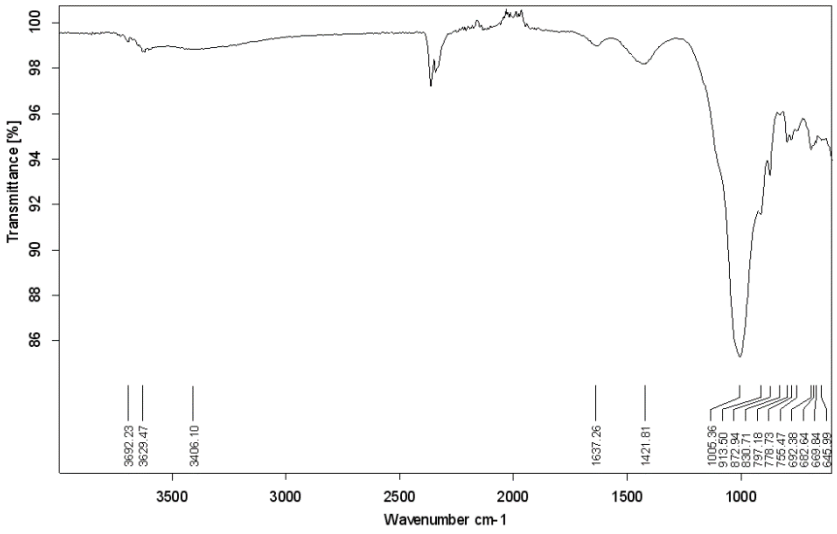
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\4194s1 clay PWD.0 clay PWD Instrument type and / or accessory 04/09/2013

Page 1/1



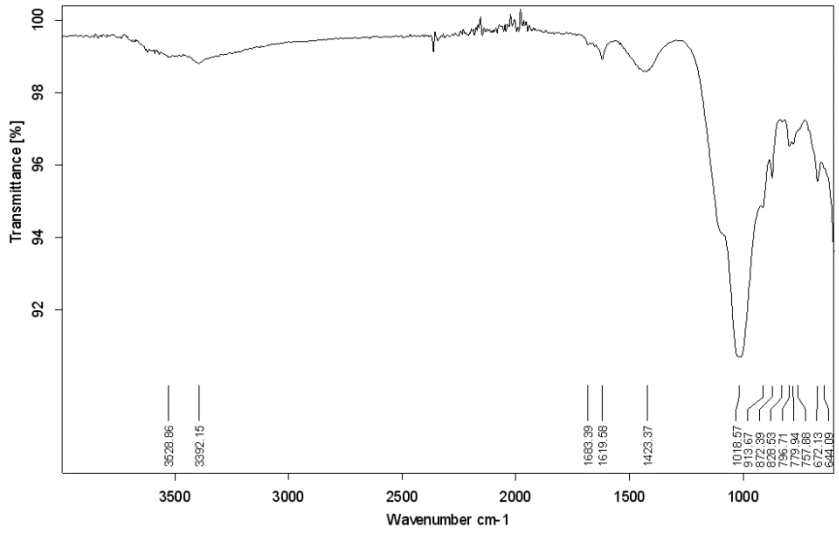
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\4225s8green.1 green mineral Instrument type and / or accessory 04/09/2013

Page 1/1



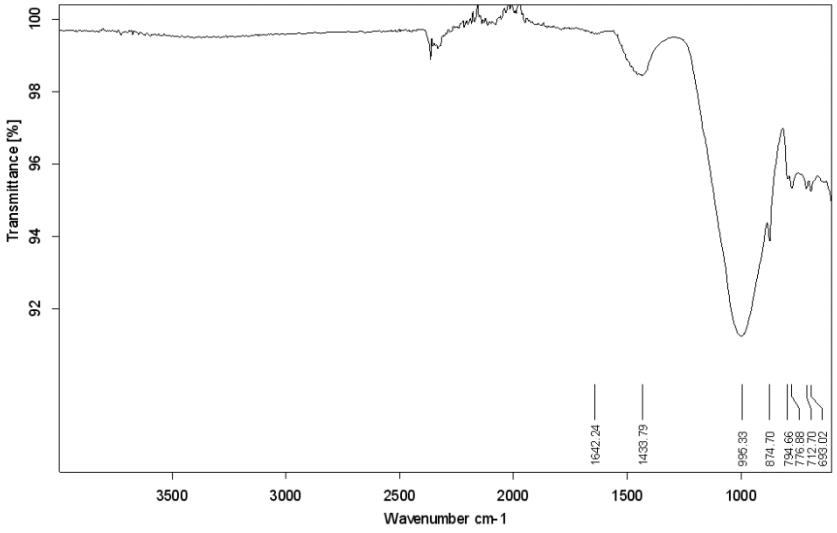
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\4407s4.0	red PWD	Instrument type and / or accessory	05/09/2013

Page 1/1



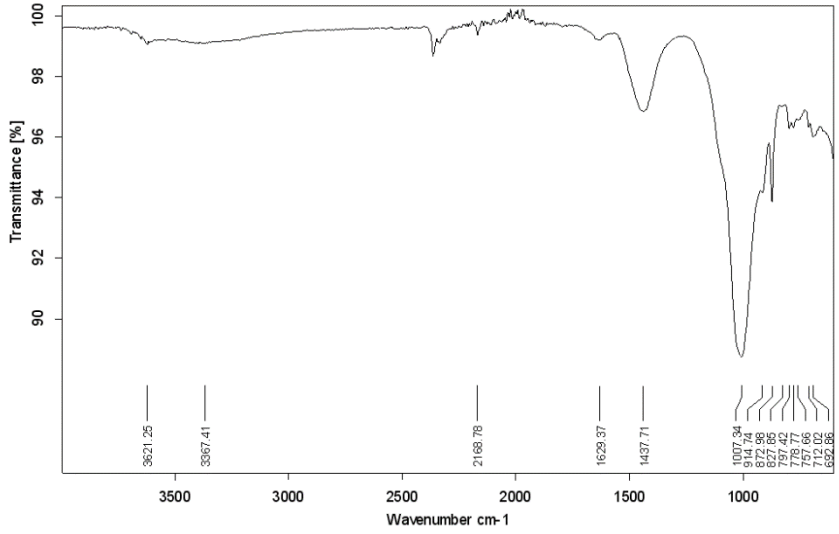
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\4464s13 PWD.0	red PWD	Instrument type and / or accessory	04/09/2013

Page 1/1



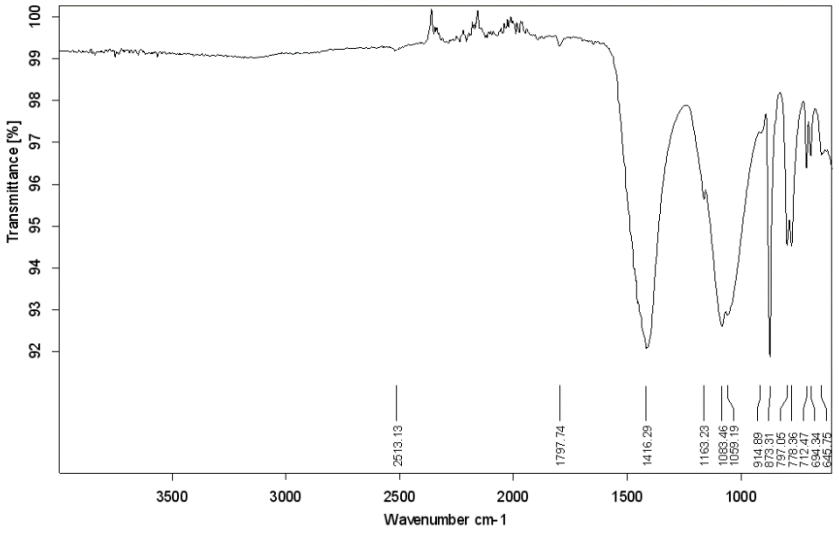
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\4464s14 mudbrick PWD.0	mudbrick PWD	Instrument type and / or accessory	04/09/2013

Page 1/1



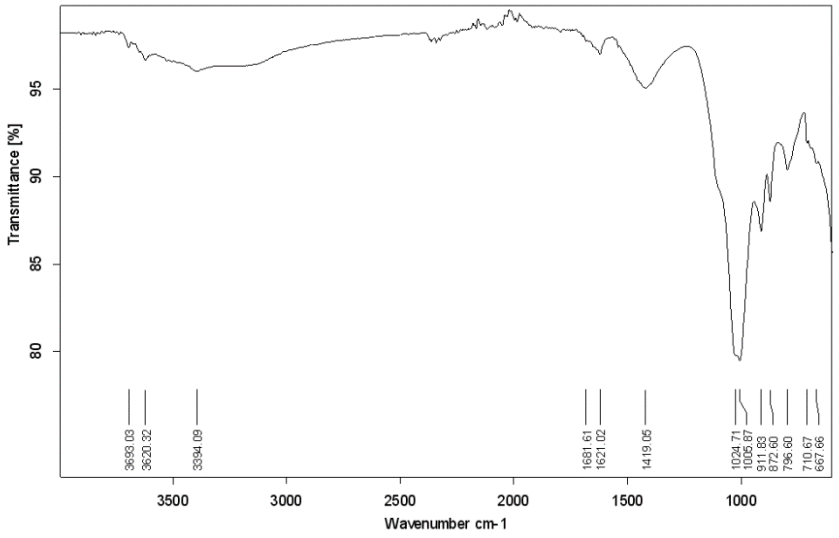
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\4620s4.0	red particles in soil PWD	Instrument type and / or accessory	05/09/2013

Page 1/1



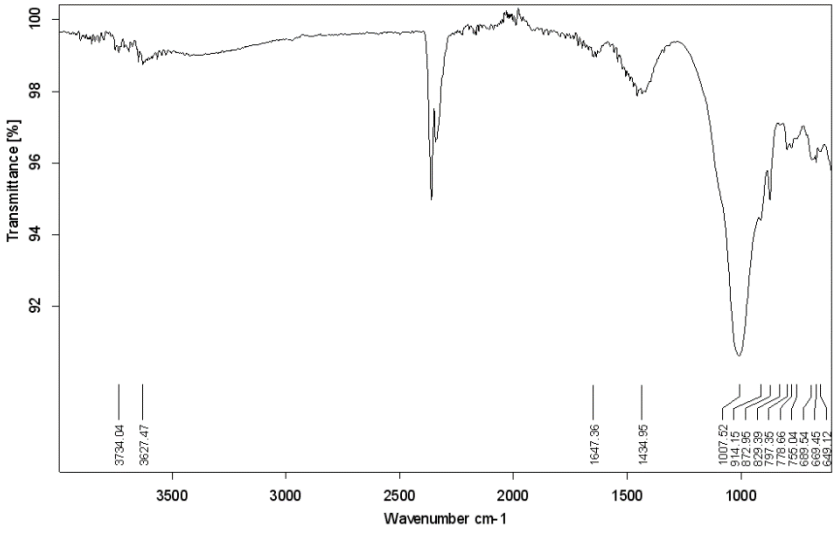
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\4671s6 PWD.0	red PWD	Instrument type and / or accessory	04/09/2013

Page 1/1



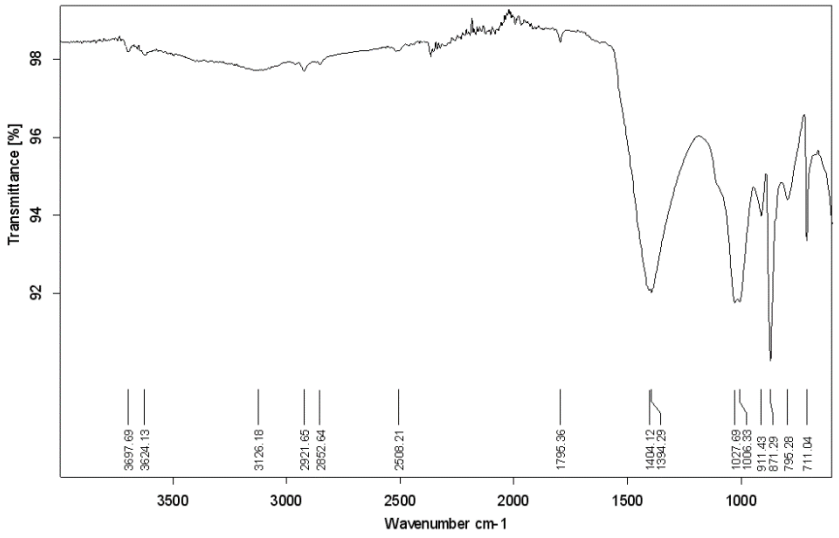
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\4947s5 PWD.0	red PWD	Instrument type and / or accessory	04/09/2013

Page 1/1



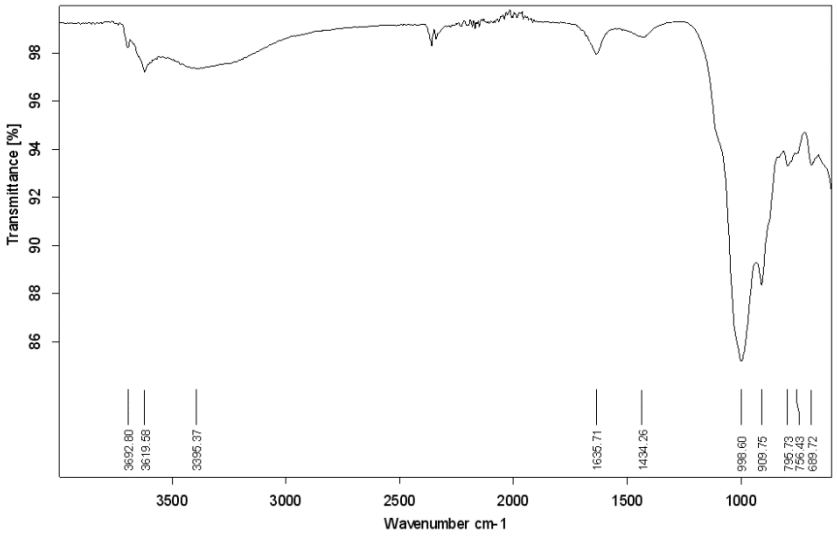
C:\Program Files\OPUS_65\MEAS\Ina\Peak labelled FT_IR\5153s6.0	red particles with soil	Instrument type and / or accessory	05/09/2013

Page 1/1



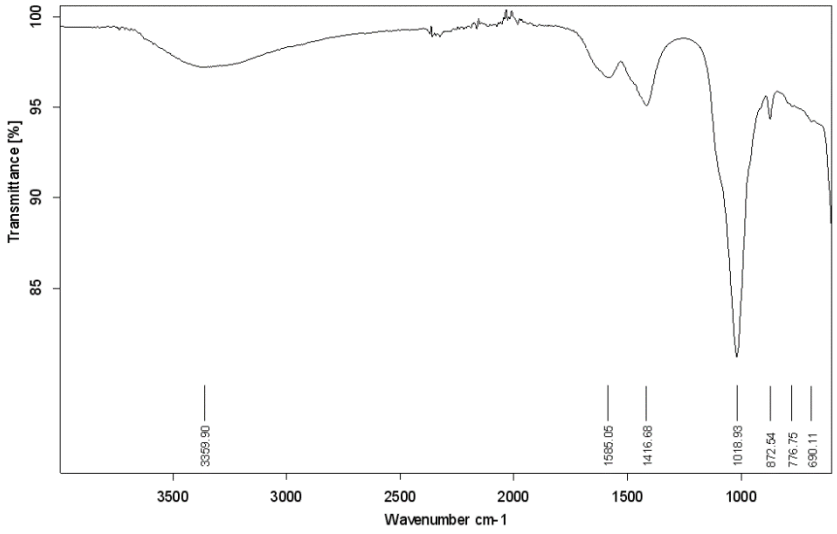
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\5214s2 PWD.0	red PWD	Instrument type and / or accessory	04/09/2013

Page 1/1



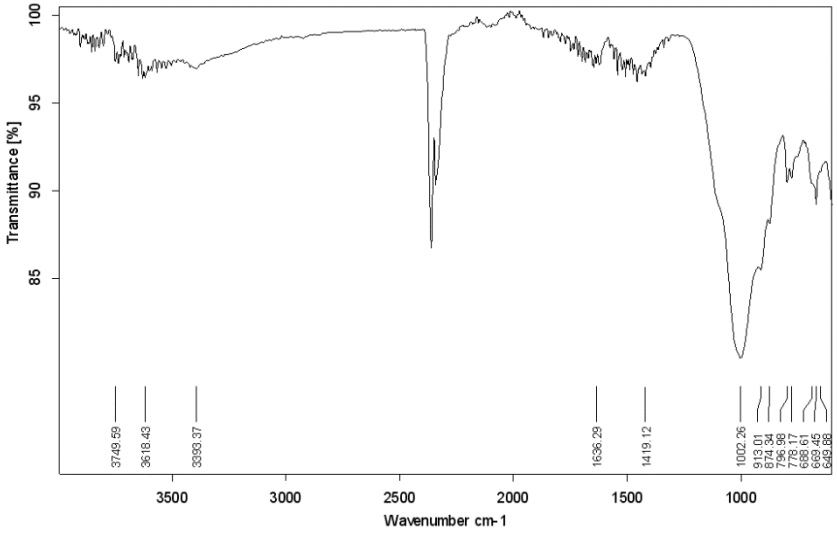
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\5228s3 PWD.0	red PWD	Instrument type and / or accessory	04/09/2013

Page 1/1



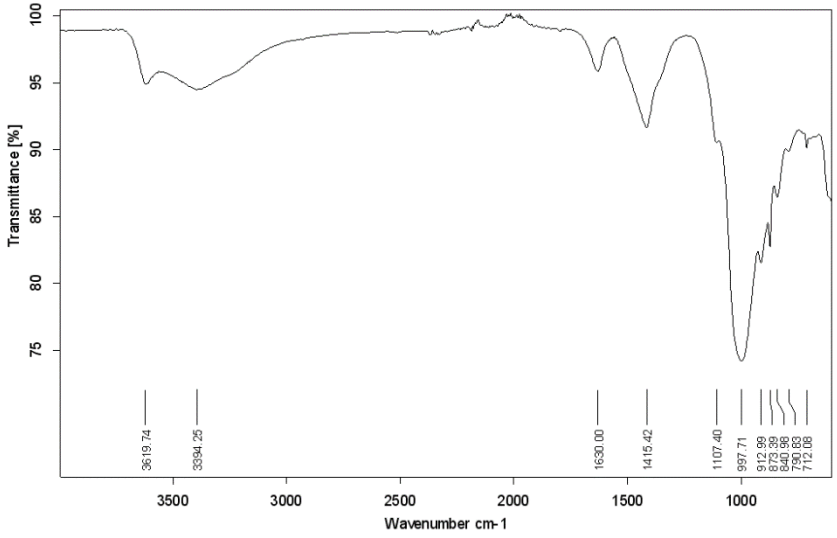
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\5349s5 PWD.0	yellow PWD	Instrument type and / or accessory	04/09/2013

Page 1/1



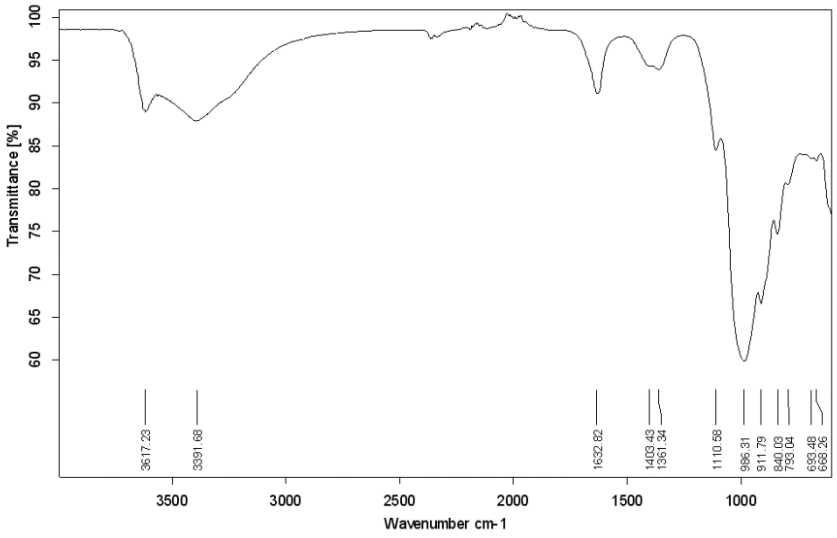
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\5575s3clay PWD.2	clay	Instrument type and / or accessory	04/09/2013

Page 1/1



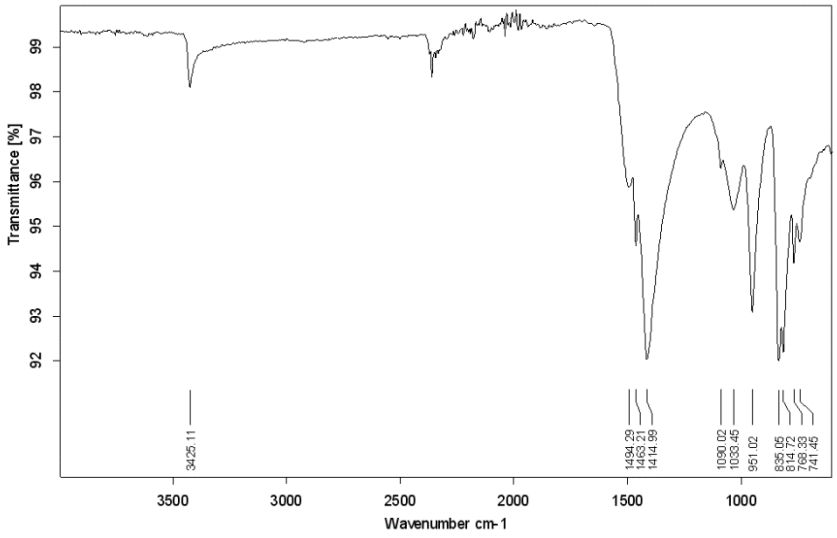
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\6250s8 PWD.0	white PWD	Instrument type and / or accessory	04/09/2013

Page 1/1



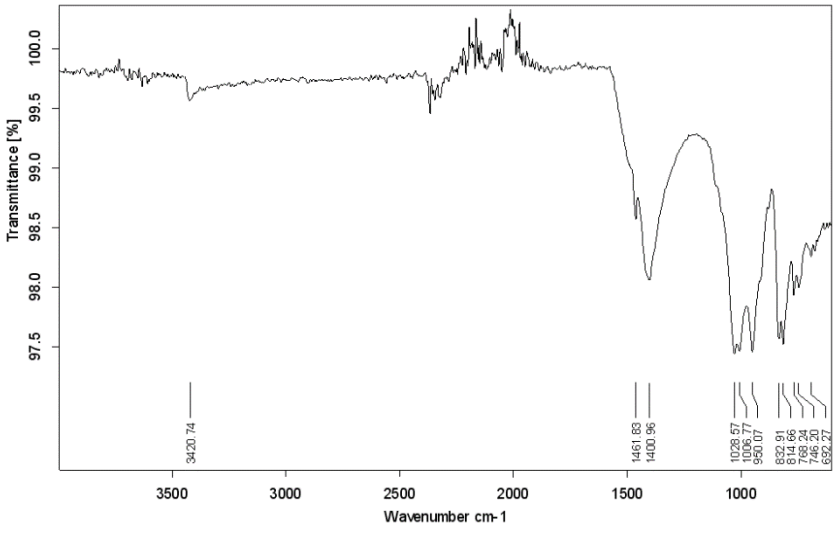
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\6250s8 PWD.1	red PWD	Instrument type and / or accessory	04/09/2013

Page 1/1



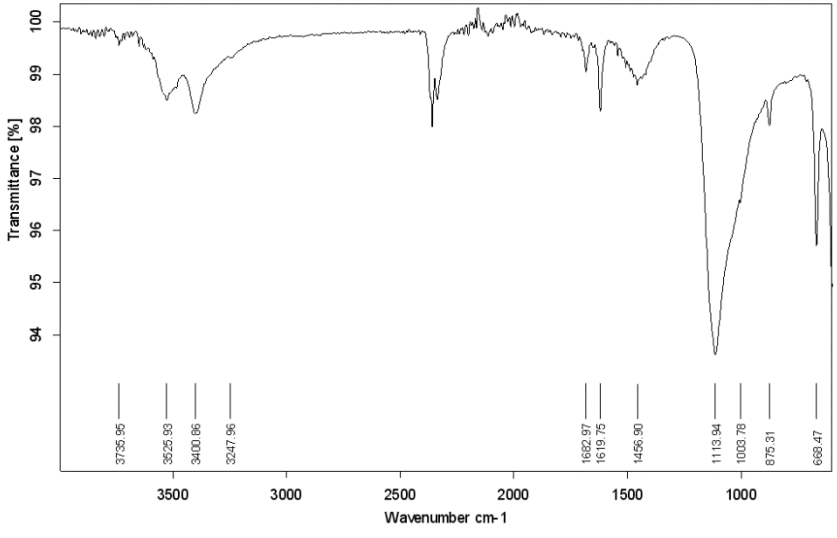
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\7575s7.0	blue	Instrument type and / or accessory	04/09/2013

Page 1/1



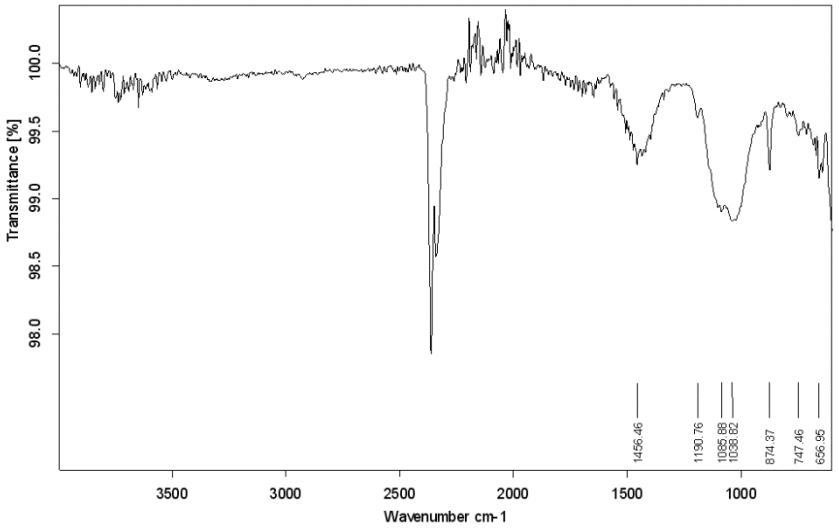
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\7597s4.0	blue	Instrument type and / or accessory	04/09/2013

Page 1/1



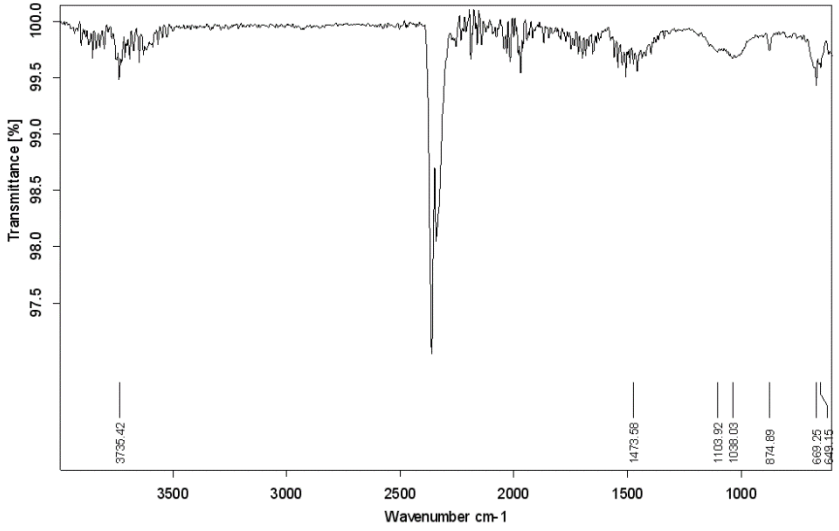
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\11862s6_3.0	pinkplaster	Instrument type and / or accessory	03/09/2013

Page 1/1



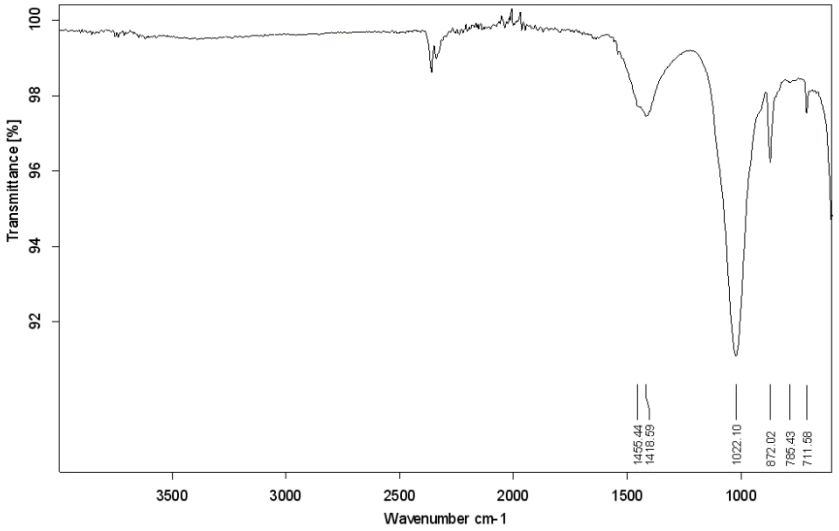
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\11862s9.0	pinkred	Instrument type and / or accessory	03/09/2013

Page 1/1



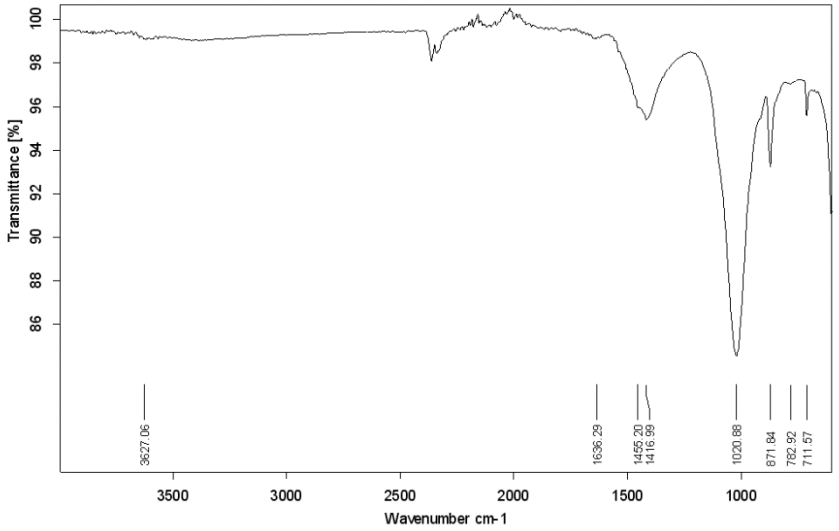
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\11862s9_2.0	pinkred	Instrument type and / or accessory	03/09/2013

Page 1/1



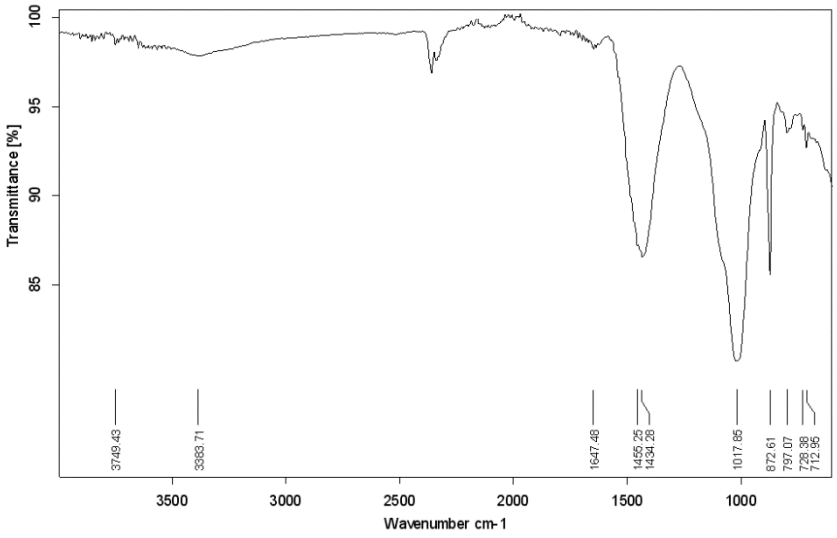
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\12456s7.0	pinkcake	Instrument type and / or accessory	03/09/2013

Page 1/1



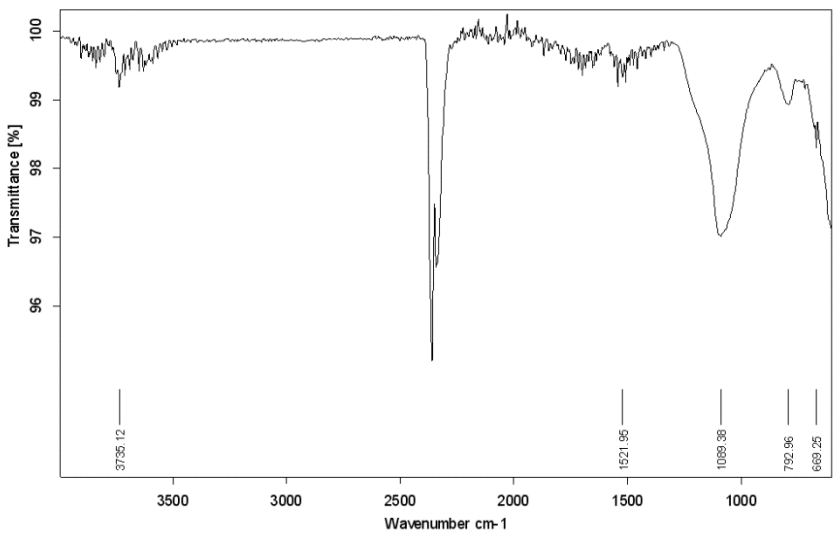
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\12456s7_2.0	pinkcake	Instrument type and / or accessory	03/09/2013

Page 1/1



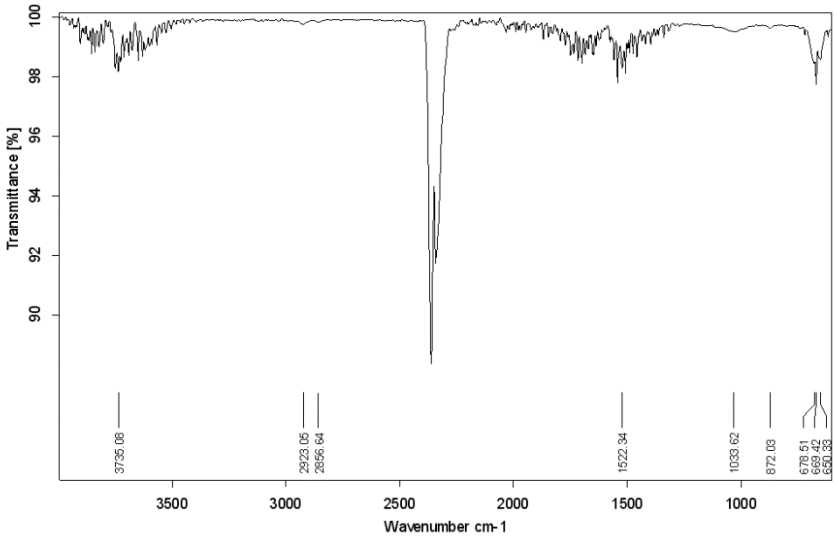
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\12456s7_2.1	re	Instrument type and / or accessory	03/09/2013

Page 1/1



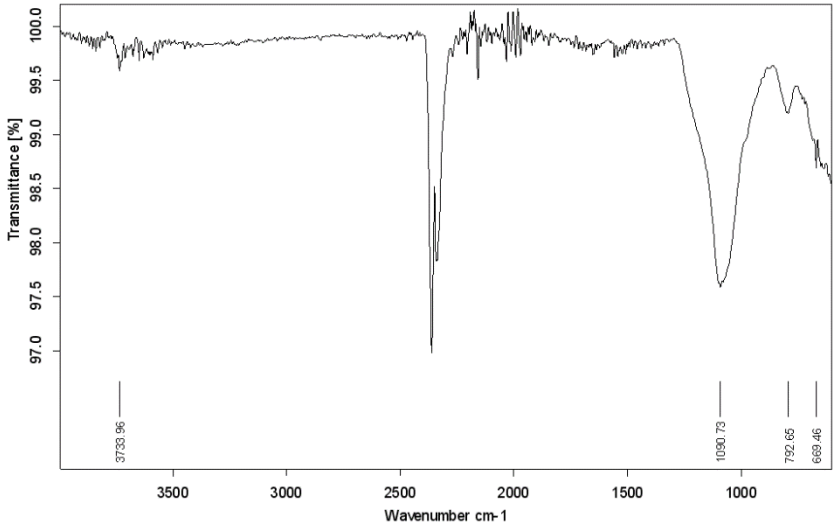
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\12487s7_2.0	red	Instrument type and / or accessory	03/09/2013

Page 1/1



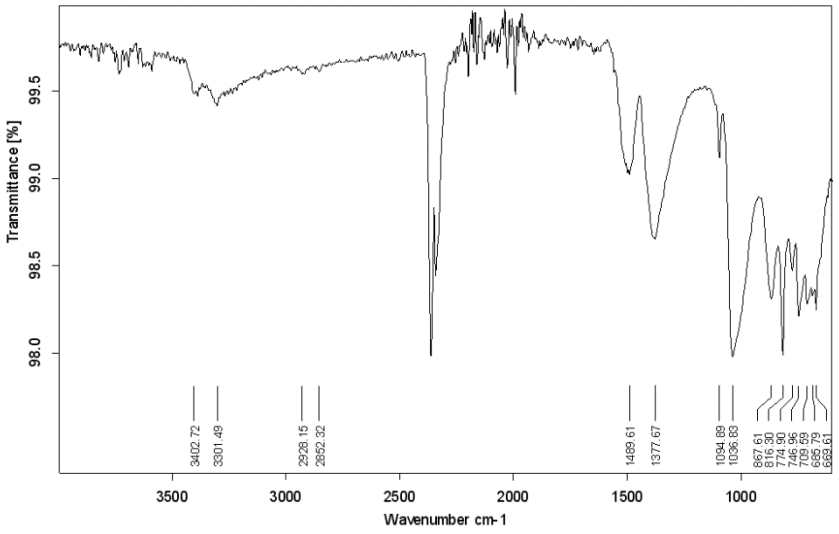
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\12540s3bonechip.0	blue bone chip off of frag	Instrument type and / or accessory	04/09/2013

Page 1/1



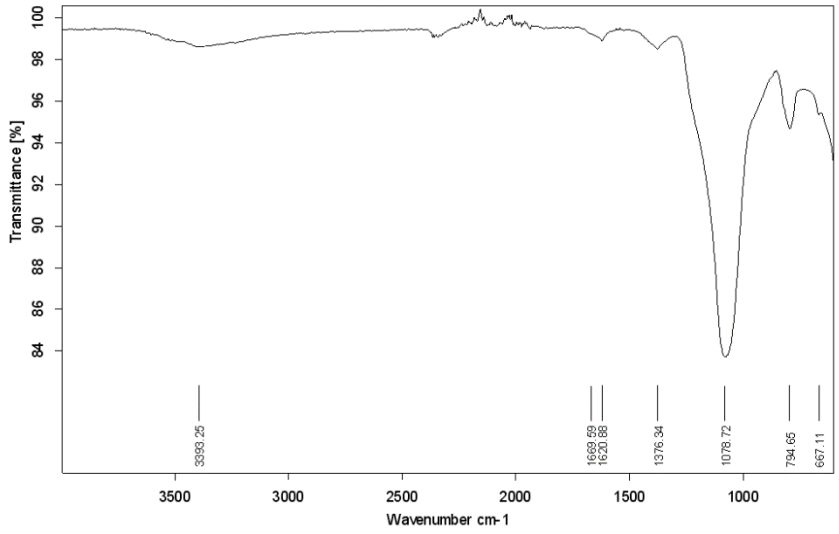
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\12867s3.0	red	Instrument type and / or accessory	03/09/2013

Page 1/1



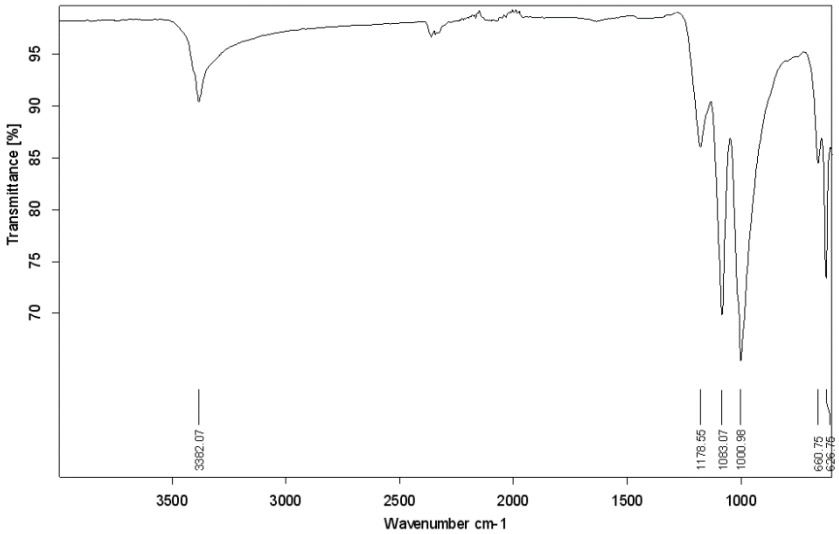
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\12867s4green.0	green mineral	Instrument type and / or accessory	04/09/2013

Page 1/1



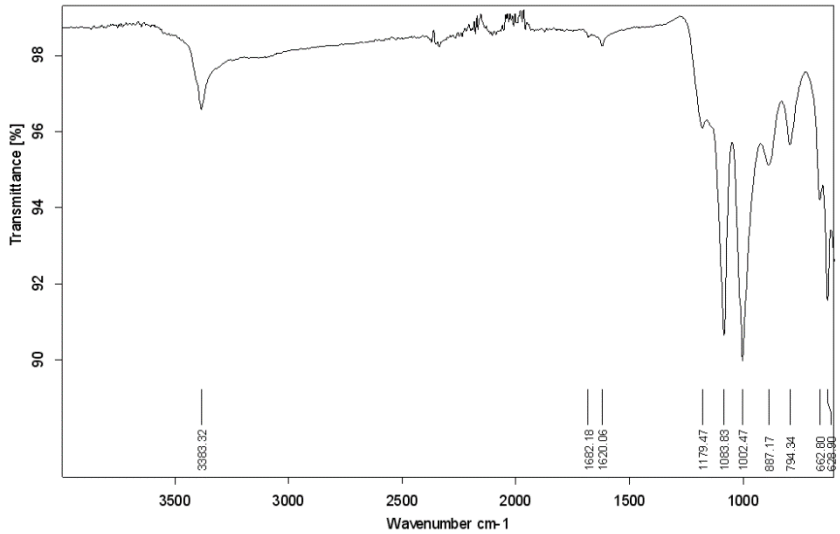
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\13365s4.0	red	Instrument type and / or accessory	03/09/2013

Page 1/1



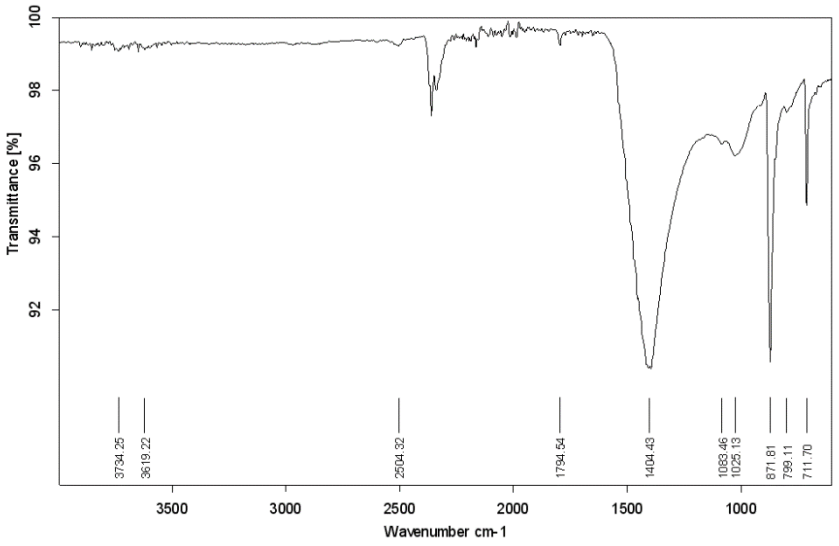
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\13801s9.0	yelllow powder west area PWD	Instrument type and / or accessory	05/09/2013

Page 1/1



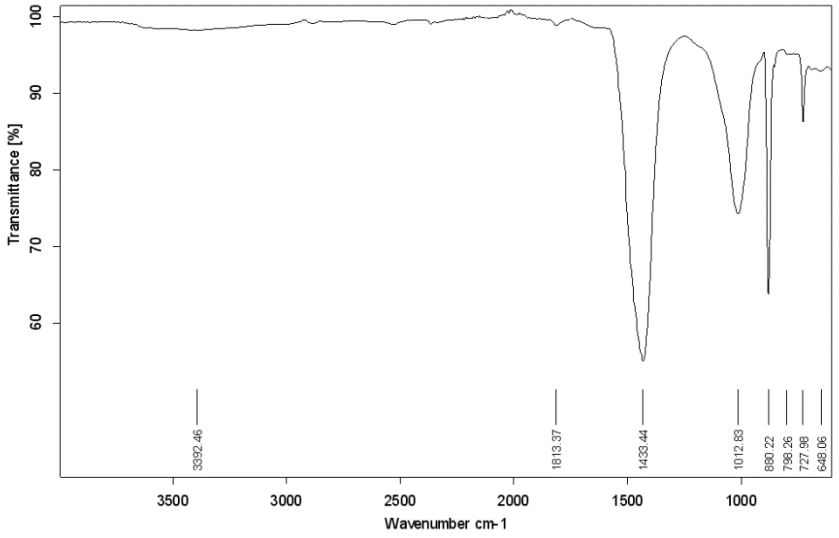
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\14009s1.0	red	Instrument type and / or accessory	03/09/2013

Page 1/1



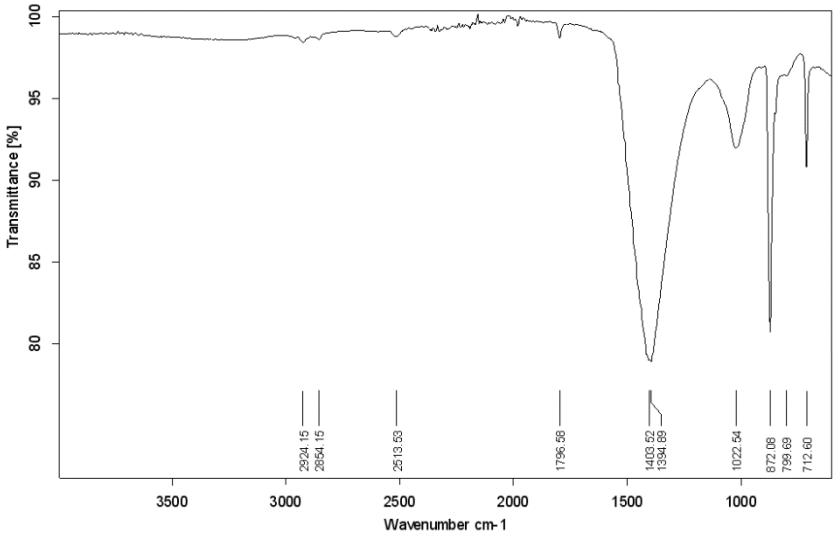
C:\Program Files\OPUS_65\MEAS\Ina\Peak labelled FT_IR\15160s5.0	YELLOW PWDWest Area	Instrument type and / or accessory	05/09/2013

Page 1/1



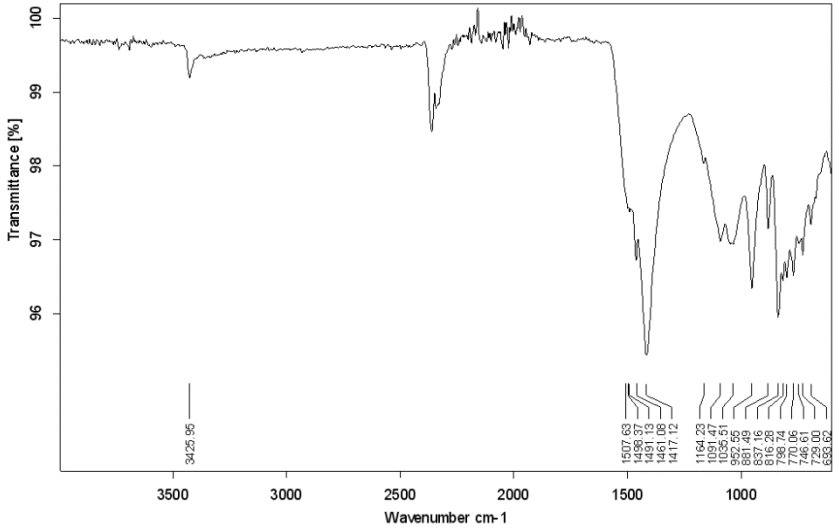
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\15180s4.0	white powder west area PWD	Instrument type and / or accessory	05/09/2013

Page 1/1



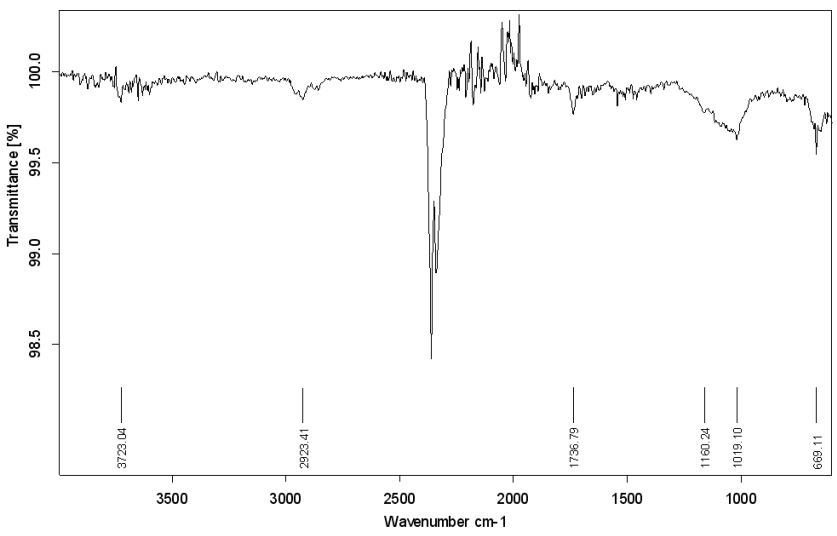
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\15839s39 PWD.0	yellowPWD	Instrument type and / or accessory	04/09/2013

Page 1/1



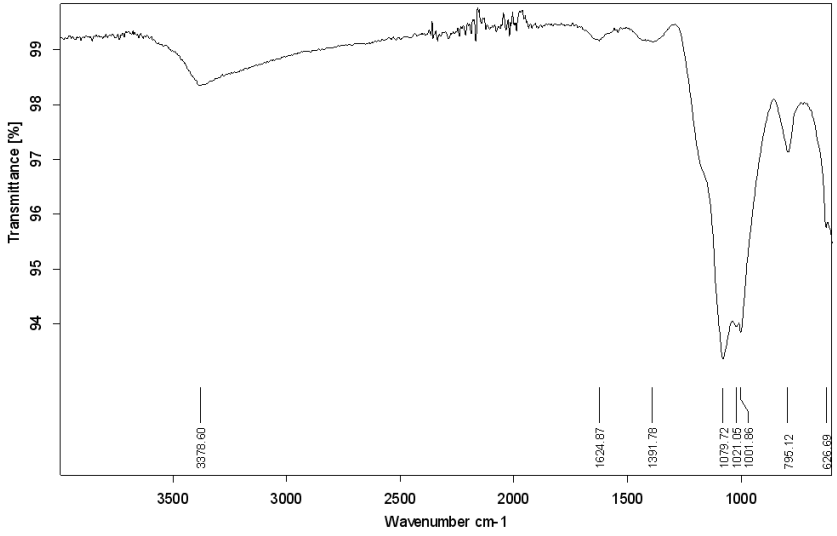
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\16308s4.0	bluegreen	Instrument type and / or accessory	04/09/2013

Page 1/1



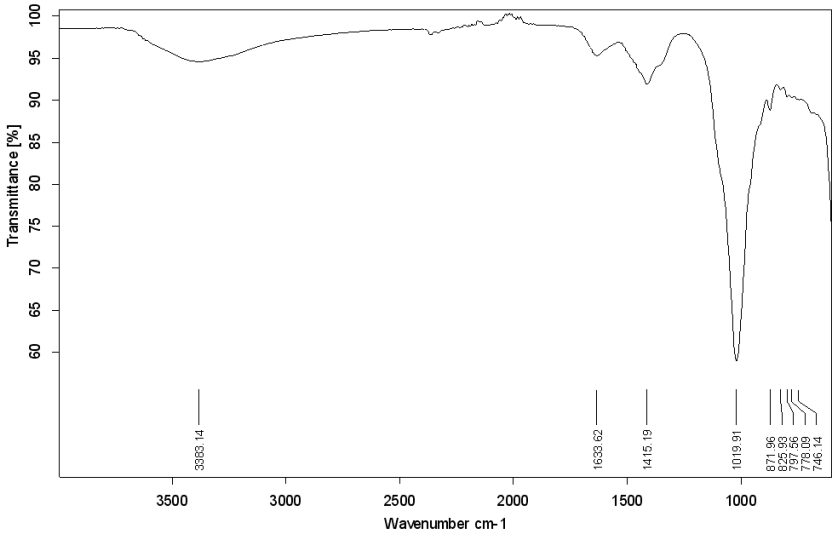
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\17048s3.0	red Instrument type and / or accessory	03/09/2013

Page 1/1



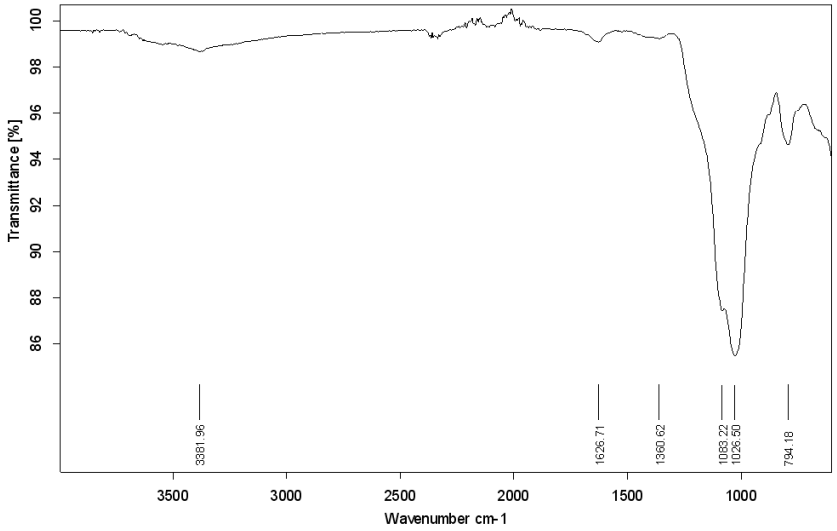
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\17339s12 PWD.0	red PWD Instrument type and / or accessory	04/09/2013

Page 1/1



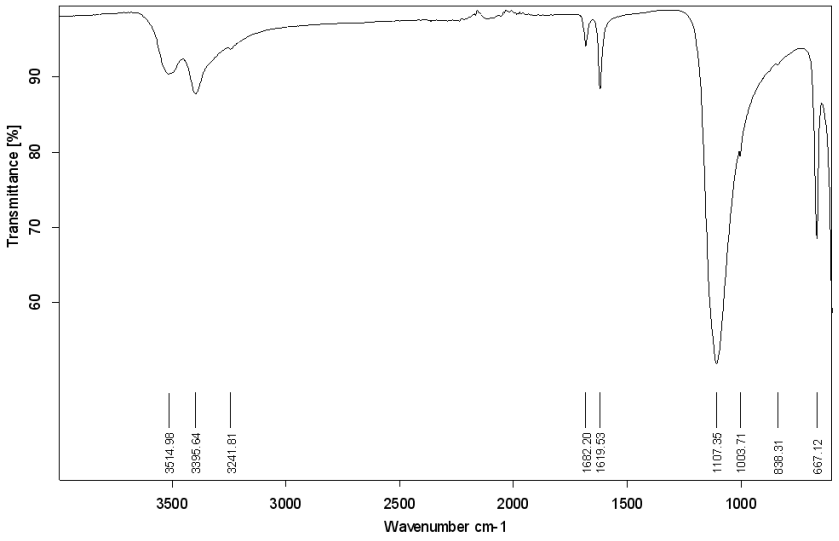
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\17485s3.0	contains soil PWD Instrument type and / or accessory	05/09/2013

Page 1/1



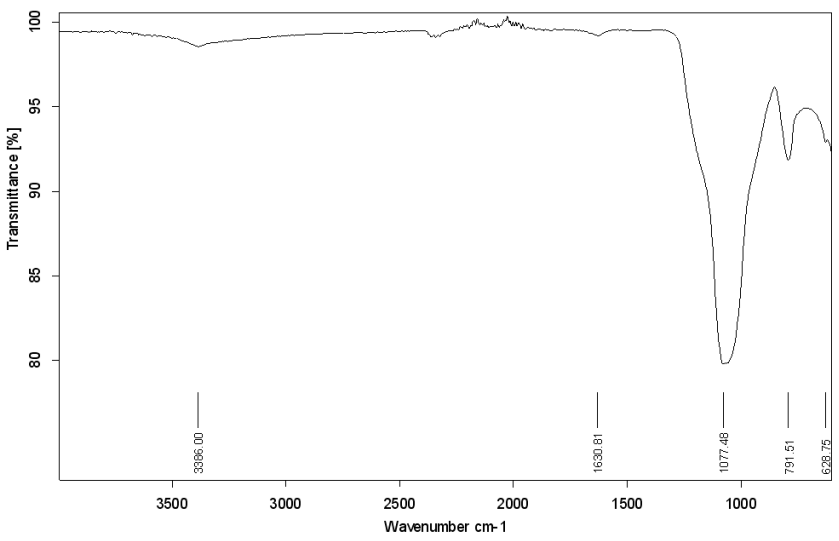
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\17532s3 PWD.0	yellow PWD Instrument type and / or accessory	04/09/2013

Page 1/1



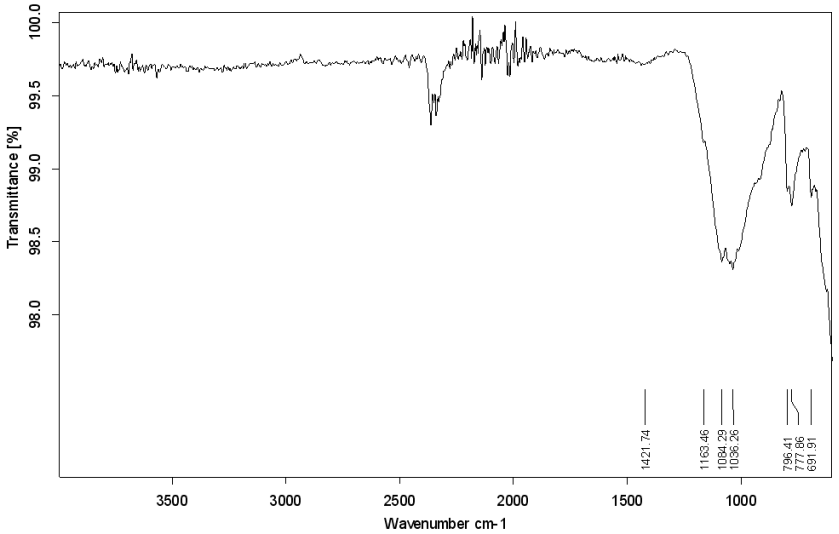
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\18318s15.0	white powder west area PWD	Instrument type and / or accessory	05/09/2013

Page 1/1



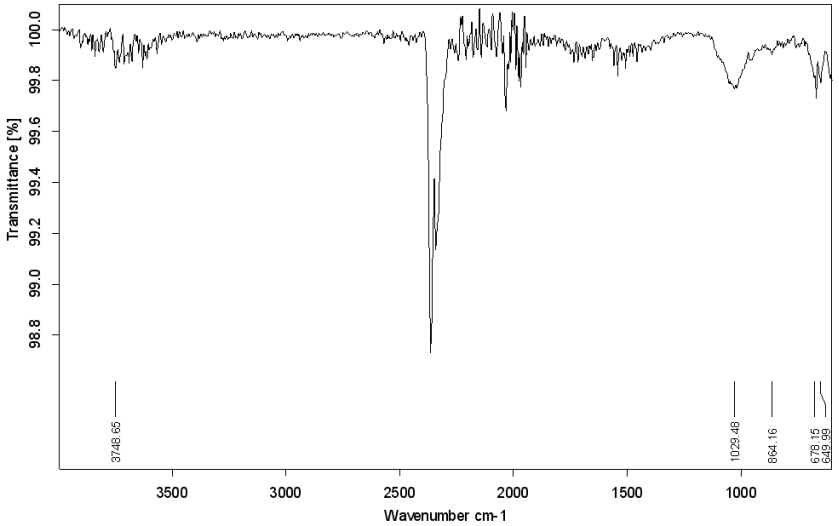
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\18343s3.0	red powder west area PWD	Instrument type and / or accessory	05/09/2013

Page 1/1



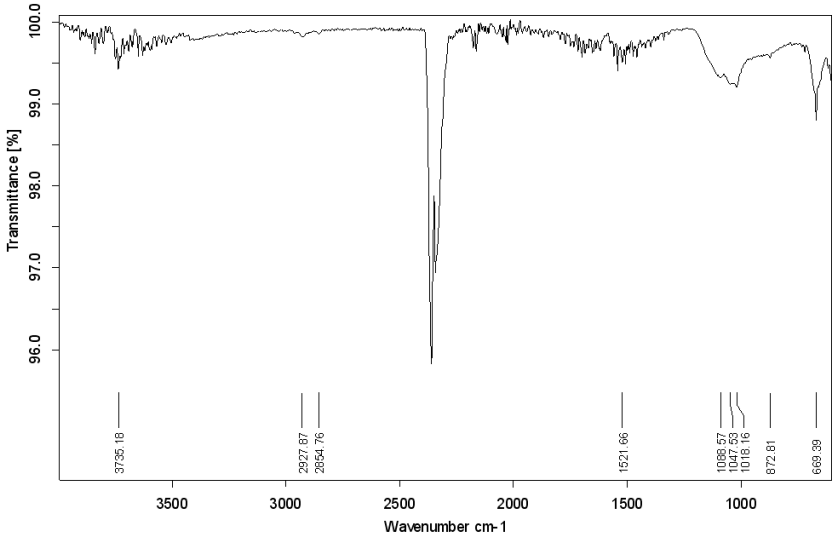
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\18488s3.0	red	Instrument type and / or accessory	03/09/2013

Page 1/1



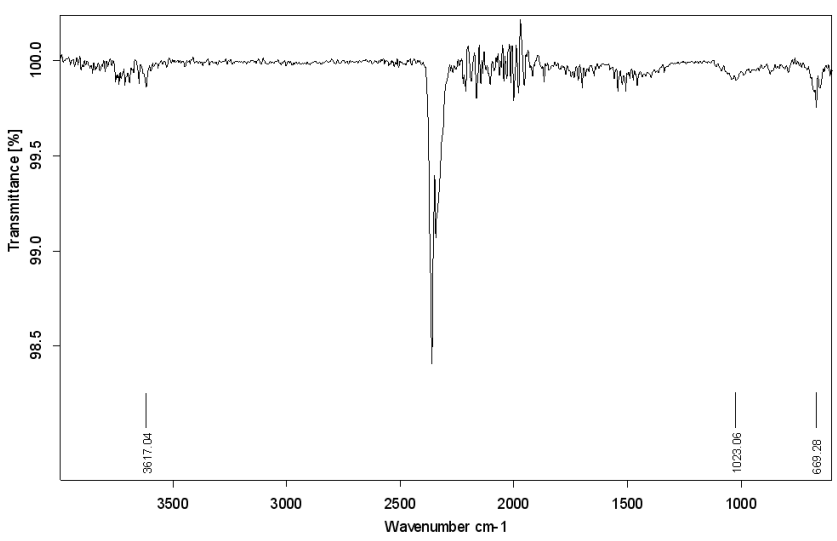
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\18508s7redstainbone.0	bone particles red	Instrument type and / or accessory	04/09/2013

Page 1/1



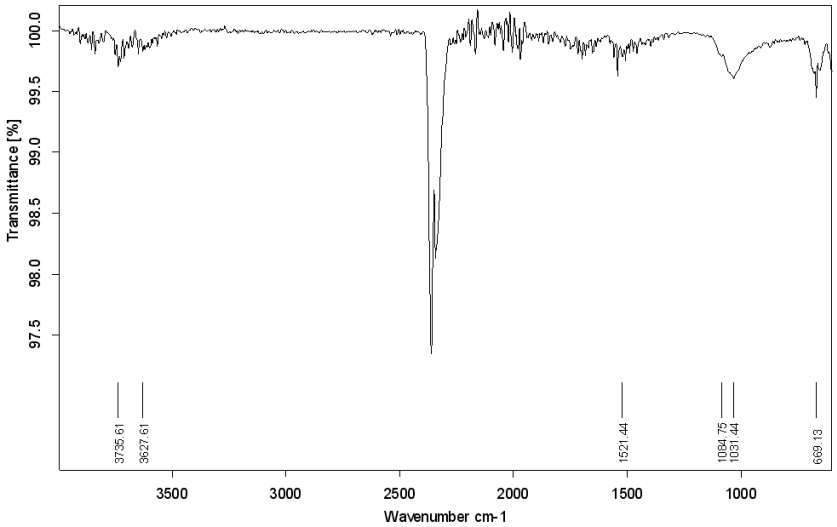
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\18508s8bluebone.0 blue staining Instrument type and / or accessory 04/09/2013

Page 1/1



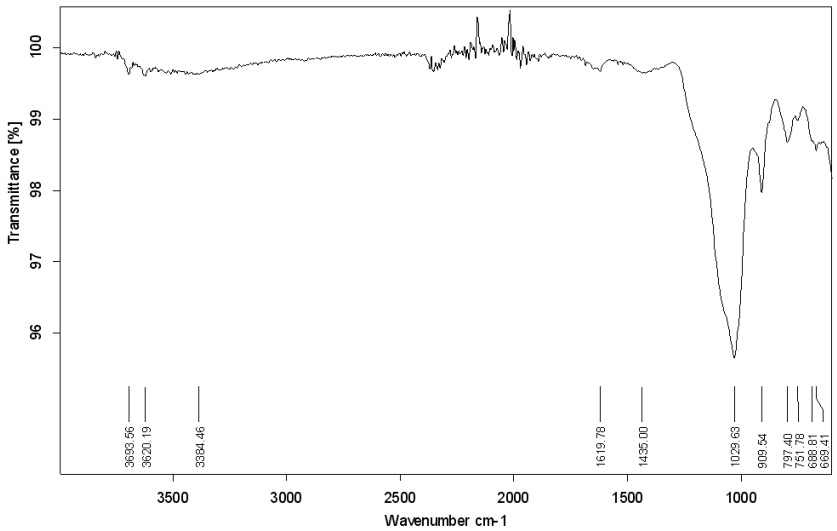
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\18508s9bluebone.0 blue staining Instrument type and / or accessory 04/09/2013

Page 1/1



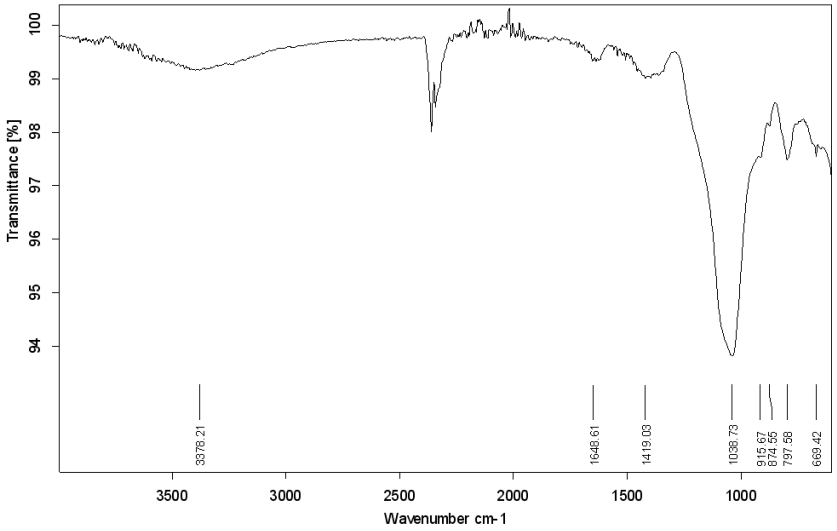
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\18508s10bluebone.0 blue staining Instrument type and / or accessory 04/09/2013

Page 1/1



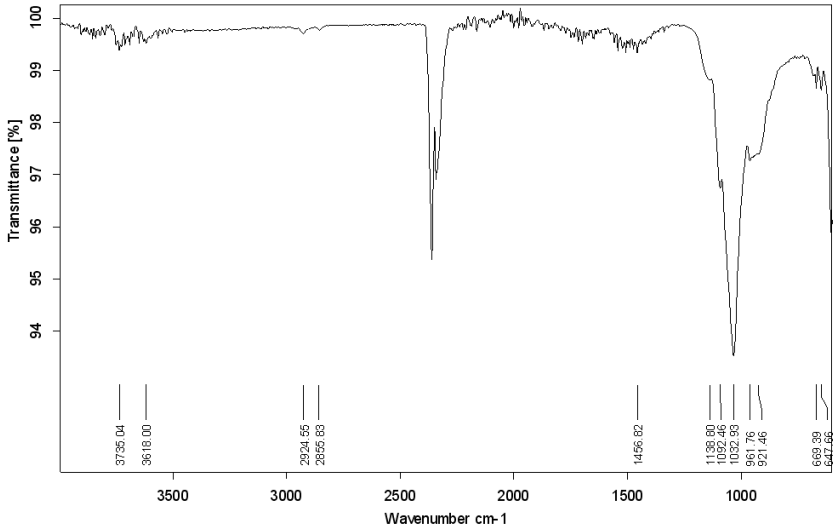
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\18536s3.0 red Instrument type and / or accessory 03/09/2013

Page 1/1



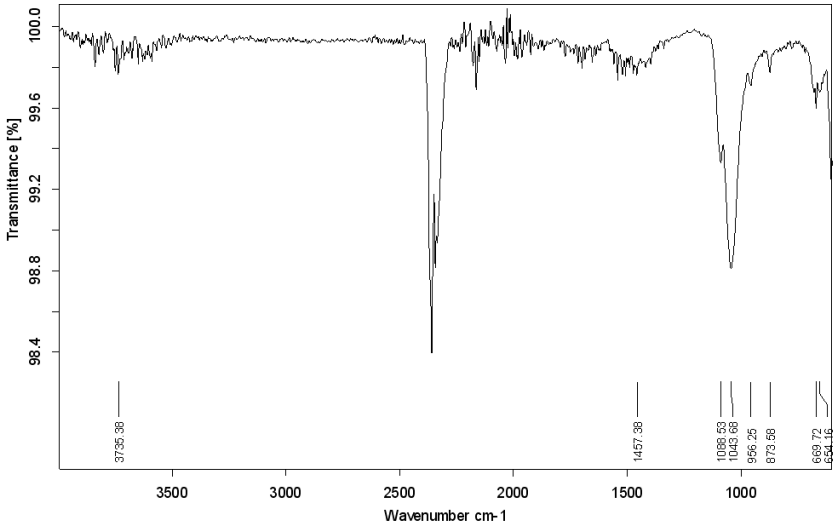
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\18544s4.0	red	Instrument type and / or accessory	03/09/2013

Page 1/1



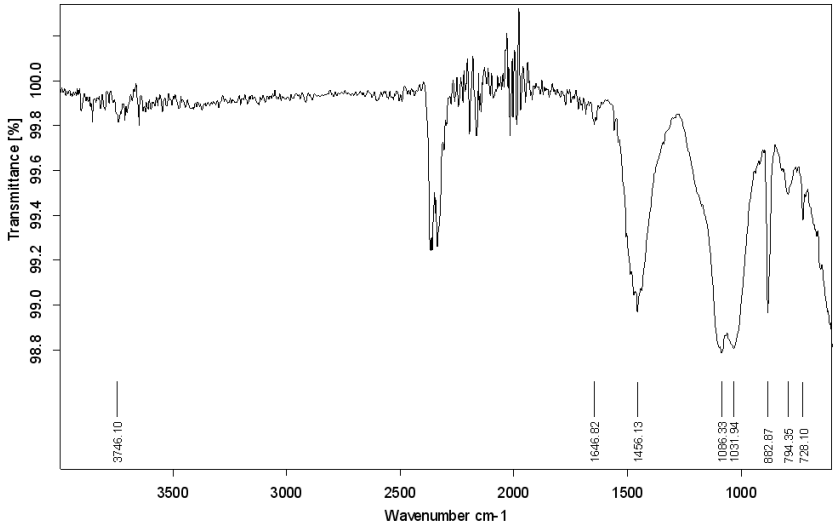
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\18545s10bone.0	bone particles	Instrument type and / or accessory	04/09/2013

Page 1/1



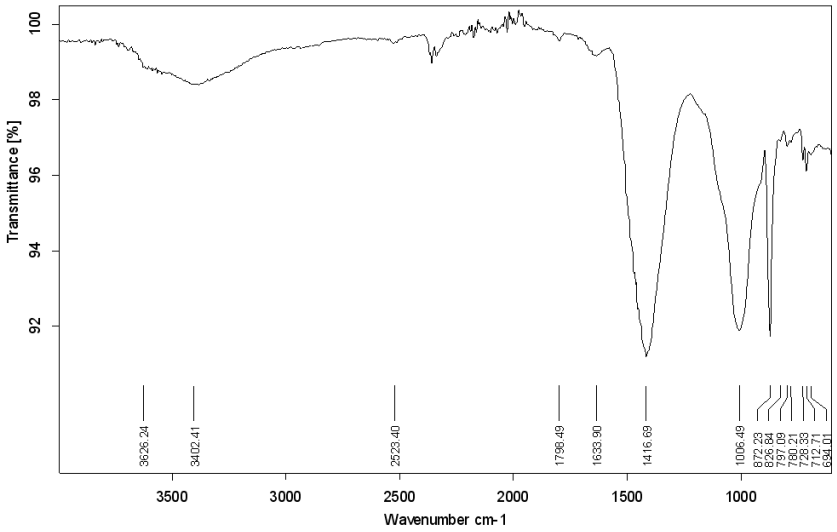
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\18552s3bluebone.0	blue staining	Instrument type and / or accessory	04/09/2013

Page 1/1



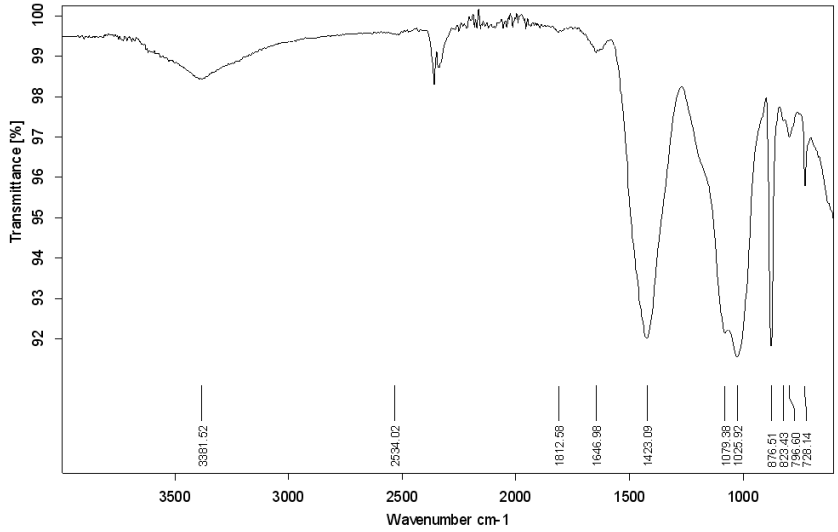
C:\Program Files\OPUS_65\MEAS\Ina\Peak labelled FT_IR\18918s5.0	red PWD	Instrument type and / or accessory	05/09/2013

Page 1/1



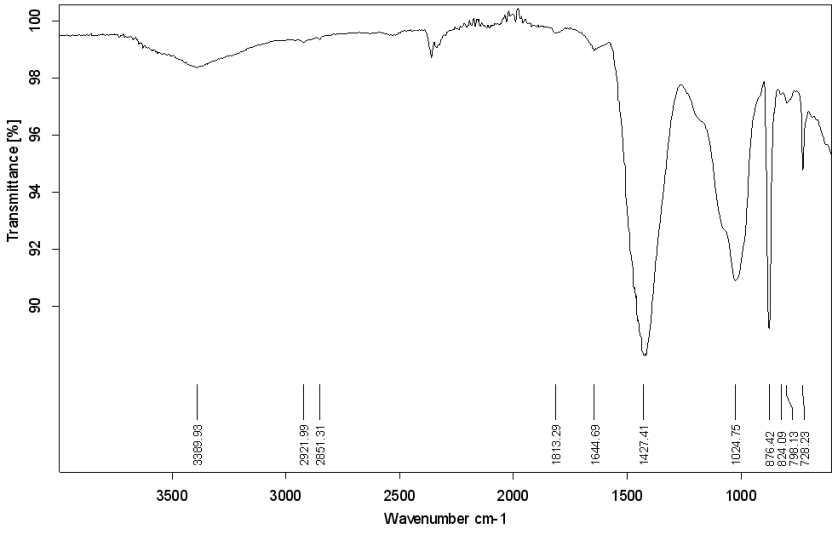
C:\Program Files\OPUS_65\MEAS\Ina\Peak labelled FT_IR\18918s6.0	red PWD	Instrument type and / or accessory
05/09/2013		

Page 1/1



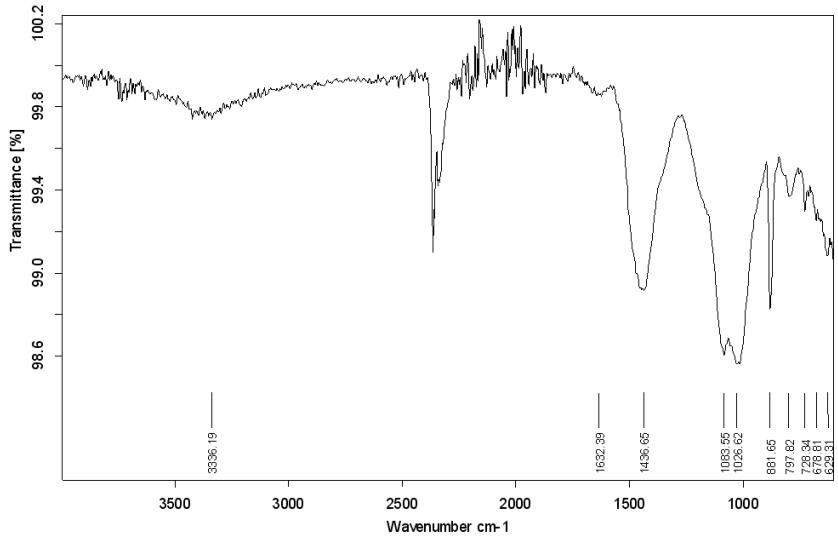
C:\Program Files\OPUS_65\MEAS\Ina\Peak labelled FT_IR\18918s.7	red PWD	Instrument type and / or accessory
05/09/2013		

Page 1/1



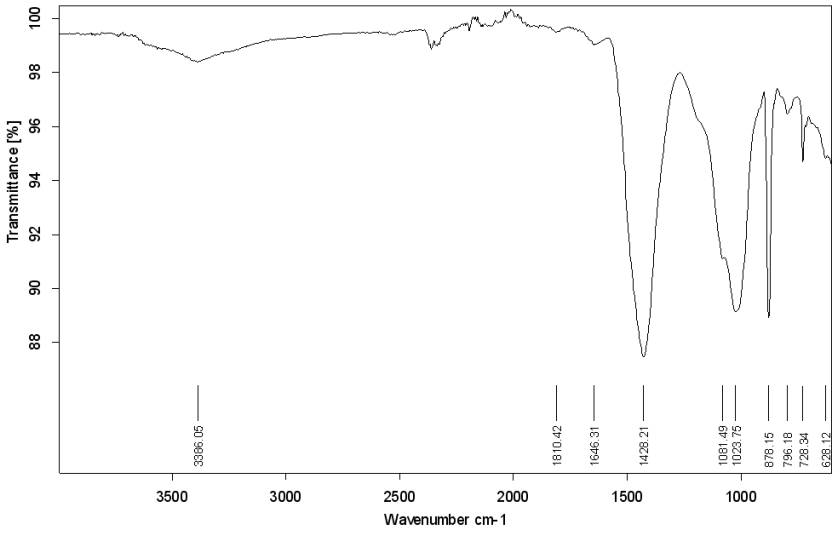
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\18918s8.0	red-orange	Instrument type and / or accessory
03/09/2013		

Page 1/1



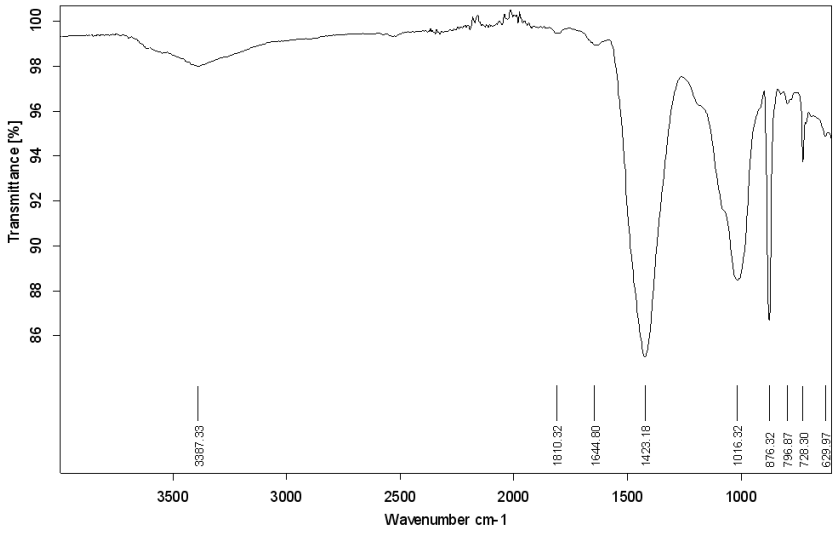
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\18918s9.0	red-orange	Instrument type and / or accessory
03/09/2013		

Page 1/1



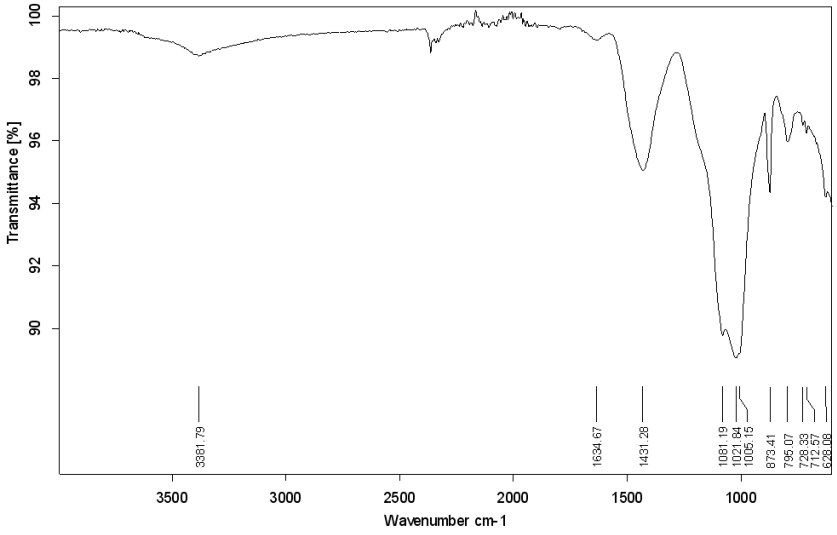
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\18918s10_2.0	red	Instrument type and / or accessory	03/09/2013

Page 1/1



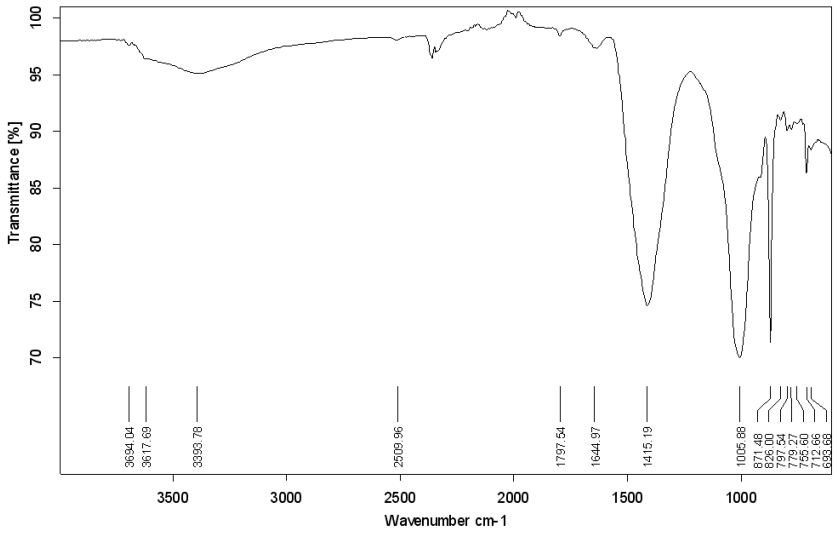
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\18918s11.0	red	Instrument type and / or accessory	03/09/2013

Page 1/1



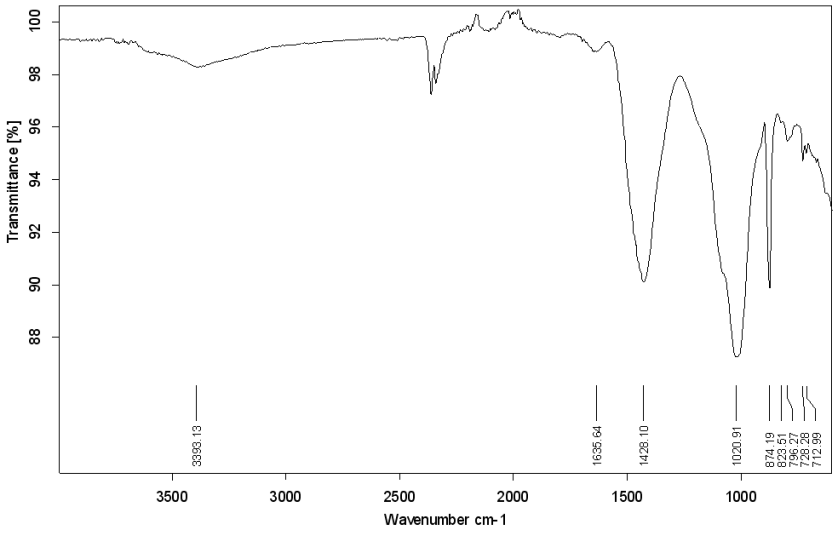
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\18918s12.0	red	Instrument type and / or accessory	03/09/2013

Page 1/1



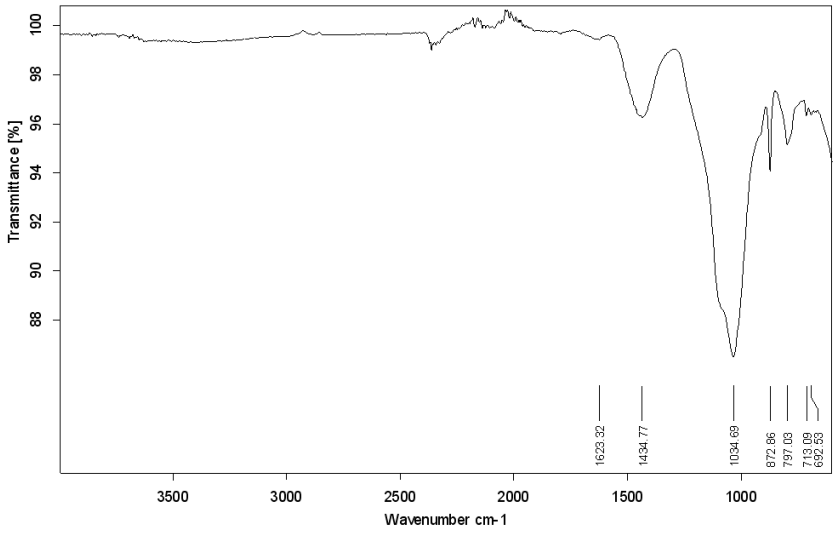
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\18918s13plaster.0	red-orange	Instrument type and / or accessory	03/09/2013

Page 1/1



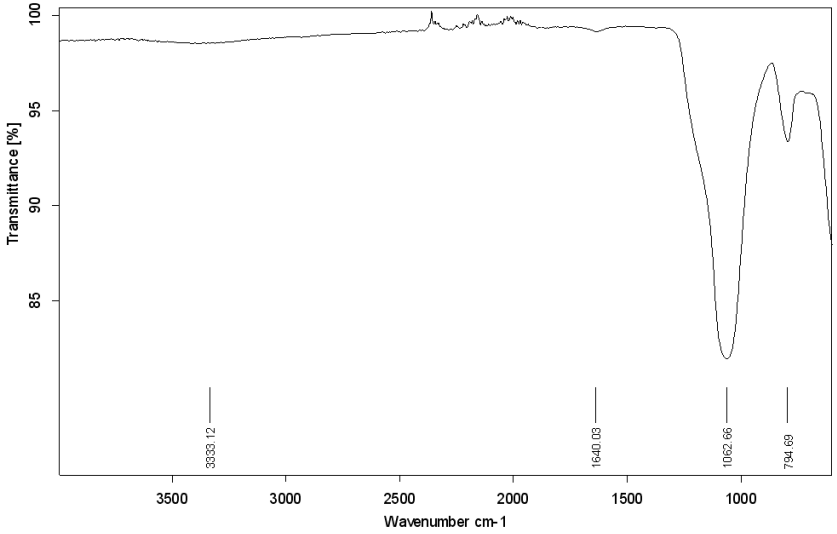
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\18918s14.0	red	Instrument type and / or accessory	03/09/2013

Page 1/1



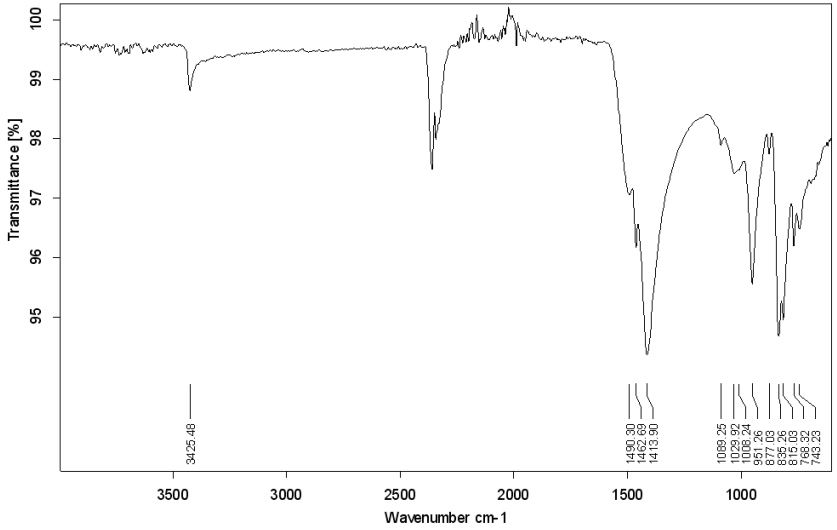
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\19223s8_2.0	red	Instrument type and / or accessory	03/09/2013

Page 1/1



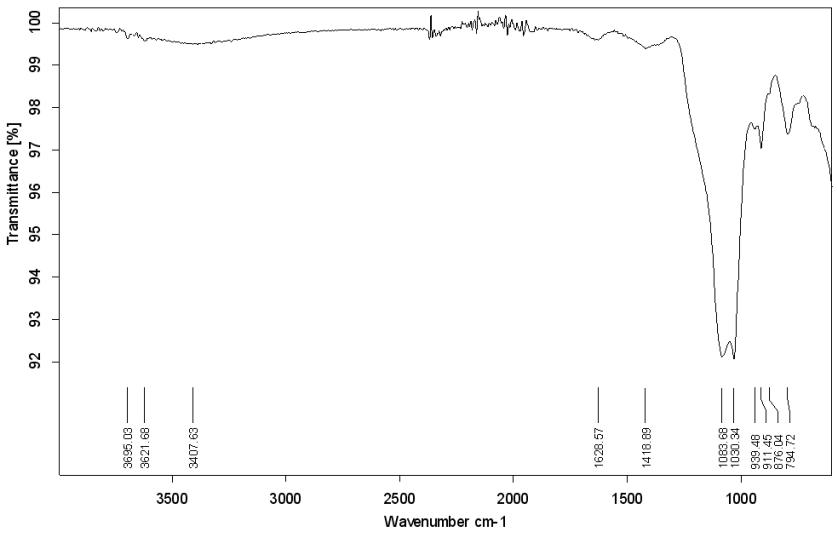
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\19306s1 PWD.0	red PWD	Instrument type and / or accessory	04/09/2013

Page 1/1



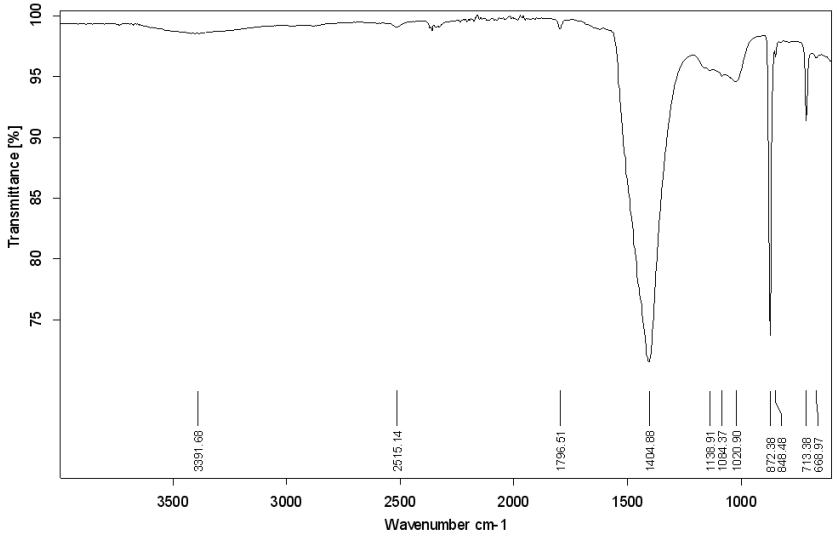
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\19447s14.0	blue	Instrument type and / or accessory	04/09/2013

Page 1/1



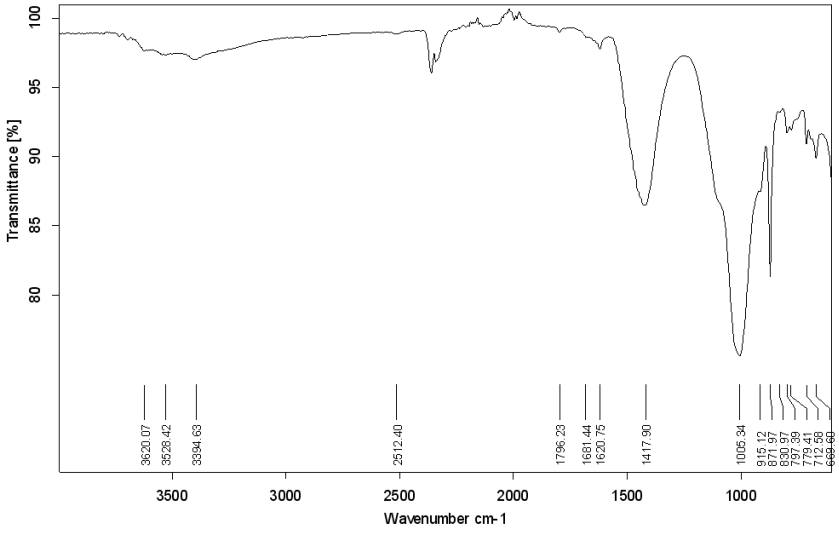
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\19457s1.PWD.0	red PWD	Instrument type and / or accessory	04/09/2013

Page 1/1



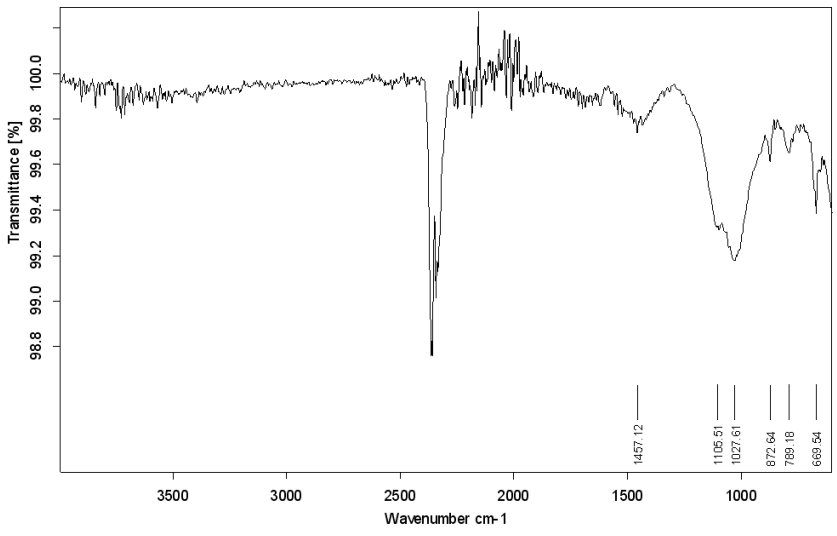
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\19457s1.PWD.1	white PWD	Instrument type and / or accessory	04/09/2013

Page 1/1



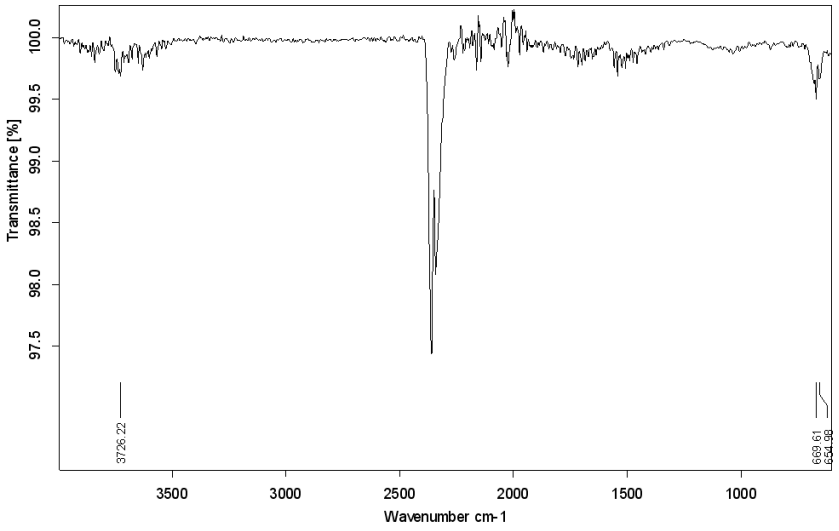
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\19700s5.0	Powdered surface including plaster layers, blackened red pigment and red pig		03/09/2013

Page 1/1



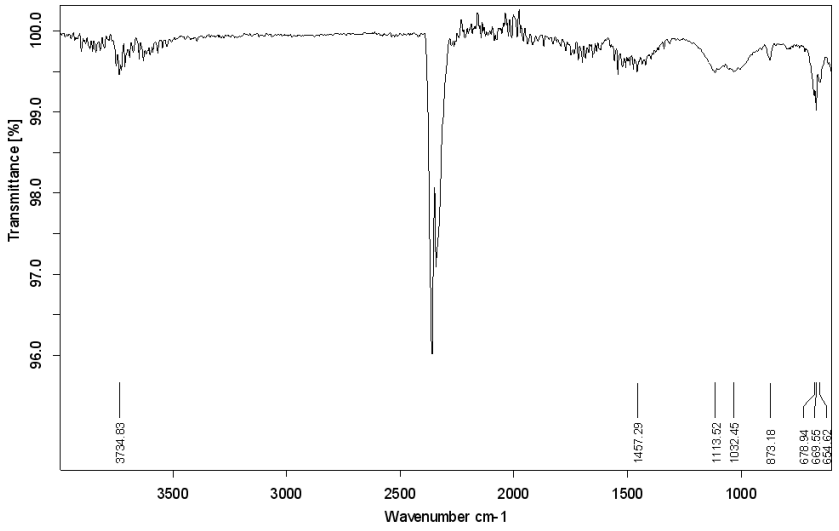
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\19700s6a.0	red	Instrument type and / or accessory	03/09/2013

Page 1/1



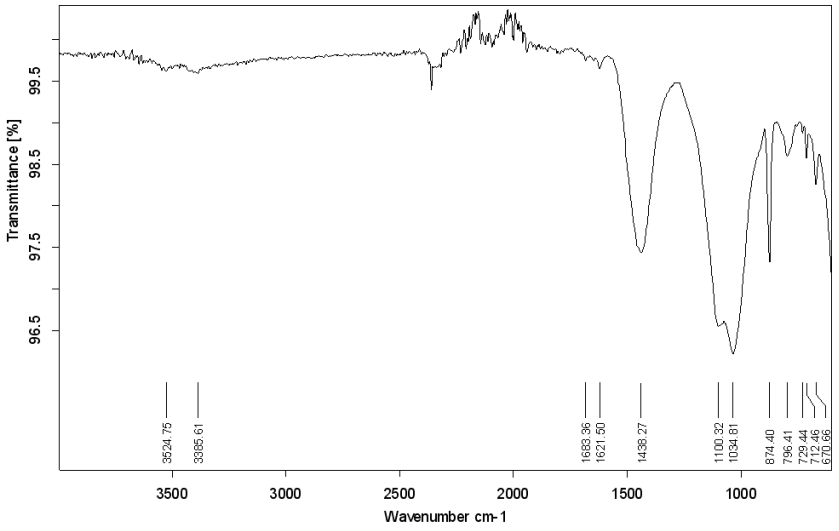
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\19700s6a_2.0	red	Instrument type and / or accessory	03/09/2013

Page 1/1



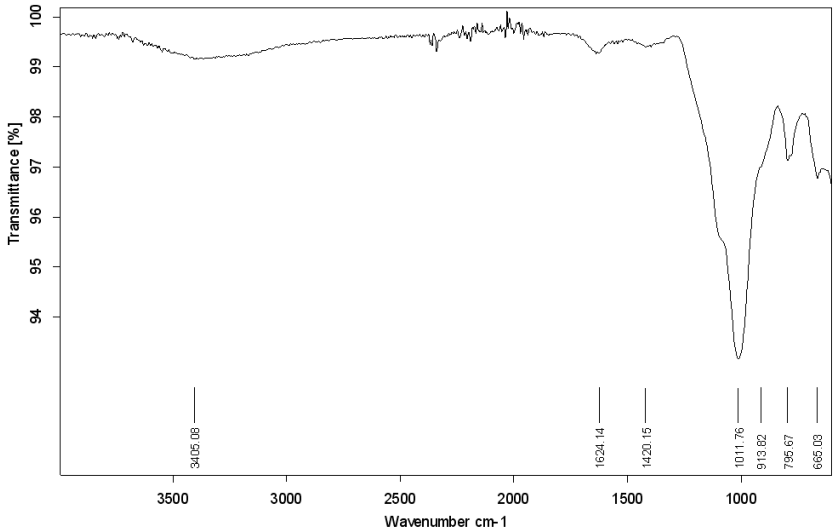
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\19700s6b.0	red	Instrument type and / or accessory	03/09/2013

Page 1/1



C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\19700s7.0	red	Instrument type and / or accessory	03/09/2013

Page 1/1

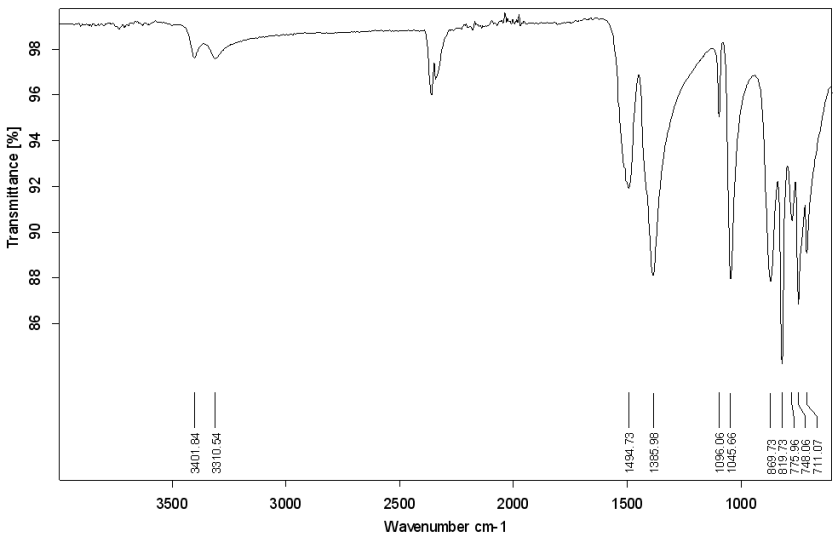


C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\19808s3 PWD.0	red PWD	Instrument type and / or accessory	04/09/2013

Page 1/1

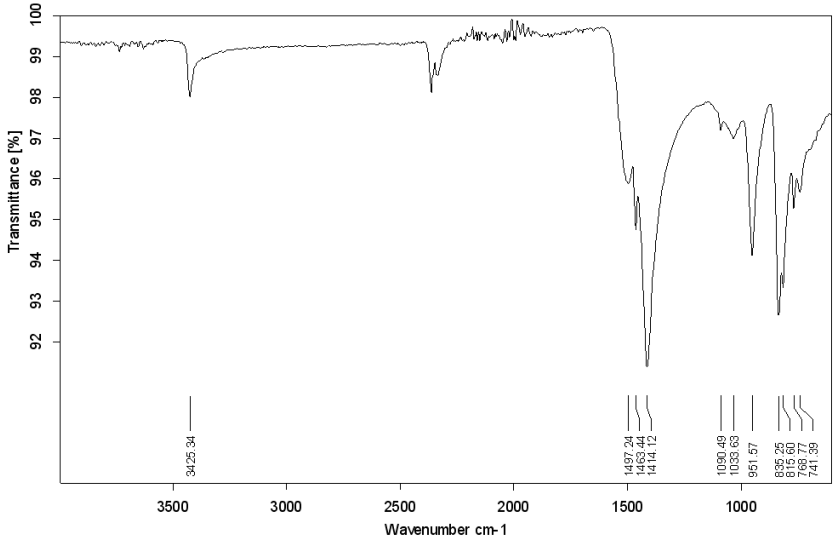
Reference Standard Pigments with Product/Batch Numbers:

- Azurite natural standard, 10200.12050.108 standard grind, 0 - 120 µ
- Azurite natural – Stone, 102005 in pieces
- Malachite natural, standard, 10300.12050.104 intense color, 0 - 120 µ
- Atacamite, 103900.12010.104, 0 - 120 µ
- Chrysocolla, 10350.12050.104, bluish green, copper silicate, 0 - 120 µ
- Natural Cinnabar Monte Amiata, 10610.12010.104 < 63 µ, mercuric sulphide
- Lapis Lazuli – Stone, 105005 medium quality, in pieces
- Lapis Lazuli powder, medium quality, 10510.12010.104 natural ultramarine
- Jarosite, from Cyprus, 17000.12100.136, genuine, pale yellow ochre
- Anhydrite Plaster, 58320.13010.140, dead-burnt gypsum
- Quartz Powder, coarse, 58620.13010.140 approx. 100 µ
- Calcite, 58720.13010.140 white, average particle size 20 µ
- Bone Ash, 58920.12100.136



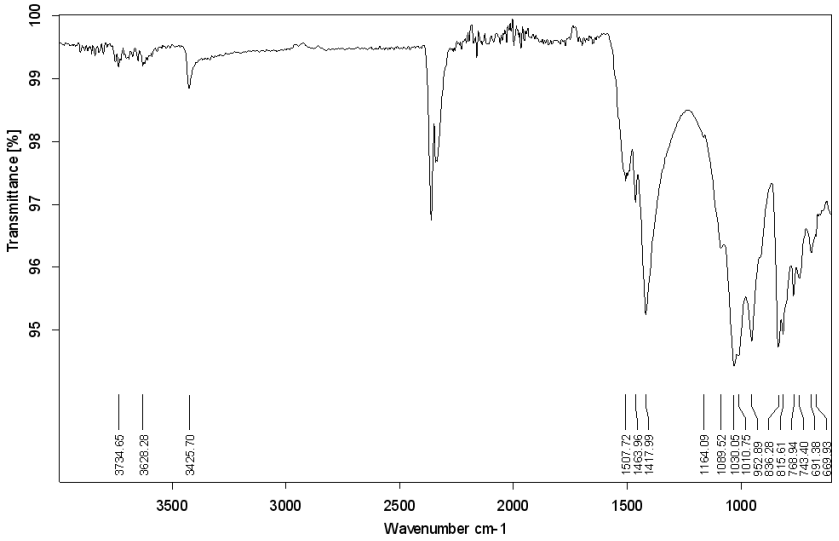
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\KremerPigmenteAtakamitePWD.0 green Instrument type and / or accessory 04/09/2013

Page 1/1



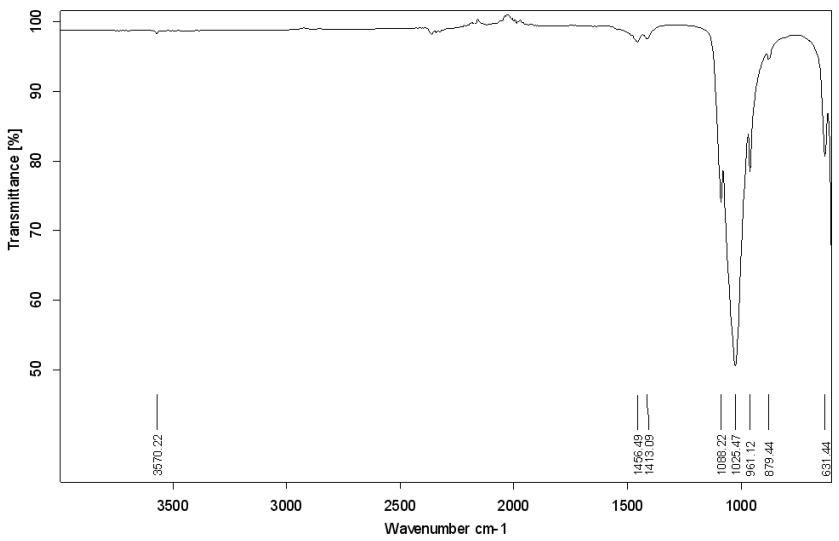
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\KremerPigmenteAzuritestonegroundPWD.0 blue Instrument type and / or accessor 04/09/2013

Page 1/1



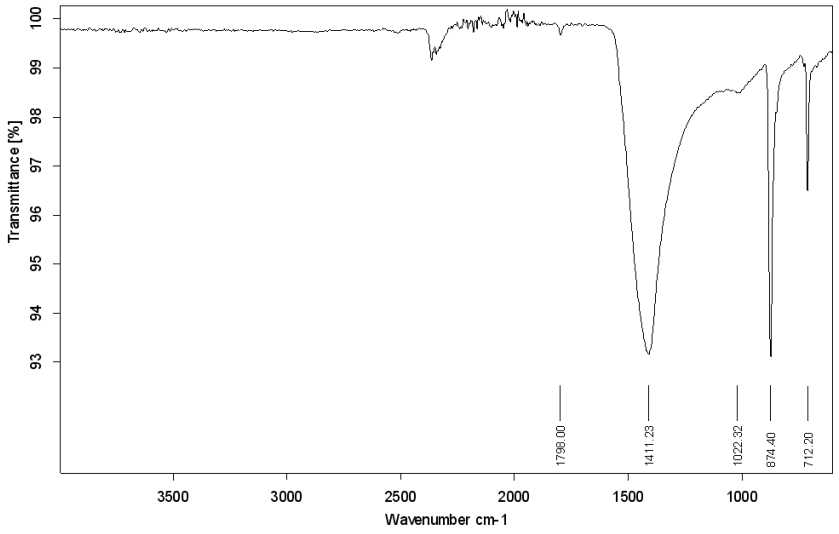
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\KremerPigmenteAzuritePWD.0 blue Instrument type and / or accessory 04/09/2013

Page 1/1



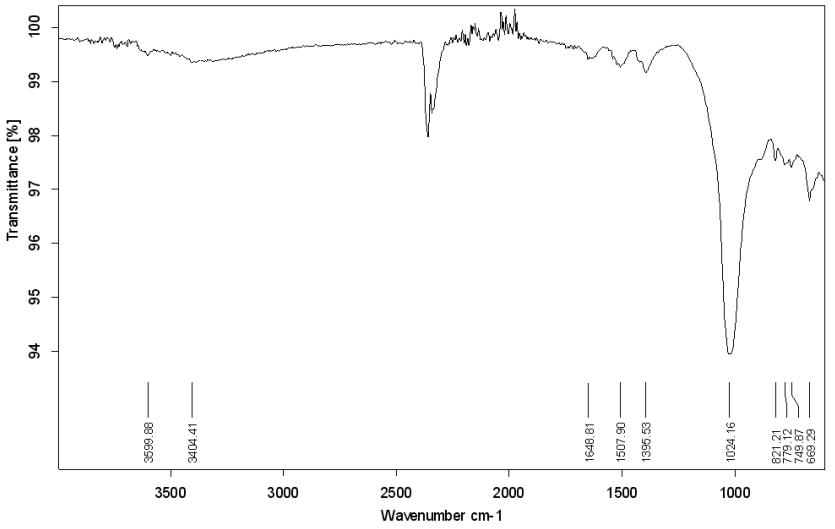
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\Kremer Pigmente Bone ash PWD.0 Kremer Pigmente Bone Ash PWD Instrument 05/09/2013

Page 1/1



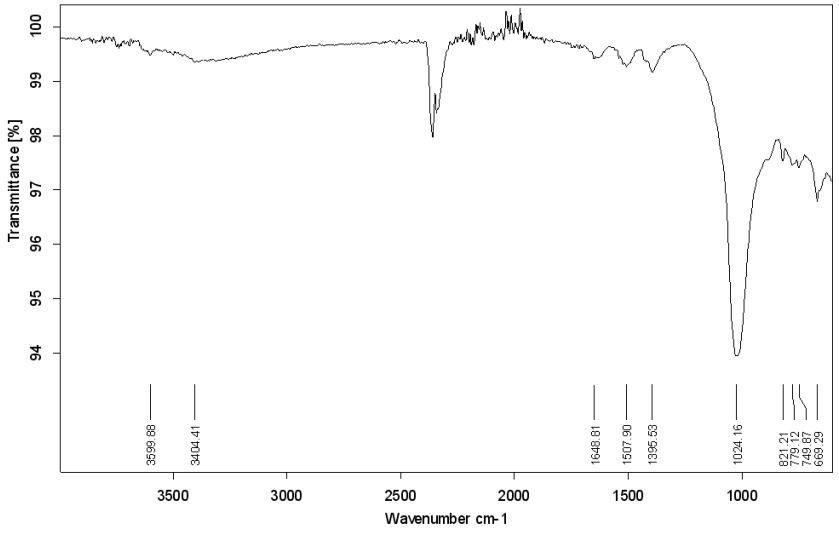
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\Kremer Pigmente Calcite PWD.0	Kremer Pigmente Calcite PWD	Instrument type a	05/09/2013

Page 1/1



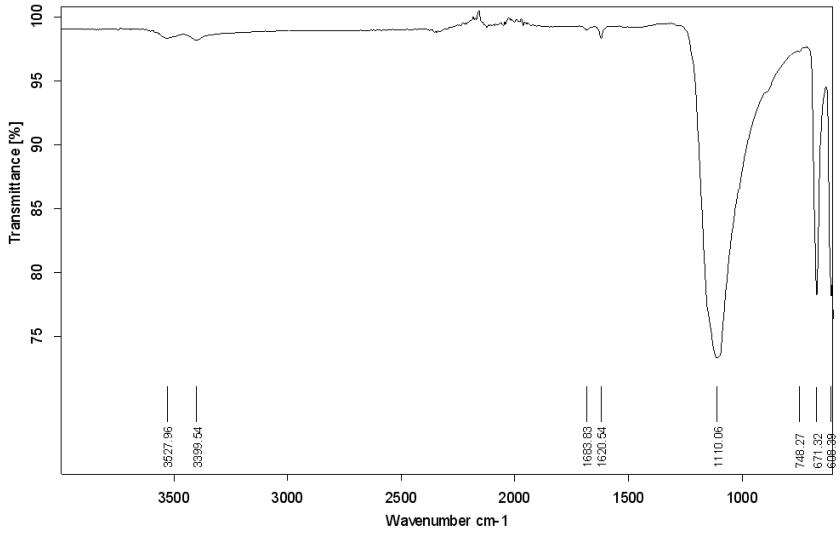
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\KremerPigmenteChrysocollaPWD.1	green	Instrument type and / or accessory	04/09/2013

Page 1/1



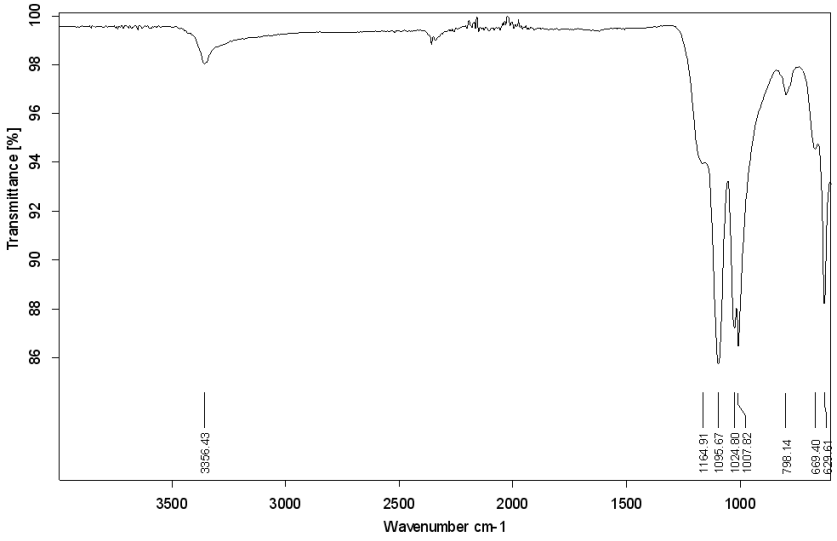
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\KremerPigmenteChrysocollaPWD.1	green	Instrument type and / or accessory	04/09/2013

Page 1/1



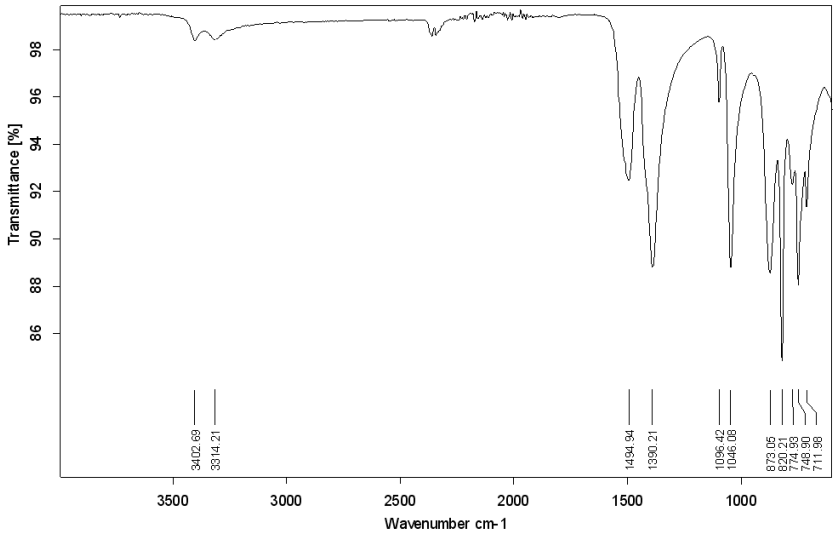
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\Kremer Pigmente Gypsum PWD.0	Kremer Pigmente Gypsum PWD	Instrument typ	05/09/2013

Page 1/1



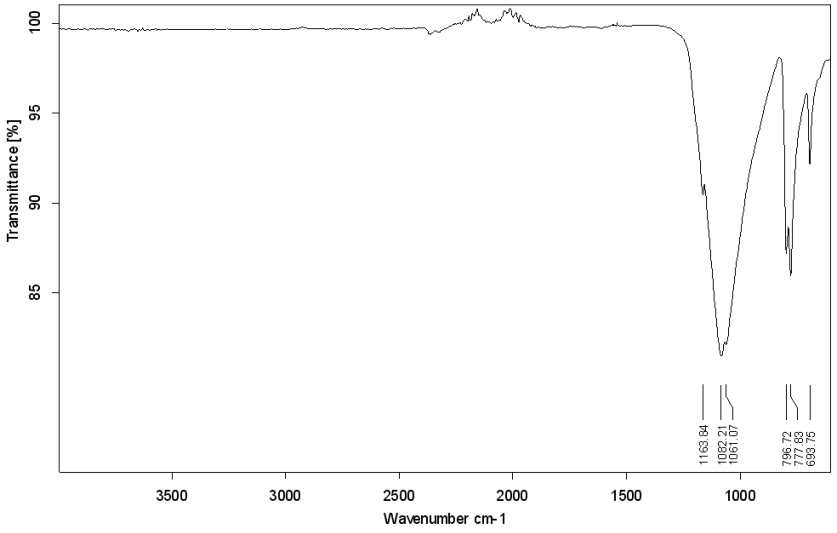
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\Kremer Pigmente Jarosite PWD.0	Kremer Pigmente Jarosite PWD	Instrument type	05/09/2013

Page 1/1



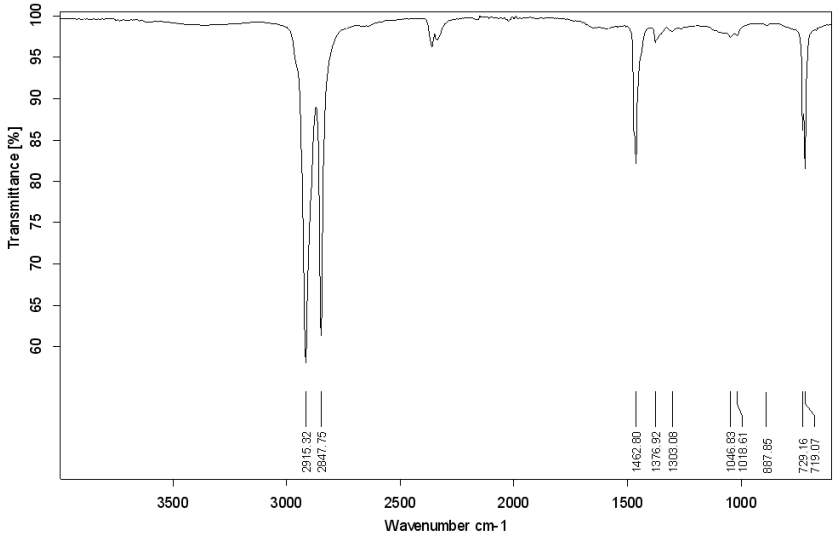
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\KremerPigmenteMalachitePWD.0	green	Instrument type and / or accessory	04/09/2013

Page 1/1



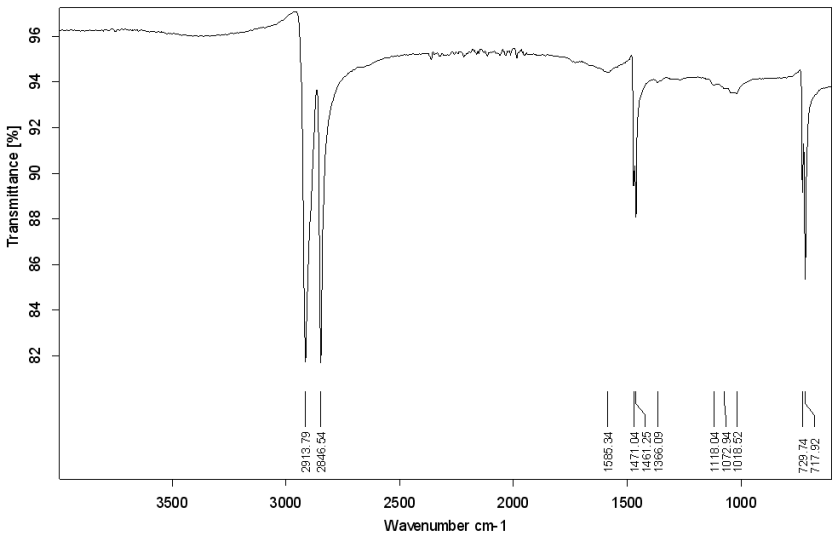
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\Kremer Pigmente Quartz PWD.0	Kremer Pigmente Quartz PWD	Instrument type a	05/09/2013

Page 1/1



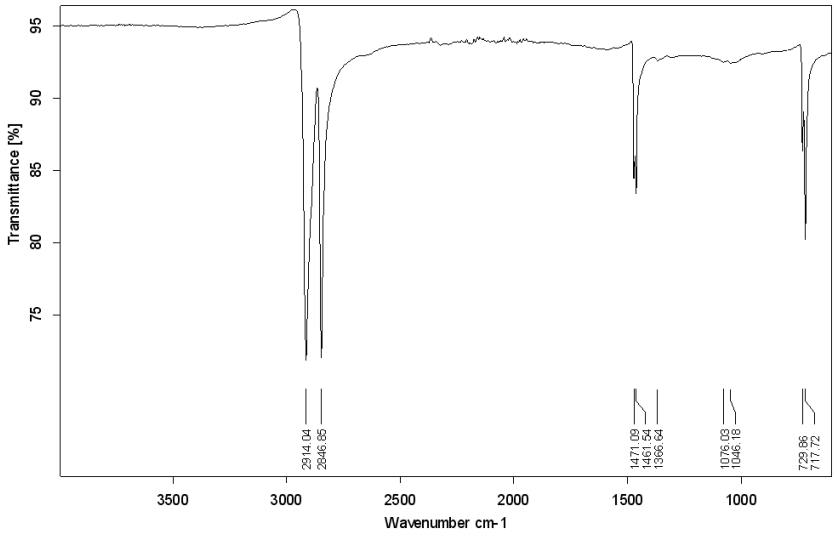
C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\Sample bag 1.0	Sample bag 1 with red line above seal	Instrument type and / or acc	05/09/2013

Page 1/1



C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\Tyvek label.0	Tyvek label used on excavation	Instrument type and / or accessory	05/09/2013

Page 1/1



C:\Program Files\OPUS_65\MEAS\Ina\FT-IR bitmap\Tyvek label with Sharpie ink.0	Tyvek label with sharpie ink used on excavation	Inst	05/09/2013

Page 1/1

X-Ray Fluorescence Results

ALL RESULTS BELOW STANDARDISED TO THE VALUE OF Fe, (VALUE OF ELEMENT X DIVIDED BY VALUE OF Fe MULTIPLIED BY 100; PLACE $ BEFORE Fe VALUE)

	As K12	As L1	Br K12	Br L1	Ca K12	Cl K12	Cu K12	Fe K12	Hg L1	Hg M1	K K12	Mn K12	Ni K12	P K12	Pb L1	Pb M1	Rb K12	Rb L1	S K12	Si K12	Sr K12	Ti K12	Zn K12
3290_S1_1@130214_055405	12.622	0.000	0.187	0.002	65.212	0.002	0.048	100.000	0.169	0.003	0.546	0.833	-0.010	0.010	0.799	0.000	0.298	0.000	0.049	0.002	0.450	0.065	0.150
3290_S1_2@130214_055405	13.578	0.000	0.432	0.002	98.161	0.020	0.035	100.000	0.158	0.027	0.391	1.068	0.018	0.221	0.575	0.008	0.276	0.002	0.014	0.002	0.745	0.002	0.082
4407_S4_1@130214_055405	18.491	0.037	0.441	0.012	7.594	0.001	0.054	100.000	0.054	-0.009	0.780	0.569	0.156	-0.001	1.910	-0.001	0.962	0.000	0.001	0.009	3.081	0.780	2.144
4407_S4_2@130214_055405	3.167	0.021	0.510	0.021	8.977	0.001	0.121	100.000	-0.008	-0.013	1.155	0.579	0.313	0.001	0.581	0.000	2.646	0.023	0.003	0.001	6.301	1.100	0.940
4407_S4_3@130214_055405	6.286	0.003	0.055	0.010	4.059	0.000	0.056	100.000	0.023	0.000	0.966	0.323	0.140	0.000	0.378	0.000	0.589	0.005	0.000	0.001	1.586	0.851	1.366
4407_S4_4@130214_055405	10.731	0.008	0.110	0.004	1.426	0.001	0.061	100.000	-0.012	0.000	0.223	0.286	0.072	0.001	0.553	0.000	0.839	0.001	0.001	0.001	2.930	0.258	1.478

	As K12	As L1	Br K12	Br L1	Ca K12	Cl K12	Cu K12	Fe K12	Hg L1	Hg M1	K K12	Mn K12	Ni K12	P K12	Pb L1	Pb M1	Rb K12	Rb L1	S K12	Si K12	Sn K12	Sr K12	Y K12	Zr K12
4464_S13_1@130214_060843	8.207	0.027	0.261	0.038	9.835	0.001	0.097	100.000	-0.004	0.014	1.401	1.234	0.264	0.003	0.450	0.000	1.260	0.005	0.196	0.015	0.055	5.228	0.339	1.131
4464_S13_2@130214_060843	7.086	0.028	0.356	0.025	41.686	0.039	0.088	100.000	0.085	0.015	0.603	1.558	0.159	0.033	0.370	0.008	0.891	0.000	1.016	0.001	0.084	5.923	-0.042	1.321

	As K12	As L1	Br K12	Br L1	Ca K12	Cl K12	Cu K12	Fe K12	Hg L1	Hg M1	K K12	Mn K12	Ni K12	P K12	Pb L1	Pb M1	Rb K12	Rb L1	S K12	Si K12	Sr K12	Ti K12	Zn K12
4620_S4_1@130214_055405	11.309	0.004	0.768	0.061	9.904	0.001	0.127	100.000	0.115	-0.003	1.124	0.436	0.227	0.013	1.023	0.000	1.619	0.001	0.022	0.040	11.016	0.671	1.166
4620_S4_2@130214_055405	46.008	0.089	2.549	0.068	3.950	0.003	0.150	100.000	0.198	-0.024	0.436	0.276	0.181	0.082	1.776	0.000	3.783	0.037	0.003	0.003	17.190	0.204	1.905
4671_1@130214_055405, fresh break e	0.082	0.000	0.000	0.000	36.285	0.000	0.011	100.000	0.054	-0.001	0.149	3.954	0.014	0.000	0.176	0.000	0.071	0.000	0.001	0.002	0.995	0.012	0.088
4671_2@130214_055405, same as site 3	0.127	0.000	0.008	0.000	37.987	0.000	0.004	100.000	0.025	-0.002	0.181	3.952	0.017	0.000	0.096	0.000	0.040	0.000	0.010	0.001	1.018	0.000	0.069
4947_S5_1@130214_055405	18.203	0.031	0.590	-0.001	14.549	0.001	0.088	100.000	0.036	-0.020	0.752	0.312	0.090	0.002	0.314	0.000	0.189	0.007	0.020	0.001	1.073	0.235	0.192
4947_S5_2@130214_055405	13.647	0.020	0.247	0.009	10.141	0.001	0.031	100.000	0.083	-0.001	0.350	0.206	0.043	0.044	0.306	0.000	0.092	0.001	0.001	0.001	0.435	0.720	0.083
4947_S5_3@130214_055405	13.792	0.002	0.052	0.000	6.309	0.000	0.048	100.000	0.051	0.000	0.142	0.232	0.032	0.000	0.081	0.000	0.038	0.000	0.000	0.000	0.164	0.079	0.101
5153_S6_1@130214_055405	1.232	0.441	21.004	0.423	499.356	0.184	1.398	100.000	5.683	0.460	3.347	1.490	7.798	1.030	9.877	0.055	7.854	0.018	0.405	0.018	158.874	0.441	19.441
5153_S6_2@130214_055405	3.721	0.569	26.632	0.304	651.177	0.285	2.620	100.000	4.081	0.550	3.588	1.234	10.099	1.557	8.428	0.057	14.389	0.019	0.057	0.076	228.132	1.272	26.405
5214_1@130214_055405	18.833	0.000	0.000	0.000	11.223	0.000	0.032	100.000	0.096	0.000	0.218	0.268	0.018	0.000	0.066	0.000	0.042	0.000	0.000	0.010	0.129	0.104	0.140
5214_2@130214_055405	8.078	0.000	0.000	0.000	0.538	0.000	0.018	100.000	0.042	0.000	0.000	0.199	0.008	0.000	0.144	0.000	0.055	0.000	0.000	0.000	0.062	0.039	0.065
5228_1@130214_055405, fresh break e	9.155	0.006	0.084	0.022	3.202	0.000	0.098	100.000	0.032	0.000	0.270	0.337	0.150	0.000	0.217	0.000	1.633	0.009	0.000	0.108	0.949	0.399	0.211
5228_2@130214_055405, fresh break e	10.266	0.029	0.169	0.020	8.522	0.005	0.163	100.000	0.060	0.016	0.453	0.477	0.181	0.001	0.556	0.001	5.814	0.040	0.001	0.289	1.878	0.600	0.332
5228_3@130214_055405, fresh break e	6.557	0.000	0.000	0.000	0.624	0.000	0.112	100.000	0.011	0.000	0.311	0.441	0.152	0.000	0.157	0.000	0.243	0.000	0.000	0.008	0.468	0.539	0.208
5228_S3_1@130214_055405	5.921	0.000	0.111	0.000	0.645	0.000	0.117	100.000	0.019	0.000	0.294	0.350	0.181	0.000	0.242	0.000	0.608	0.000	0.000	0.000	0.620	0.527	0.252
6250_1@130214_055405	0.065	0.784	6.405	0.392	243.529	0.915	4.575	100.000	2.418	0.719	5.098	5.817	1.830	0.065	23.137	0.784	187.190	0.719	0.065	10.065	77.516	1.438	1.307
6250_2@130214_055405	0.017	0.000	14.457	0.283	252.238	0.333	2.412	100.000	-0.433	0.349	5.107	6.555	1.298	0.017	17.568	0.067	190.517	0.017	0.017	10.015	73.632	2.662	4.176
6250_3@130214_055405	0.003	0.013	2.571	0.096	7.057	0.430	1.044	100.000	0.188	0.036	5.384	1.712	0.446	0.056	3.808	0.010	4.988	0.102	0.281	0.426	6.211	0.407	1.947
6250_4@130214_055405	0.015	0.239	2.140	0.045	90.301	0.689	1.916	100.000	1.392	0.359	3.667	2.230	0.494	0.554	6.646	0.135	69.166	0.015	0.389	3.577	20.506	1.991	1.557
19223_S8_1@130214_055405	0.102	0.014	0.145	0.019	29.390	0.058	0.162	100.000	0.022	0.040	1.756	0.651	0.124	0.012	0.252	0.001	1.013	0.000	0.001	0.041	7.102	0.772	0.330
19223_S8_2@130214_055405	0.001	0.011	0.115	-0.002	2.460	0.001	0.060	100.000	0.059	-0.004	0.161	0.215	0.026	0.002	0.287	0.000	0.562	0.006	-0.001	0.004	6.538	0.086	0.150
12867_1@130214_055405	0.312	0.007	0.281	0.005	0.126	0.001	0.070	100.000	0.019	0.000	0.207	0.179	0.008	-0.001	0.452	0.000	0.168	0.001	0.001	0.197	1.944	0.841	0.043
12867_2@130214_055405	0.317	0.006	0.336	0.002	0.122	0.000	0.040	100.000	0.006	0.000	0.186	0.175	0.001	0.000	0.391	0.000	0.122	0.000	0.000	0.169	1.972	0.805	0.034
13365_1@130214_055405	0.640	0.256	1.664	0.448	241.184	1.504	0.960	100.000	1.344	0.736	3.072	3.360	0.992	0.032	4.448	0.544	72.704	0.640	8.896	1.824	41.824	0.448	1.728
13365_2@130214_055405	0.004	0.000	1.290	0.057	239.175	0.464	0.781	100.000	0.224	0.212	3.775	2.136	0.334	0.004	1.908	0.037	70.804	0.004	9.007	2.726	35.213	1.066	1.550
14009_S9_1@130214_055405	0.000	0.000	0.000	0.000	2.964	0.000	0.008	100.000	0.060	0.000	0.764	0.130	0.001	0.000	0.112	0.000	0.120	0.000	0.128	0.000	0.400	0.000	0.007
14009_S1_2@130214_055405	0.001	0.000	0.148	0.018	11.518	0.001	0.047	100.000	0.051	0.007	0.596	0.170	0.005	0.001	0.185	0.000	0.049	0.001	0.452	0.001	0.952	0.002	0.000

	As K12	As L1	Br K12	Br L1	Ca K12	Cl K12	Cu K12	Fe K12	Hg L1	Hg M1	K K12	Mn K12	Ni K12	P K12	Pb L1	Pb M1	Rb K12	Rb L1	S K12	Si K12	Sr K12	Ti K12	Zn K12
17048_1@130214_060424	0.001	0.023	0.227	0.017	0.741	0.000	0.033	100.000	0.125	-0.006	1.561	0.333	0.026	0.001	0.410	-0.067	0.459	0.029	0.001	0.290	1.976	1.994	0.159
17048_2@130214_060424	0.001	0.023	0.166	0.011	0.717	0.023	0.065	100.000	0.090	0.001	1.104	0.349	0.032	0.004	0.273	0.000	0.238	0.019	0.001	0.184	1.773	0.673	0.154
17048_3@130214_060424	0.004	0.057	0.370	0.021	11.698	0.044	0.050	100.000	0.050	0.013	1.562	0.477	0.104	0.057	0.352	0.000	2.805	0.001	0.001	0.690	3.802	1.946	0.098
17339_S12_1@130214_060424	0.324	-0.001	0.008	0.006	0.117	0.001	0.008	100.000	0.037	0.001	0.286	0.133	0.001	0.001	0.305	0.000	0.113	0.001	0.001	0.004	1.704	0.616	0.073
17339_S12_2@130214_060424	0.187	0.001	0.065	0.002	0.112	0.001	0.006	100.000	0.047	-0.010	0.308	0.198	-0.003	0.001	0.334	0.000	0.087	0.001	0.001	0.000	1.262	0.874	0.042
18488_S3_1@130214_060424	0.119	0.006	0.023	0.000	0.141	0.000	0.015	100.000	0.080	0.001	0.013	0.546	0.028	0.000	0.217	0.000	0.105	0.000	0.000	0.017	0.353	0.538	0.055
18488_S3_2@130214_060424	0.088	0.013	0.064	0.000	0.379	0.000	0.001	100.000	0.037	0.000	0.117	0.464	0.005	0.000	0.188	0.000	0.112	0.000	0.000	0.000	0.424	1.942	0.099
18536_1@130214_060424	0.241	0.132	1.004	0.071	15.462	0.422	0.252	100.000	0.088	0.132	1.679	1.246	0.302	0.055	0.532	0.000	14.052	0.121	0.104	0.735	4.357	0.636	0.587
18536_2@130214_060424	0.002	0.023	0.617	0.061	8.882	0.284	0.079	100.000	0.188	-0.018	3.169	1.345	0.184	0.002	0.451	0.017	0.572	0.003	0.014	1.187	1.665	1.116	0.172
18536_3@130214_060424	0.000	0.014	0.747	0.031	8.856	0.320	0.057	100.000	0.179	0.006	3.168	1.272	0.140	0.010	0.538	0.004	0.483	0.000	0.003	1.192	1.578	1.116	0.223
18544_1@130214_060424	0.000	0.090	2.476	0.021	27.433	0.424	0.193	100.000	0.193	0.049	2.624	0.461	0.058	0.004	0.588	0.037	13.834	0.498	0.049	1.345	6.312	0.481	0.456
18544_2@130214_060424	0.141	0.039	1.162	0.058	0.806	0.178	0.082	100.000	0.043	-0.013	0.878	0.077	0.024	0.011	0.258	0.000	0.255	0.037	0.002	0.353	2.169	0.677	0.061
18918_S5_1@130214_060424	0.024	0.058	0.975	0.018	58.354	0.161	0.163	100.000	0.063	0.045	3.328	1.088	0.290	0.003	0.867	0.000	1.987	0.000	0.003	-0.005	28.248	0.754	0.638
18918_S5_2@130214_060424	0.004	0.004	1.175	0.069	136.456	0.608	0.314	100.000	0.535	0.053	5.473	1.371	0.306	0.004	1.069	0.012	1.743	0.004	0.004	0.004	41.725	1.171	0.539
18918_S5_3@130214_060424	0.003	0.000	0.964	0.003	97.484	0.335	0.162	100.000	0.239	0.048	3.654	1.421	0.297	0.003	0.906	-0.003	1.493	0.003	0.003	0.007	29.495	0.760	0.560
18918_S5_Bag@130214_060424	0.043	0.000	0.723	0.000	115.787	0.383	1.745	100.000	1.191	0.043	5.277	2.000	0.766	0.043	2.723	0.128	2.596	0.043	0.043	0.170	5.277	1.106	1.319
18918_S6_1@130214_060424	0.003	0.003	1.098	0.003	103.784	0.253	0.135	100.000	0.220	0.020	3.561	1.756	0.360	0.003	0.780	0.000	2.301	-0.035	0.115	0.013	25.808	0.825	0.518
18918_S6_2@130214_060424	0.415	0.010	0.880	0.003	106.102	0.242	0.105	100.000	0.111	0.043	3.797	1.324	0.141	0.003	1.020	0.000	2.426	0.003	0.150	0.003	45.746	0.569	0.468
18918_S6_3@130214_060424	0.004	0.090	1.461	0.004	83.472	0.219	0.251	100.000	0.239	0.039	4.358	1.527	0.337	0.004	1.034	0.000	1.966	0.004	0.004	0.004	41.131	1.034	0.783
18918_S6_Bag@130214_060424	0.094	0.566	0.189	0.189	118.019	0.094	2.075	100.000	11.509	0.566	7.925	1.698	1.226	0.283	14.340	0.189	5.943	0.377	0.094	0.472	7.358	1.226	2.075
18918_S7_1@130214_060424	0.110	0.023	1.582	0.039	71.261	0.360	0.146	100.000	0.309	0.023	3.085	1.039	0.224	0.003	1.039	0.000	1.751	0.010	0.052	0.003	41.558	0.971	0.490
18918_S7_2@130214_060424	0.007	0.038	0.856	0.018	60.954	0.213	0.222	100.000	-0.022	0.031	2.571	0.876	0.211	0.002	0.777	0.000	1.529	0.013	0.027	0.002	23.687	0.817	0.460
18918_S7_3@130214_060424	0.000	0.038	2.321	-0.014	145.310	0.559	0.218	100.000	0.052	0.118	4.292	1.568	0.441	0.005	1.398	0.005	2.696	0.000	0.028	0.005	62.327	0.810	0.673
18918_S7_Bag@130214_060424	0.047	0.000	0.047	0.426	26.941	0.663	0.663	100.000	4.356	0.284	2.509	0.568	0.331	0.095	5.066	0.000	5.824	0.095	0.047	0.047	0.616	8.097	1.752
18918_S8_1@130214_060424	0.005	0.005	0.934	0.000	129.354	0.506	0.111	100.000	0.448	-0.029	5.576	1.777	0.323	0.226	1.026	0.005	1.526	0.005	0.067	0.005	26.687	1.464	0.660
18918_S8_2@130214_060424	0.097	0.058	0.991	0.051	87.472	0.326	0.210	100.000	-0.031	0.019	3.089	1.442	0.315	0.120	0.804	0.031	1.850	0.008	0.004	0.004	29.163	0.579	0.462
18918_S8_3@130214_060424	0.066	-0.022	0.798	0.013	57.447	0.184	0.075	100.000	0.048	0.011	2.397	1.578	0.175	0.011	0.526	0.000	0.852	0.002	0.002	0.002	17.441	0.877	0.342
18918_S8_Bag@130214_060424	3.125	1.042	33.854	0.521	165.104	-1.042	1.563	100.000	3.125	4.167	4.167	3.646	6.250	0.521	43.229	0.521	0.521	1.042	0.521	0.521	53.646	0.521	21.875
18918_S9_1@130214_060424	0.194	0.032	0.345	0.023	62.831	0.274	0.113	100.000	0.068	-0.003	3.222	0.742	0.119	0.003	0.713	0.019	0.439	0.013	0.003	0.039	8.485	0.977	0.313
18918_S9_2@130214_060424	0.223	0.000	0.823	0.005	117.372	0.411	0.179	100.000	0.082	0.024	4.487	1.113	0.300	0.005	1.021	0.058	0.799	0.005	0.044	0.005	18.098	1.486	0.363
18918_S9_3@130214_060424	0.381	0.040	1.398	0.010	132.273	0.356	0.135	100.000	0.396	0.050	3.502	0.857	0.195	0.005	1.558	0.000	2.315	-0.005	0.210	0.060	45.564	0.787	0.536
18918_S9_Bag@130214_060424	0.111	0.557	4.905	0.557	36.455	0.557	2.007	100.000	5.128	0.669	3.122	0.111	1.338	0.557	9.030	0.111	7.915	0.111	0.111	0.111	11.483	0.892	1.003
18918_S10_1@130214_060424	0.098	0.040	1.146	0.087	47.243	0.218	0.182	100.000	0.036	0.058	2.627	1.132	0.448	0.004	0.757	0.007	3.741	0.018	0.015	0.018	37.913	0.808	1.103
18918_S10_2@130214_060424	0.003	0.108	0.603	0.072	112.591	0.200	0.154	100.000	0.105	0.033	3.919	1.605	0.262	0.023	0.724	0.016	2.736	0.003	0.092	0.003	30.382	1.003	0.934
18918_S11_1@130214_060424	0.003	0.038	1.475	0.008	72.486	0.204	0.110	100.000	0.102	0.030	2.225	1.024	0.290	0.003	0.744	0.000	1.913	0.030	0.075	0.003	26.587	0.844	0.594
18918_S11_2@130214_060424	0.096	0.009	1.428	0.009	76.864	0.200	0.003	100.000	0.035	0.075	2.181	0.669	0.136	0.020	0.776	0.000	2.100	0.003	0.087	0.055	38.813	0.849	0.478
18918_S12_1@130214_060424	0.246	0.086	0.607	0.027	40.852	0.152	0.163	100.000	0.129	0.031	2.679	1.084	0.169	0.042	0.740	0.000	1.651	0.006	0.002	0.033	17.952	1.095	0.423
18918_S12_2@130214_060424	0.146	0.027	0.587	0.033	23.857	0.045	0.166	100.000	0.022	0.006	1.986	0.678	0.116	0.052	0.346	0.012	1.053	0.027	0.001	0.022	17.608	0.912	0.302
18918_S12_3@130214_060424	0.002	0.050	0.554	0.054	39.495	0.074	0.132	100.000	0.177	0.024	2.518	0.909	0.182	0.002	0.599	0.022	1.653	0.003	0.002	0.038	19.768	0.992	0.374
18918_S13_1@130214_060424	0.205	0.023	0.778	0.049	39.021	0.145	0.047	100.000	0.000	0.018	1.768	0.412	0.058	0.001	0.433	0.014	1.076	0.001	0.098	0.001	23.096	0.759	0.298
18918_S13_2@130214_060424	0.356	0.029	0.488	0.014	11.932	0.041	0.014	100.000	0.025	0.015	1.372	0.297	0.026	0.001	0.360	0.006	0.699	0.000	0.057	0.028	17.078	0.818	0.141
18918_S13_3@130214_060424	0.282	0.010	0.690	0.008	20.615	0.080	0.044	100.000	-0.019	0.006	1.529	0.352	0.066	0.000	0.353	0.000	0.800	0.000	0.117	0.016	19.819	0.966	0.200
18918_S14_1@130214_060424	0.289	0.030	1.292	0.046	45.853	0.175	0.162	100.000	0.025	0.046	2.081	0.945	0.155	0.003	0.545	0.003	1.728	0.023	0.079	0.033	30.705	0.770	0.345
18918_S14_2@130214_060424	0.227	0.124	1.207	0.046	46.335	0.111	0.111	100.000	0.028	0.046	1.984	0.477	0.093	0.003	0.655	0.013	1.434	0.003	0.049	0.003	30.582	0.699	0.441
19306_1@130214_060424	0.664	0.025	0.176	0.001	8.262	0.030	0.012	100.000	0.062	-0.004	0.606	0.218	0.033	0.074	0.592	0.003	5.758	0.001	0.022	0.311	2.554	0.599	0.138
19306_2@130214_060424	0.391	0.019	0.009	0.023	5.341	0.000	0.014	100.000	0.100	-0.002	0.423	0.224	0.012	0.001	0.341	0.000	3.479	0.008	0.021	0.202	1.495	0.543	0.068
19306_3@130214_060424	0.155	0.046	0.002	0.048	11.733	0.054	0.075	100.000	0.203	0.002	0.288	0.488	0.064	0.039	0.776	0.000	7.797	0.002	0.002	0.433	2.531	0.408	0.172
19457_1@130214_060424	0.001	0.017	0.553	0.017	0.455	0.100	0.055	100.000	0.065	-0.005	0.502	1.364	0.026	0.000	0.618	0.000	0.244	0.001	0.001	0.301	1.926	0.001	0.177
19457_1@130214_060424	0.001	0.017	0.553	0.017	0.455	0.100	0.055	100.000	0.065	-0.005	0.502	1.364	0.026	0.000	0.618	0.000	0.244	0.001	0.001	0.301	1.926	0.001	0.177
19457_1@130214_060424	0.001	0.017	0.553	0.017	0.455	0.100	0.055	100.000	0.065	-0.005	0.502	1.364	0.026	0.000	0.618	0.000	0.244	0.001	0.001	0.301	1.926	0.001	0.177

	As K12	As L1	Br K12	Br L1	Ca K12	Cl K12	Cu K12	Fe K12	Hg L1	Hg M1	K K12	Mn K12	Ni K12	P K12	Pb L1	Pb M1	Rb K12	Rb L1	S K12	Si K12	Sr K12	Ti K12	Zn K12
19700_S5_1@130214_060424	0.003	0.102	0.096	0.037	73.112	0.003	0.149	100.000	0.169	0.042	3.110	1.159	0.319	0.161	0.502	0.054	3.076	0.008	1.342	0.192	27.564	1.356	0.730
19700_S5_2@130214_060424	0.001	0.028	0.264	0.028	54.875	0.001	0.153	100.000	0.045	0.027	3.603	1.108	0.324	0.106	0.423	0.052	2.535	0.001	0.982	0.208	20.428	1.047	0.620
19700_S5_3@130214_060424	0.002	0.053	0.195	0.053	80.192	0.121	0.193	100.000	0.070	0.037	3.908	4.658	0.509	0.193	0.605	0.000	2.355	0.000	0.215	0.191	18.460	1.257	0.575
19700_S5_4@130214_060424	0.003	0.041	0.506	0.023	85.612	0.106	0.284	100.000	-0.041	0.010	4.261	1.286	0.256	0.152	0.566	0.008	3.030	0.005	0.003	0.287	21.263	1.100	0.568
19700_S5_5@130214_060424	0.094	0.047	0.486	0.039	45.788	0.094	0.262	100.000	0.037	0.047	2.766	1.104	0.342	0.113	0.494	0.000	2.514	0.002	1.031	0.088	20.243	1.150	0.639
19700_S5_6@130214_060424	0.001	0.012	0.080	0.015	17.618	0.002	0.069	100.000	0.176	0.017	0.543	0.260	0.092	0.001	0.663	0.013	1.267	0.001	0.640	0.084	8.624	0.171	0.228
19700_S5_7_PWD@130214_060424	0.234	0.062	0.587	0.009	52.476	0.057	0.222	100.000	0.201	0.066	2.414	1.195	0.350	0.002	0.665	0.014	2.317	0.000	0.159	0.002	18.726	1.385	0.618
19700_S5_8_PWD@130214_060424	0.330	0.077	0.405	0.021	54.323	0.089	0.199	100.000	0.077	0.036	2.457	1.199	0.244	0.027	0.351	0.003	2.332	0.006	0.104	0.003	18.920	1.502	0.568
19700_S5_9_In_Epoxy@130214_06042	0.003	0.067	0.786	0.098	34.788	0.106	0.282	100.000	0.464	0.053	1.375	1.621	0.405	0.022	1.090	0.000	1.786	0.003	0.109	0.067	10.707	0.889	0.721
19700_S5_10_In_Epoxy@130214_0604	0.002	0.069	0.571	0.028	38.518	0.133	0.279	100.000	0.102	0.011	1.921	1.277	0.363	0.002	0.807	0.022	1.391	0.008	0.094	0.008	9.509	1.383	0.854
19700_S6D_1@130214_060424	0.062	0.011	0.203	0.028	8.843	0.002	0.130	100.000	-0.011	0.022	0.598	0.221	0.023	0.067	0.808	0.006	0.484	0.021	0.185	0.041	3.916	0.710	0.136
19700_S6D_2@130214_060424	0.384	0.023	0.202	0.023	9.213	0.001	0.131	100.000	0.017	0.006	0.686	0.240	0.062	0.001	0.408	0.000	0.330	0.014	0.123	0.057	4.031	0.701	0.142
19700_S7_1@130214_060424	0.011	0.077	0.143	0.080	78.117	0.125	0.077	100.000	0.214	0.077	1.399	0.436	0.154	0.197	0.721	0.000	1.796	0.000	1.479	0.100	26.679	0.547	0.259
19700_S7_2@130214_060424	0.282	0.080	0.688	0.011	59.213	0.049	0.129	100.000	0.009	0.027	1.261	0.375	0.135	0.133	0.546	0.013	1.390	0.084	0.642	0.002	21.549	0.657	0.171
19700_S7_3@130214_060424	0.415	0.148	0.470	0.118	204.182	0.439	0.142	100.000	0.421	0.130	2.951	0.829	0.501	0.829	1.720	0.000	3.273	0.043	0.062	0.006	60.629	0.464	0.489
	As K12	As L1	Br K12	Br L1	Ca K12	Cl K12	Cu K12	Fe K12	Hg L1	Hg M1	K K12	Mn K12	Ni K12	P K12	Pb L1	Pb M1	Rb K12	Rb L1	S K12	Si K12	Sr K12	Ti K12	Zn K12
4464_S14_1@130214_055405	0.000	0.001	0.038	0.000	6.789	0.000	0.035	100.000	0.020	0.000	1.073	0.870	0.144	0.000	0.203	0.000	0.780	0.000	0.000	0.003	3.112	1.630	0.451
4464_S14_2@130214_055405	0.001	0.004	0.198	0.007	13.438	0.015	0.119	100.000	0.108	0.014	1.802	0.861	0.264	0.047	0.458	0.000	2.483	0.026	0.023	0.001	10.471	1.333	0.783
	As K12	As L1	Br K12	Br L1	Ca K12	Cl K12	Cu K12	Fe K12	Hg L1	Hg M1	K K12	Mn K12	Ni K12	P K12	Pb L1	Pb M1	Rb K12	Rb L1	S K12	Si K12	Sr K12	Ti K12	Zn K12
1525_S8_1@130214_055405	5.713	0.024	0.079	0.016	7.083	0.001	0.057	100.000	0.041	-0.009	0.703	0.133	0.017	0.001	4.330	0.000	0.515	0.001	0.001	0.001	1.167	0.398	0.769
1525_S8_2@130214_055405	6.501	0.029	0.159	0.022	16.127	0.001	0.123	100.000	0.023	0.007	0.930	0.352	0.078	0.001	5.102	0.002	0.725	0.023	0.001	0.001	4.281	0.375	0.918
	As K12	As L1	Br K12	Br L1	Ca K12	Cl K12	Cu K12	Fe K12	Hg L1	Hg M1	K K12	Mn K12	Ni K12	P K12	Pb L1	Pb M1	Rb K12	Rb L1	S K12	Si K12	Sr K12	Ti K12	Zn K12
4194_S1_1@130214_055405	0.153	0.013	0.061	0.024	3.953	0.001	0.173	100.000	-0.002	-0.006	1.156	0.977	0.245	0.001	0.374	0.000	1.744	0.005	0.001	0.002	2.218	1.188	0.613
4194_S1_2@130214_055405	0.105	0.052	0.130	0.030	9.156	0.010	0.103	100.000	0.038	-0.006	1.550	1.496	0.344	0.041	0.279	0.005	1.885	0.002	0.001	0.001	2.457	1.290	0.610
5575_S3_1@130214_055405	0.029	0.038	0.015	0.037	2.813	0.006	0.170	100.000	-0.005	0.016	0.968	0.803	0.284	0.001	0.624	0.000	1.695	0.011	0.001	0.001	1.977	1.047	0.464
5575_S3_2@130214_055405	0.168	0.070	0.066	0.043	15.235	0.041	0.234	100.000	-0.007	0.009	1.424	57.123	2.723	0.027	0.720	0.002	2.678	0.002	0.129	0.070	5.317	1.058	1.124
Late Levels, IST Area, Pink plaster, cake,	As K12	As L1	Br K12	Br L1	Ca K12	Cl K12	Cu K12	Fe K12	Hg L1	Hg M1	K K12	Mn K12	Ni K12	P K12	Pb L1	Pb M1	Rb K12	Rb L1	S K12	Si K12	Sr K12	Ti K12	Zn K12
12487_1@130214_055405	0.237	0.005	0.030	0.000	0.051	0.000	0.005	100.000	0.046	0.000	0.185	0.084	0.007	0.000	0.359	0.000	0.121	0.000	0.000	0.036	1.537	0.654	0.050
12487_2@130214_055405	0.628	0.109	0.158	0.094	0.361	0.011	0.090	100.000	0.177	0.079	0.794	0.207	0.026	0.004	1.057	0.004	0.670	0.004	0.004	1.035	6.941	0.937	0.166
12487_3@130214_055405	0.171	0.011	0.052	-0.002	0.062	0.000	0.014	100.000	0.028	0.000	0.155	0.099	0.011	0.000	0.436	0.000	0.128	0.000	0.000	0.060	2.129	0.646	0.063
12487_S7_1@130214_055405	0.390	0.008	0.071	0.005	0.080	0.000	0.014	100.000	0.011	0.000	0.256	0.162	0.004	0.000	0.348	0.000	0.158	0.004	0.000	0.028	1.856	0.694	0.094
12487_S7_2@130214_055405	0.216	0.000	0.020	0.000	0.038	0.000	0.008	100.000	0.016	0.000	0.094	0.120	0.000	0.000	0.287	0.000	0.109	0.000	0.000	0.000	1.324	0.624	0.052
12456_S25_1@130214_055405	0.000	0.000	0.433	0.004	401.384	0.433	0.416	100.000	0.337	0.184	9.743	1.016	1.125	0.871	0.495	0.009	2.373	0.000	0.416	0.004	30.502	0.709	6.012
12456_S25_2@130214_055405	0.006	0.000	1.486	0.006	362.934	0.258	0.725	100.000	0.180	0.096	10.346	1.336	1.300	0.629	4.385	0.000	1.576	0.000	0.246	0.006	58.471	0.827	14.839
11862_S6_1@130214_055405	0.027	0.300	3.380	0.818	547.288	0.572	0.818	100.000	1.499	0.654	5.669	1.117	1.008	0.055	3.516	0.191	3.107	0.027	12.810	0.191	61.216	0.354	0.218
11862_S6_2@130214_055405	0.039	1.093	4.020	0.937	643.091	0.546	1.991	100.000	0.351	1.483	6.050	4.137	1.249	0.078	2.888	0.351	7.104	0.000	10.578	0.312	91.569	0.429	1.874
11862_S9_1@130214_055405	0.106	0.027	0.275	0.052	32.772	0.035	0.044	100.000	0.164	0.056	9.094	0.474	0.067	0.067	1.117	0.021	0.572	0.002	0.566	0.002	15.074	0.581	0.194
11862_S9_2@130214_055405	0.003	0.000	0.215	0.035	46.402	0.123	0.057	100.000	0.087	0.035	23.129	1.293	0.117	0.019	1.276	0.022	0.995	0.068	1.134	0.003	20.293	0.586	0.237
	As K12	As L1	Br K12	Br L1	Ca K12	Cl K12	Cu K12	Fe K12	Hg L1	Hg M1	K K12	Mn K12	Ni K12	P K12	Pb L1	Pb M1	Rb K12	Rb L1	S K12	Si K12	Sr K12	Ti K12	Zn K12
19808_1@130214_060424	0.095	0.030	0.216	0.015	1.168	0.072	0.049	100.000	0.158	0.001	0.211	0.235	0.027	0.032	0.170	0.000	0.115	0.012	0.001	0.054	1.478	0.207	0.217
19808_2@130214_060424	0.012	0.000	0.009	0.000	0.099	0.000	0.006	100.000	0.001	0.000	0.000	0.270	0.002	0.000	0.047	0.000	0.033	0.000	0.000	0.000	0.156	0.032	0.088
19808_3@130214_060424	0.000	0.000	0.004	0.000	0.034	0.000	0.007	100.000	0.004	0.000	0.000	0.198	0.000	0.000	0.039	0.000	0.047	0.000	0.000	0.000	0.051	0.027	0.054
19808_4@130214_060424	0.000	0.004	0.028	0.001	2.094	0.000	0.024	100.000	0.022	0.000	0.010	0.279	0.001	0.000	0.081	0.000	0.819	0.000	0.000	0.108	0.433	0.000	0.094
19808_5@130214_060424	0.007	0.000	0.000	0.000	0.046	0.000	0.008	100.000	0.009	0.000	0.000	0.167	0.002	0.000	0.080	0.000	0.017	0.000	0.000	0.000	0.054	0.000	0.057
19808_6@130214_060424	0.017	0.000	0.009	0.000	0.042	0.000	0.003	100.000	0.005	0.000	0.000	0.156	0.001	0.000	0.056	0.000	0.027	0.000	0.000	0.002	0.048	0.013	0.051

Yellow pigments	ALL RESULTS BELOW STANDARDISED TO THE VALUE OF Fe, (VALUE OF ELEMENT X DIVIDED BY VALUE OF Fe MULTIPLIED BY 100; PLACE $ BEFORE Fe VALUE)																														
	As K12	As L1	Br K12	Br L1	Ca K12	Cl K12	Co K12	Cr K12	Cu K12	Fe K12	Hg L1	Hg M1	K K12	Mn K12	Mo K12	Mo L1	Ni K12	P K12	Pb L1	Pb M1	Rb K12	Rb L1	S K12	Sb K12	Sb L1	Si K12	Sn K12	Sn L1	Sr K12	Sr L1	Ti K12	Zn K12	Zr K12
Ref_Kremer_Jarosite	0.000	0.000	0.000	0.000	0.171	0.000	2.990	0.024	0.015	100.000	0.019	0.000	0.000	0.236	2.391	0.000	0.002	0.000	0.074	0.000	0.031	0.000	-0.005	0.004	0.000	0.000	0.012	0.000	0.424	0.000	0.340	0.021	0.183
Ref_Kremer_Jarosite	0.000	0.000	0.000	0.000	0.103	0.000	2.929	0.039	0.009	100.000	0.002	0.000	0.000	0.205	1.956	-0.001	0.000	0.000	0.088	0.000	0.080	0.000	0.008	0.004	0.000	0.000	0.009	0.000	0.401	0.000	0.240	0.006	0.144
	As K12	As L1	Br K12	Br L1	Ca K12	Cl K12	Co K12	Cr K12	Cu K12	Fe K12	Hg L1	Hg M1	K K12	Mn K12	Mo K12	Mo L1	Ni K12	P K12	Pb L1	Pb M1	Rb K12	Rb L1	S K12	Sb K12	Sb L1	Si K12	Sr K12	Sr L1	Ti K12	Zn K12	Zr K12	Zr L1	
5349_S5_1@130214	0.000	0.014	0.953	0.041	23.943	0.002	1.457	0.039	0.206	100.000	0.045	0.011	1.255	10.967	14.376	0.002	0.997	0.105	0.973	0.000	2.544	0.002	0.008	0.081	0.002	0.002	9.622	0.005	0.705	2.322	1.573	0.002	
5349_S10_2@13021	0.000	0.018	0.516	0.011	11.931	0.016	0.883	0.087	0.197	100.000	0.045	-0.008	1.484	1.359	9.601	0.000	0.258	0.064	0.573	0.003	1.623	0.002	0.001	0.015	0.091	0.025	5.435	0.001	0.959	1.397	1.276	0.003	
15839_X12_1@1302	0.000	0.004	0.360	0.004	123.194	0.040	0.578	0.047	0.113	100.000	0.160	0.025	0.851	0.712	6.336	0.007	0.109	0.015	1.385	0.000	0.509	0.000	0.004	0.142	1.850	0.004	2.352	0.004	0.004	0.167	0.836	0.004	
15839_X12_2@1302	0.000	0.005	0.174	0.005	127.451	0.026	0.534	0.015	0.149	100.000	0.298	0.021	1.036	1.082	6.808	0.005	0.118	0.159	0.734	0.051	0.144	0.005	0.005	0.144	1.980	0.005	2.011	0.021	0.005	0.262	0.882	0.005	
17532_1@130214_0	0.000	0.030	0.144	0.035	0.421	0.010	0.285	0.093	0.136	100.000	0.055	0.001	0.681	0.619	11.318	0.000	0.048	0.011	2.401	0.000	0.844	0.001	0.001	-0.011	0.001	0.223	3.864	0.042	0.376	0.098	1.423	-0.002	
17532_2@130214_0	0.000	0.019	0.080	0.018	0.909	0.095	0.278	0.001	0.122	100.000	0.055	-0.012	1.733	0.552	9.963	0.000	0.009	0.007	1.122	0.001	0.315	0.001	0.001	0.028	0.012	0.371	2.261	0.091	2.947	0.057	1.118	-0.001	
17485_S3_1@13021	1.000	0.133	6.316	0.036	162.363	0.908	1.332	0.285	1.187	100.000	0.242	0.145	5.026	5.808	61.642	0.006	1.599	0.678	2.162	0.055	2.392	0.000	0.182	-0.048	2.846	0.006	101.478	0.006	0.951	43.311	8.860	0.006	
17485_S3_2@13021	0.000	0.093	3.289	0.055	104.080	0.584	1.075	0.254	1.041	100.000	0.889	0.021	4.305	2.908	36.135	0.004	1.244	0.419	0.910	0.000	1.943	0.004	0.131	-0.017	1.659	0.004	49.384	0.063	1.003	31.039	5.257	0.004	
1993_1@130214_05	0.000	0.100	3.109	0.242	126.818	0.310	0.315	0.200	0.987	100.000	-0.147	0.179	2.185	2.610	62.175	0.042	1.843	1.150	2.311	0.000	18.484	0.084	0.137	0.142	1.796	0.977	24.240	0.095	0.662	2.206	180.707	0.005	
1993_2@130214_05	0.000	0.090	1.734	0.034	130.594	0.188	0.476	0.058	1.443	100.000	0.177	0.116	2.236	2.151	61.565	0.003	2.159	0.899	1.358	0.055	18.143	0.016	0.032	0.248	2.019	0.854	23.492	0.185	0.632	2.003	184.352	0.003	
1993_3@130214_05	0.000	0.075	1.773	0.085	130.091	0.091	0.424	0.025	1.336	100.000	-0.041	0.037	2.363	2.357	60.373	0.169	2.179	1.064	2.094	0.000	17.975	0.001	0.001	0.083	2.181	0.873	23.665	0.126	0.791	2.115	182.141	0.001	
	ALL RESULTS BELOW STANDARDISED TO THE VALUE OF Fe, (VALUE OF ELEMENT X DIVIDED BY VALUE OF Fe MULTIPLIED BY 100; PLACE $ BEFORE Fe VALUE)																														

ROCKS

					As K12	As L1	Br K12	Br L1	Ca K12	Cu K12	Fe K12	Hg L1	Hg M1	K K12	Mn K12	Ni K12	P K12	Pb L1	Pb M1	Rb K12	S K12	Si K12	Sr K12	Sr L1	Ti K12	Zn K12
soil and rock			(i)	5228_S3_1@	5.921	0.000	0.111	0.000	0.645	0.117	100.000	0.019	0.000	0.294	0.350	0.181	0.000	0.242	0.000	0.608	0.000	0.000	0.620	0.000	0.527	0.252
				5228_1@13(	9.155	0.006	0.084	0.022	3.202	0.098	100.000	0.032	0.000	0.270	0.337	0.150	0.000	0.217	0.000	1.633	0.000	0.108	0.949	0.000	0.399	0.211
				5228_2@13(	10.266	0.029	0.169	0.020	8.522	0.163	100.000	0.060	0.016	0.453	0.477	0.181	0.001	0.556	0.001	5.814	0.001	0.289	1.878	0.010	0.600	0.332
				5228_3@13(	6.557	0.000	0.000	0.000	0.624	0.112	100.000	0.011	0.000	0.311	0.441	0.152	0.000	0.157	0.000	0.243	0.000	0.008	0.468	0.000	0.539	0.208
powder		red area	(ii)	12867_1@13	0.312	0.007	0.281	0.005	0.126	0.070	100.000	0.019	0.000	0.207	0.179	0.008	-0.001	0.452	0.000	0.168	0.001	0.197	1.944	0.001	0.841	0.043
powder		white area		12867_2@13	0.317	0.006	0.336	0.002	0.122	0.040	100.000	0.006	0.000	0.186	0.175	0.001	0.000	0.391	0.000	0.122	0.000	0.169	1.972	0.000	0.805	0.034
red and white striped rock		red area	(iii)	18536_1@13	0.241	0.132	1.004	0.071	15.462	0.252	100.000	0.088	0.132	1.679	1.246	0.302	0.055	0.532	0.000	14.052	0.104	0.735	4.357	0.027	0.636	0.587
red and white striped rock		white area		18536_2@13	0.002	0.023	0.617	0.061	8.882	0.079	100.000	0.188	-0.018	3.169	1.345	0.184	0.002	0.451	0.017	0.572	0.014	1.187	1.665	0.137	1.116	0.172
red and white striped rock		white area		18536_3@13	0.000	0.014	0.747	0.031	8.856	0.057	100.000	0.179	0.006	3.168	1.272	0.140	0.010	0.538	0.004	0.483	0.003	1.192	1.578	0.085	1.116	0.223
Rock and powder, used as colourant in plas			(iv)	12487_1@13	0.237	0.005	0.030	0.000	0.051	0.005	100.000	0.046	0.000	0.185	0.084	0.007	0.000	0.359	0.000	0.121	0.000	0.036	1.537	0.000	0.654	0.050
Rock and powder, used as colourant in plaster?				12487_2@13	0.628	0.109	0.158	0.094	0.361	0.090	100.000	0.177	0.079	0.794	0.207	0.026	0.004	1.057	0.004	0.670	0.004	1.035	6.941	0.041	0.937	0.166
Rock and powder, used as colourant in plaster?				12487_3@13	0.171	0.011	0.052	-0.002	0.062	0.014	100.000	0.028	0.000	0.155	0.099	0.011	0.000	0.436	0.000	0.128	0.000	0.060	2.129	0.003	0.646	0.063
Rock and powder, used as colourant in plaster?				12487_S7_1(	0.390	0.008	0.071	0.005	0.080	0.014	100.000	0.011	0.000	0.256	0.162	0.004	0.000	0.348	0.000	0.158	0.000	0.028	1.856	0.000	0.694	0.094
Rock and powder, used as colourant in plaster?				12487_S7_2(	0.216	0.000	0.020	0.000	0.038	0.008	100.000	0.016	0.000	0.094	0.120	0.000	0.000	0.287	0.000	0.109	0.000	0.000	1.324	0.000	0.624	0.052
rock with red with white inc		ligher area, inside break edg		18544_1@13	0.000	0.090	2.476	0.021	27.433	0.193	100.000	0.193	0.049	2.624	0.461	0.058	0.004	0.588	0.037	13.834	0.049	1.345	6.312	0.090	0.481	0.456
rock with red with white inc		darker area, inside break edg		18544_2@13	0.141	0.039	1.162	0.058	0.806	0.082	100.000	0.043	-0.013	0.878	0.077	0.024	0.011	0.258	0.000	0.255	0.002	0.353	2.169	0.030	0.677	0.061
			(vi)	19808_1@13	0.095	0.030	0.216	0.015	1.168	0.049	100.000	0.158	0.001	0.211	0.235	0.027	0.032	0.170	0.000	0.115	0.001	0.054	1.478	0.016	0.207	0.217
				19808_2@13	0.012	0.000	0.009	0.000	0.099	0.006	100.000	0.001	0.000	0.000	0.270	0.002	0.000	0.047	0.000	0.033	0.000	0.000	0.156	0.000	0.032	0.088
				19808_3@13	0.000	0.000	0.004	0.000	0.034	0.007	100.000	0.004	0.000	0.000	0.198	0.000	0.000	0.039	0.000	0.047	0.000	0.000	0.051	0.000	0.027	0.054
		white		19808_4@13	0.000	0.004	0.028	0.001	2.094	0.024	100.000	0.022	0.000	0.010	0.279	0.001	0.000		0.000	0.819	0.000	0.108	0.433	0.000	0.000	0.094
		black/blue		19808_5@13	0.007	0.000	0.000	0.000	0.046	0.008	100.000	0.009	0.000	0.000	0.167	0.002	0.000	0.080	0.000	0.017	0.000	0.000	0.054	0.000	0.000	0.057
				19808_6@13	0.017	0.000	0.009	0.000	0.042	0.003	100.000	0.005	0.000	0.000	0.156	0.001	0.000	0.056	0.000	0.027	0.000	0.002	0.048	0.000	0.013	0.051
red and white rock		dark area	(vii)	6250_1@13(	0.065	0.784	6.405	0.392	243.529	4.575	100.000	2.418	0.719	5.098	5.817	1.830	0.065	23.137	0.784	187.190	0.065	10.065	77.516	0.065	1.438	1.307
red and white rock		dark area		6250_2@13(	0.017	0.000	14.457	0.283	252.238	2.412	100.000	-0.433	0.349	5.107	6.555	1.298	0.017	17.568	0.067	190.517	0.017	10.015	73.632	0.250	2.662	4.176
red and white rock		red stripe		6250_3@13(	0.003	0.013	2.571	0.096	7.057	1.044	100.000	0.188	0.036	5.384	1.712	0.446	0.056	3.808	0.010	4.988	0.281	0.426	6.211	0.063	0.407	1.947
red and white rock		white stripe		6250_4@13(	0.015	0.239	2.140	0.045	90.301	1.916	100.000	1.392	0.359	3.667	2.230	0.494	0.554	6.646	0.135	69.166	0.389	3.577	20.506	0.284	1.991	1.557
rock with white mineral red		dark area	(viii)	19457_1@13	0.001	0.017	0.553	0.017	0.455	0.055	100.000	0.065	-0.005	0.502	1.364	0.026	0.000	0.618	0.000	0.244	0.001	0.301	1.926	0.033	0.001	0.177
rock with white mineral red		red area		19457_1@13	0.001	0.017	0.553	0.017	0.455	0.055	100.000	0.065	-0.005	0.502	1.364	0.026	0.000	0.618	0.000	0.244	0.001	0.301	1.926	0.033	0.001	0.177
rock with white mineral red		white area		19457_1@13	0.001	0.017	0.553	0.017	0.455	0.055	100.000	0.065	-0.005	0.502	1.364	0.026	0.000	0.618	0.000	0.244	0.001	0.301	1.926	0.033	0.001	0.177
rock and pwd in ochre bin				4671_1@13(	0.082	0.000	0.000	0.000	36.28	0.011	100.000	0.054	-0.001	0.149	3.954	0.014	0.00	0.18	0.000	0.071	0.001	0.002	0.995	0.000	0.012	0.088
rock and pwd in ochre bin				4671_2@13(	0.127	0.000	0.008	0.000	37.99	0.004	100.000	0.025	-0.002	0.181	3.952	0.017	0.00	0.10	0.000	0.040	0.010	0.001	1.018	0.000	0.000	0.069
soil and rock				4947_S5_1@	18.203	0.031	0.590	-0.001	14.55	0.088	100.000	0.036	-0.020	0.752	0.312	0.090	0.00	0.31	0.000	0.189	0.020	0.001	1.073	0.001	0.235	0.192
soil and rock				4947_S5_2@	13.647	0.020	0.247	0.009	10.14	0.031	100.000	0.083	-0.001	0.350	0.206	0.043	0.04	0.31	0.000	0.092	0.001	0.001	0.435	0.001	0.720	0.083
rock and pwd				5214_1@13(	18.833	0.000	0.000	0.000	11.22	0.032	100.000	0.096	0.000	0.218	0.268	0.018	0.00	0.07	0.000	0.042	0.000	0.010	0.129	0.000	0.104	0.140
rock and pwd				5214_2@13(	8.078	0.000	0.000	0.000	0.54	0.018	100.000	0.042	0.000	0.000	0.199	0.008	0.00	0.14	0.000	0.055	0.000	0.000	0.062	0.000	0.039	0.065

	19700_S5_1@130214_060424	0.003	0.102	0.096	0.037	73.112	0.149	100.000	3.110	1.159	0.319	0.502	0.054	3.076	0.008	1.342	0.192	27.564	0.003	1.356	0.730
	19700_S5_2@130214_060424	0.001	0.028	0.264	0.028	54.875	0.153	100.000	3.603	1.108	0.324	0.423	0.052	2.535	0.001	0.982	0.208	20.428	0.029	1.047	0.620
	19700_S5_3@130214_060424	0.002	0.053	0.195	0.053	80.192	0.193	100.000	3.908	4.658	0.509	0.605	0.000	2.355	0.000	0.215	0.191	18.460	0.057	1.257	0.575
	19700_S5_4@130214_060424	0.003	0.041	0.506	0.023	85.612	0.284	100.000	4.261	1.286	0.256	0.566	0.008	3.030	0.005	0.003	0.287	21.263	0.065	1.100	0.568
	19700_S5_5@130214_060424	0.094	0.047	0.486	0.039	45.788	0.262	100.000	2.766	1.104	0.342	0.494	0.000	2.514	0.002	1.031	0.088	20.243	0.100	1.150	0.639
	19700_S5_6@130214_060424	0.001	0.012	0.080	0.015	17.618	0.069	100.000	0.543	0.260	0.092	0.663	0.013	1.267	0.001	0.640	0.084	8.624	0.009	0.171	0.228
	19700_S5_7_PWD@130214_06042	0.234	0.062	0.587	0.009	52.476	0.222	100.000	2.414	1.195	0.350	0.665	0.014	2.317	0.000	0.159	0.002	18.726	0.012	1.385	0.618
	19700_S5_8_PWD@130214_06042	0.330	0.077	0.405	0.021	54.323	0.199	100.000	2.457	1.199	0.244	0.351	0.003	2.332	0.006	0.104	0.003	18.920	0.000	1.502	0.568
	19700_S6D_1@130214_060424	0.062	0.011	0.203	0.028	8.843	0.130	100.000	0.598	0.221	0.023	0.808	0.006	0.484	0.021	0.185	0.041	3.916	0.027	0.710	0.136
	19700_S6D_2@130214_060424	0.384	0.023	0.202	0.023	9.213	0.131	100.000	0.686	0.240	0.062	0.408	0.000	0.330	0.014	0.123	0.057	4.031	0.015	0.701	0.142
	19700_S7_1@130214_060424	0.011	0.077	0.143	0.080	78.117	0.077	100.000	1.399	0.436	0.154	0.721	0.000	1.796	0.000	1.479	0.100	26.679	0.071	0.547	0.259
	19700_S7_2@130214_060424	0.282	0.080	0.688	0.011	59.213	0.129	100.000	1.261	0.375	0.135	0.546	0.013	1.390	0.084	0.642	0.002	21.549	0.056	0.657	0.171
	19700_S7_3@130214_060424	0.415	0.148	0.470	0.118	204.182	0.142	100.000	2.951	0.829	0.501	1.720	0.000	3.273	0.043	0.062	0.006	60.629	0.080	0.464	0.489

		As K12	As L1	Br K12	Br L1	Ca K12	Cu K12	Fe K12	K K12	Mn K12	Ni K12	Pb L1	Pb M1	Rb K12	Rb L1	S K12	Si K12	Sr K12	Sr L1	Ti K12	Zn K12
B 80 powder from painting	18918_S5_1@130214_060424	0.024	0.058	0.975	0.018	58.354	0.163	100.000	3.328	1.088	0.290	0.867	0.000	1.987	0.000	0.003	-0.005	28.248	0.003	0.754	0.638
B 80 powder from painting	18918_S5_2@130214_060424	0.004	0.004	1.175	0.069	136.456	0.314	100.000	5.473	1.371	0.306	1.069	0.012	1.743	0.004	0.004	0.004	41.725	0.008	1.171	0.539
B 80 powder from painting	18918_S5_3@130214_060424	0.003	0.000	0.964	0.003	97.484	0.162	100.000	3.654	1.421	0.297	0.906	-0.003	1.493	0.003	0.003	0.007	29.495	-0.038	0.760	0.560
B 80 powder from painting	18918_S6_1@130214_060424	0.003	0.003	1.098	0.003	103.784	0.135	100.000	3.561	1.756	0.360	0.780	0.000	2.301	-0.035	0.115	0.013	25.808	0.003	0.825	0.518
B 80 powder from painting	18918_S6_2@130214_060424	0.415	0.010	0.880	0.003	106.102	0.105	100.000	3.797	1.324	0.141	1.020	0.000	2.426	0.003	0.150	0.003	45.746	0.010	0.569	0.468
B 80 powder from painting	18918_S6_3@130214_060424	0.004	0.090	1.461	0.004	83.472	0.251	100.000	4.358	1.527	0.337	1.034	0.000	1.966	0.004	0.004	0.004	41.131	0.004	1.034	0.783
B 80 powder from painting	18918_S7_1@130214_060424	0.110	0.023	1.582	0.039	71.261	0.146	100.000	3.085	1.039	0.224	1.039	0.000	1.751	0.010	0.052	0.003	41.558	0.019	0.971	0.490
B 80 powder from painting	18918_S7_2@130214_060424	0.007	0.038	0.856	0.018	60.954	0.222	100.000	2.571	0.876	0.211	0.777	0.000	1.529	0.013	0.027	0.002	23.687	0.002	0.817	0.460
B 80 powder from painting	18918_S7_3@130214_060424	0.000	0.038	2.321	-0.014	145.310	0.218	100.000	4.292	1.568	0.441	1.398	0.005	2.696	0.000	0.028	0.005	62.327	0.057	0.810	0.673
B 80 powder from painting	18918_S8_1@130214_060424	0.005	0.005	0.934	0.000	129.354	0.111	100.000	5.576	1.777	0.323	1.026	0.005	1.526	0.005	0.067	0.005	26.687	0.005	1.464	0.660
B 80 powder from painting	18918_S8_2@130214_060424	0.097	0.058	0.991	0.051	87.472	0.210	100.000	3.089	1.442	0.315	0.804	0.031	1.850	0.008	0.004	0.004	29.163	0.031	0.579	0.462
B 80 powder from painting	18918_S8_3@130214_060424	0.066	-0.022	0.798	0.013	57.447	0.075	100.000	2.397	1.578	0.175	0.526	0.000	0.852	0.002	0.002	0.002	17.441	0.002	0.877	0.342
B 80 powder from painting	18918_S9_1@130214_060424	0.194	0.032	0.345	0.023	62.831	0.113	100.000	3.222	0.742	0.119	0.713	0.019	0.439	0.013	0.003	0.039	8.485	0.013	0.977	0.313
B 80 powder from painting	18918_S9_2@130214_060424	0.223	0.000	0.823	0.005	117.372	0.179	100.000	4.487	1.113	0.300	1.021	0.058	0.799	0.005	0.044	0.005	18.098	0.039	1.486	0.363
B 80 powder from painting	18918_S9_3@130214_060424	0.381	0.040	1.398	0.010	132.273	0.135	100.000	3.502	0.857	0.195	1.558	0.000	2.315	-0.005	0.210	0.060	45.564	0.005	0.787	0.536
B 80 powder from painting	18918_S10_1@130214_060424	0.098	0.040	1.146	0.087	47.243	0.182	100.000	2.627	1.132	0.448	0.757	0.007	3.741	0.018	0.015	0.018	37.913	0.004	0.808	1.103
B 80 powder from painting	18918_S10_2@130214_060424	0.003	0.108	0.603	0.072	112.591	0.154	100.000	3.919	1.605	0.262	0.724	0.016	2.736	0.003	0.092	0.003	30.382	0.003	1.003	0.934
B 80 painted frag	18918_S11_1@130214_060424	0.003	0.038	1.475	0.008	72.486	0.110	100.000	2.225	1.024	0.290	0.744	0.000	1.913	0.030	0.075	0.003	26.587	0.003	0.844	0.594
B 80 painted frag	18918_S11_2@130214_060424	0.096	0.009	1.428	0.009	76.864	0.003	100.000	2.181	0.669	0.136	0.776	0.000	2.100	0.003	0.087	0.055	38.813	0.003	0.849	0.478
B 80 painted frag	18918_S12_1@130214_060424	0.246	0.086	0.607	0.027	40.852	0.163	100.000	2.679	1.084	0.169	0.740	0.000	1.651	0.006	0.002	0.033	17.952	0.002	1.095	0.423
B 80 painted frag	18918_S12_2@130214_060424	0.146	0.027	0.587	0.033	23.857	0.166	100.000	1.986	0.678	0.116	0.346	0.012	1.053	0.027	0.001	0.022	17.608	0.013	0.912	0.302
B 80 painted frag	18918_S12_3@130214_060424	0.002	0.050	0.554	0.054	39.495	0.132	100.000	2.518	0.909	0.182	0.599	0.022	1.653	0.003	0.002	0.038	19.768	0.002	0.992	0.374
B 80 painted frag	18918_S13_1@130214_060424	0.205	0.023	0.778	0.049	39.021	0.047	100.000	1.768	0.412	0.058	0.433	0.014	1.076	0.001	0.098	0.001	23.096	0.034	0.759	0.298
B 80 painted frag	18918_S13_2@130214_060424	0.356	0.029	0.488	0.014	11.932	0.014	100.000	1.372	0.297	0.026	0.360	0.006	0.699	0.000	0.057	0.028	17.078	0.006	0.818	0.141
B 80 painted frag	18918_S13_3@130214_060424	0.282	0.010	0.690	0.008	20.615	0.044	100.000	1.529	0.352	0.066	0.353	0.000	0.800	0.000	0.117	0.016	19.819	0.005	0.966	0.200
B 80 painted frag	18918_S14_1@130214_060424	0.289	0.030	1.292	0.046	45.853	0.162	100.000	2.081	0.945	0.155	0.545	0.003	1.728	0.023	0.079	0.033	30.705	0.041	0.770	0.345
B 80 painted frag	18918_S14_2@130214_060424	0.227	0.124	1.207	0.046	46.335	0.111	100.000	1.984	0.477	0.093	0.655	0.013	1.434	0.003	0.049	0.003	30.582	-0.003	0.699	0.441

Copper-based green									
	As K12	As L1	Cu K12	Fe K12	Hg L1	Ni K12	Pb L1	Sn K12	Zn K12
Ref_Kremer_Chrysocolla_1@130214_060843	0.019	0.000	100.000	0.803	0.001	0.130	0.009	0.005	1.229
Ref_Kremer_Chrysocolla_2@130214_060843	0.000	0.000	100.000	1.181	0.008	0.113	0.010	0.005	1.063
Ref_Kremer_Malachite_1@130214_060843	0.003	0.000	100.000	0.224	0.001	0.127	0.011	0.005	0.861
Ref_Kremer_Malachite_2@130214_060843	0.000	0.000	100.000	0.207	0.000	0.128	0.007	0.004	0.873
Ref_Kremer_Atakamite_1@130214_060843	0.002	0.000	100.000	0.213	0.002	0.157	0.007	0.003	0.820
Ref_Kremer_Atakamite_2@130214_060843	0.000	0.000	100.000	0.196	0.001	0.138	0.007	0.004	0.836
Unit number_number of scan, two samples tota	As K12	As L1	Cu K12	Fe K12	Hg L1	Ni K12	Pb L1	Sr K12	Zn K12
Sample 5, 4225_S8_1@130214_055405	0.283	0.005	100.000	0.237	0.158	0.098	0.028	0.023	0.357
Sample 5, 4225_S8_2@130214_055405	0.219	0.001	100.000	0.254	0.606	0.107	0.060	0.081	0.383
Sample 6, 12867_S4_1@130214_055405	0.000	0.000	100.000	2.852	-0.001	0.085	0.011	0.009	0.249
Sample 6, 12867_S4_2@130214_055405	0.000	0.000	100.000	2.252	0.001	0.098	0.016	0.029	0.264

Appendix VII

Results of the Survey of 164 archaeological samples in the on-site archive at Çatalhöyük

RLAH.Unit number	Area	Year	FindSampleLet	FindNumber	SampleNumber	FlotNumber	Material	IMS notes I	Sample larger than 2 cm?	Volcanic/igneous source indicated?	inclusion, 1) quartz/sand/feldspar 2) mica 3) black matte 4) black glassy 5)soft white chalky	other options 1)burnt mudbrick 2) colluvium 3) ceramic 4) other	'hardness 1) softer than finger nail 2) harder than fingernail, 3) softer than steel needle/scalpel 4) harder than needle 5) harder than outer crust with softer than exposed body 6) harder than steel knife	porosity	organic lacunae, or phytolith visible	density/wt	Processing	shaping,1) round, 2) flat	burning	plaster on surface	streak on tile	uniform/homogenous particles in matrix	Notes	IMSexamine /sa	MellaartLevels	HodderLevel
16448	4040	2008	s		3		Pigment	mostly soil with 2-3 bits of red painted plaster <0.5 cm	n	-												red			,4040.?G,
19036	4040	2010	s		1		Pigment	not in crate																	,4040.?G,
14460	4040	2008					Pigment	red with white inclusions, 2 cm red <1 cm lumps 2X	y	y												red			,4040.G,
16679	4040	2008	s		2	8402	Pigment	with koalinite type materila in matrix	n	y												red			,4040.G,
16309	4040	2007	no sample available					yellow														yellow, associated with blue 16308, burial cor			4040.G
13127	4040	2006					Pigment	red orange/terracotta large lump with grey and black accretions, clay body 12 cm	y	-		3 clay		1	low				y		uniform within	red/orange			,4040.I,
8829	4040	2003	s		1		Pigment	mostly soil with 2-3 bits of poss yellow ochre 1 cm	n	-												Yelow Ocher			,4040.Post-Cha
10015	4040	2004	s		2	5782	pigment	red ?HR pigment, red, poss cinnabar	y	y												2bags	1		,4040.Post-Cha
7527	4040	2003					Pigment	dark red, homogenous, looks ground then in block, largest piece (3-4 cm) flat plane as if it's been ground flat. Good GC-MS candidate.	y	poss sedimentary	3) poss charcoal				low	y			2	y		uniform	red	1		,4040.Unknown
7584	4040	2003					Pigment	red large 5 cm lump with grey encrustations 12 cm	y	y															,4040.Unknown
7575	4040	2003	X	19			Pigment	blue small pieces, 0.05 cm, some darker and cylindrical from processing/shaping, bright blue, azurite?,	n	-								1) 2 cylindrical fragments, bead making?				blue	1		,4040.Unstratifi
7597	4040	2003	X	1			Pigment	0.5-1 cm	n	-												blue	1		,4040.Unstratifi
17532	4040	2008	s		3		Pigment	yellow ochre 1-1.5 cm piece bagged with context soil with poss more ochre	n	-		1			1 low	n	low				hetero	yellow	2		,4040.Unstratifi
16308	4040	2007	X	2			Pigment	hue,lump 2cm lump, fingernail soft, powdery, good GC-MS candidate. ID as bone by AD matches to bone samples with similar blue accretions from Unit 18508 in bldg 79, South.O	y	-					1								blue	1		,SCRAPE.?G,
2241	Bach	1997	s		1	895	Pigment	yellow powder, bright color	n	-												yellow ochre			,BACH.?G,
2255	Bach	1997	X	1			Pigment	5 cm red lump in soil context, pkg tuperware red lid	y	y					high		low					ochre lump	1		,BACH.?G,
8306	Bach	2001	s		3		Pigment	soil, not pigment	n	-												grey-brown			,Bach.?G,
6147	Bach	1999					Pigment															red			,BACH.?G,
6247	Bach	1999	s		7		Pigment	red lump, white kaolinite streak	n	y												red			,BACH.?G,
6250	Bach	1999	s		5		Pigment	red streaks, veins white matrix														red			,BACH.?G,
6250	Bach	1999	s		3		Pigment	soil with dark red lumps	n	-												red			,BACH.?G,
8375	Bach	2002	s		2	5014	ochre	bright red, yellow and white kaolinite-like streaks	n	y												red	1		,BACH.?G,
8408	Bach	2002	s		2	5028	ochre	red pink, with black on some plane faces	n	-												red	1		,BACH.?G,
8457	Bach	2002	s		3		Pigment	not in crate																	,BACH.?G,
8587	Bach	2002	s		1		Pigment	not in crate														yellow			,BACH.?G,
8630	Bach	2003	s		3		Pigment	red pinkish, shaped	y	y, volcanic pipe formation example												red			,BACH.?G,
8251	Bach	2001	s		8		Pigment	soil, not pigment	n	-												grey-brown			,BACH.?G,Bach
8699	Bach	2006					Pigment	red-orange														red			
12450	IST	2006	s		7		Pigment	red pink, chalky, plaster layer, rare mix of plaster and pigment	y	-								y			plaster layer with red mineral in matrix	red			,IST.Unassigned
12456	IST	2006					Pigment	green, plane cleavage, bright sap green when scratched															1		,IST.Unassigned
12487	IST	2006	s		2	6849	pigment	bright red hue	n	y												red	1		,IST.Unassigned
11862	IST	2005	s		6			red pink flat on 2 planes, poss plaster and pigment mixture	y	-											yes, pigment p	is it positive for carbonate or sulphate?			IST
6029	Kopal	1999					Pigment	yellow green tinge, porous coral like texture, volcanic/igneous, not viable pigment. Texture similar to spongy bone visual exam by AD in faunal confirmed not bone.	y	-					high							yellow			
17485 F. 402	North	2008	s		3		Pigment	Beads not beige yellow, poss plaster	n	-							y					yellow, assoc wth skeleton 17485, phytoliths			,NORTH.?F,
1411	North	1996	s		1	464	Pigment	rusted red pink, plaster?flat plane	n	-								1) beads				red			,NORTH.?G,
1412	North	1996	X	1			Pigment	shaped	n	-								y			painted plaster	red			,NORTH.?G,
1474	North	1996	s		1	679	Pigment	bright red hue	n	y												red			,NORTH.?G,
1965	North	1997					Pigment	soil, not pigment	n	-												white			,NORTH.?G,
1993	North	1997	s		4		Pigment	poss yellow ochre lump, mostly soil														yellow			,NORTH.?G,

| | | |

13365	South	2006	X		30			Pigment	grey rock with red ochre, 7 cm, scratches with fingernai, dark outer surface	y	y													yes, dark outer	white inclusion	red				,South.Q,
14009	South	2006						Pigment	orange terracotta color with white depression when scratched, softer than fingernail, largest 4 cm1X, with 2 cm 2X red orange,	y	-															red/orange				,South.Q,
5391	South	2002						Pigment	homogenous, 1 cm	n	-															red				,South.R,
12867	South	2006						Pigment	cuprous green ore with bright and dark streaks	y	-			one example of mudbrick three examples, other 2 of haematite sinter		low	n	high	y	2	n	y		green dense, h	green		1		,South.R,
12867	South	2006						Pigment	red orange porous harder than fingernai 2X +,1 example mudbrick 3 in sample total	y	-					high		low	n	n	n		red 1 largest,	red		1		,South.R,
8009	South	2003	s		2	5551	pigment	evidence.	orange, rounded, same size and shape as unit 8023 without burning	n	-															red orange		1	,,,,	,South.S,
8023	South	2003	s		2	5564	pigment	8023	orange, rounded, black encrustations. This same size and shape and body colour under burned surface as	n	-										y					red orange			,,,,	,South.S,
2610	South	1997	s		2	101	Pigment	20X	red grains> 0.1 cm ~	n	-															red				,South.T,
2617	South	1997	s		2	108	Pigment	red > 0.5 cm	light orange, terracotta color largest >2 cm wth . 1	n	?															red				,South.T,
1719	South	1996	s		1	13	mudbrick	cm13x	orange, terracotta	y	-	1, 2, 3		1		1	high	y	low							yellow				,South.Unstrati
4194	South	1999						Pigment	color 3 cm	y	-		clay											terracotta colo	red/orange				,South.Unstrati
19217	South	2010						Pigment	purplish black with orange veins harder than fingernail rock, 5 cm	y	y	poss ore												dense, hard, or	red				South
5325	South	1999	s		4	3806	mudbrick	orange2.5 cm	scratches with fingernail	-	-	1, 2		1		1	high	yes	low			y	terracotta		red				South
5575	South	2002						Pigment	orange red	n	-	4,2, 3		2,3			low,none, compact	n	high	black splatter					red with black splatters				South
19306	South	2010						Pigment	bright red large rock 5 cm, scratches with fingernail	y	y												yes, dark burn	black inclusion	red				
19700	South	2012	s		4		Pigment	Painted plaster		y	-	1, 5				1	low			y	2	painted plaster layer		yes	red to black, colour change within 24 hours of excavation, hc				
18918	South	2012	s		10		painted plaster layer	subsample of varieties of pigment on wall	red orange 8-9 cm	n															from wall painting in bldg 80, variations in color from differer				
15803	TP	2007	X		11			Pigment	rock	y	-														red		1		,TP.Unassigned
15839	TP	2008	s		4		Pigment	soil, not pigment	yellow ochre, 2 cm	-	-																			,TP.Unassigned
15839	TP	2008	X		12			Pigment	rock	-	-														Yellow		1		,TP.Unassigned
6919	TP	2001	s		2	4599	pigment	red HR pigment, red		n	y														red		1		
7658	TP	2003						pigment	red 'HR 0.5cm red	n	-														red				
10936	TP	10936	s		1			Pigment	red particles in mostly soil, burial context by foot noted on tag	-	-														grey brown				
17804	TP	2008	X		29			Pigment	dark rock, not ochre, dark grey patina, not pigment, shaped with rounded and flat surface	y	-														yellow				
17804	TP	2008	X		30			Pigment	grey rock with pink and yellow cast	y	-		1	4		2	med	n	low						red				
17806	TP	2008	X		2			Pigment	not in crate	-	-																			
15139	Trench 5	2010						Pigment	red <02 cm	n	y														red				,Trench 5.Chalk
18314	Trench 5	2009						Pigment	poss quartz 1X with cleavage in thin sheets with limestone rock 1X chalky, scratches with	n	-														white and crystal				,Trench 5.Chalk
18318	Trench 5	2009	s		3		Pigment	fingernail		-	-														white				,Trench 5.Chalk
18318	Trench 5	2009	s		13		Pigment	lumps X3 with powder	dark red , <1 cm	n	-														red				,Trench 5.Chalk
18318	Trench 5	2009	s		4		Pigment	red 4cm		y	y														red				,Trench 5.Chalk
18318	Trench 5	2009	s		14		Pigment	white chalk like, 2 cm	red with rusty (oxide) inclusions, large, 9 cm	n	-														white				,Trench 5.Chalk
18323	Trench 5	2009	X		5			Pigment	rock	y	y														red/orange				,Trench 5.Chalk
18328	Trench 5	2009	s		9		Pigment	red lumps with largest 1.5 cm	dark red, < 0.5 cm	n	y														red				,Trench 5.Chalk
18331	Trench 5	2009						Pigment	lump 2X	n	y														red				,Trench 5.Chalk
18331	Trench 5	2009						Pigment	green, bright poss copper, ,3cm lump	y	-														green		1		,Trench 5.Chalk
18343	Trench 5	2009	s		6		Pigment	and powder	deep red <1cm lumps	n	-														red				,Trench 5.Chalk
18343	Trench 5	2009	s		7		Pigment	poss cake of ochre,	red large lump 5-6 cm, red white inclusions	y	poss sedimentary														red ochre		1		,Trench 5.Chalk
18343	Trench 5	2009	s		3		Pigment	2cm		y	y														red ochre				,Trench 5.Chalk
15160	Trench 5	2010						Pigment	conical smooth shape yellow	y	-														yellow		1		
15160	Trench 5	2010						Pigment	red poss ochre1.25 cm	n	-														red				
15180	Trench 5	2010	X		56			Pigment	red stone with bluish tinge and grey soil, harder than stel knife	y	y					6		high							red				
15180	Trench 5	2010	X		36			Pigment	white smooth rock, not pigment, poss used for grinding from smoothed shape	y	-														white with red		1		
15153	Trench 5	2010	s		3			Pigment	yellow lump < 0.5 cm	n	-														red ochre				
15163	Trench 5	2010	s		4			Pigment	mostly soil	n	-														red				

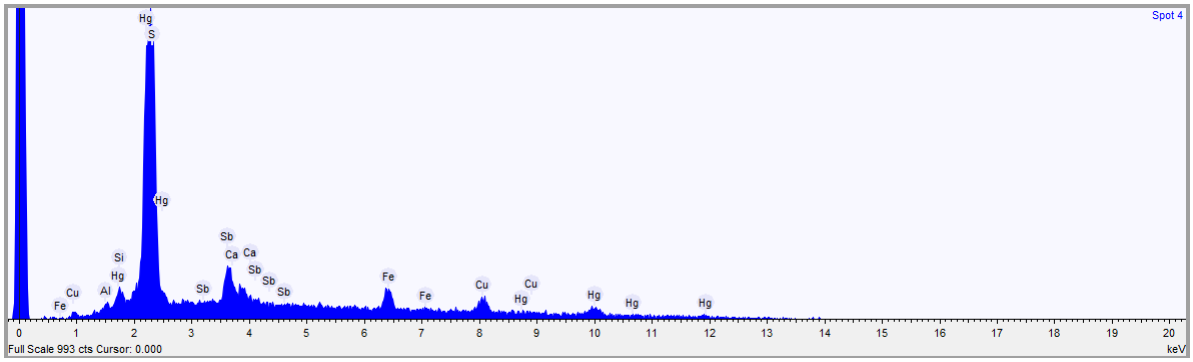
15165	Trench 5	2010				Pigment	limestone poss chalk, softer than fingernail 1 cm	n	-								white		
15193	Trench 5	2010 s		2		Pigment	mostly soil	n	-								red		
15193	Trench 5	2010 s		1		Pigment	red <0.5 cm lumps 2X	n	-								red		
15195	Trench 5	2010 s		1		Pigment	red pink and white aggregate 5-6 cm smooth curved surface	y	y, volcanic pipe formation example								red and white	1	
15335	Trench 5	2010				Pigment	dark red <3 cm lump	y	y								red		
15335	Trench 5	2010				Pigment	red, harder than fingernail, white crystalline inclusions, 3 cm	y	y								red	1	
15391	Trench 5	2011 s		3		Pigment	mostly soil with 2-3 bits of reddish fragments <0.5 cm	n	-								grey brown		
15394	Trench 5	2011 x	1			Pigment	aggregate of white and light red, harder than fingernail, rock, 4 cm	y	y								white and light red		
16820	Trench 5	2008				Pigment	red <1cm lumps	n	-								red		
16939	Trench 5	2011 x	3			Pigment	orange-red with white depression when scratched, softer than fingernail, 3 cm	y	y										
16966	Trench 5	2011 s		5		Pigment	bright yellow lumps 5+, <1 cm	n	-										
16966	Trench 5	2011 s		11		Pigment	mostly soil with 2-3 bits of reddish lumps <0.5 cm	n	-										
16967	Trench 5	2011 s		1		Pigment	large red lump with a few white inclusions4.5 cm, another 2 cm, with powdered pigment and soil in bag. Example of sinter.	y	y										
16967	Trench 5	2011				Pigment	Red with yellow, porous rock, 4 cm	y	y								red and yellow		
13801	Trench 6	2006				Pigment	yellow, bright 3 cm lump with grey soil covering	y	-								yellow		
13846	Trench 6	2006				Pigment	dark red flat, 2 cm	n	poss sedimentary								red		
15556	Trench 8	2008 s		1		Pigment	red homogenous, 3 X and powder with largest 1 cm	n	-								red		
3468	Trench I	2000				Pigment	red < 2cm	y	y								red		,Trench 1.Chalk
3454	Trench I	2000 s		1	4044	Pigment	,0.5 cm piece, fingernail hardness, poss ceramic body frag	n	-								red		
3457	Trench I	2000 X	31			Pigment	dark red 3 cm lump, scratches with fingernail	y	poss sedimentary								red	1	
3461	Trench I	2000 X	1			Pigment	red orange	y	poss sedimentary								red	1	
3464	Trench I	2000				Pigment	red to red orange 2-2.5 cm lumps 4X	y	poss sedimentary								red	1	
3476	Trench I	2000 X	23			Pigment	red large lump 4 cm, of ochre with smaller frags,	y	poss sedimentary								red	1	
3476	Trench I	2000 X	24			Pigment	red rock 3 cm, softer than nail	y	poss sedimentary								red		
7211	Trench I	2001				Pigment	bright yellow lumps 5+, <1 cm	n	-								yellow		
6525	West	2000 s		2	4232	Pigment	red orange 0.25 cm ~5X	n	-								red		,Trench 1.Chalk
7738	West	2003 s		2	5576	pigment	red orange,1 cm	n	y								red	1	,Trench 1.Chalk
7780	West	2003			5642	malachite	green rock			1	2 high	n	no				green	1	,Trench 1.Chalk
15359	West	2011 s		4		Pigment	red paint layer in plaster frag, 1.5 cm	n	-										,Trench 5.Chalk
9009	West	2003 X	1			Pigment	blue obj	n	-								blue		Trench 1, Chalk

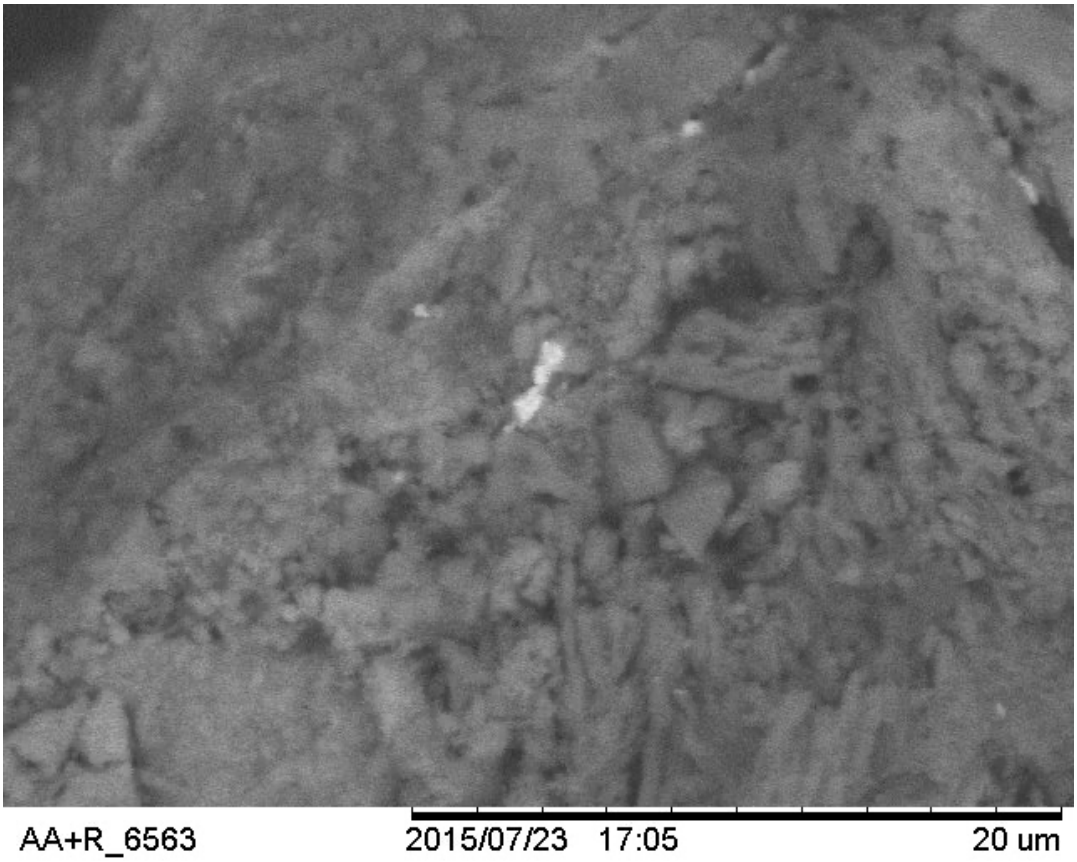
Appendix VIII

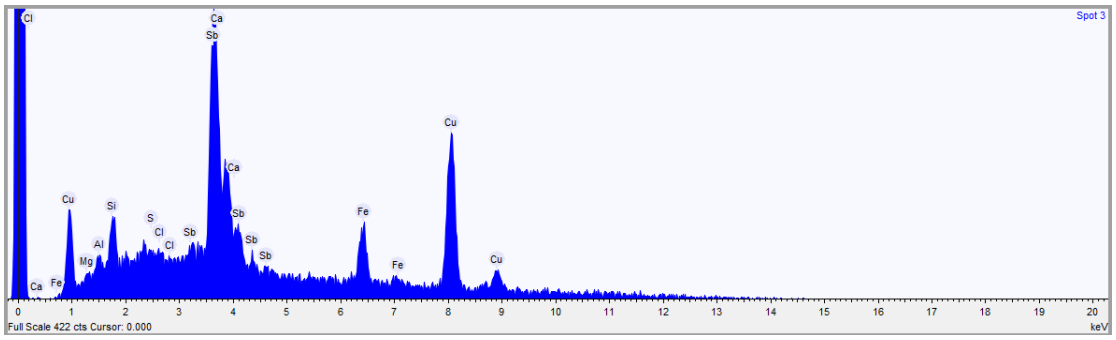
SEM Results for Çatalhöyük samples

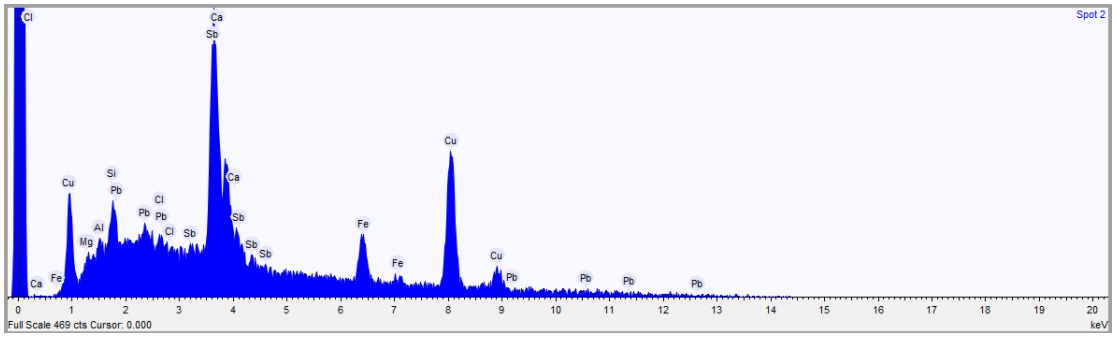
Results for Blue Pigment Samples from Çatalhöyük

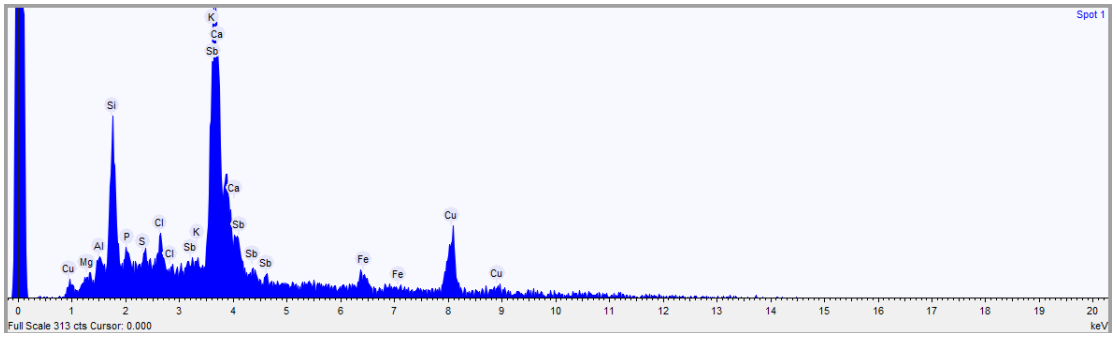
Sample from Unit 16308



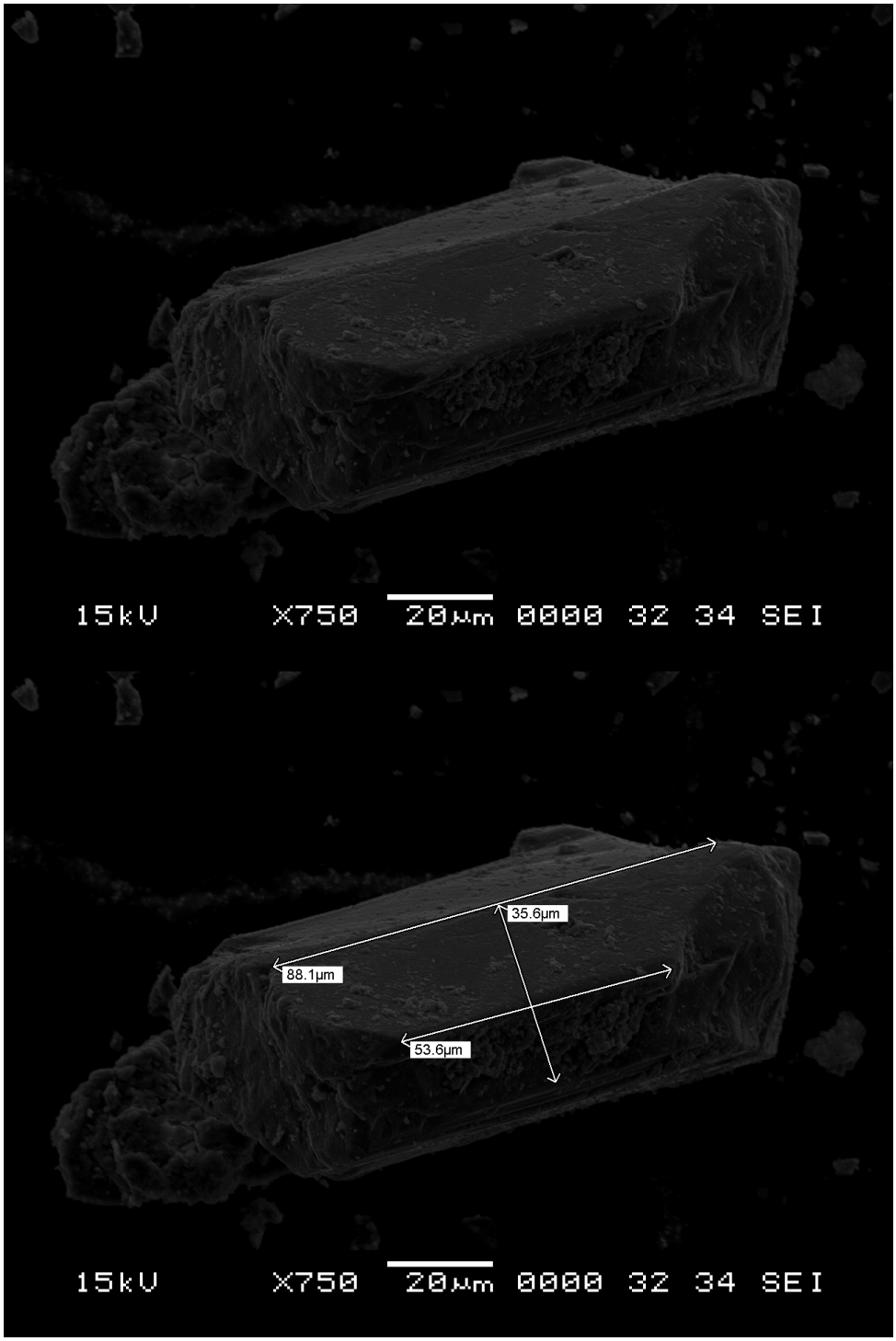


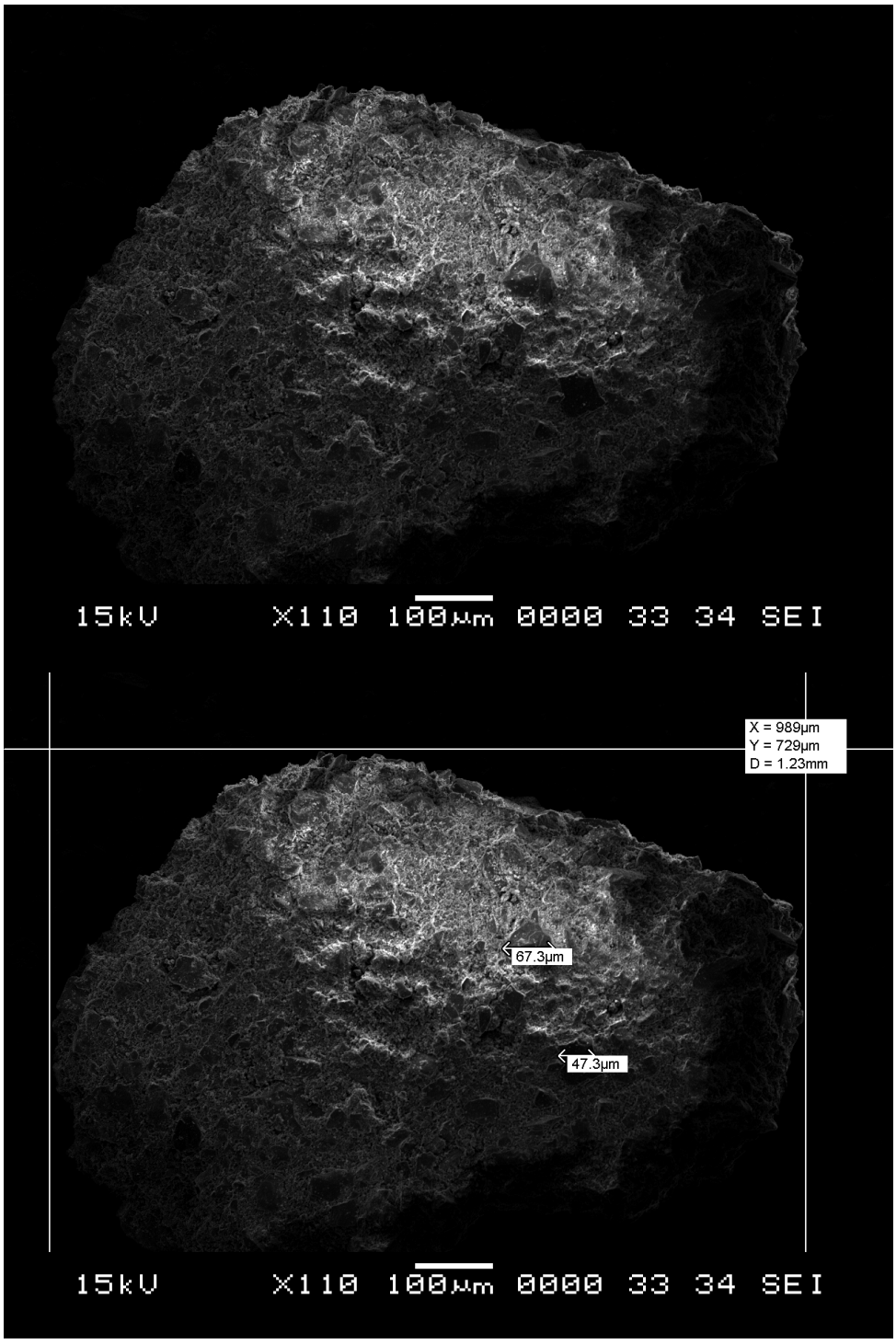

Spot 3
Cl
Ca
Sb
Cu
Ca
Cu
Si
S
Cl
Sb
Sb
Sb
Sb
Fe
Al
Cl
Mg
Fe
Cu
Ca
Fe
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Full Scale 422 cts Cursor: 0.000
keV

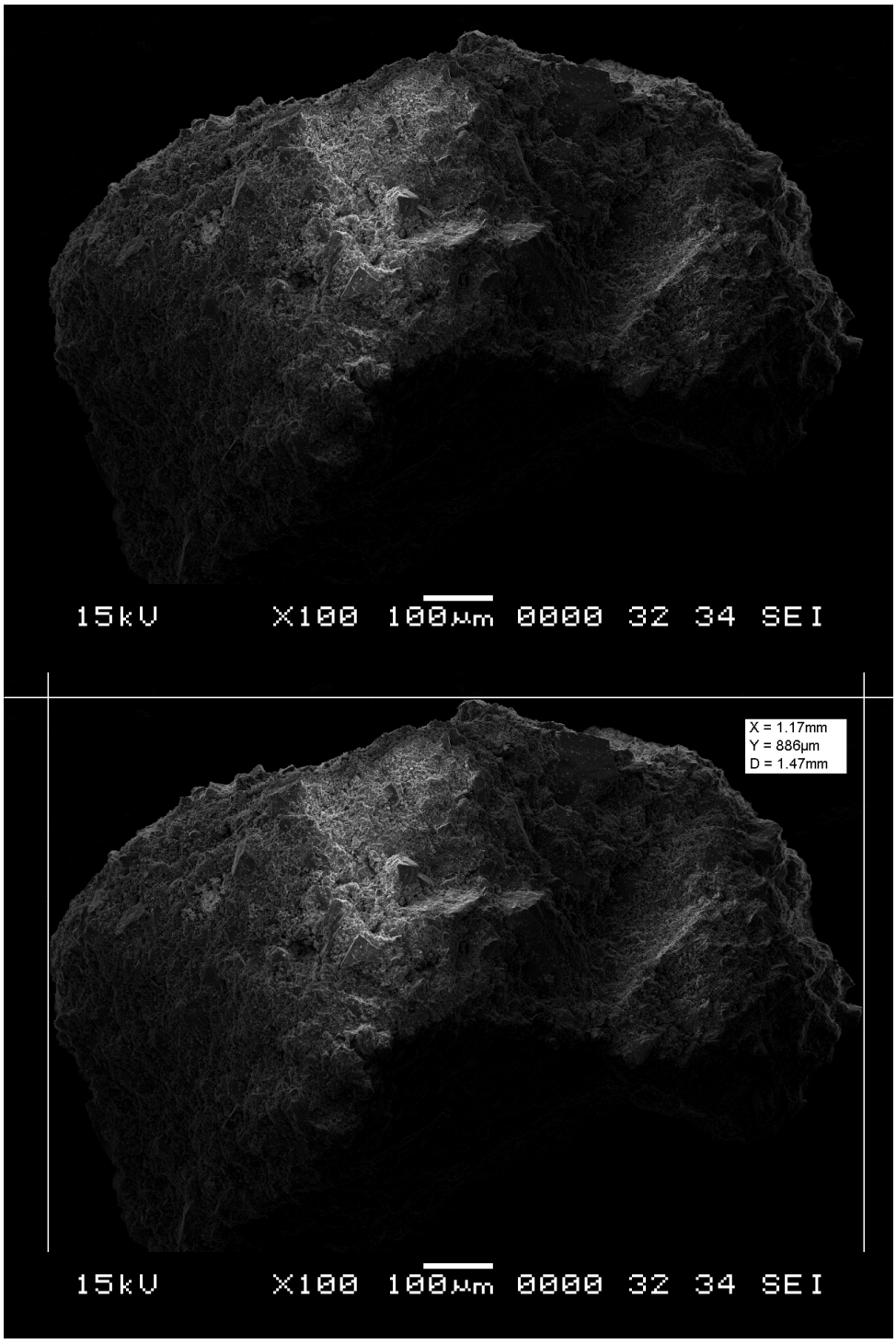

Spot 2
Cl
Ca
Sb
Cu
Si
Ca
Cu
Pb
Cl
Pb
Pb
Sb
Al
Cl
Sb
Sb
Sb
Fe
Mg
Fe
Cu
Ca
Fe
Pb
Pb
Pb
Pb
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Full Scale 469 cts Cursor: 0.000
keV

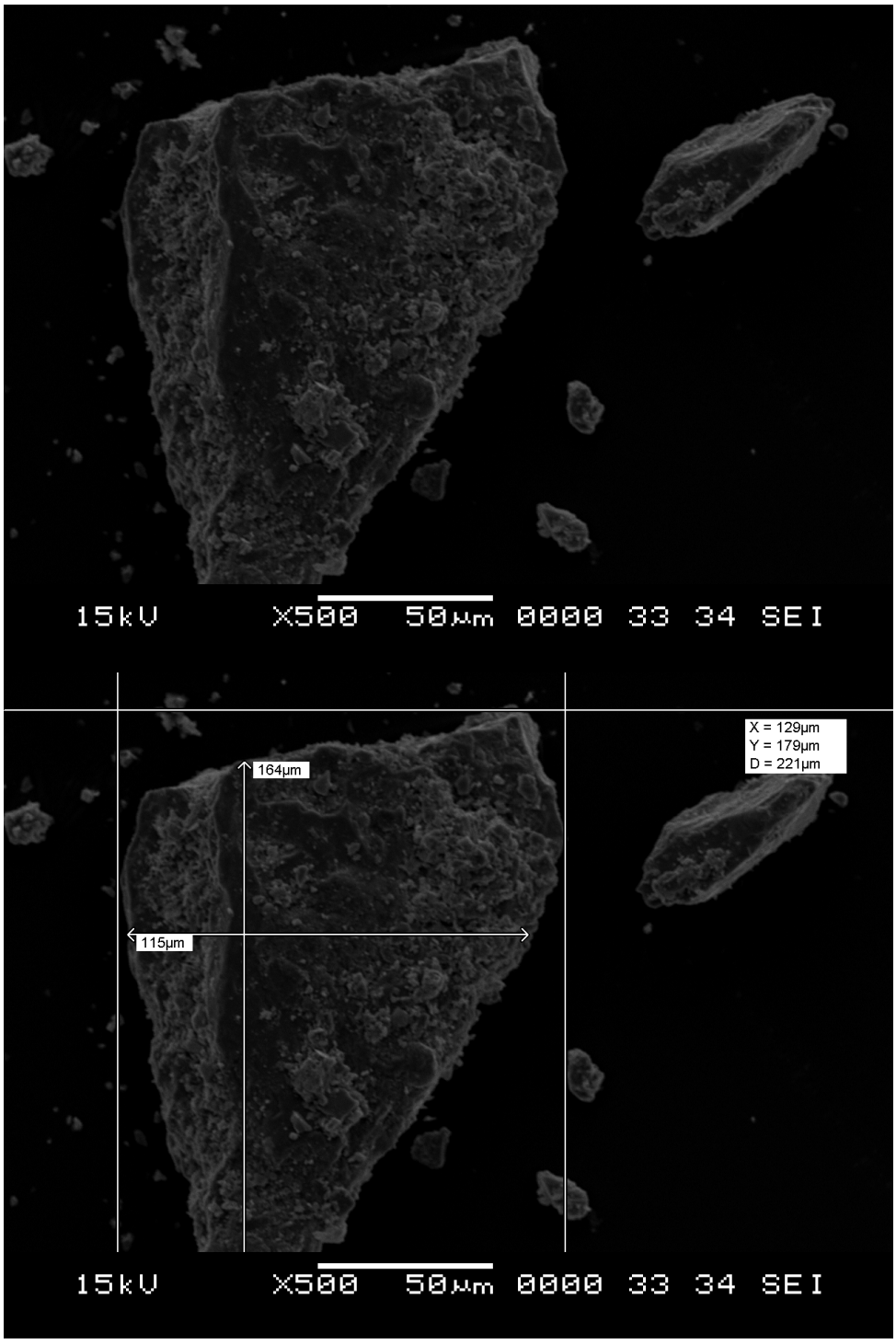

Spot 1
K
Ca
Sb
Si
Ca
Cu
Cl
K
Sb
Al
P
S
Sb
Sb
Sb
Cu
Mg
Cl
Sb
Fe
Fe
Cu
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Full Scale 313 cts Cursor: 0.000
keV

Blue SEM unit 7575

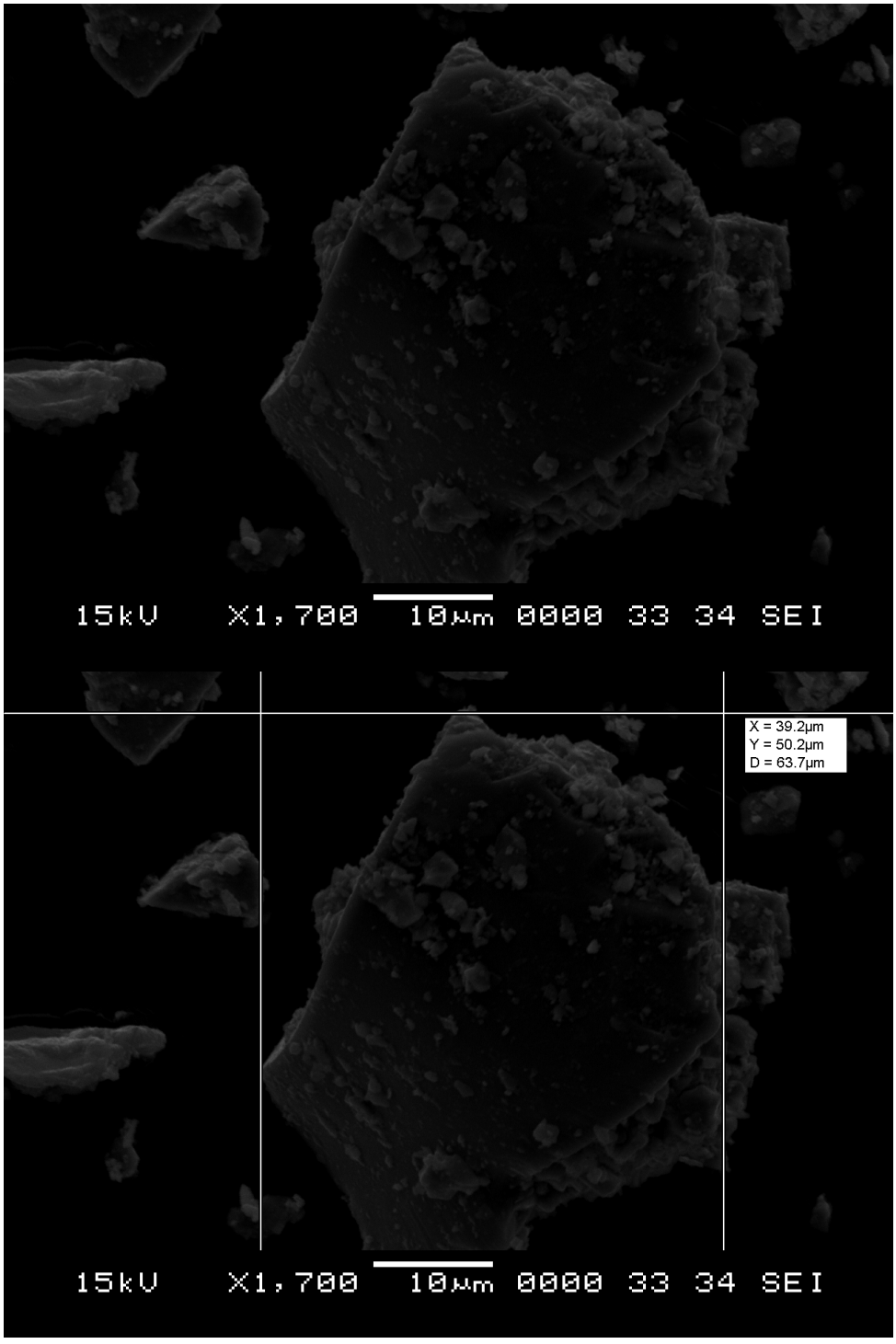


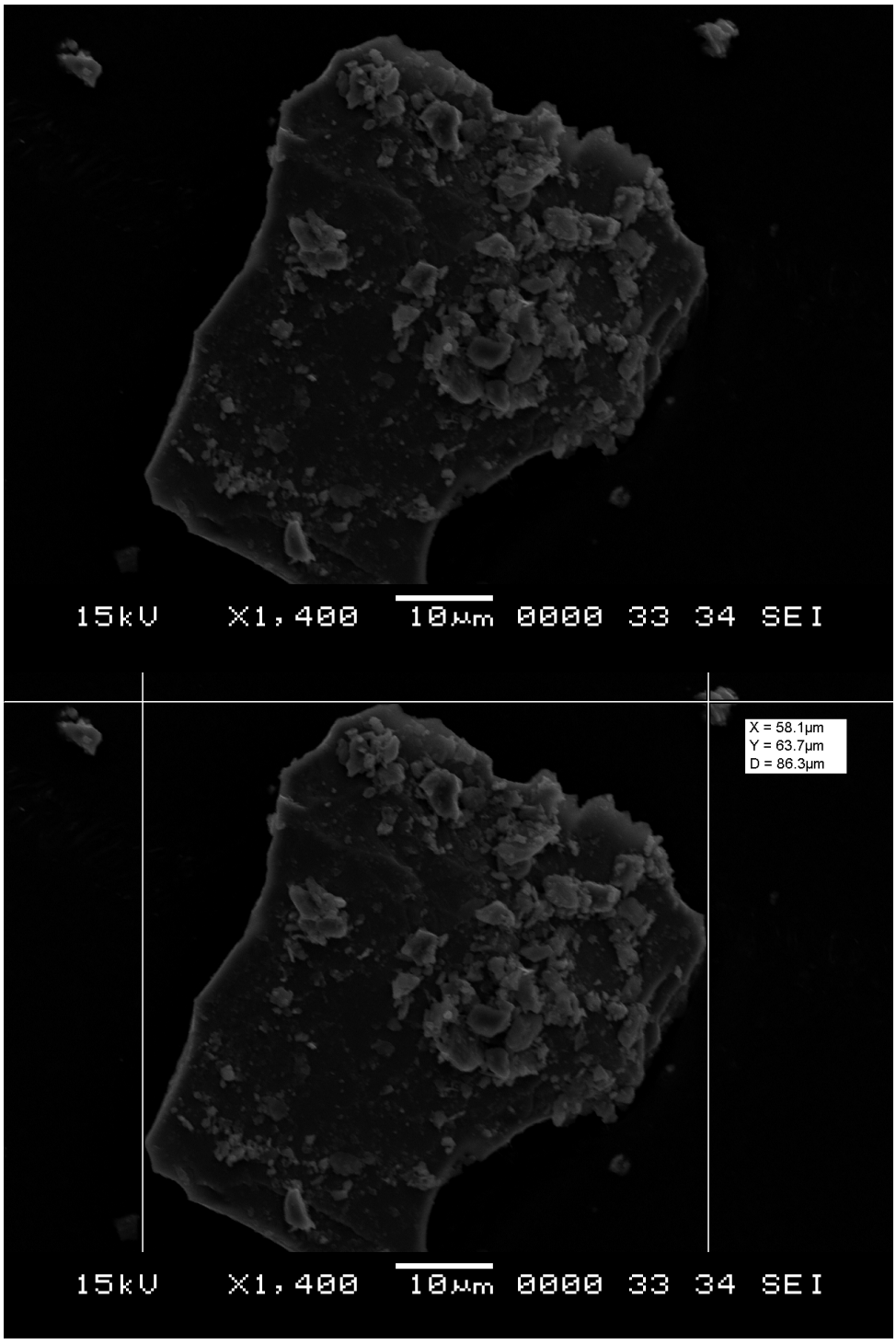

15kV X110 100µm 0000 33 34 SEI
X = 989µm
Y = 729µm
D = 1.23mm
67.3µm
47.3µm
15kV X110 100µm 0000 33 34 SEI


15kV X100 100µm 0000 32 34 SEI
X = 1.17mm
Y = 886µm
D = 1.47mm
15kV X100 100µm 0000 32 34 SEI


15kV X500 50µm 0000 33 34 SEI
164µm
115µm
X = 129µm
Y = 179µm
D = 221µm
15kV X500 50µm 0000 33 34 SEI

Blue SEM unit 19447

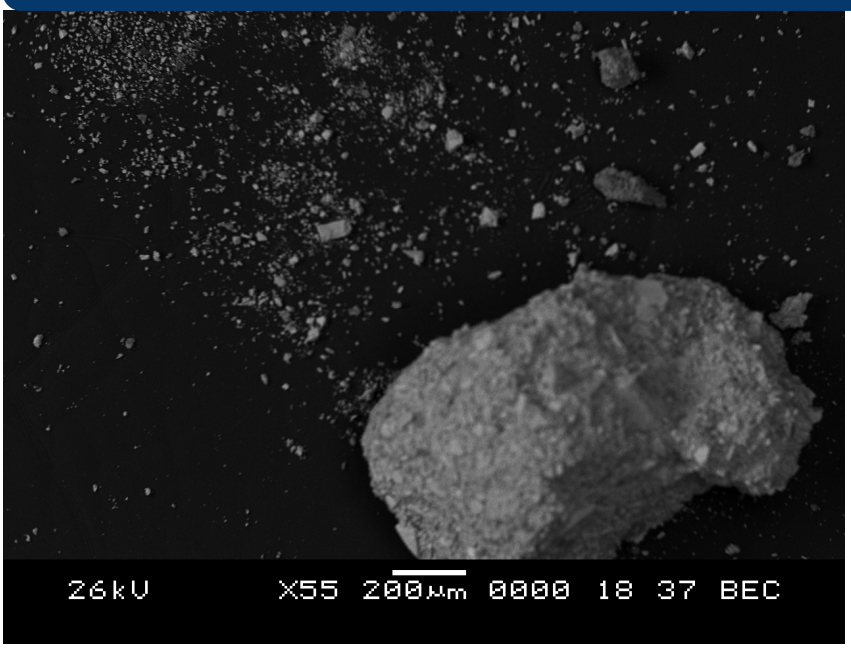


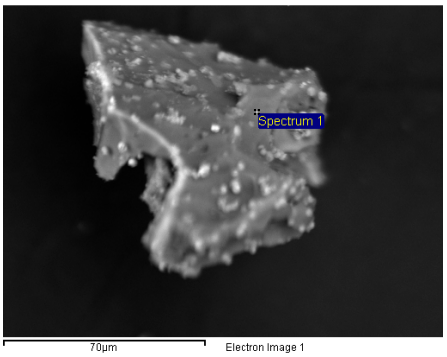

15kV X1,400 10µm 0000 33 34 SEI
X = 58.1µm
Y = 63.7µm
D = 86.3µm
15kV X1,400 10µm 0000 33 34 SEI

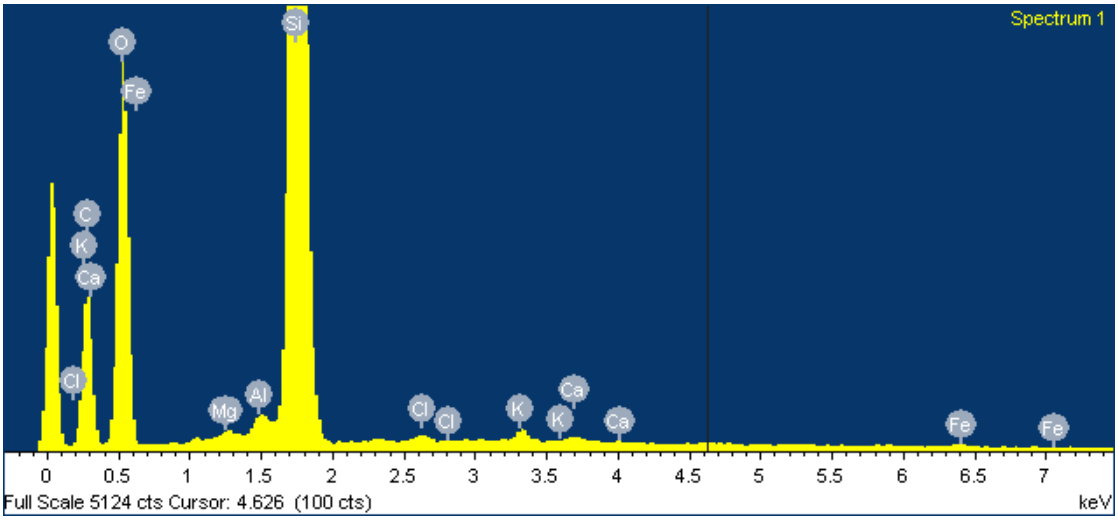
SEM unit 17339

CHLevelV. South P powders, bone

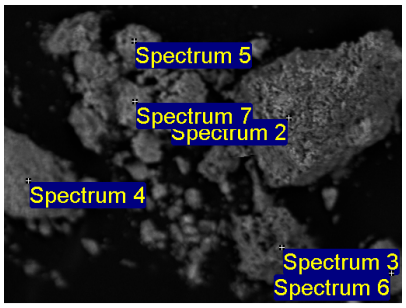
06/11/2013 13:38:29



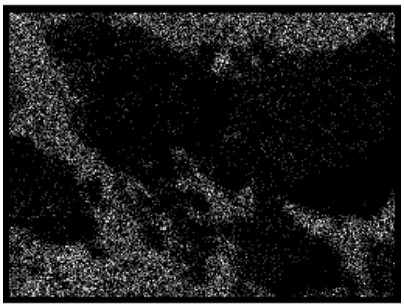


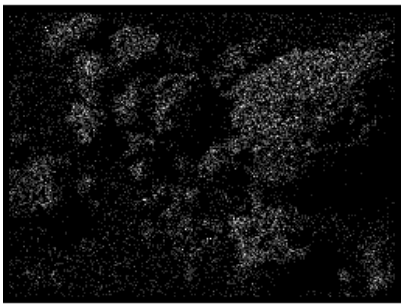


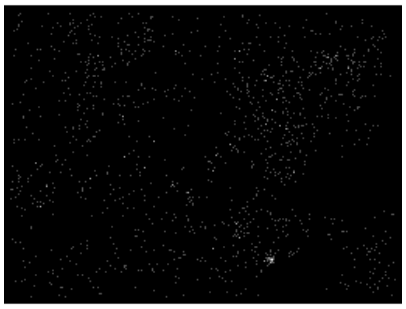
Comment: 17339

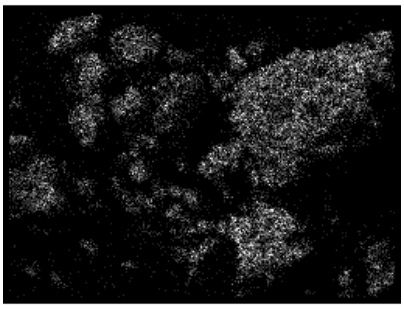


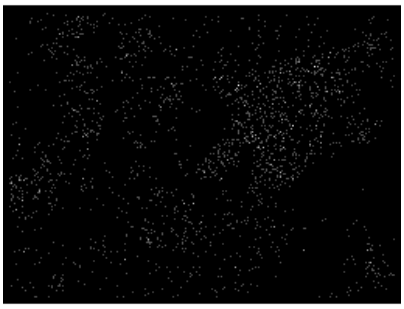
Electron Image 1

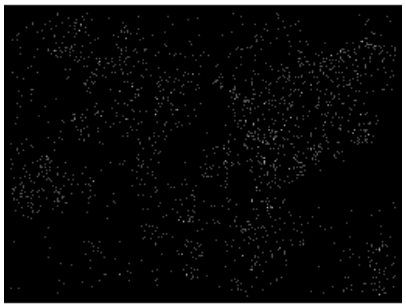

C Ka1_2


O Ka1

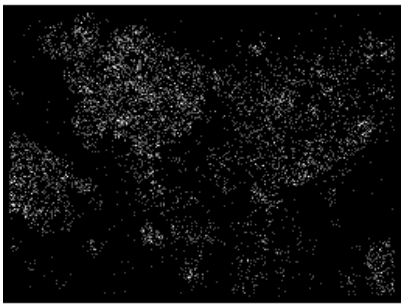

Al Ka1


Si Ka1

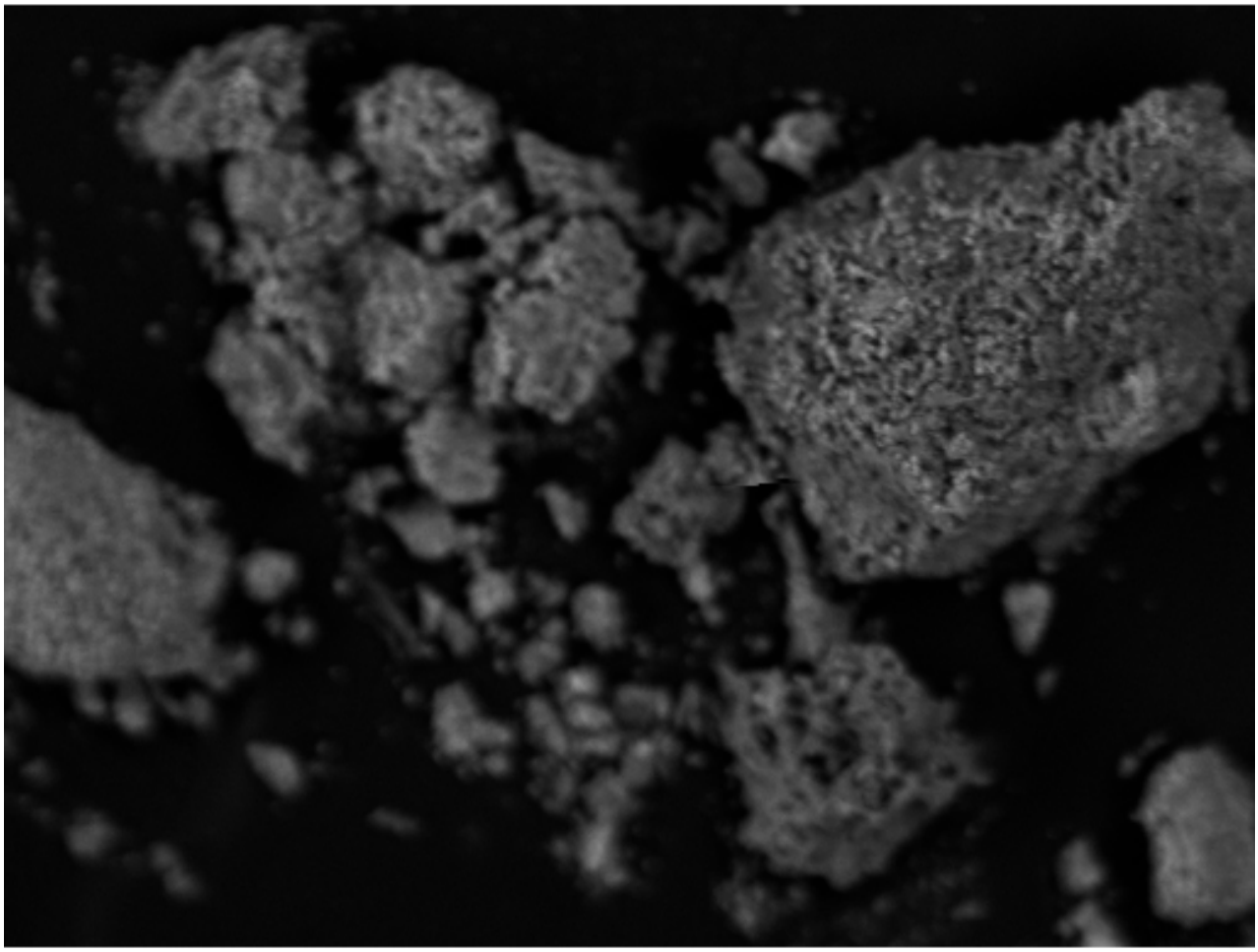

S Ka1


K Ka1

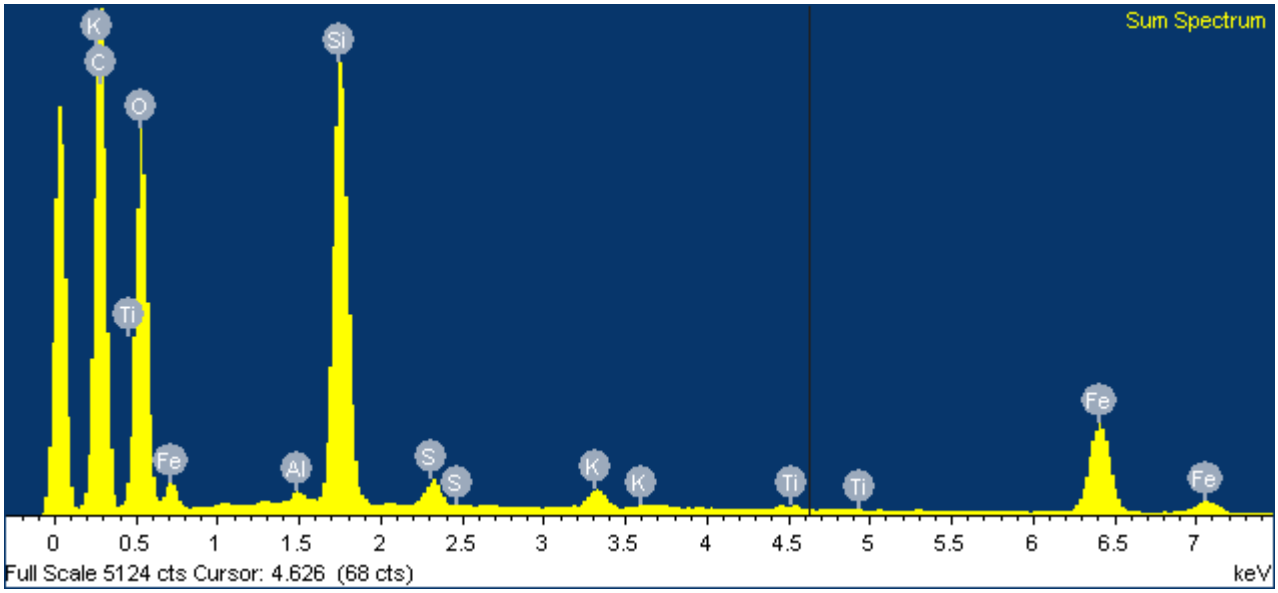

Ti Ka1


Fe Ka1

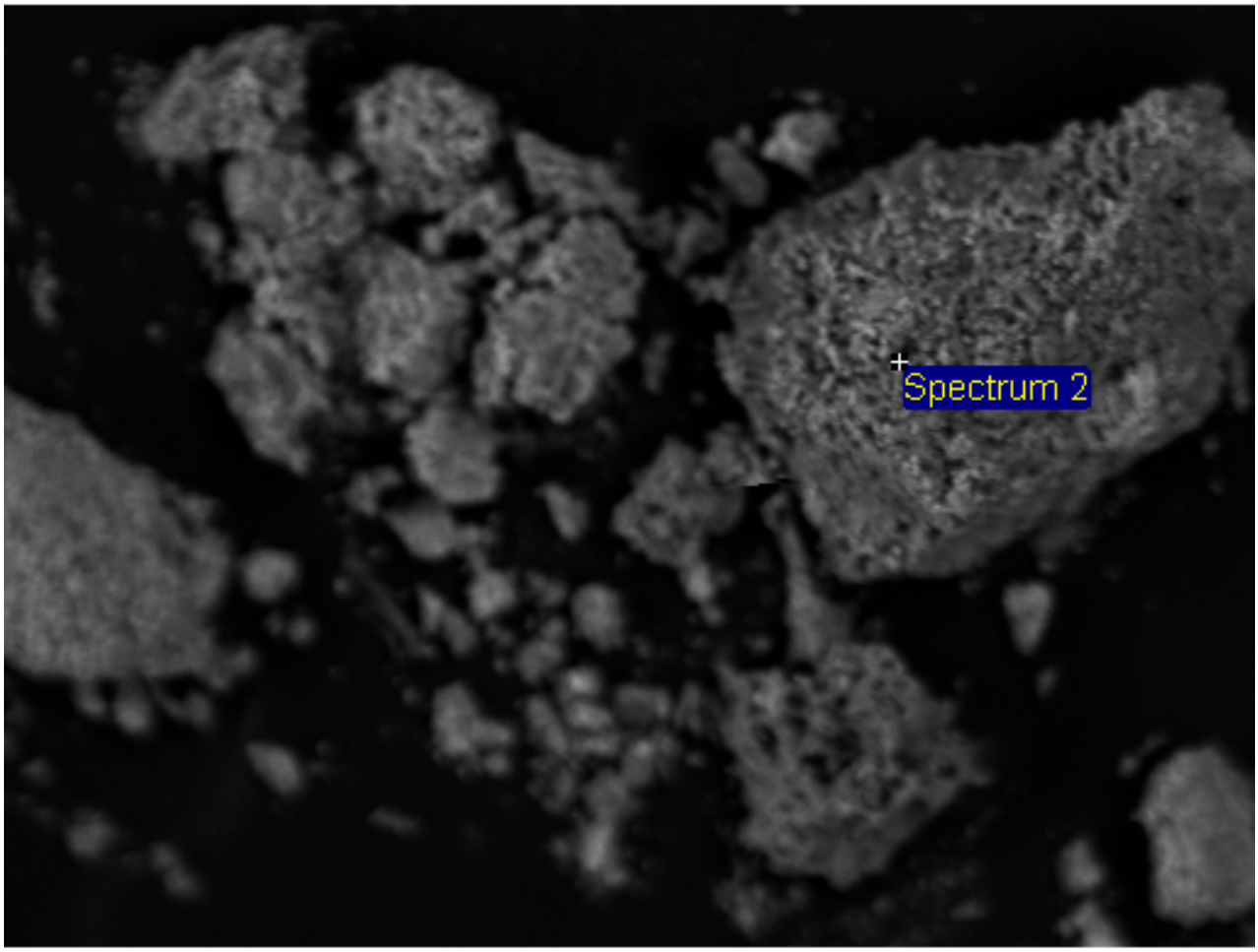
Comment: 17339

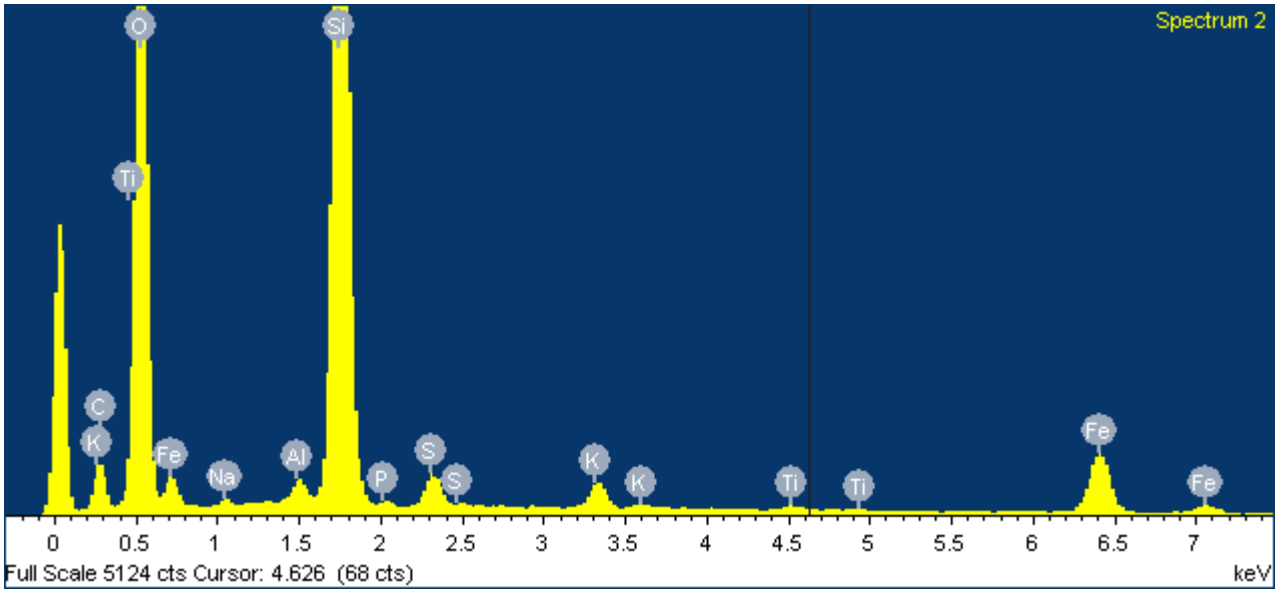


Electron Image 1

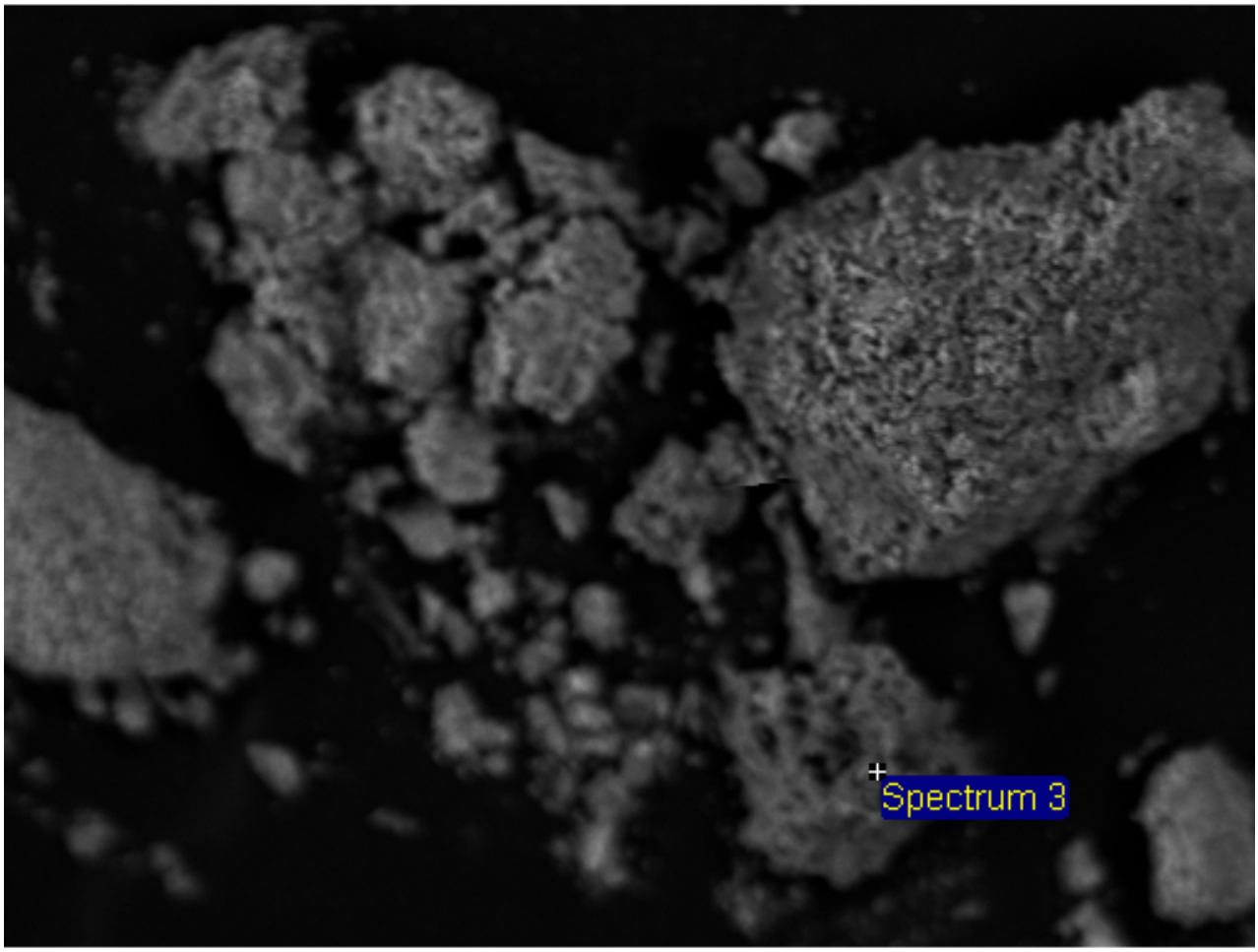


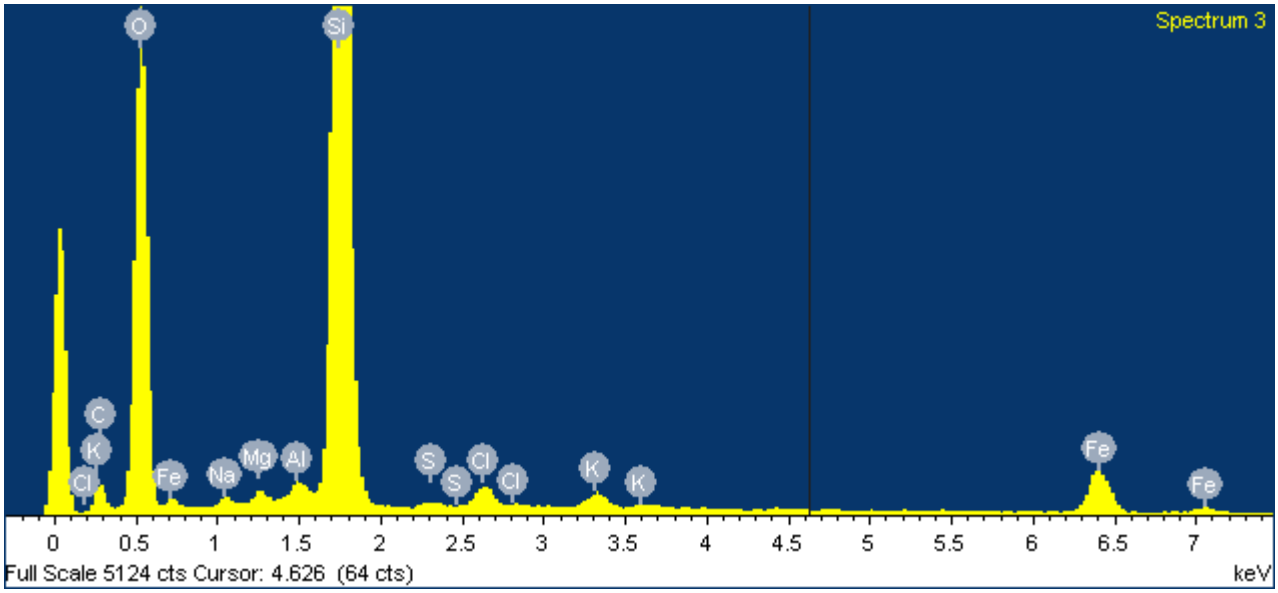
Comment: 17339





Comment: 17339

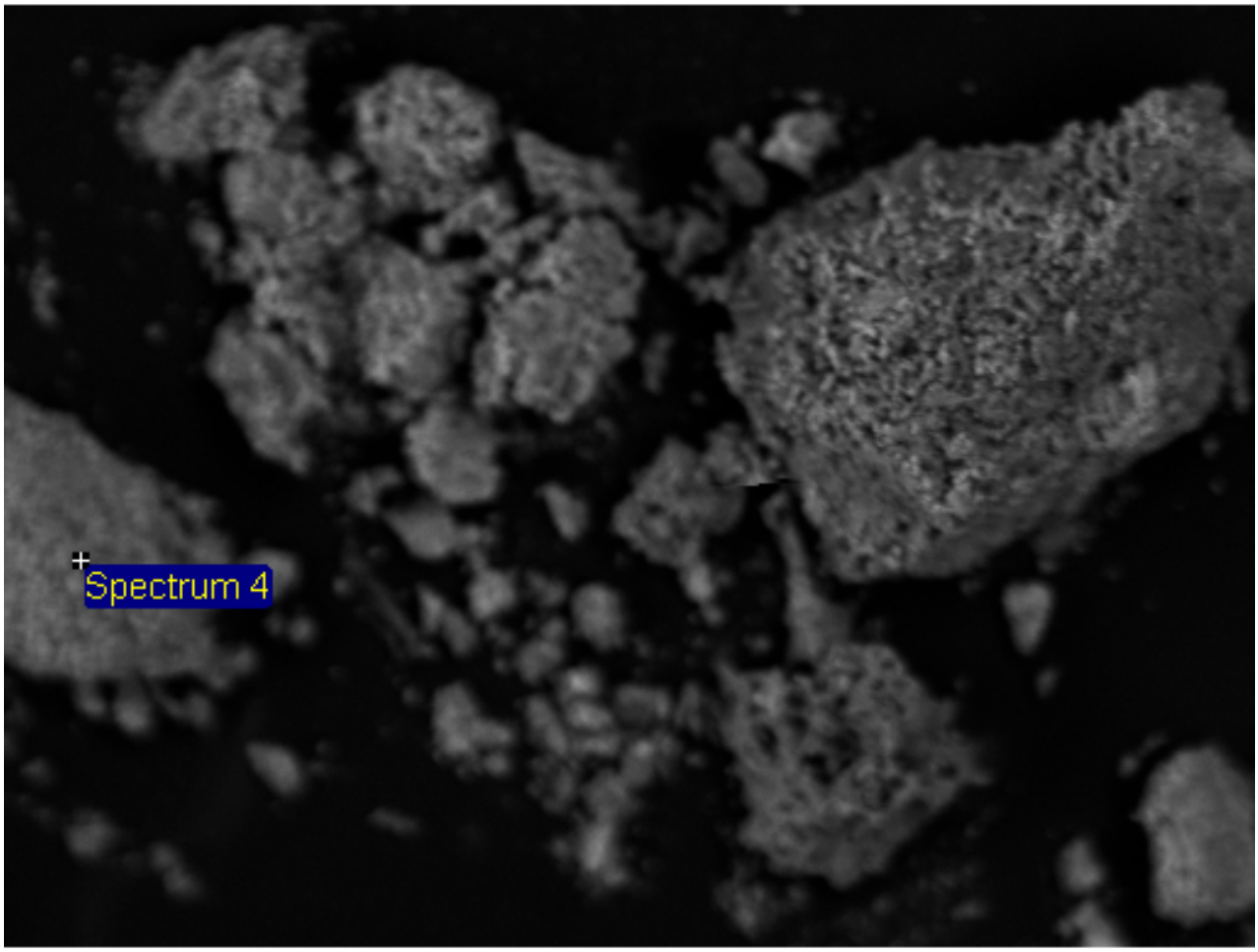


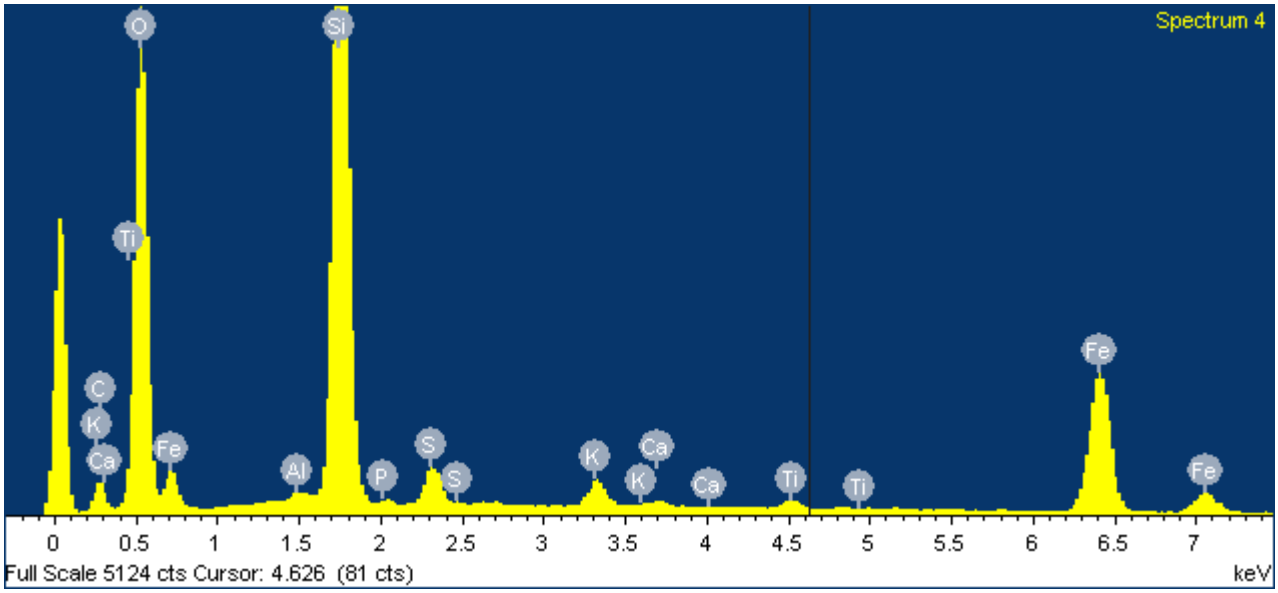


Comment: 17339

CHLevelV.South P powders, bone

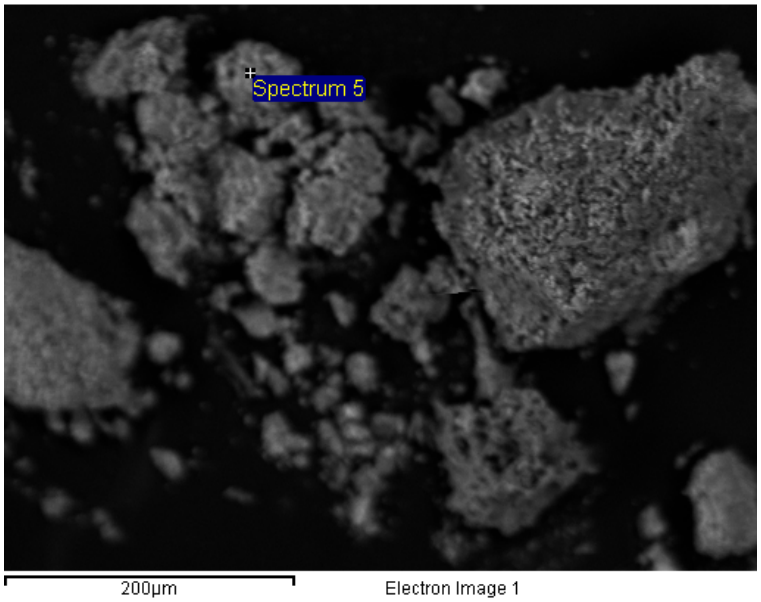
06/11/2013 13:39:29

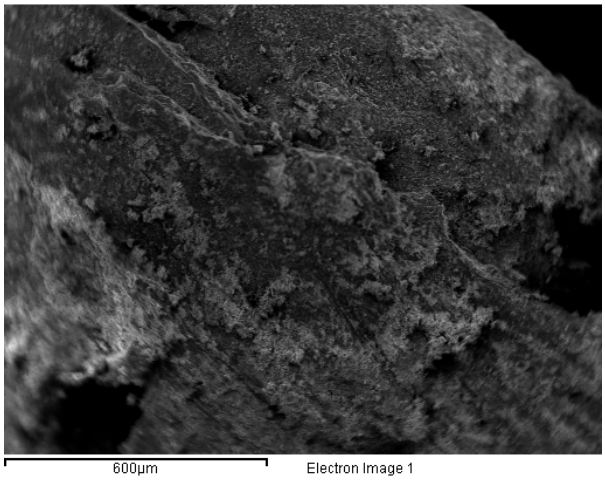


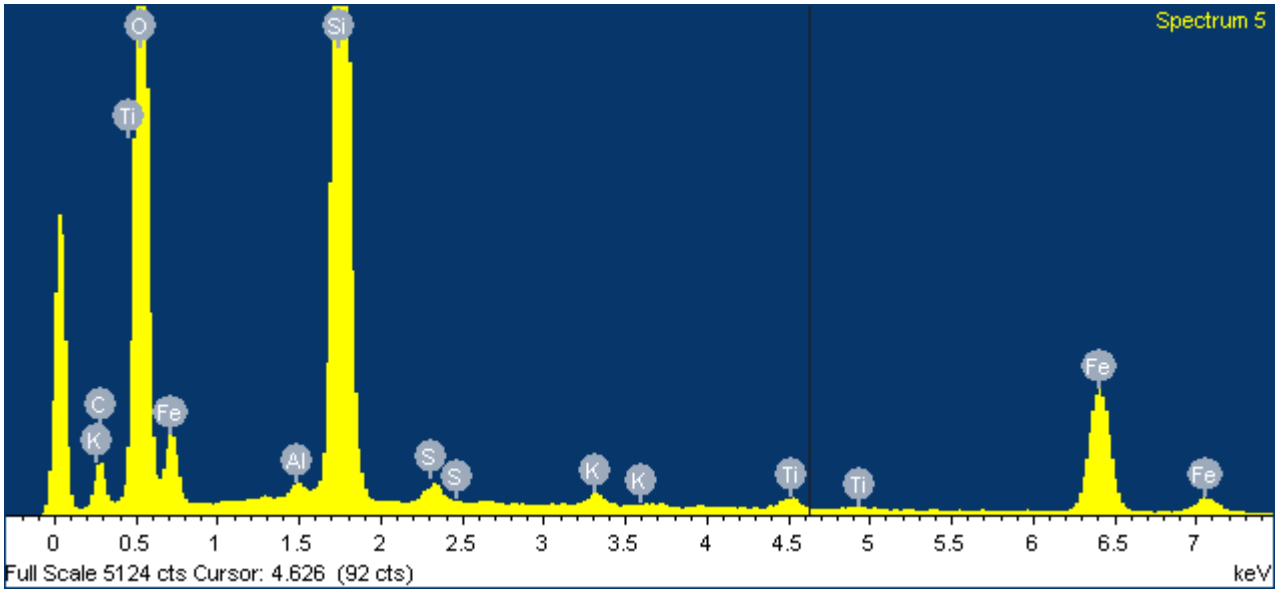


Comment: 17339

INCA



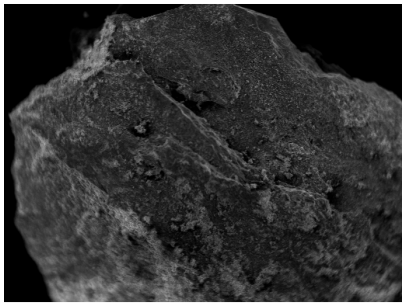




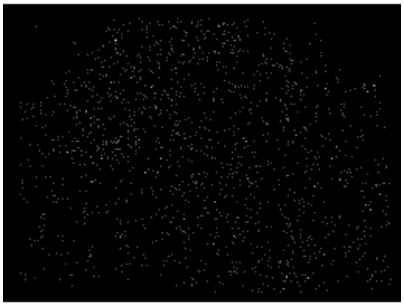
Comment: 17339

Blue bone 12450

CHLevelV.South P powders, bone

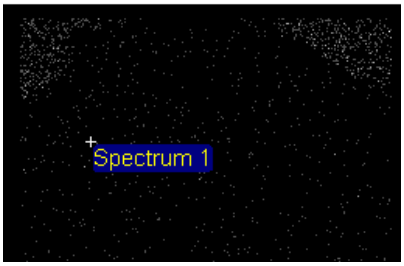


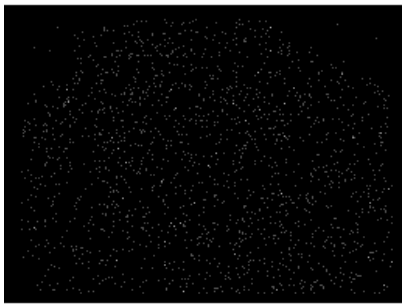
Electron Image 1



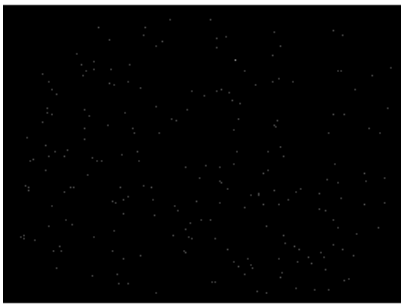
P Ka1



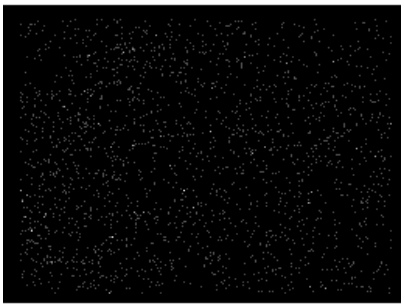




Ca Ka1

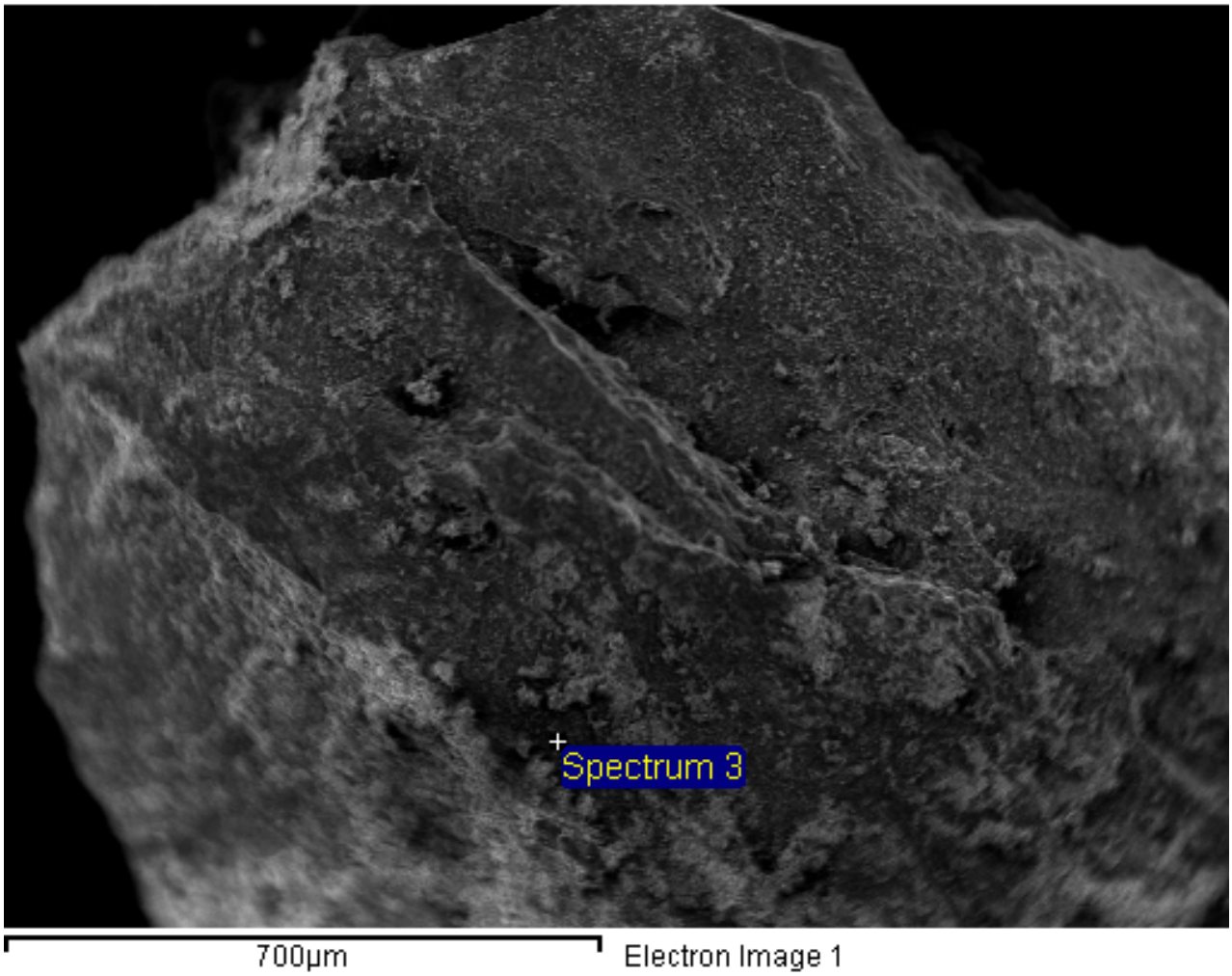


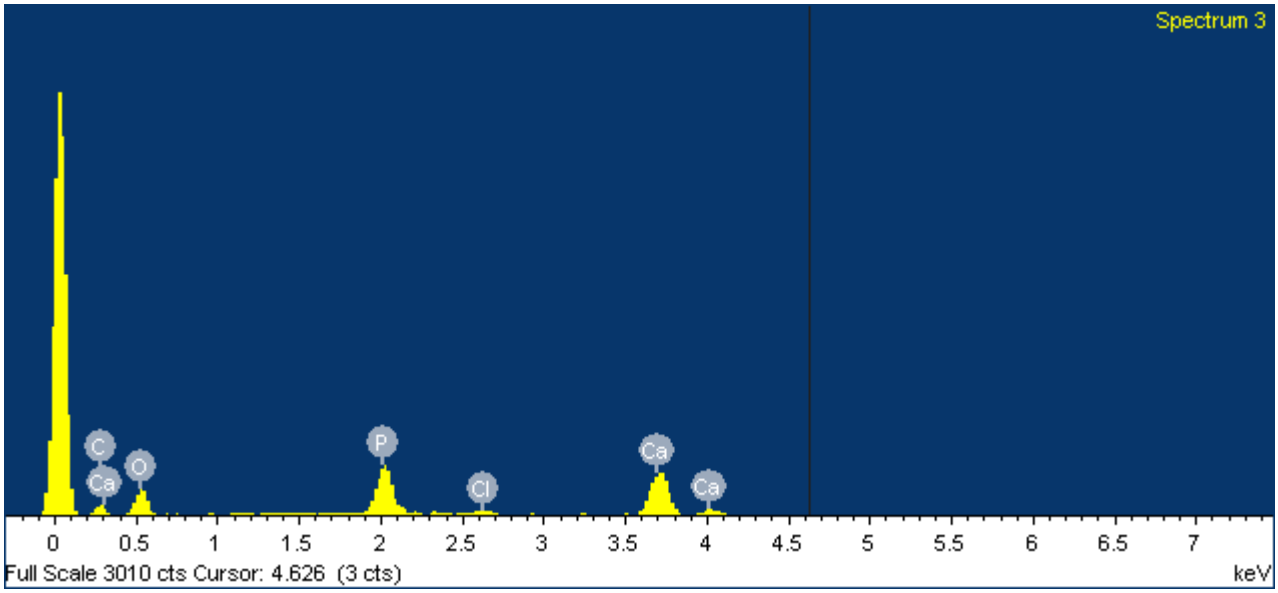
Cl Ka1



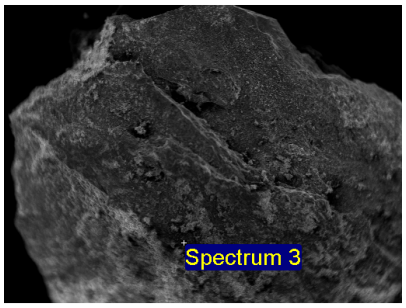
O Ka1

Comment:12450 bone

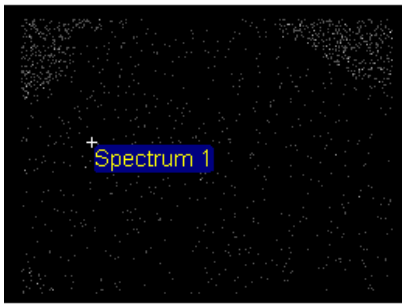




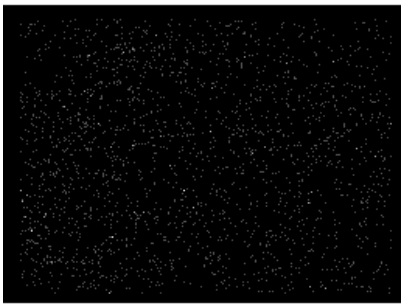
Comment:12450 bone

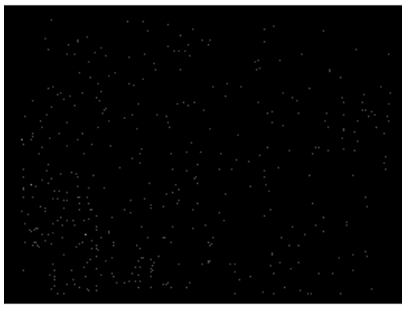


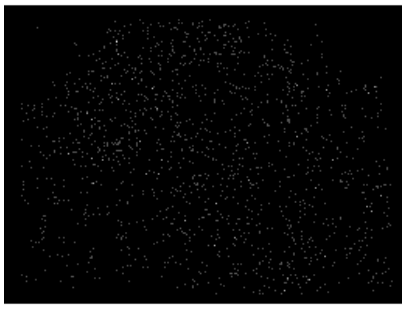
Electron Image 1

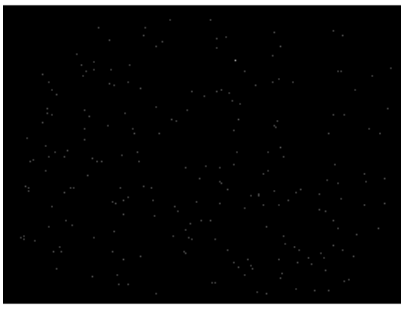


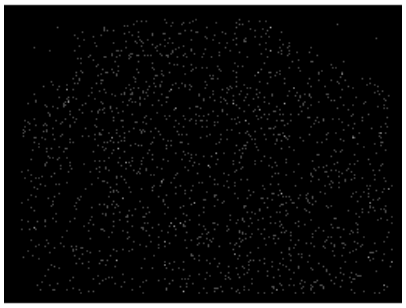
C Ka1_2


O Ka1

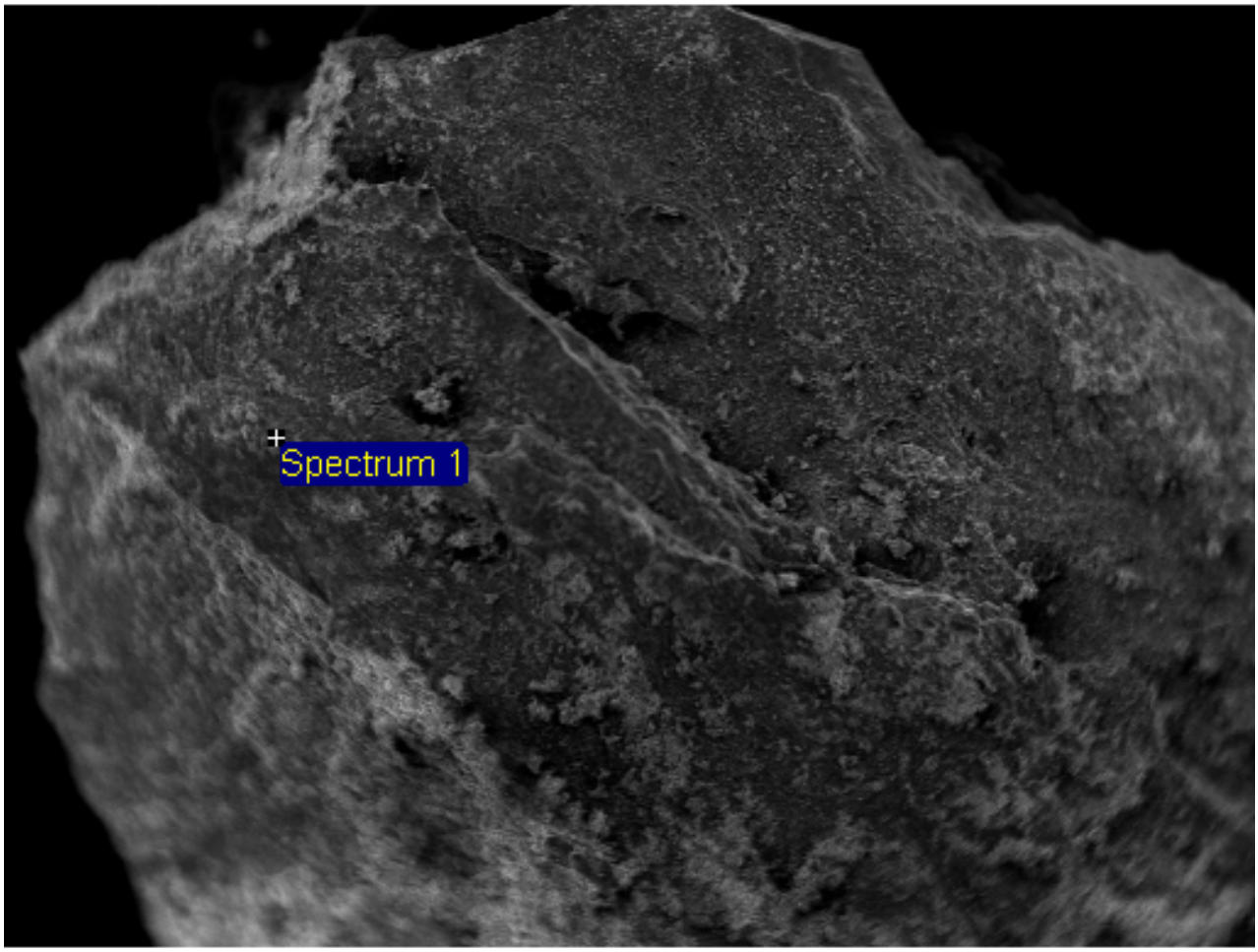

Si Ka1

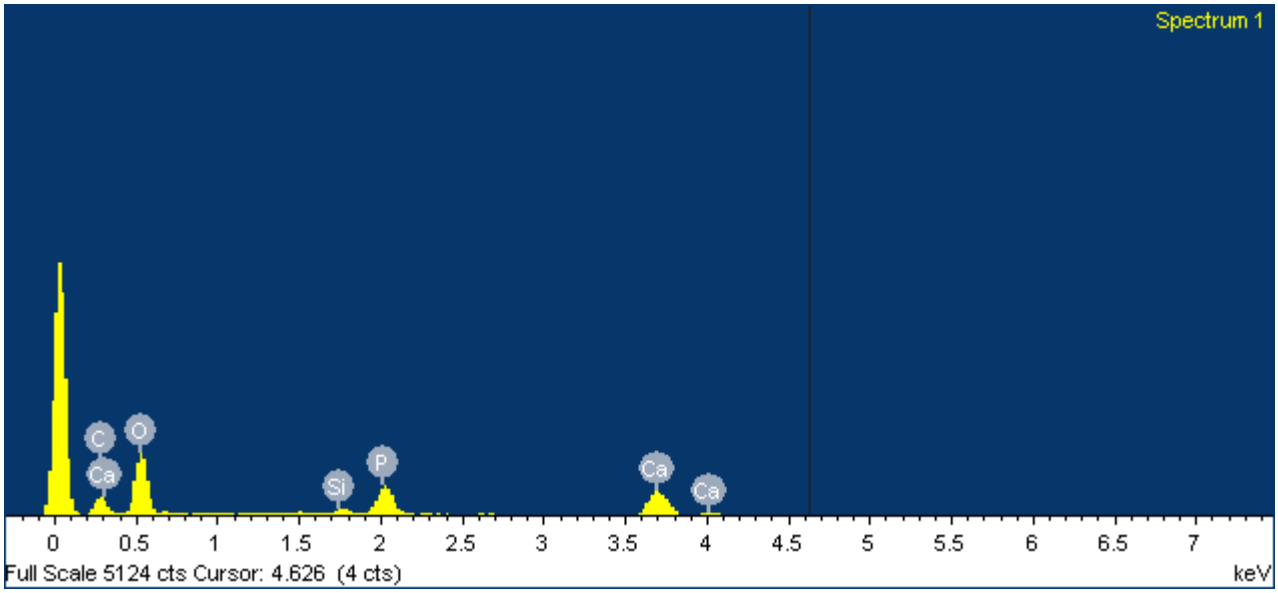

P Ka1


Cl Ka1

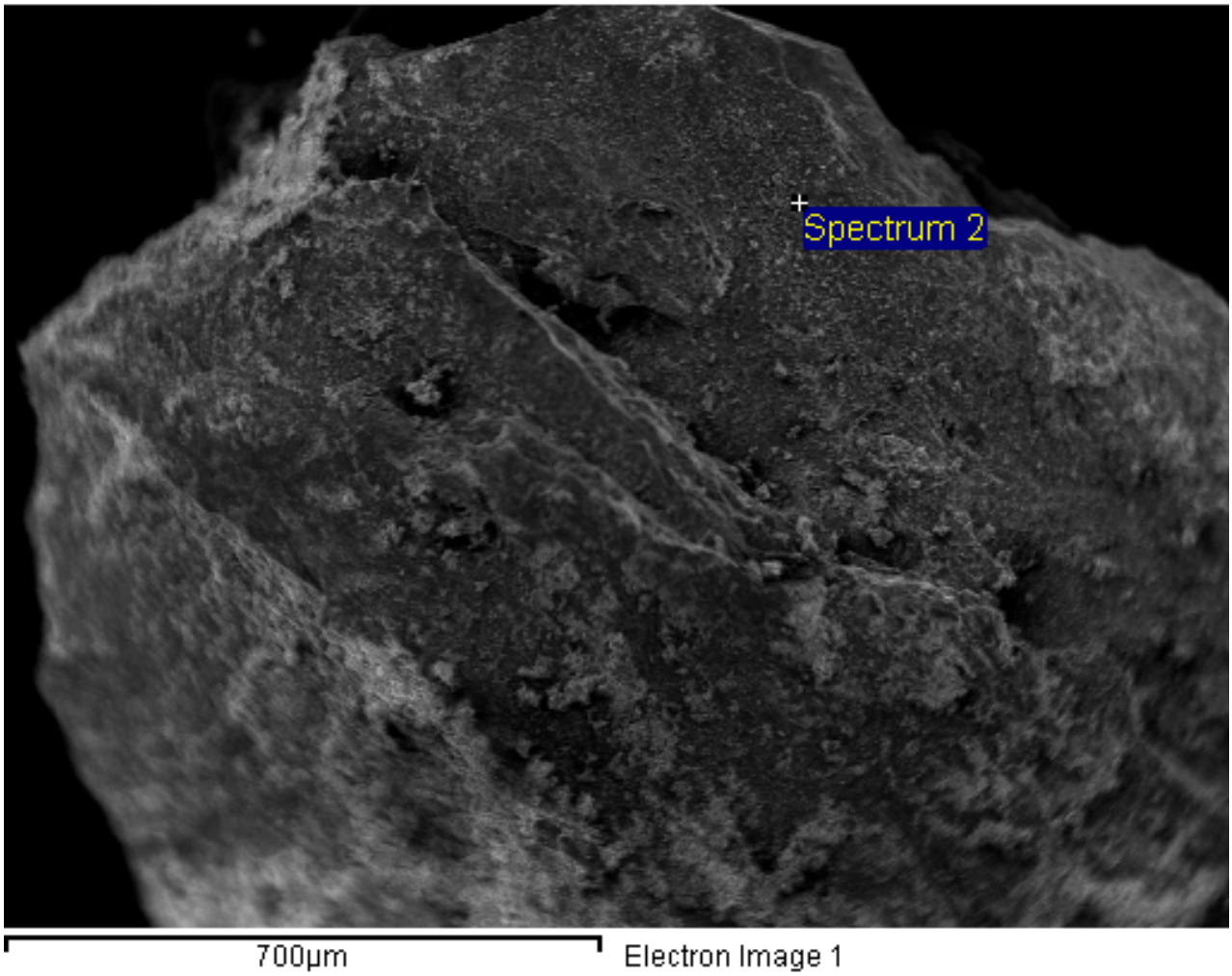

Ca Ka1

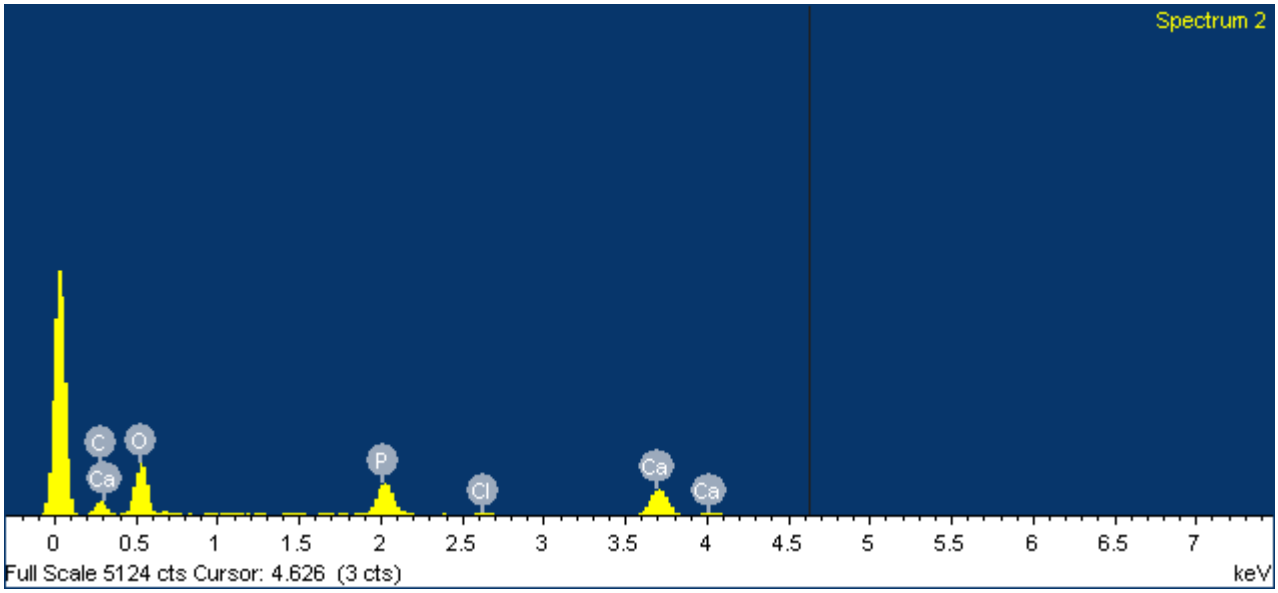
Comment:12450 bone
C, O, Si, P, Cl, Ca



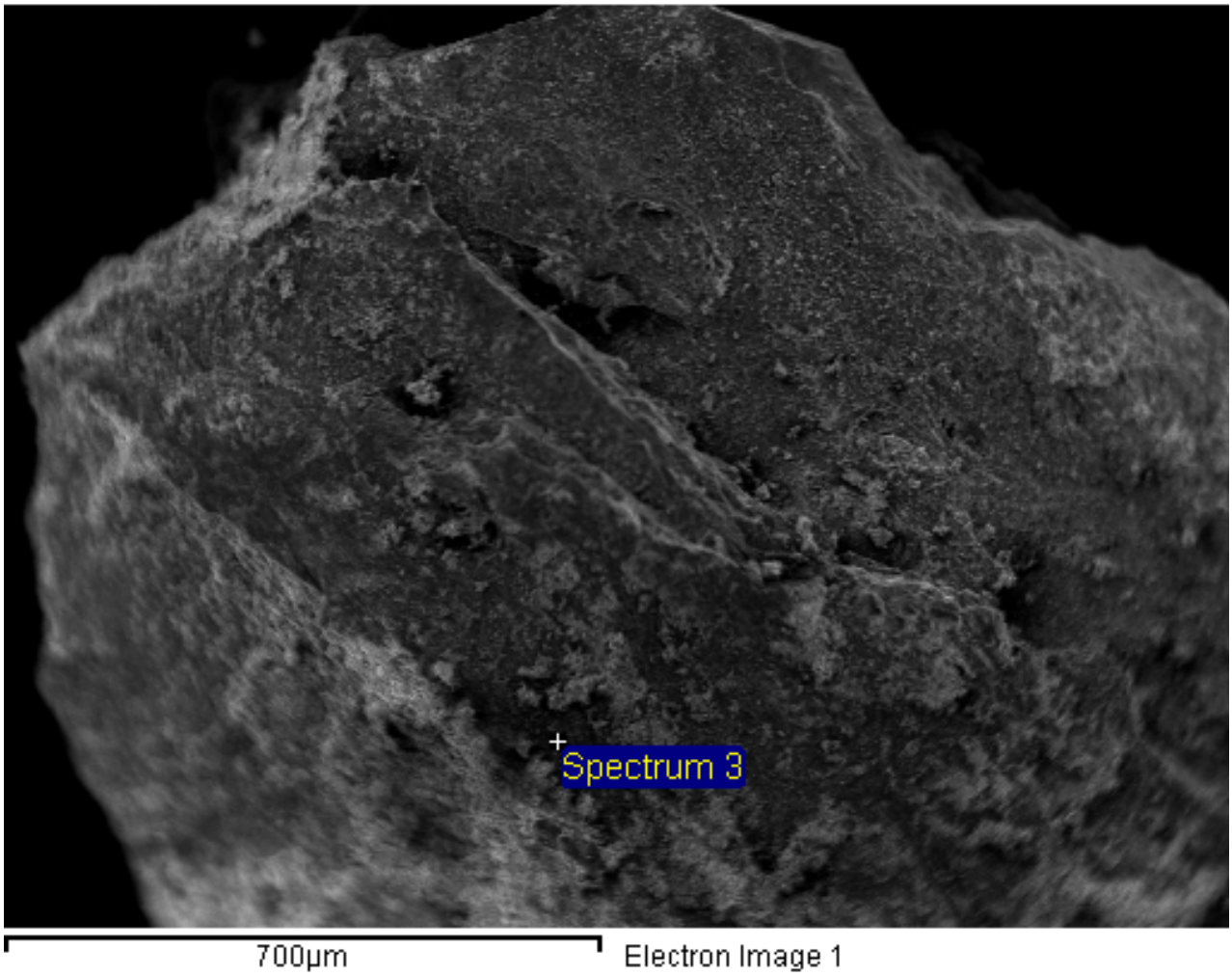


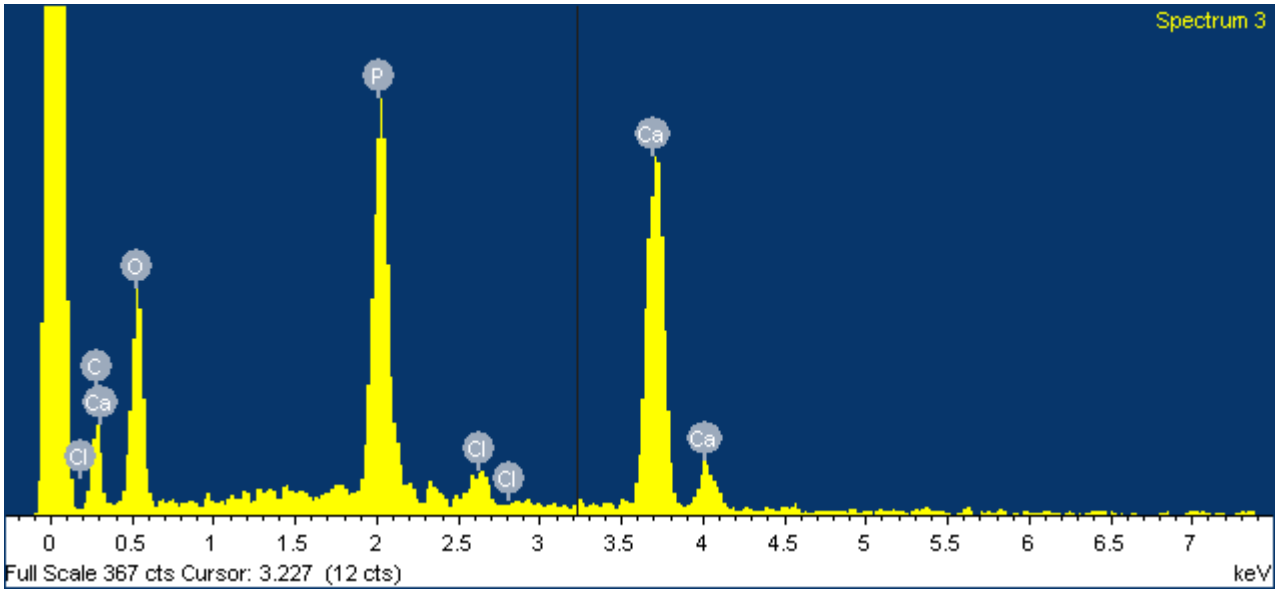
Comment:12450 bone
C, O, Si, P, Cl, Ca



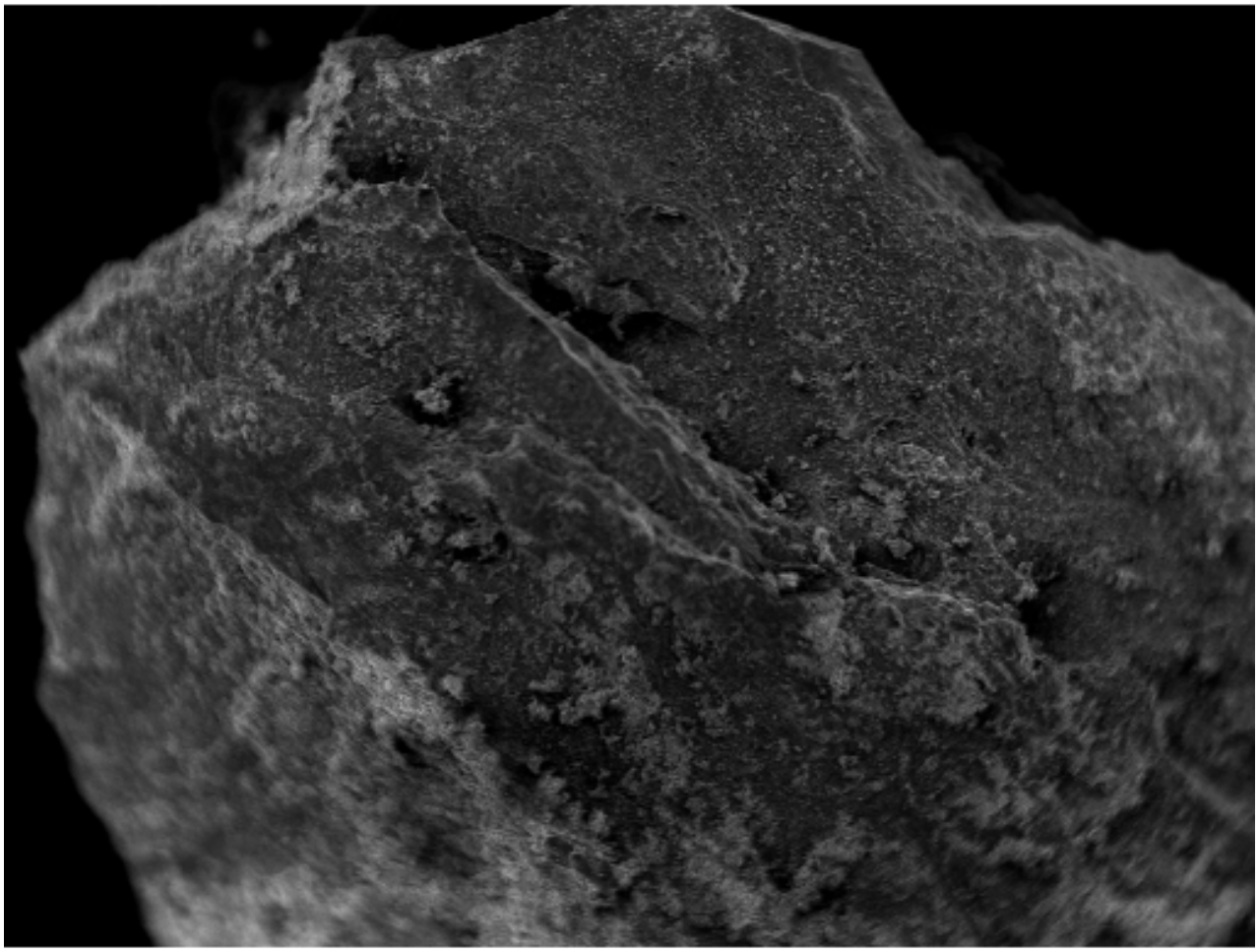


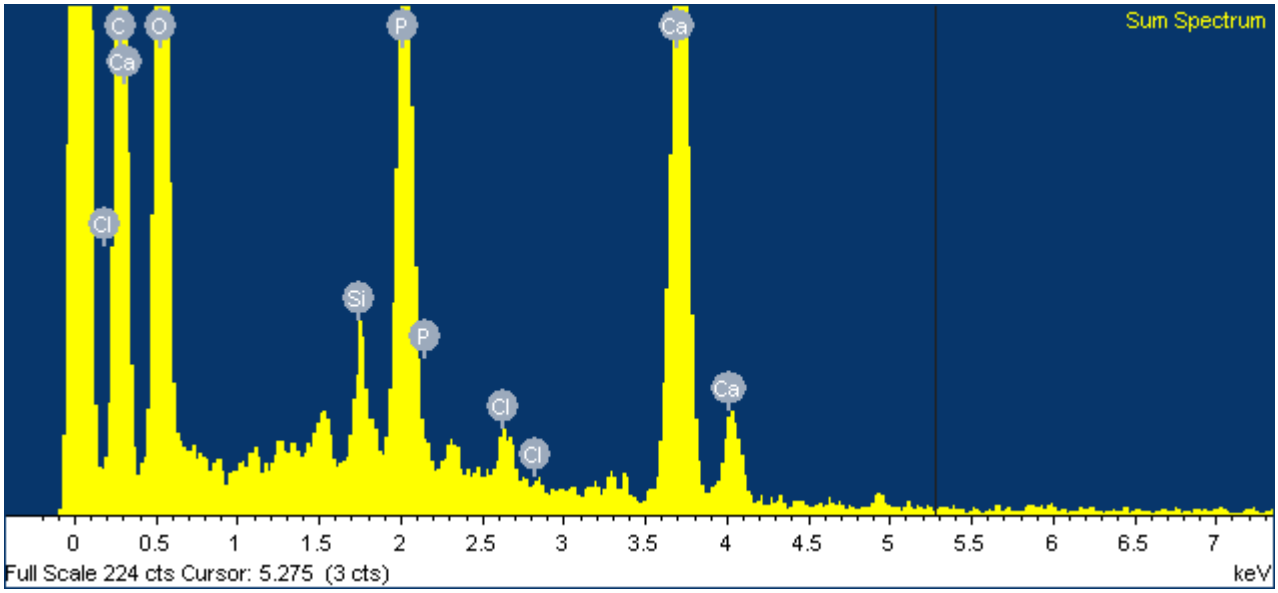
Comment:12450 bone
C, O, Si, P, Cl, Ca





Comment:12450 bone
C, O, Si, P, Cl, Ca



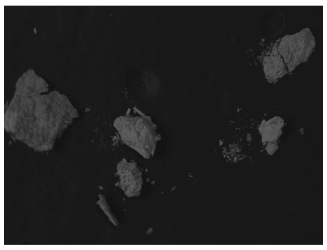


Comment:12450 bone
C, O, Si, P, Cl, Ca

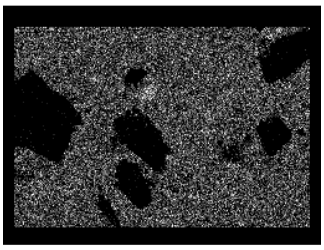
Results for Green Samples

Unit 12867 Green

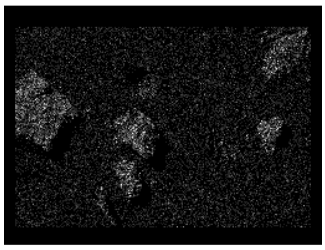
CHLevelII. South R



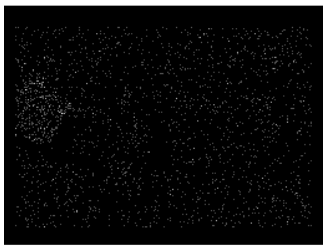
Electron Image 1



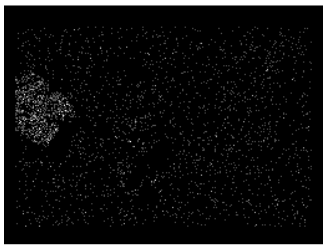
C Ka1_2



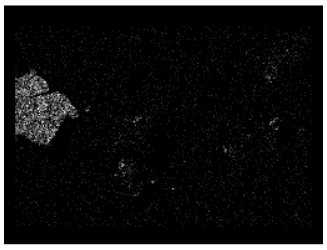
O Ka1



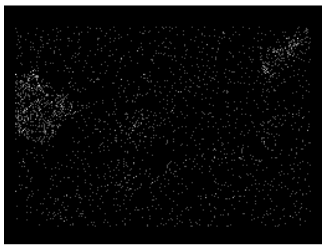
Mg Ka1_2



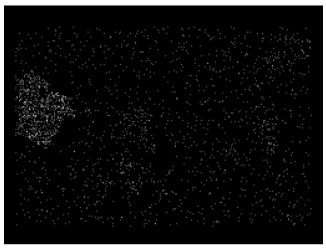
Al Ka1



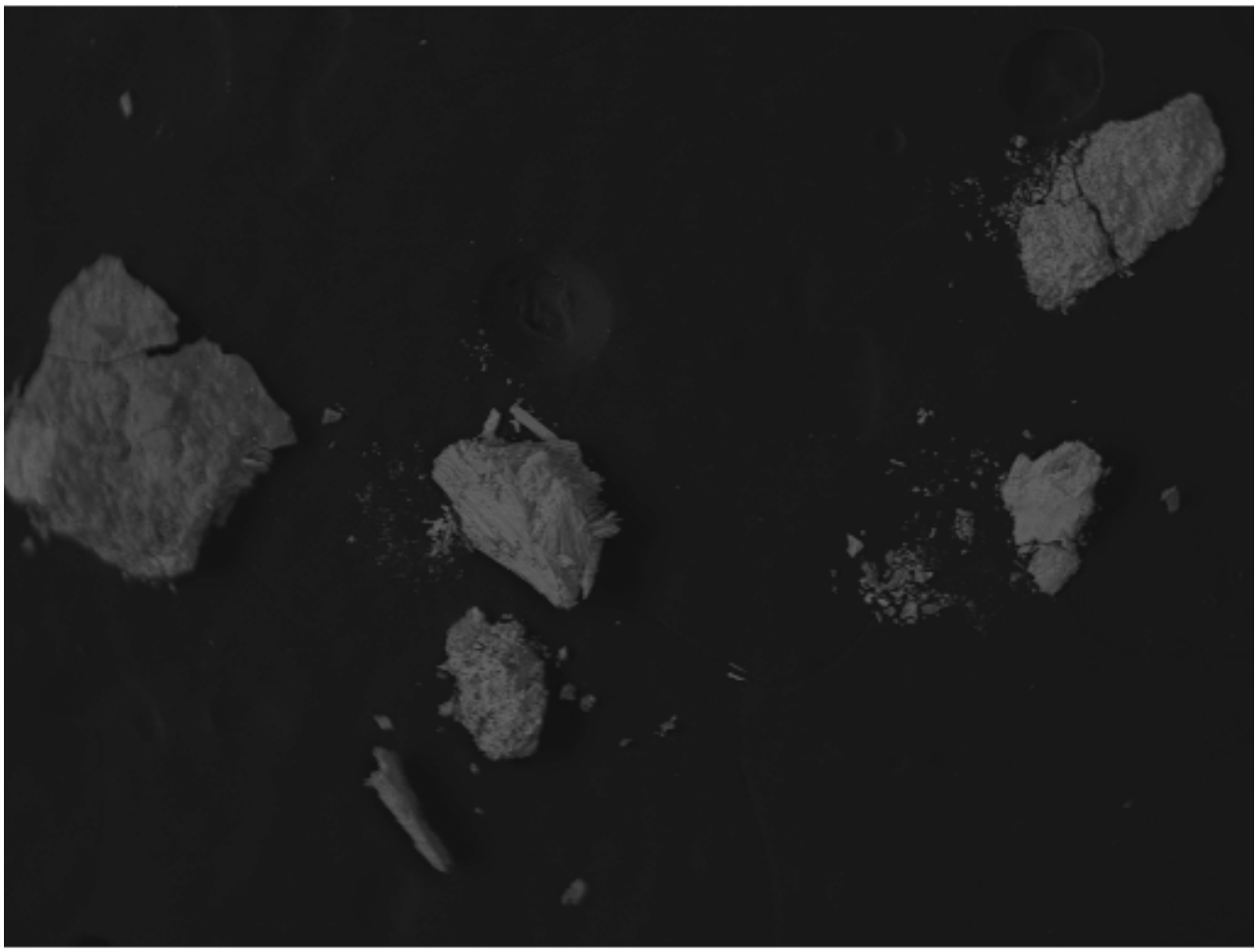
Si Ka1

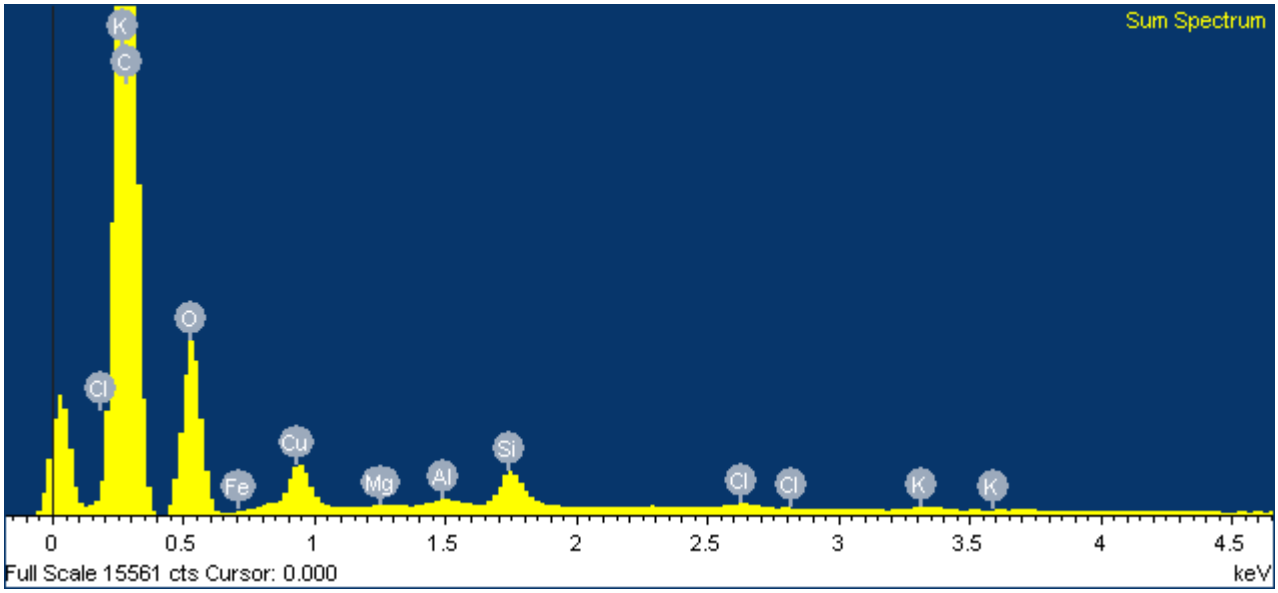


Cl Ka1

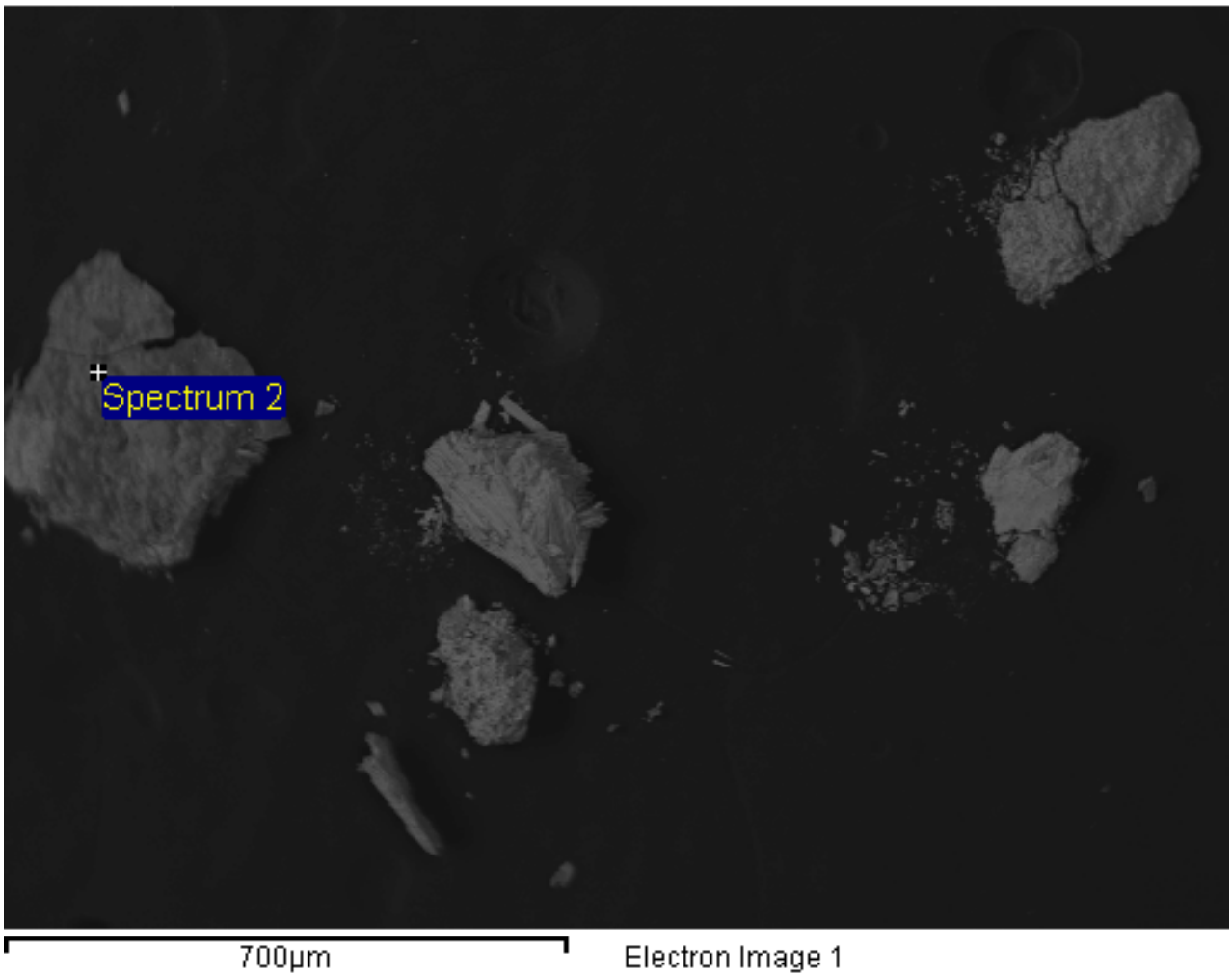


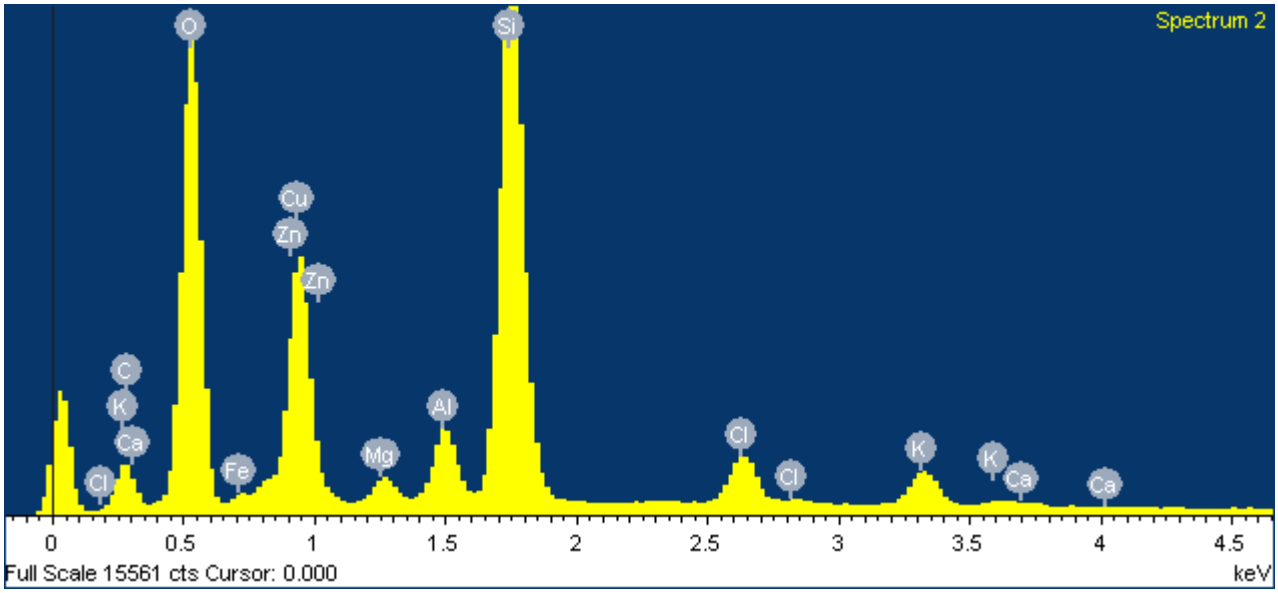
K Ka1



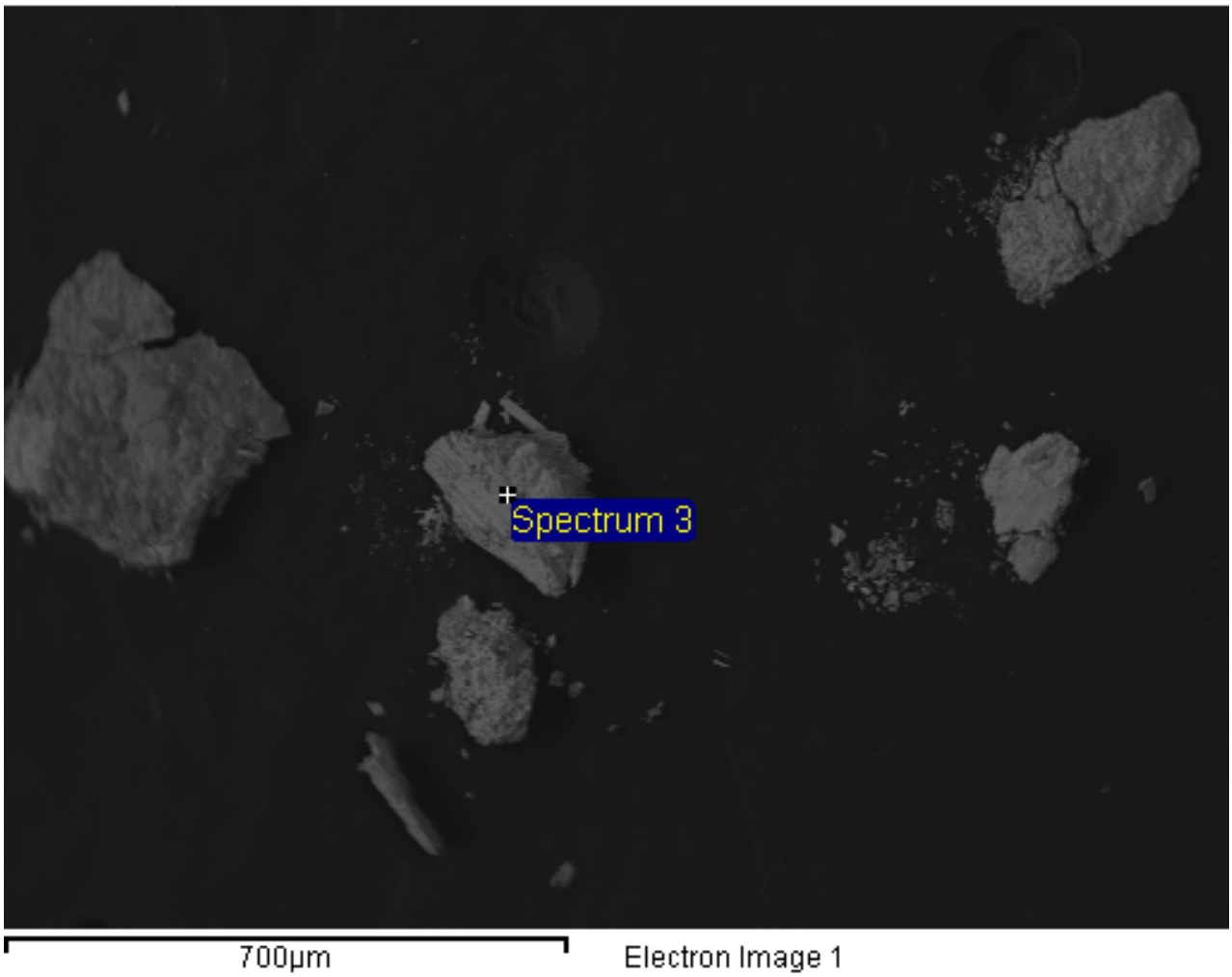


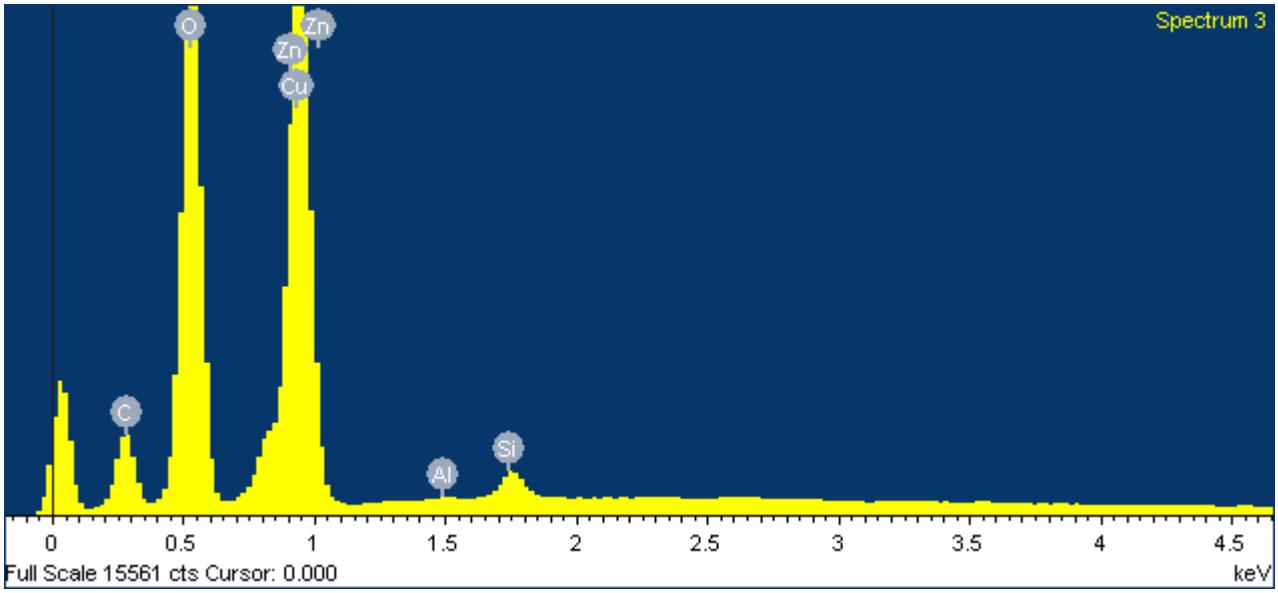
Comment: 12867 green
C, O, Mg, Al, Si, Cl, K, Fe, Cu



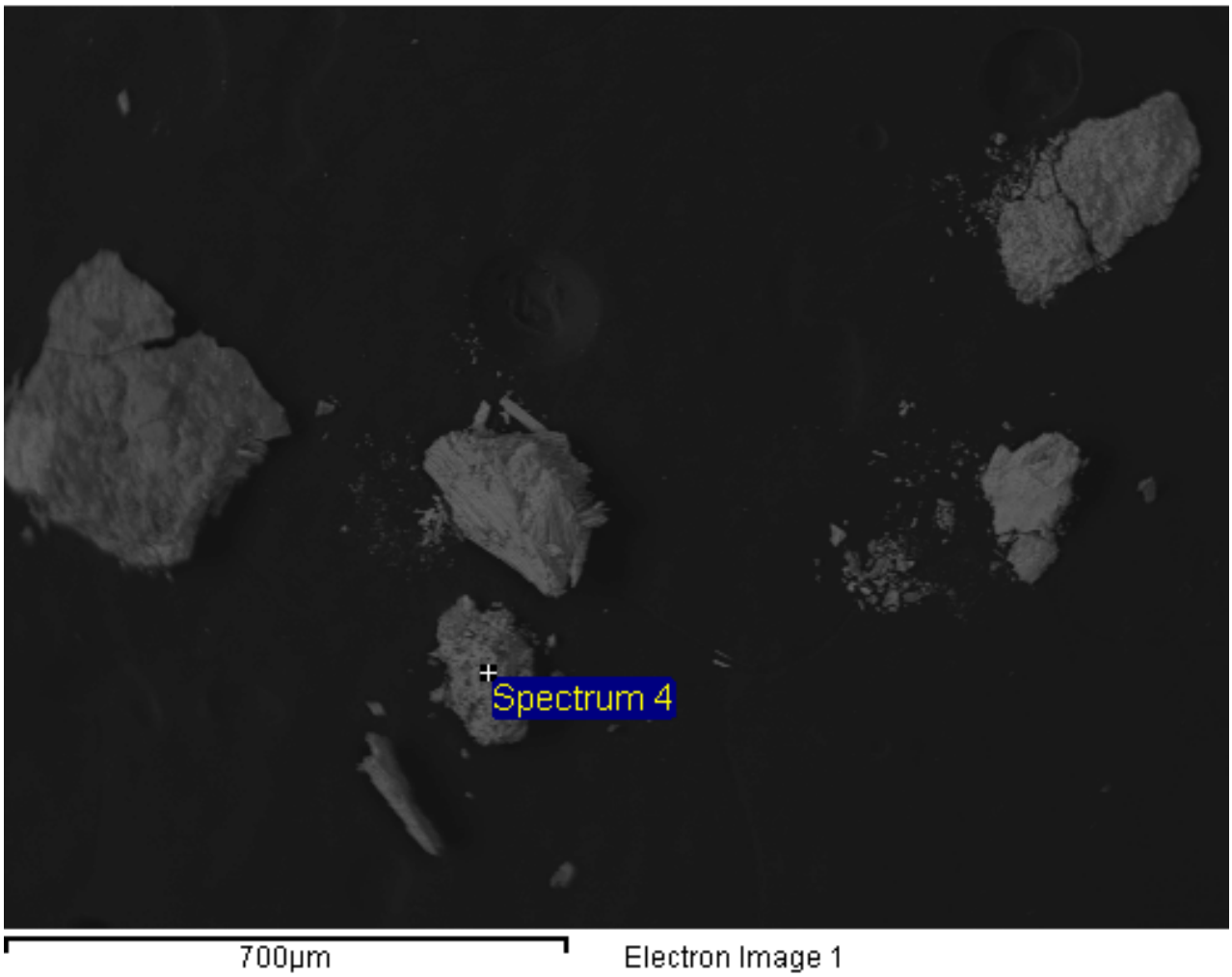


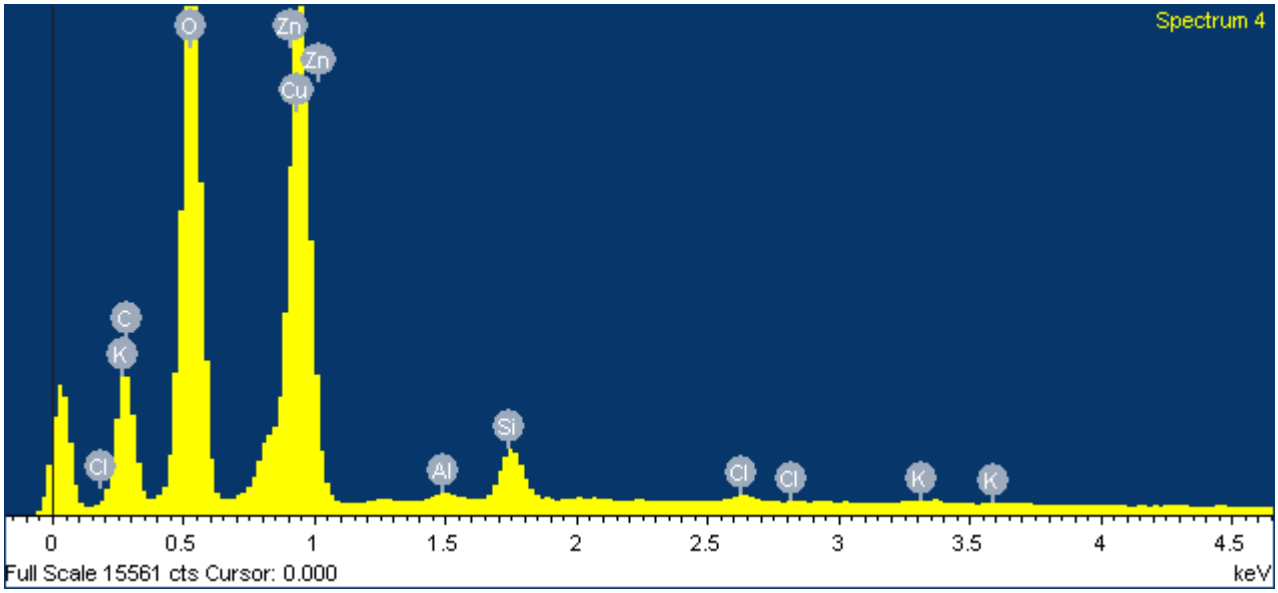
Comment: 12867 green
C, O, Mg, Al, Si, Cl, K, Fe, Cu



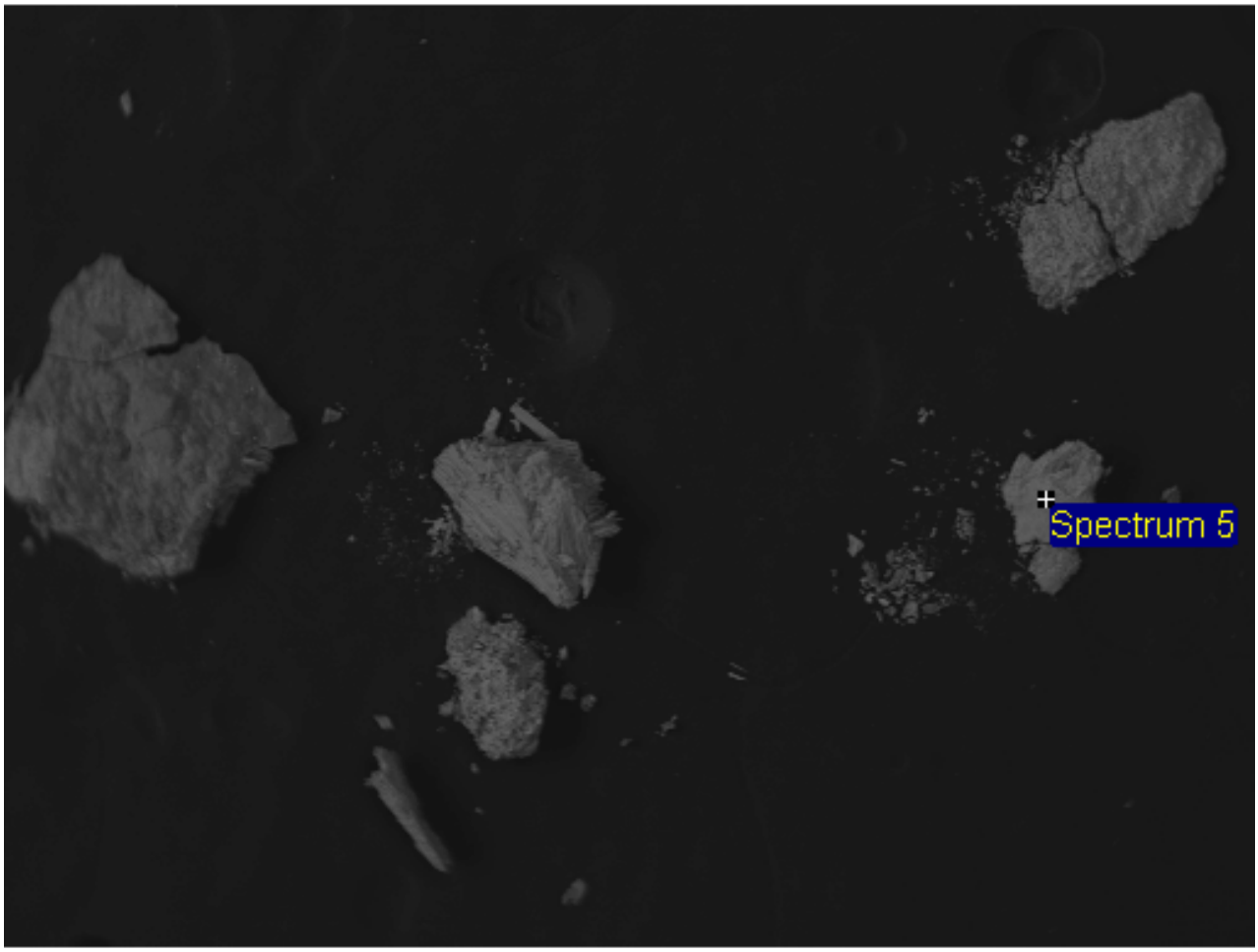


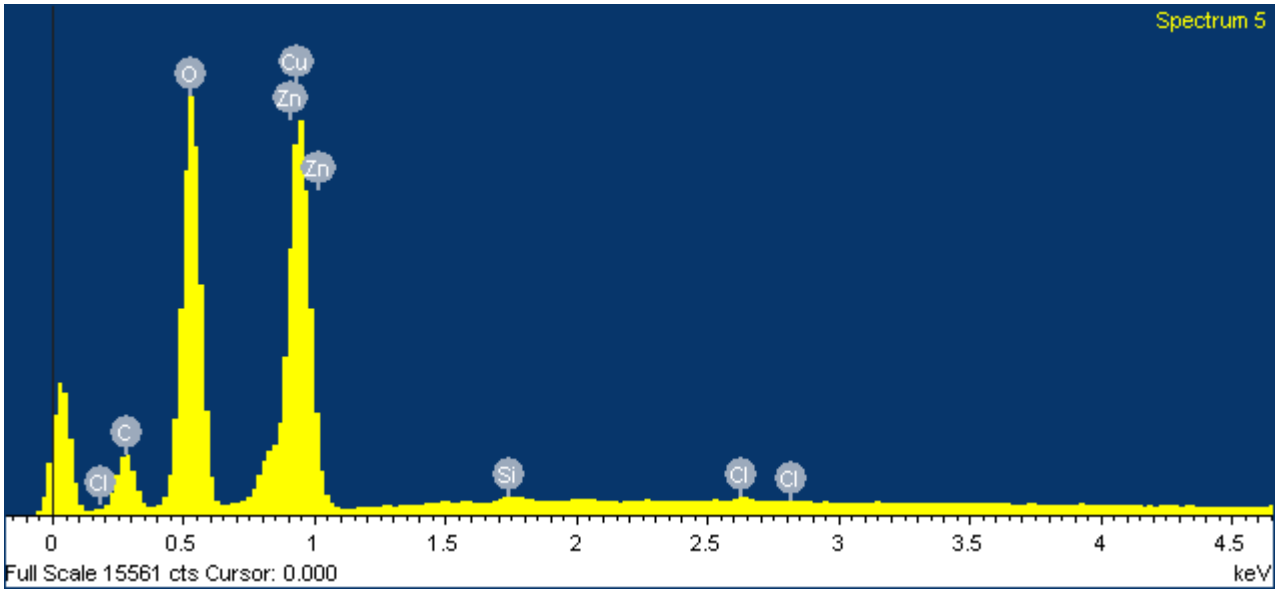
Comment: 12867 green
C, O, Mg, Al, Si, Cl, K, Fe, Cu



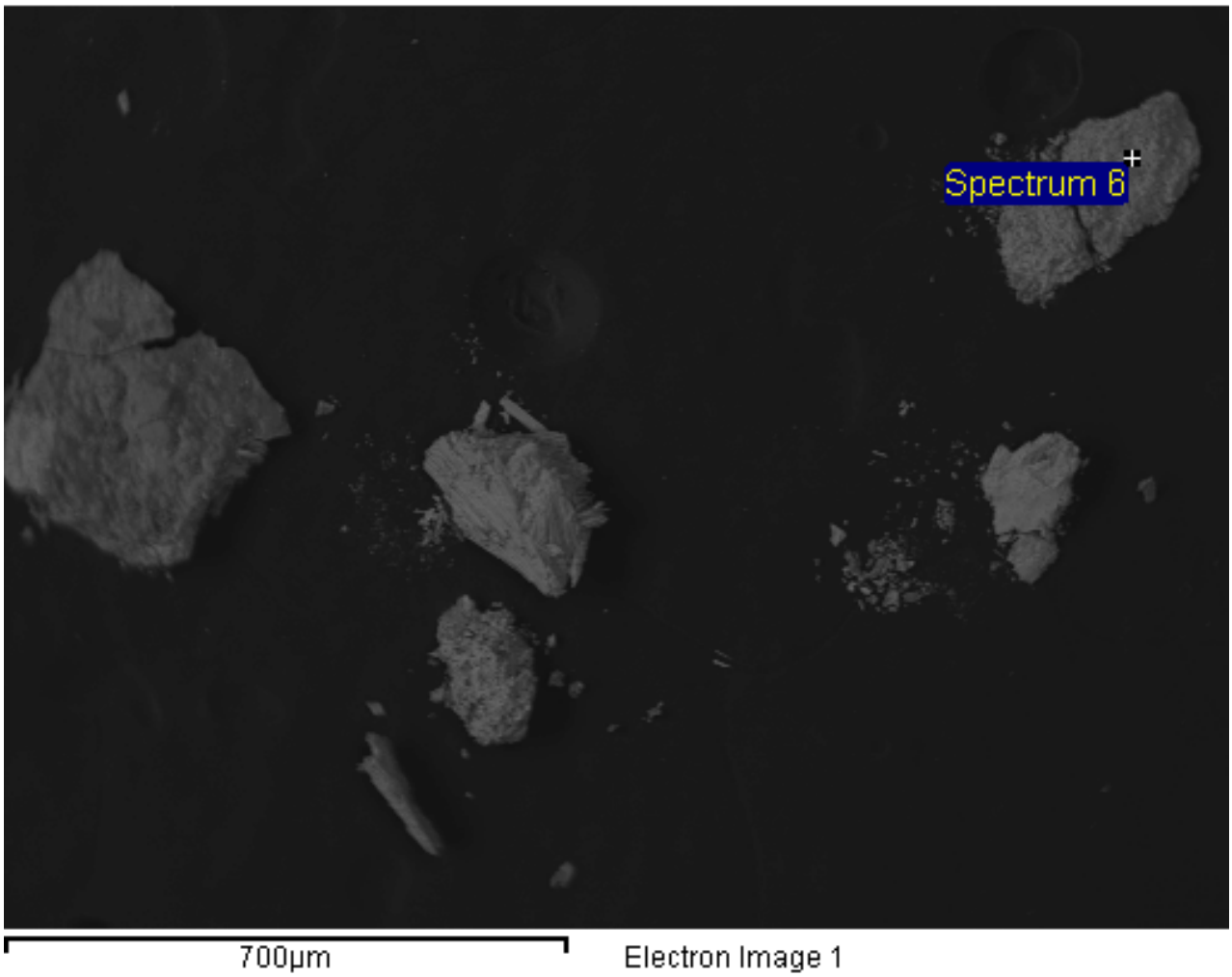


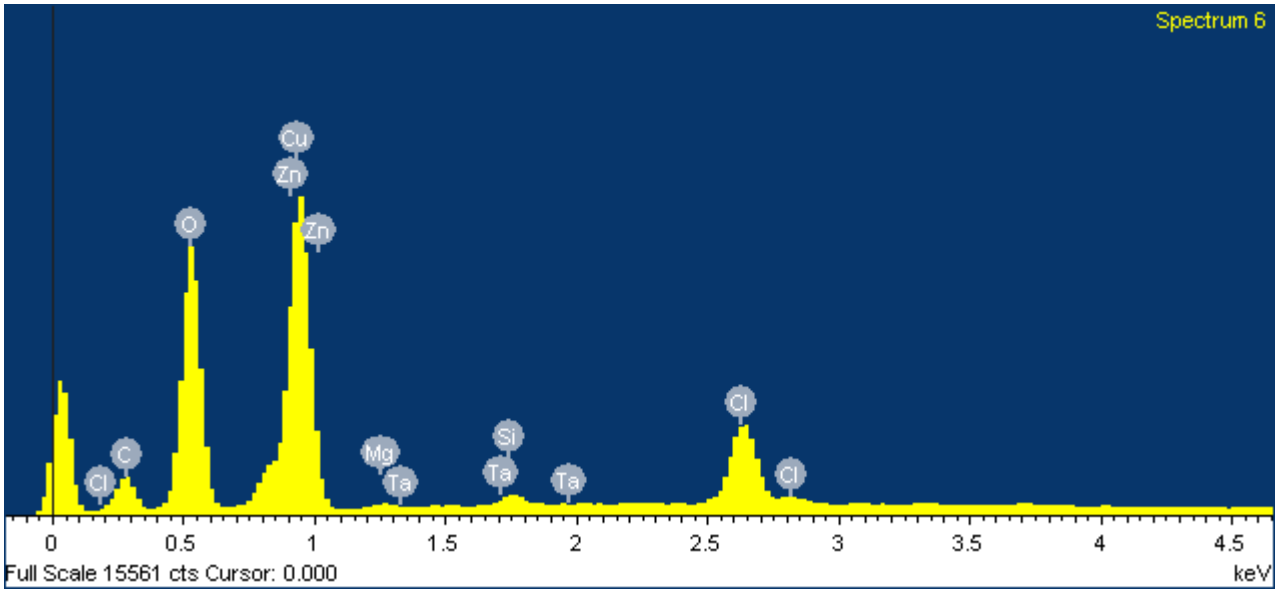
Comment: 12867 green
C, O, Mg, Al, Si, Cl, K, Fe, Cu



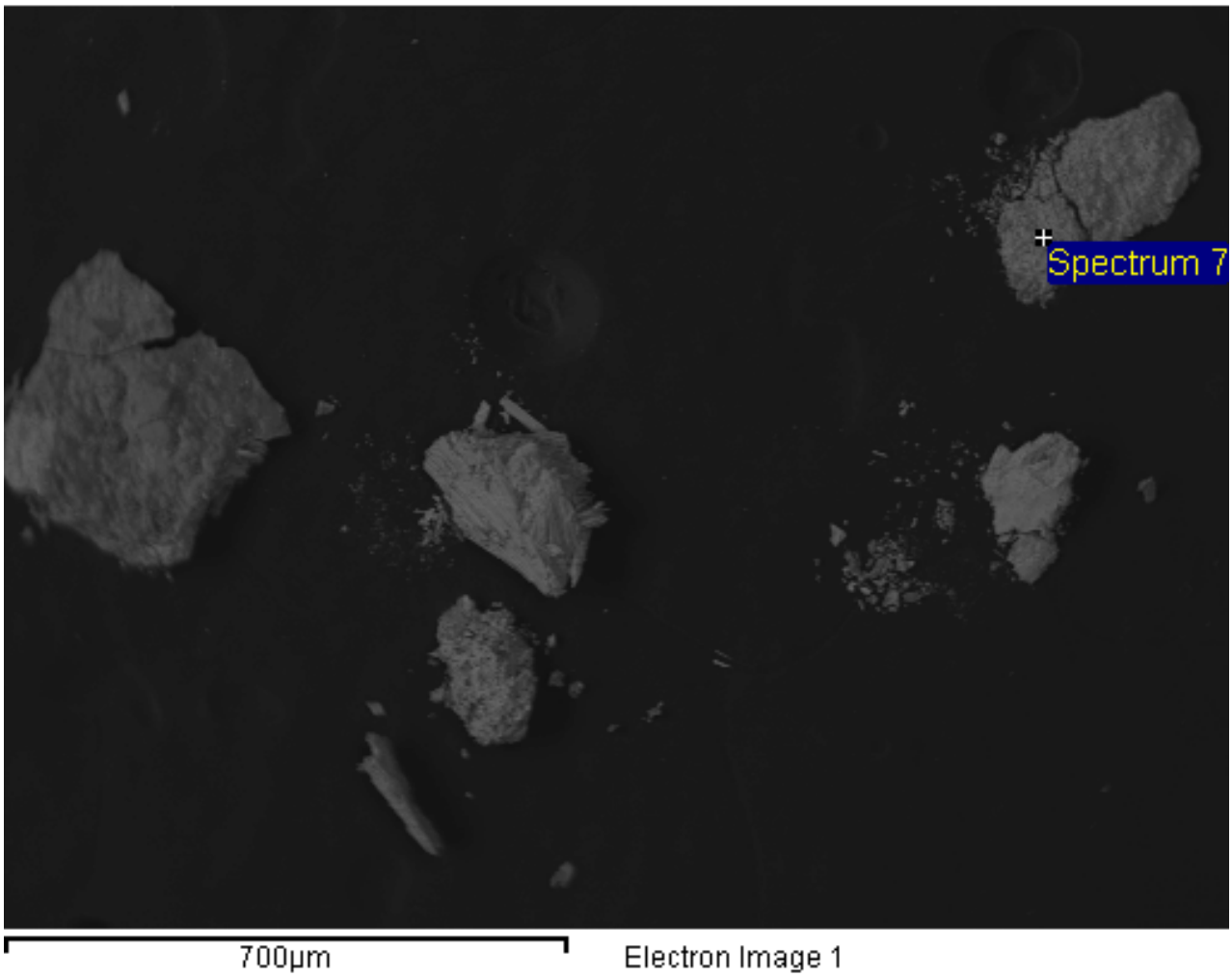


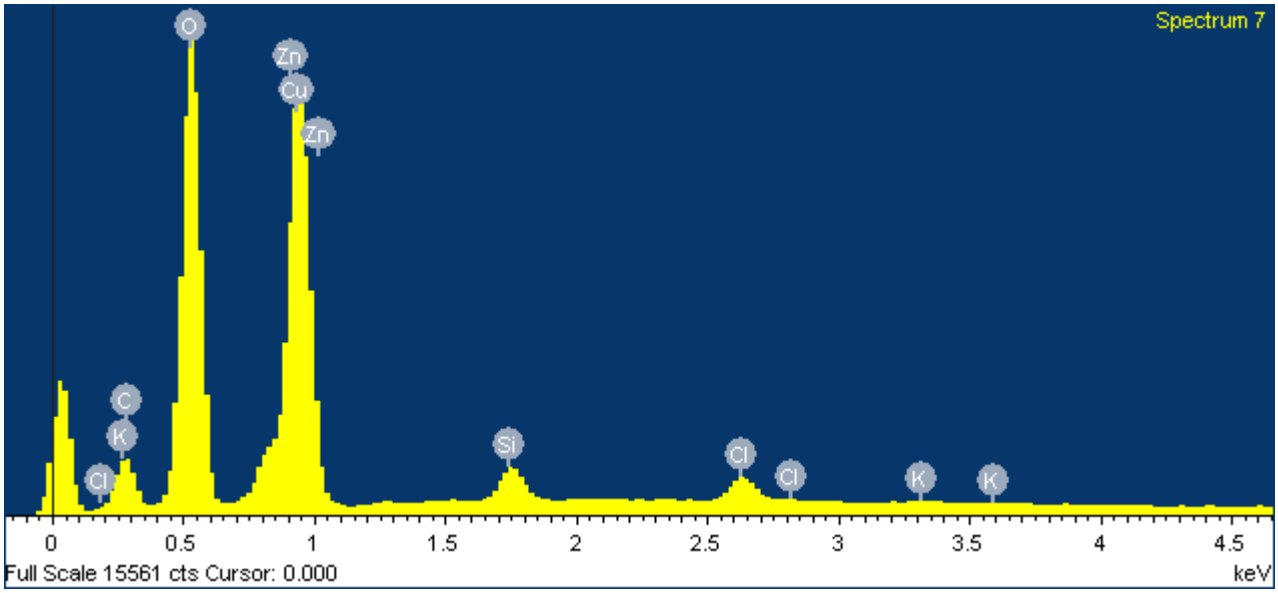
Comment: 12867 green
C, O, Mg, Al, Si, Cl, K, Fe, Cu



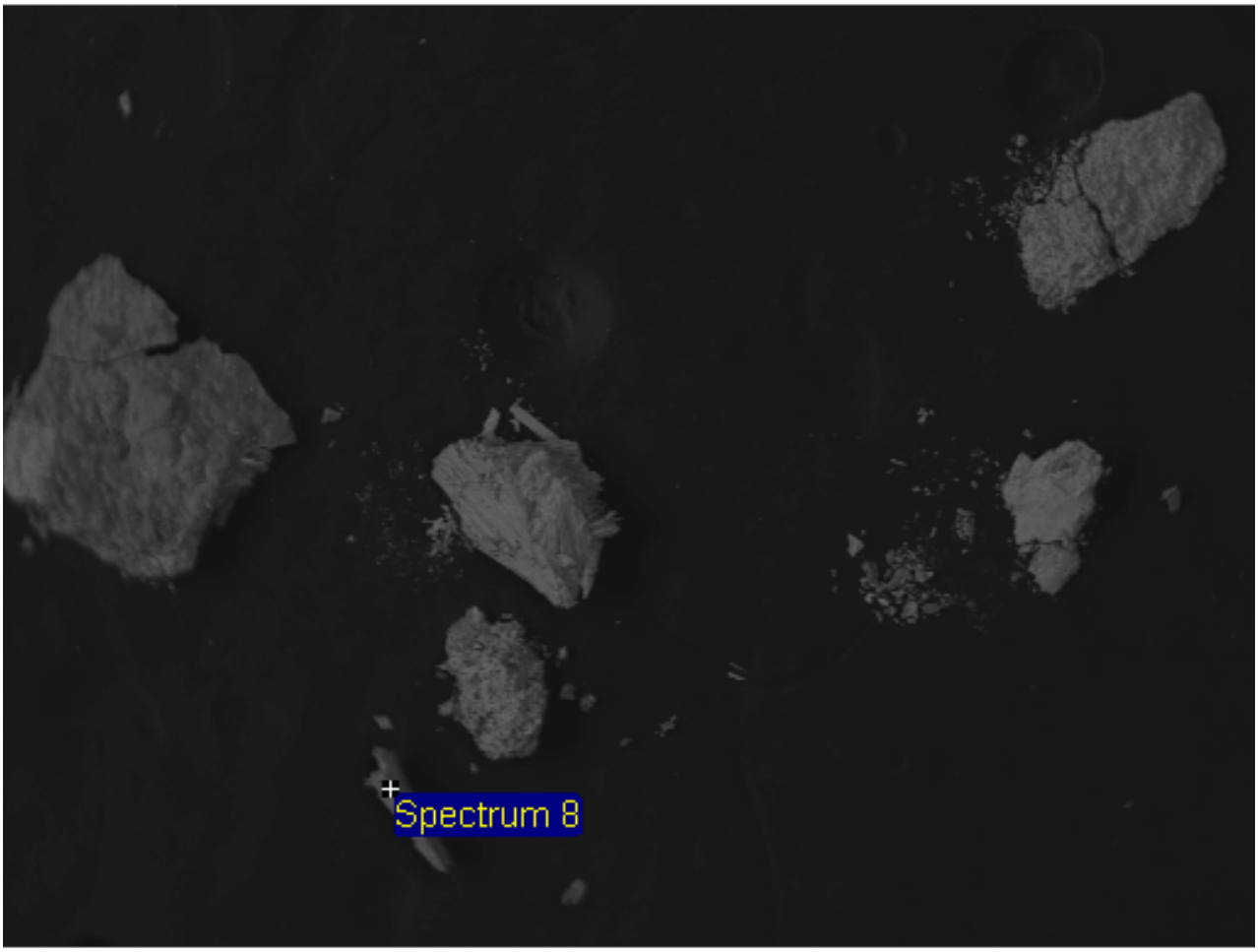


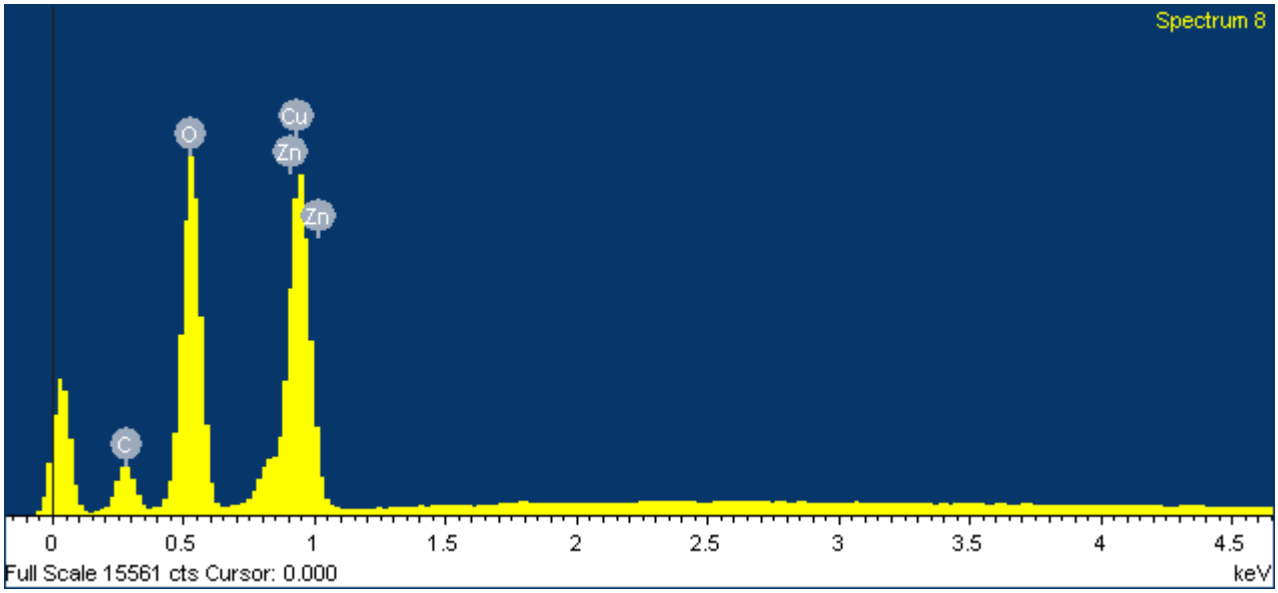
Comment: 12867 green
C, O, Mg, Al, Si, Cl, K, Fe, Cu



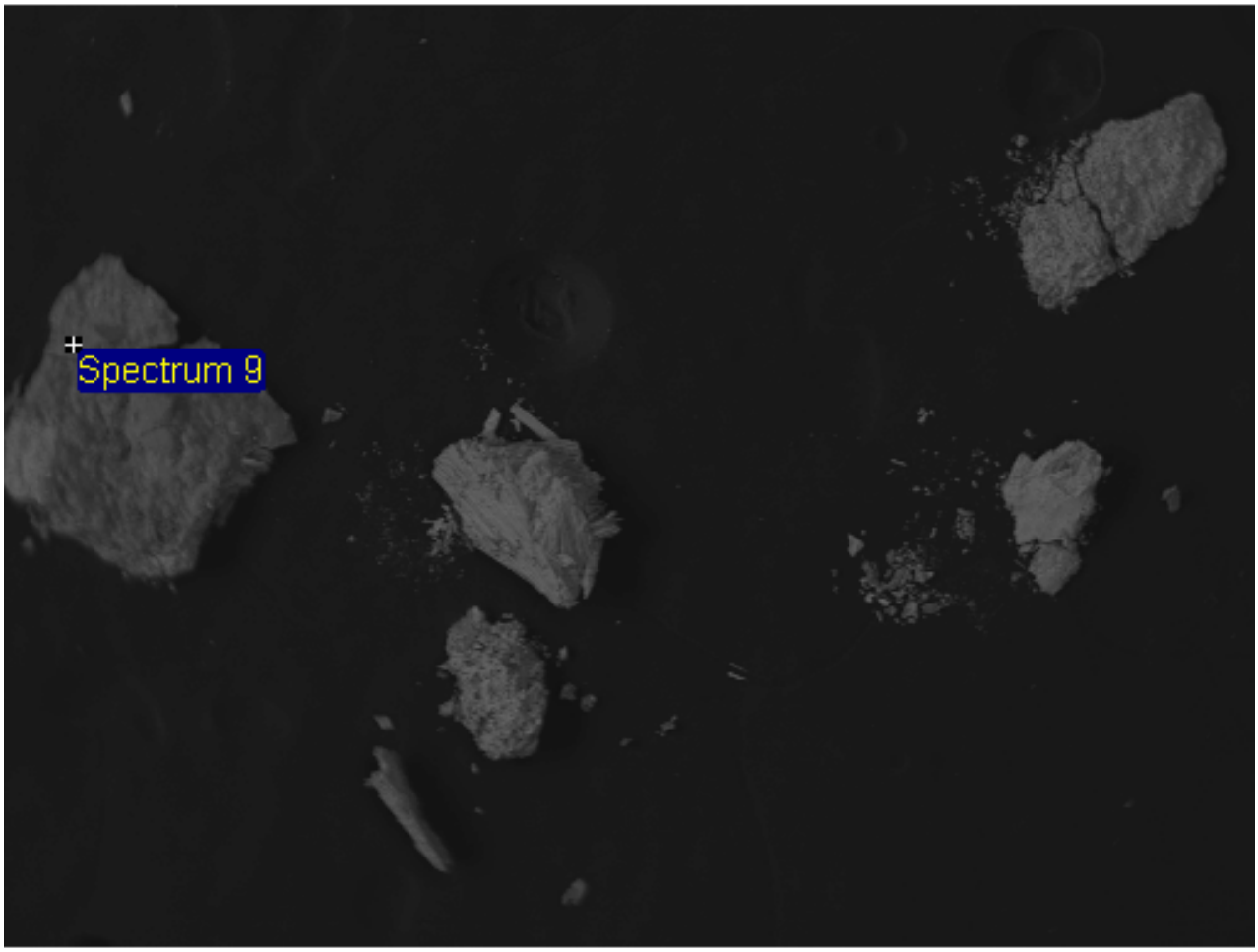


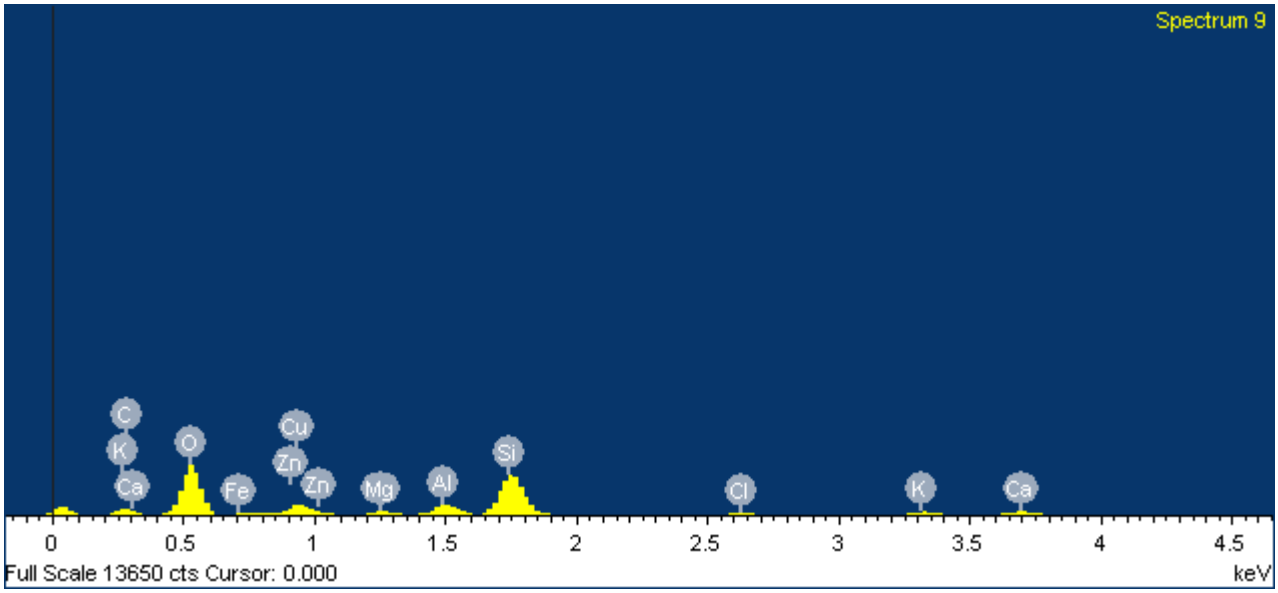
Comment: 12867 green
C, O, Mg, Al, Si, Cl, K, Fe, Cu



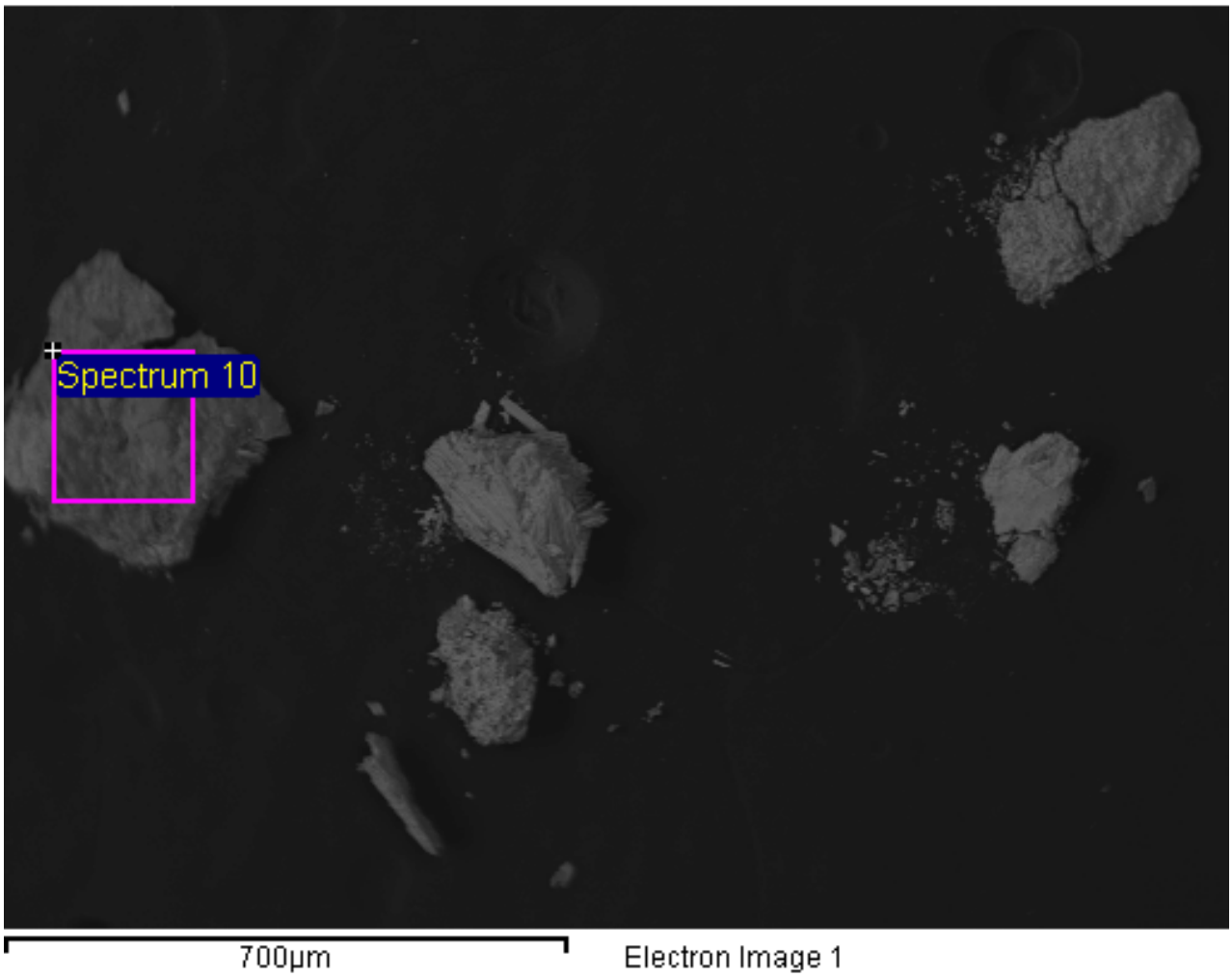


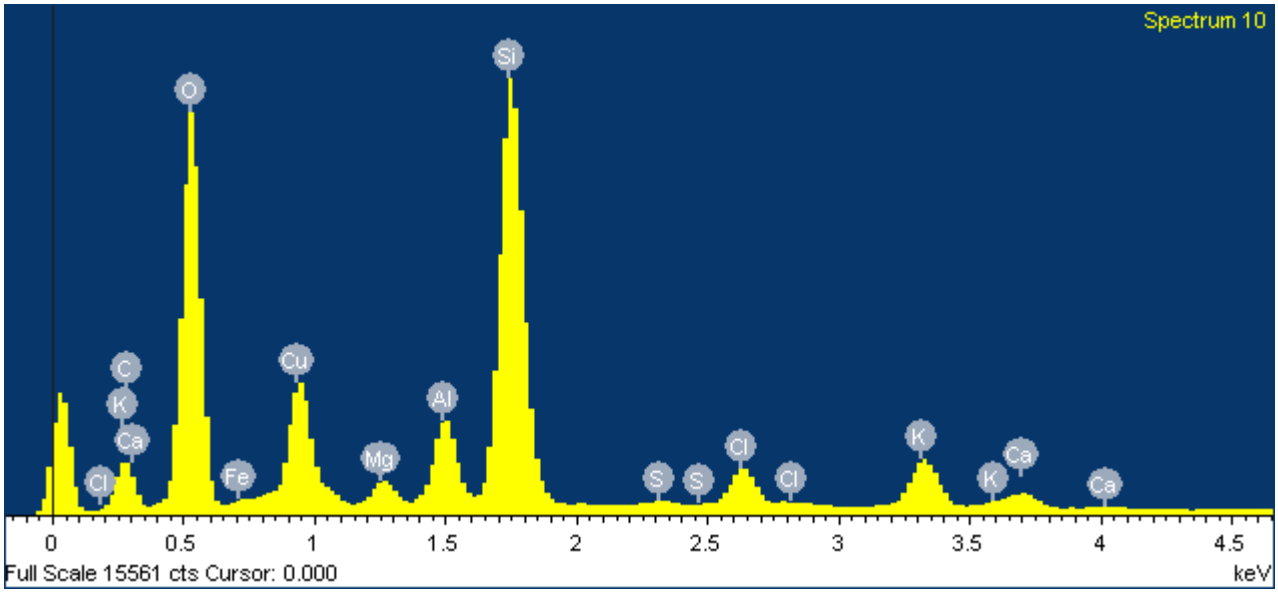
Comment: 12867 green
C, O, Mg, Al, Si, Cl, K, Fe, Cu



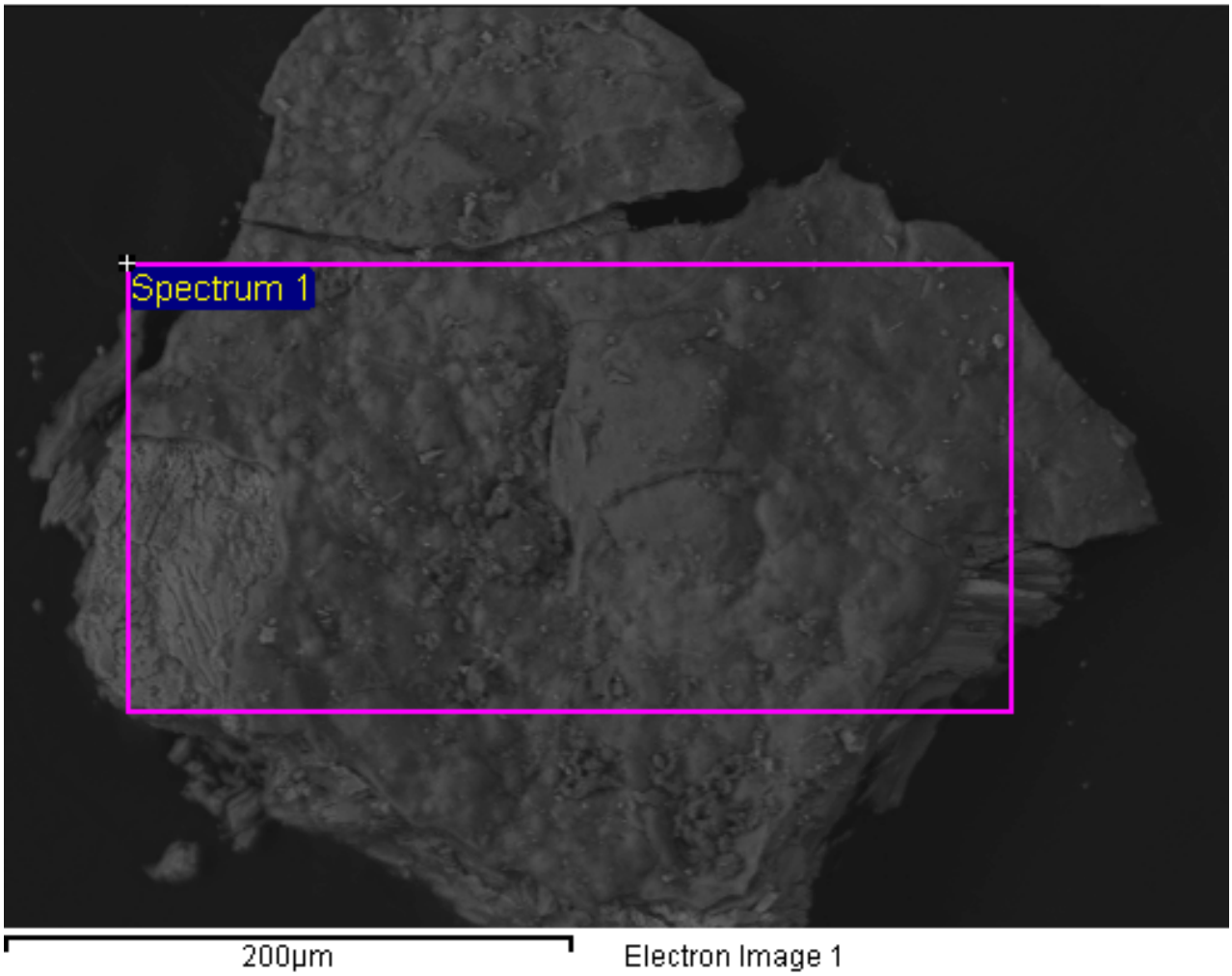


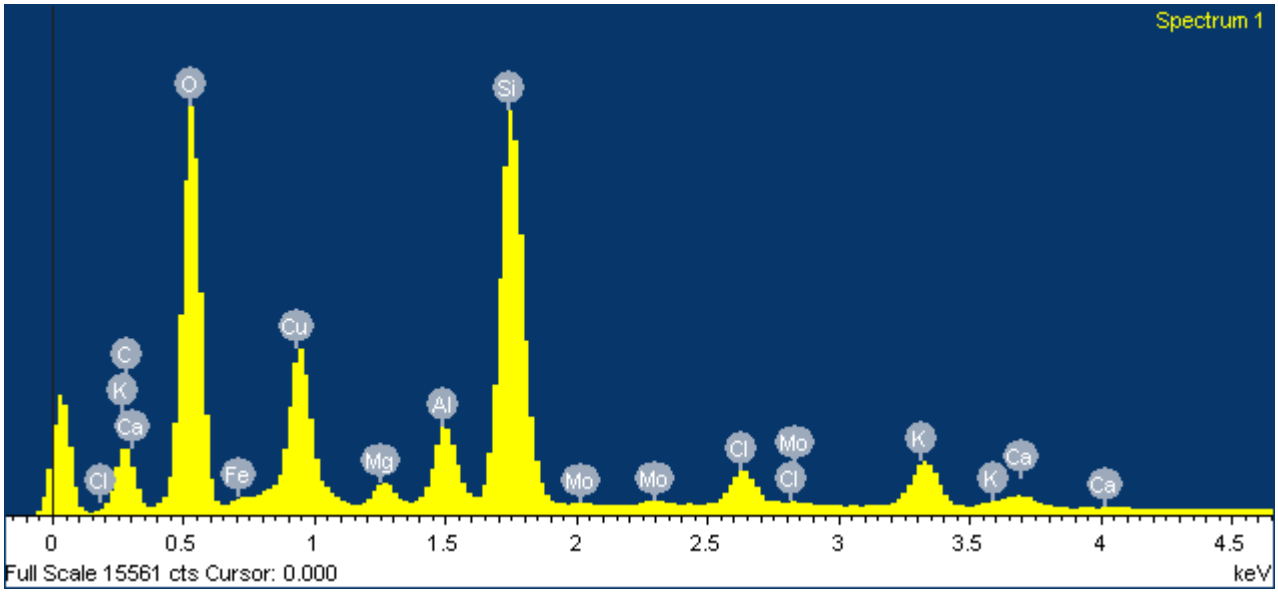
Comment: 12867 green
C, O, Mg, Al, Si, Cl, K, Fe, Cu



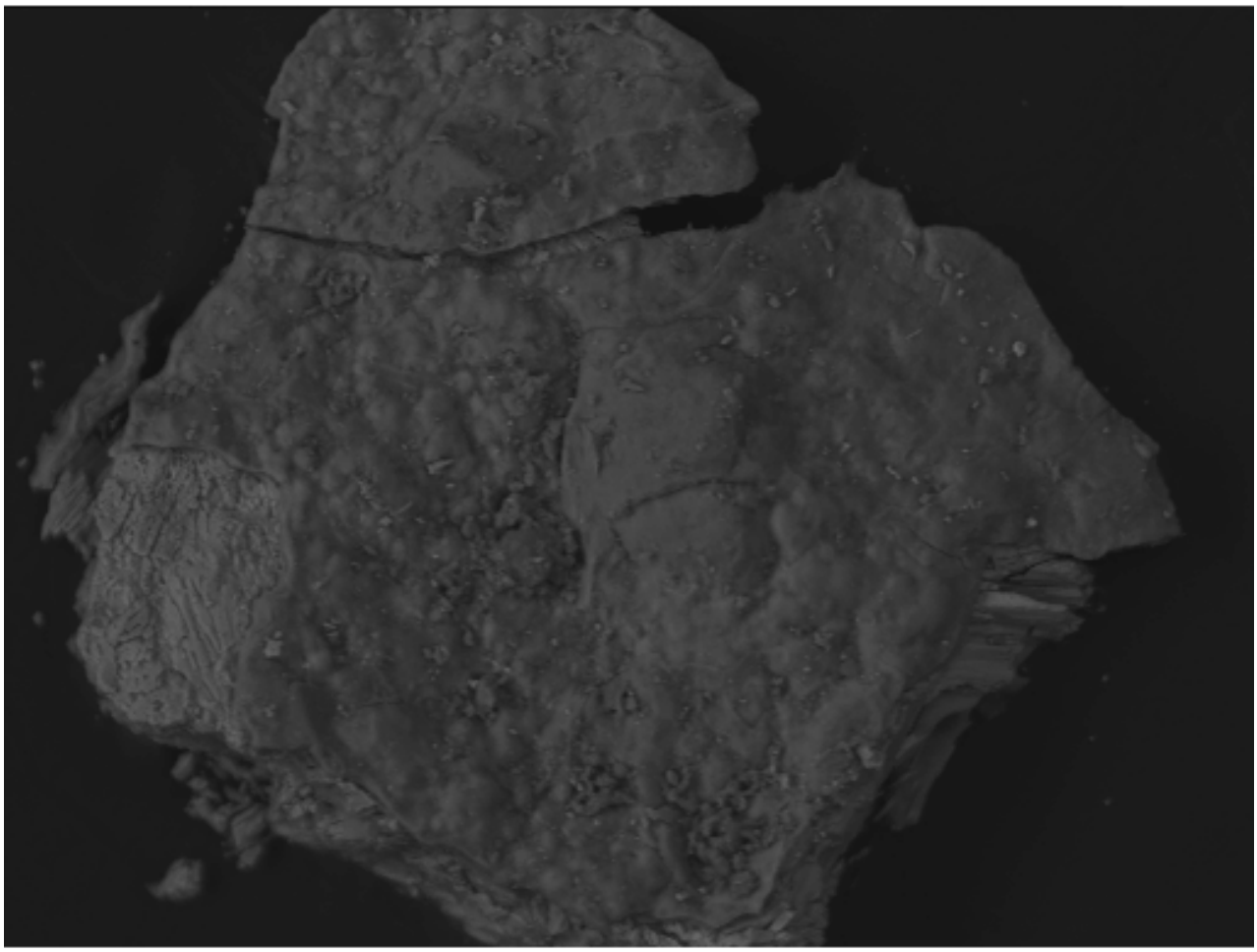


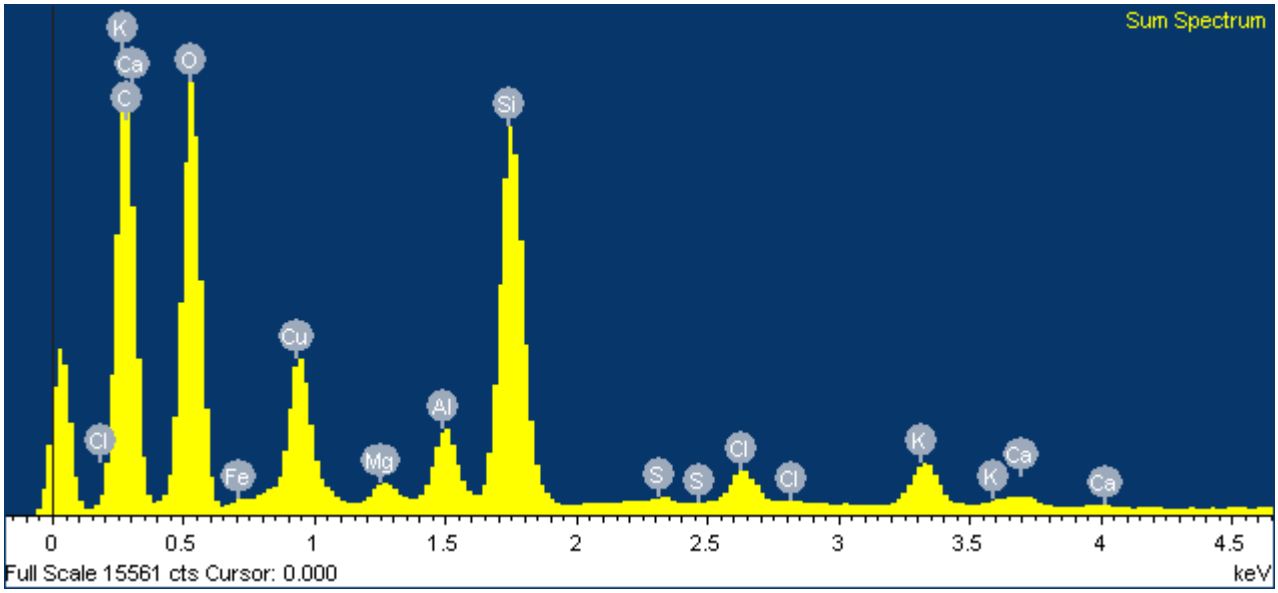
Comment: 12867 green
C, O, Mg, Al, Si, Cl, K, Fe, Cu



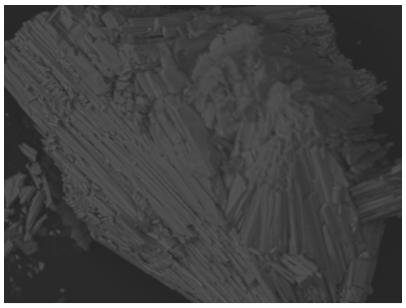


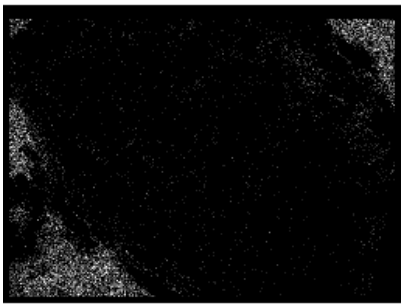
Comment:12867 green

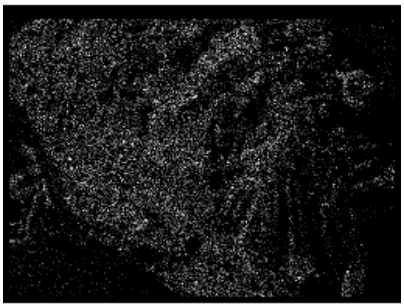


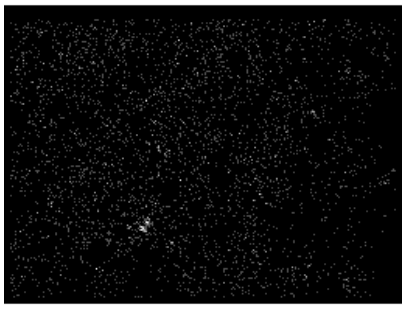


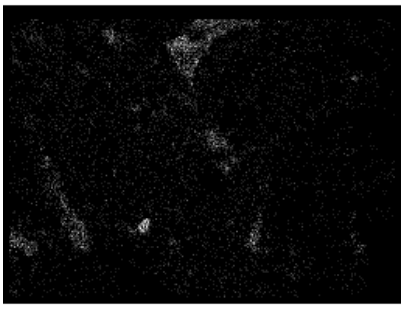
Comment:12867 green

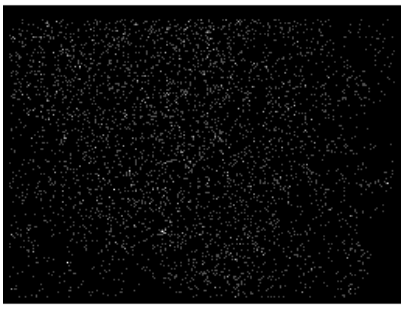

Electron Image 1

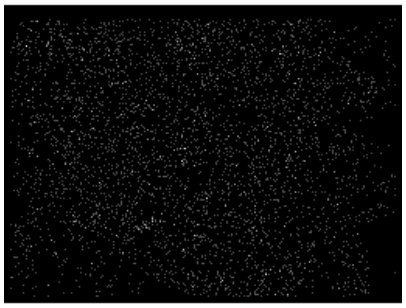

C Ka1_2

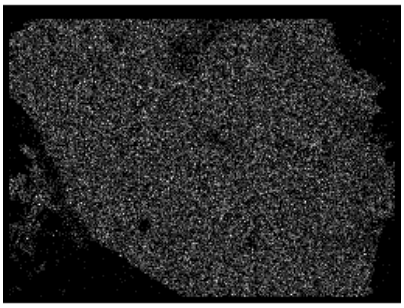

O Ka1

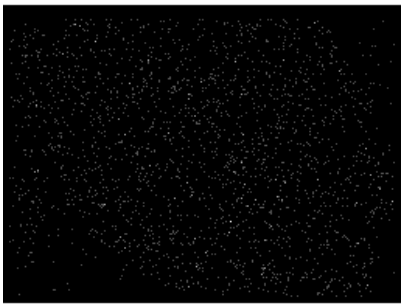

Al Ka1


Si Ka1

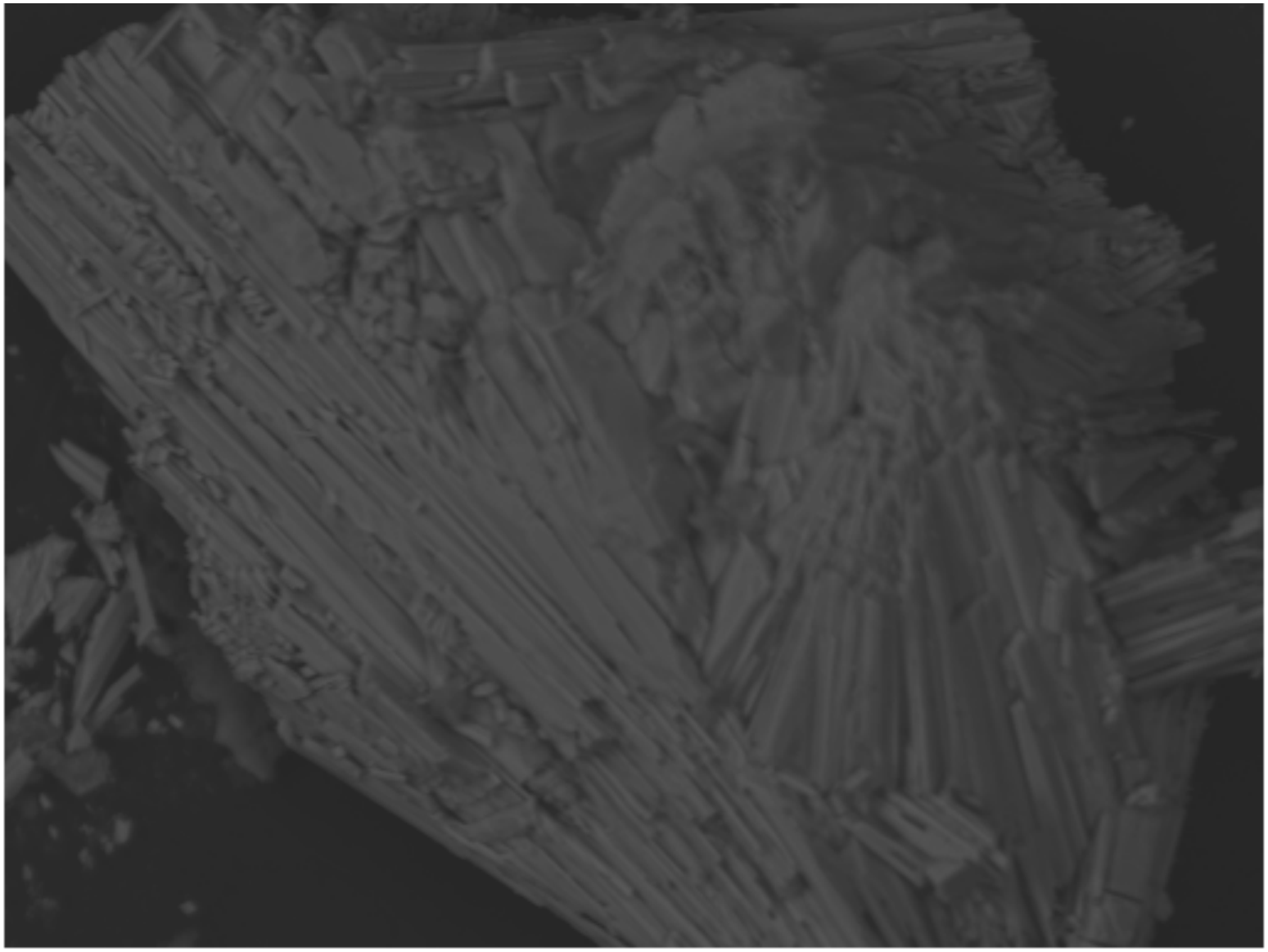

Cl Ka1


K Ka1

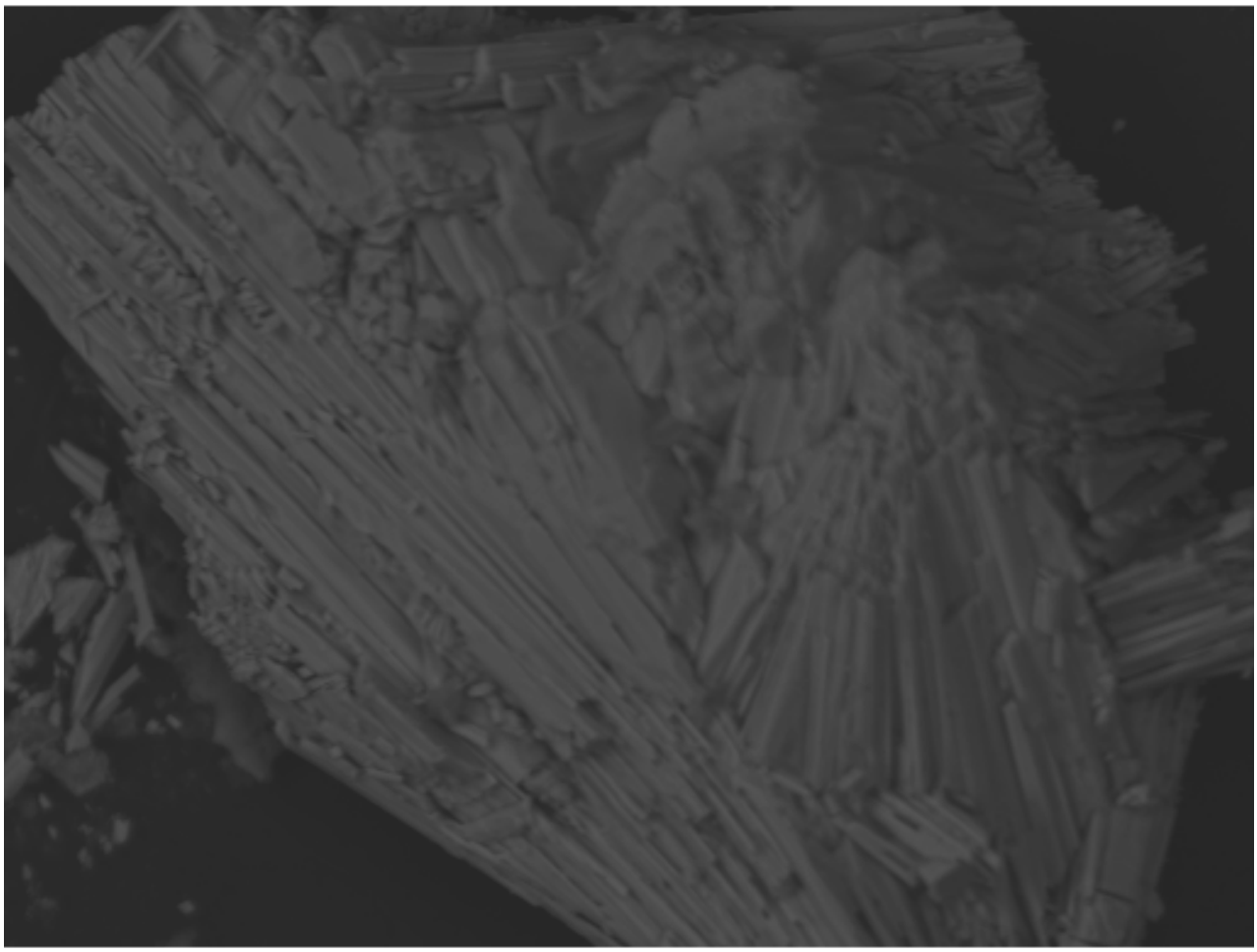

Cu Ka1

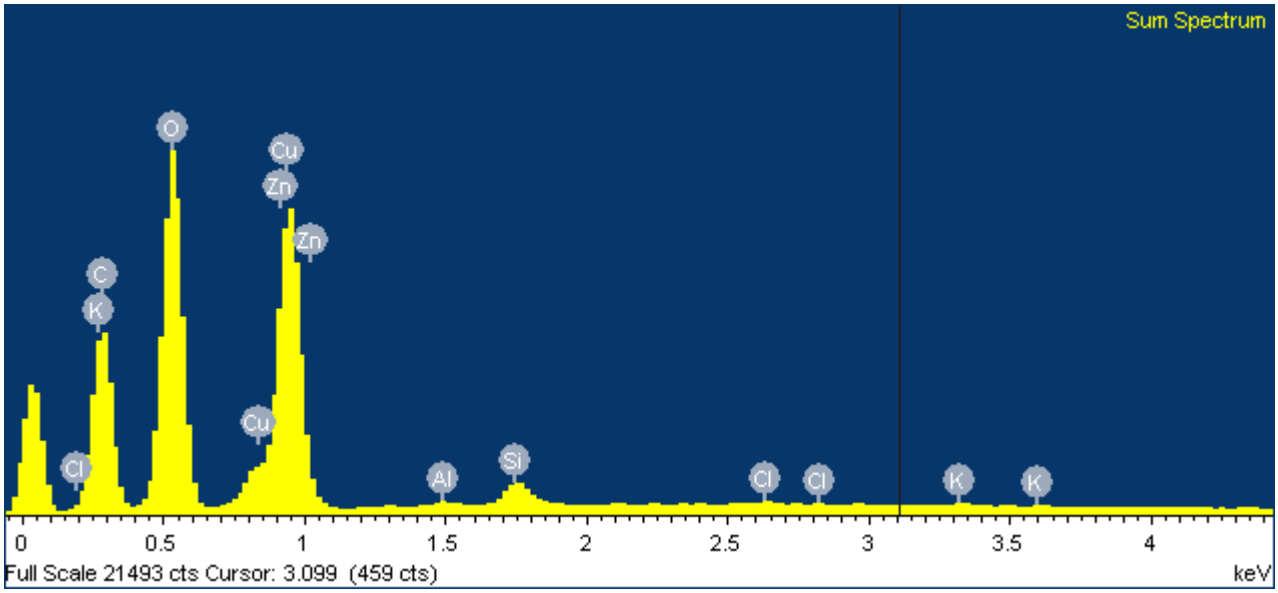

Zn Ka1

Comment:12867 green
C, O, AL, Si, Cl, K, Cu, Zn



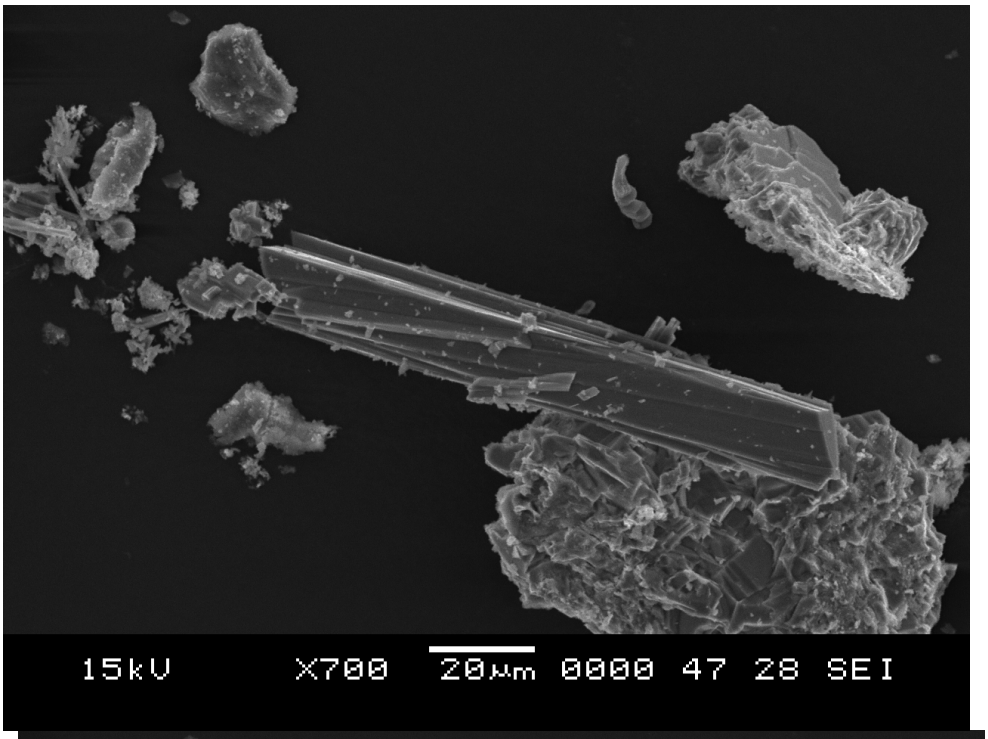
Comment:12867 green
C, O, AL, Si, Cl, K, Cu, Zn

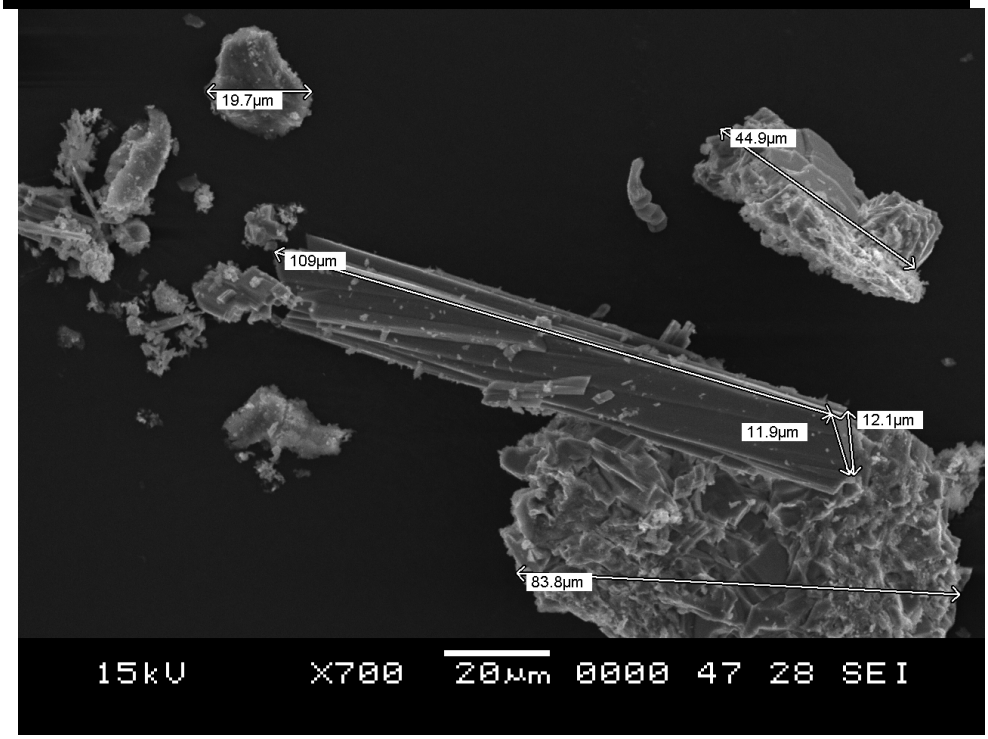


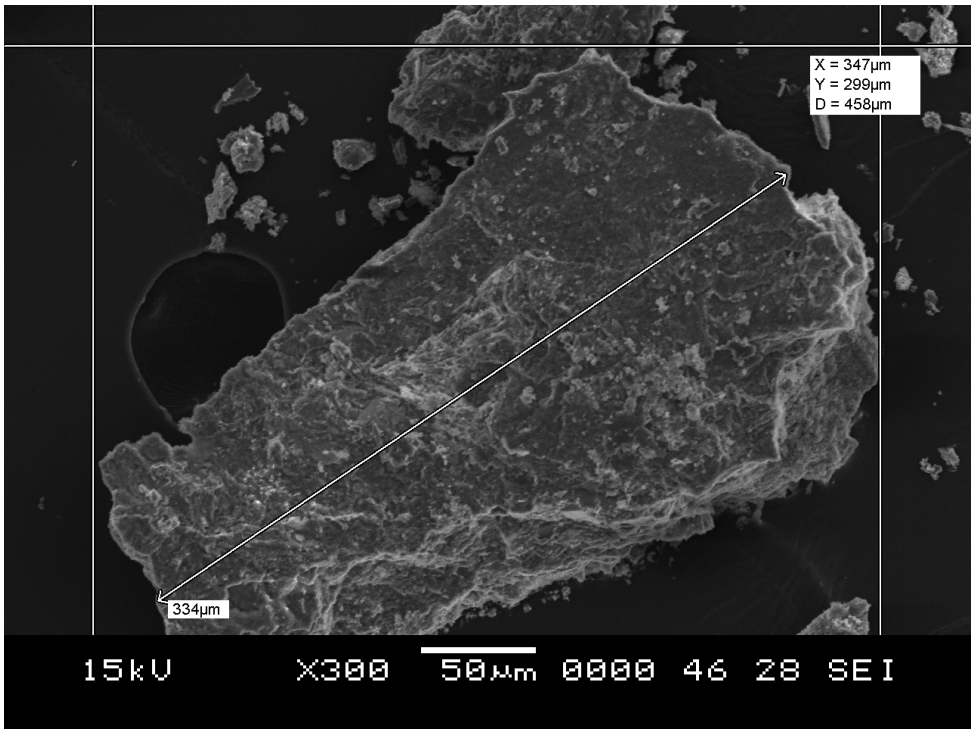


Comment:12867 green
C, O, AL, Si, Cl, K, Cu, Zn

Unit 12867 Green



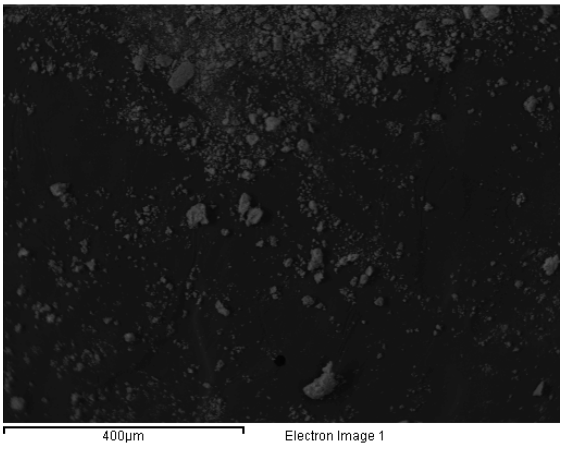


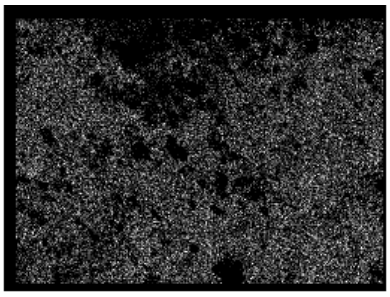

X = 347µm
Y = 299µm
D = 458µm
334µm
15kV X300 50µm 0000 46 28 SEI

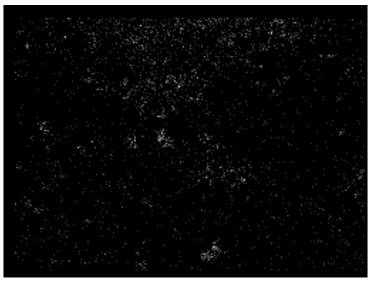
Results for Red Samples

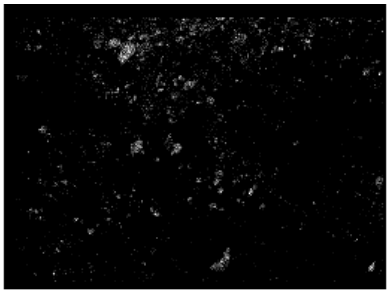
Unit 12867 Red

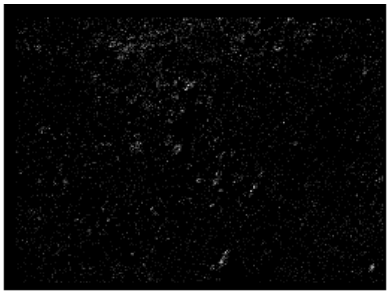
CHLevelII. South R



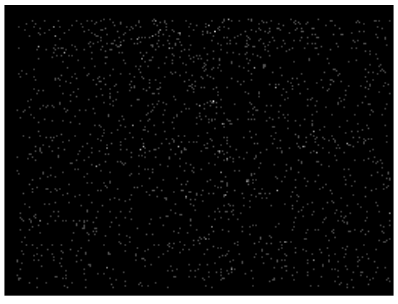

C Ka1_2


Fe Ka1

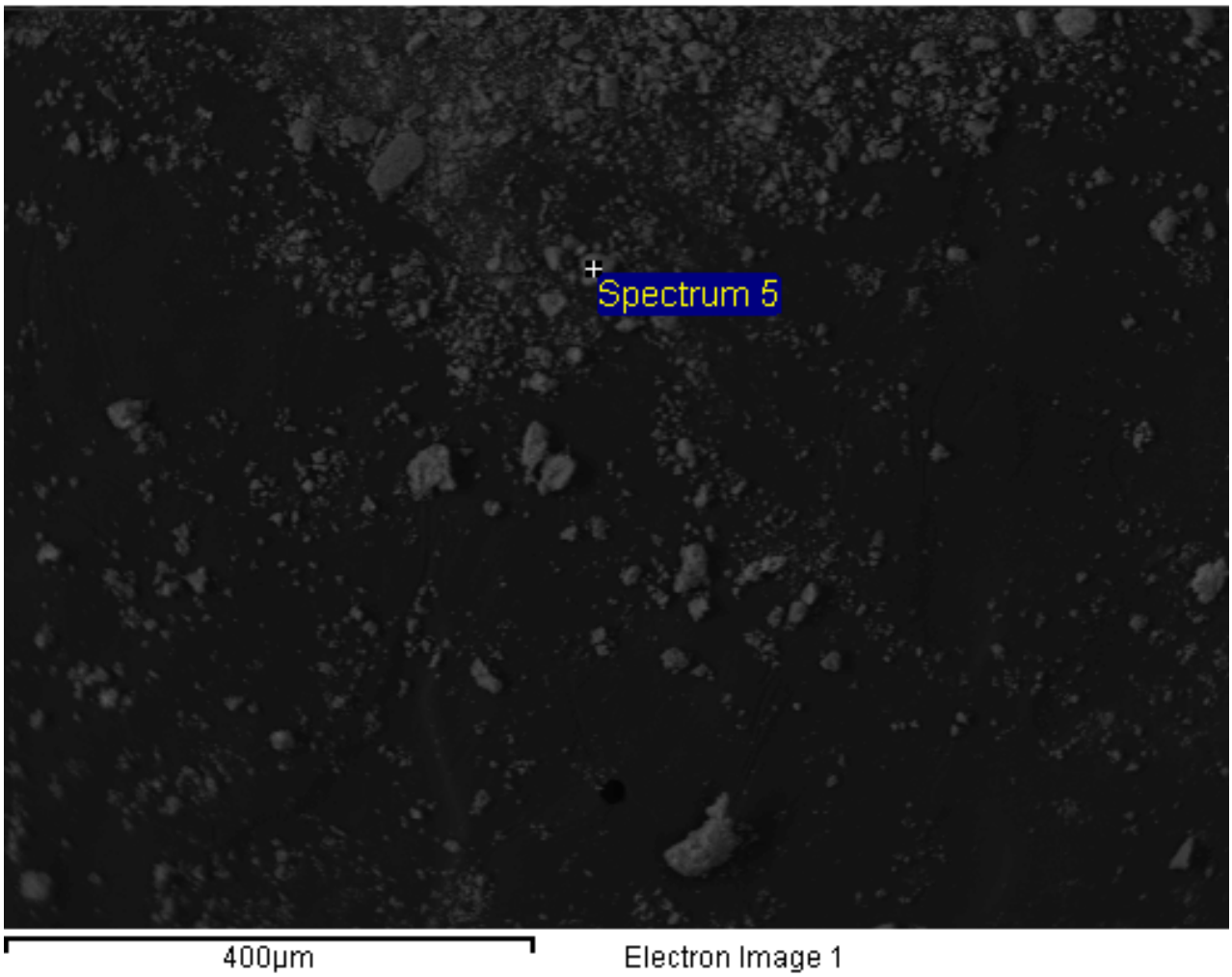

Si Ka1

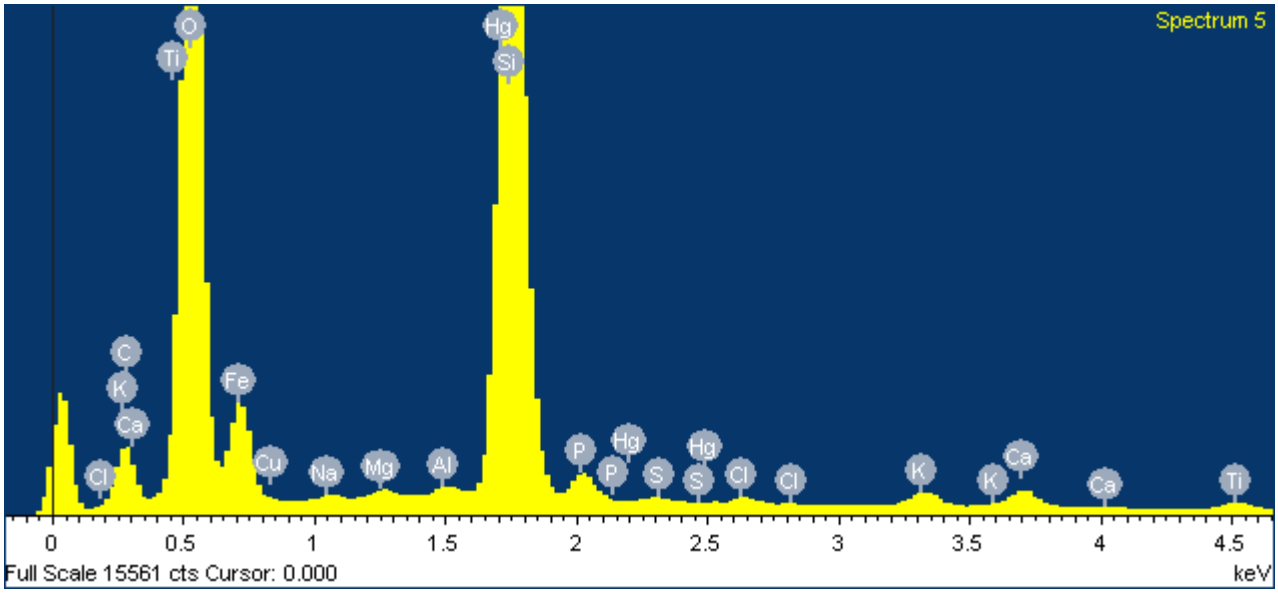

O Ka1


Cu Ka1

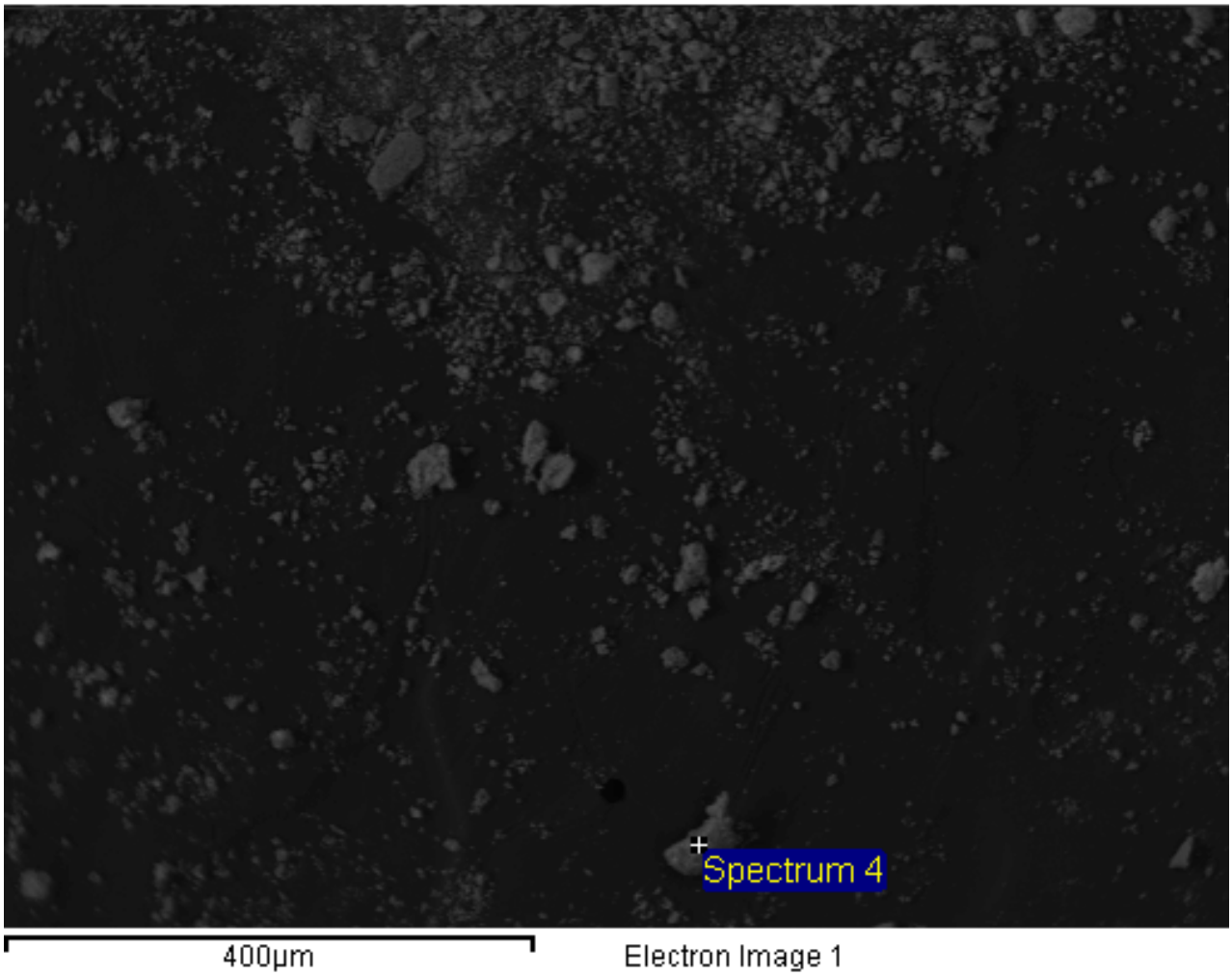

Ca Ka1

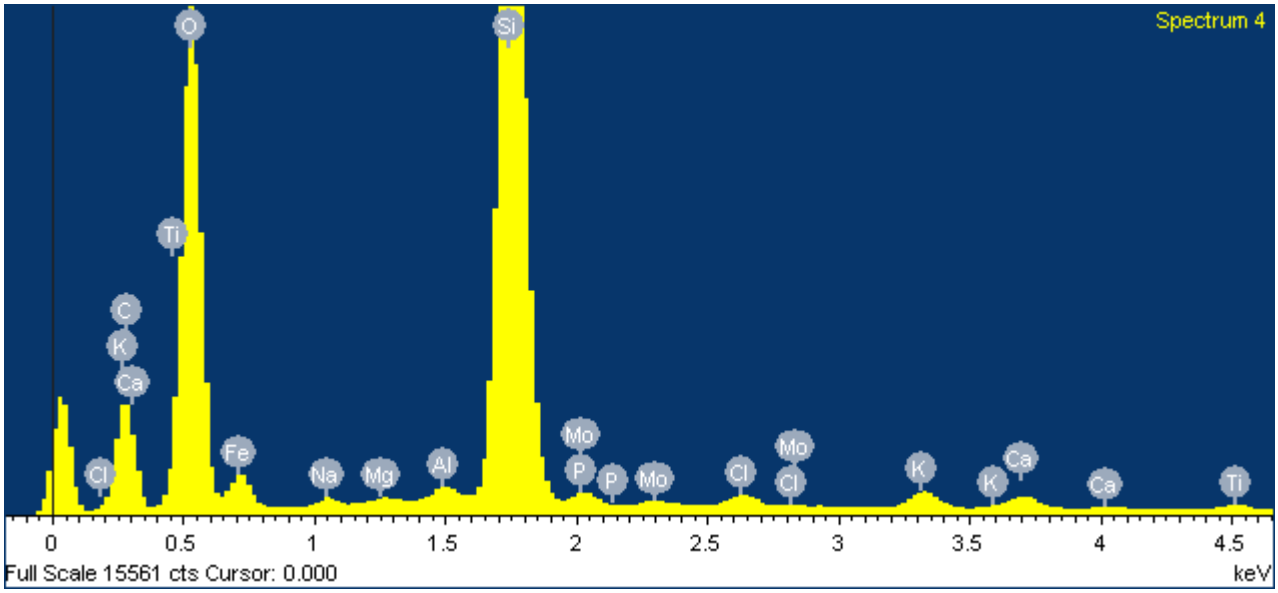
Comment: Sample 12867 red
C, O, Si, Ca, Fe, Cu



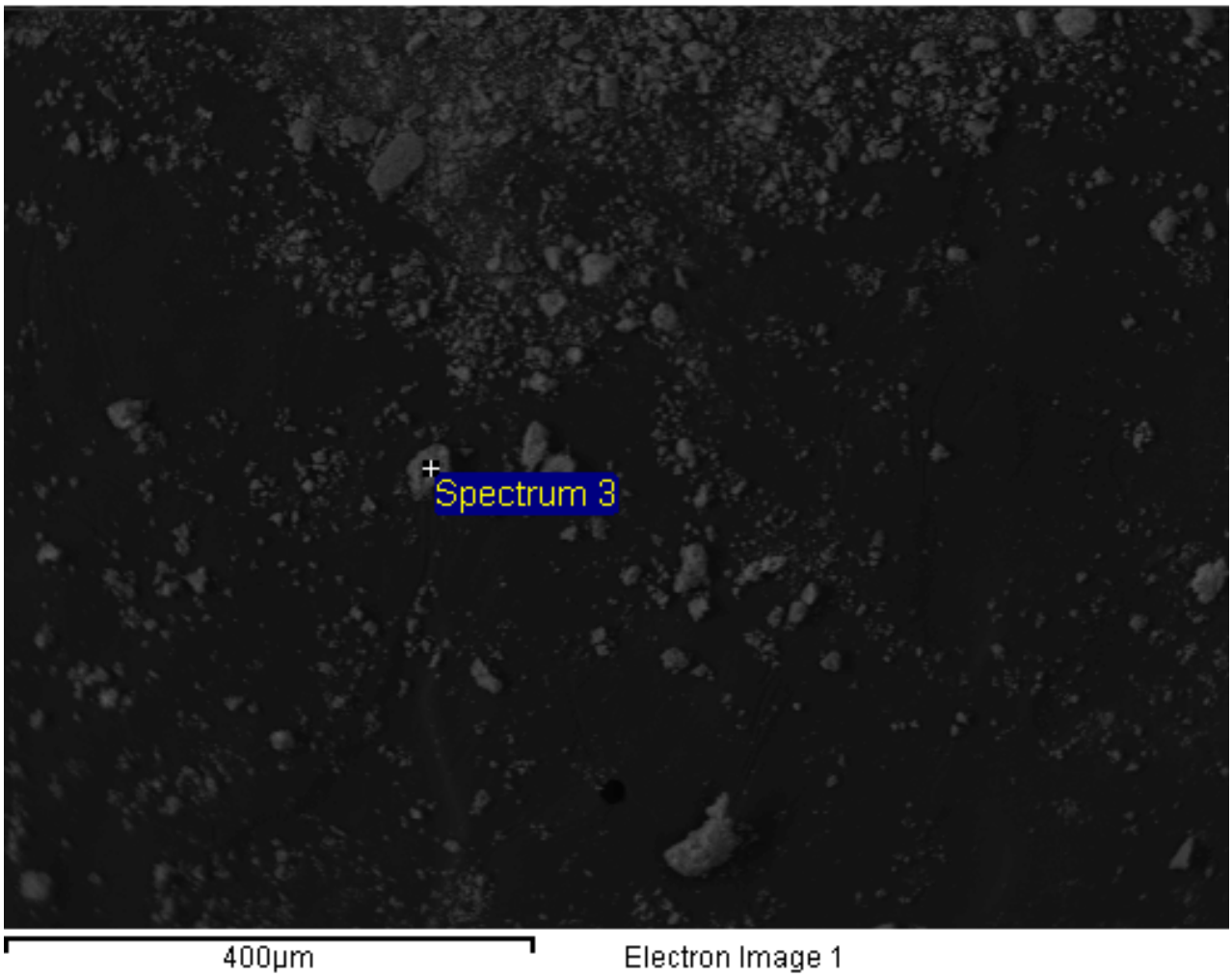


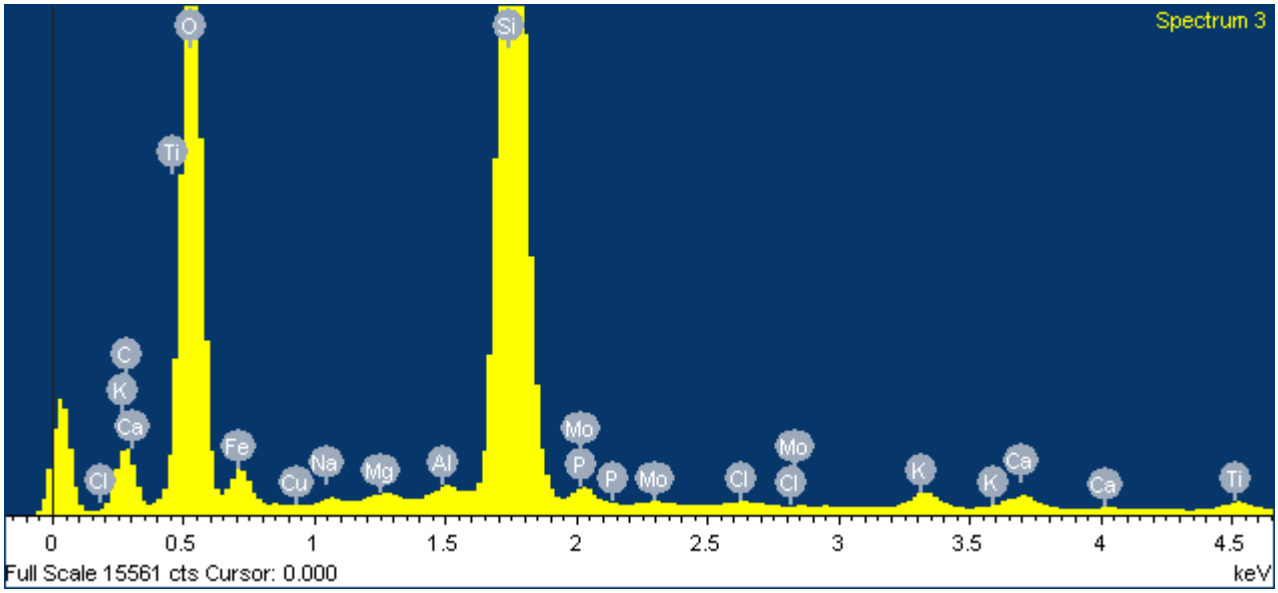
Comment: Sample 12867 red



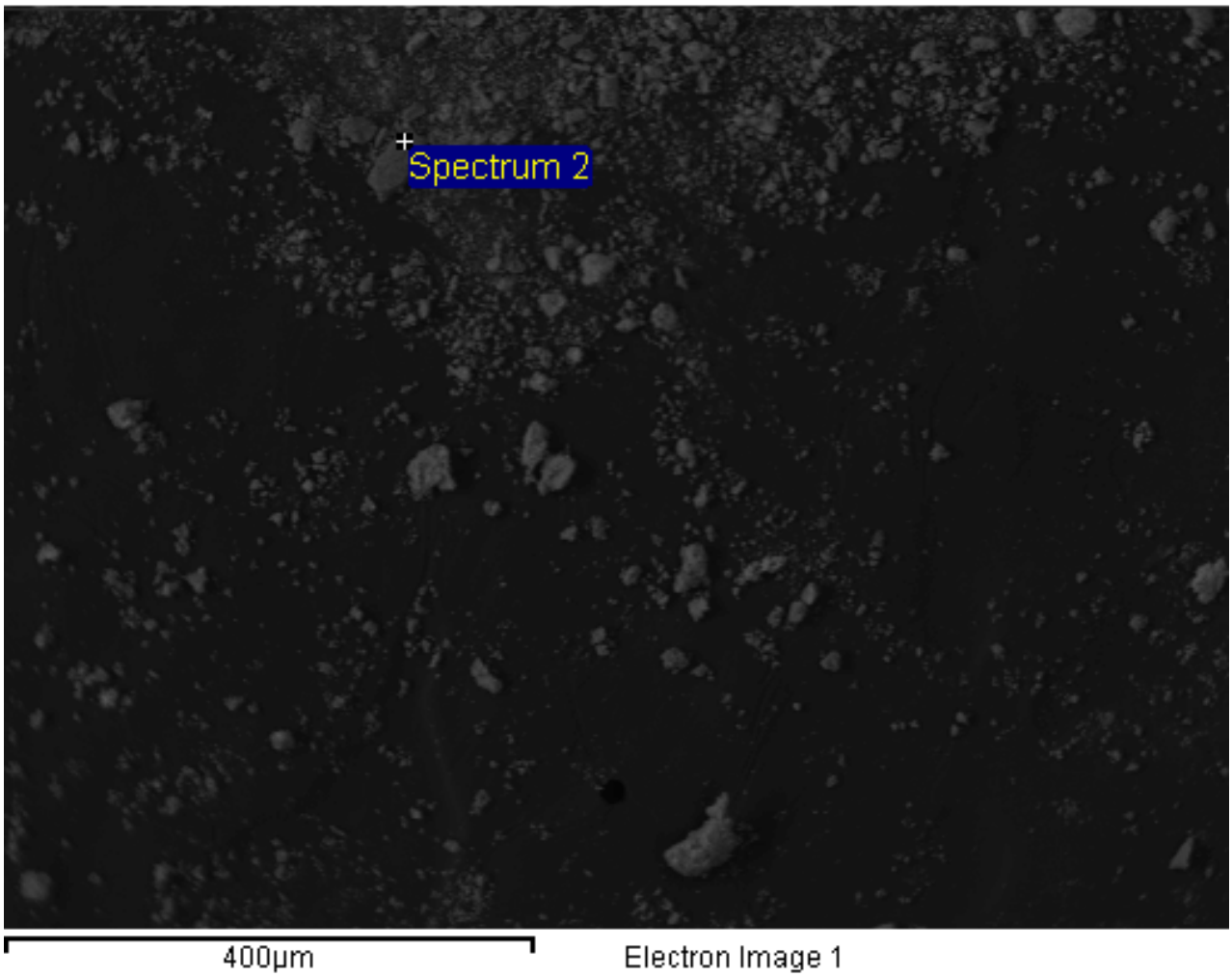


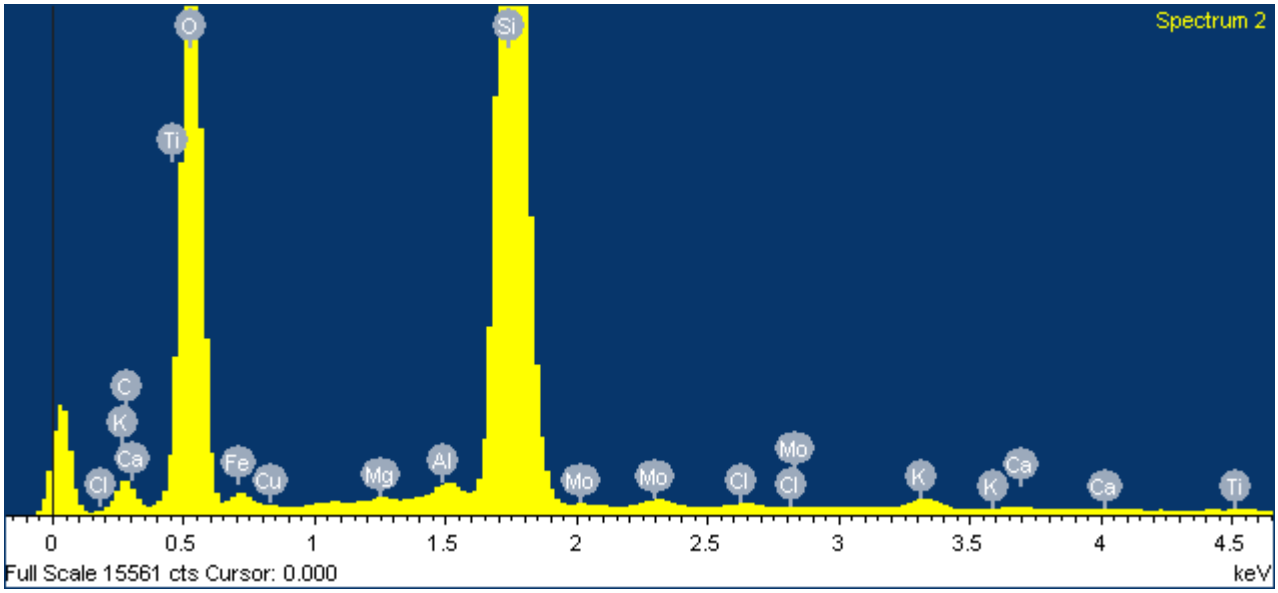
Comment: Sample 12867 red



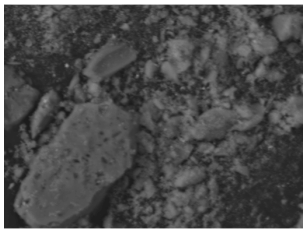


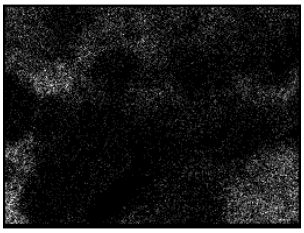
Comment: Sample 12867 red

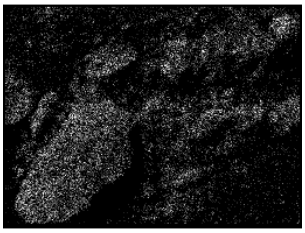


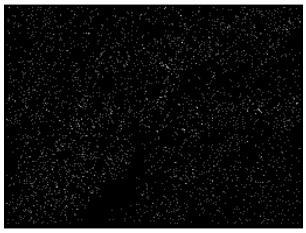


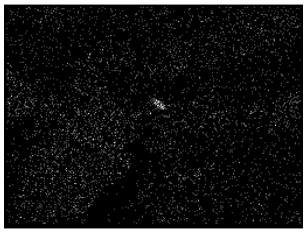
Comment: Sample 12867 red

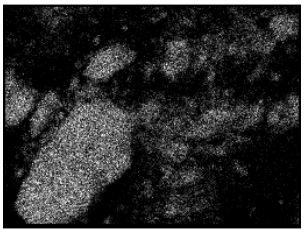

Electron Image 1

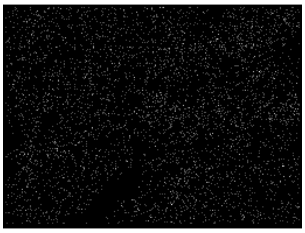

C Ka1_2

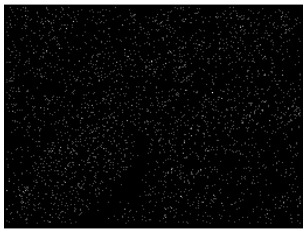

O Ka1

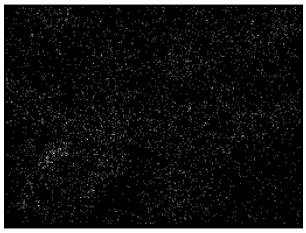

Mg Ka1_2

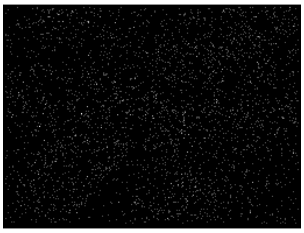

Al Ka1

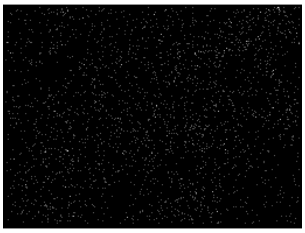

Si Ka1

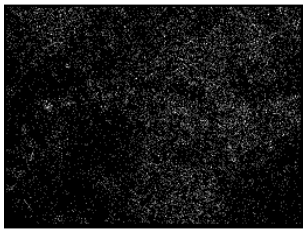

P Ka1

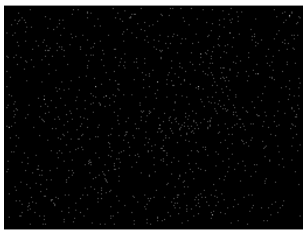

Cl Ka1

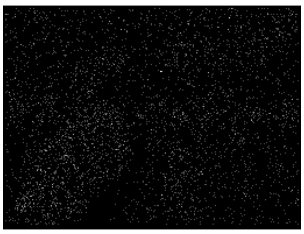

K Ka1

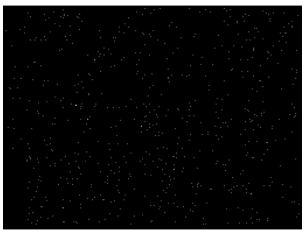

Ca Ka1

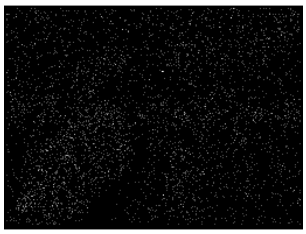

Ti Ka1


Fe Ka1


Cu Ka1


Mo La1


Hg La1

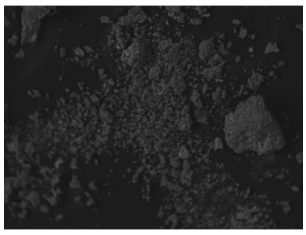

S Ka1

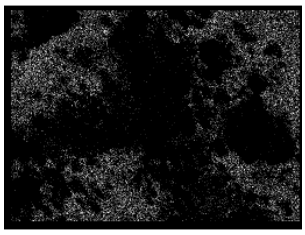
Comment: Sample 12867 red
C, O, Mg, Al, Si, P, Cl, K, Ca, Ti, Fe, Cu, Mo, Hg, S

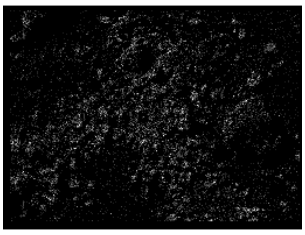
Unit 13365 Red

CHLevelII. South R

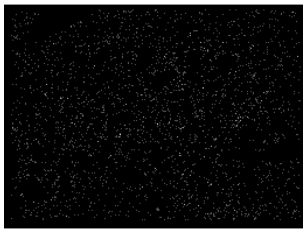
06/11/2013 12:15:30

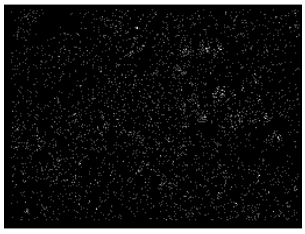

Electron Image 1

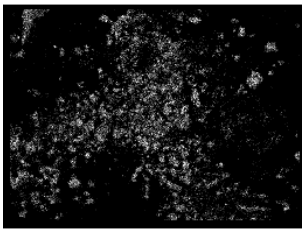

C Ka1_2

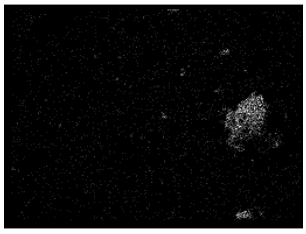

O Ka1

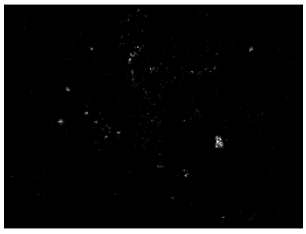

Na Ka1_2

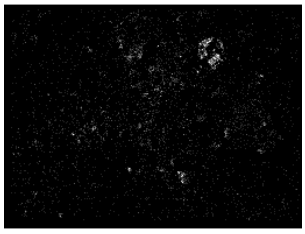

Mg Ka1_2

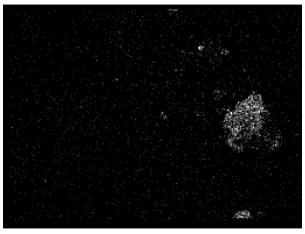

Al Ka1

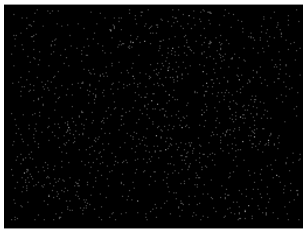

Si Ka1

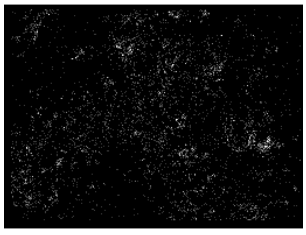

S Ka1

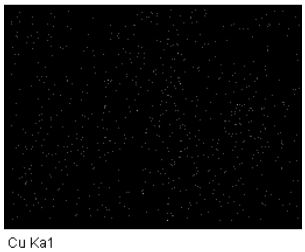

Cl Ka1


K Ka1

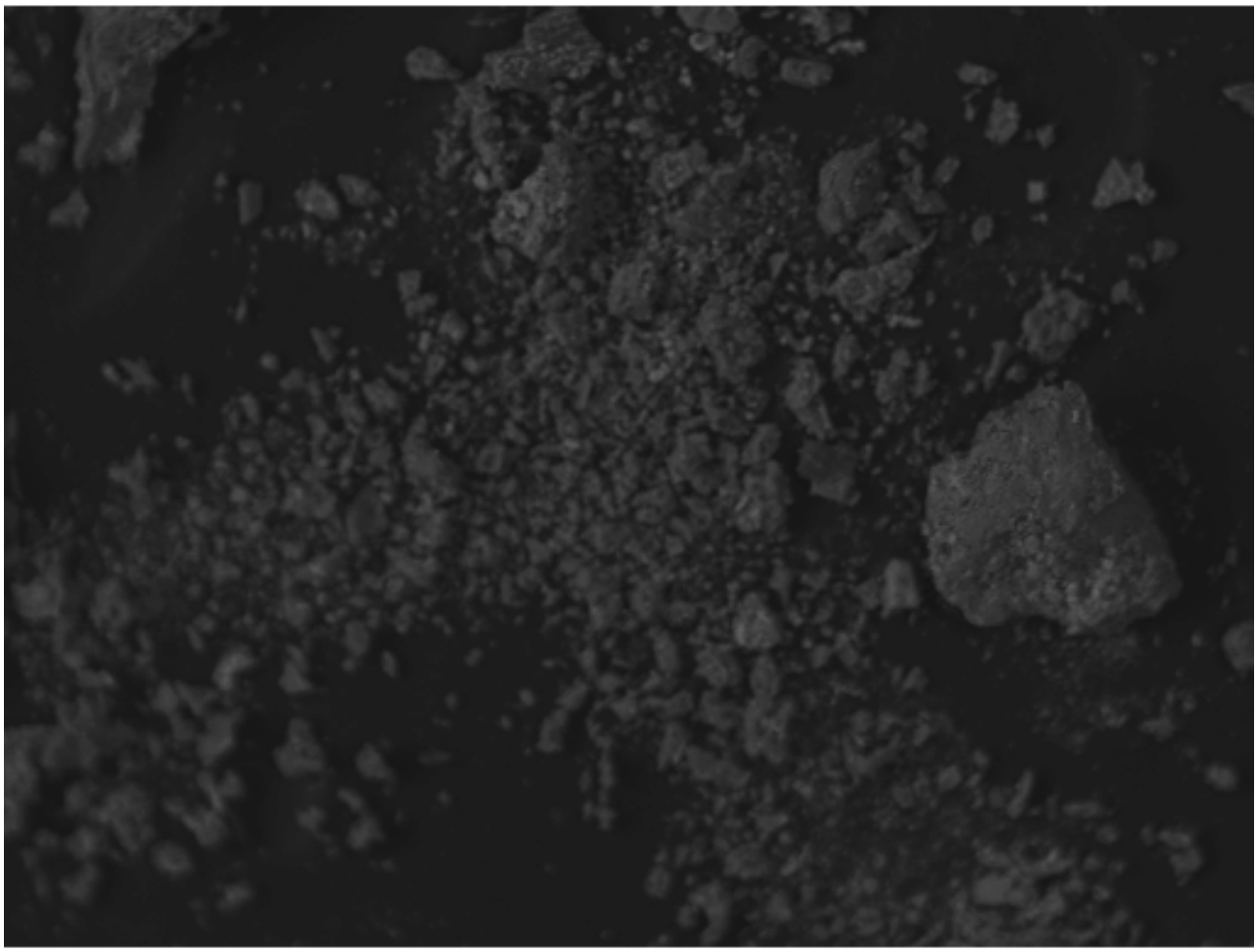

Ca Ka1


Ti Ka1

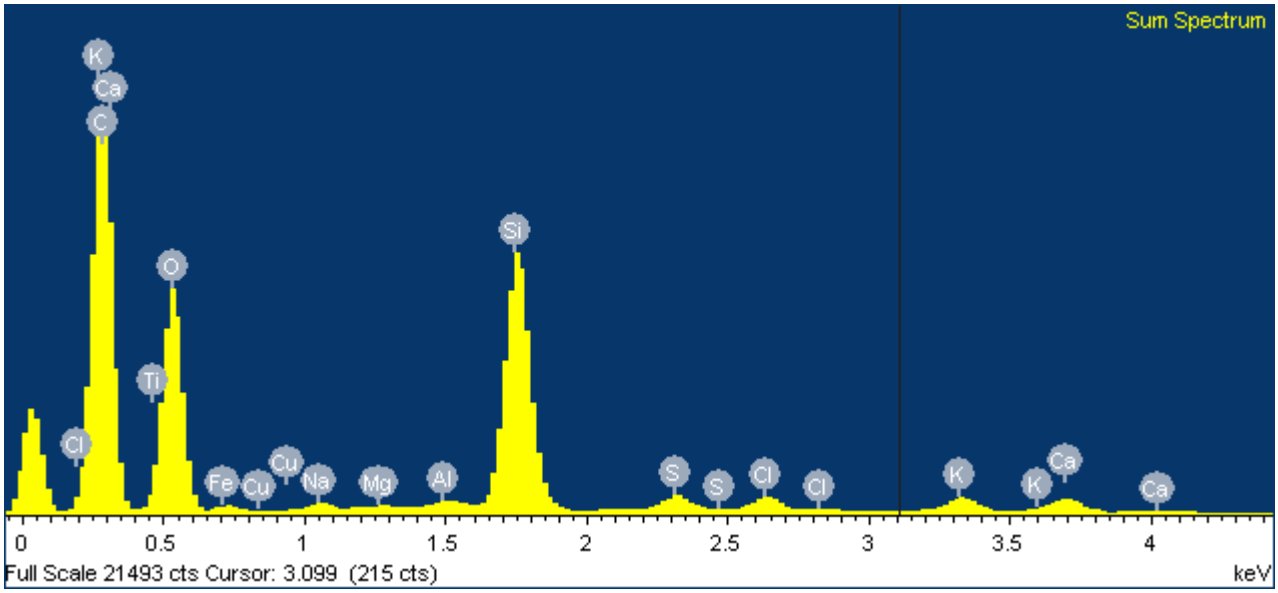

Fe Ka1


Cu Ka1

Comment: 13365 Red
C, O, Na, Mg, Al, Si, S, Cl, K, Ca, Ti, Fe, Cu



Electron Image 1

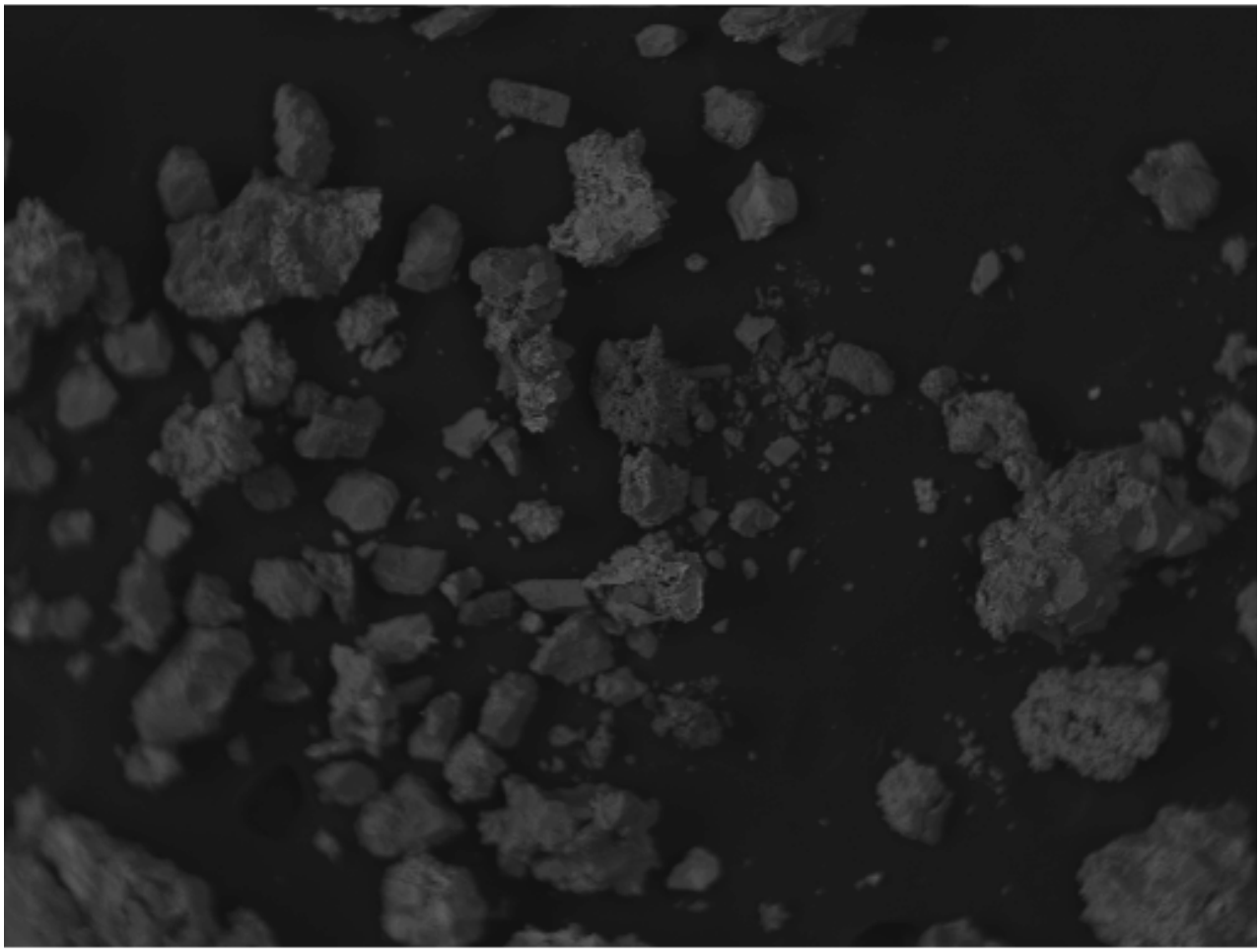


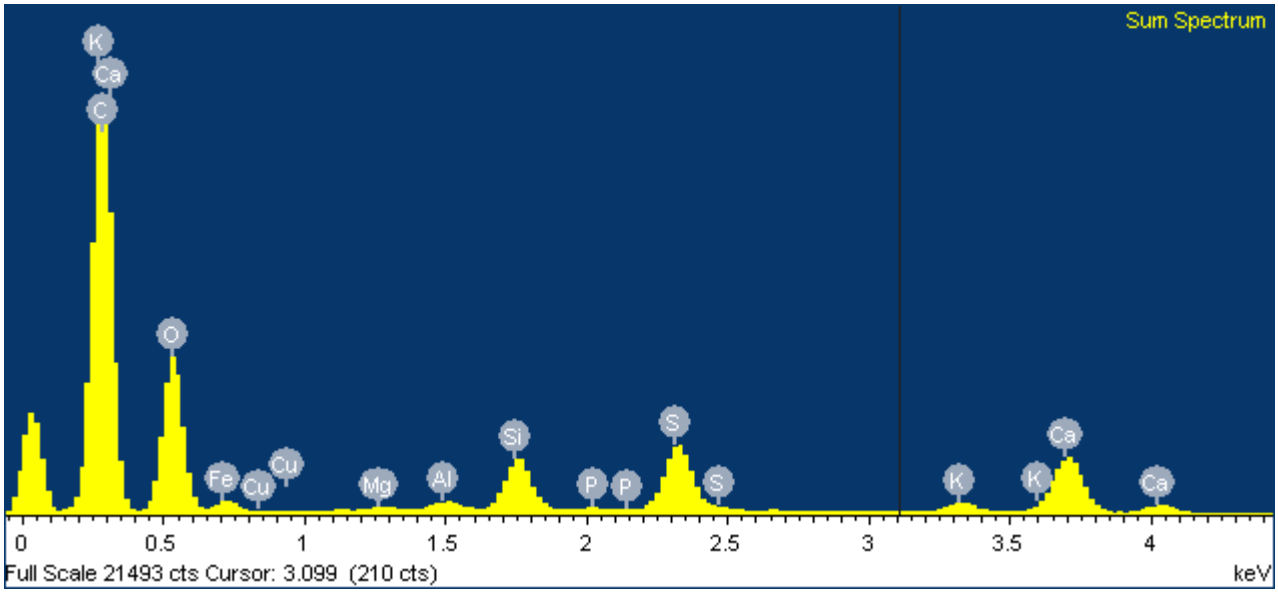
Comment: Sample 13365 Red

Unit 14009 Red

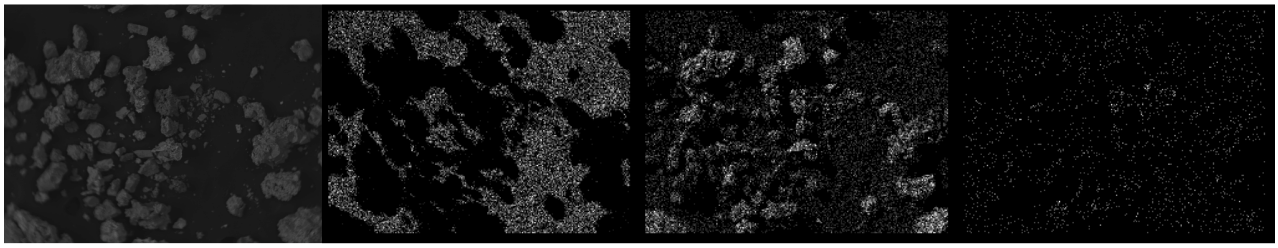
CHLevelIII. South R

06/11/2013 12:20:48

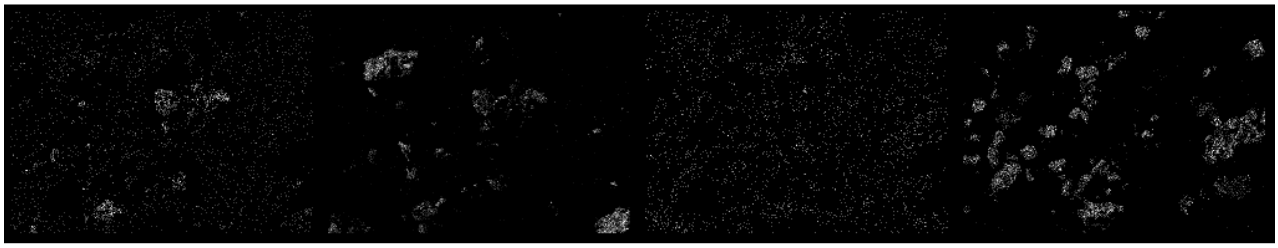




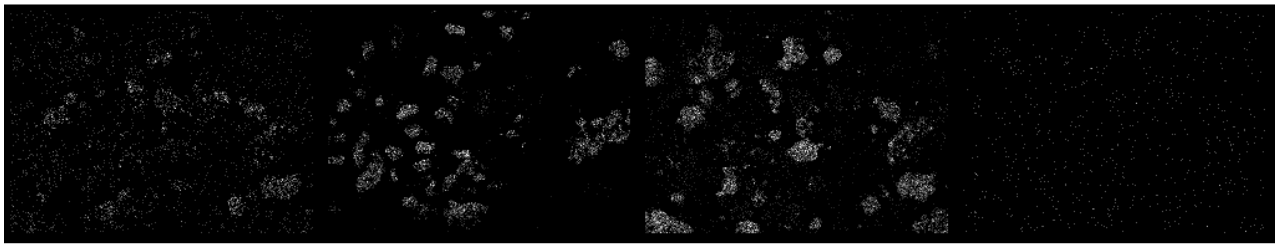
Comment: 14009 red



Electron Image 1 | C Ka1_2 | O Ka1 | Mg Ka1_2

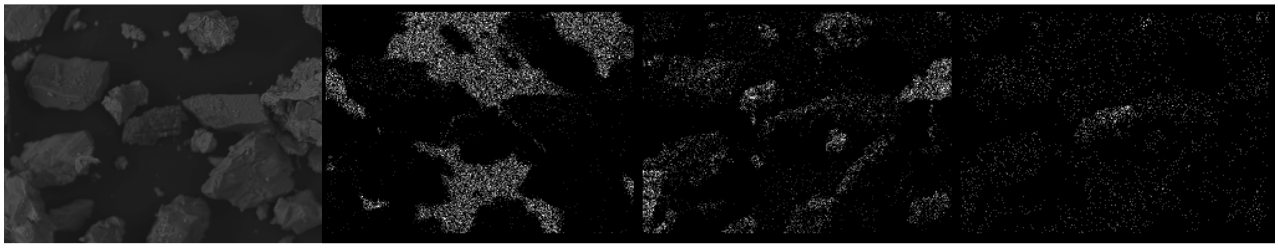


Al Ka1 | Si Ka1 | P Ka1 | S Ka1

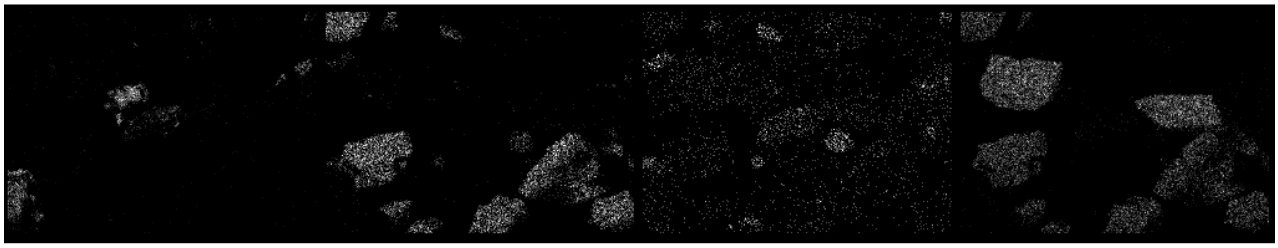


K Ka1 | Ca Ka1 | Fe Ka1 | Cu Ka1

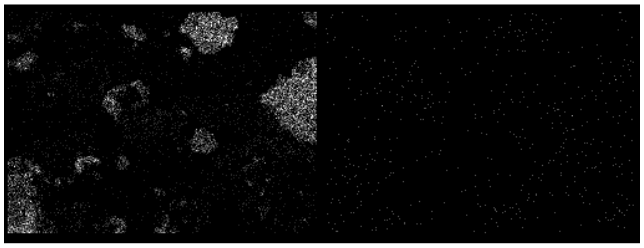
Comment: 14009 red
C, O, Mg, Al, Si, P, S, K, Ca, Fe, Cu



Electron Image 1 | C Ka1_2 | O Ka1 | Al Ka1

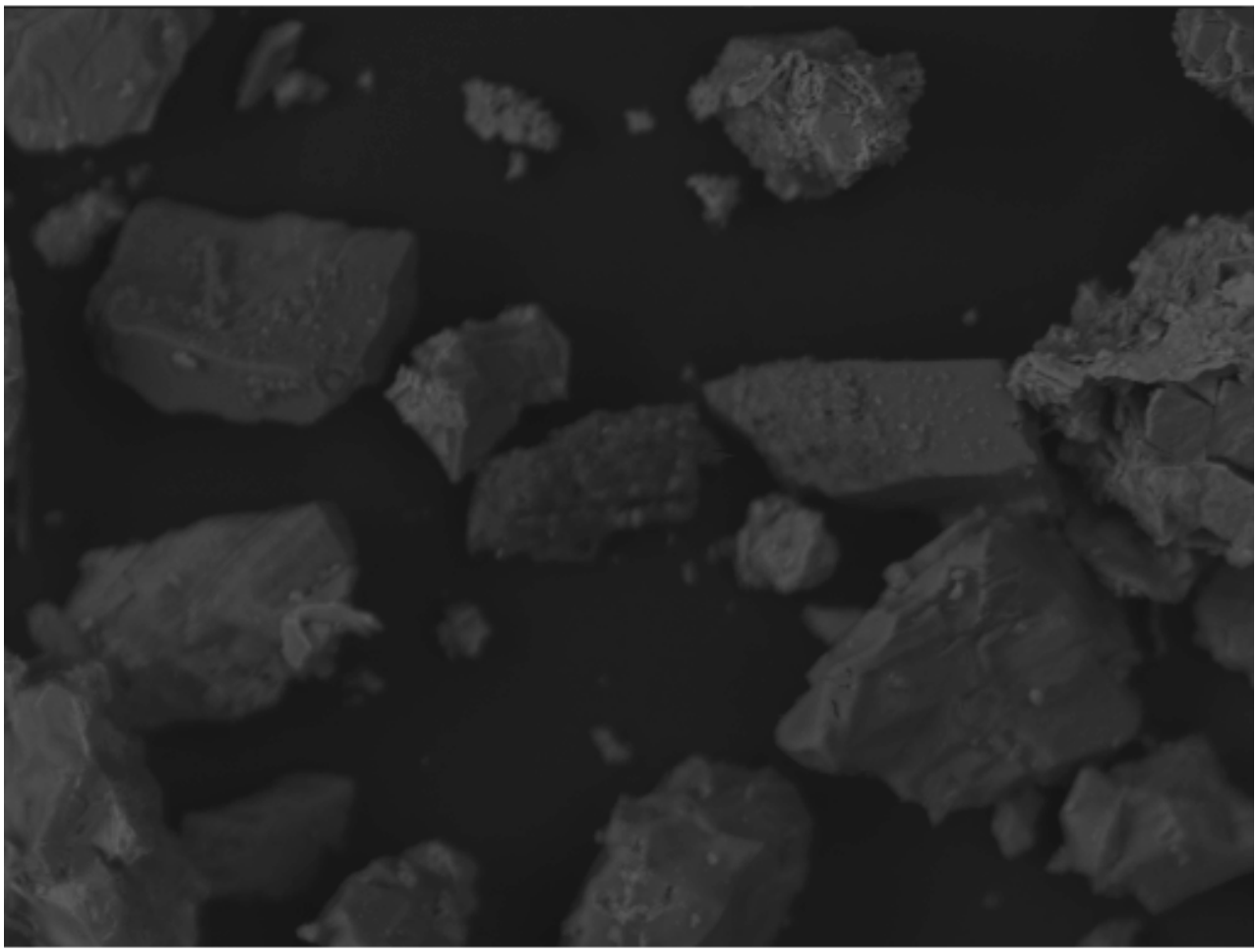


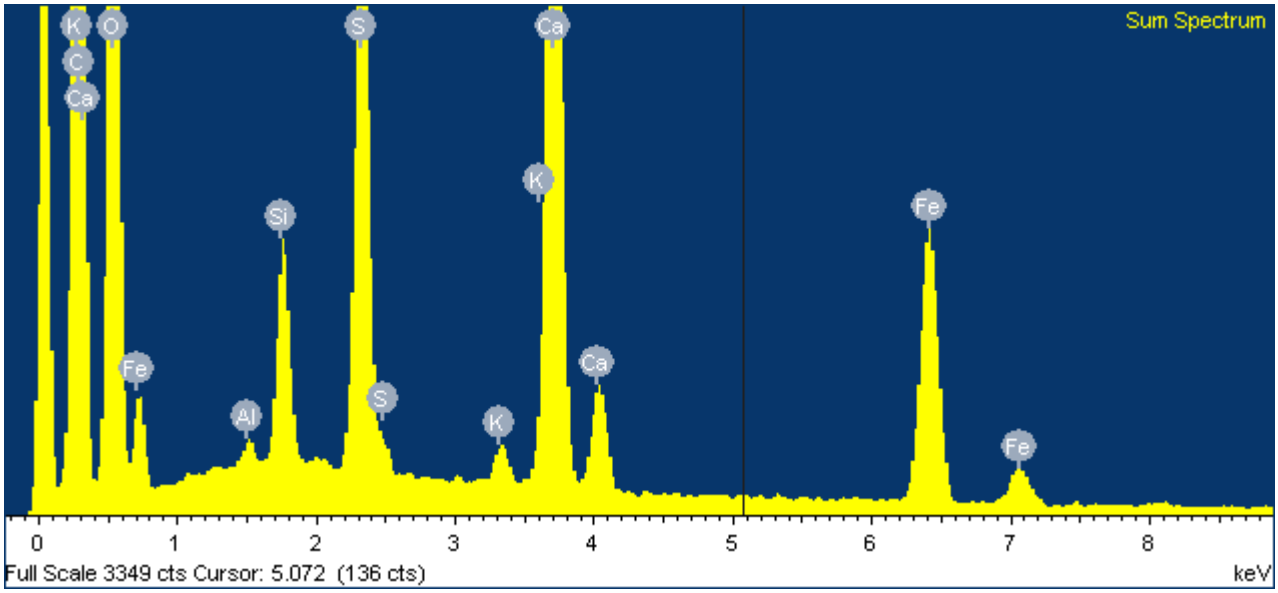
Si Ka1 | S Ka1 | K Ka1 | Ca Ka1



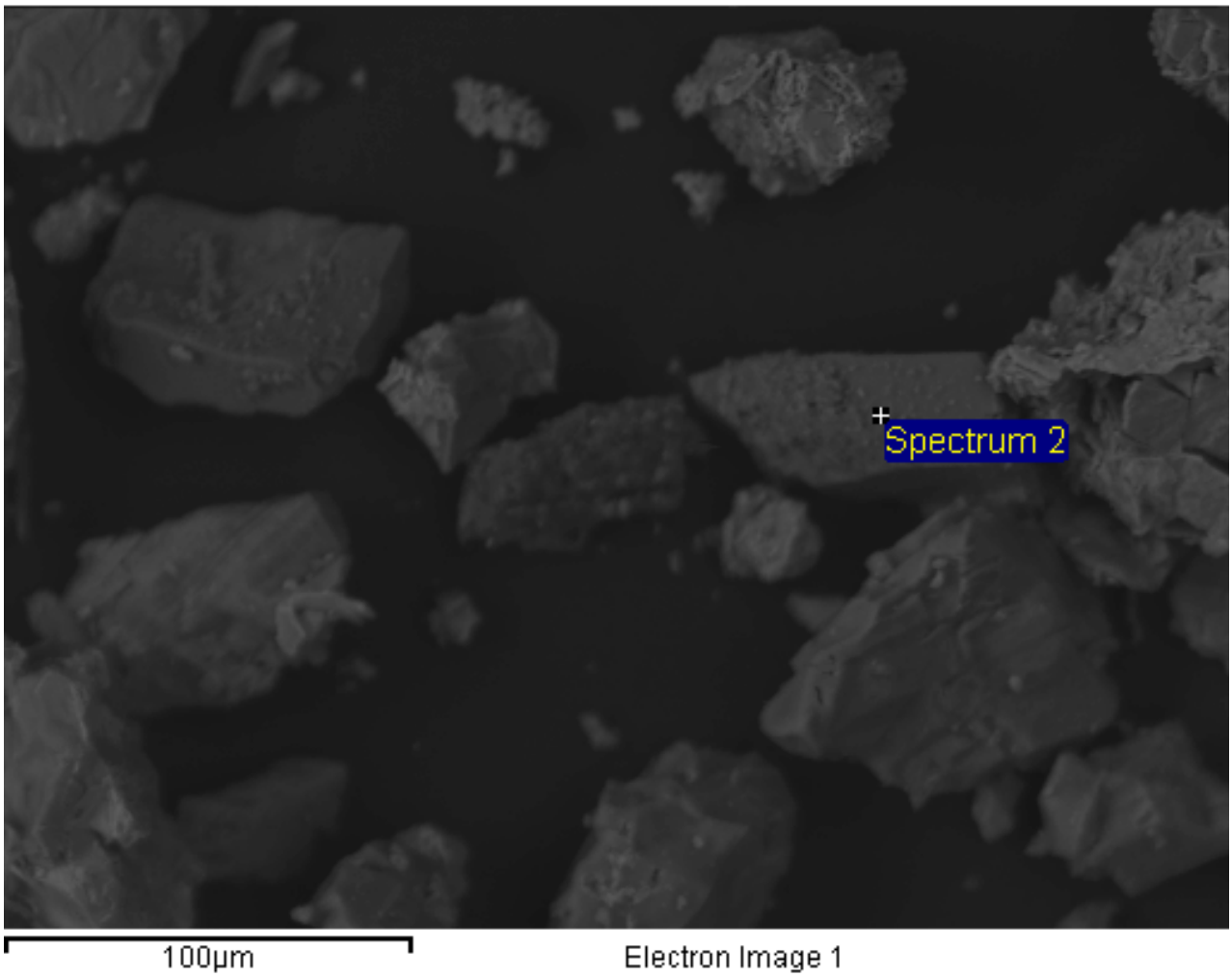
Fe Ka1 | Hg La1

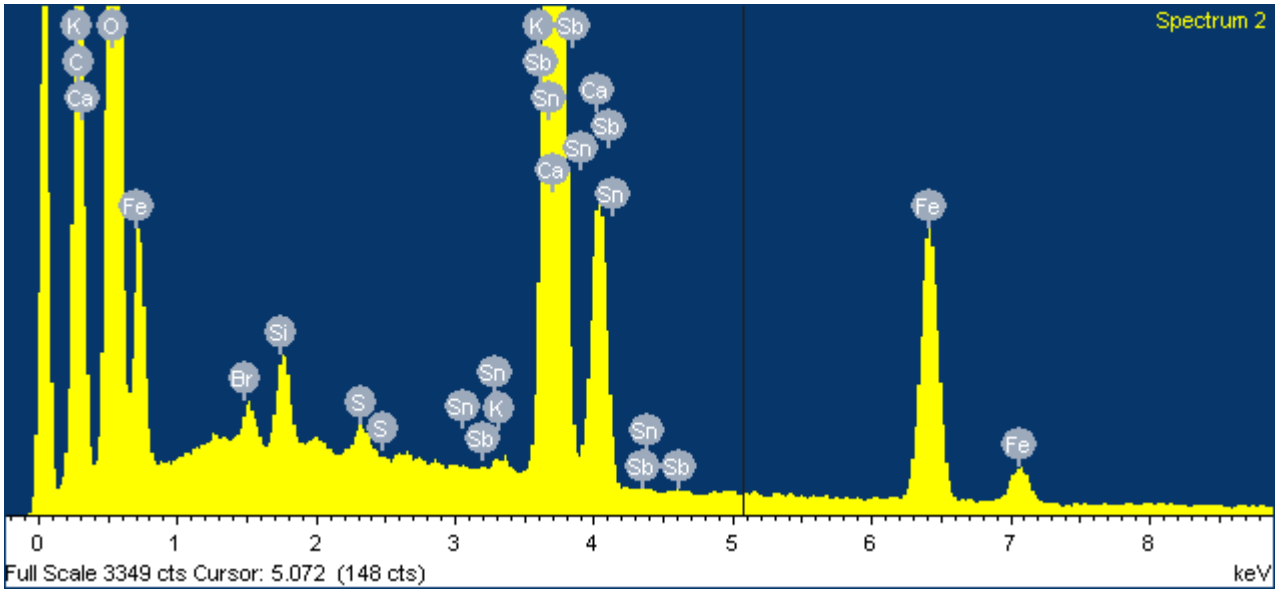
Comment: Sample 14009 red
C, O, Al, Si, S, K, Ca, Fe, Hg



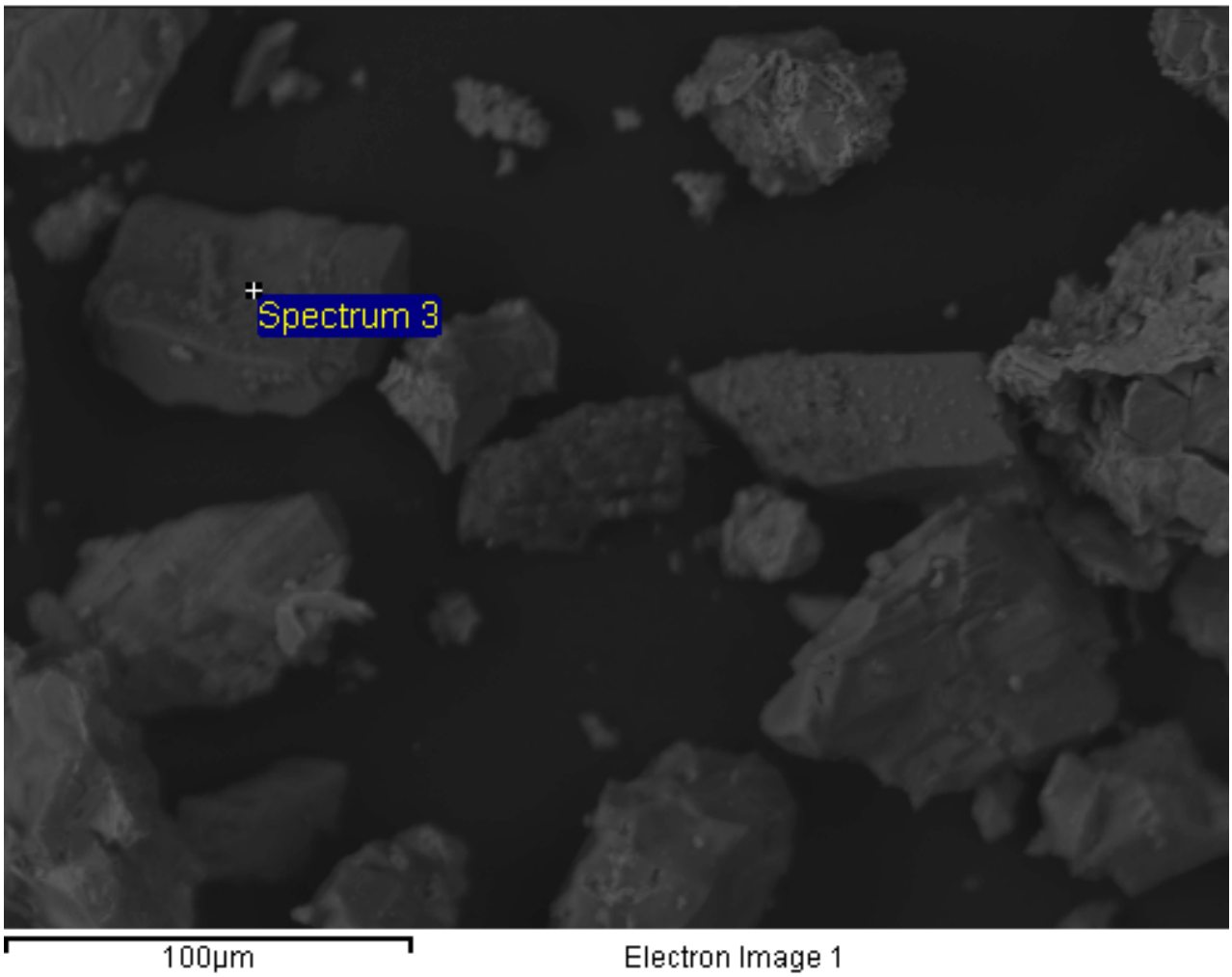


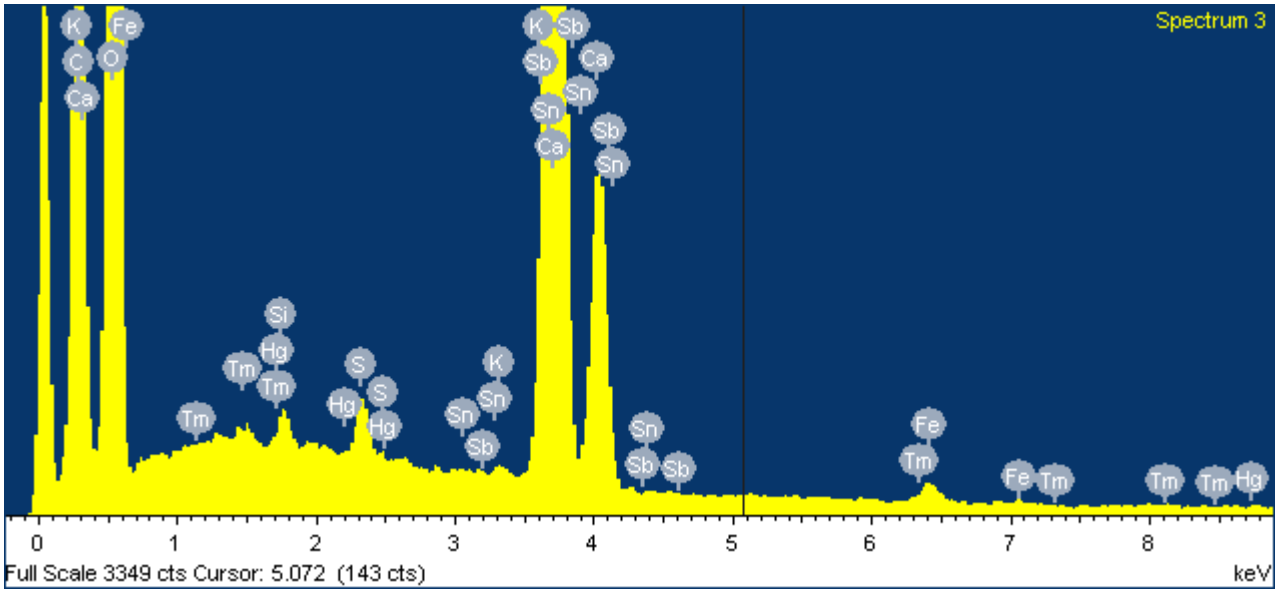
Comment: Sample 14009 red



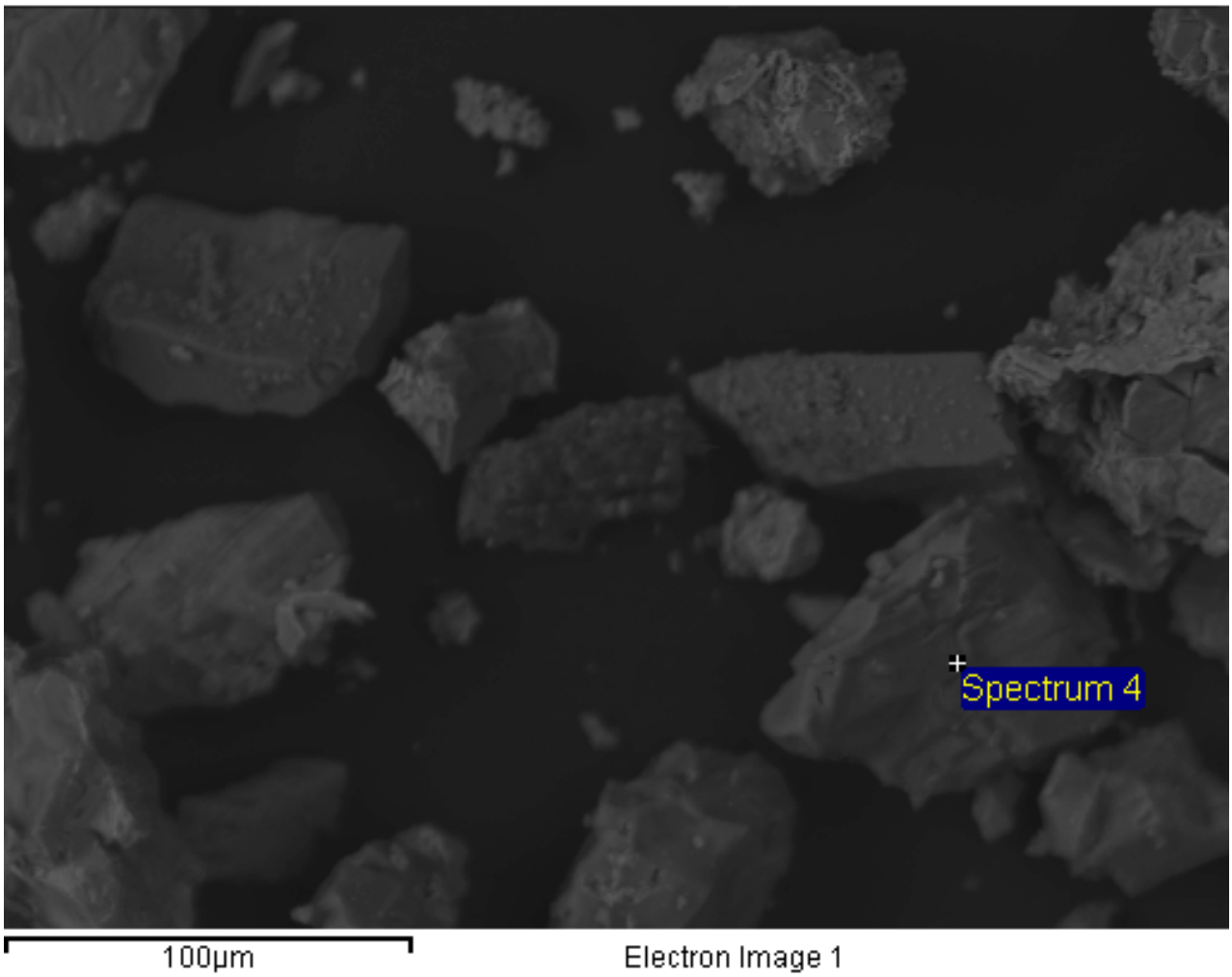


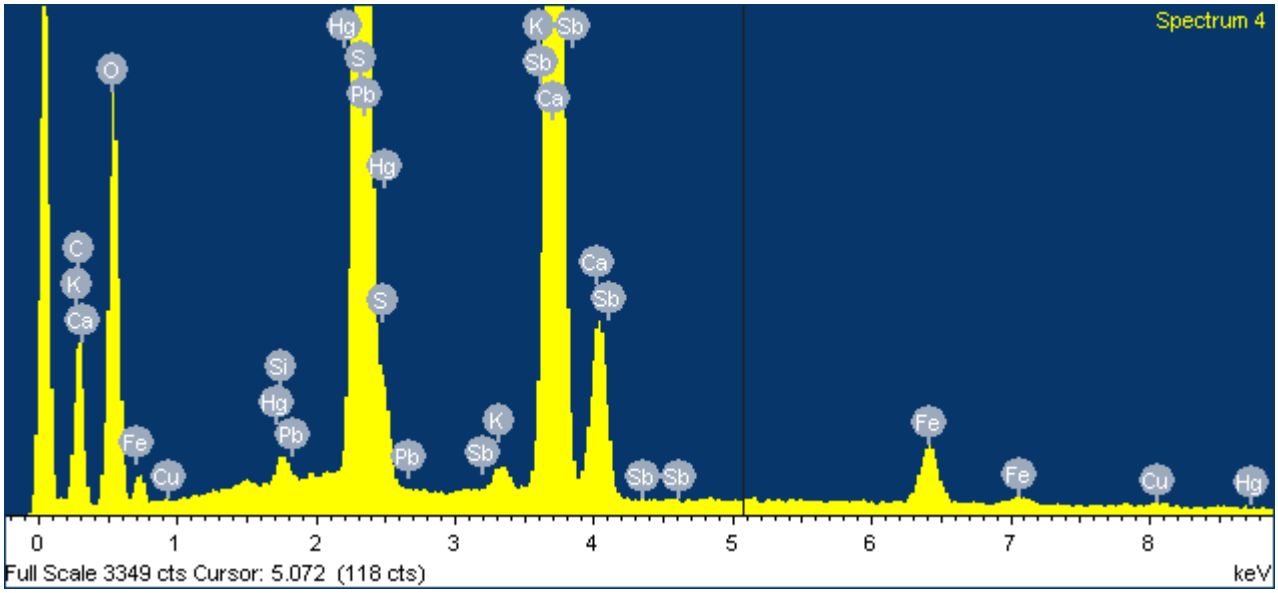
Comment: Sample 14009 red



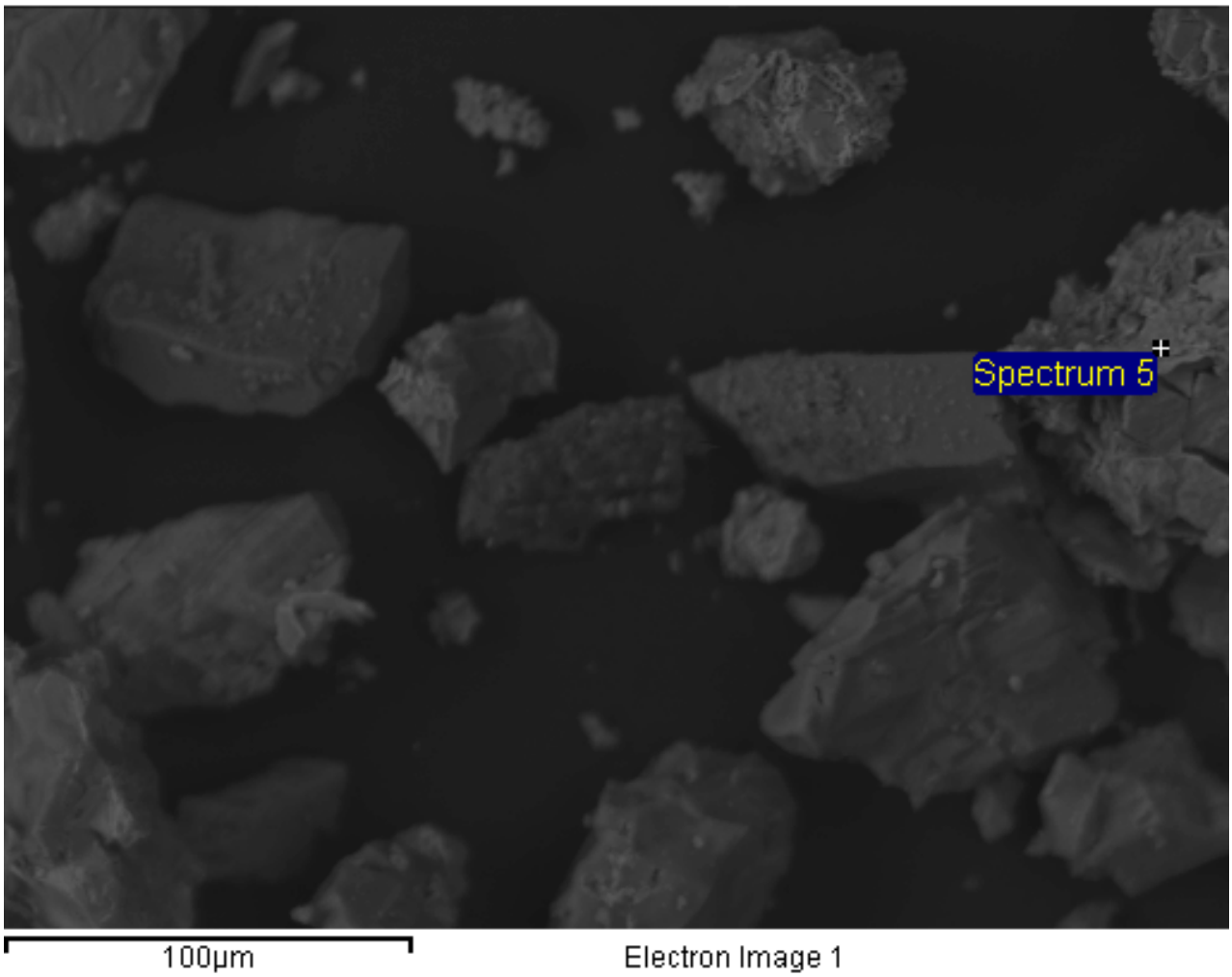


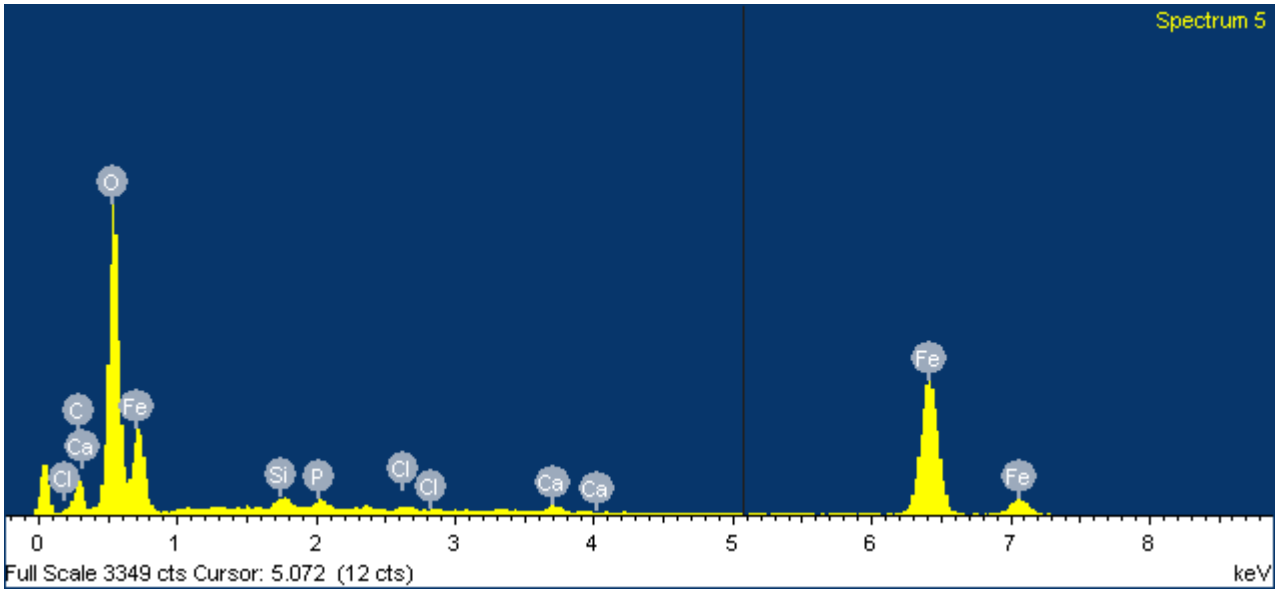
Comment: Sample 14009 red





Comment: Sample 14009 red



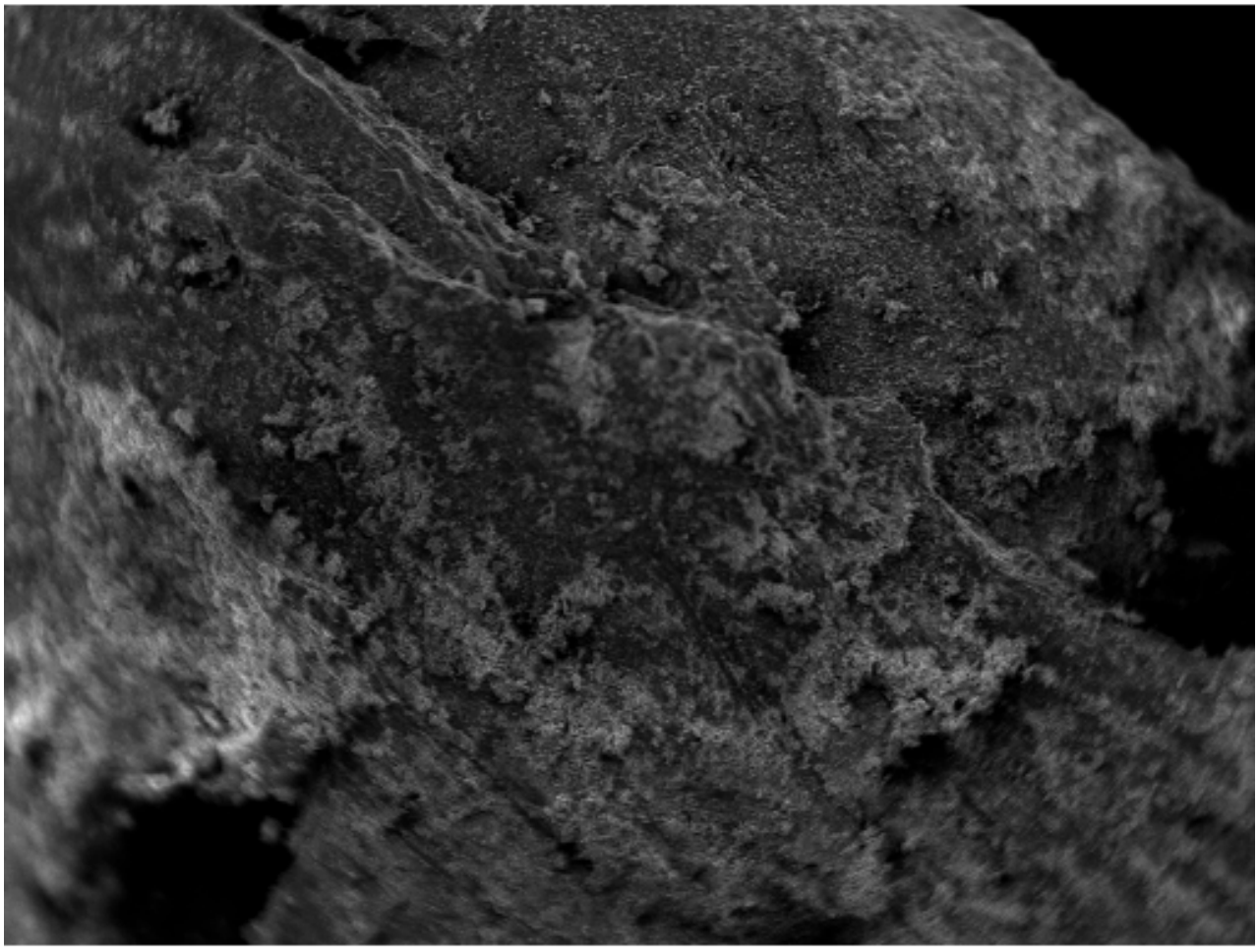


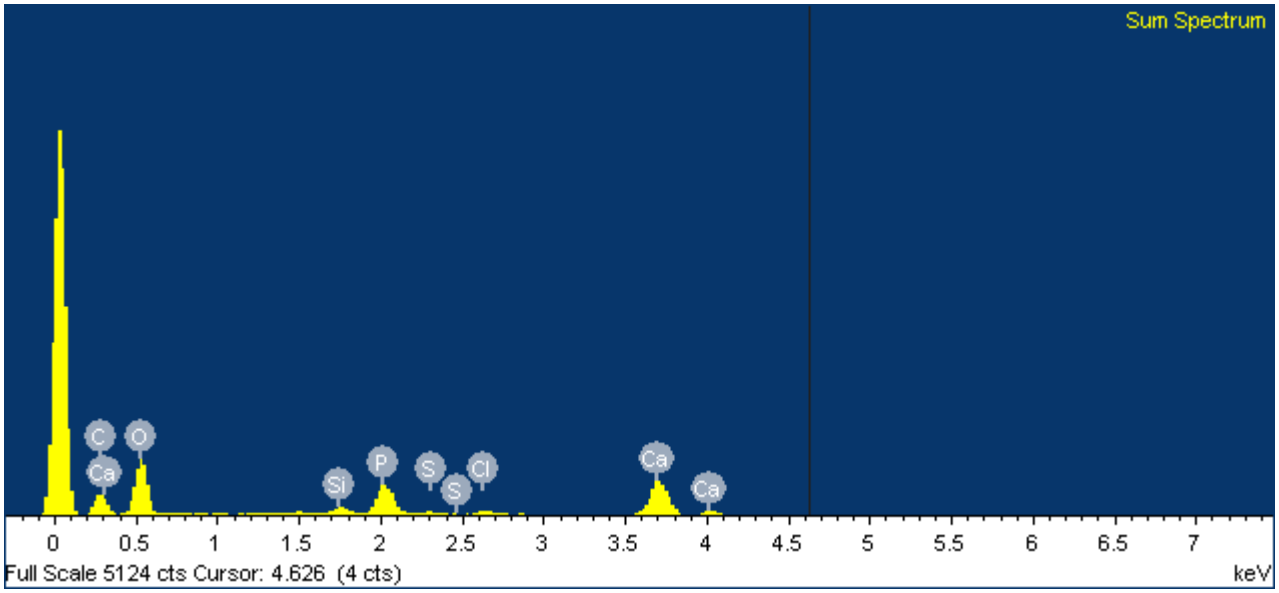
Comment: Sample 14009 red

Unit 12450 Blue bone

CHLevelV.South P powders, bone

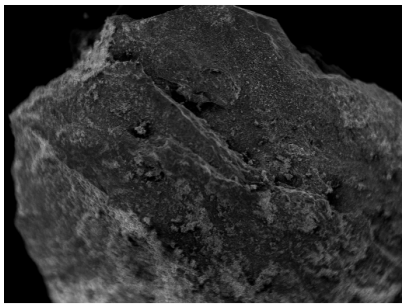
06/11/2013 13:41:57

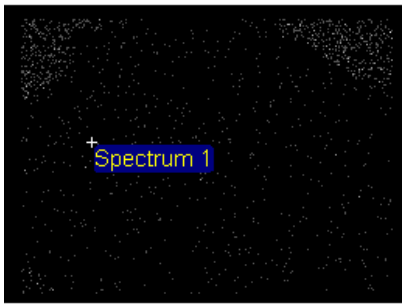




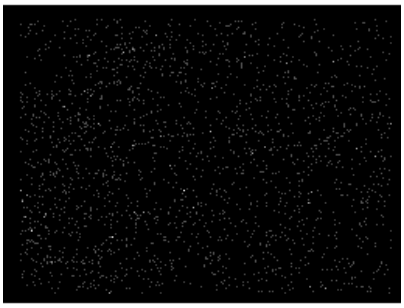
Comment: 12450 blue bone

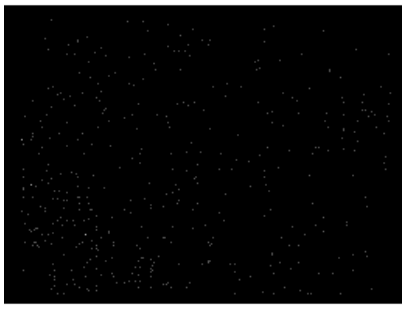
INCA

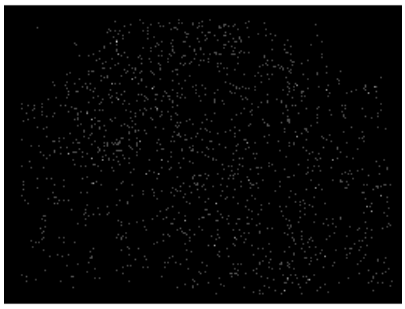

Electron Image 1

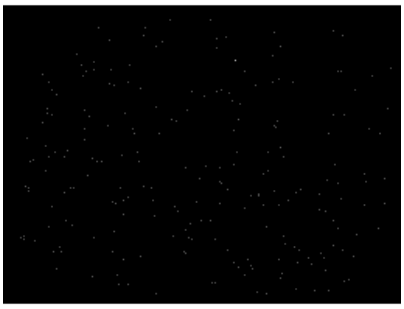


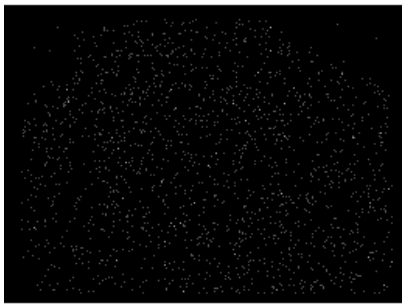
C Ka1_2


O Ka1

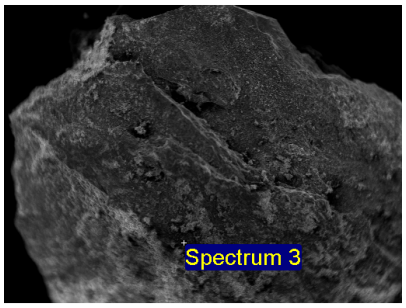

Si Ka1


P Ka1

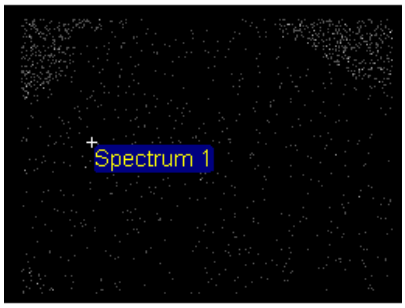

Cl Ka1


Ca Ka1

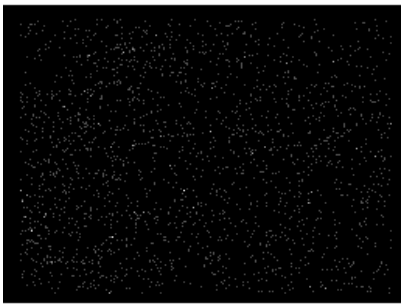
Comment:12450 bone
C, O, Na, Al, Si, Cl, K, Fe

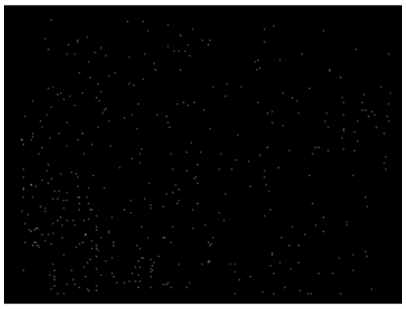


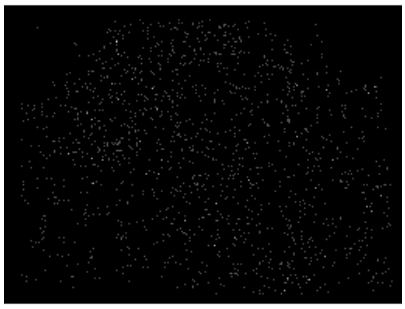
Electron Image 1

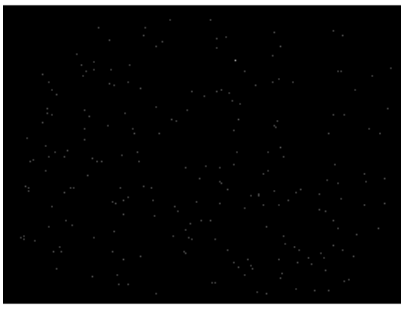


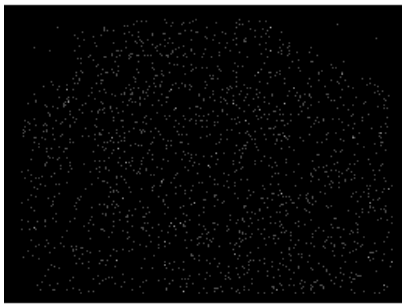
C Ka1_2


O Ka1

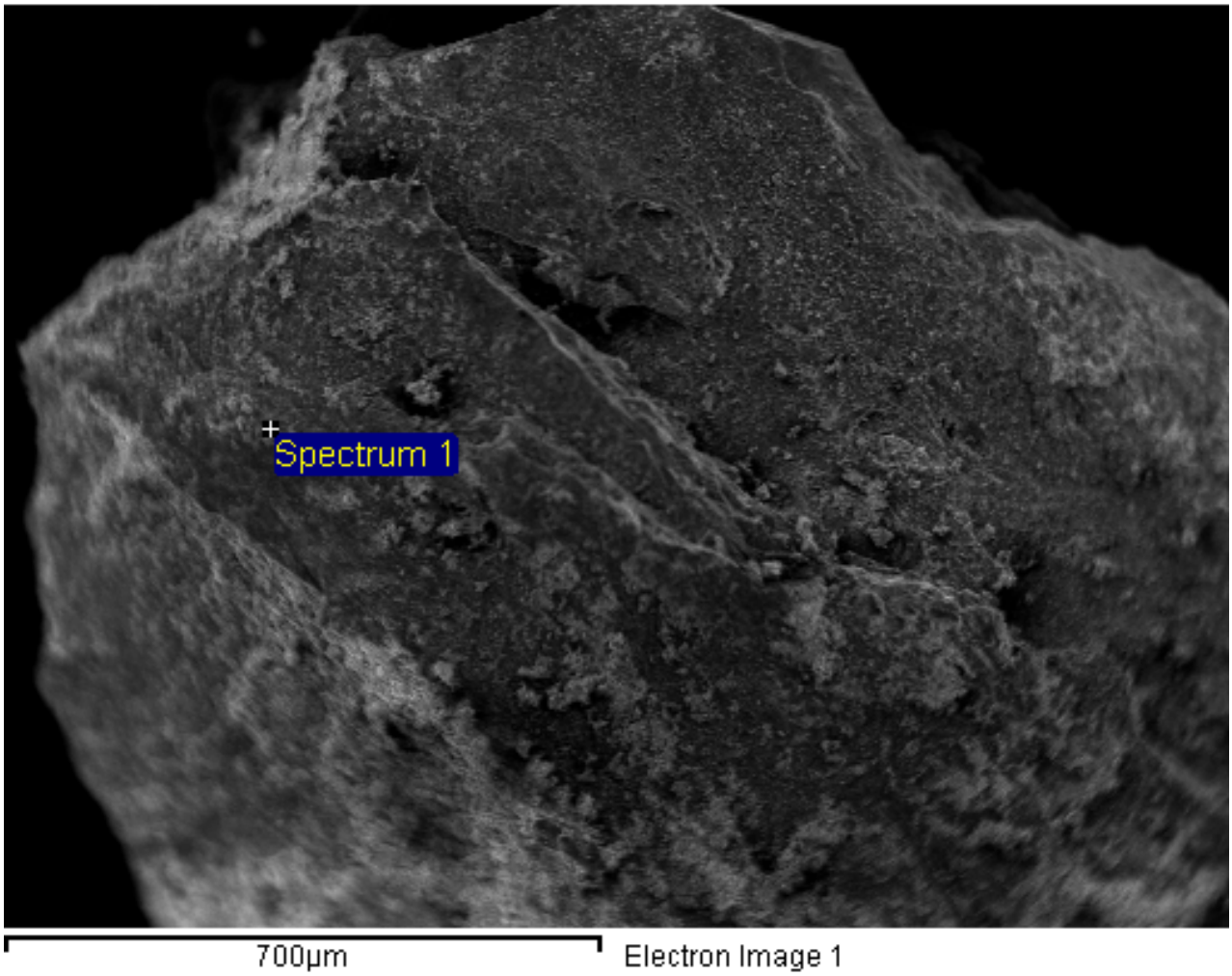

Si Ka1

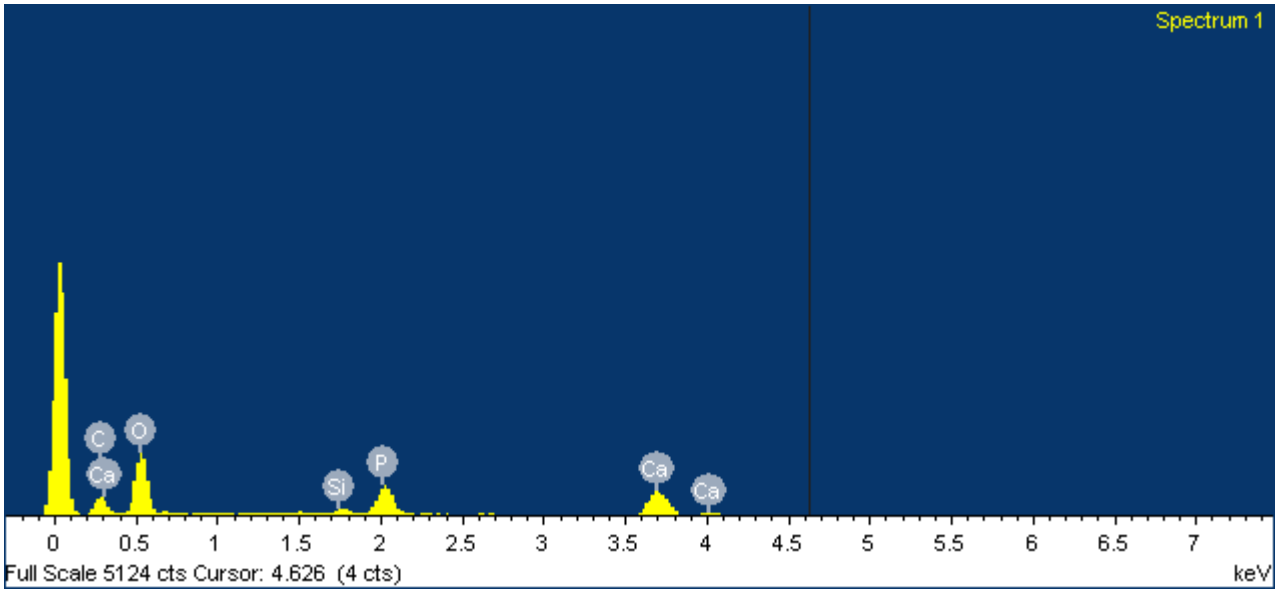

P Ka1


Cl Ka1

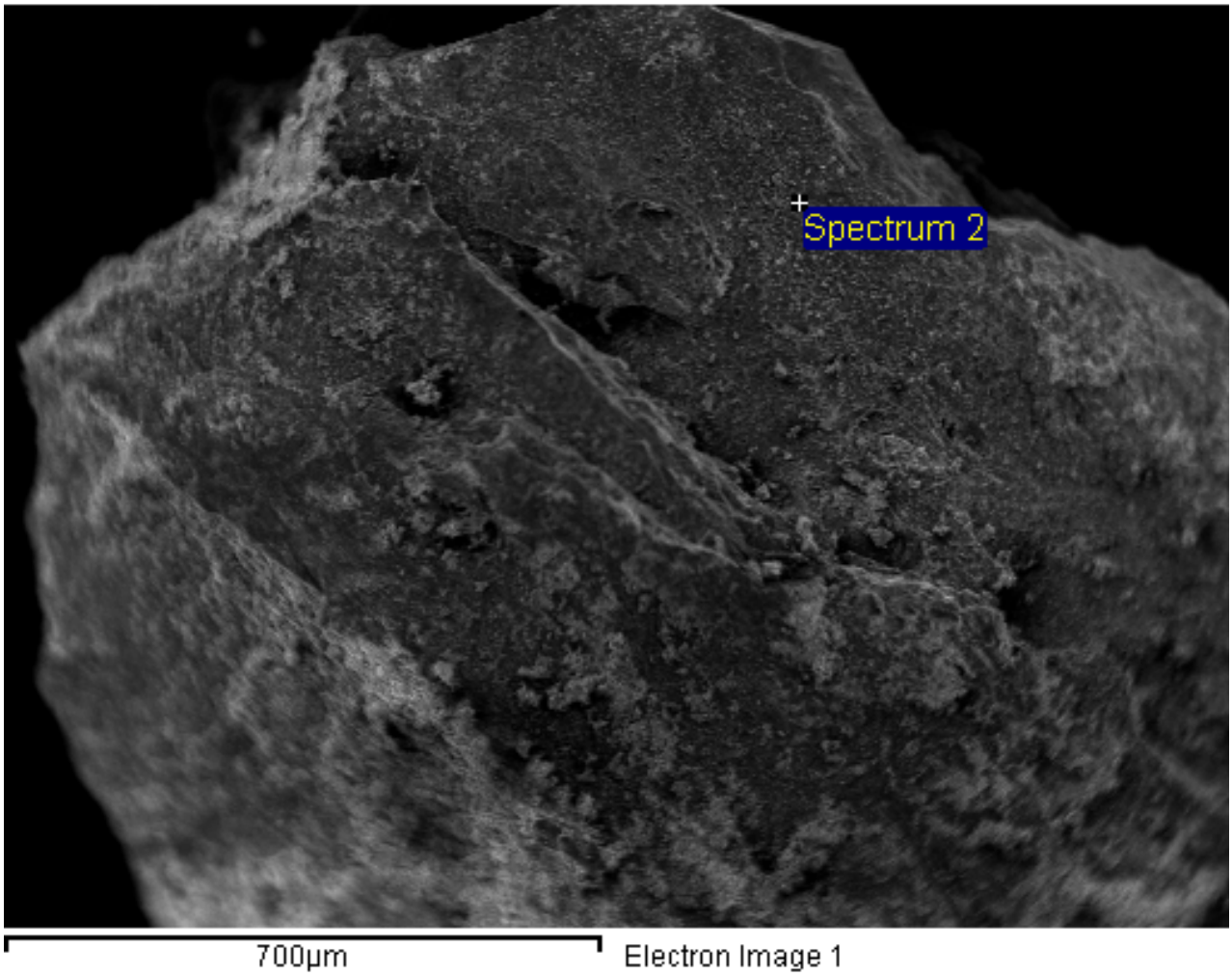

Ca Ka1

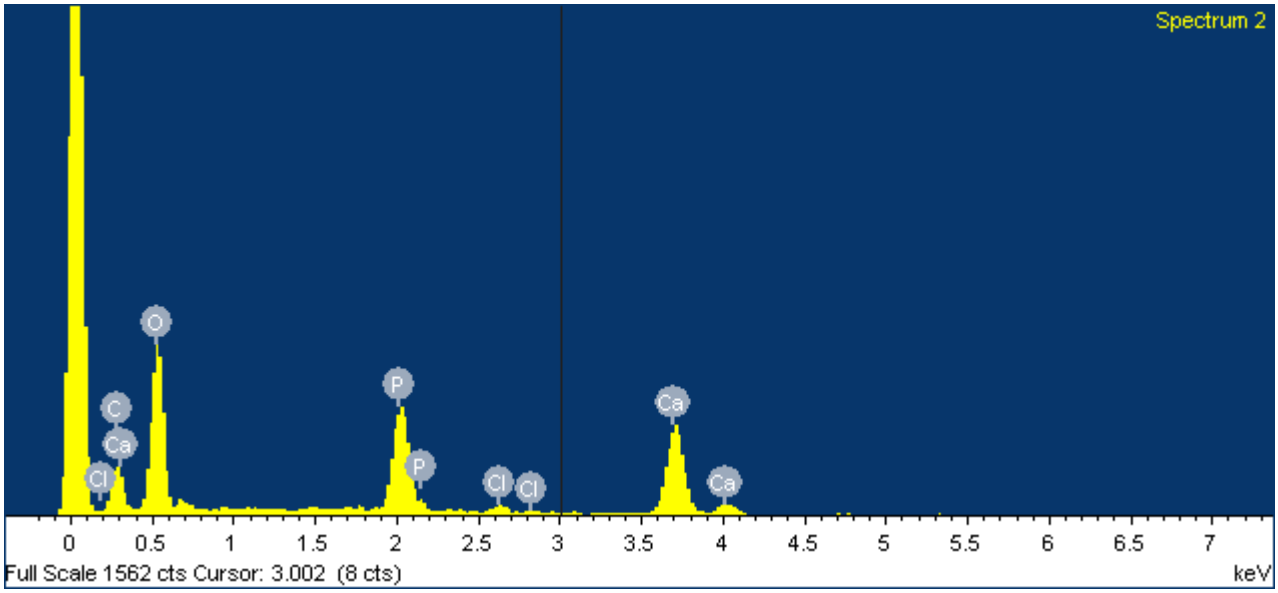
Comment:12450 bone
C, O, Si, P, Cl, Ca



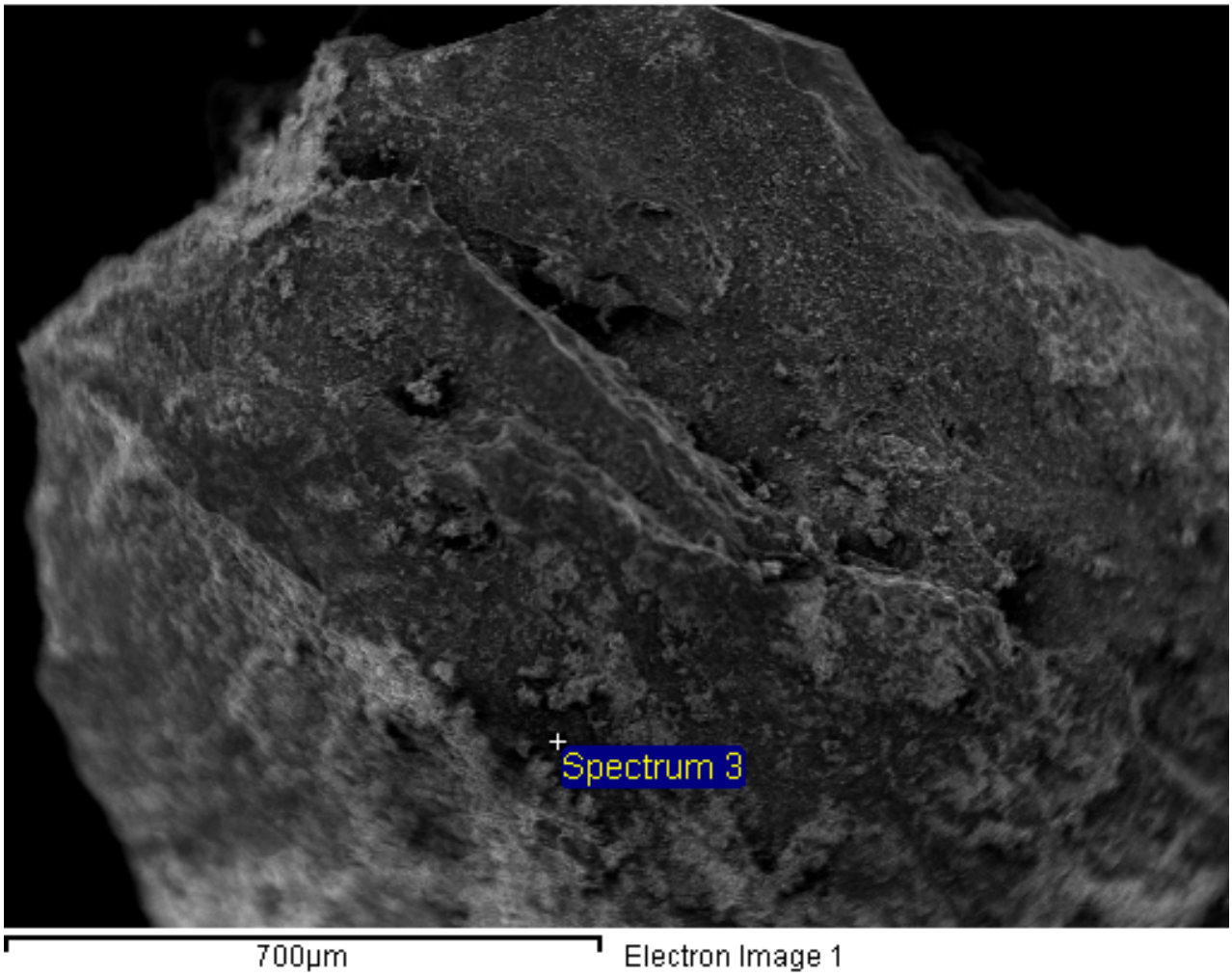


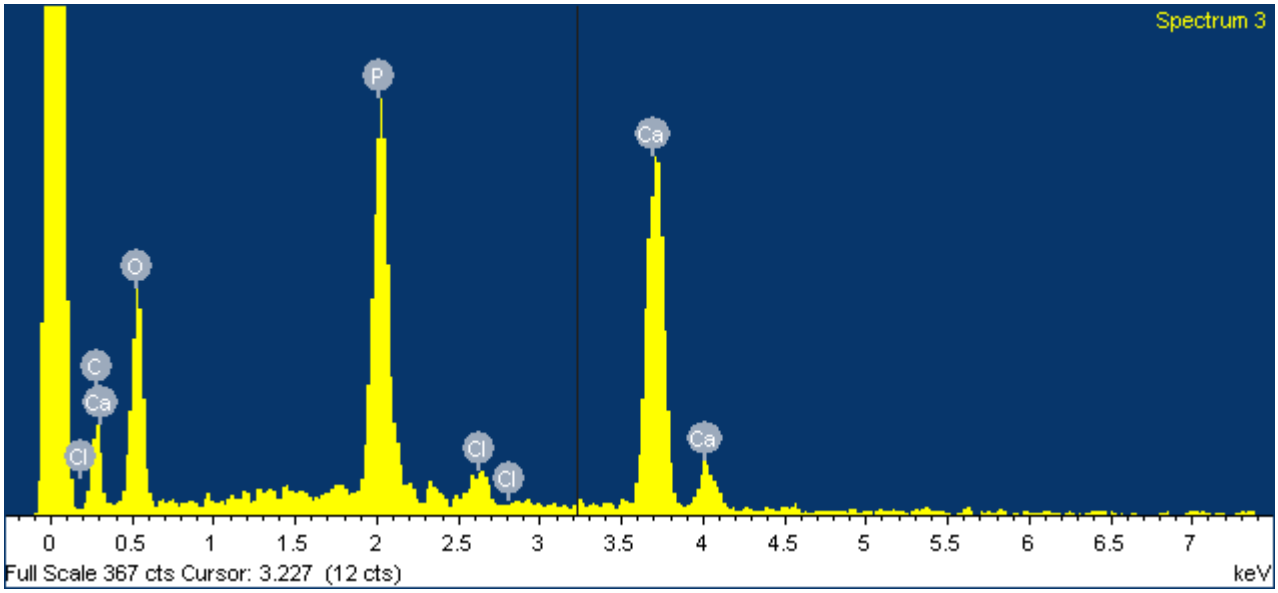
Comment:12450 bone
C, O, Si, P, Cl, Ca



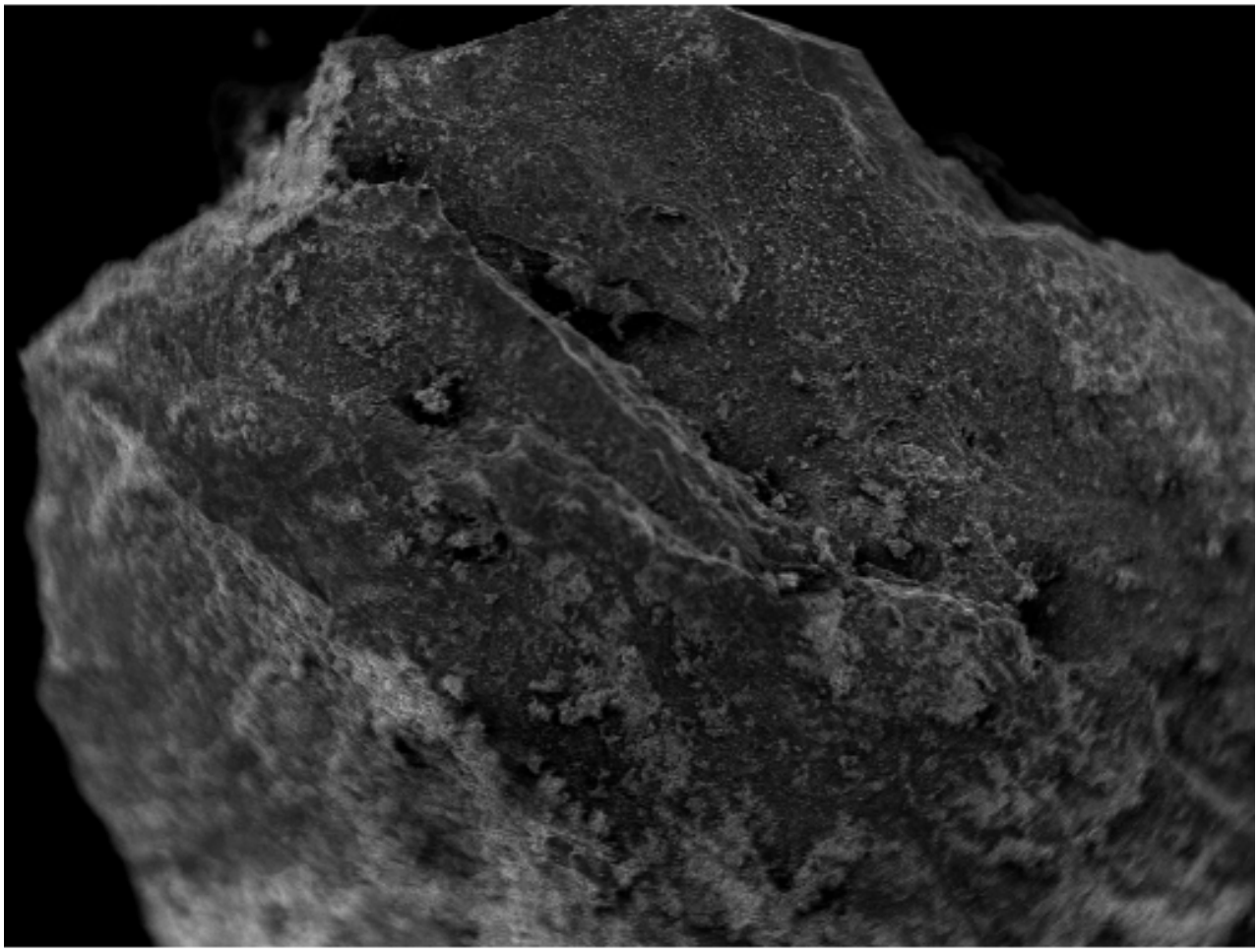


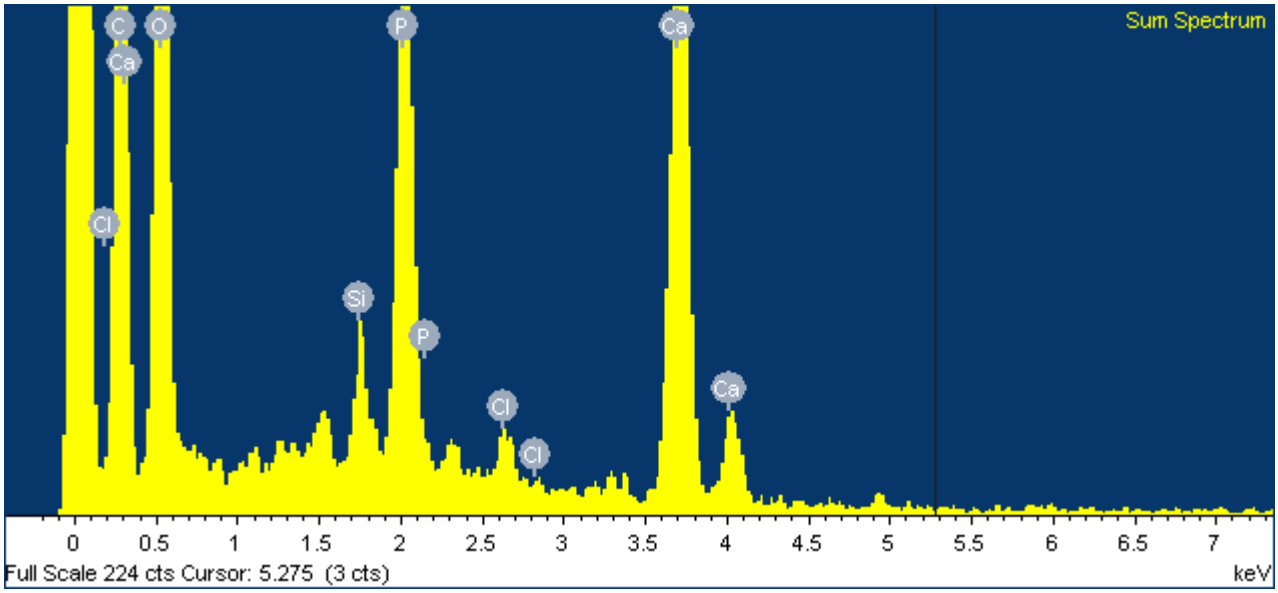
Comment:12450 bone
C, O, Si, P, Cl, Ca





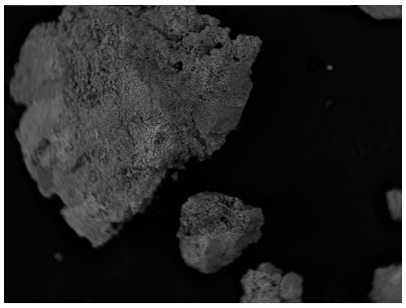
Comment:12450 bone
C, O, Si, P, Cl, Ca



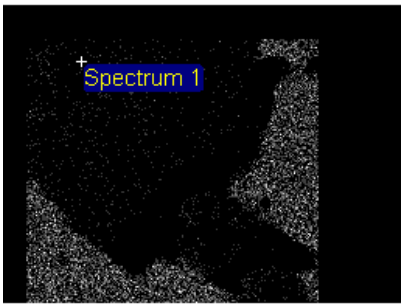


Comment:12450 bone
C, O, Si, P, Cl, Ca

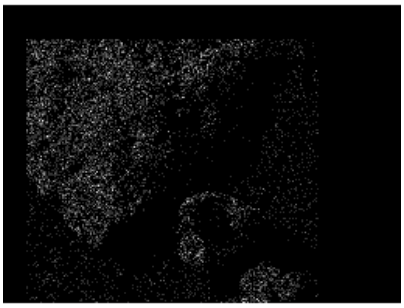
Unit 17048 Red



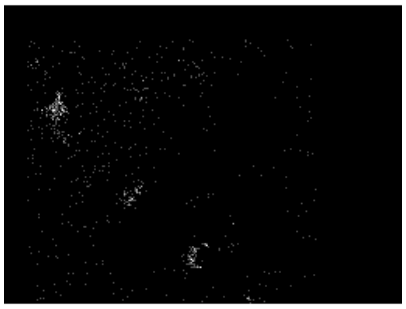
Electron Image 1



C Ka1_2



O Ka1



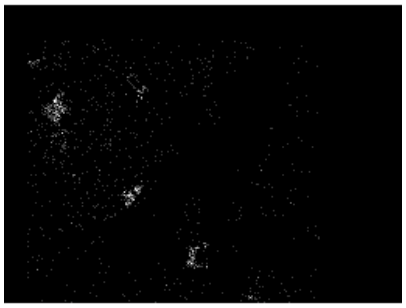
Na Ka1_2



Al Ka1



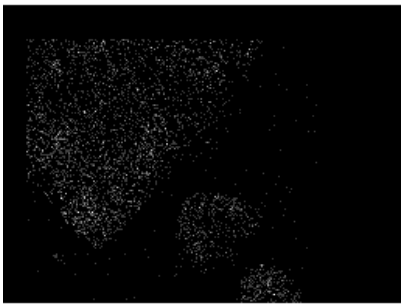
Si Ka1



Cl Ka1

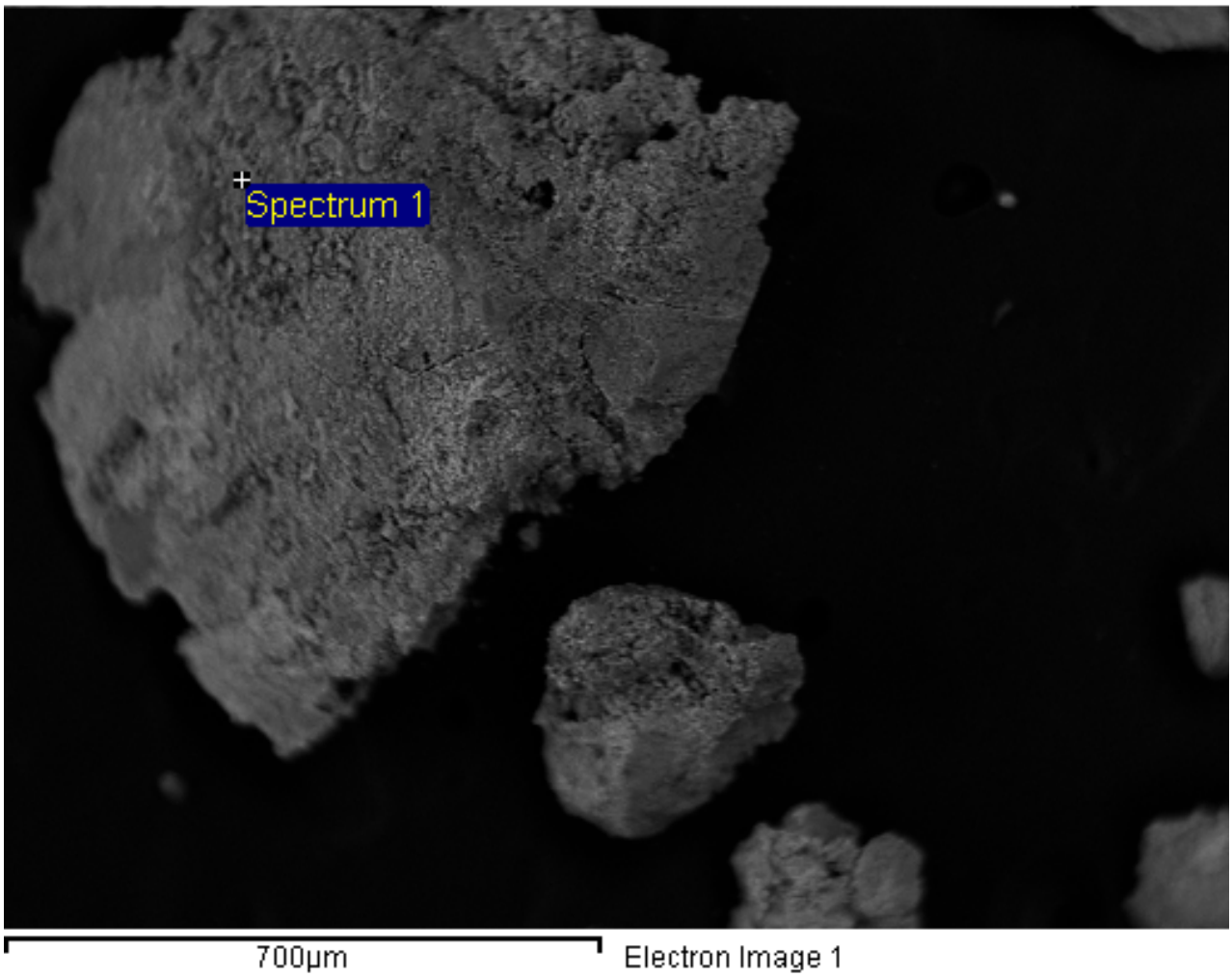


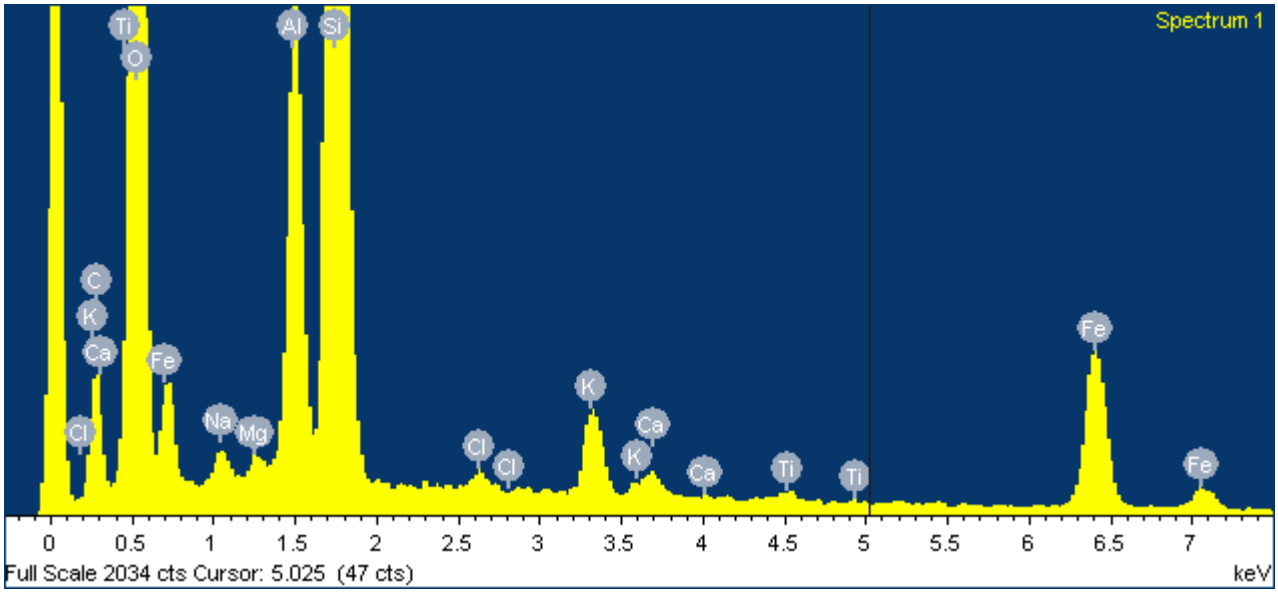
K Ka1



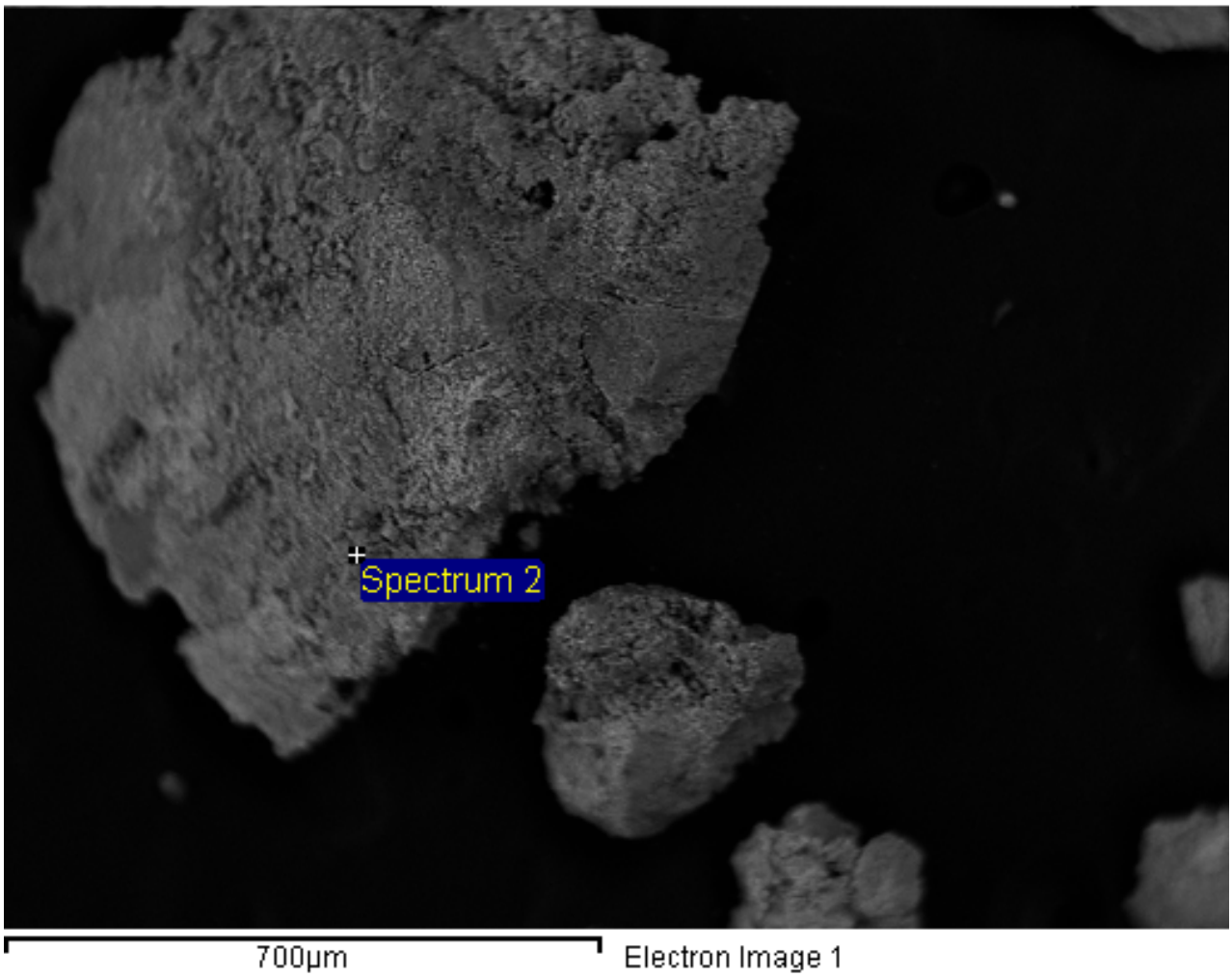
Fe Ka1

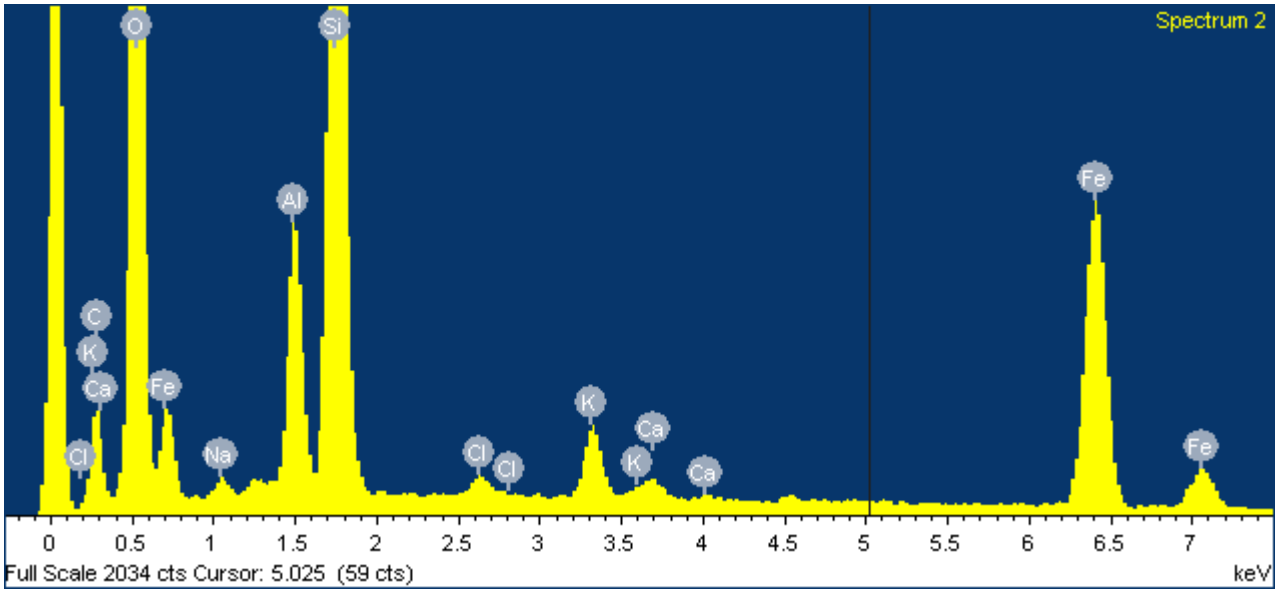
Comment: 17048 red pink



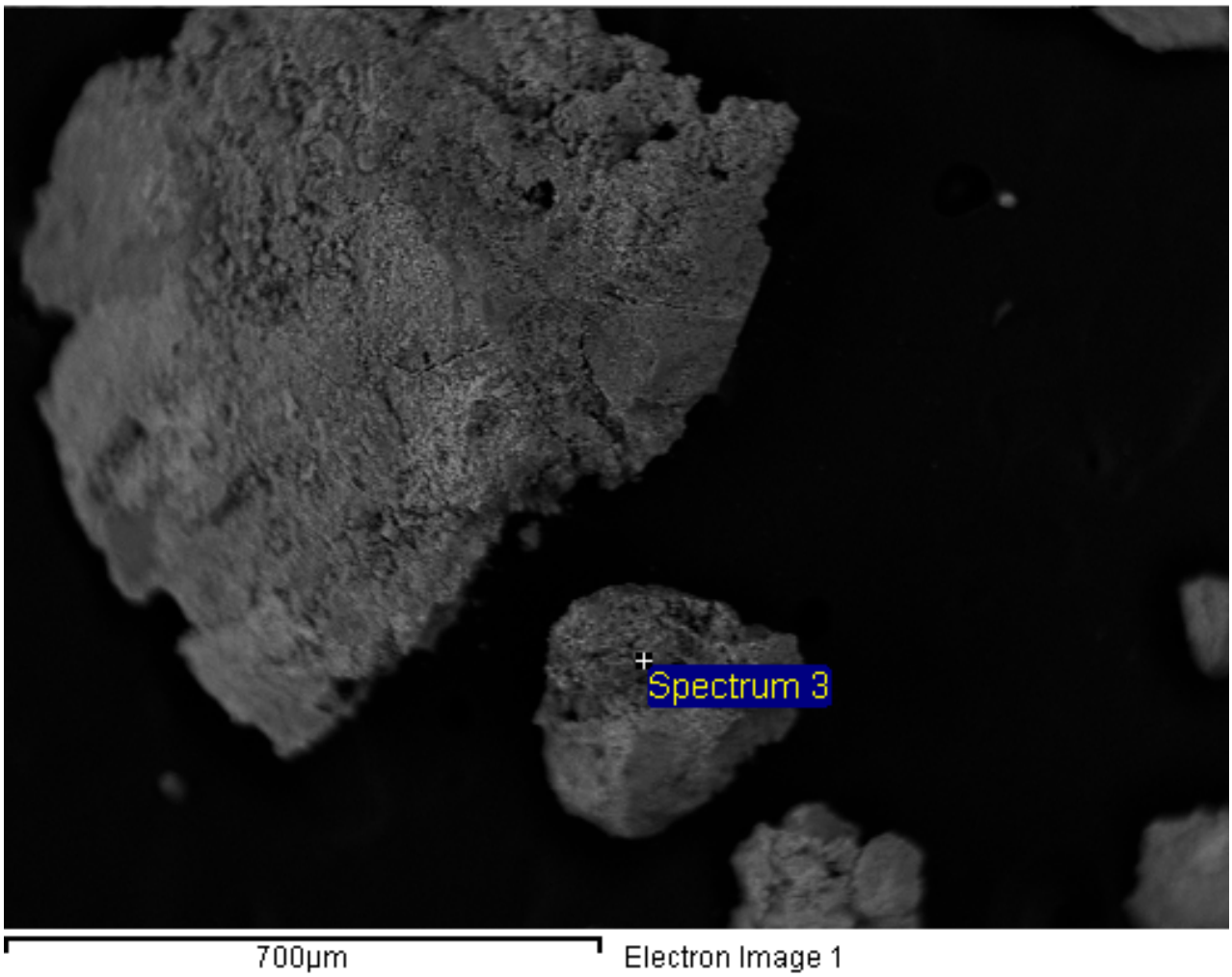


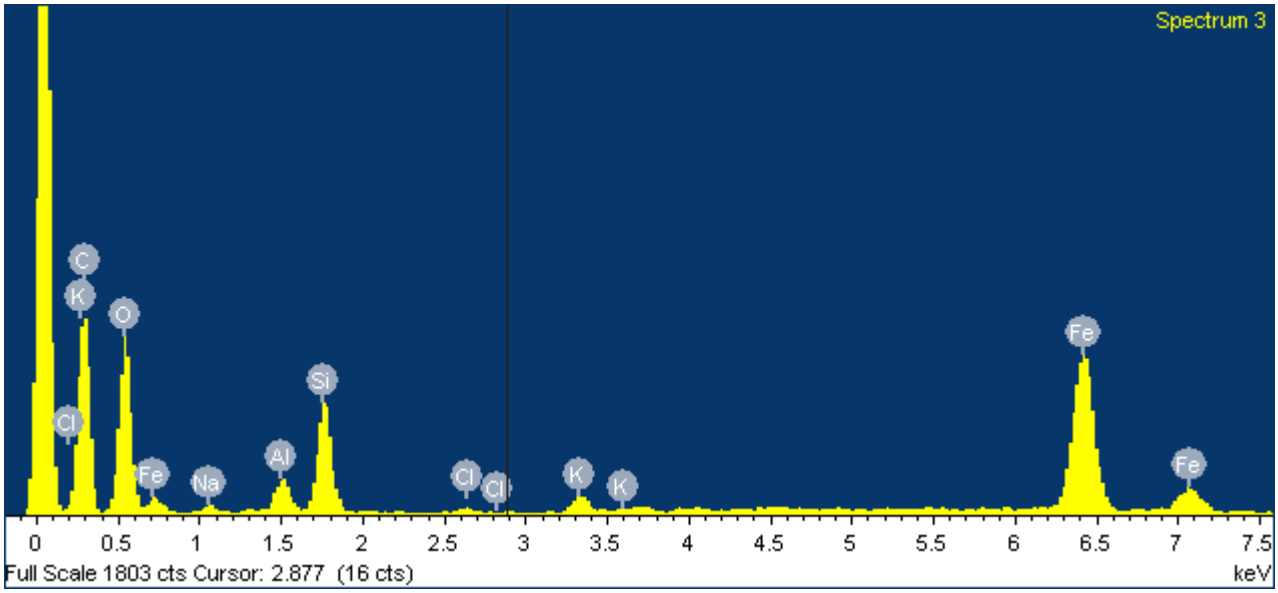
Comment: 17048 red pink



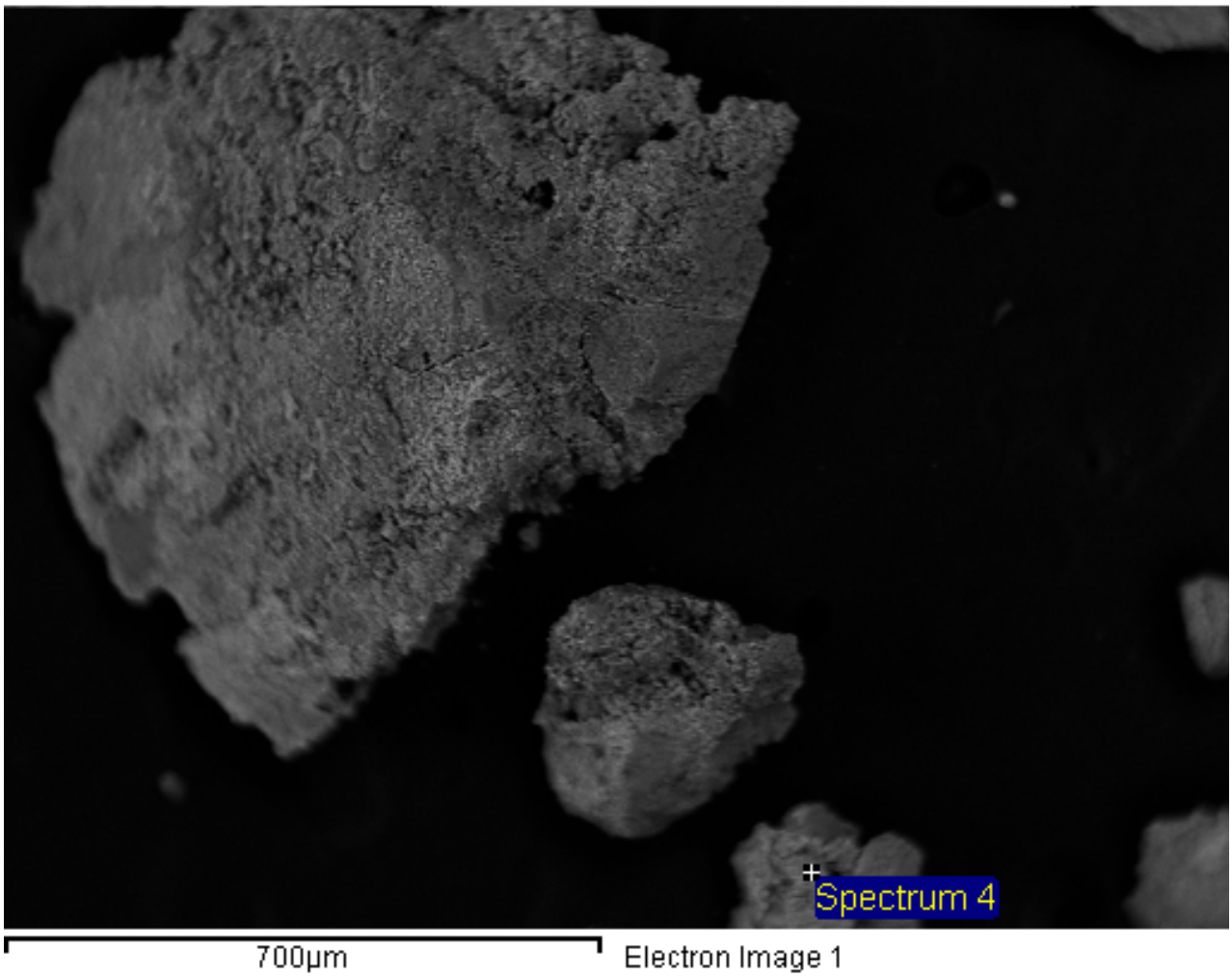


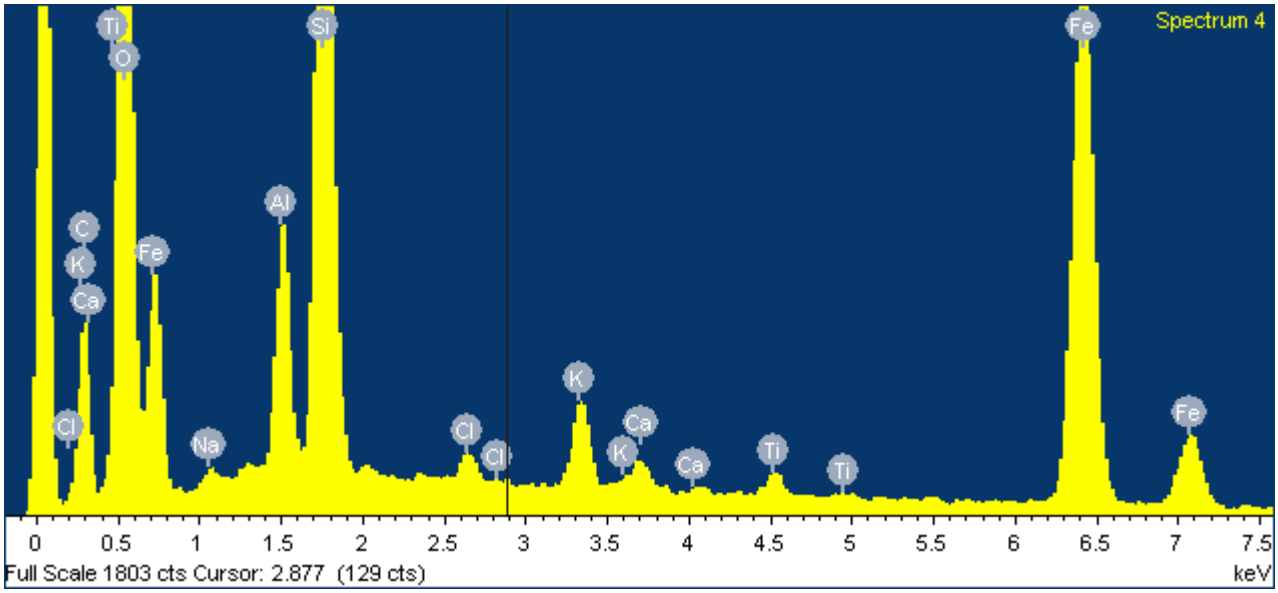
Comment: 17048 red pink



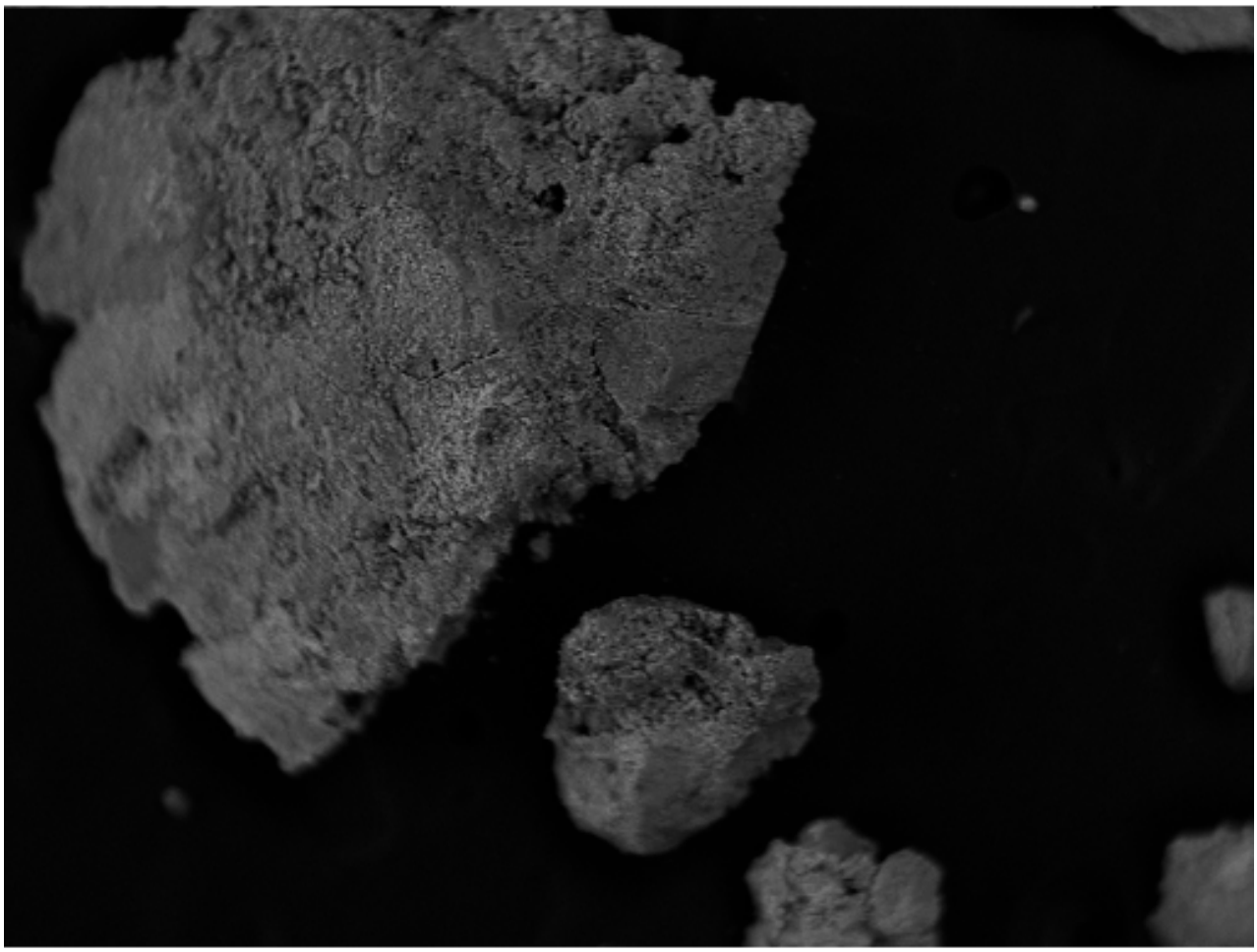


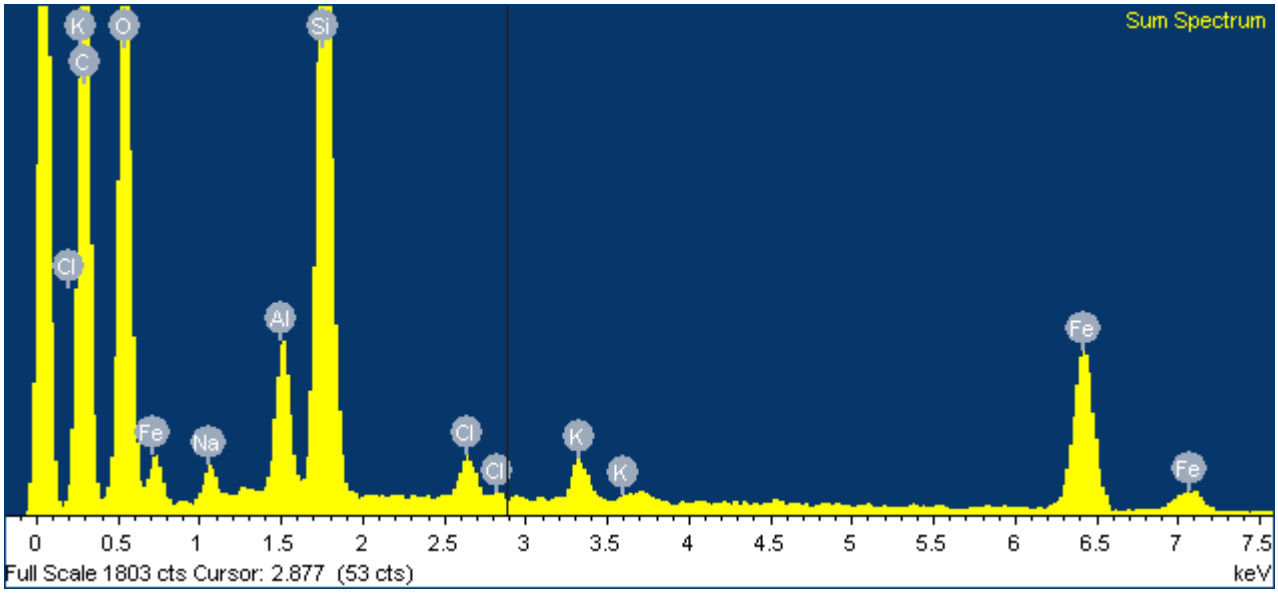
Comment: 17048 red pink



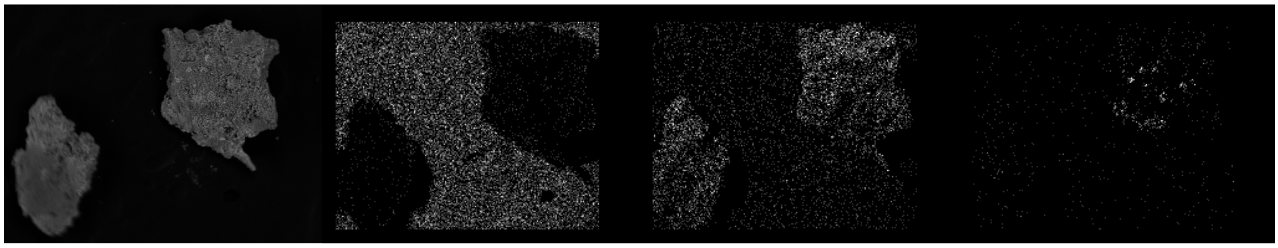


Comment: 17048 red pink

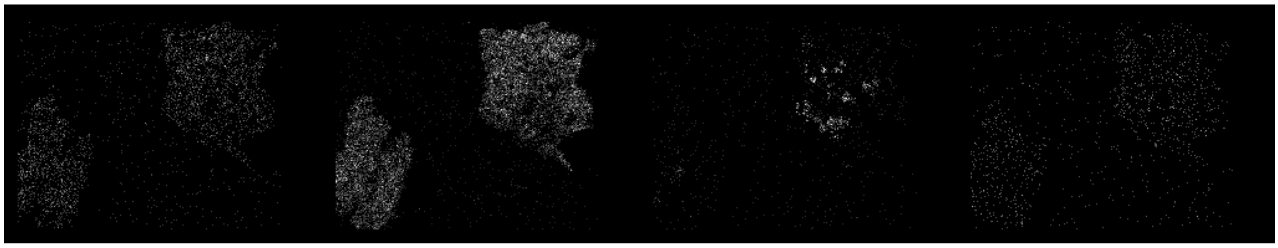




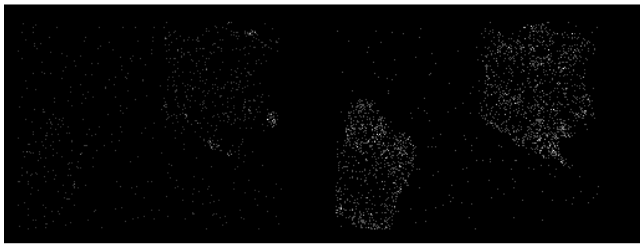
Comment: 17048 red pink



Electron Image 1 | C Ka1_2 | O Ka1 | Na Ka1_2

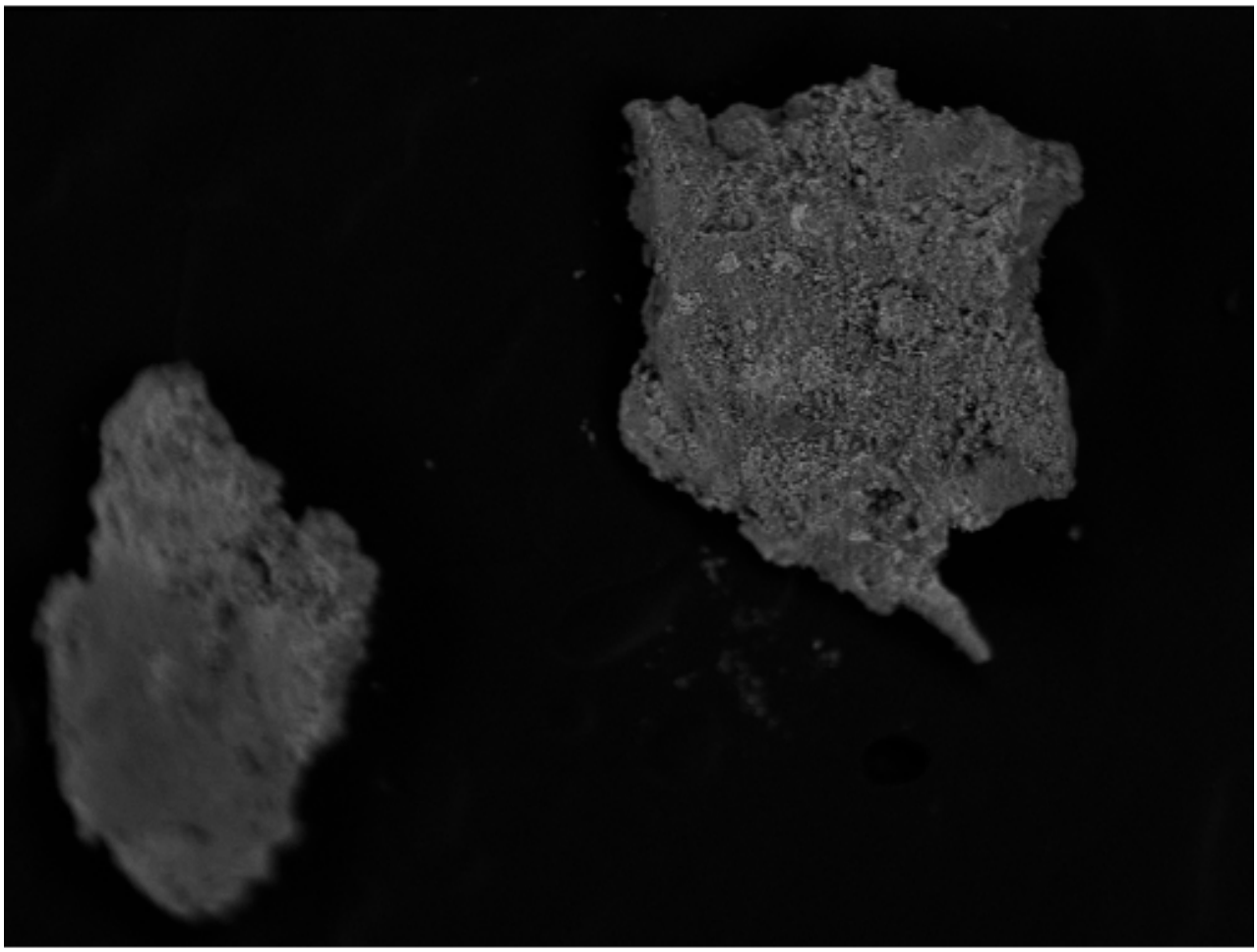


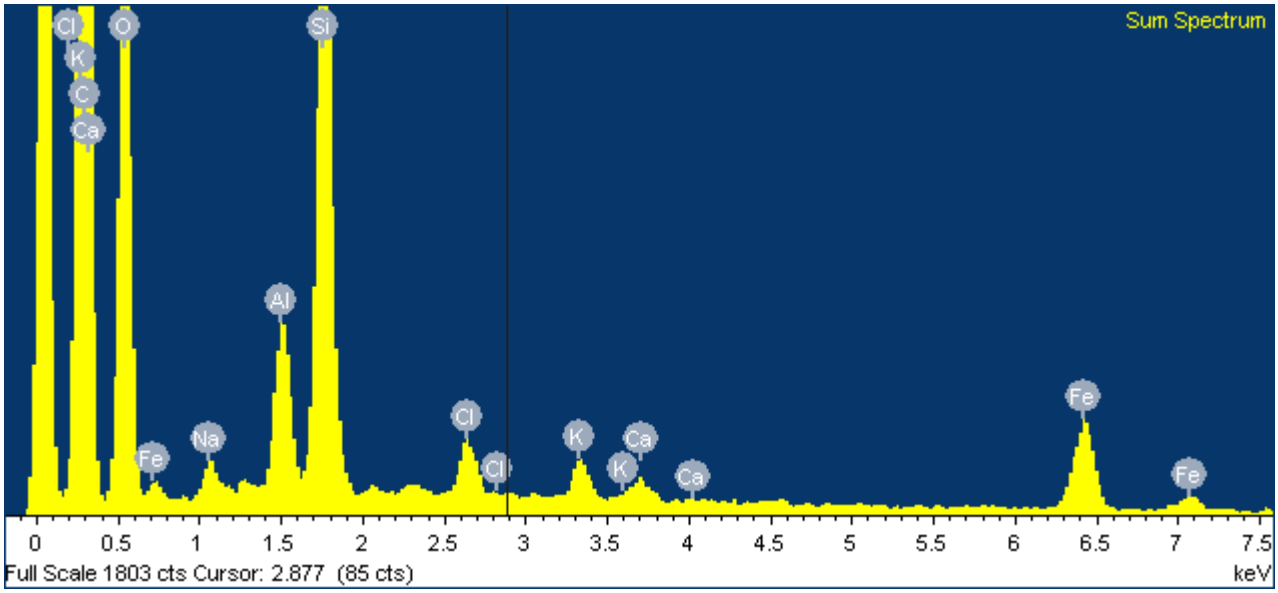
Al Ka1 | Si Ka1 | Cl Ka1 | K Ka1



Ca Ka1 | Fe Ka1

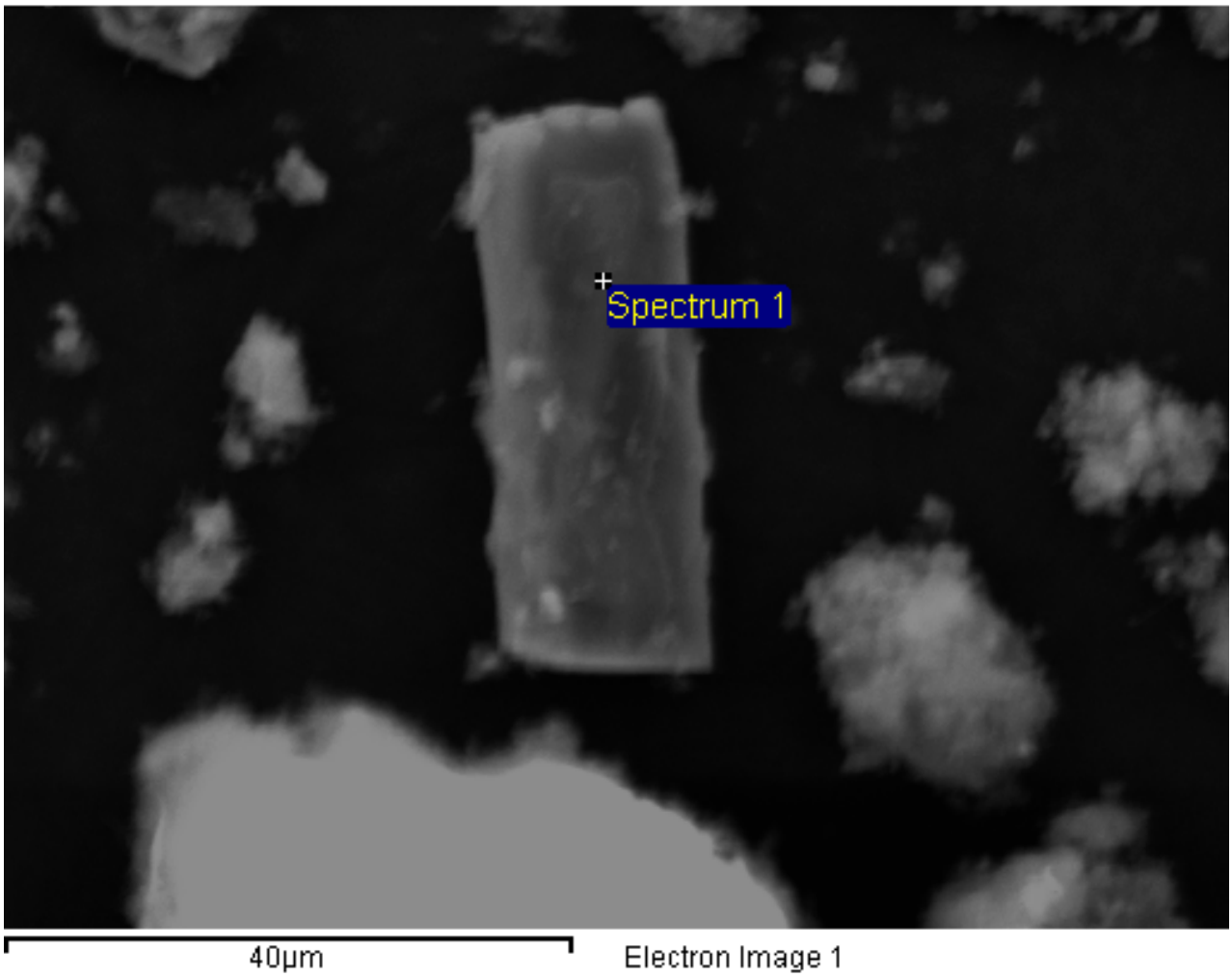
Comment: 17048 red pink
C, O, Na, Al, Si, Cl, K, Ca, Fe

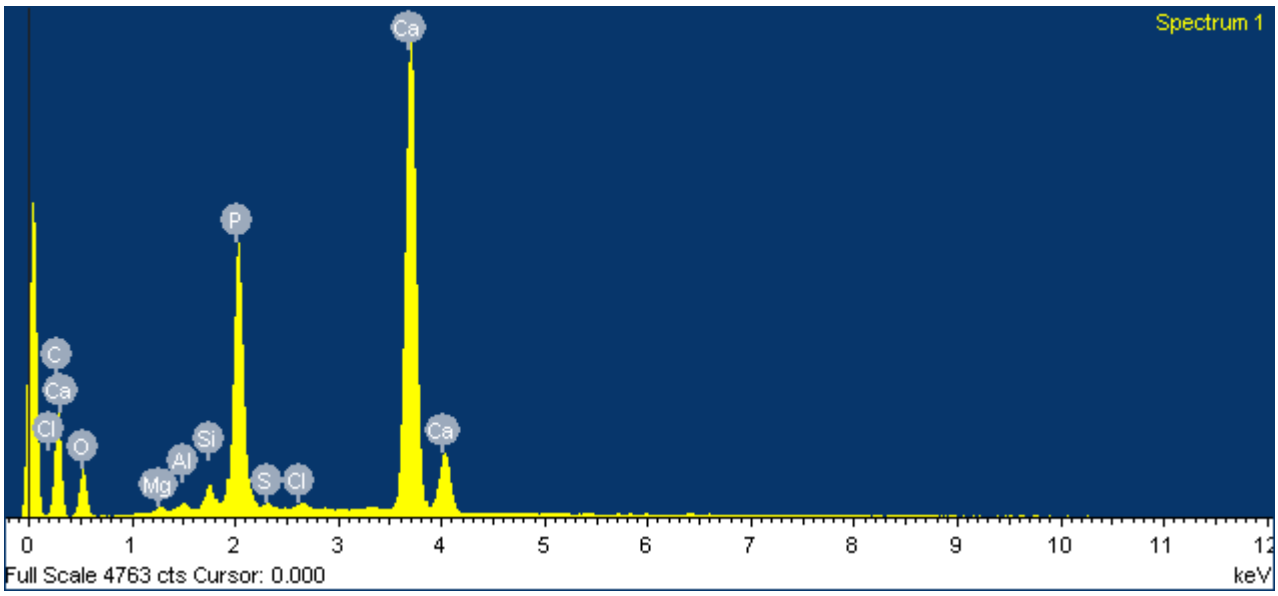




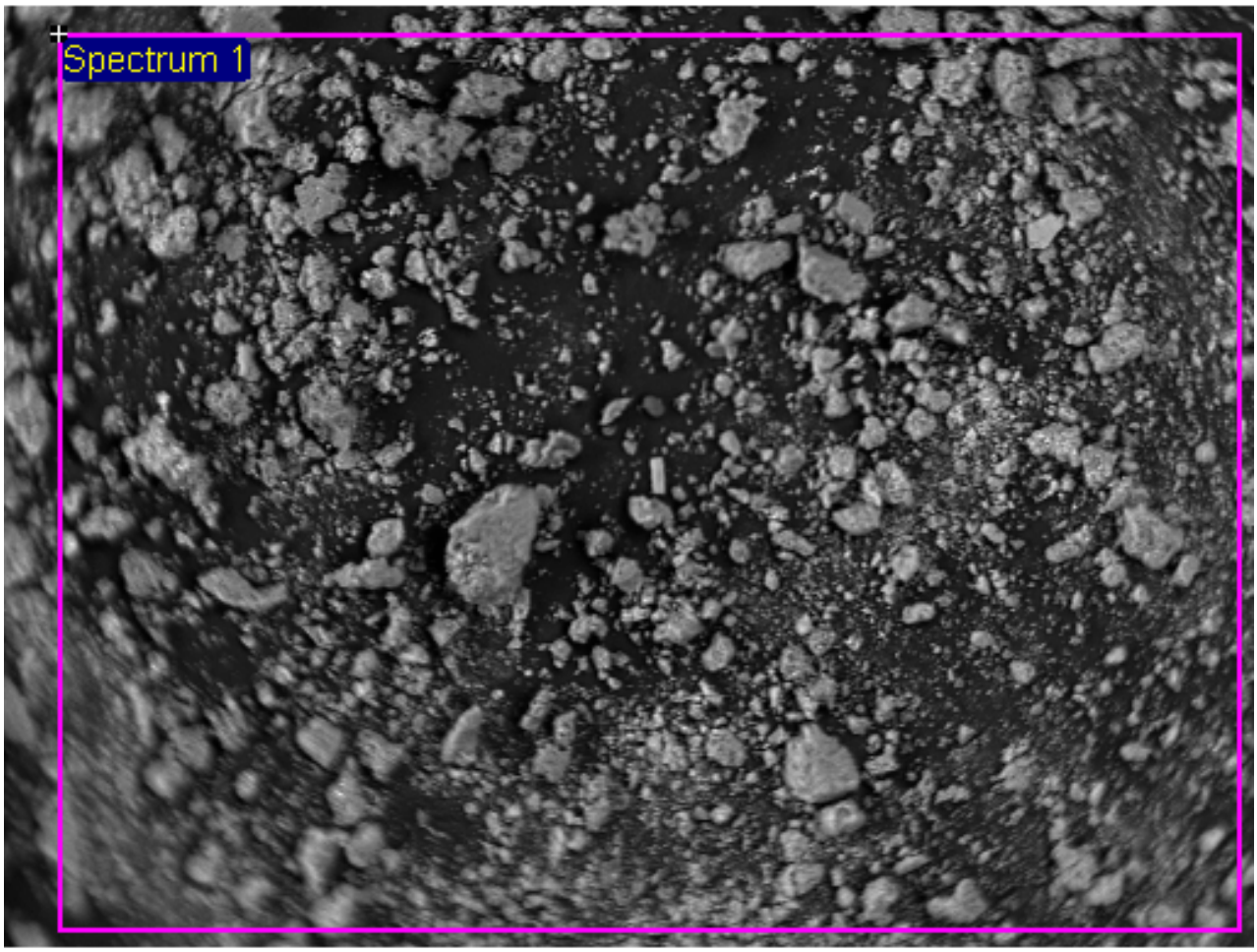
Comment: 17048 red pink
C, O, Na, Al, Si, Cl, K, Ca, Fe

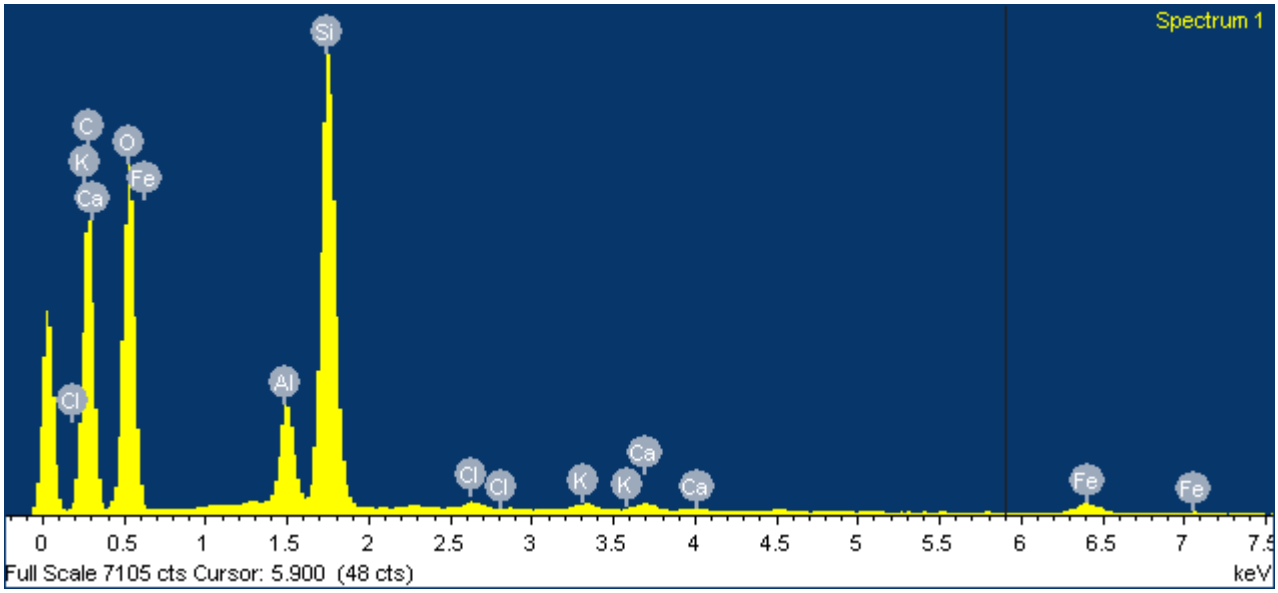
Unit Red 18536



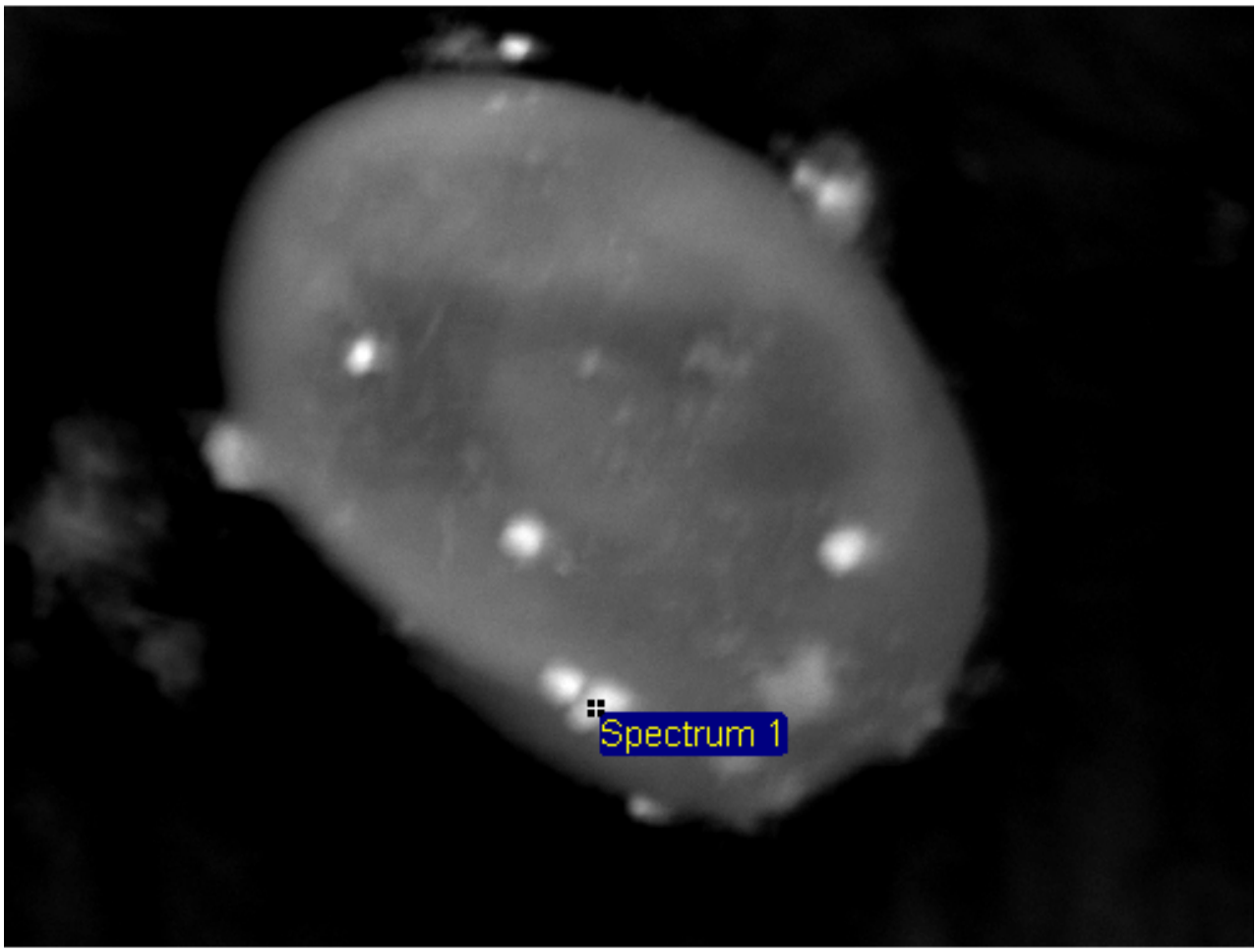


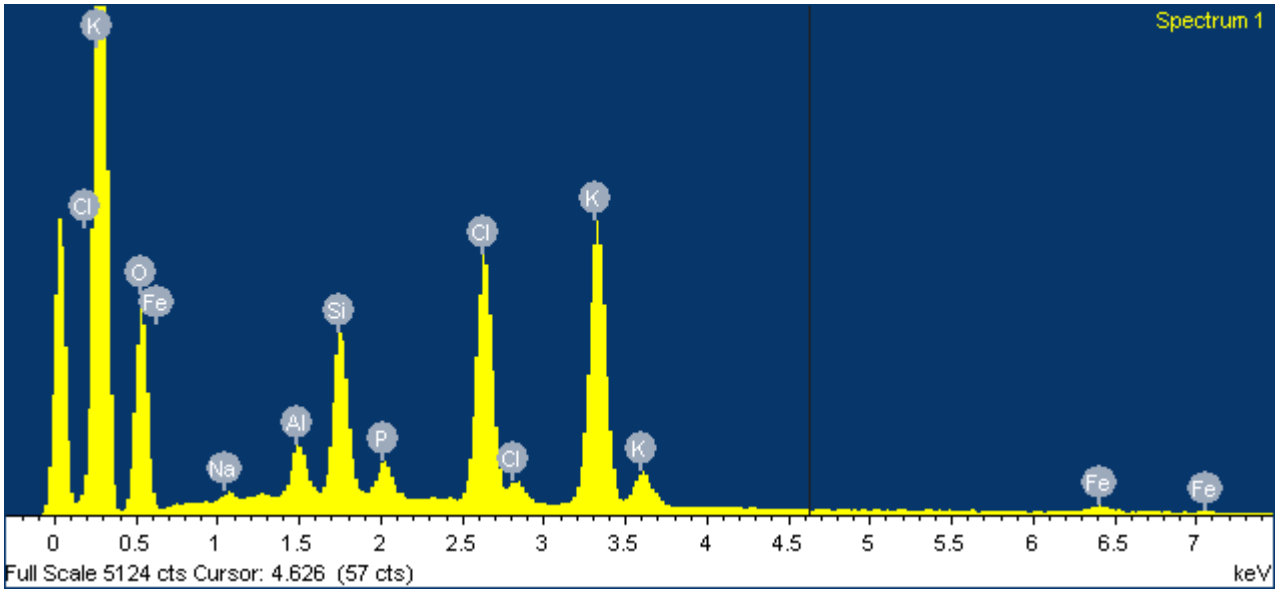
Comment: Sample 18536 red



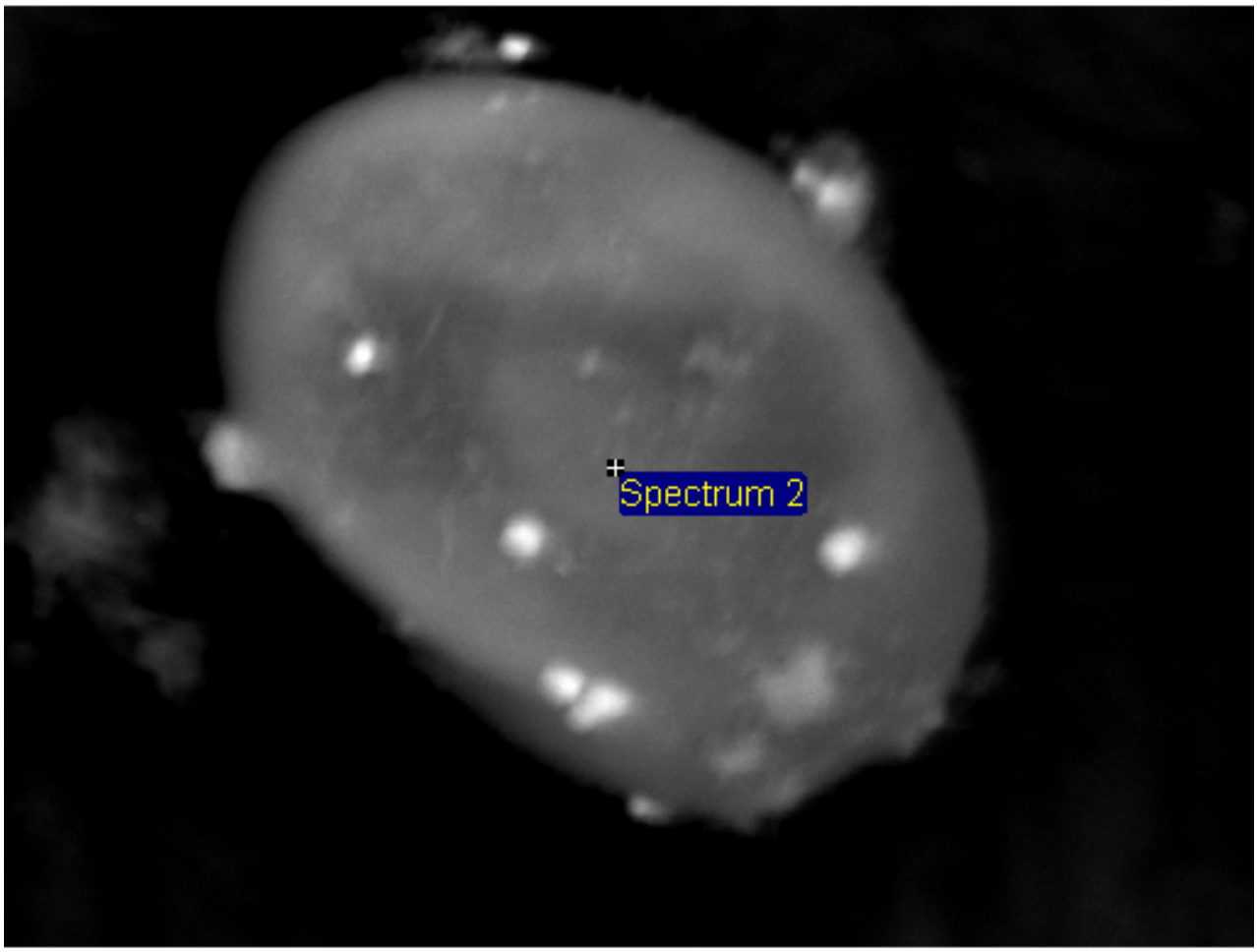


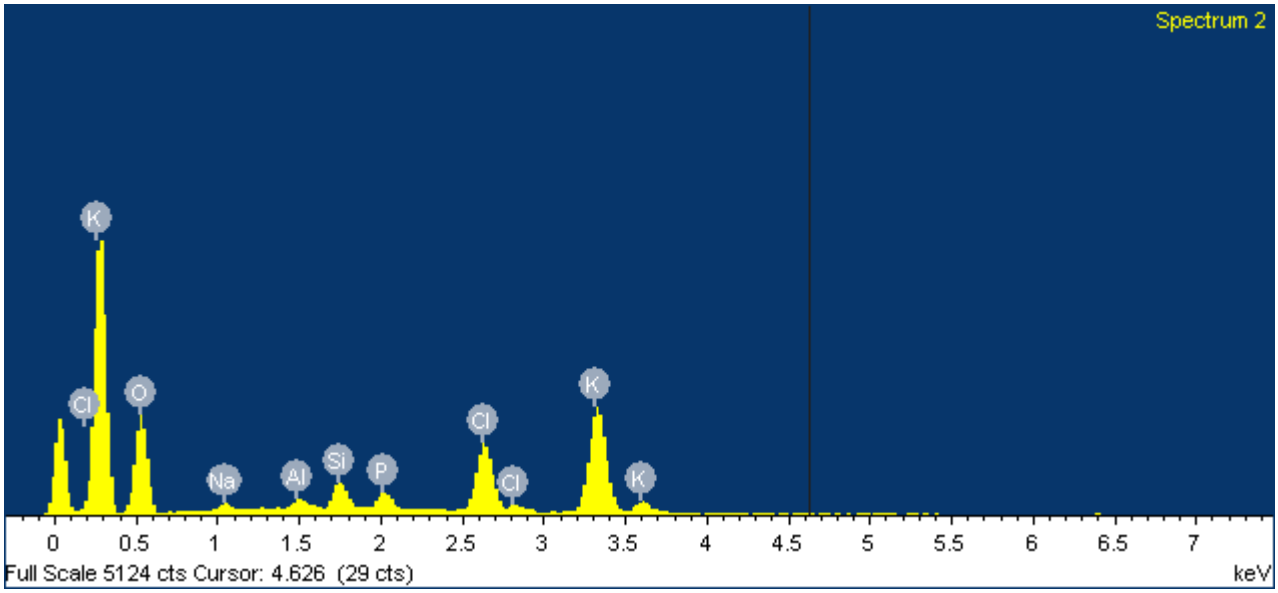
Comment: Sample 18536


Spectrum 1
10µm
Electron Image 1

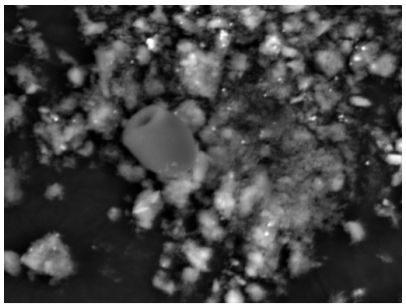

Spectrum 1
K
Cl
O
Fe
Na
Al
Si
P
Cl
Cl
K
K
Fe
Fe
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
Full Scale 5124 cts Cursor: 4.626 (57 cts)
keV

Comment:

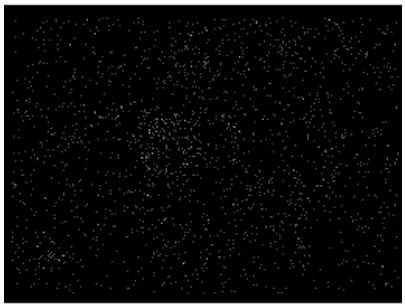

Spectrum 2
10µm
Electron Image 1


Spectrum 2
K
Cl
O
Na
Al
Si
P
Cl
Cl
K
K
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
Full Scale 5124 cts Cursor: 4.626 (29 cts)
keV

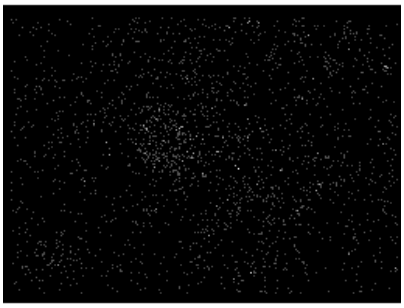
Comment:



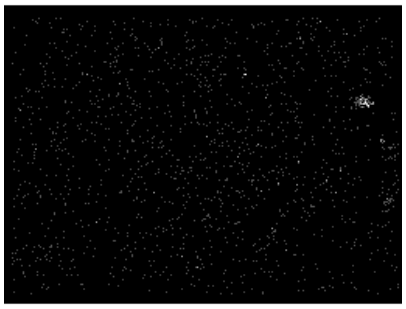
Electron Image 1



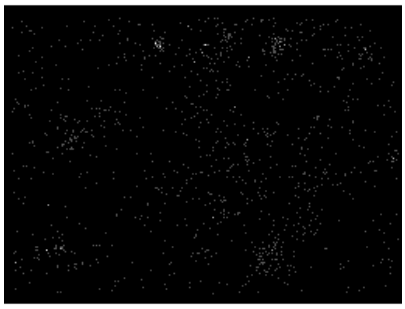
Cl Ka1



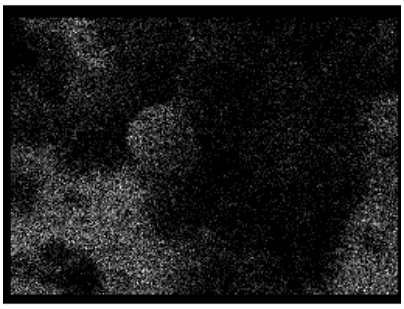
K Ka1



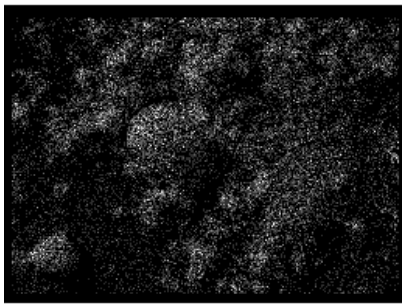
Ca Ka1



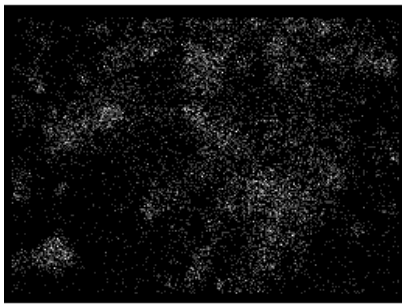
Fe Ka1



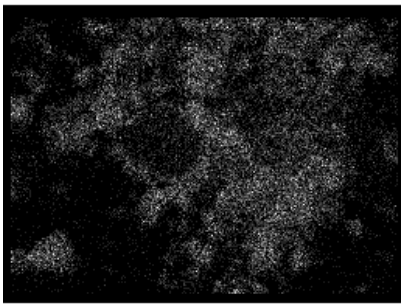
C Ka1_2



O Ka1

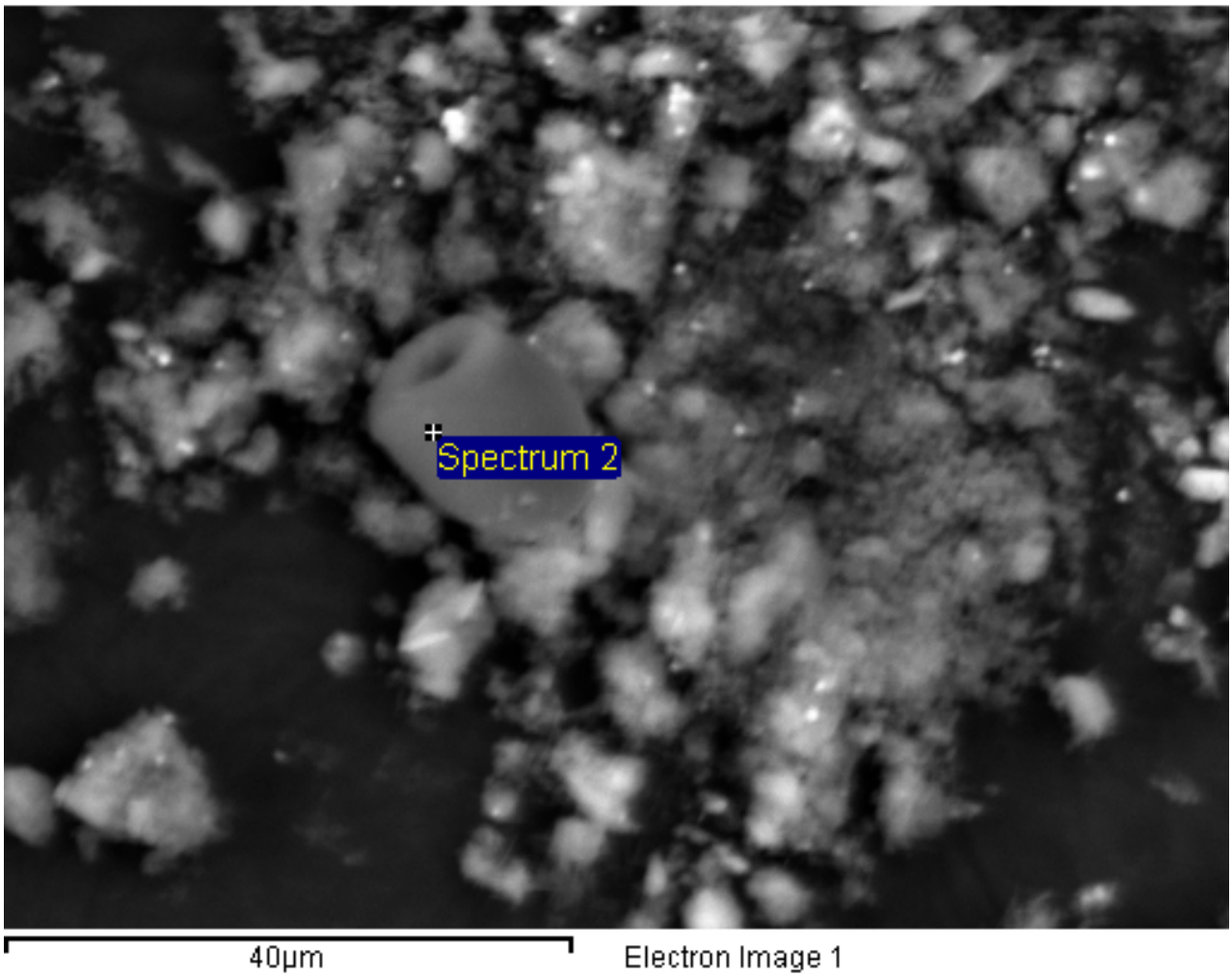


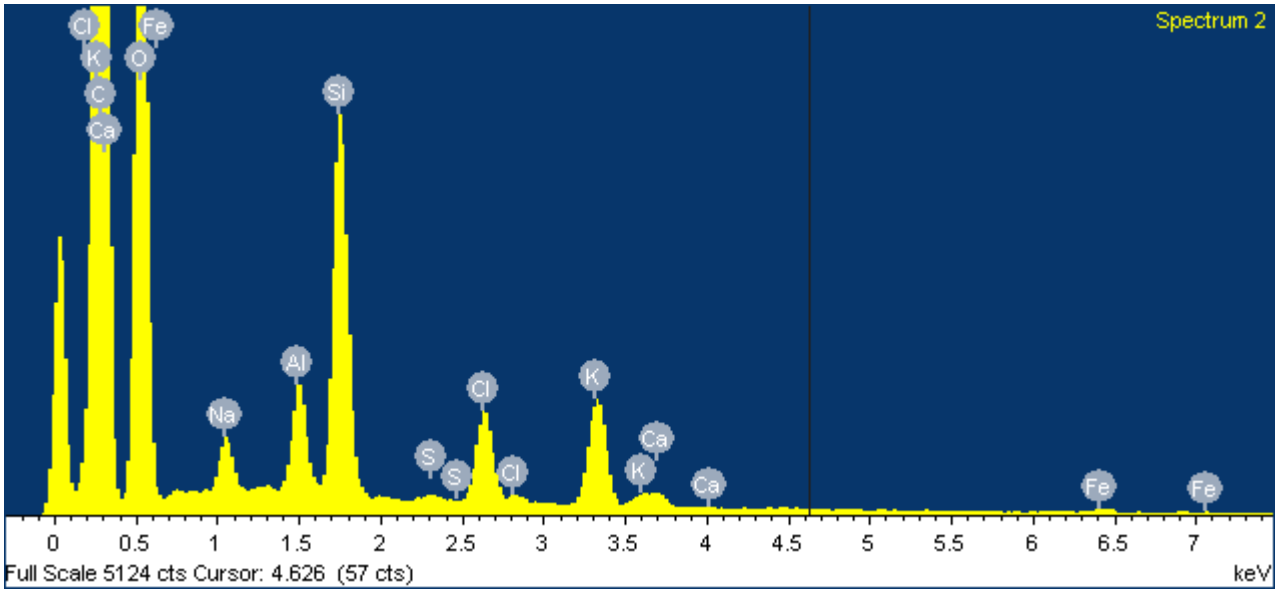
Al Ka1



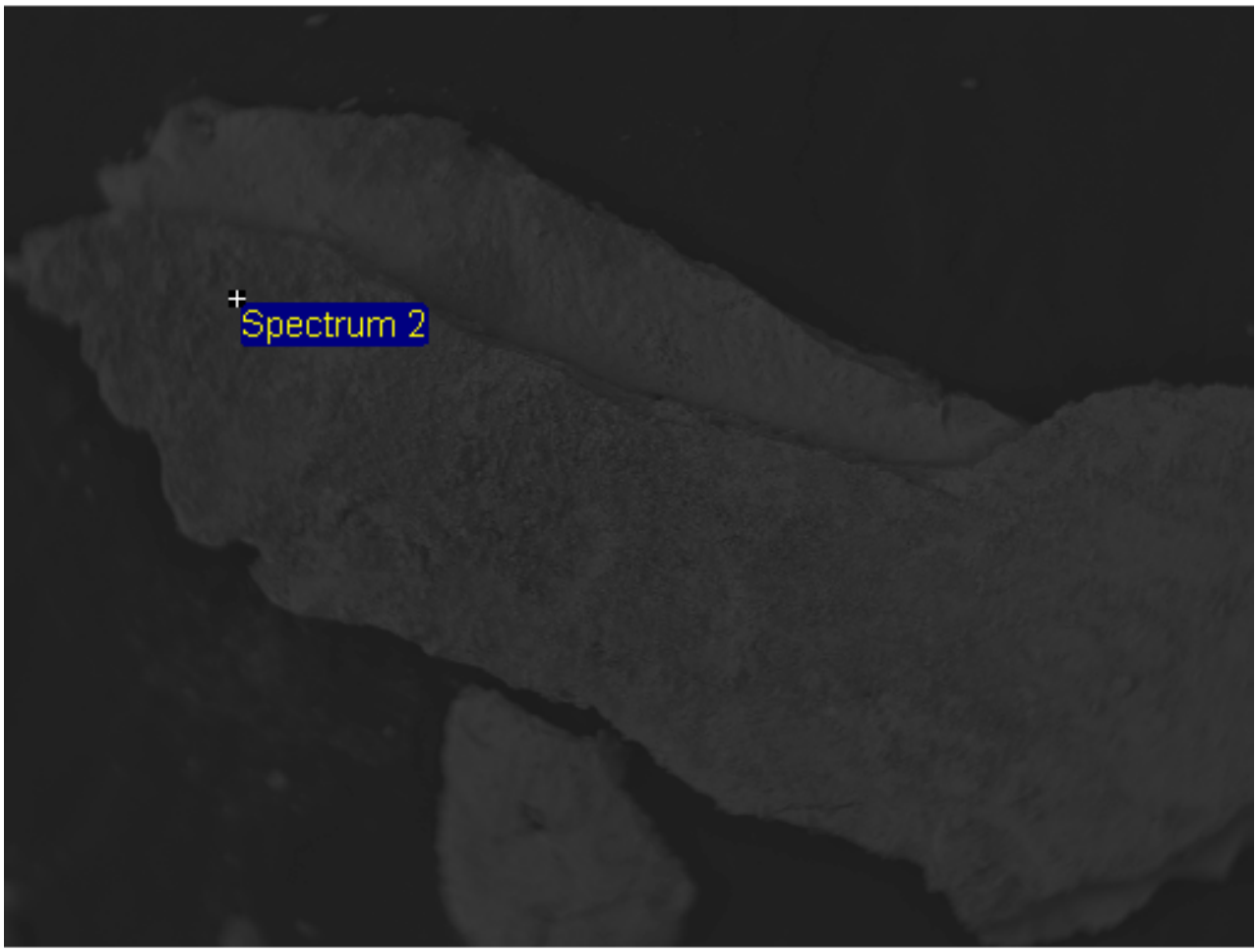
Si Ka1

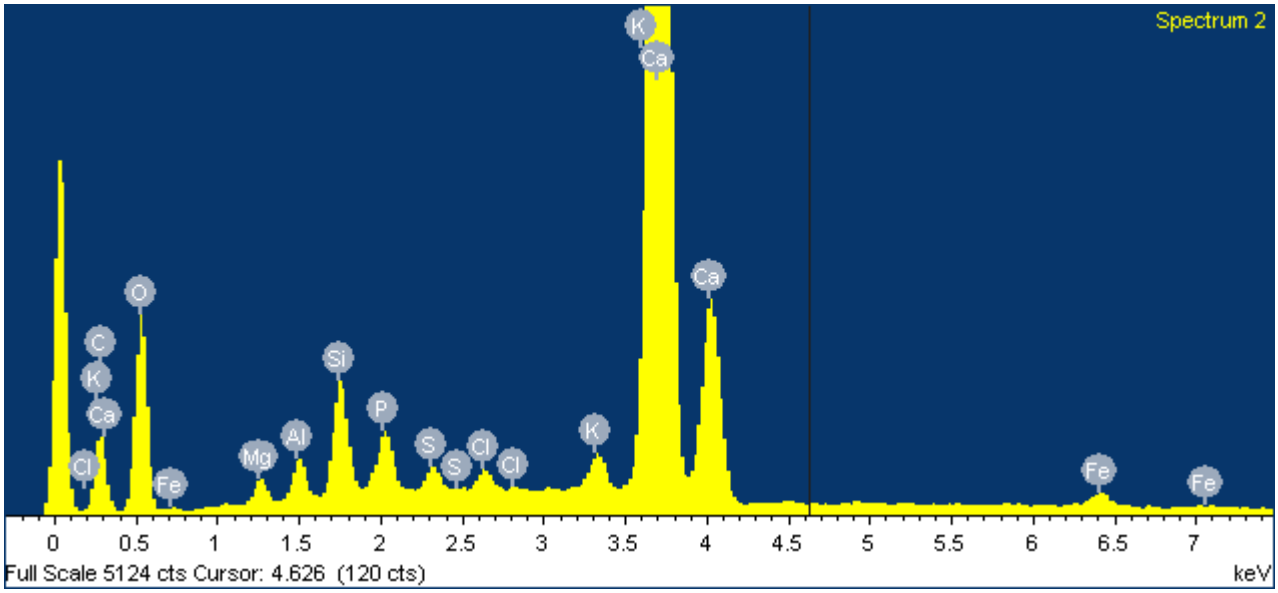
Comment: 18536 red Cl, K, Ca, Fe, C, O, Al, Si



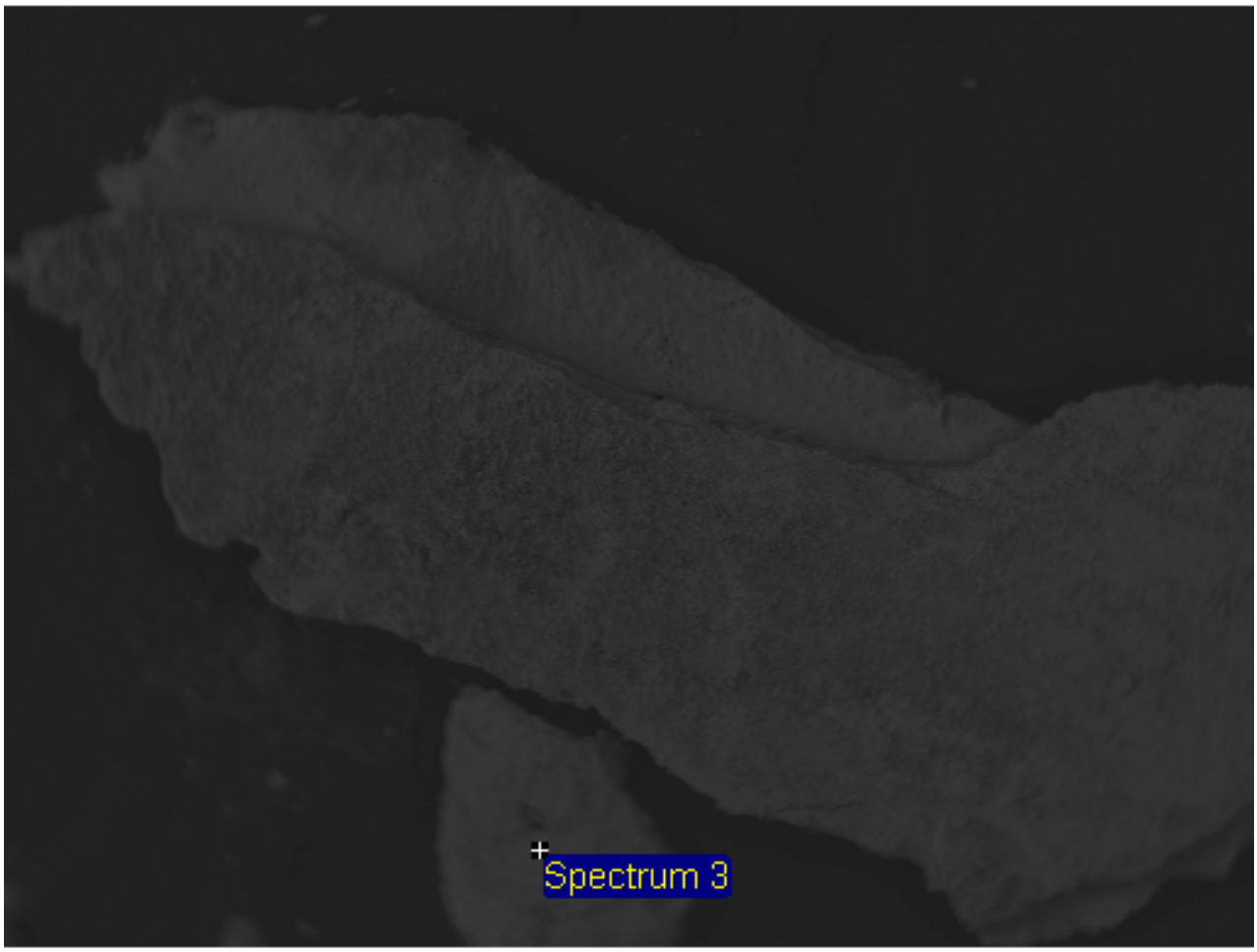


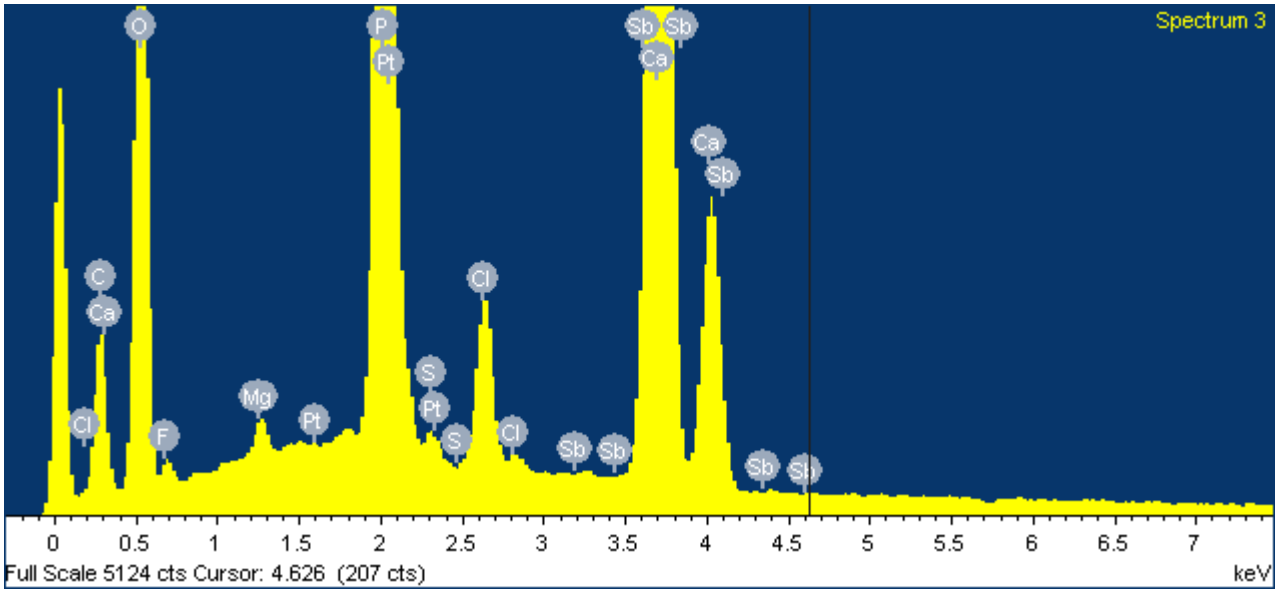
Comment: 18536 red





Comment: 18536 red



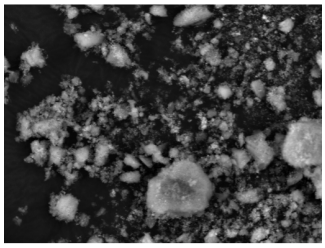


Comment: 18536 red

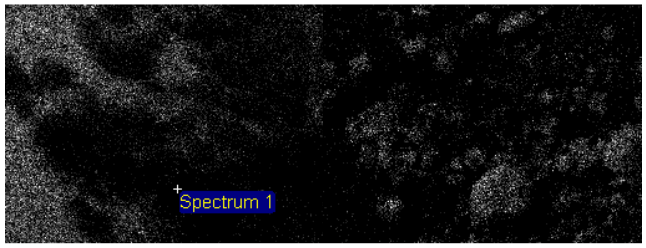
Result from samples from the Istanbul University (IST) area of Çatalhöyük

IST Area Results

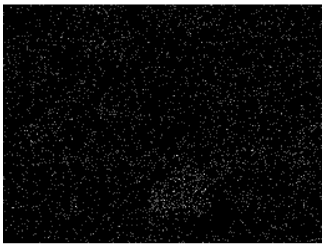
07/11/2013 12:32:43



Electron Image 1

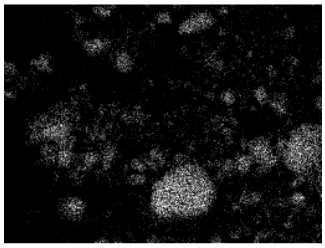


Electron Image 1

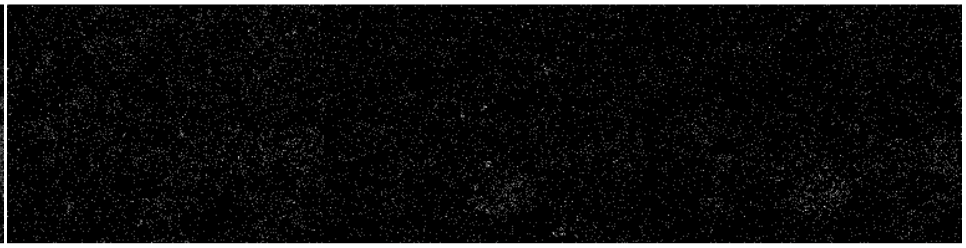


O Ka1

Al Ka1



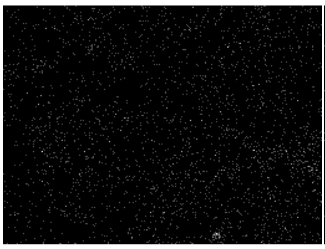
Si Ka1



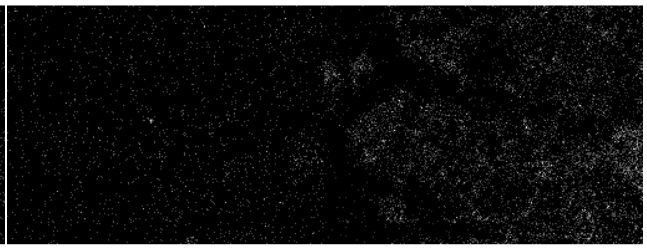
P Ka1

Cl Ka1

K Ka1



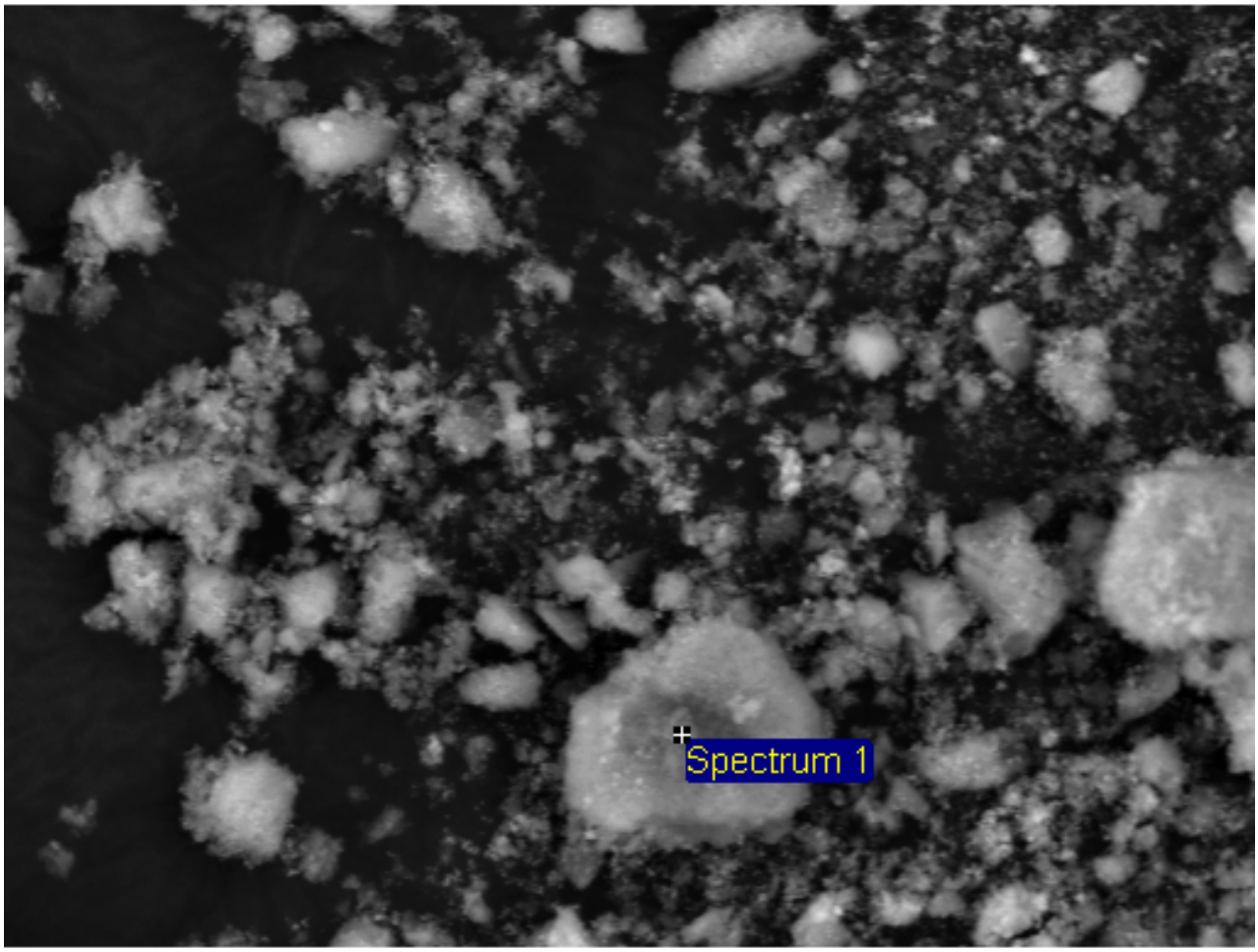
Ca Ka1

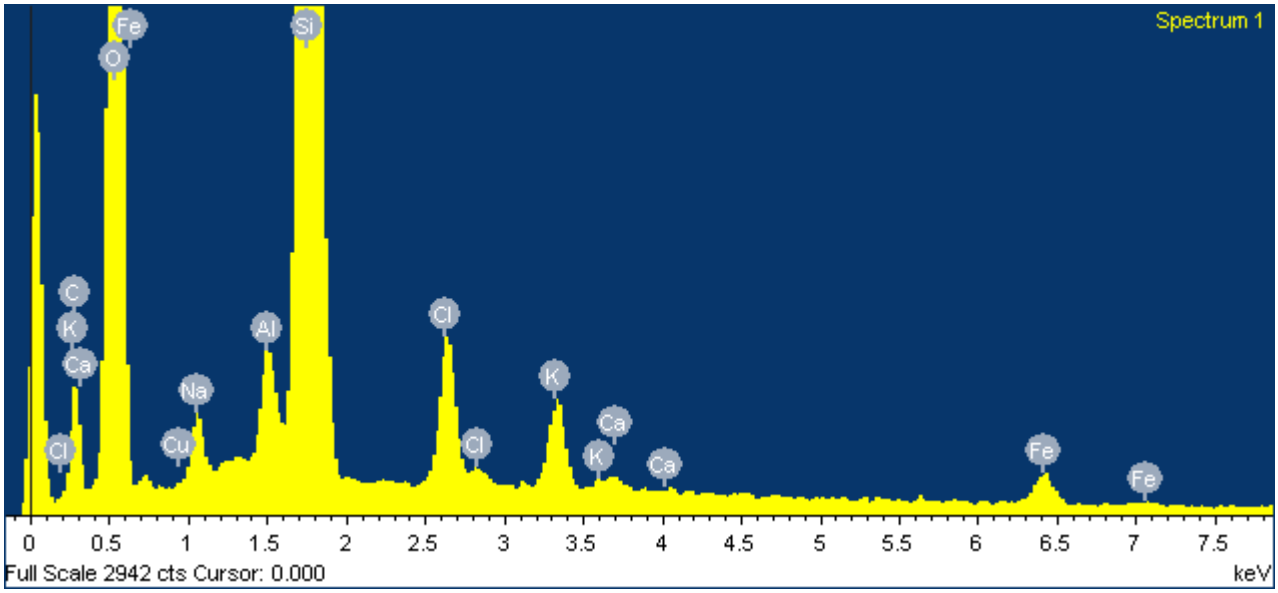


Ti Ka1

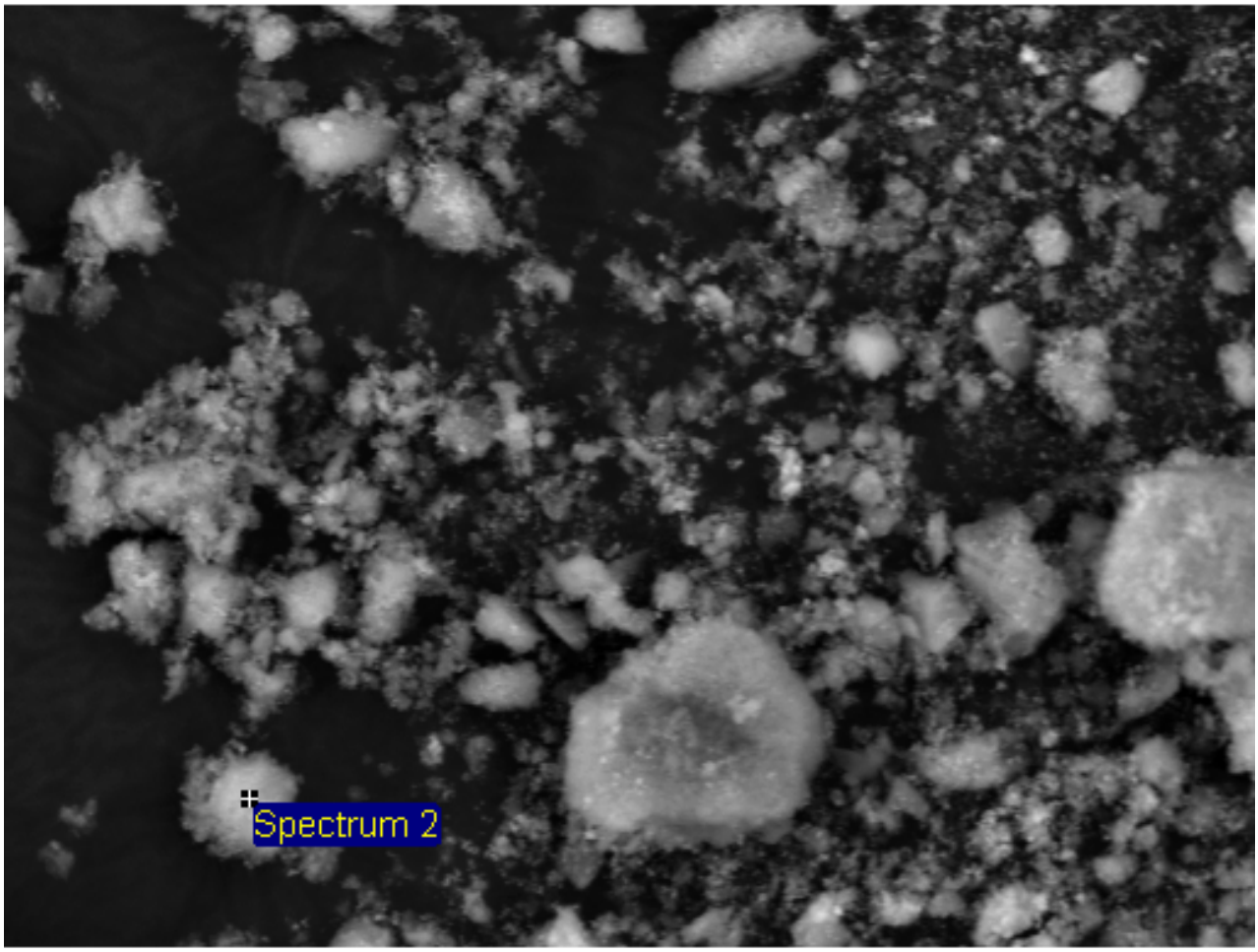
Fe Ka1

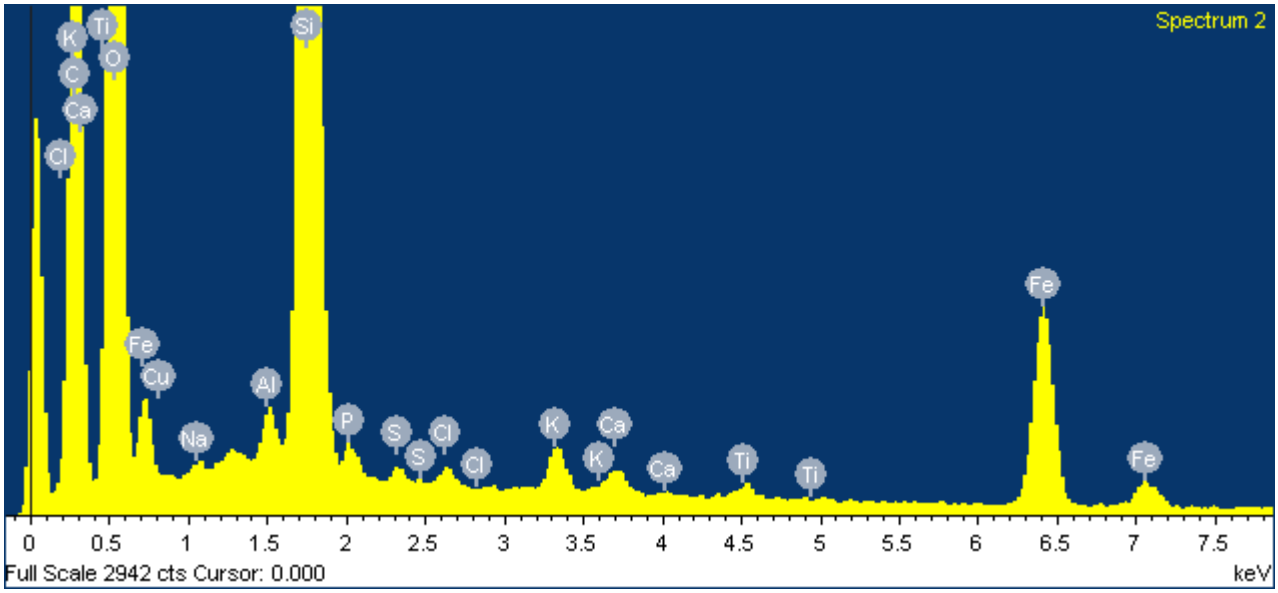
Comments: Results for units 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
O, Al, Si, P, Cl, K, Ca, Ti, Fe



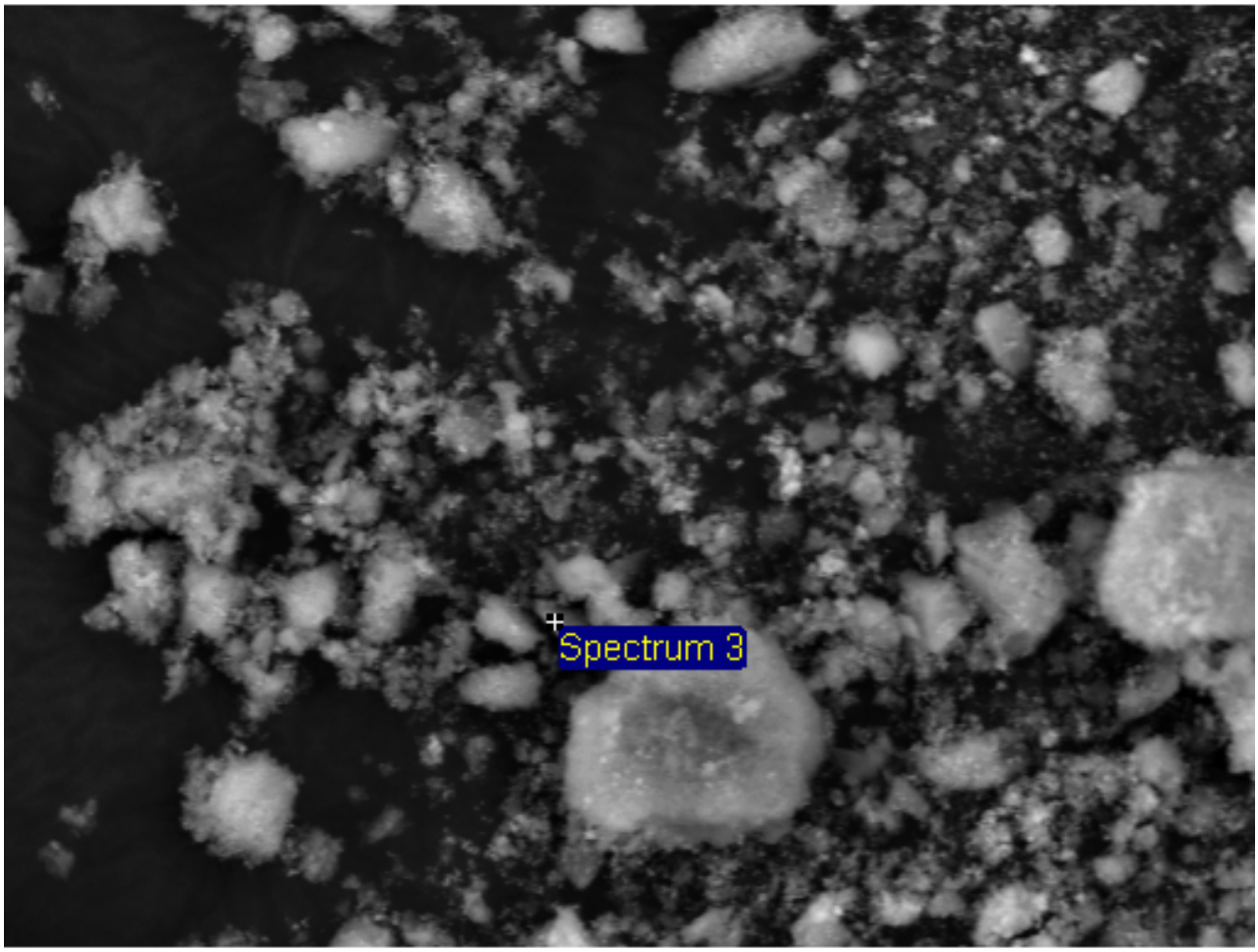


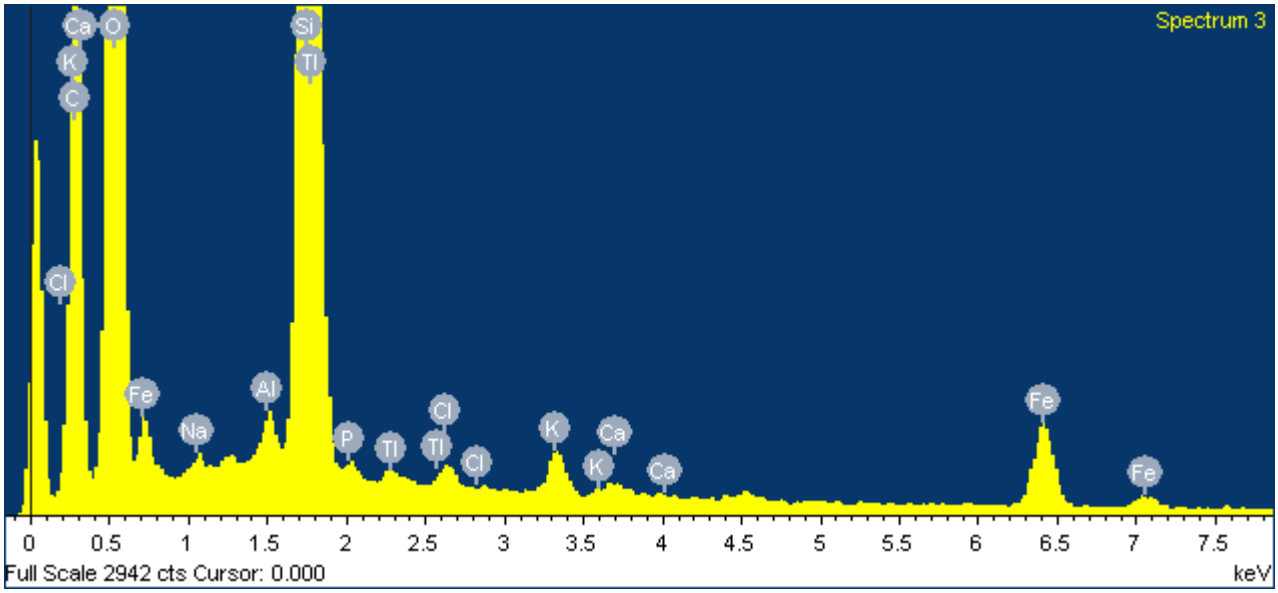
Comments: Results for units 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1



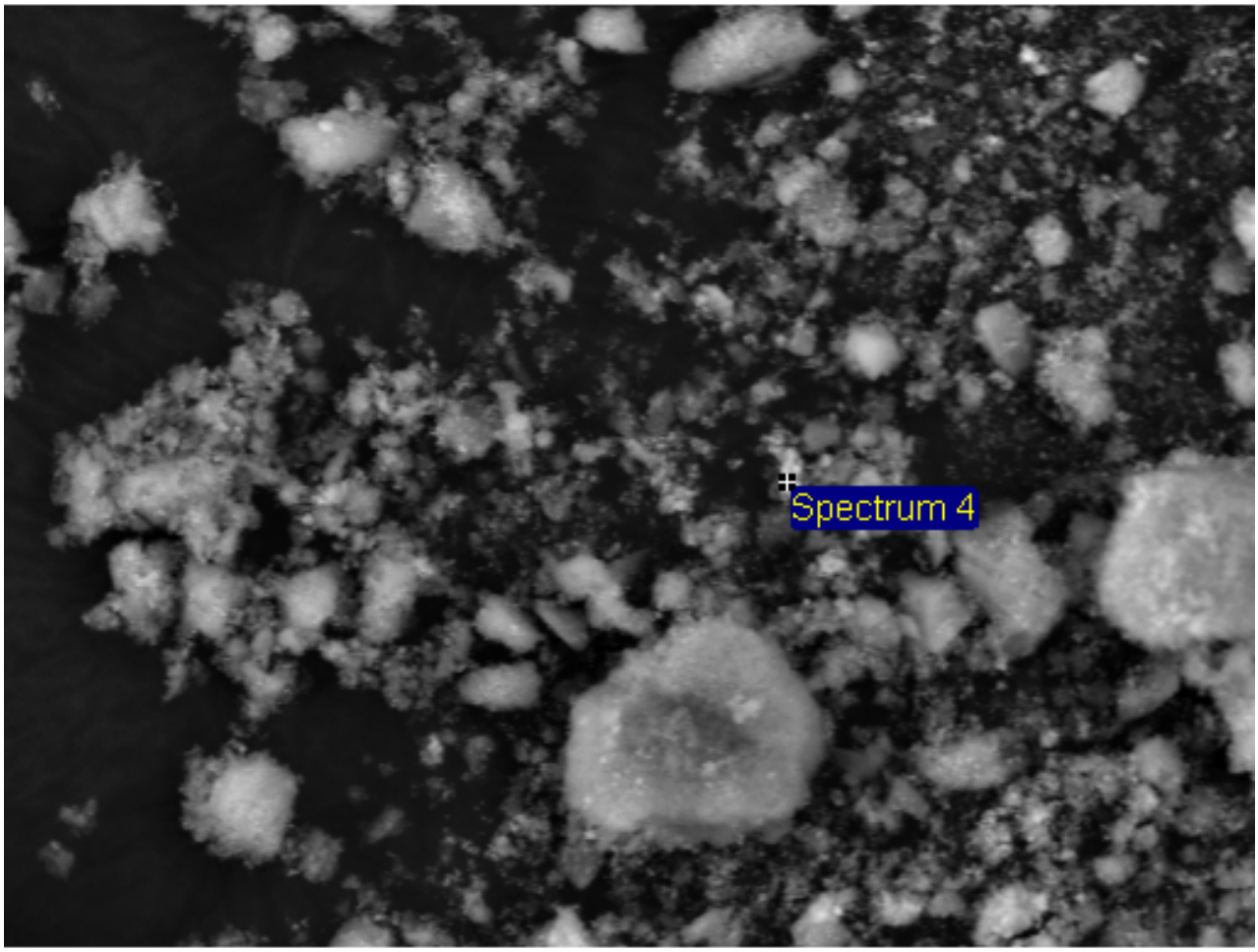


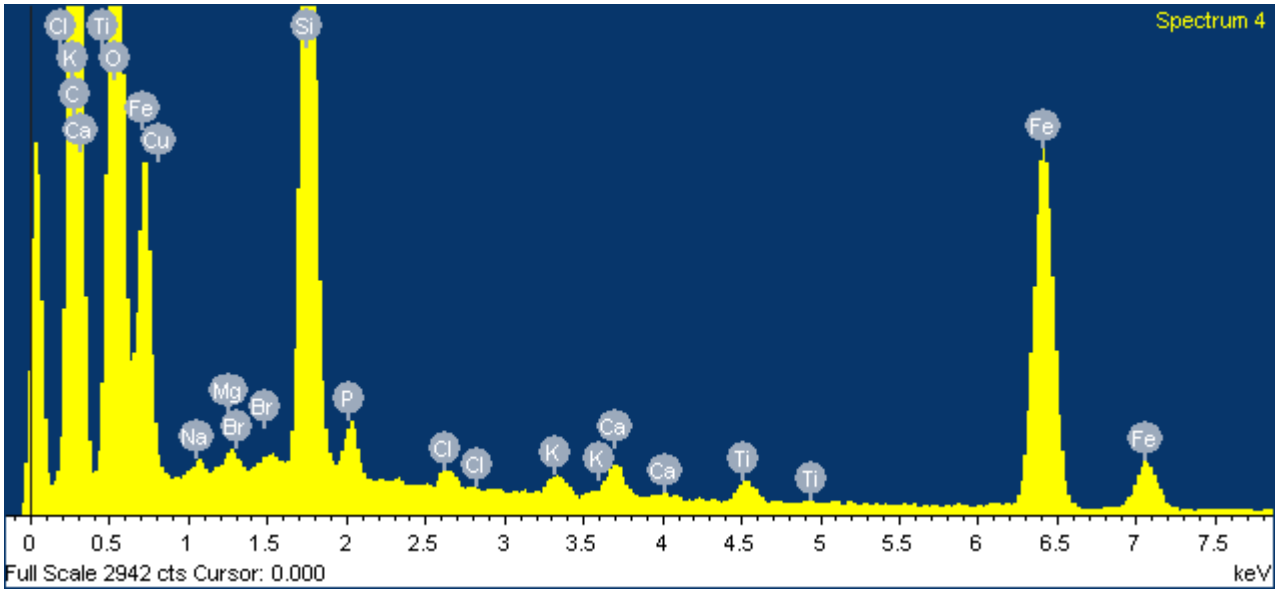
Comments: Results for units 12487 s.7, 12456, 11862 s.6, 11862 s.9. Area 1



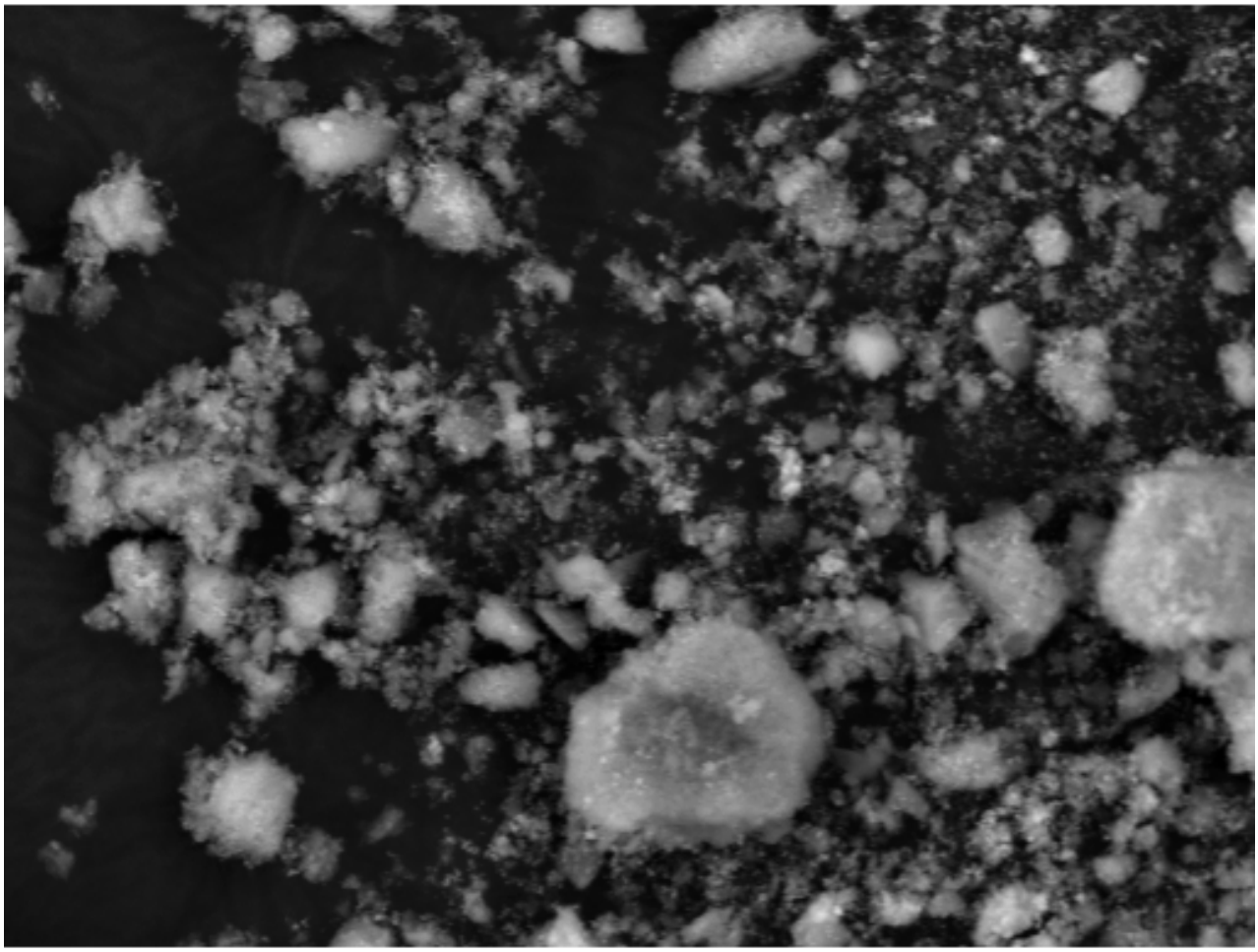


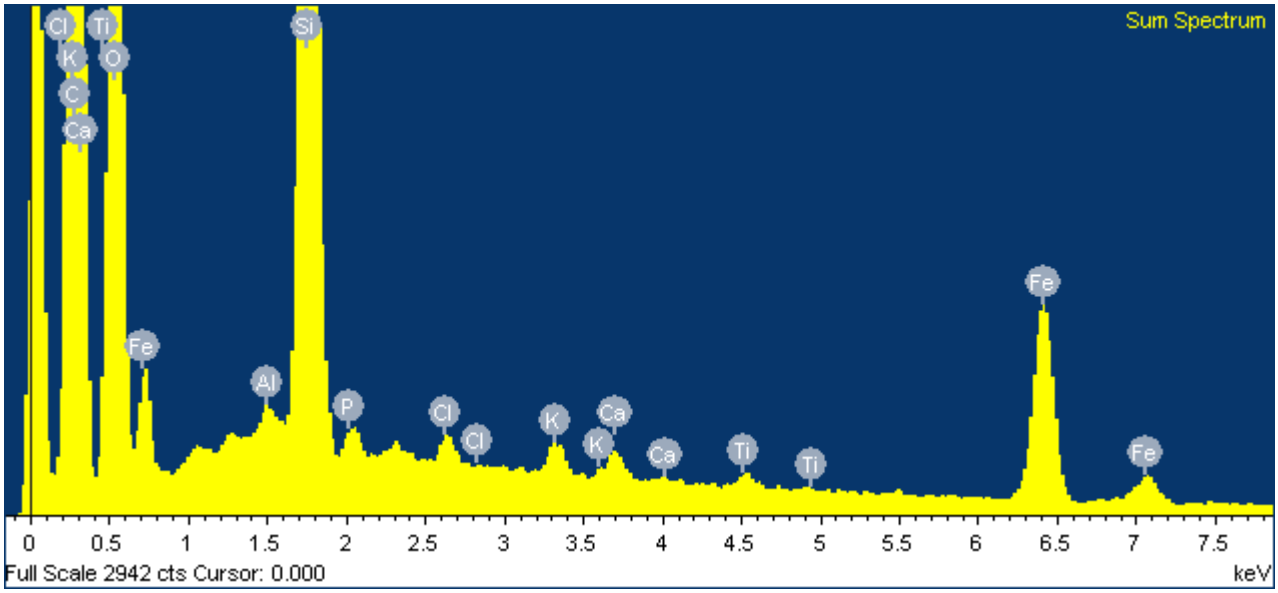
Comments: Results for units 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1



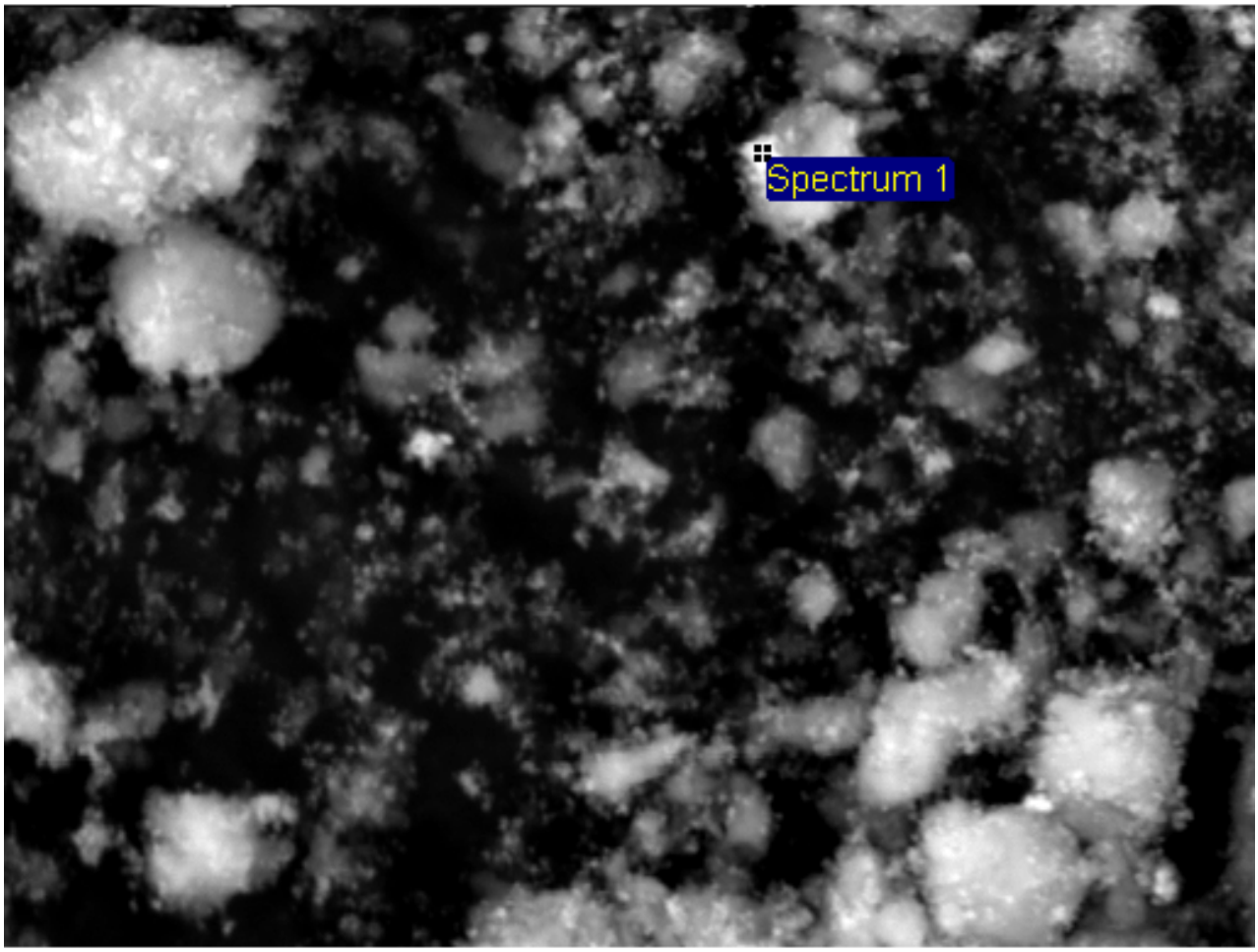


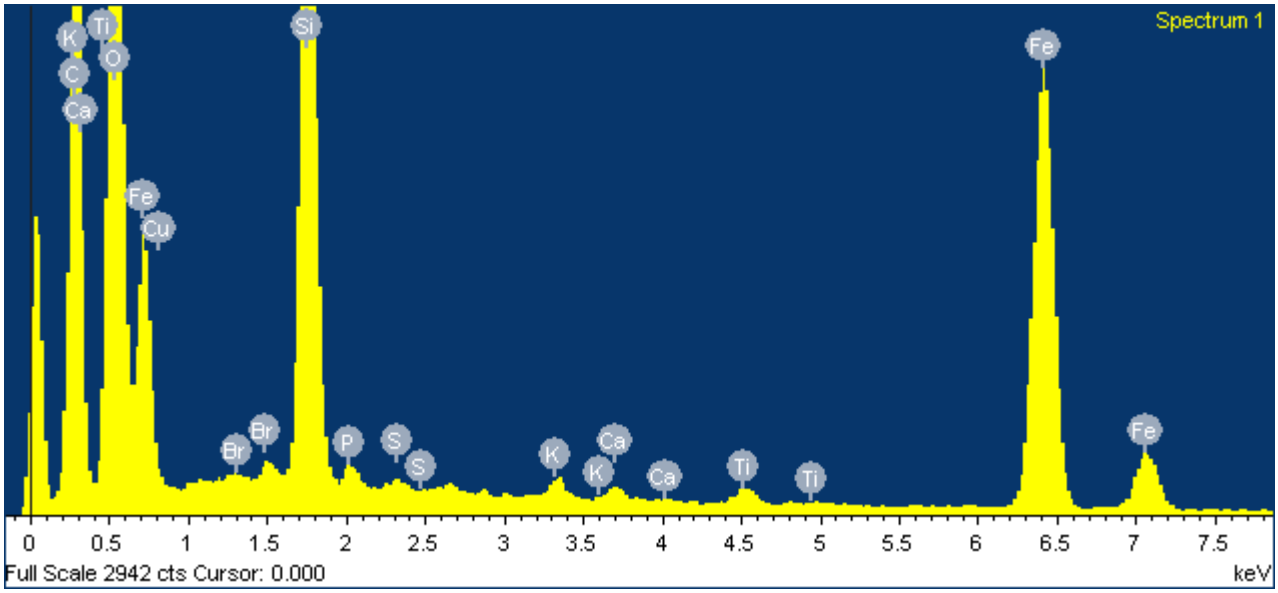
Comments: Results for units 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1



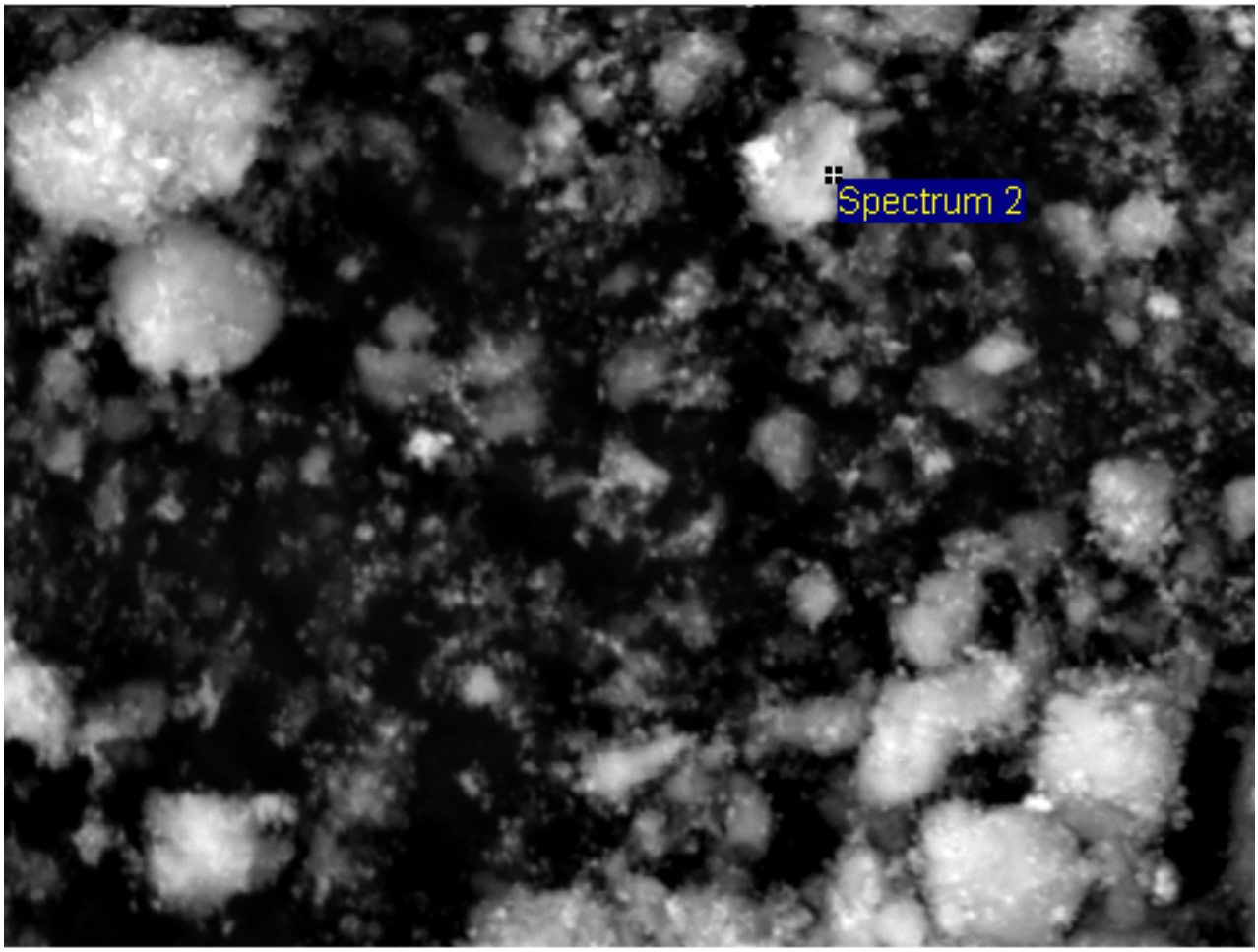


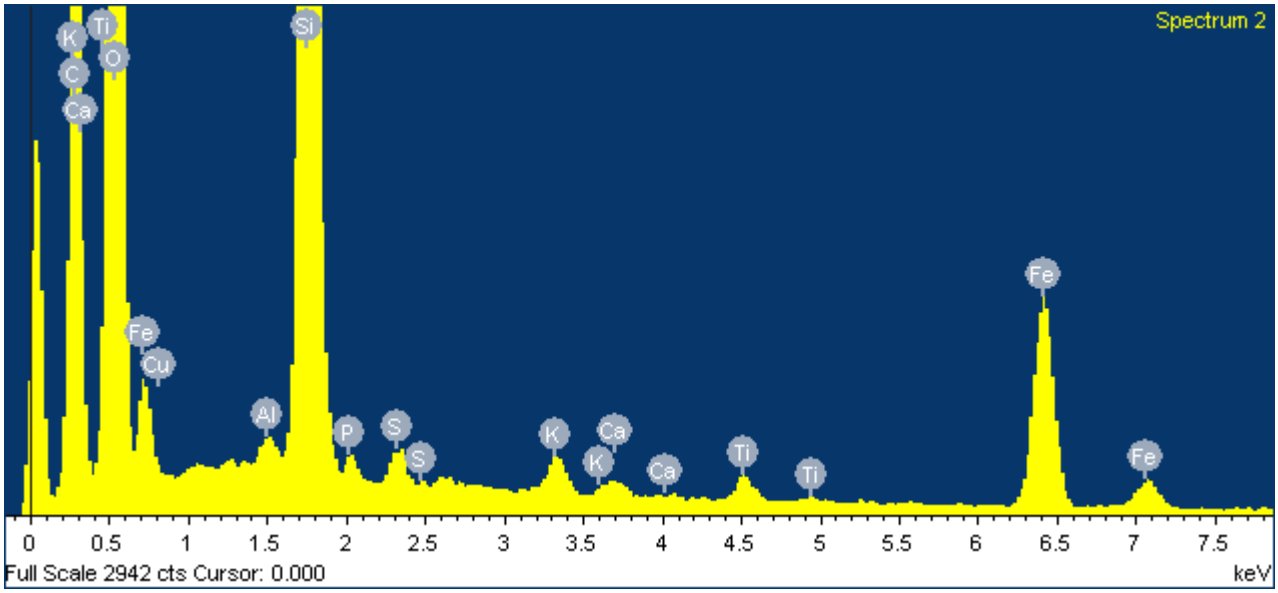
Comments: Results for units 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1



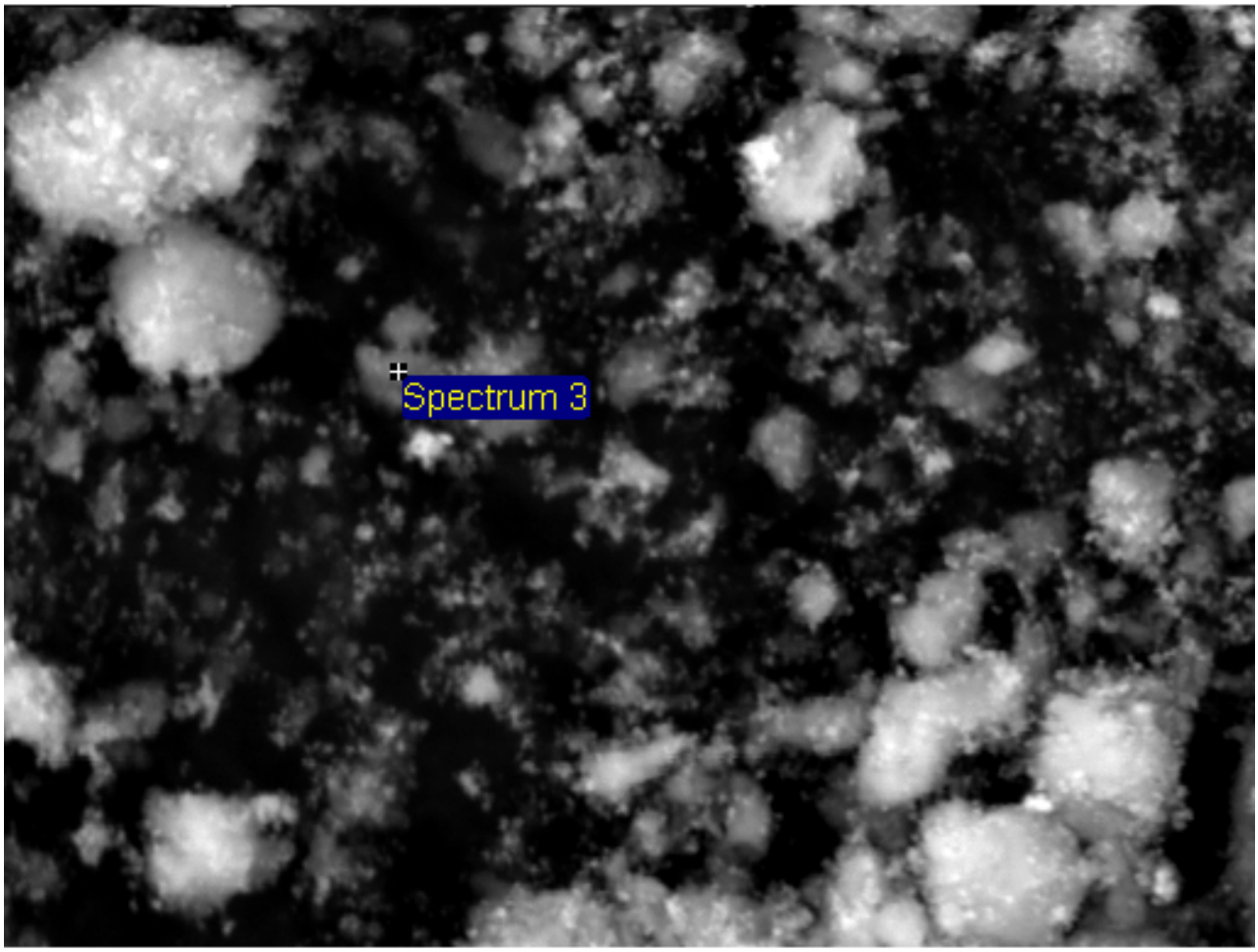


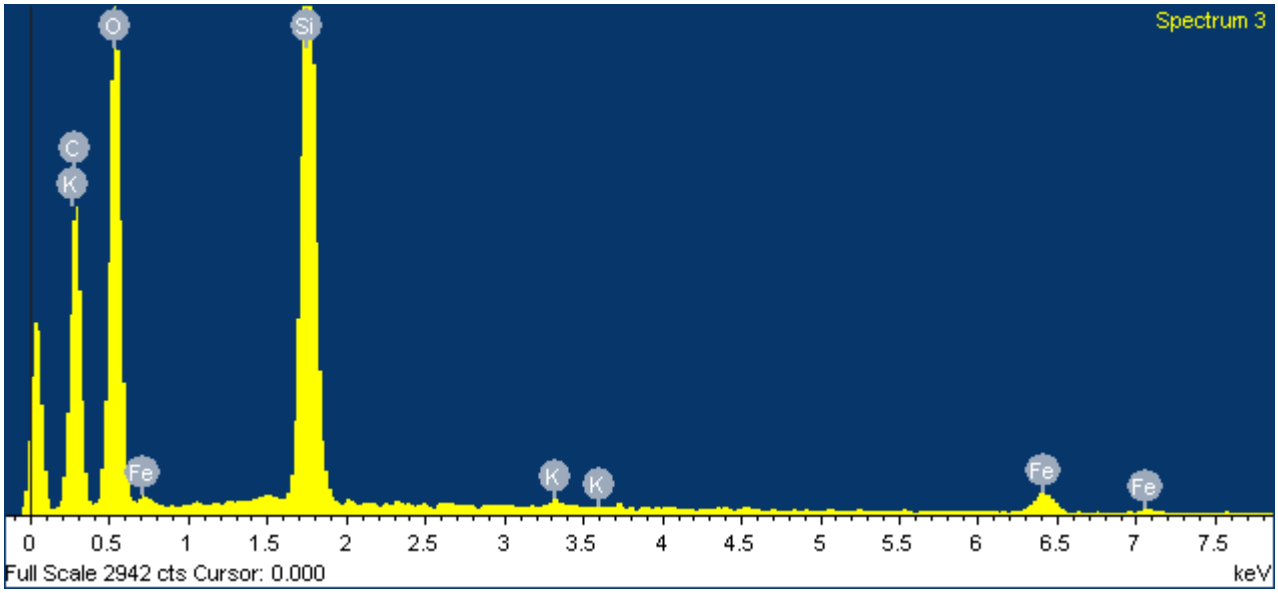
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1



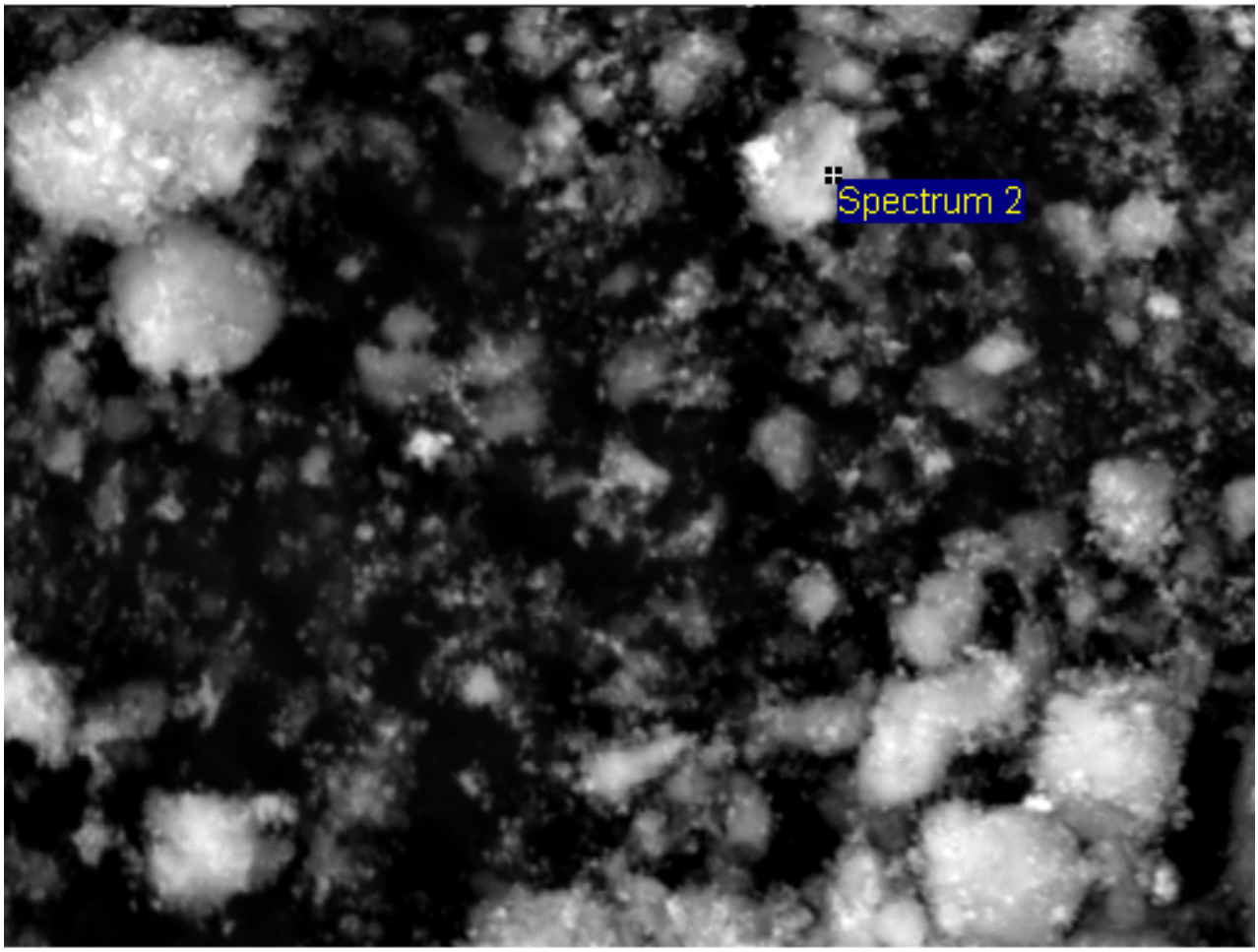


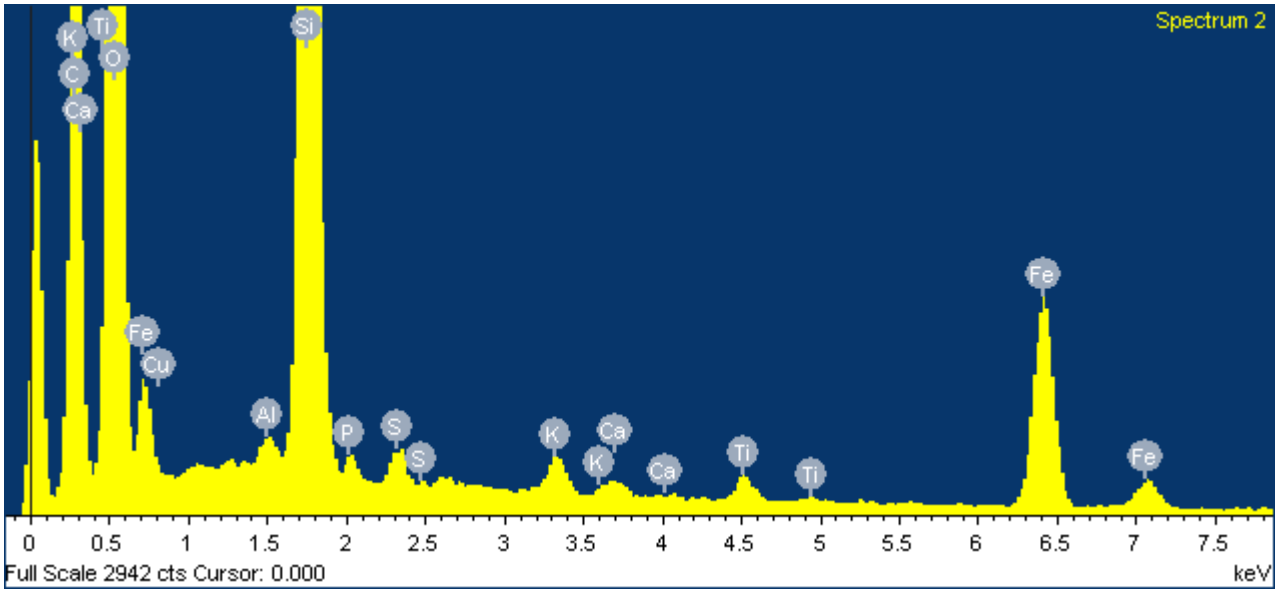
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1



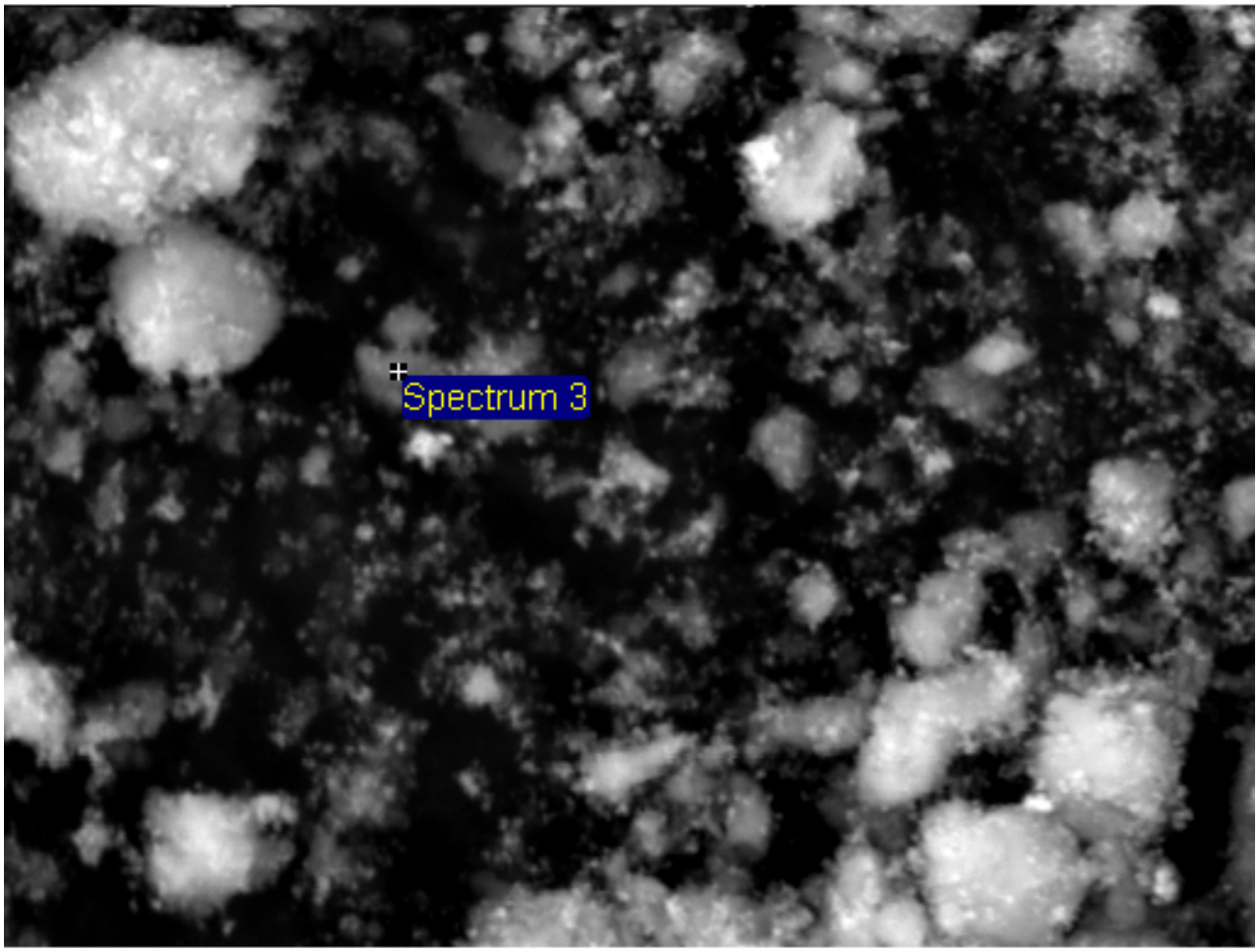


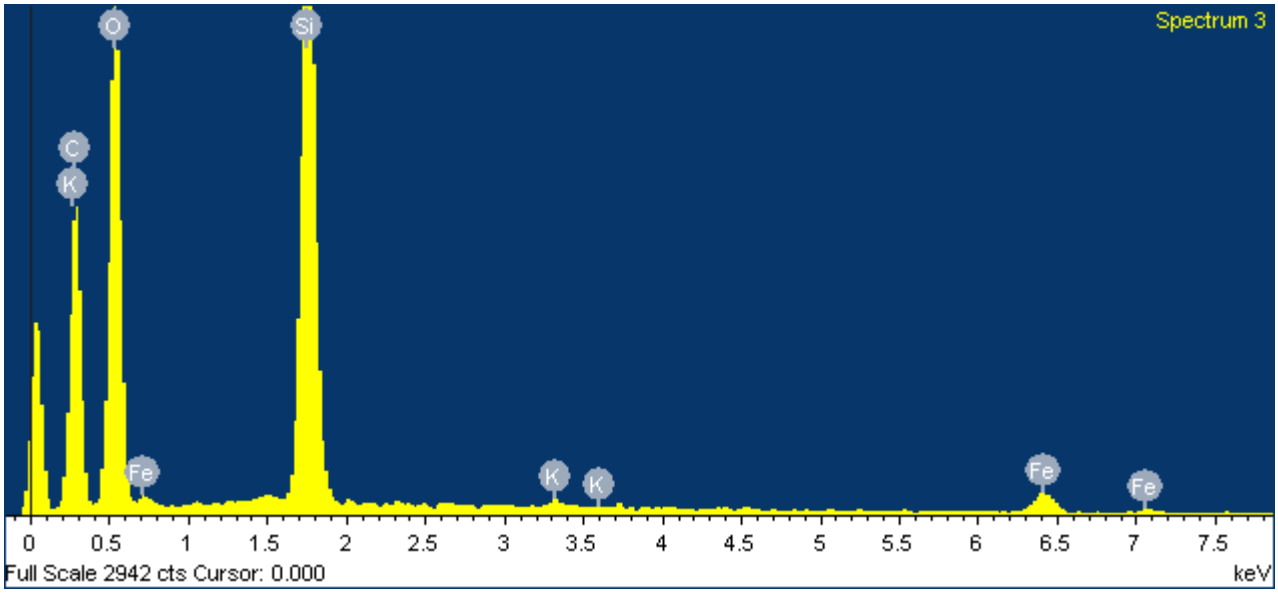
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1


Spectrum 2
20µm
Electron Image 1

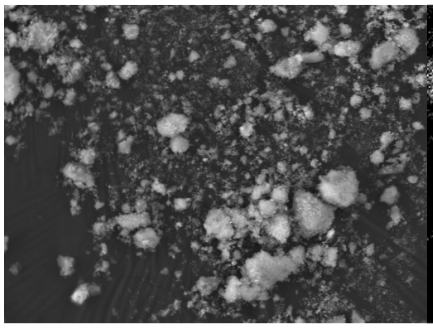

Spectrum 2
K
Ti
O
C
Ca
Si
Fe
Cu
Al
P
S
S
K
Ca
K
Ca
Ti
Ti
Fe
Fe
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
Full Scale 2942 cts Cursor: 0.000
keV

Comment:

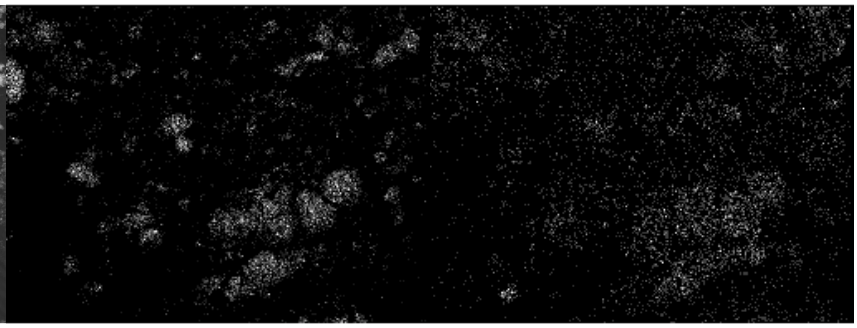

Spectrum 3
20µm
Electron Image 1


Spectrum 3
O
Si
C
K
Fe
K
K
Fe
Fe
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
Full Scale 2942 cts Cursor: 0.000
keV

Comment:

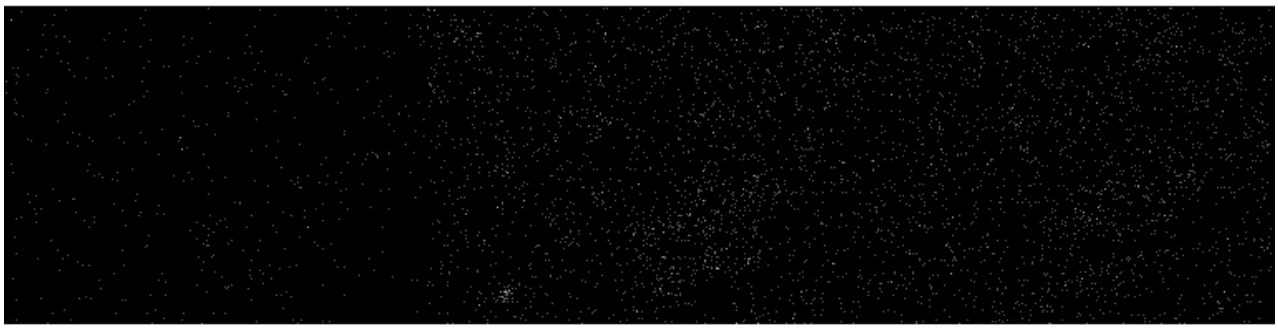


Electron Image 1



Si Ka1

Fe Ka1

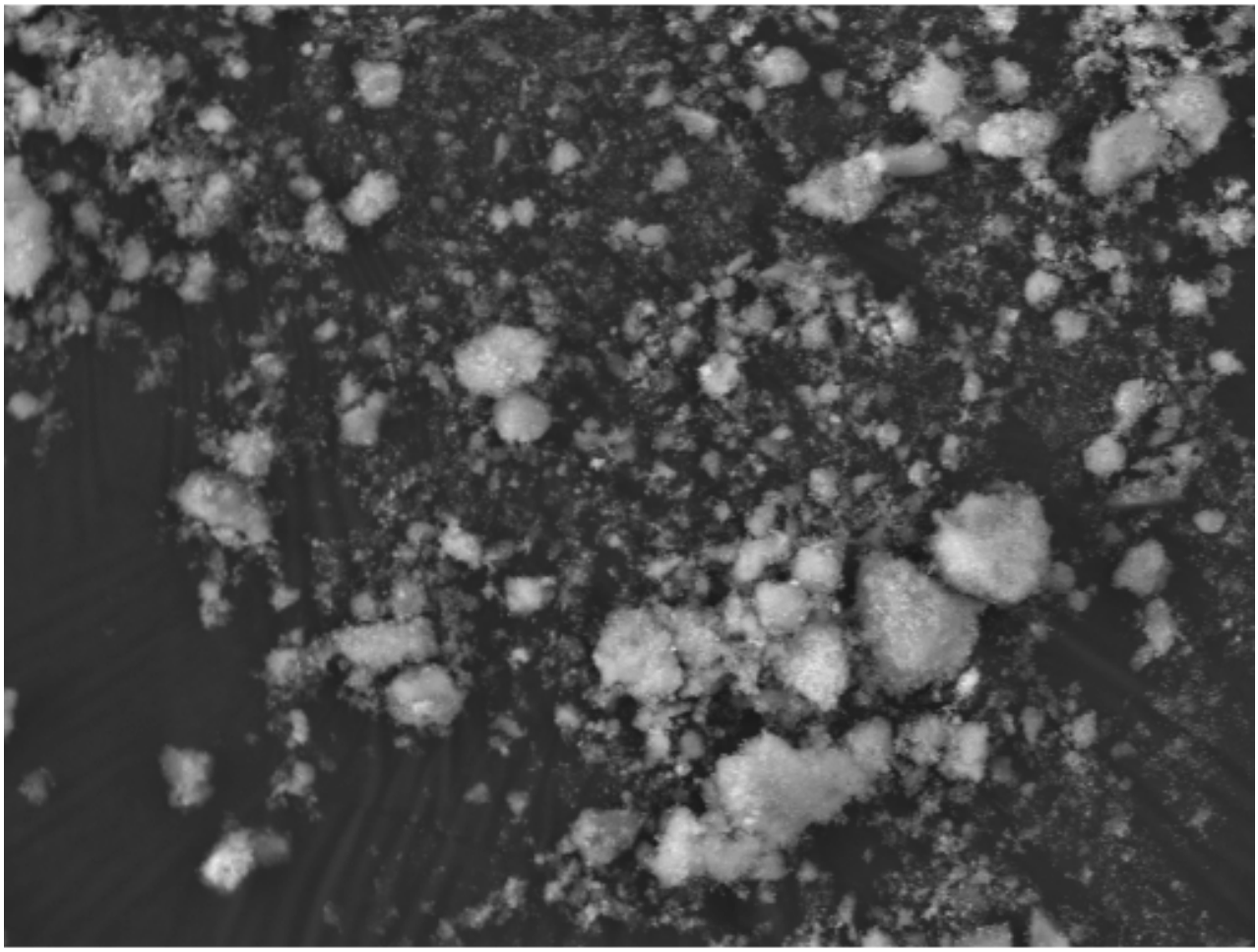


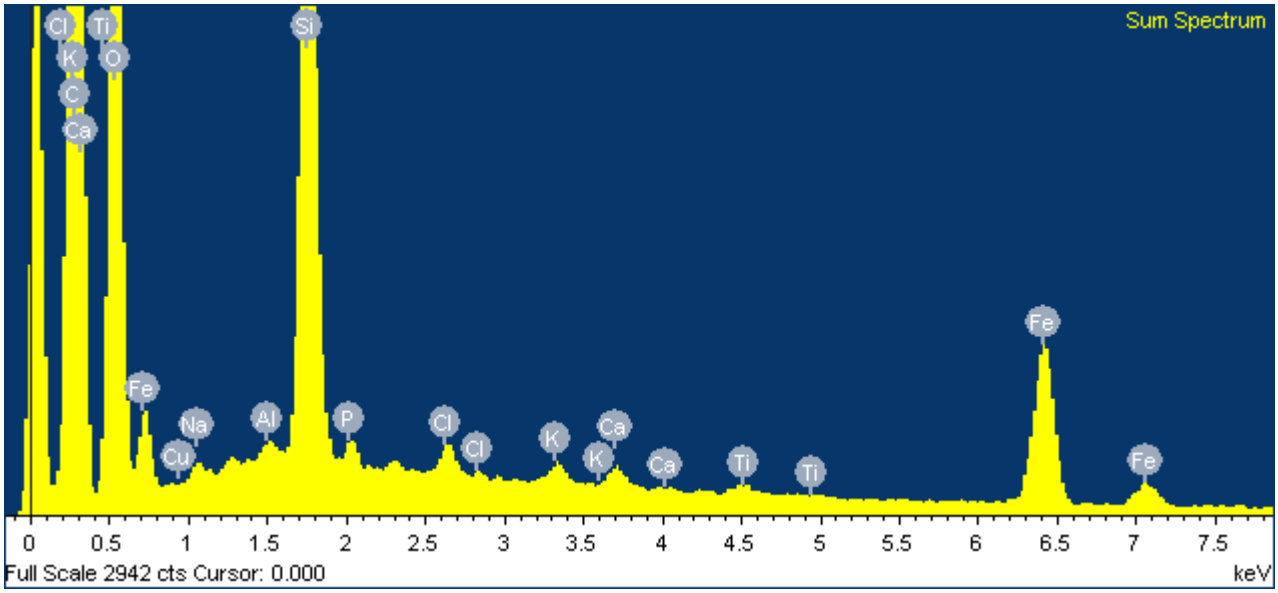
Hg La1

Ca Ka1

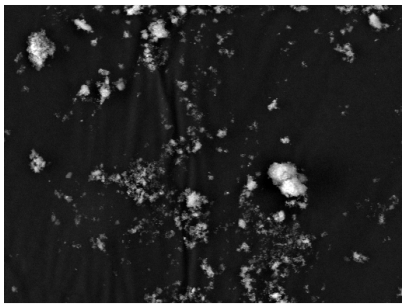
Mg Ka1_2

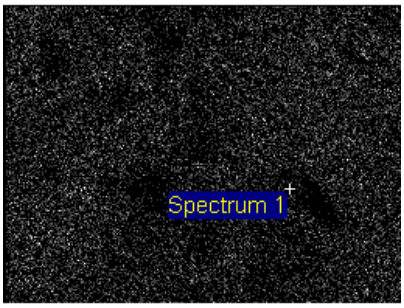
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Si, Fe, Hg, Ca, Mg



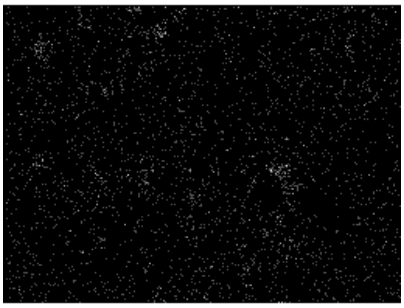


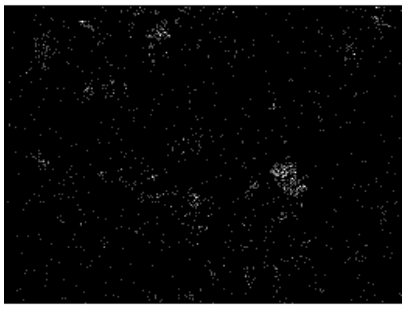
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1

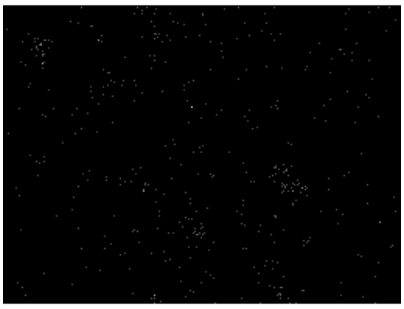

Electron Image 1

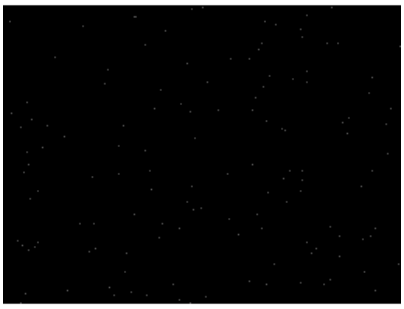


C Ka1_2


O Ka1

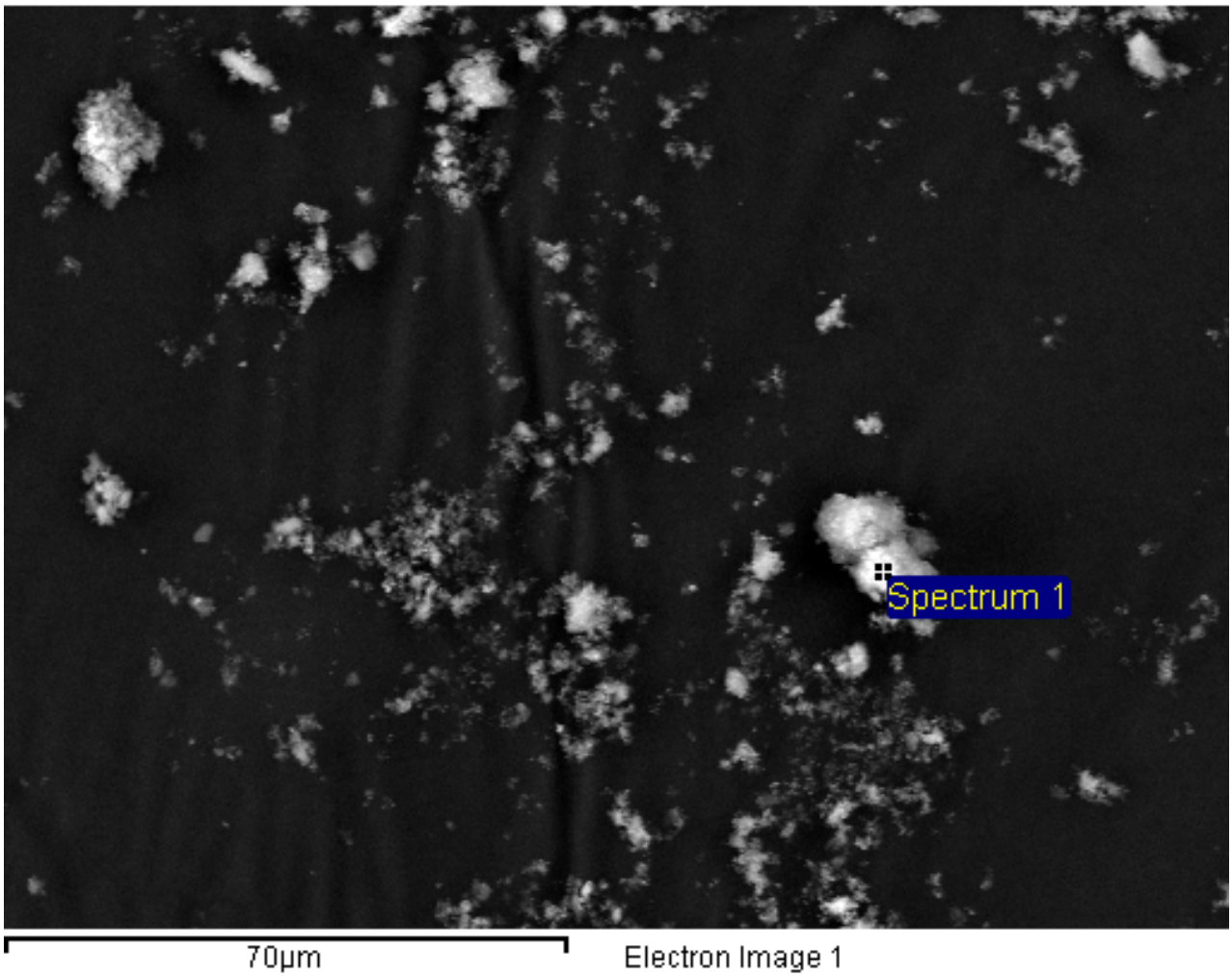

Si Ka1

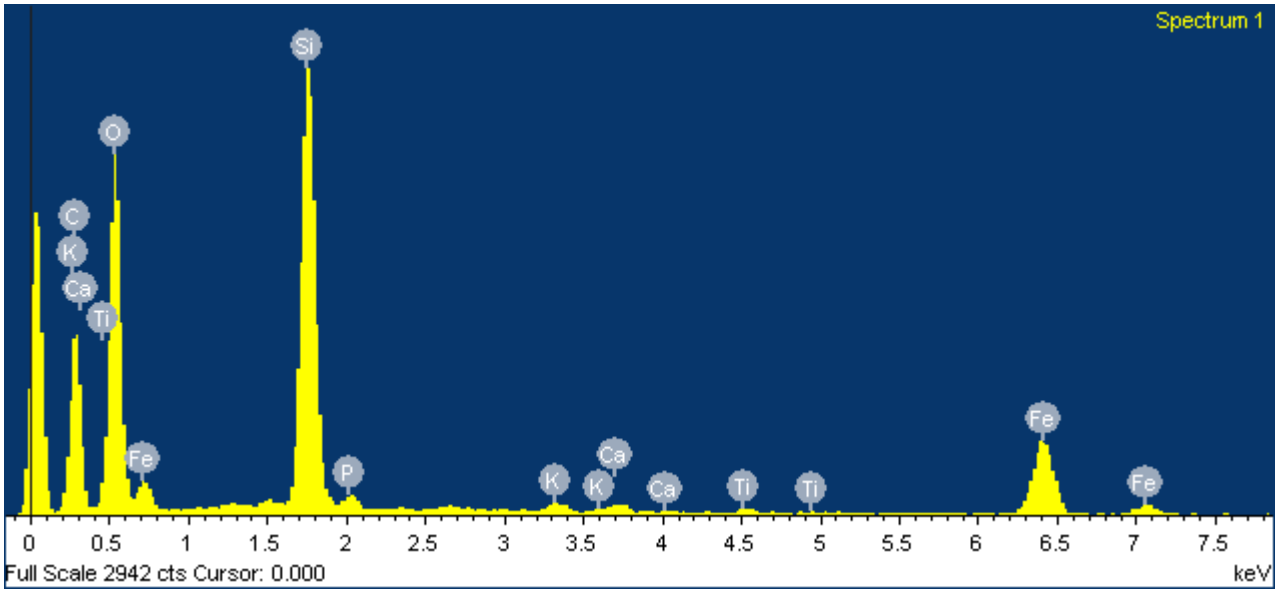

Fe Ka1


Cu Ka1

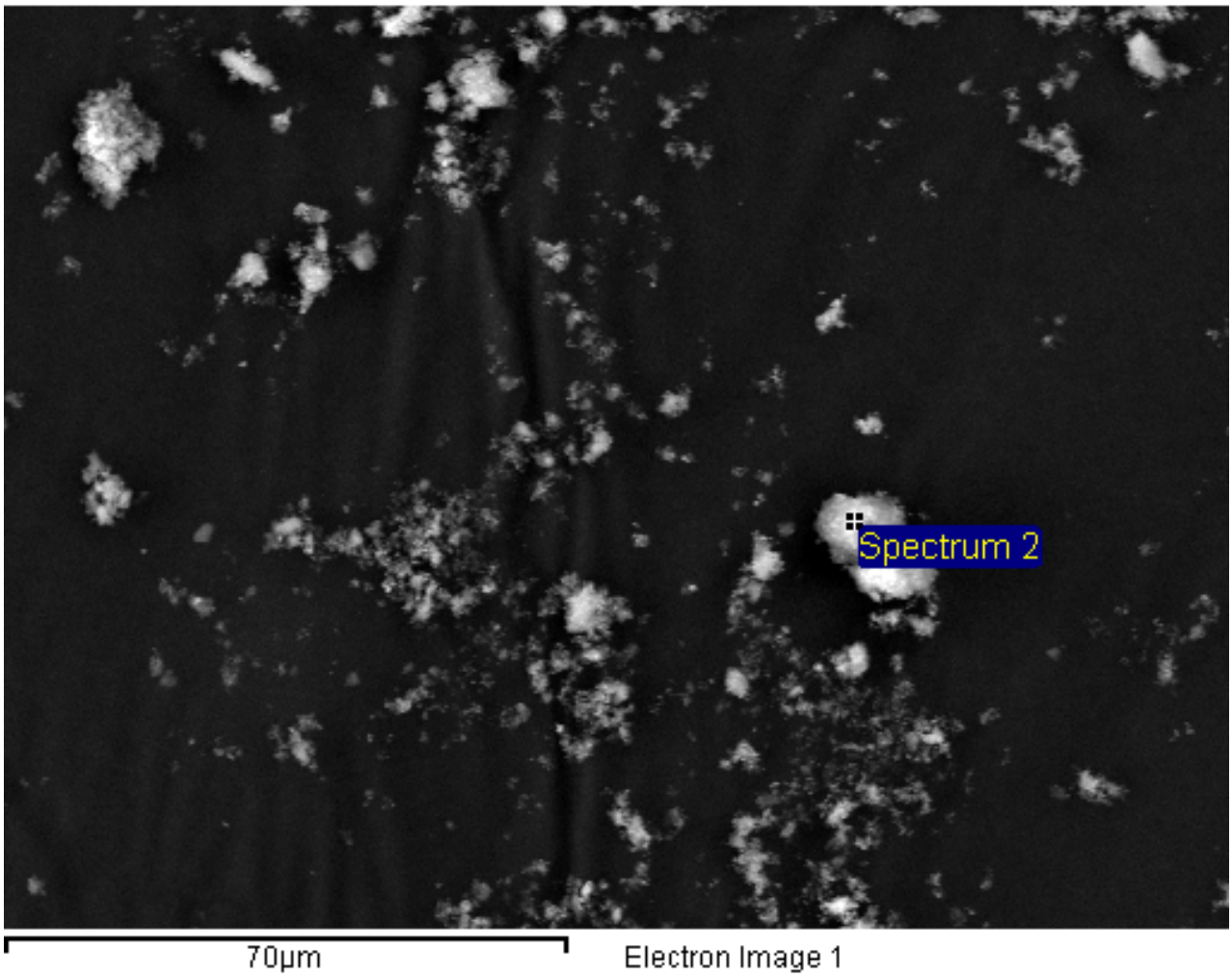

Mg Ka1_2

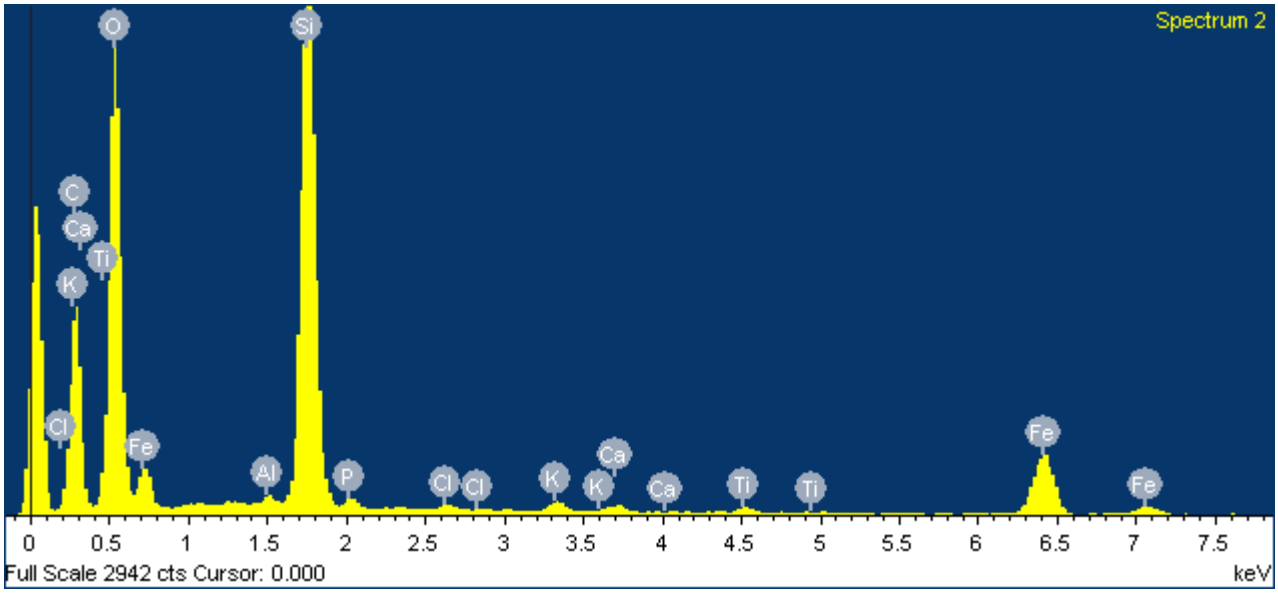
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
C, O, Si, Fe, Cu, Mg



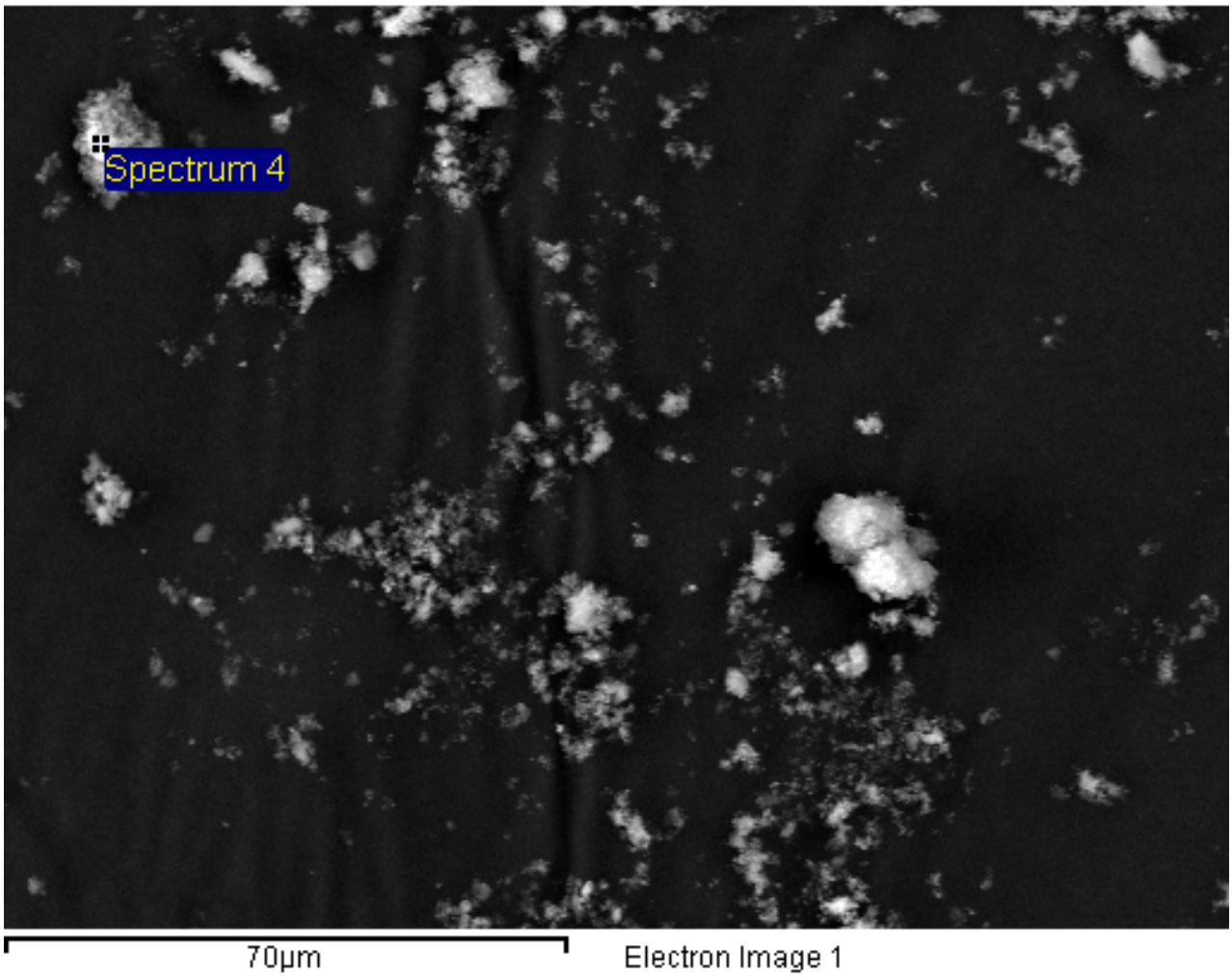


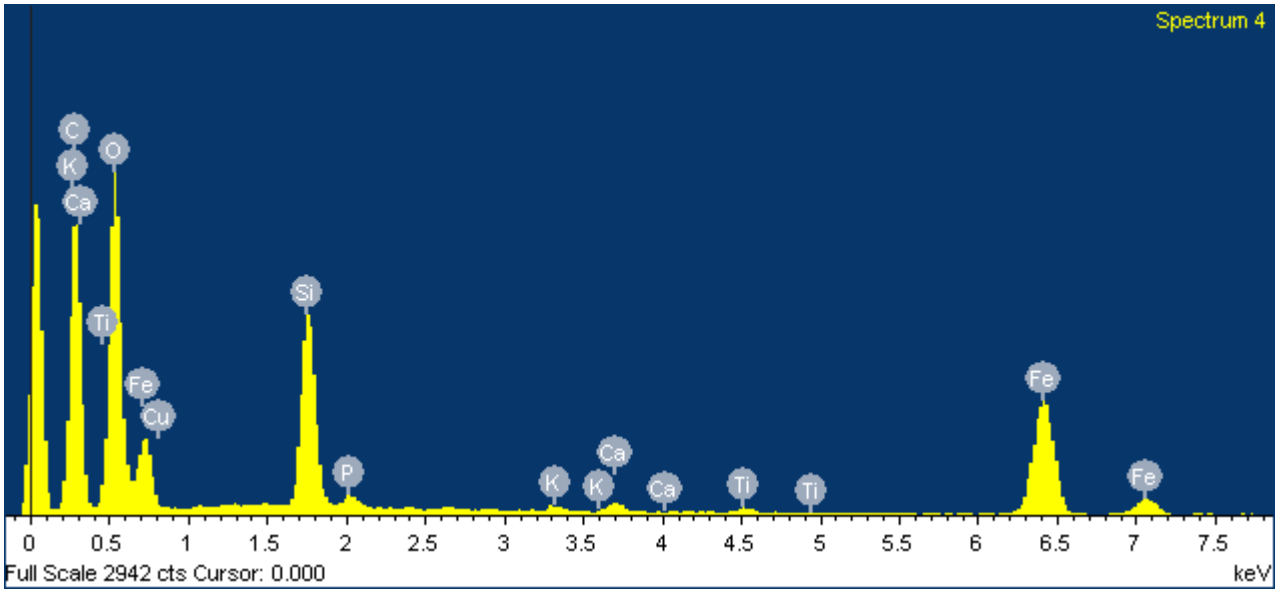
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1



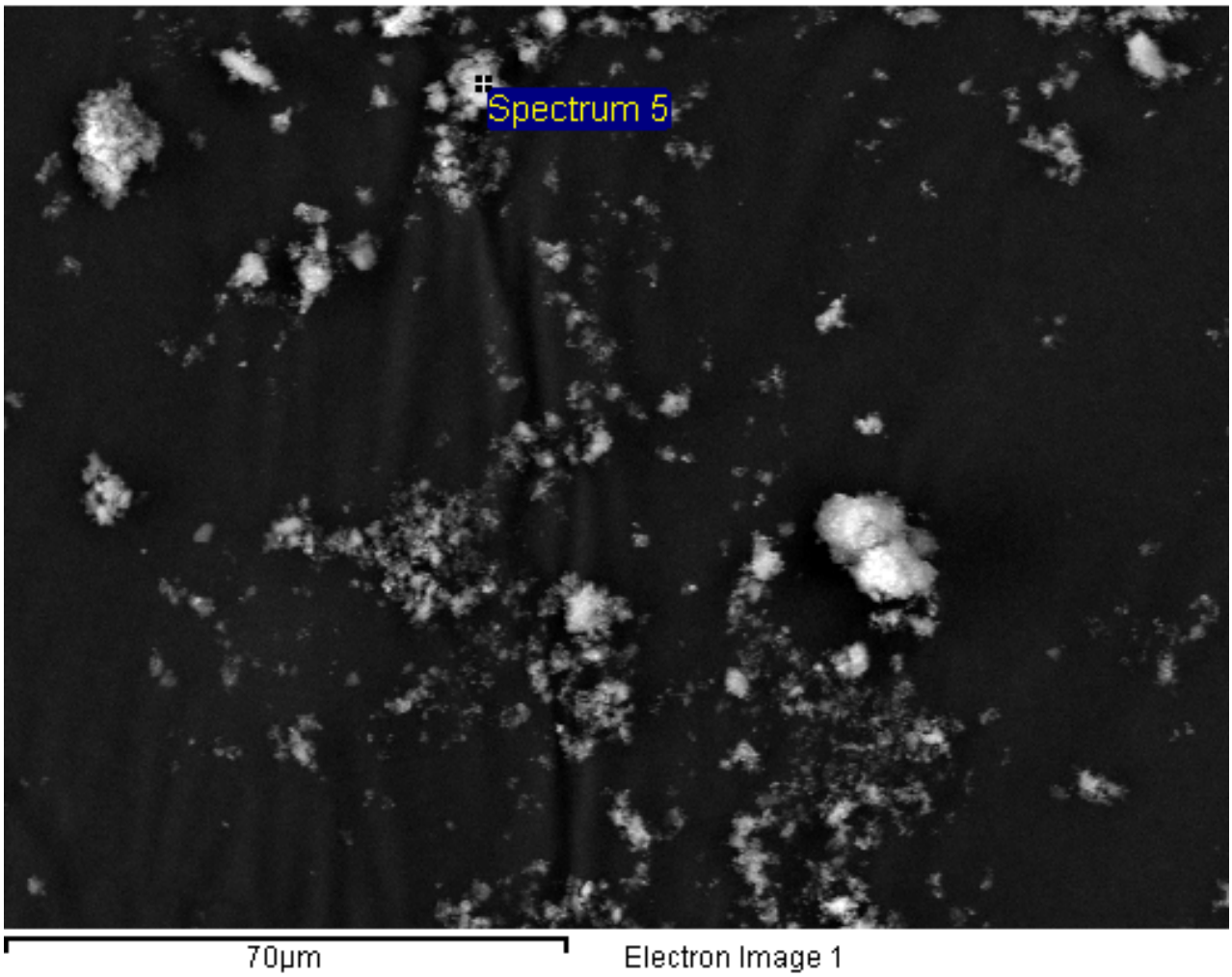


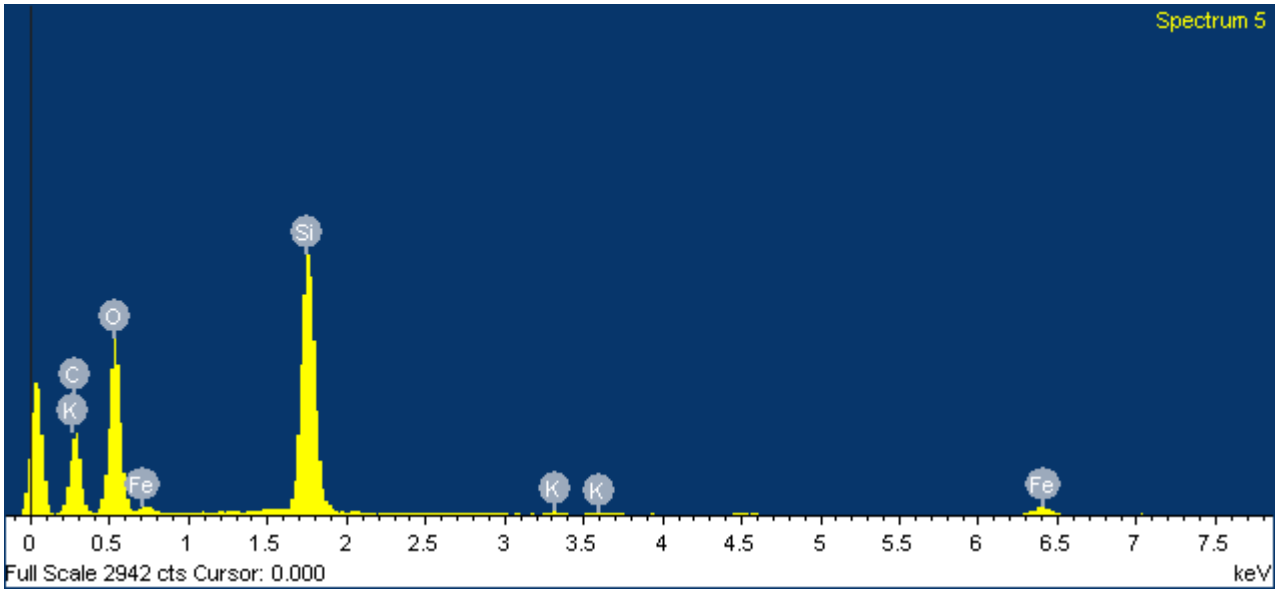
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1



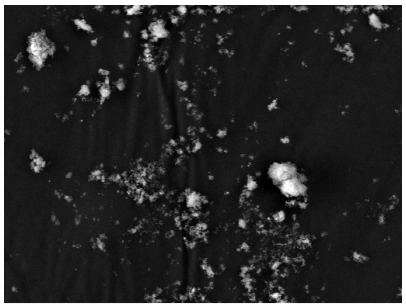


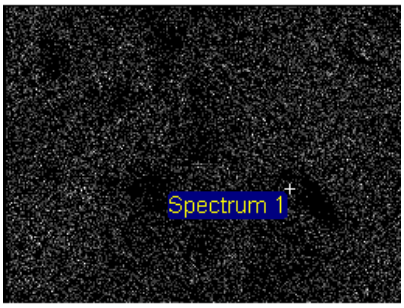
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1



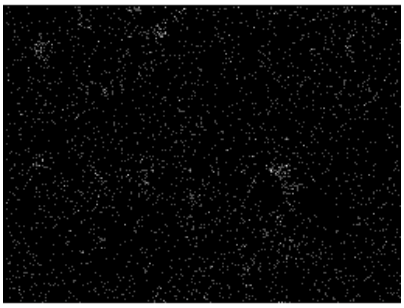


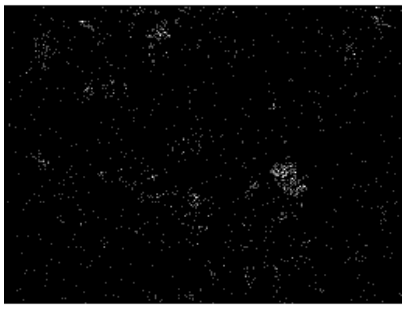
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1

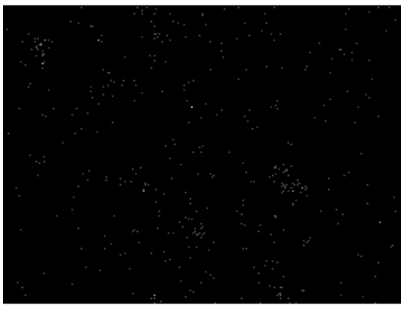

Electron Image 1

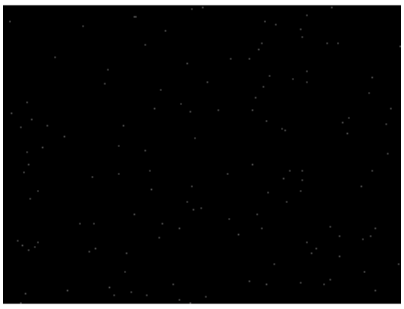


C Ka1_2


O Ka1

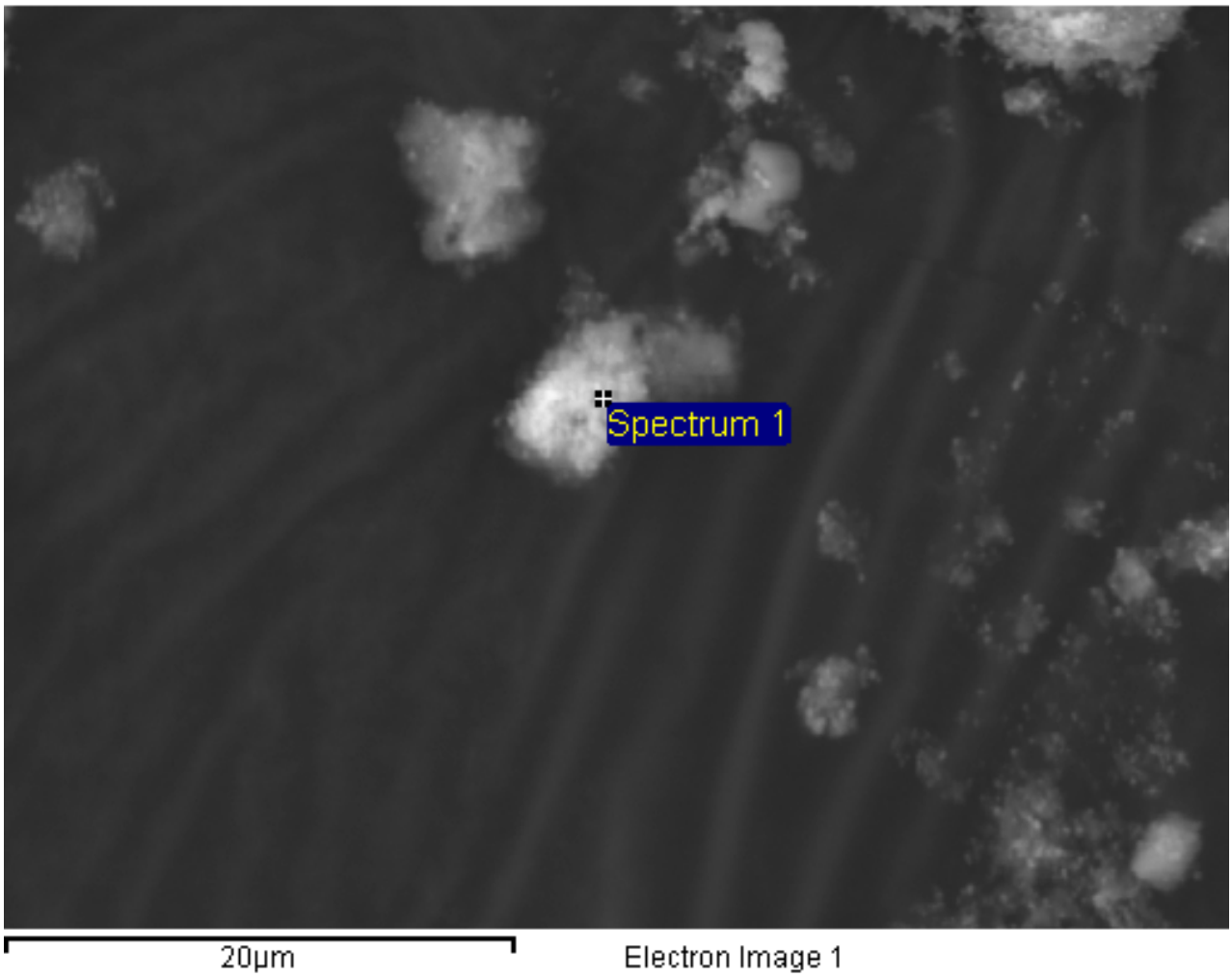

Si Ka1

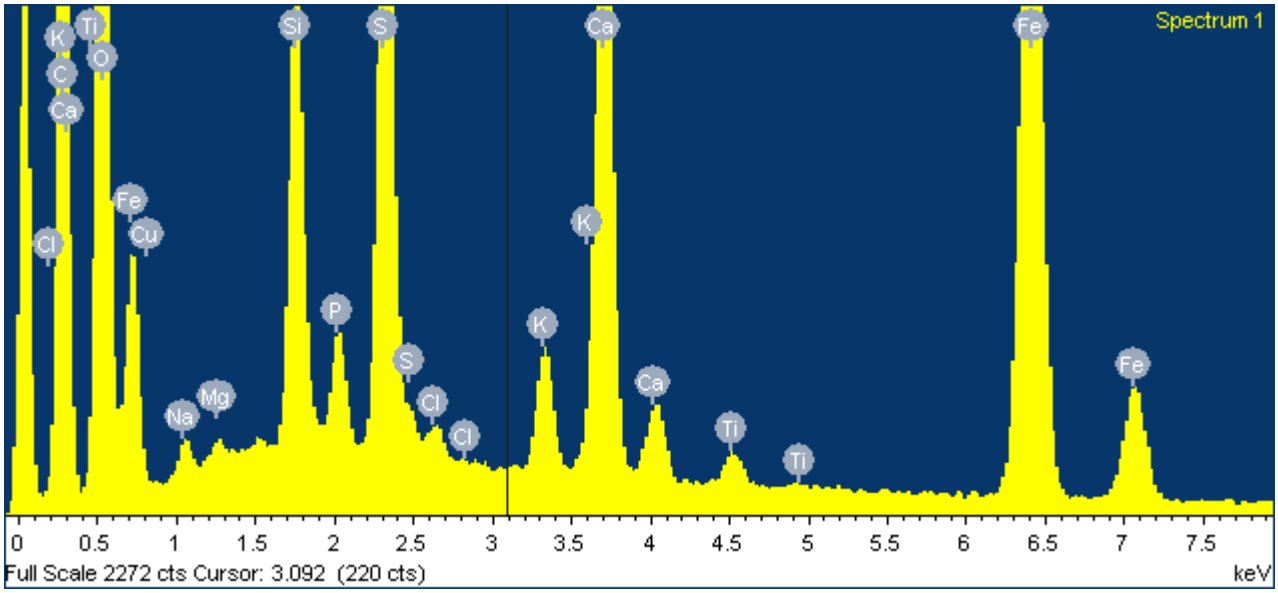

Fe Ka1


Cu Ka1

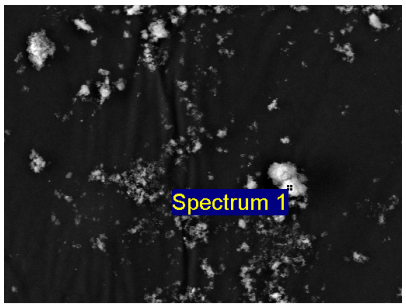

Mg Ka1_2

Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Si, Fe, HHg, Ca, Mg

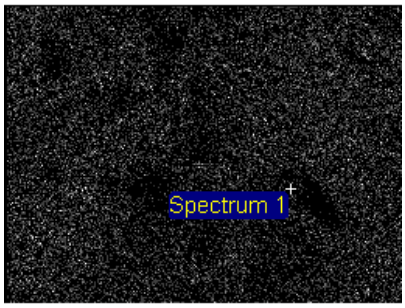




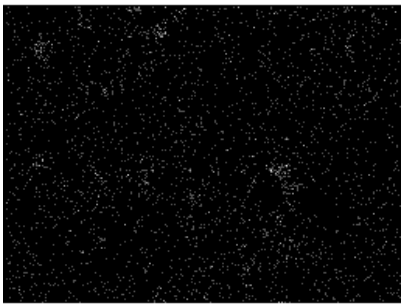
Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1

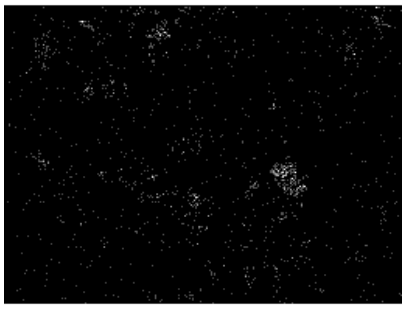


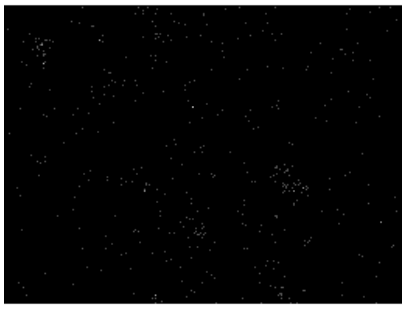
Electron Image 1

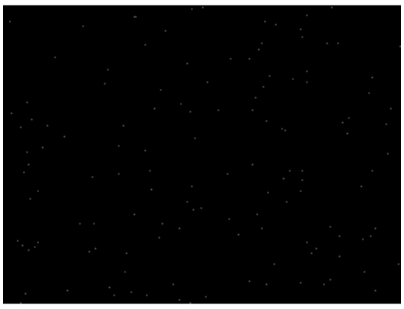


C Ka1_2


O Ka1

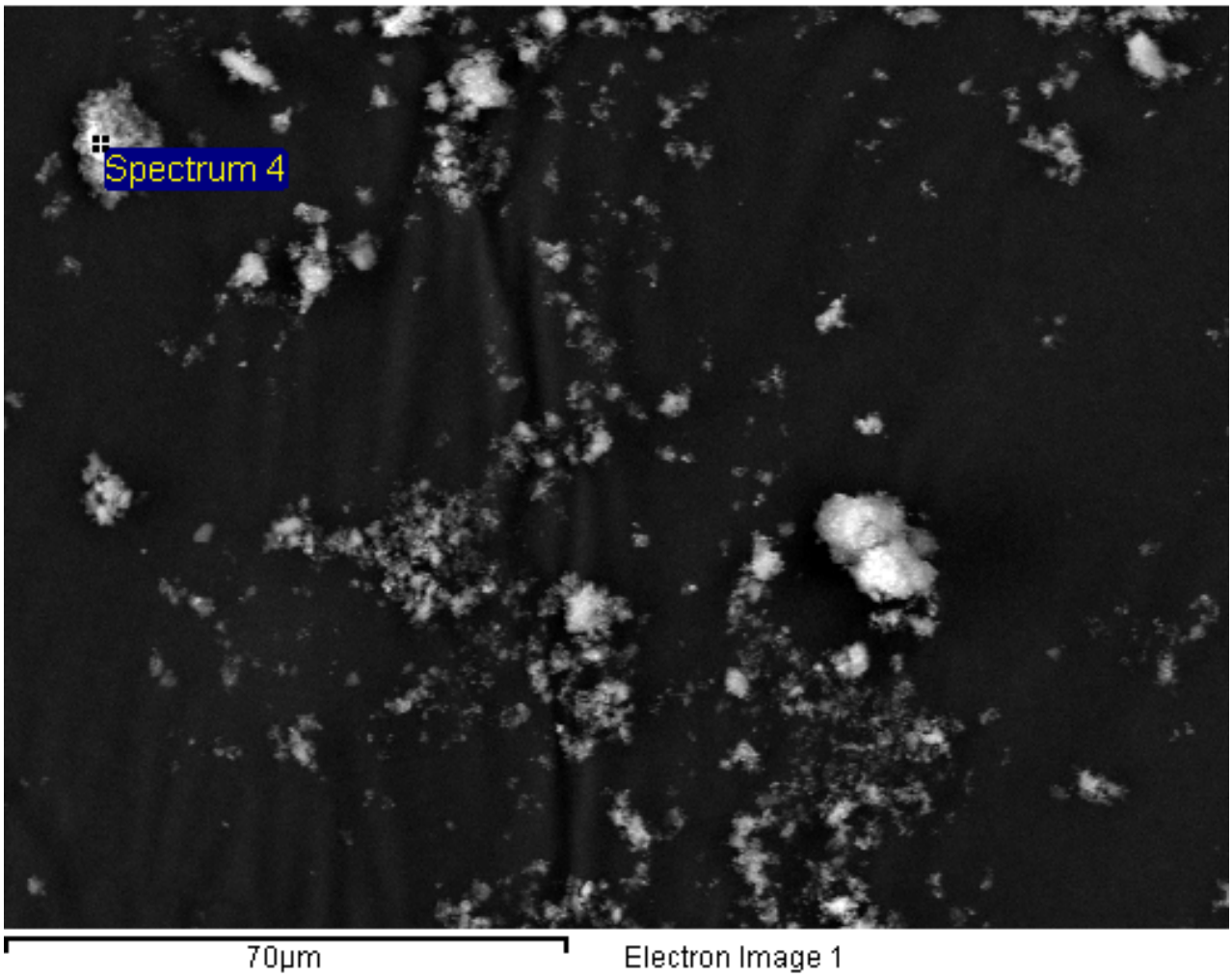

Si Ka1

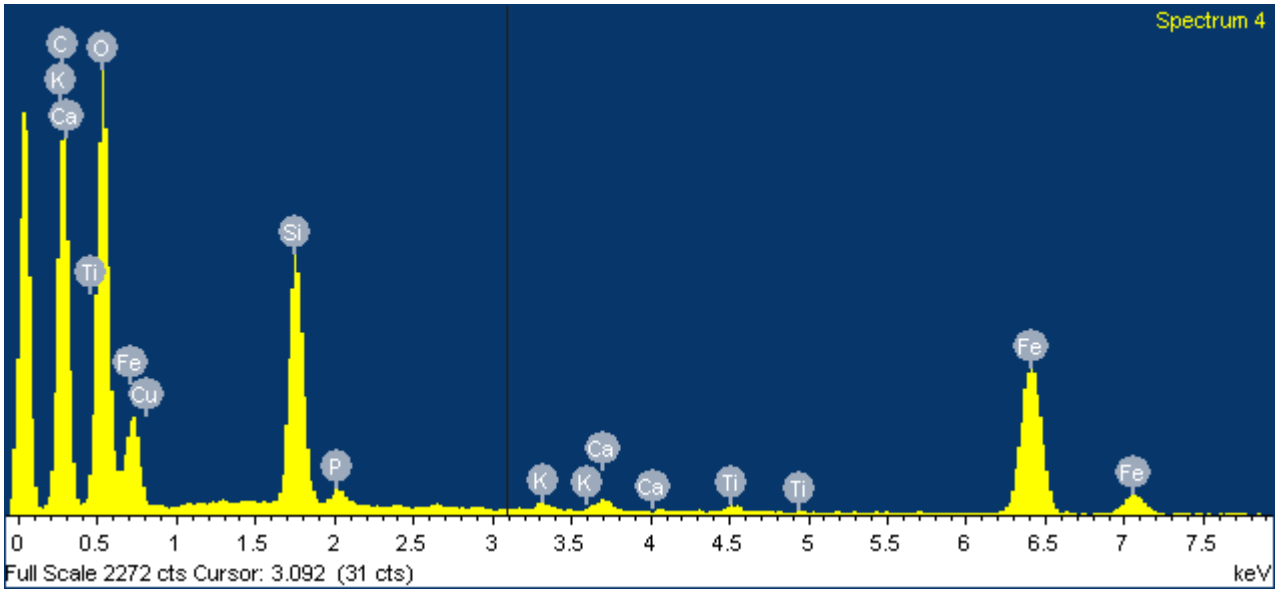

Fe Ka1


Cu Ka1

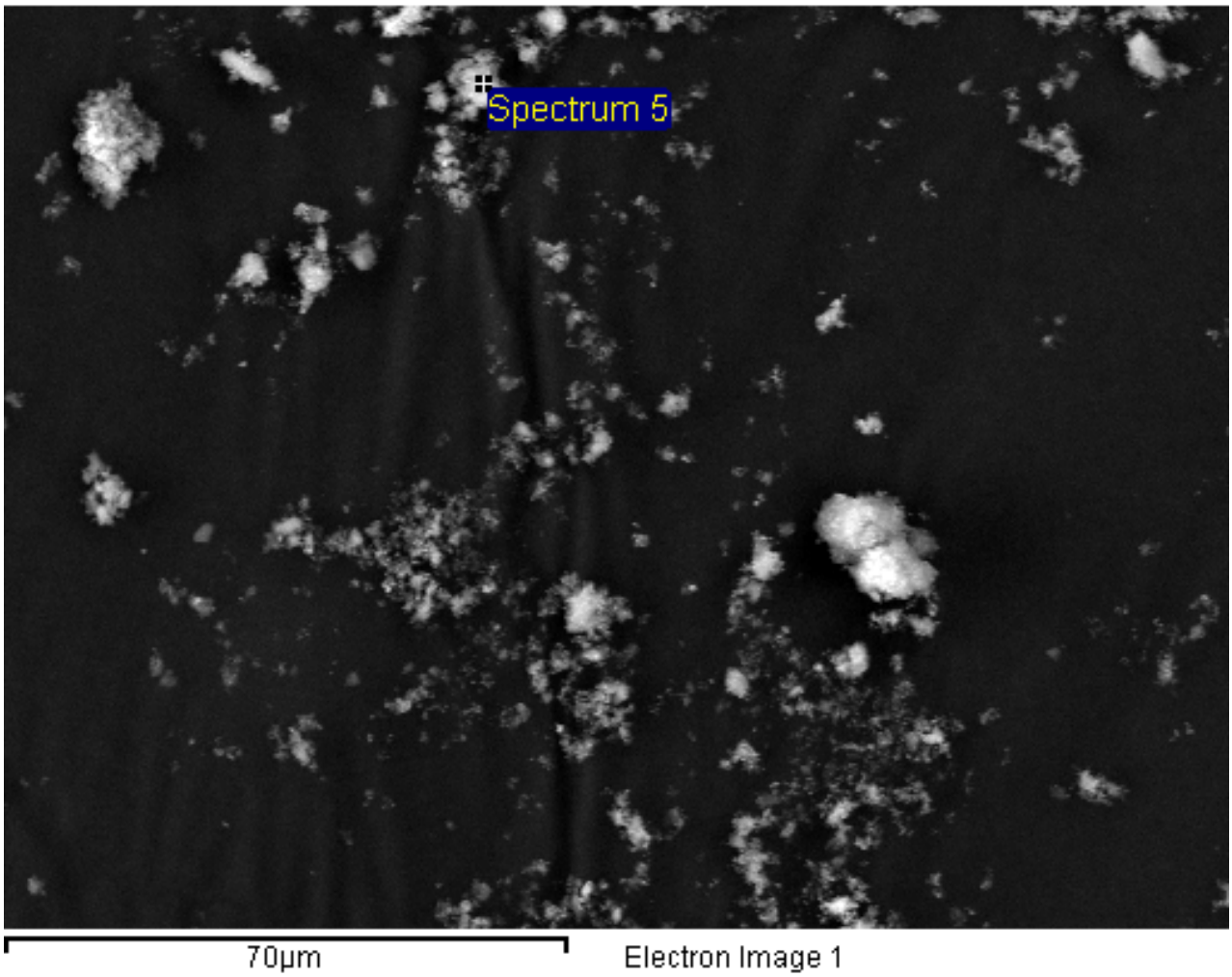

Mg Ka1_2

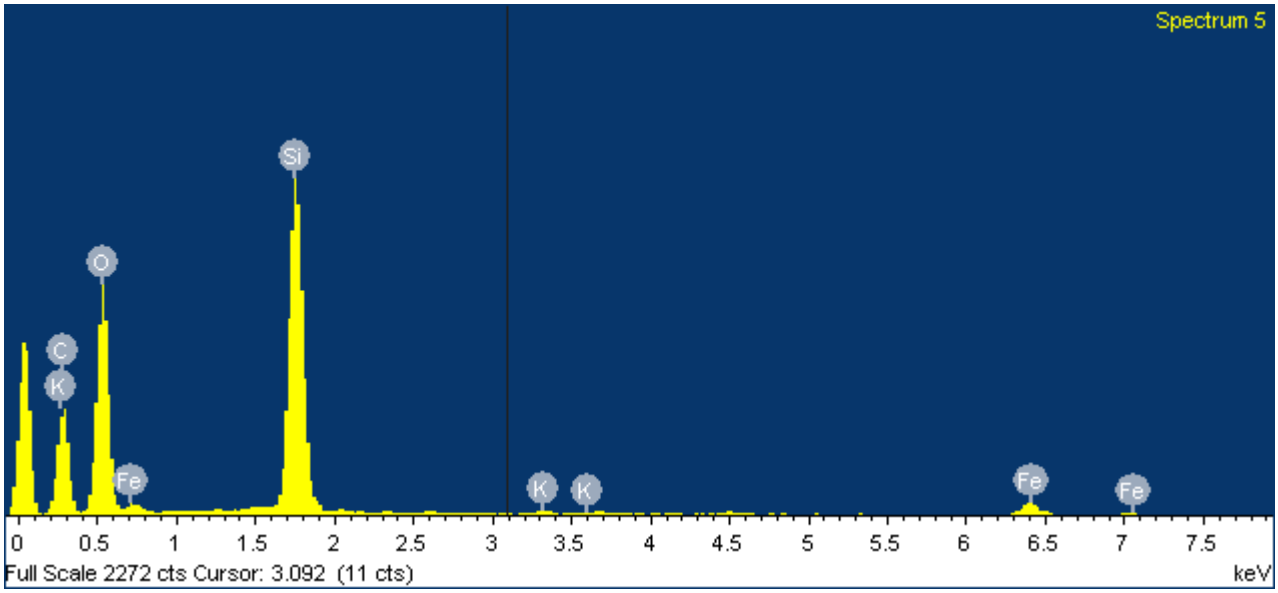
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
C, O, Si, Fe, Cu, Mg



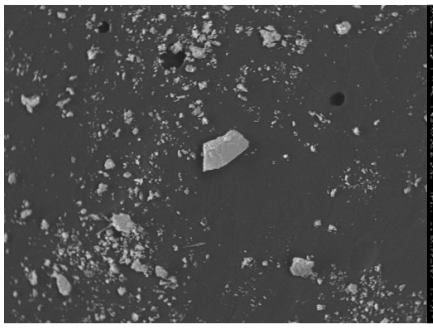


Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1

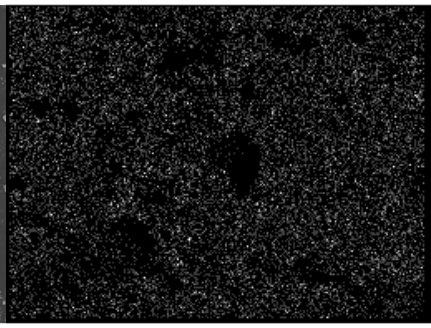




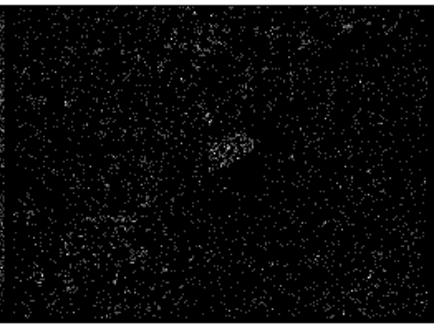
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1



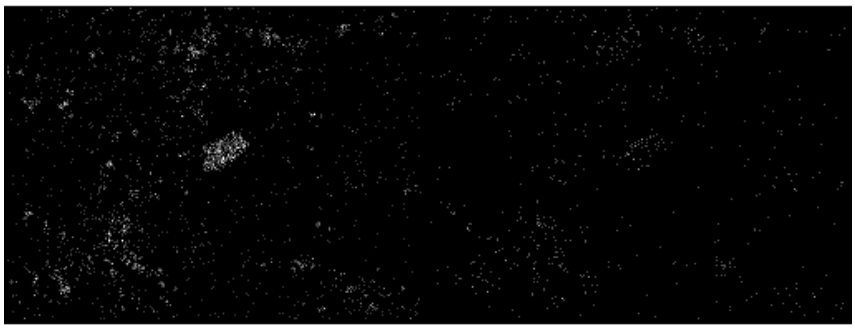
Electron Image 1



C Ka1_2



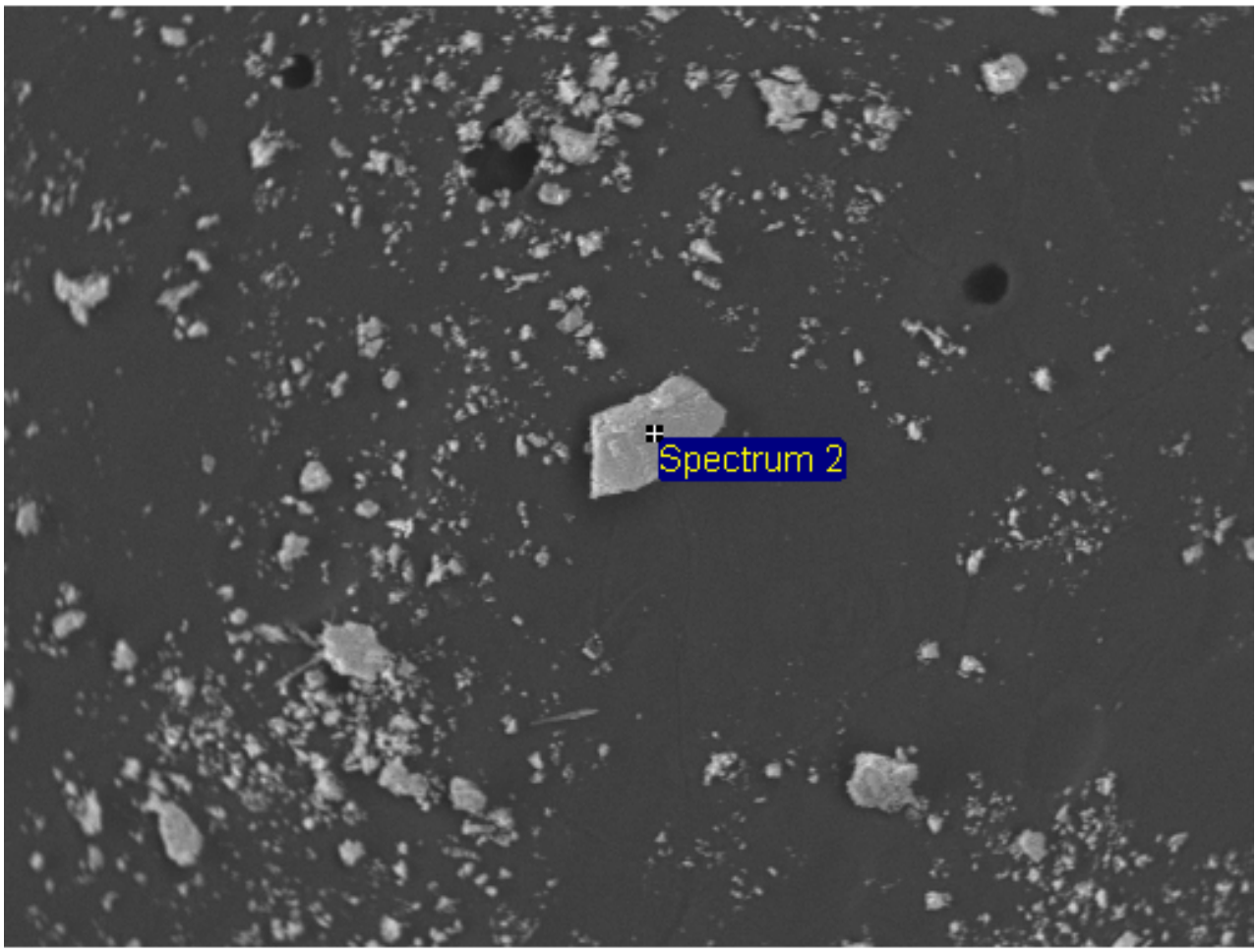
O Ka1

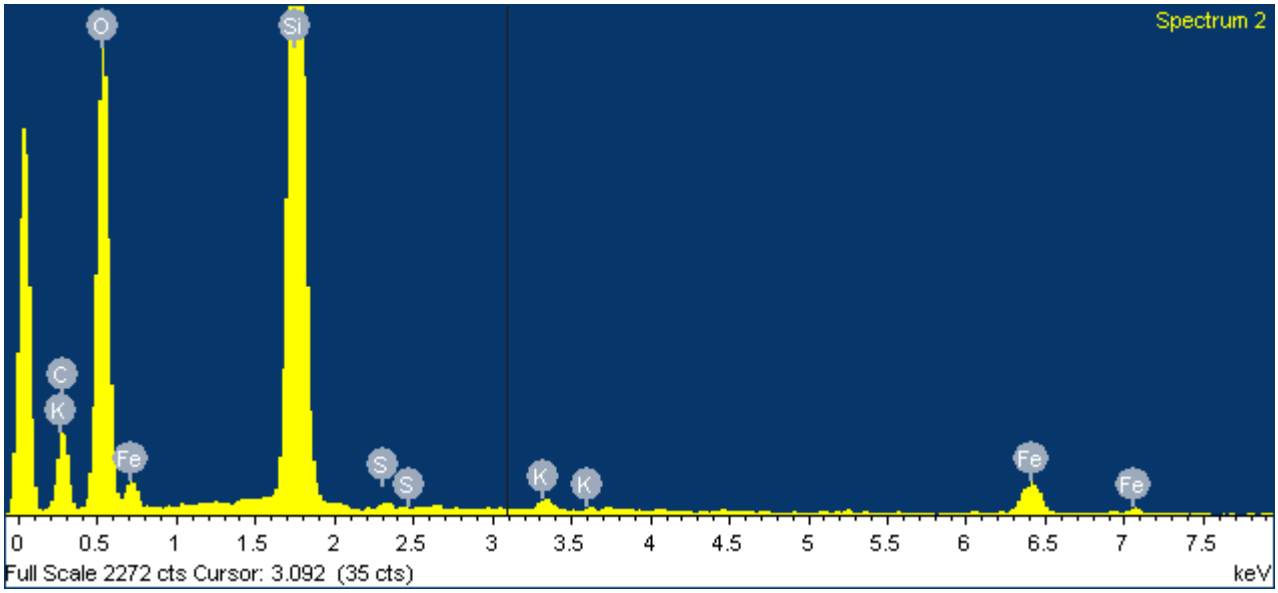


Si Ka1

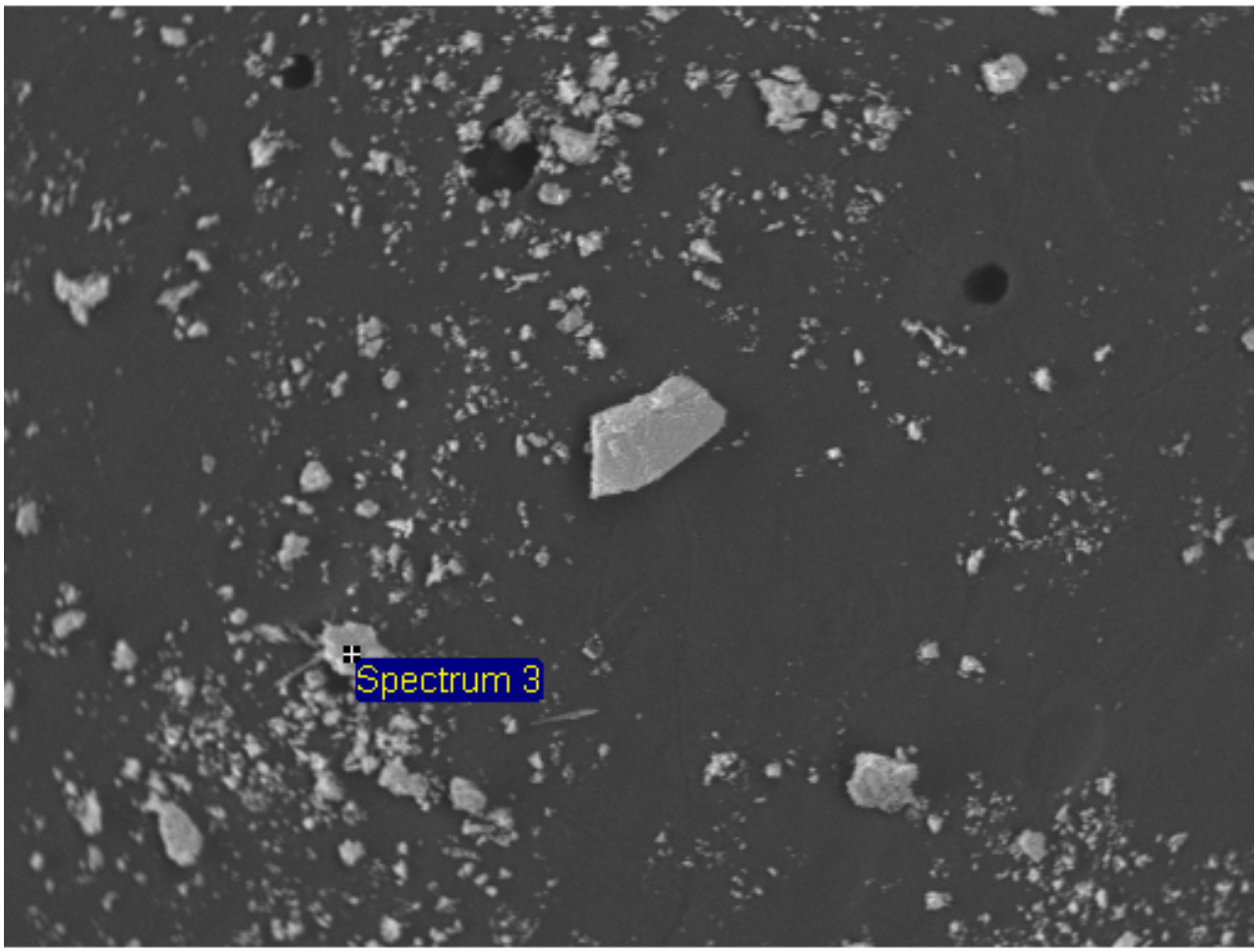
Fe Ka1

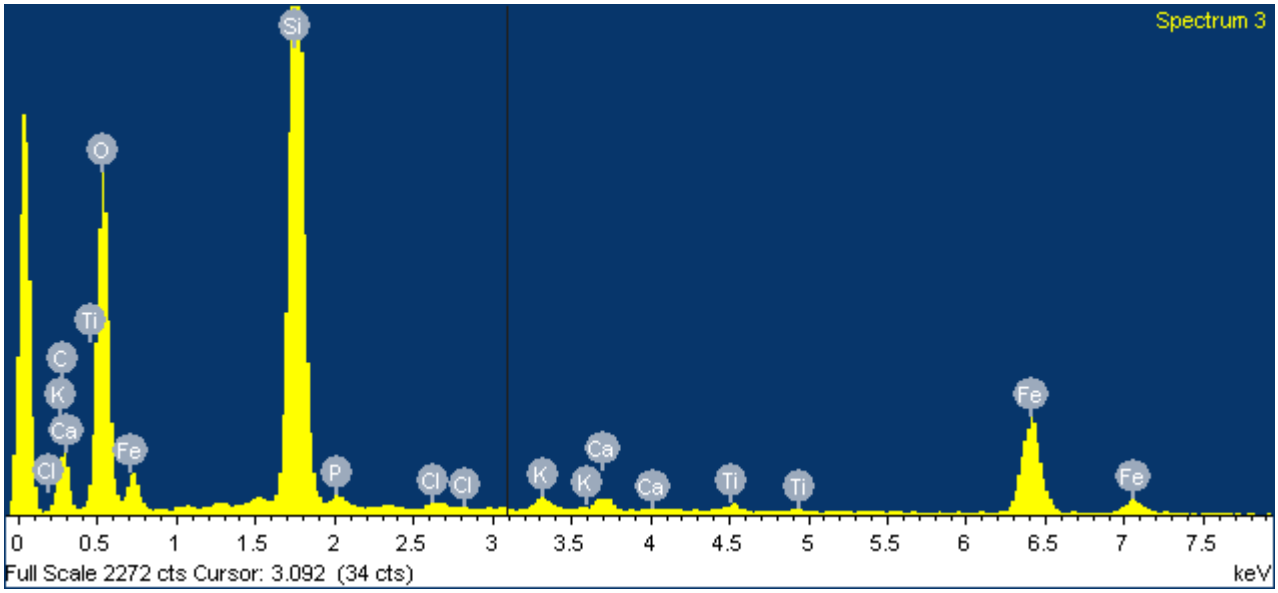
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
C, O, Si, Fe



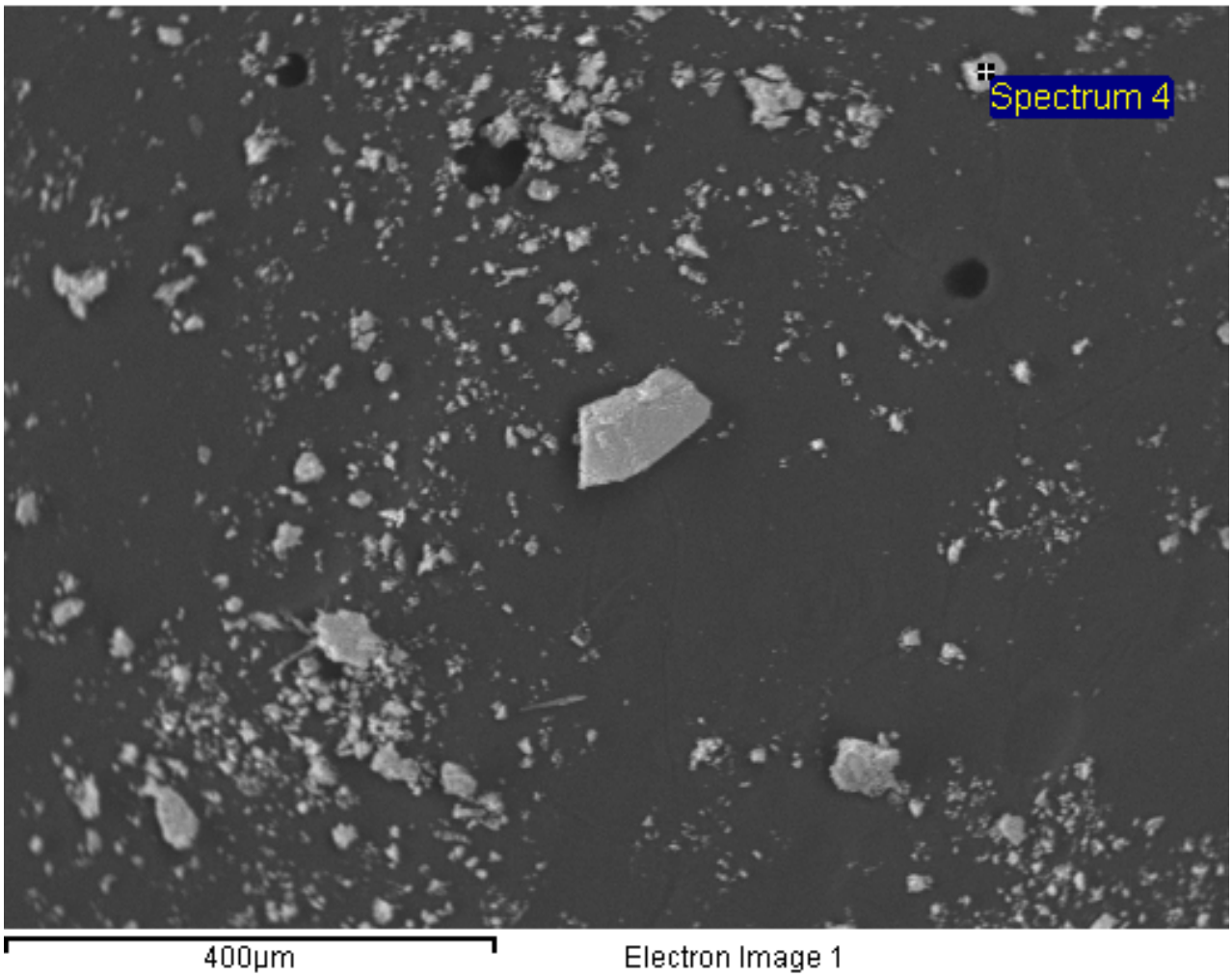


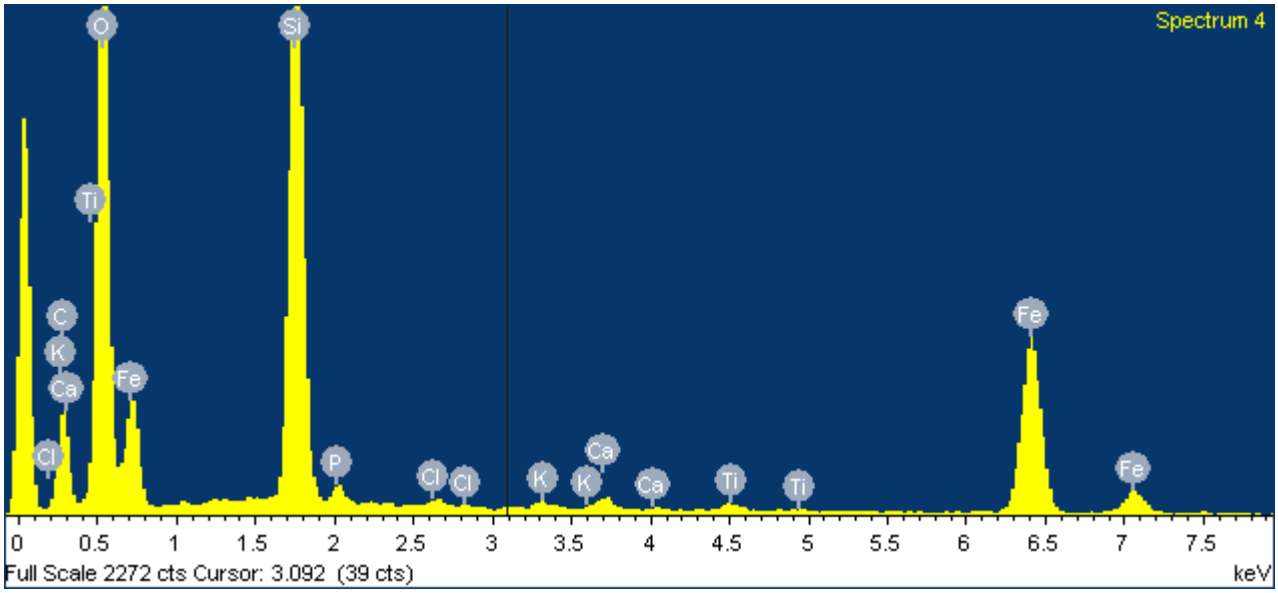
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1



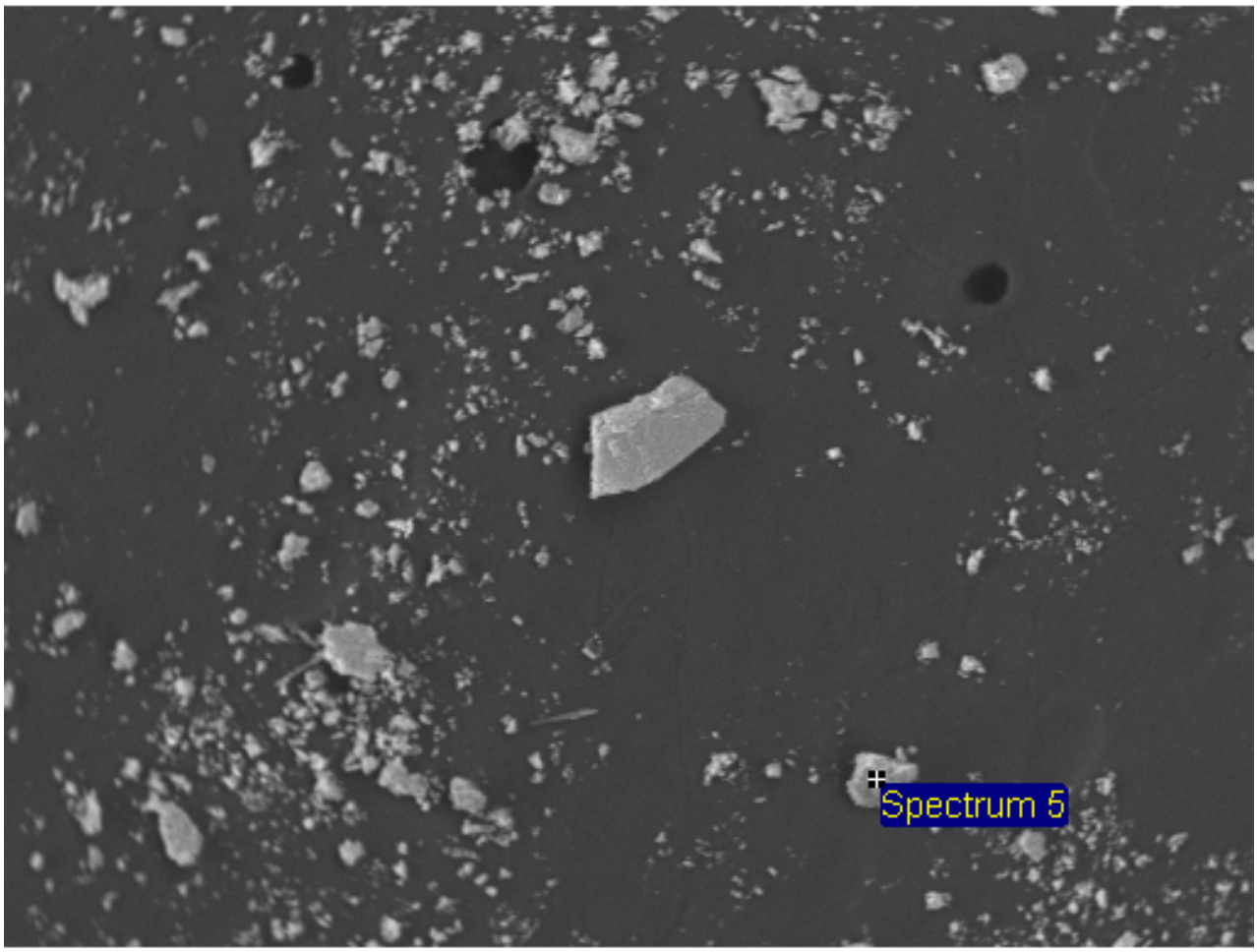


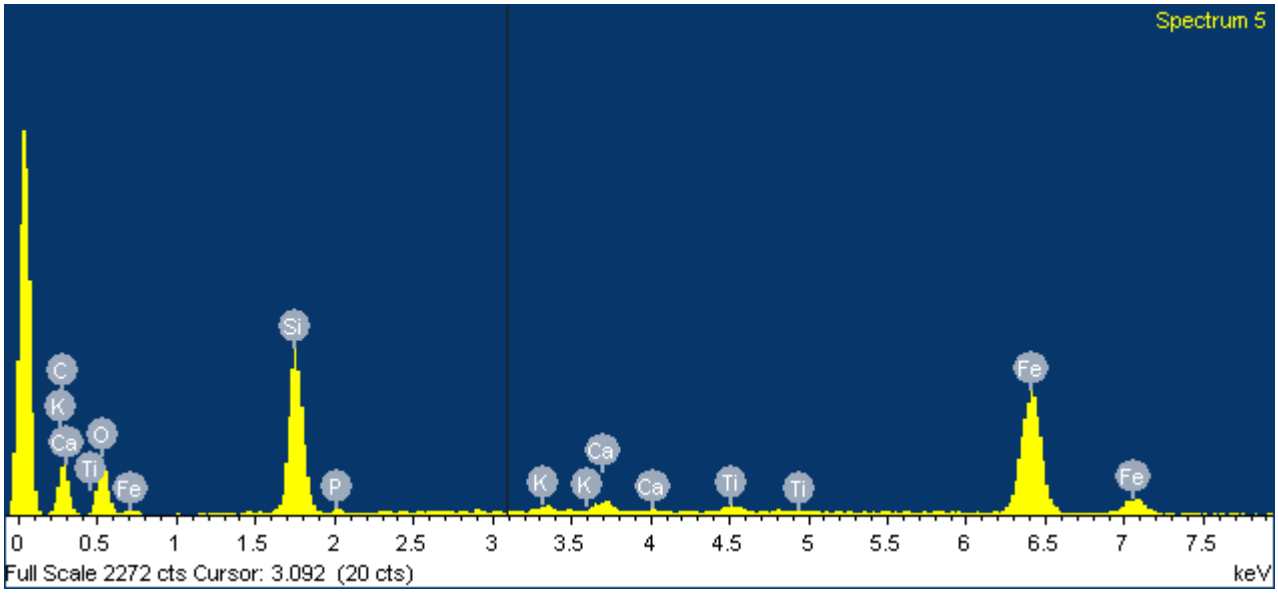
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1





Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1

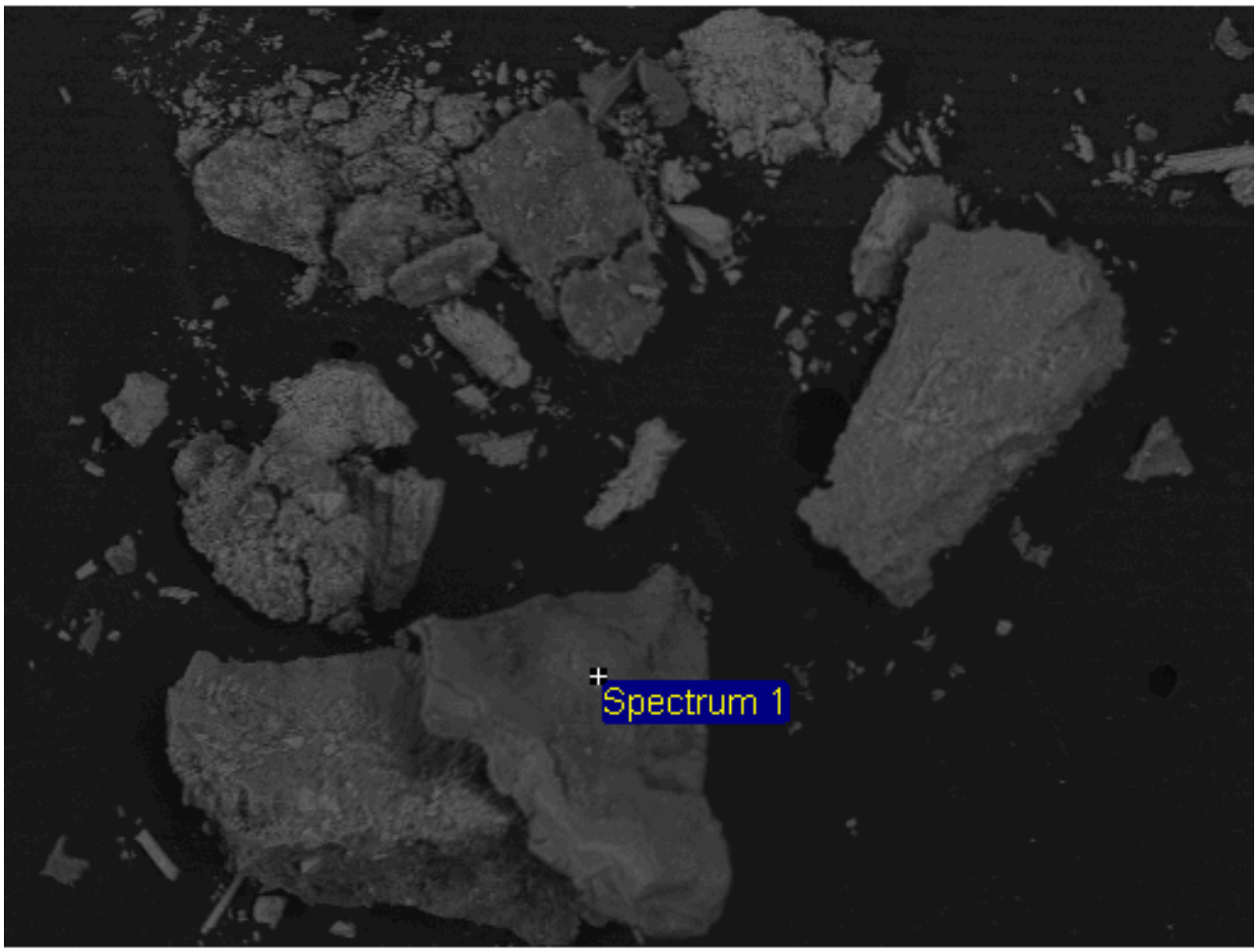


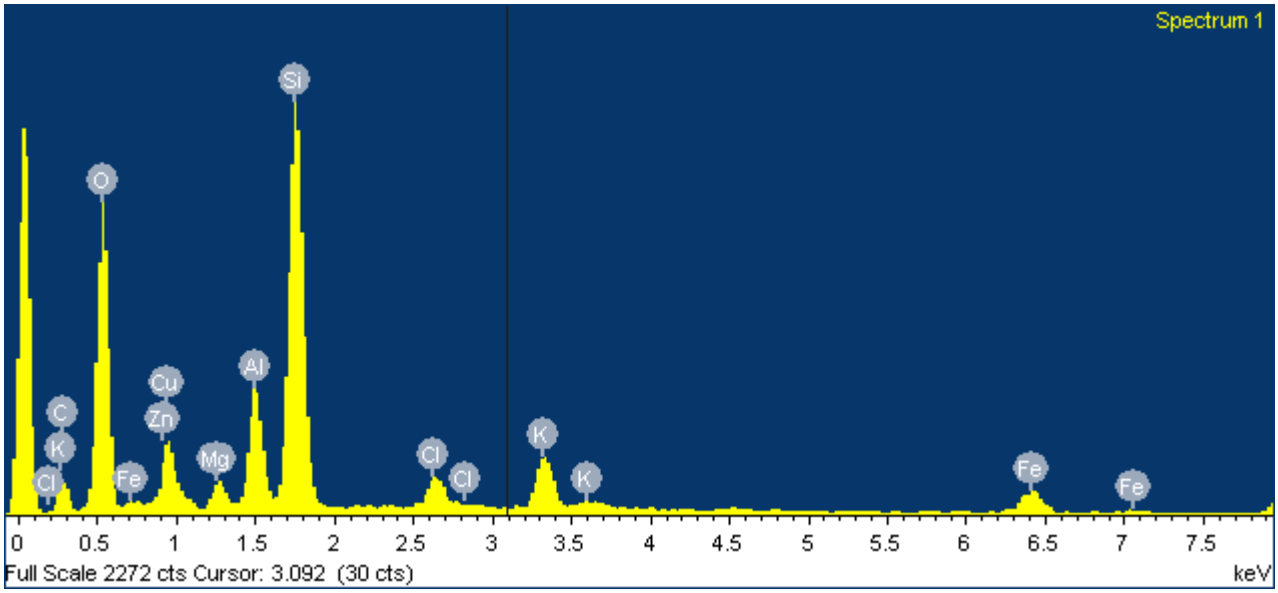


Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1

IST Area Results

07/11/2013 12:52:02

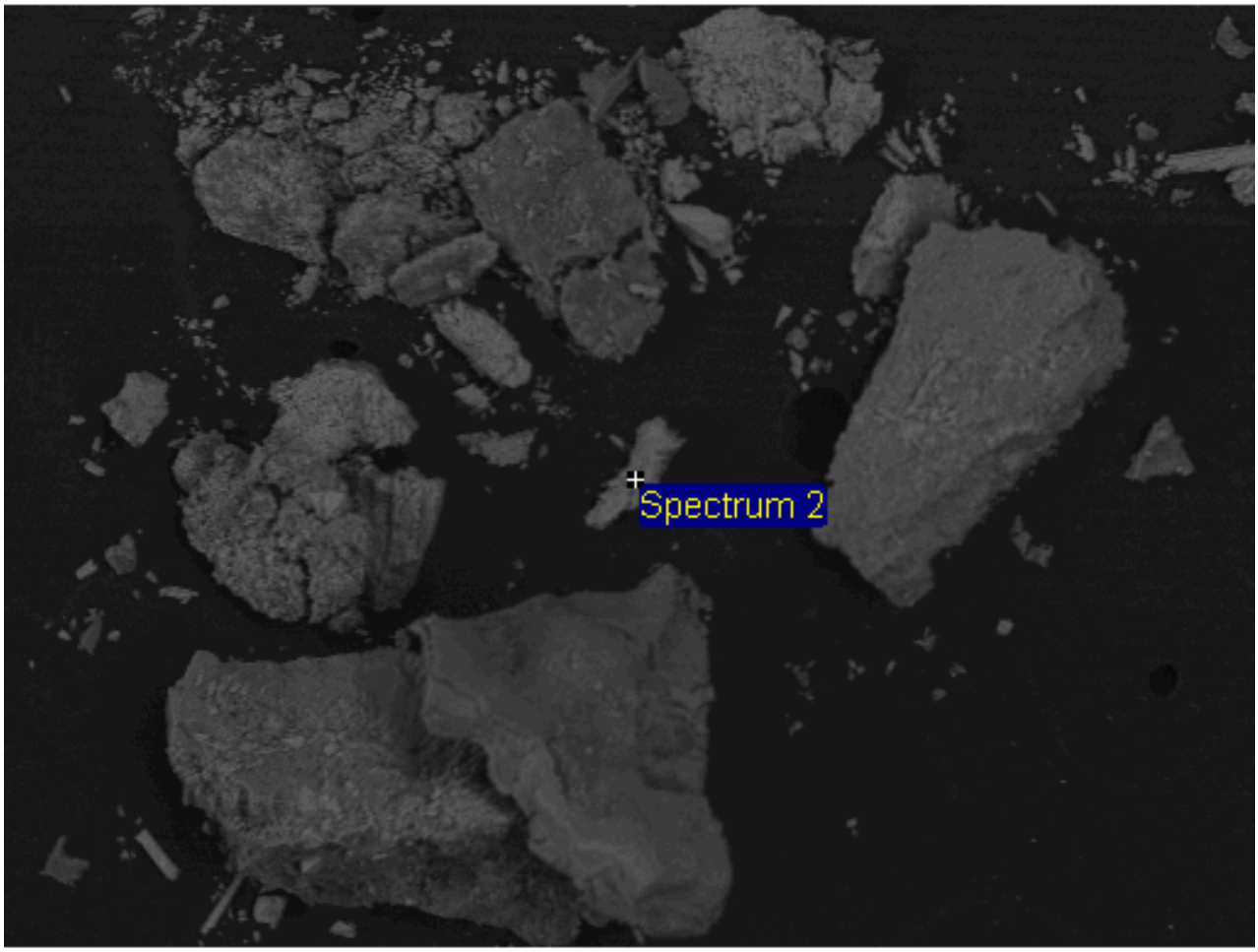


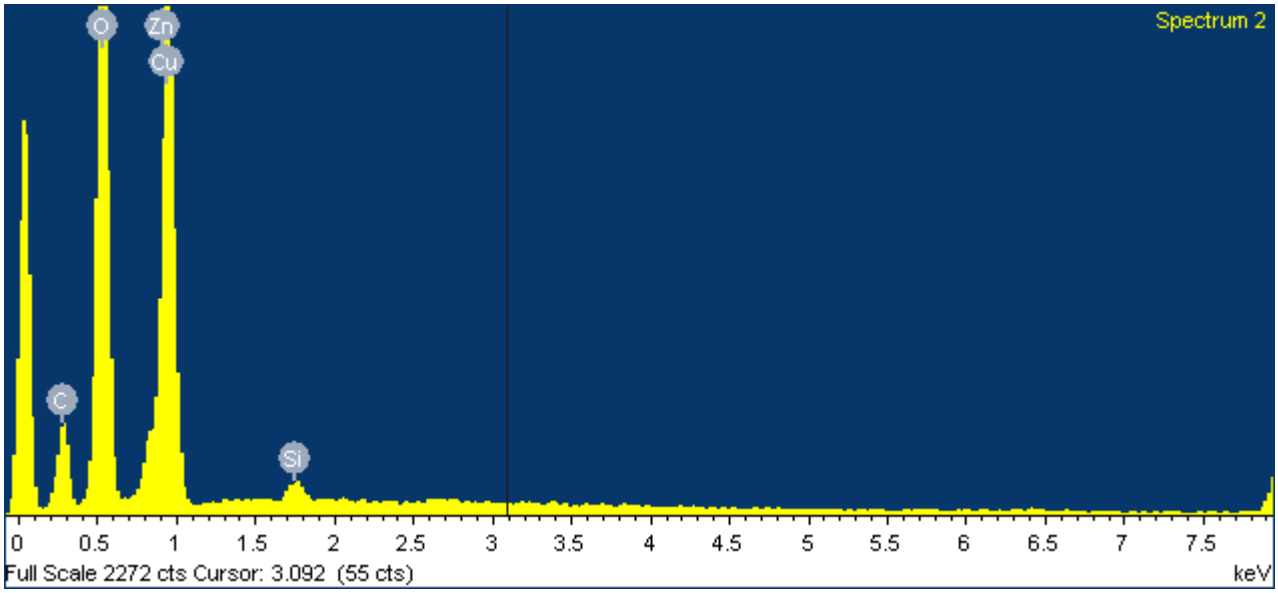


Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Copper particles

IST Area Results

07/11/2013 12:52:08

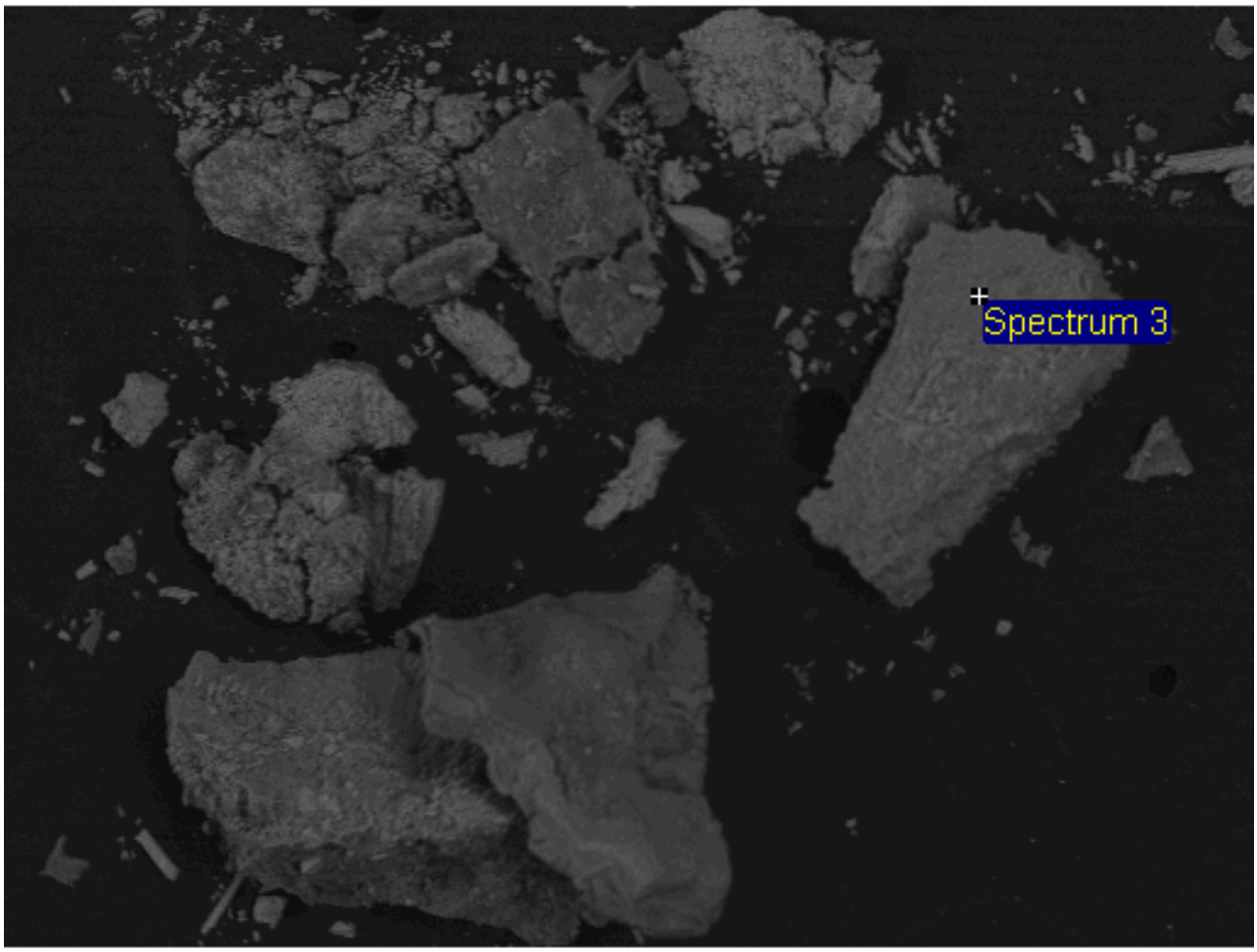


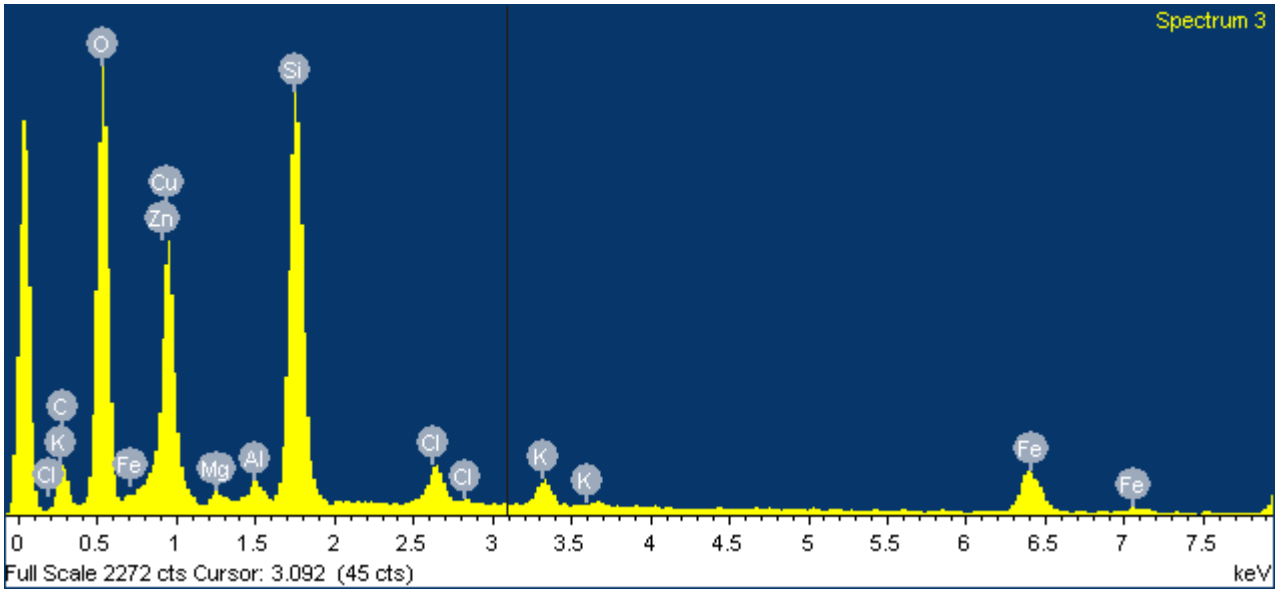


Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Copper particles

IST Area Results

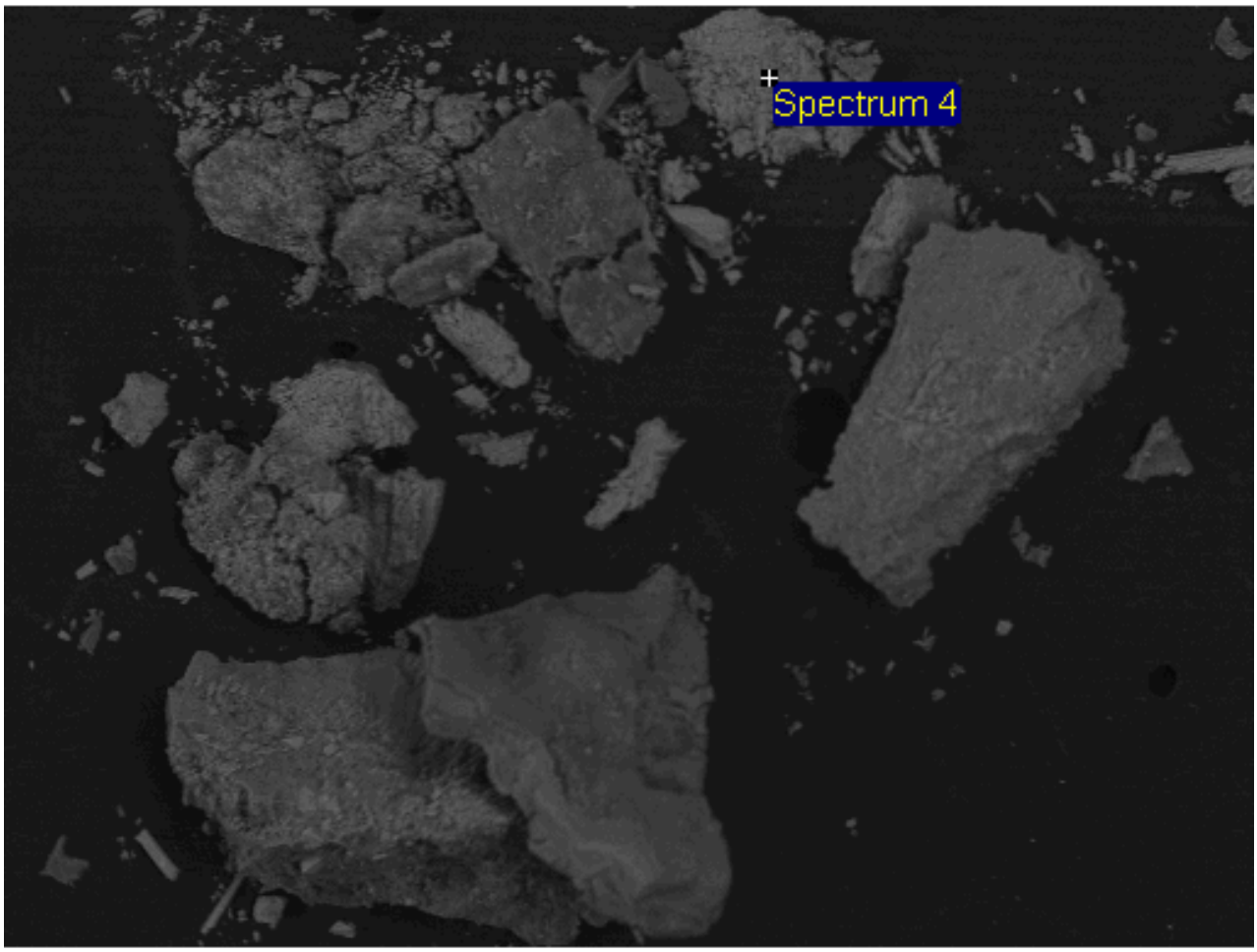
07/11/2013 12:52:14



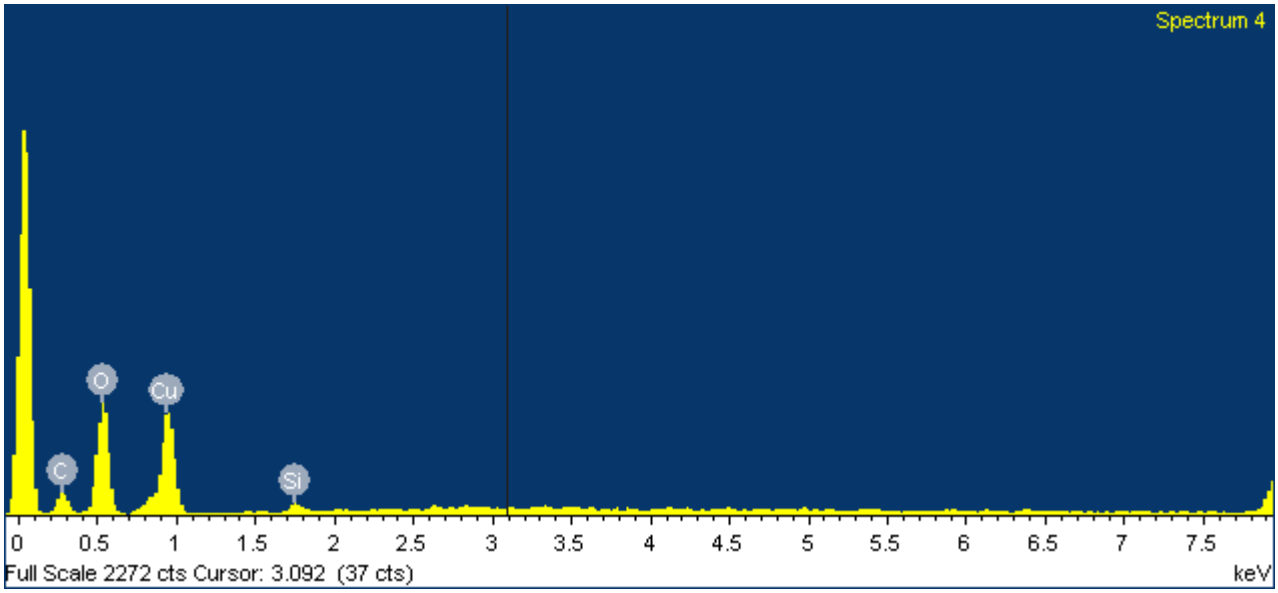


Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Copper particles

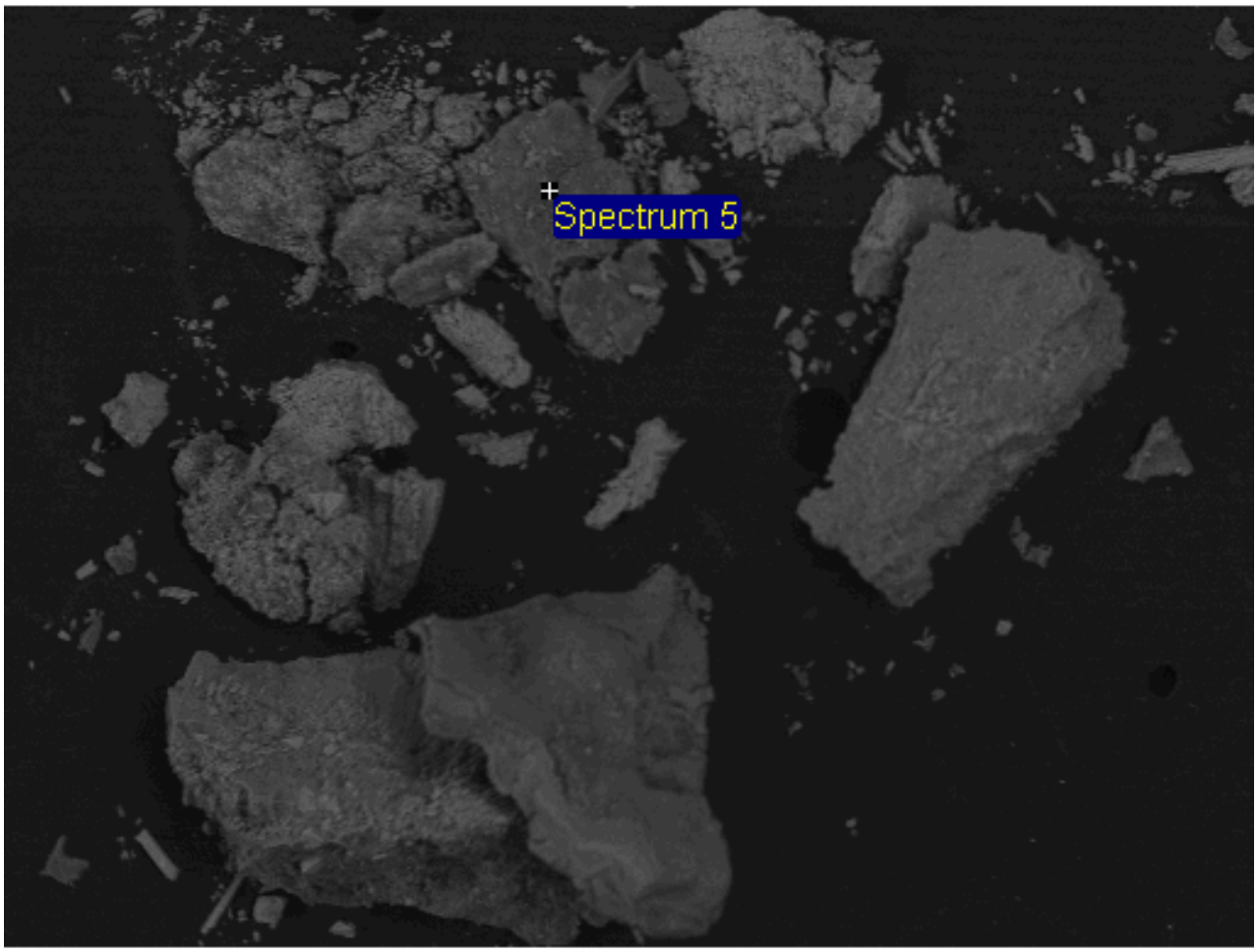
INCA

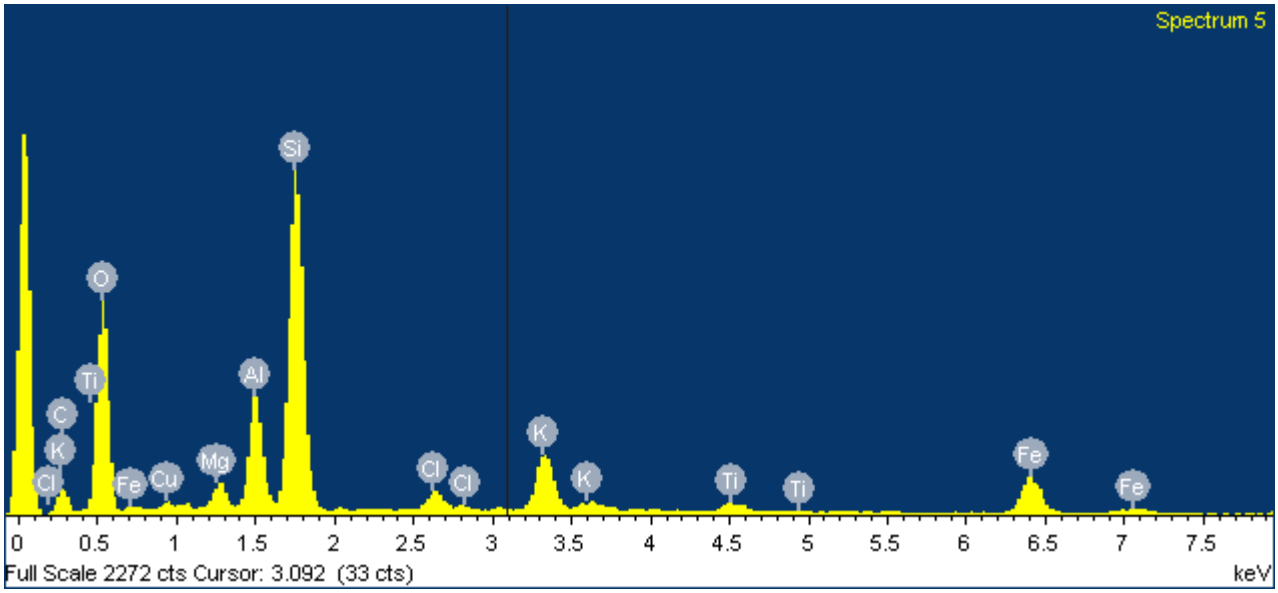


Electron Image 1



Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Copper particles

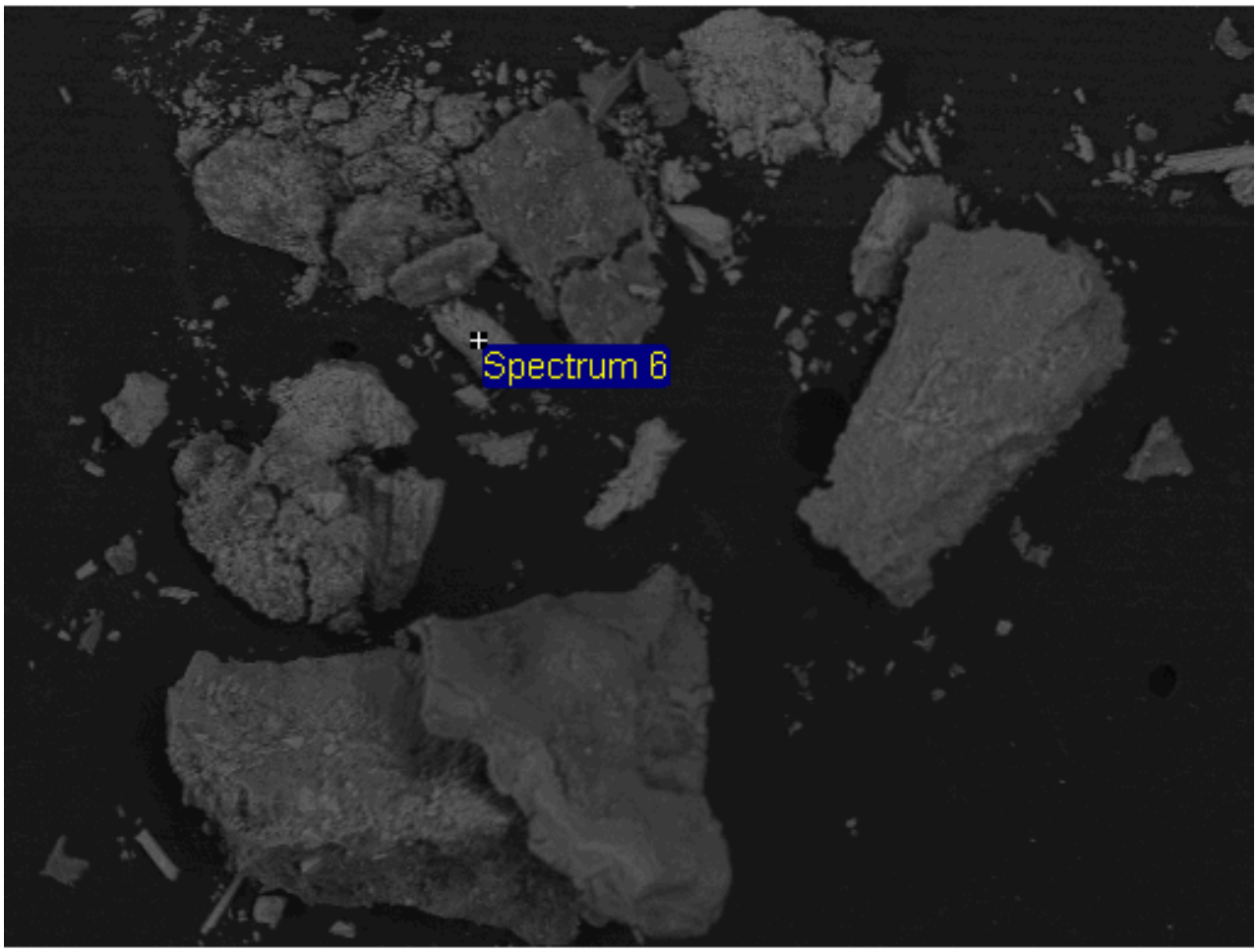


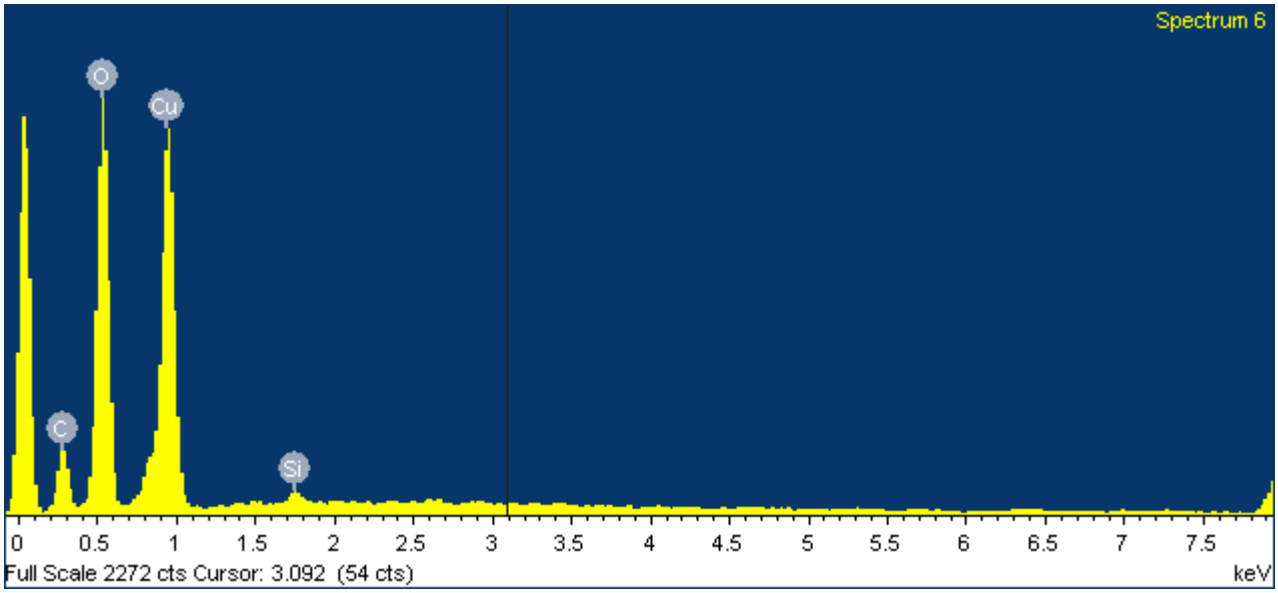


Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Copper particles

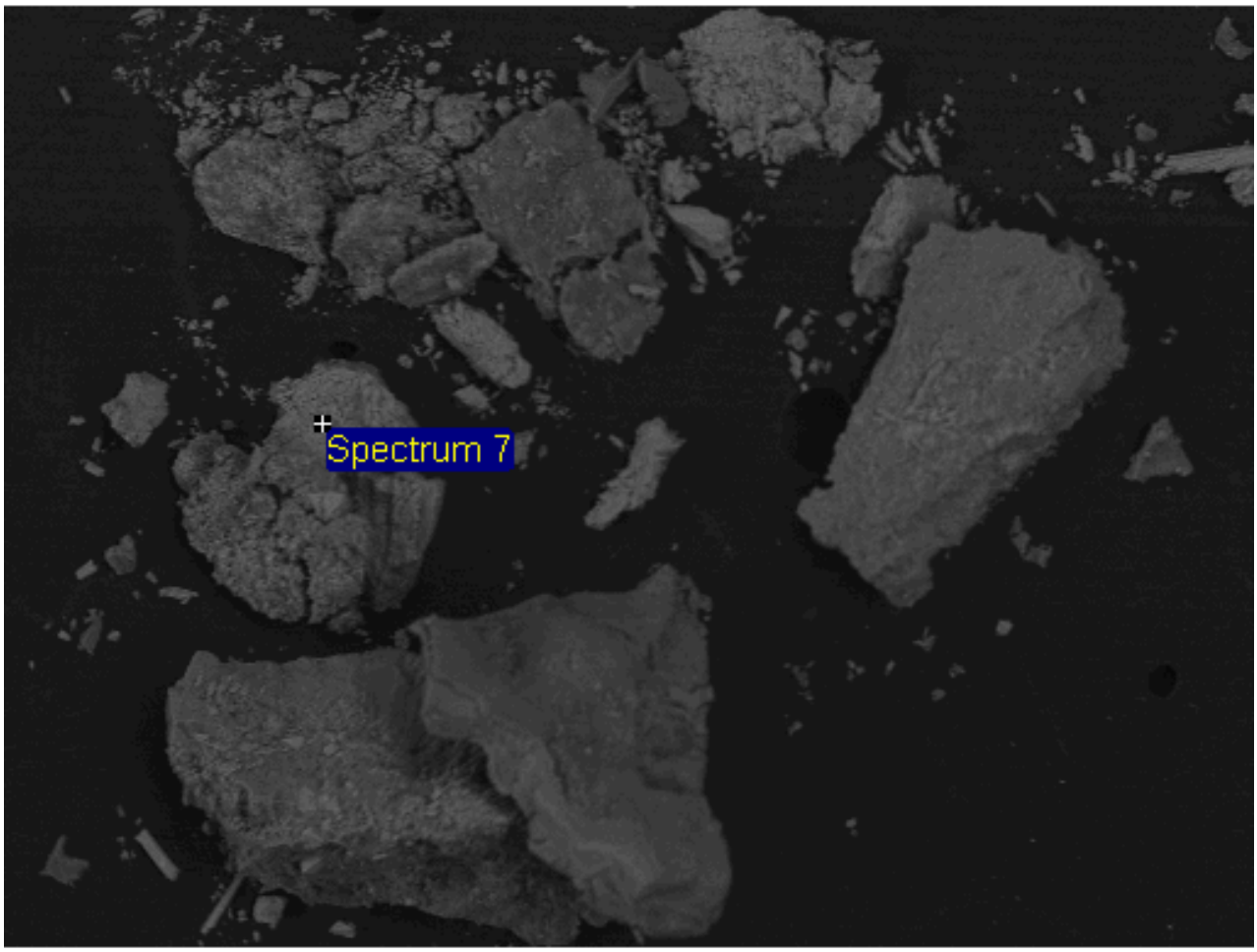
IST Area Results

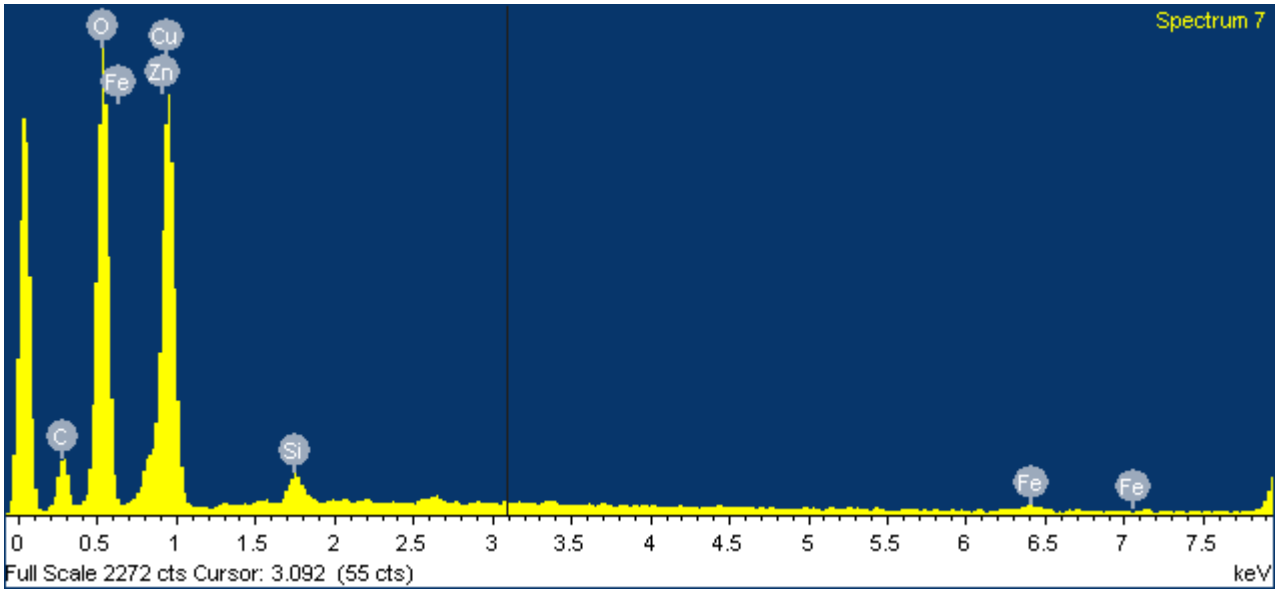
07/11/2013 12:52:29



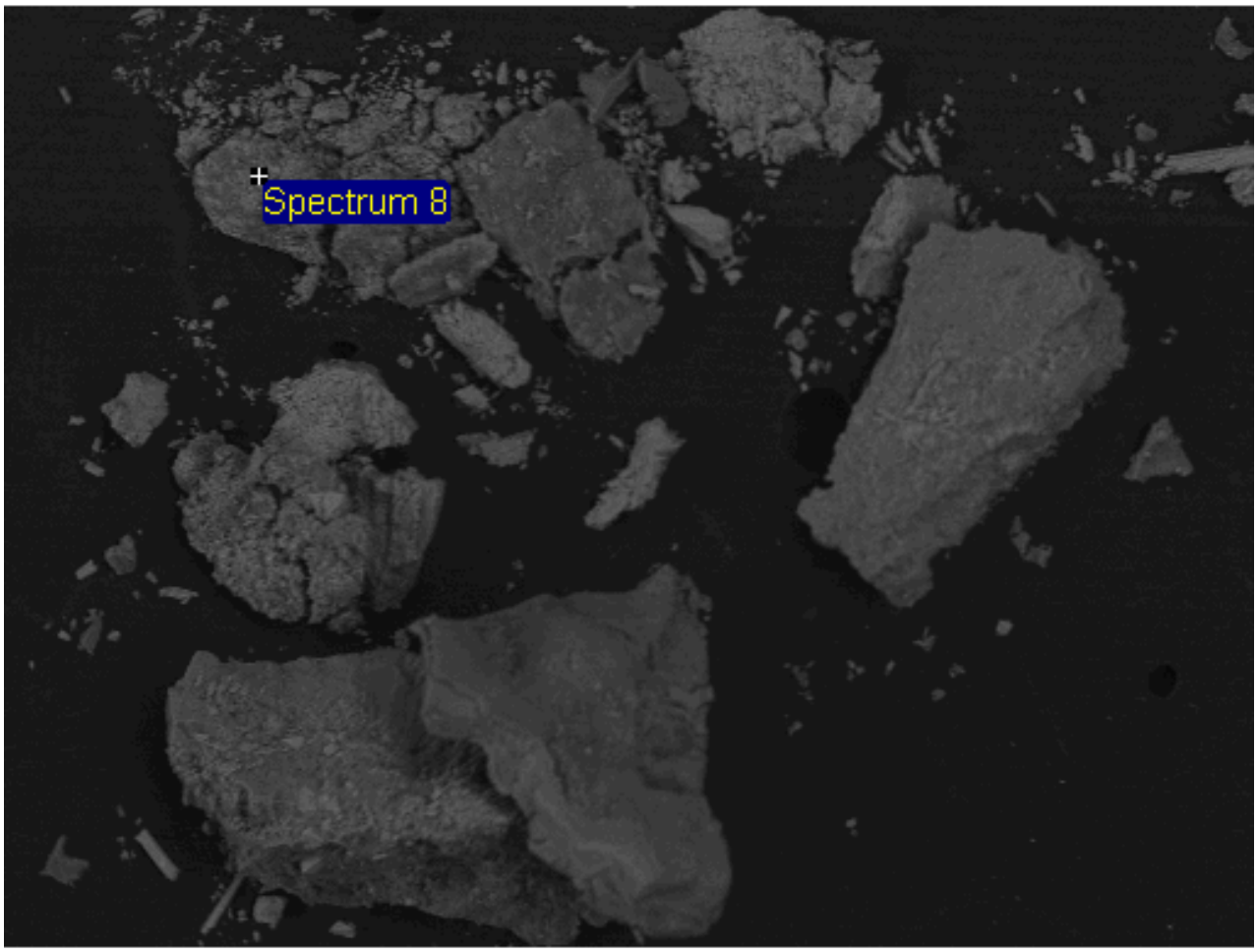


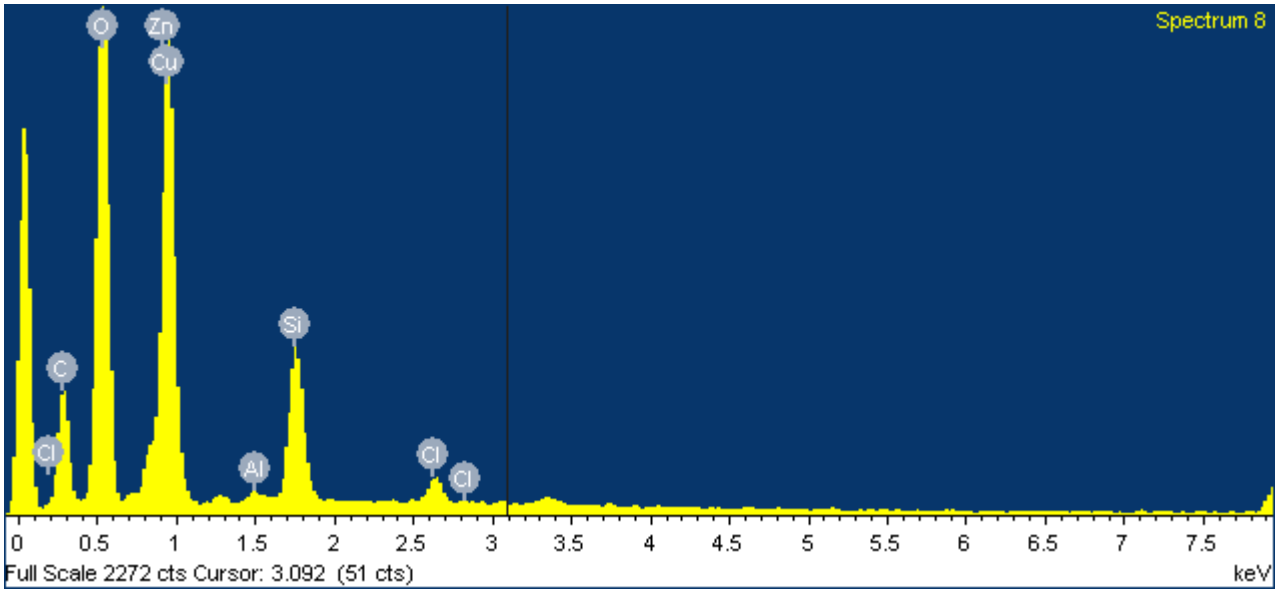
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Copper particles



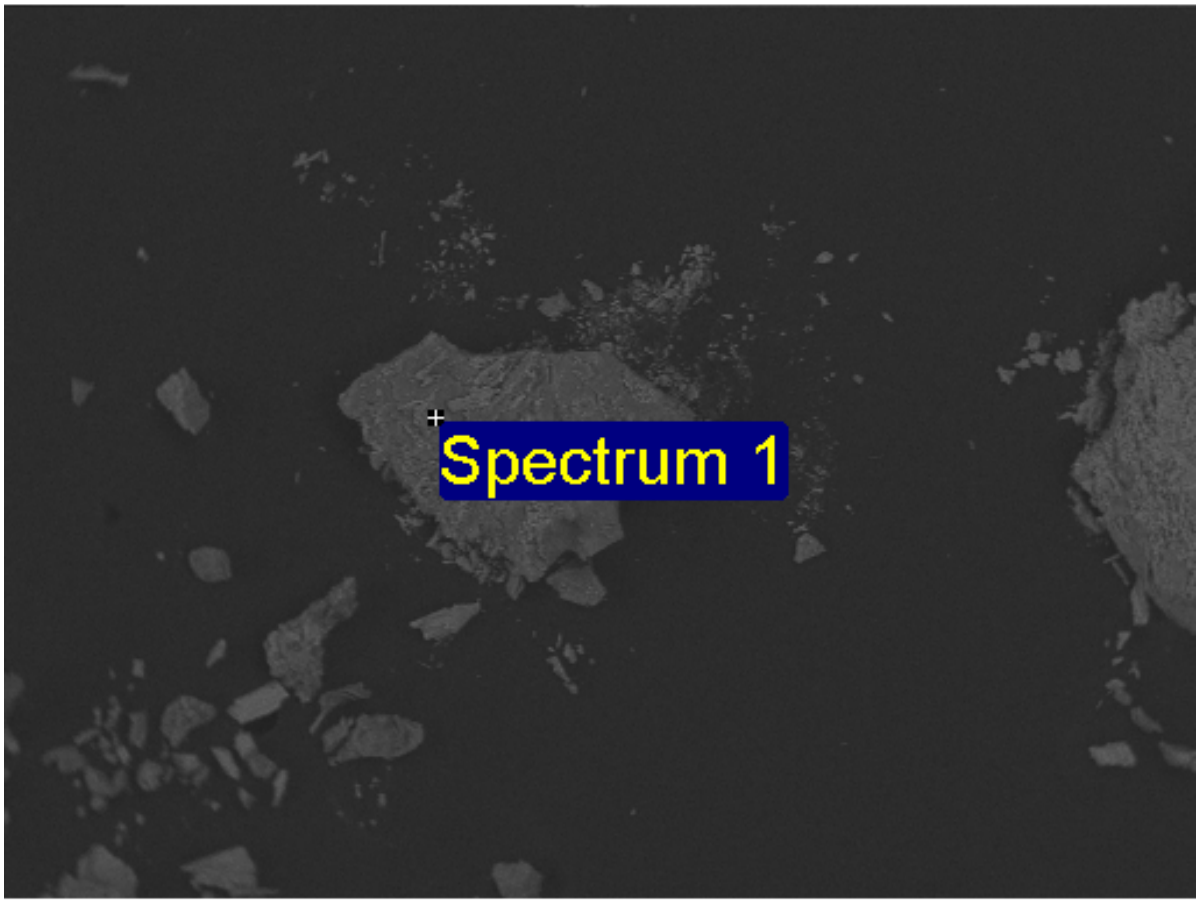


Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Copper particles





Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Copper particles



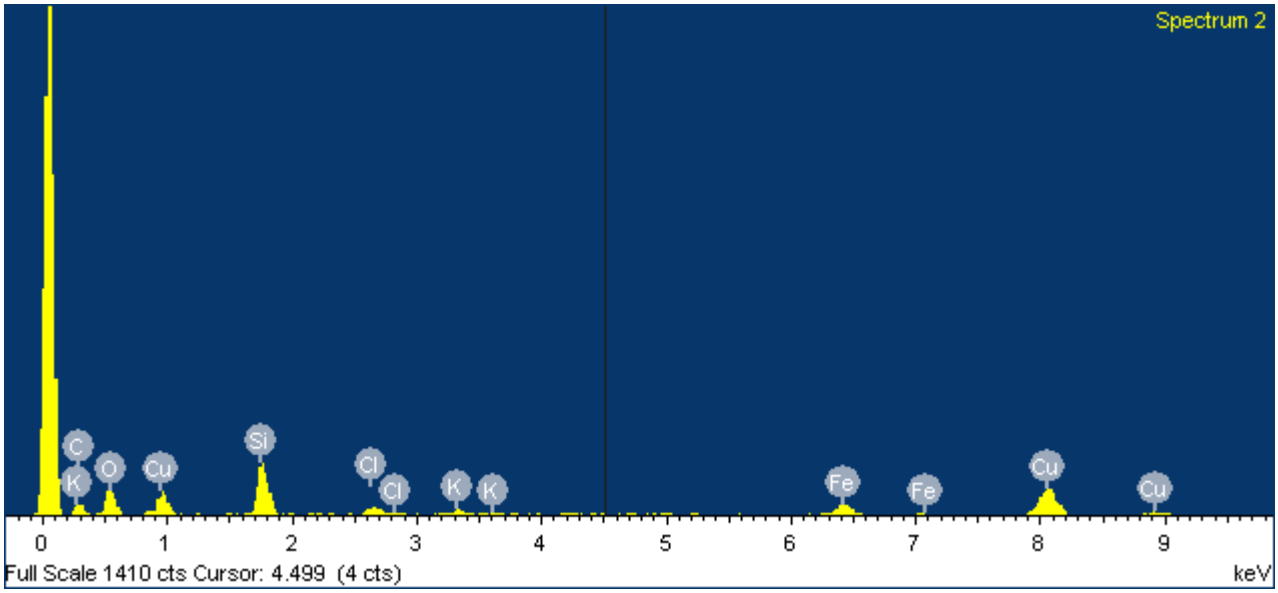
Electron Image 1

Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
copper particles

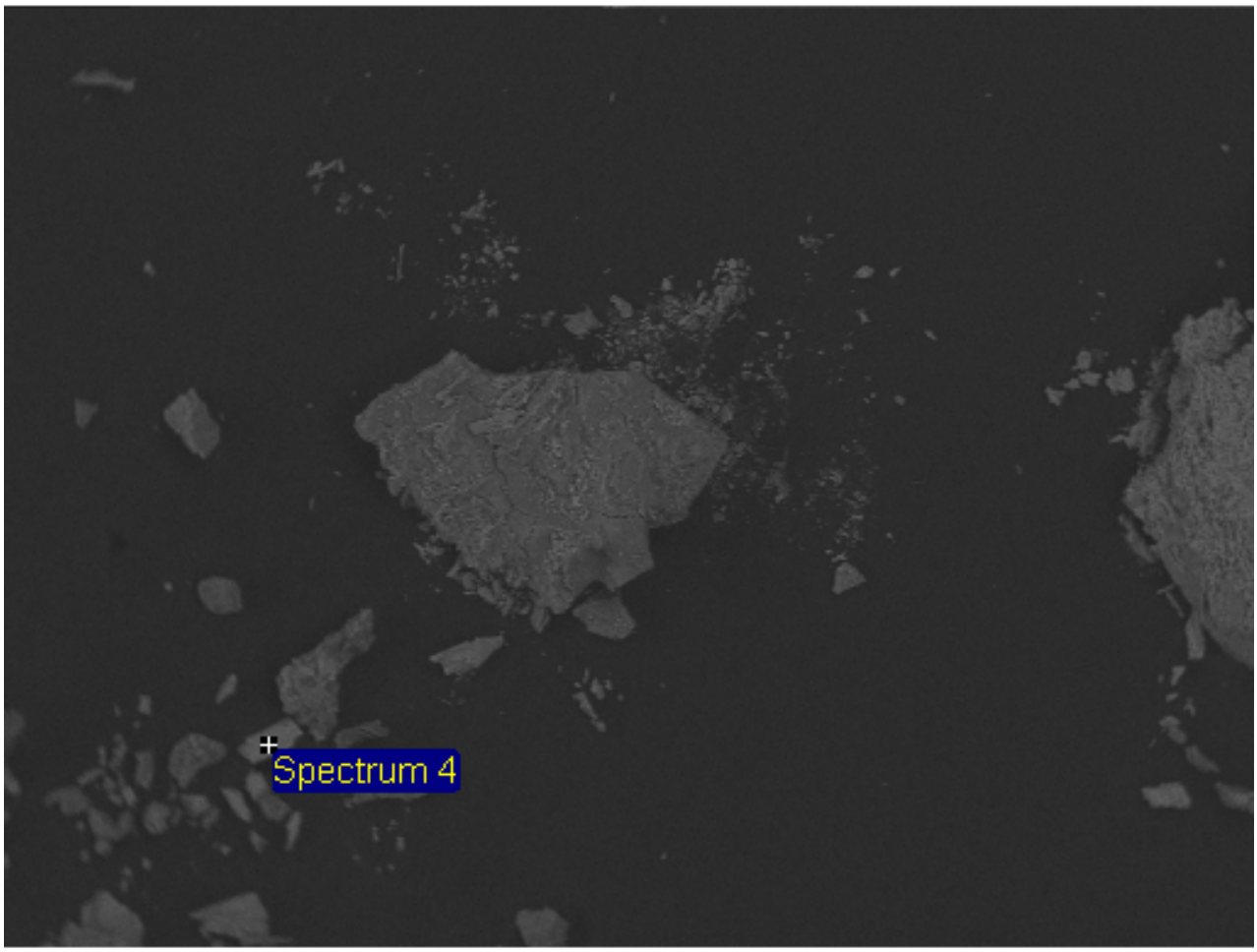
IST Area Results

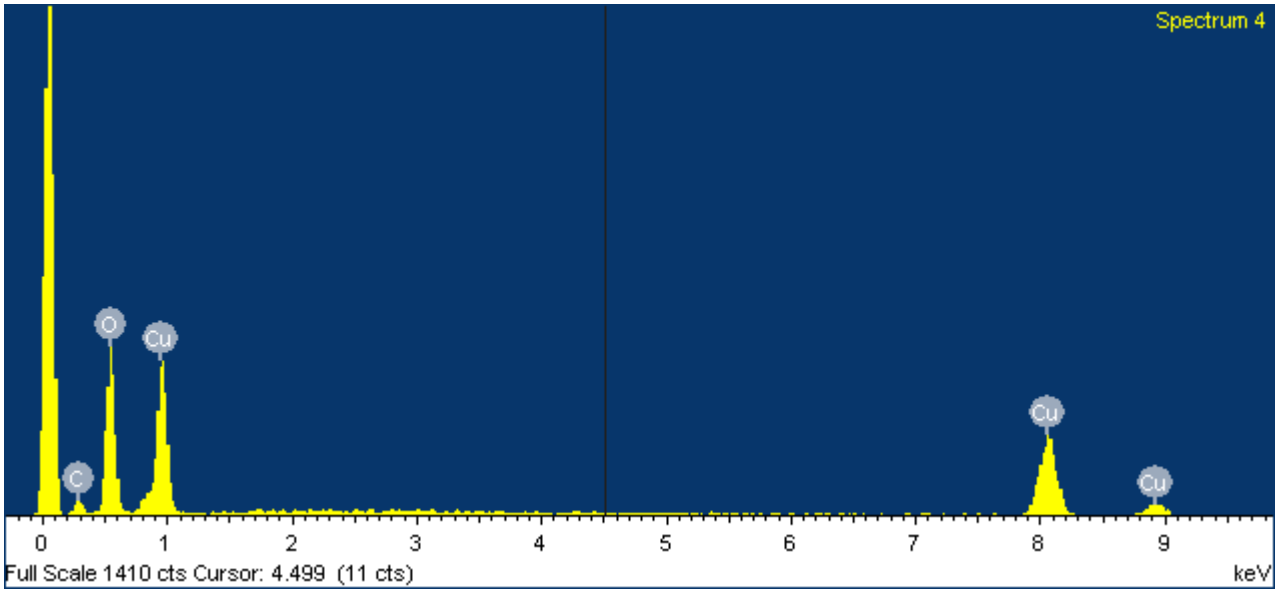
07/11/2013 12:54:33





Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
copper particles

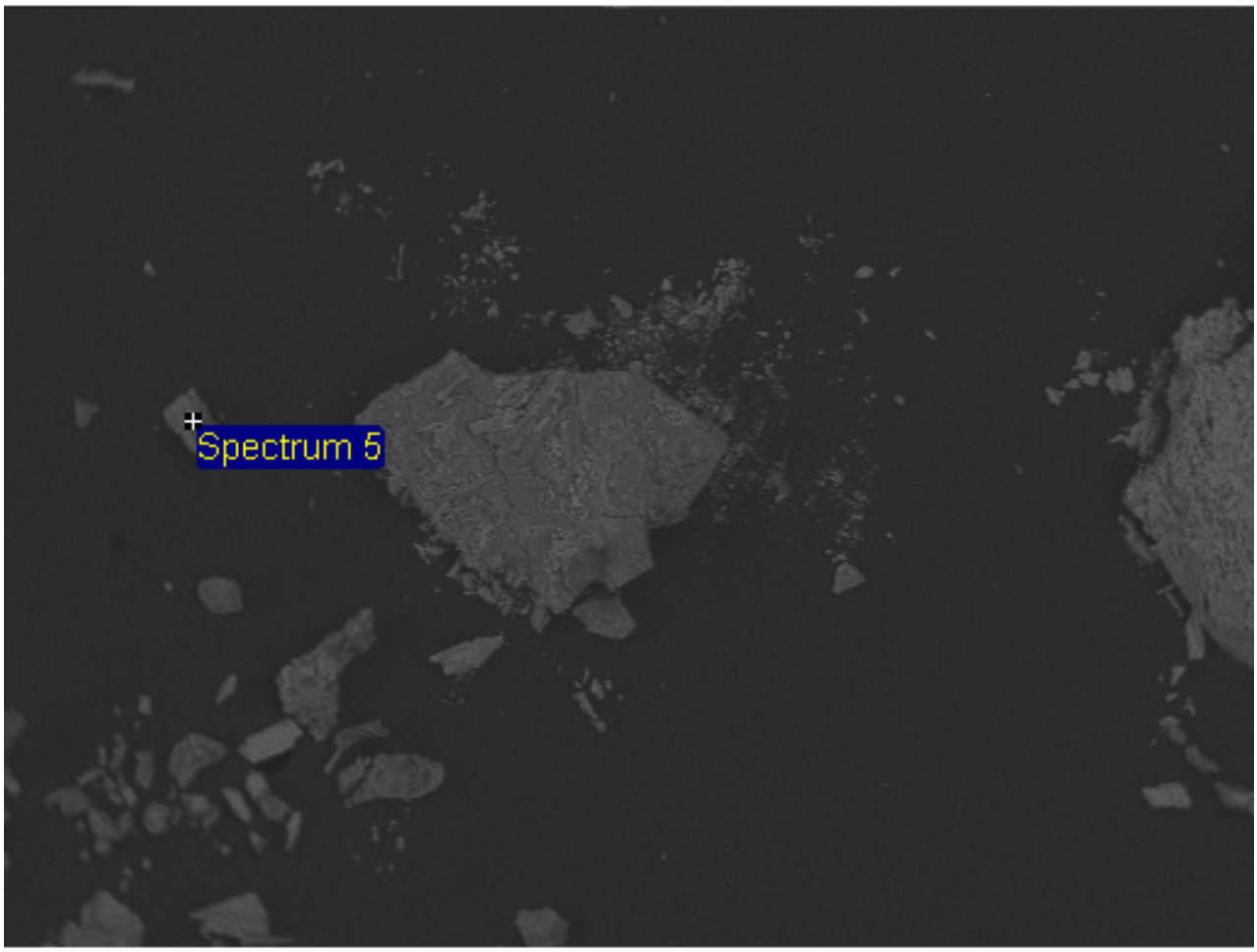


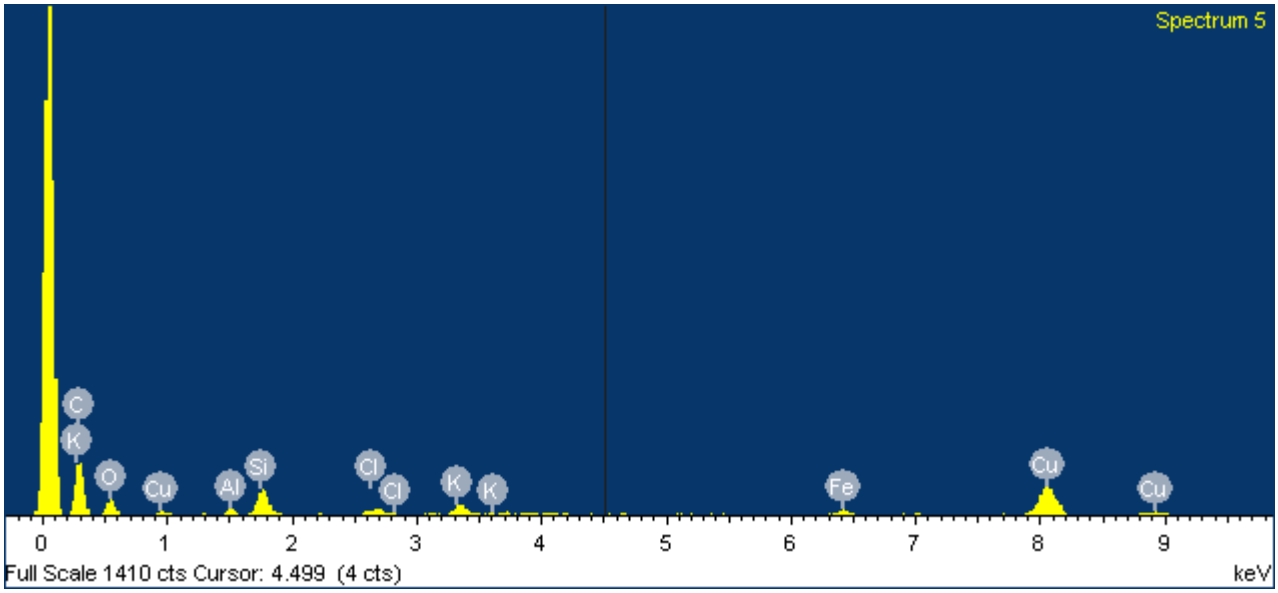


Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
copper particles

IST Area Results

07/11/2013 12:54:49

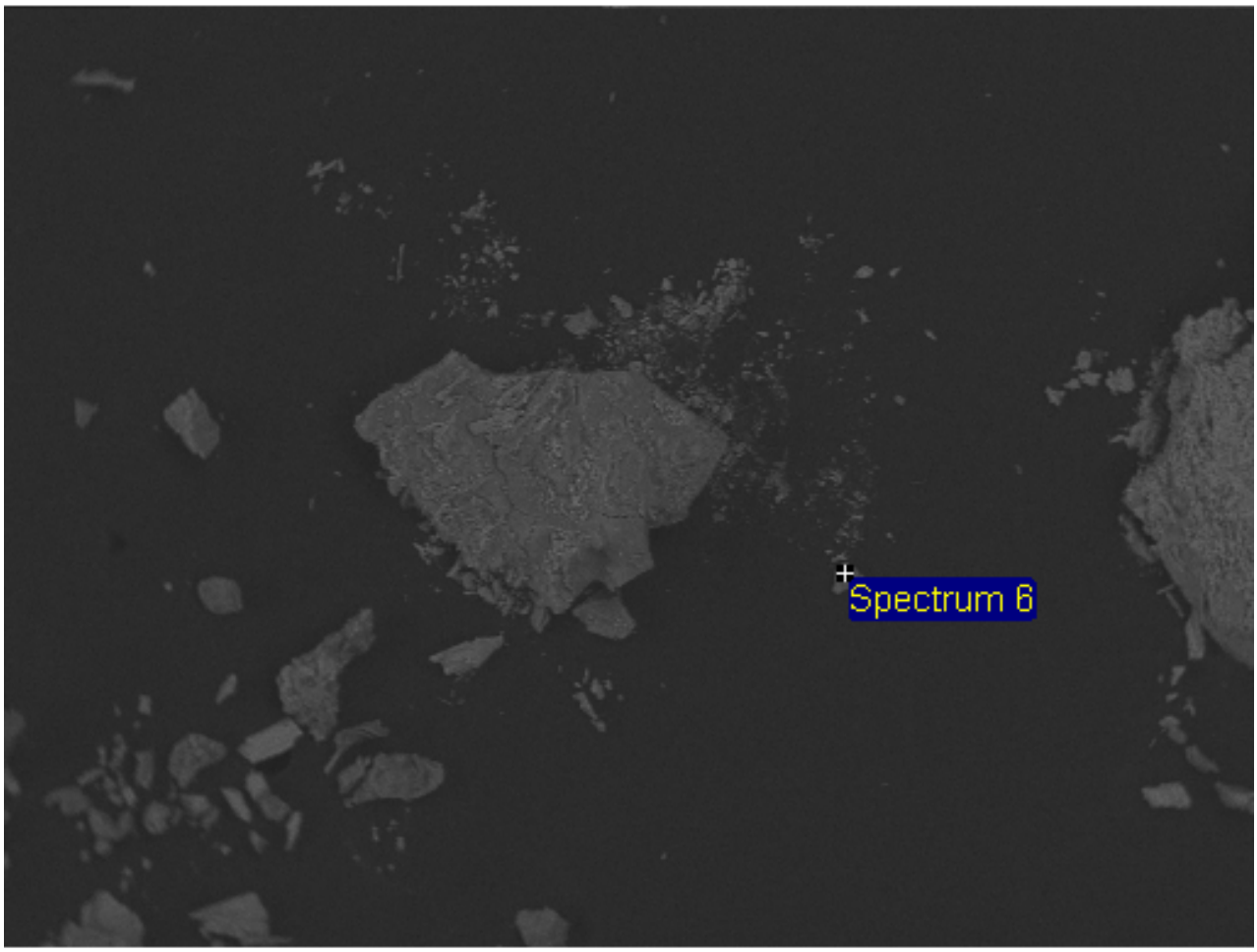


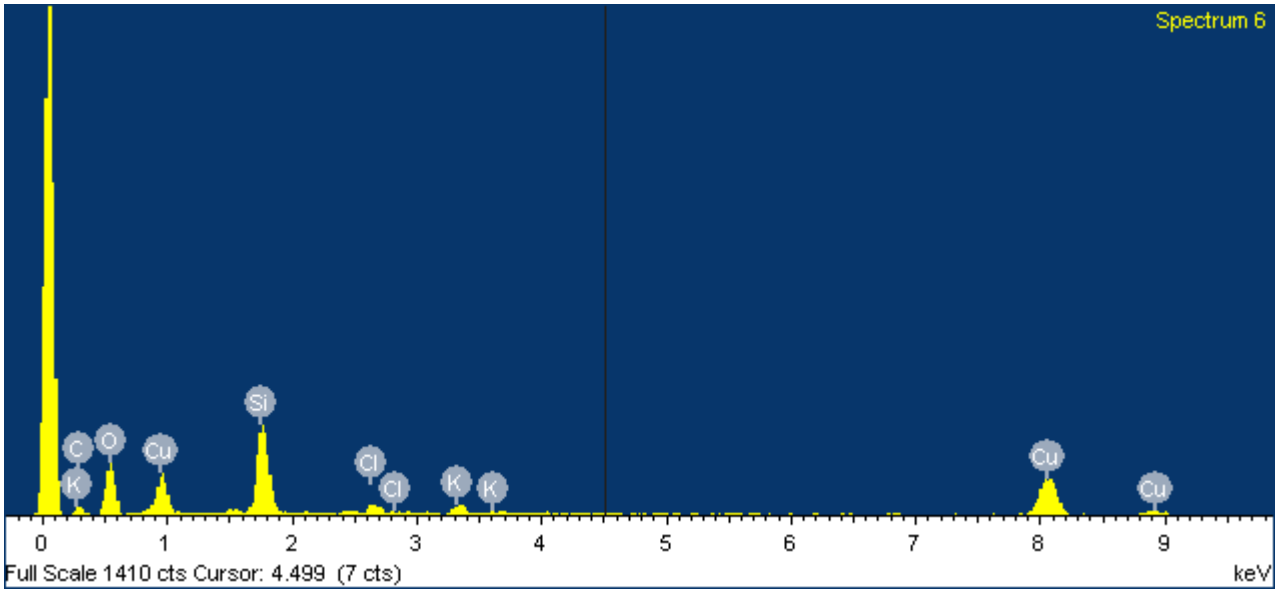


Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
copper particles

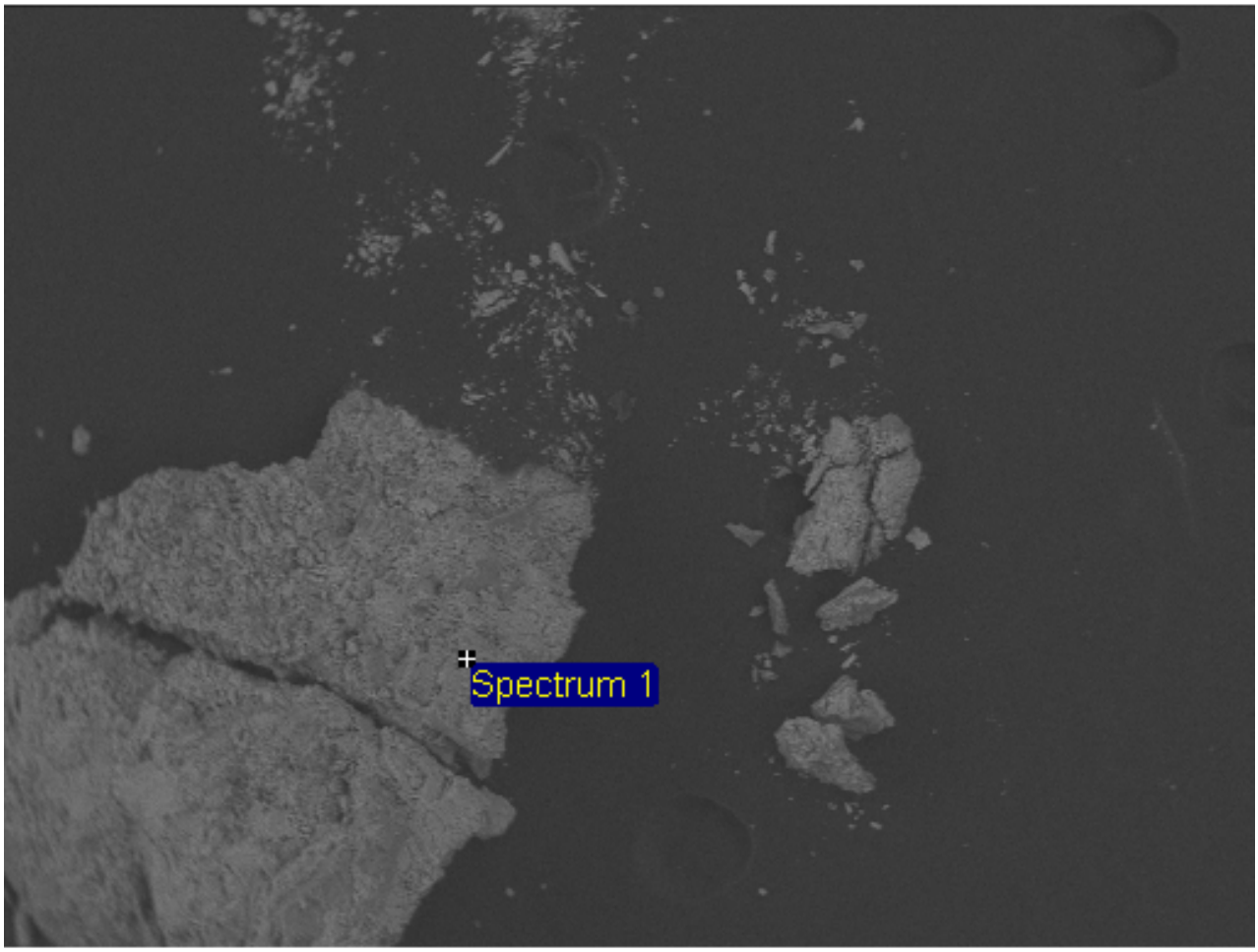
IST Area Results

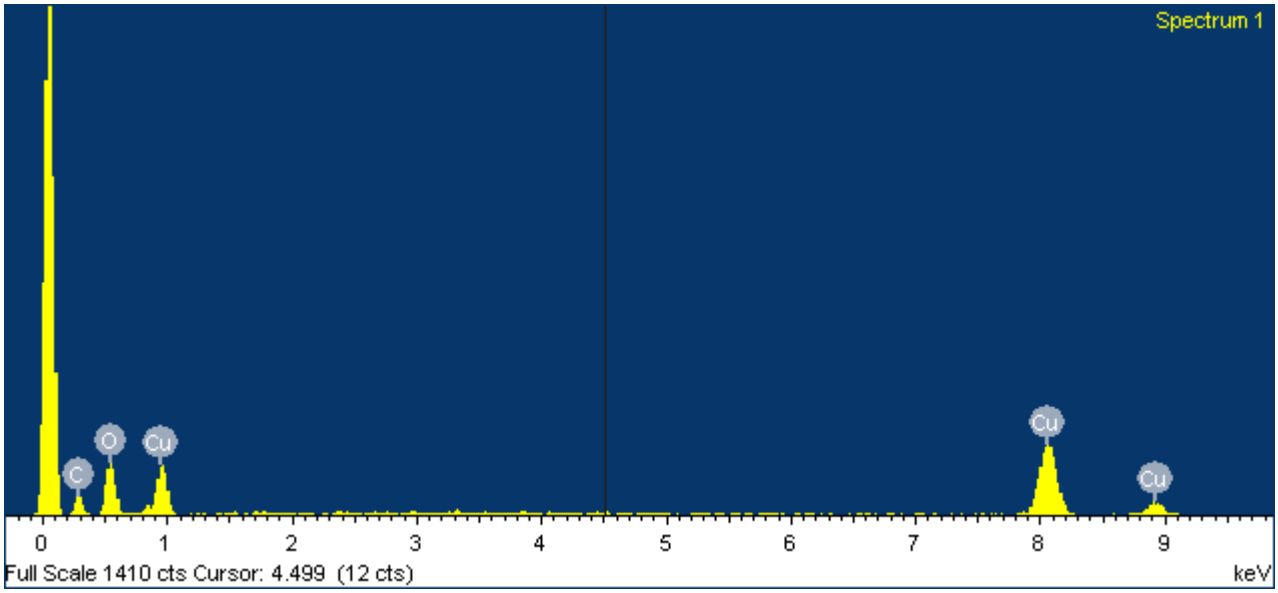
07/11/2013 12:54:58



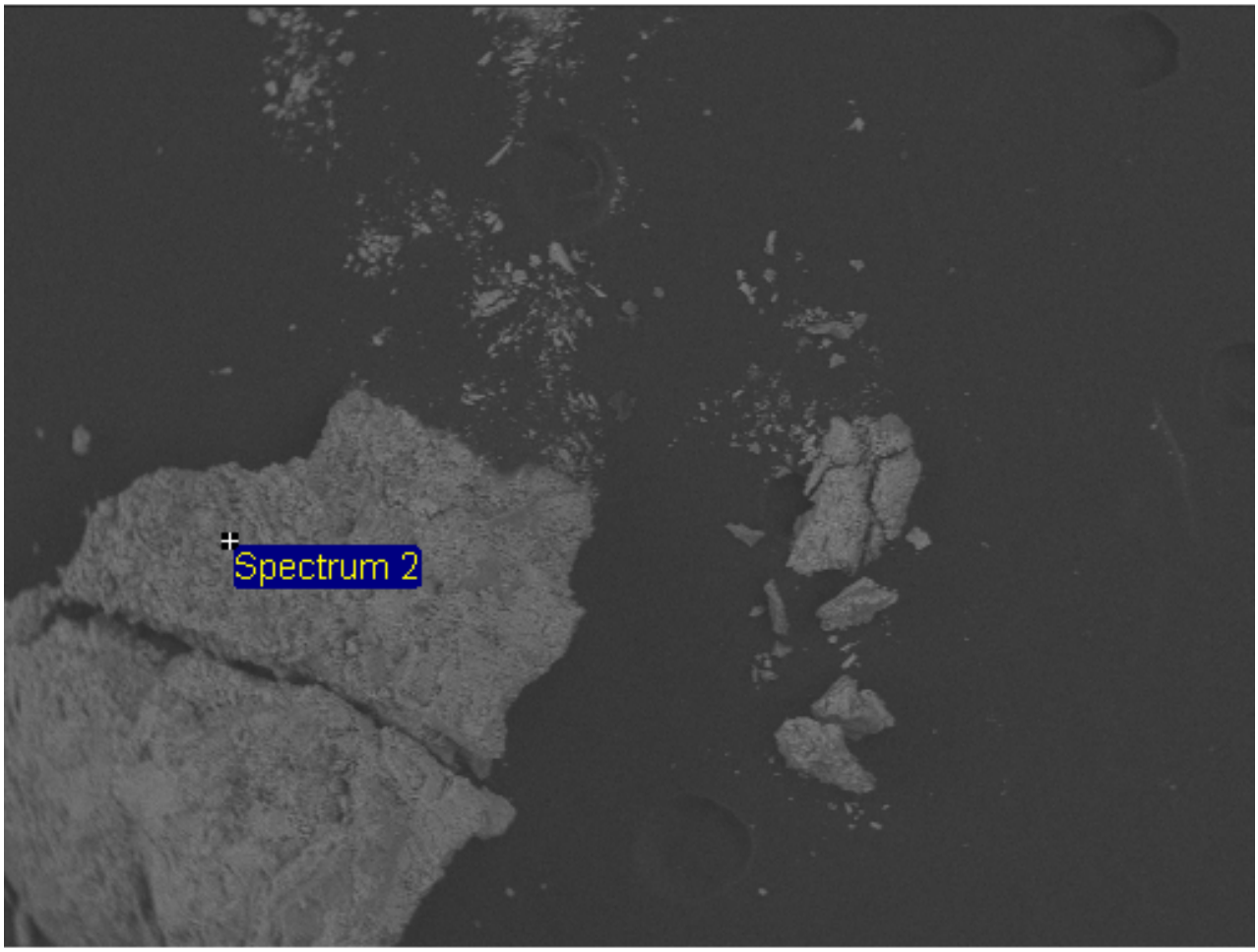


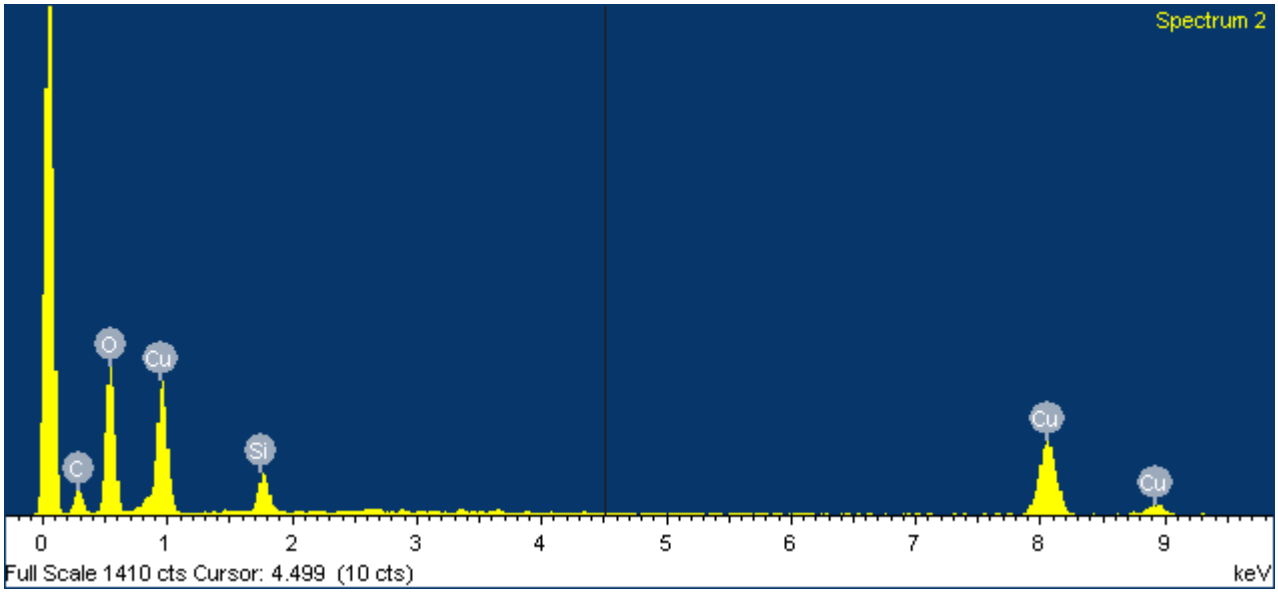
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
copper particles



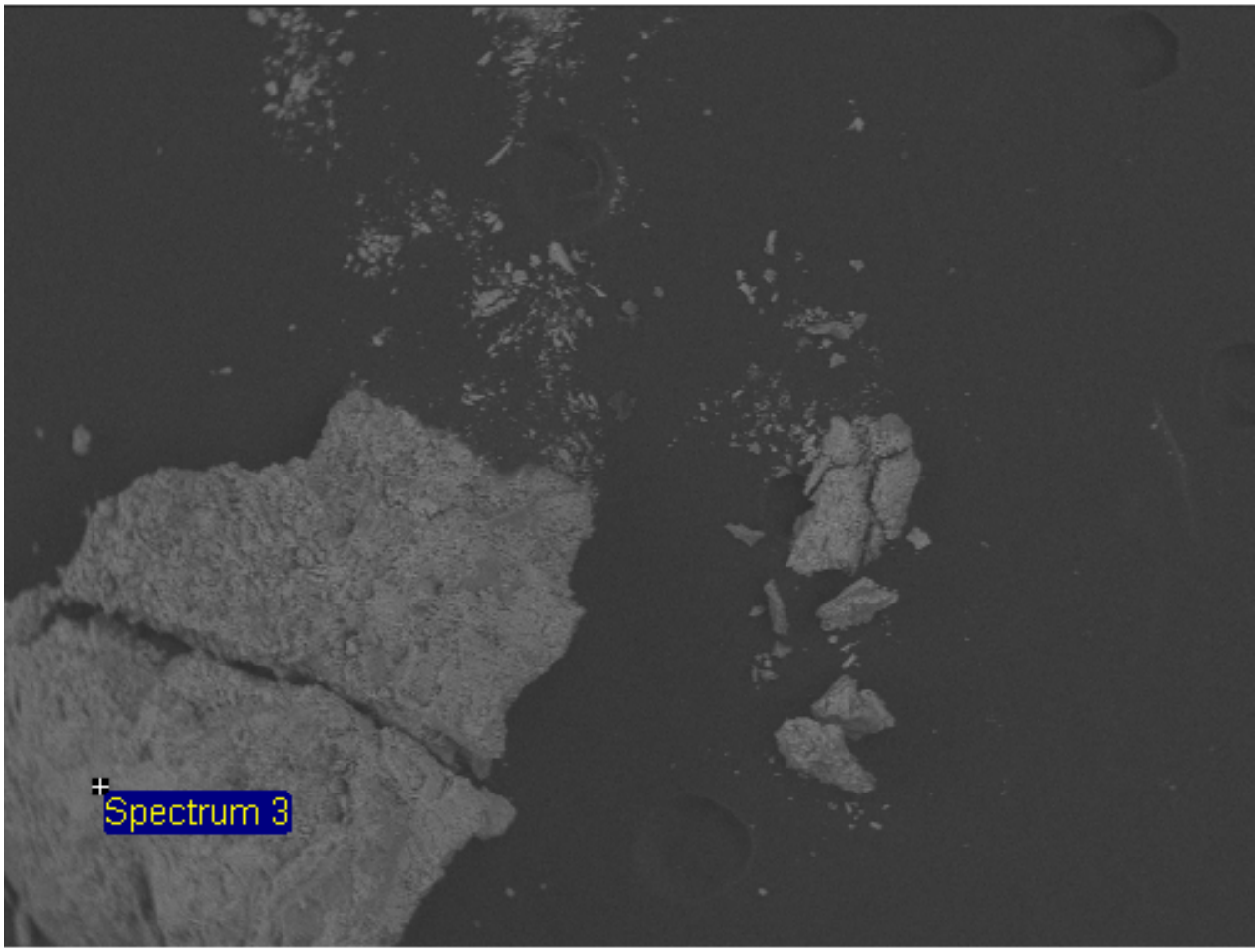


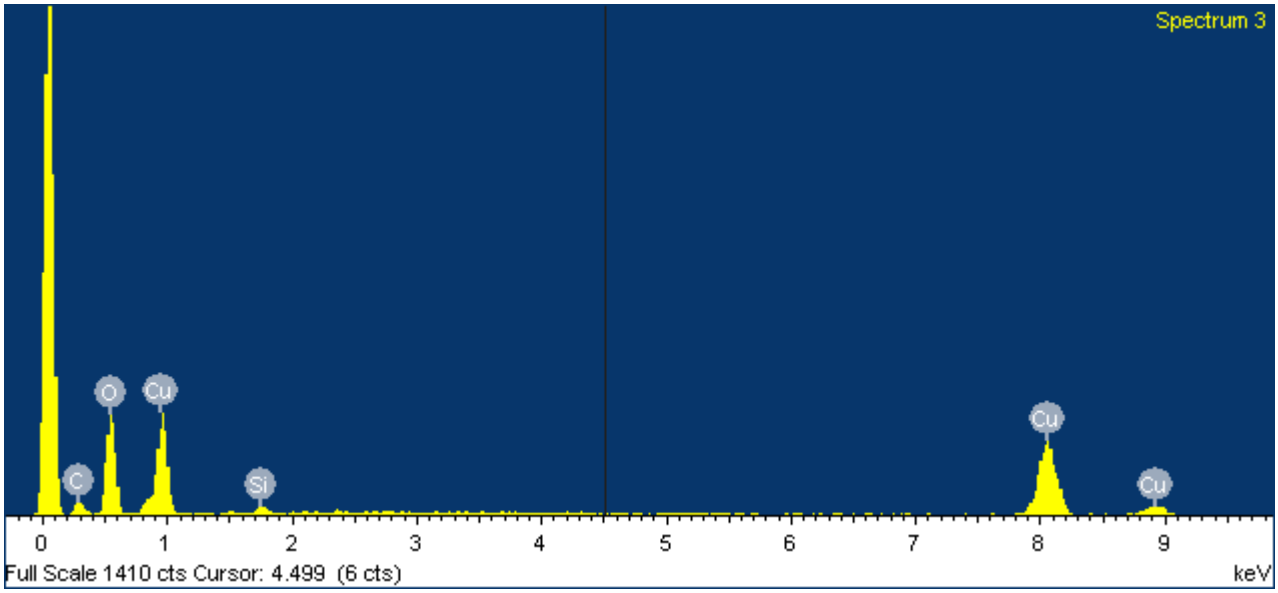
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Copper particles



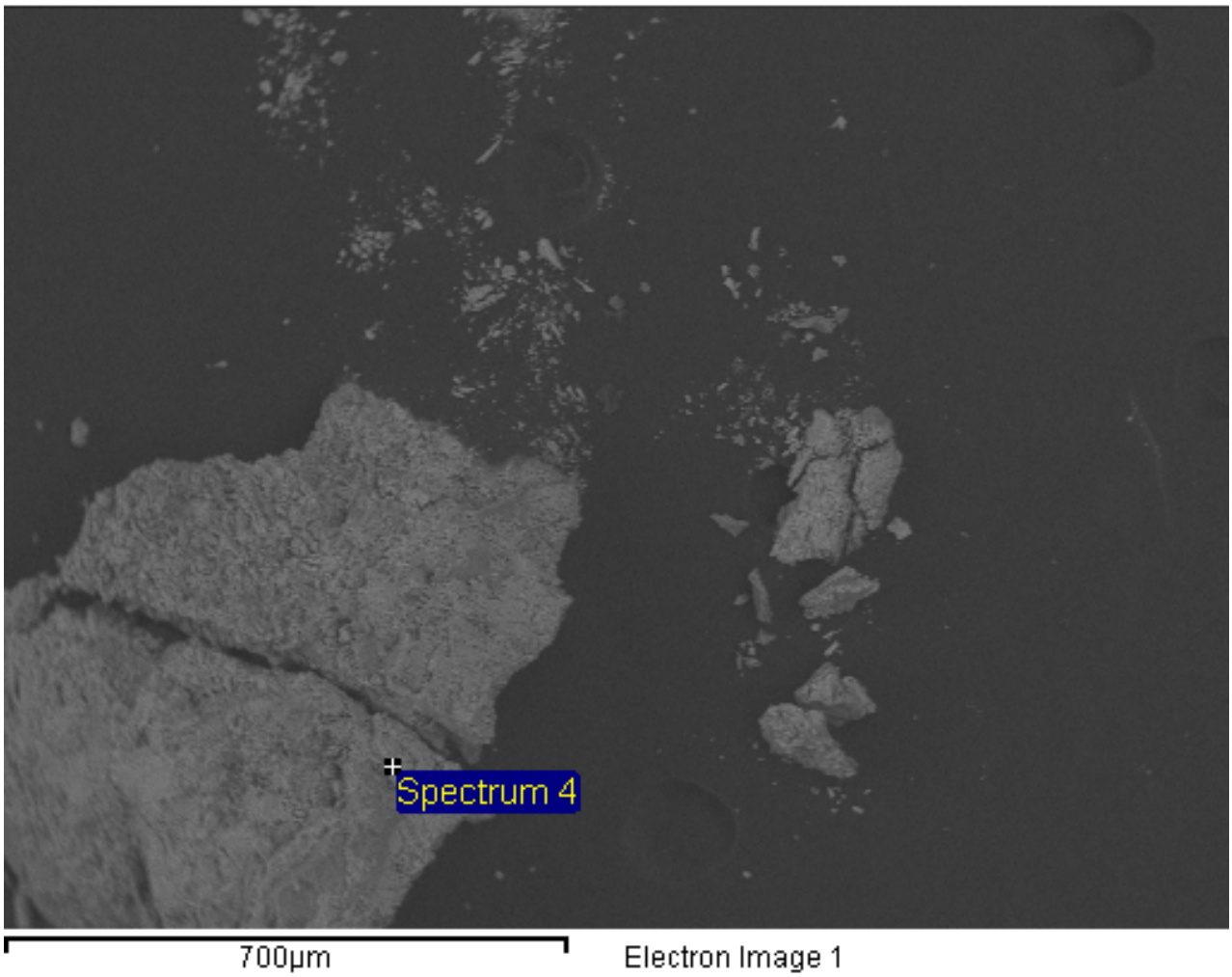


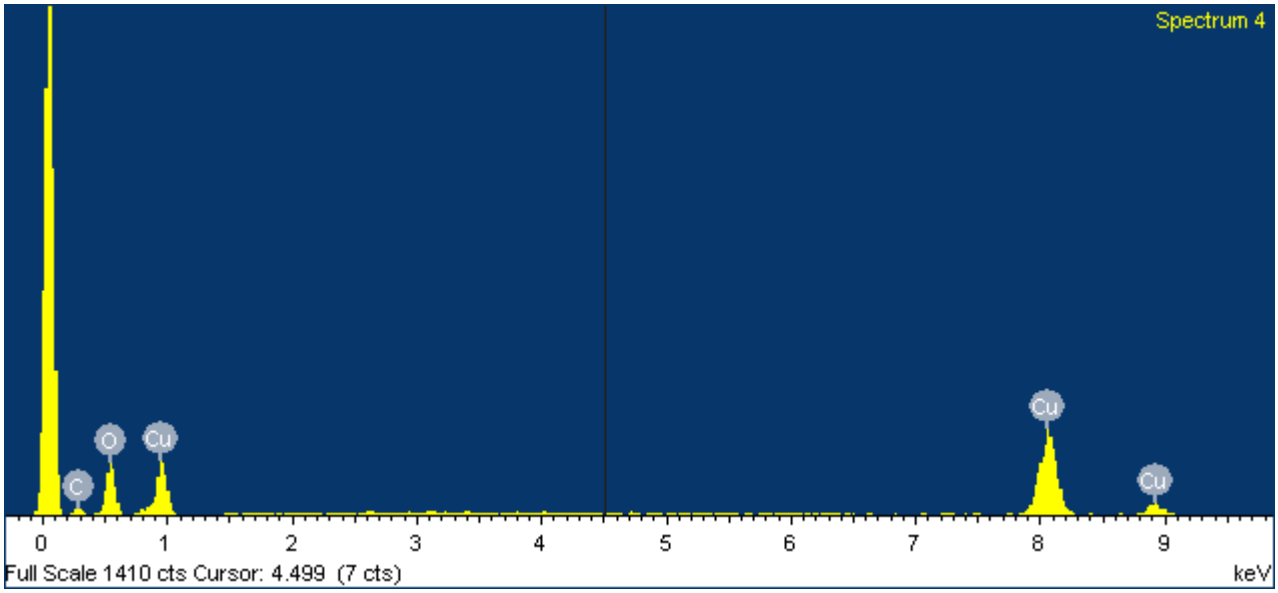
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Copper particles



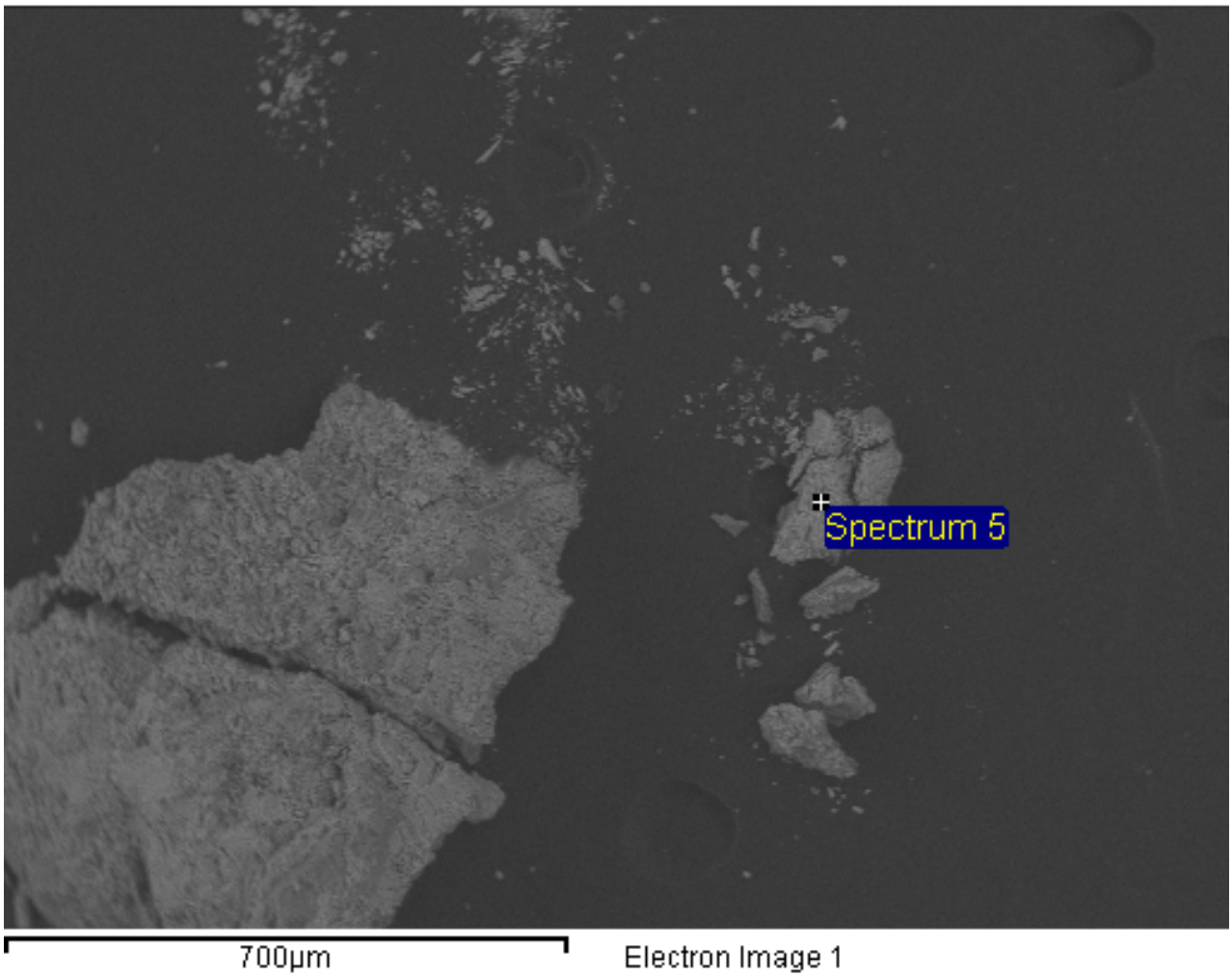


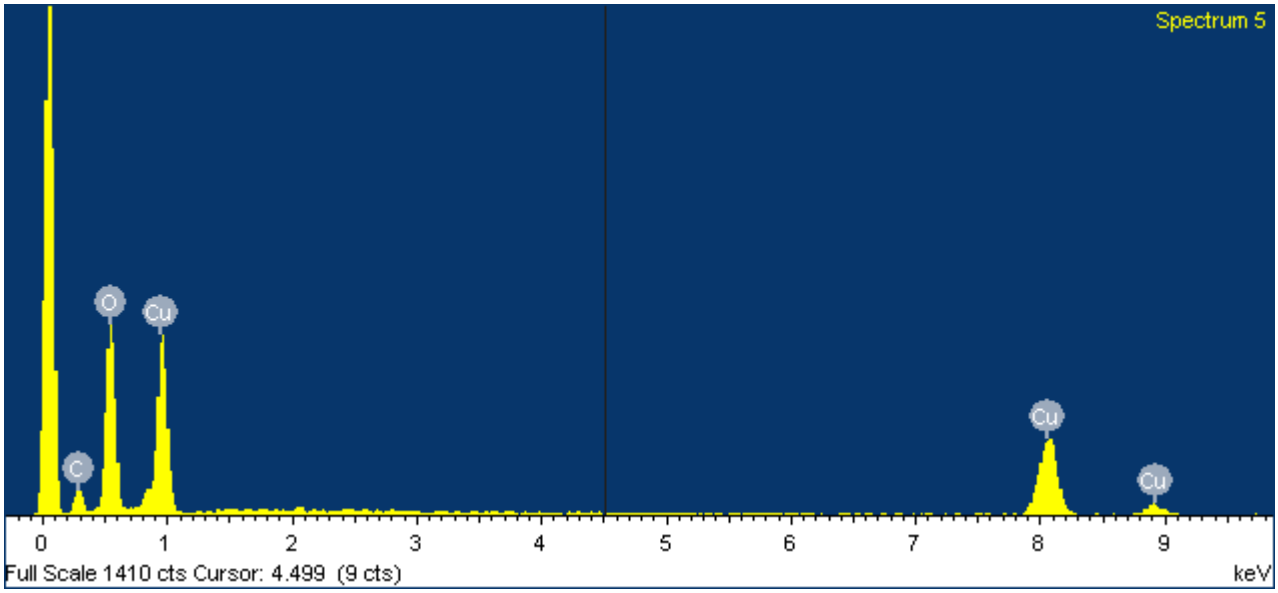
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Copper particles



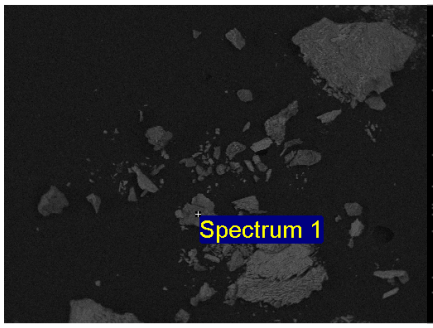


Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Copper particles

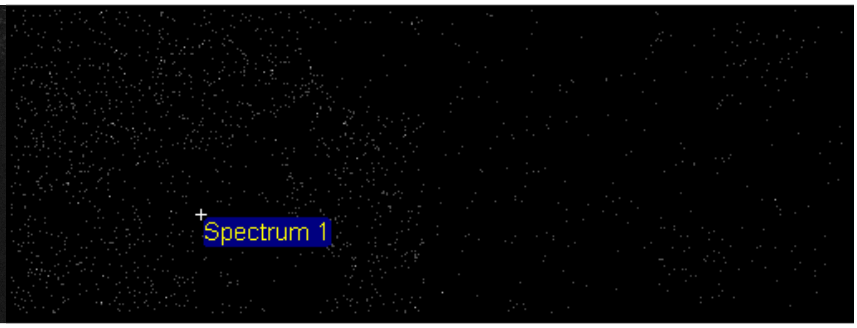




Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Copper particles



Electron Image 1



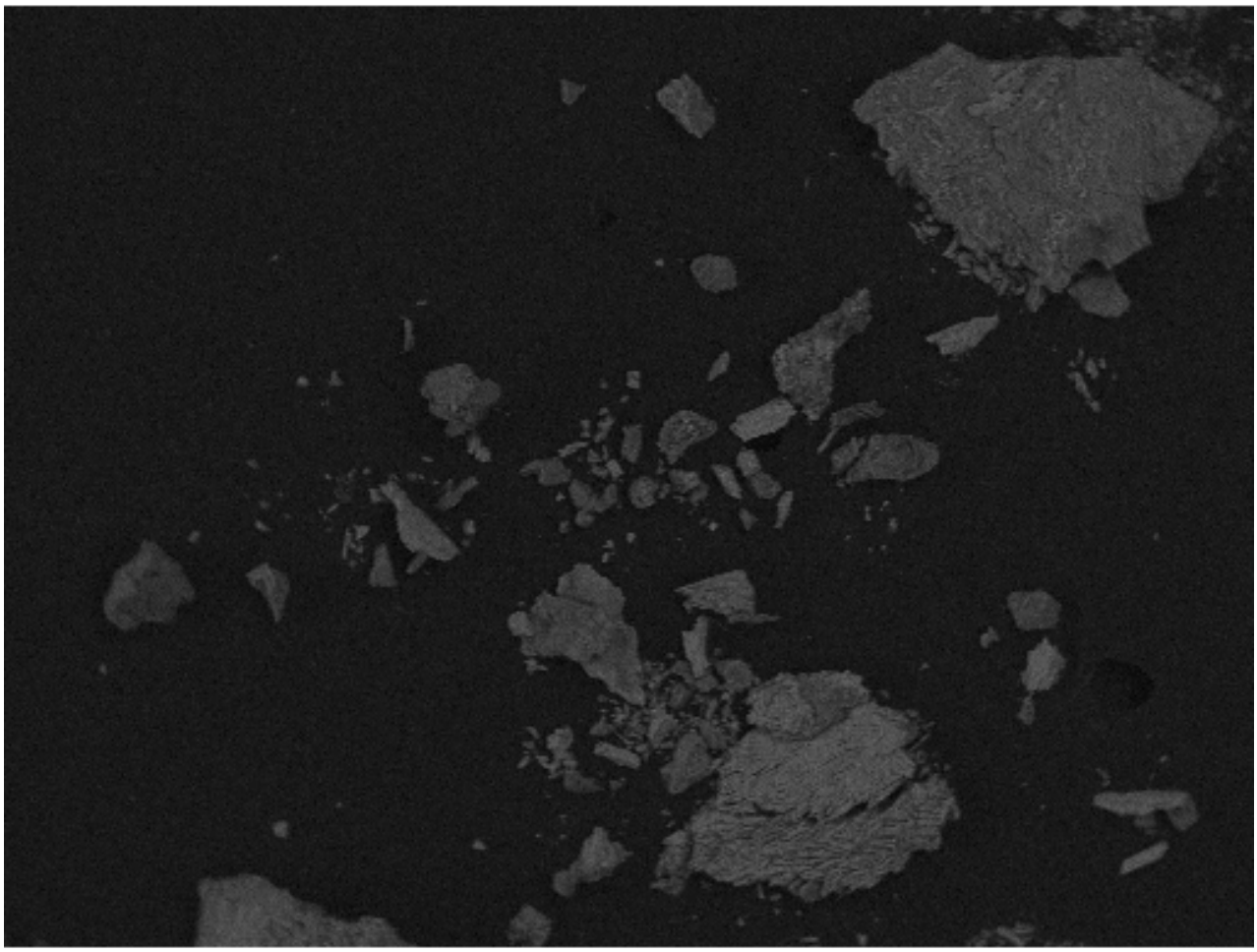
C Ka1_2

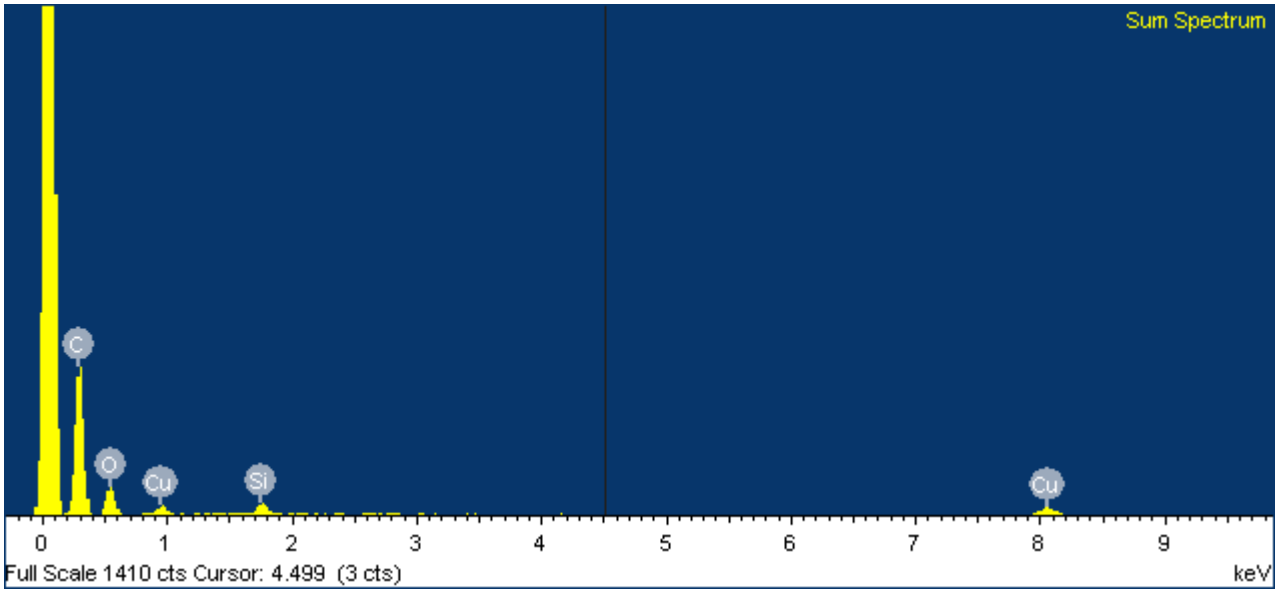
O Ka1


Si Ka1

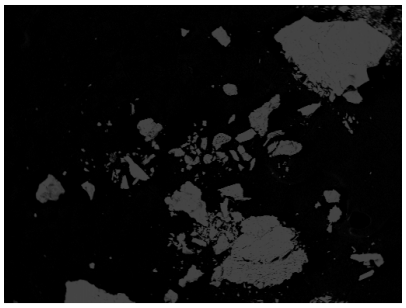
Cu Ka1

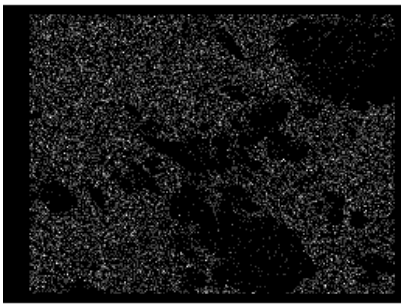
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Copper particles

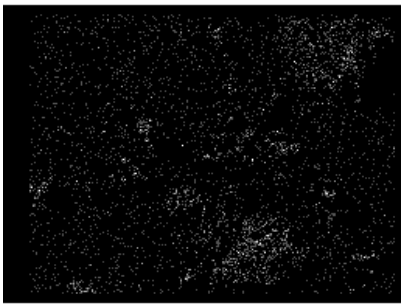


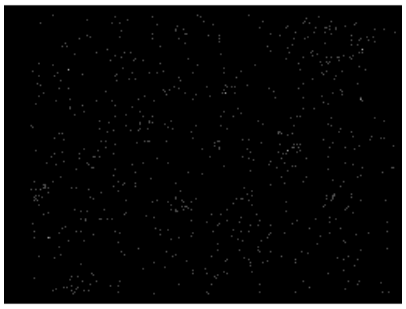


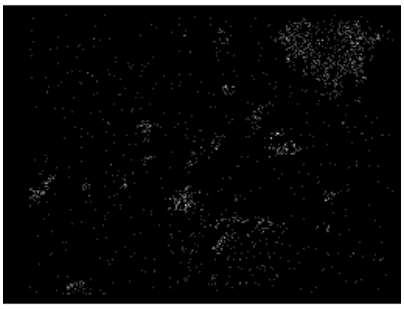
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1

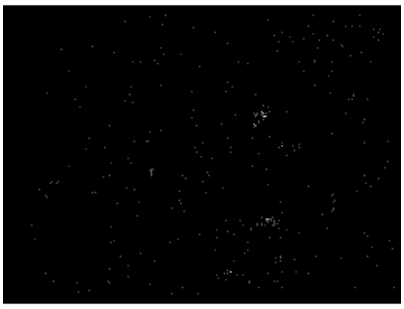

Electron Image 1

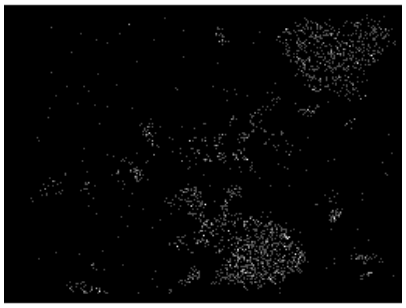

C Ka1_2


O Ka1


Al Ka1


Si Ka1

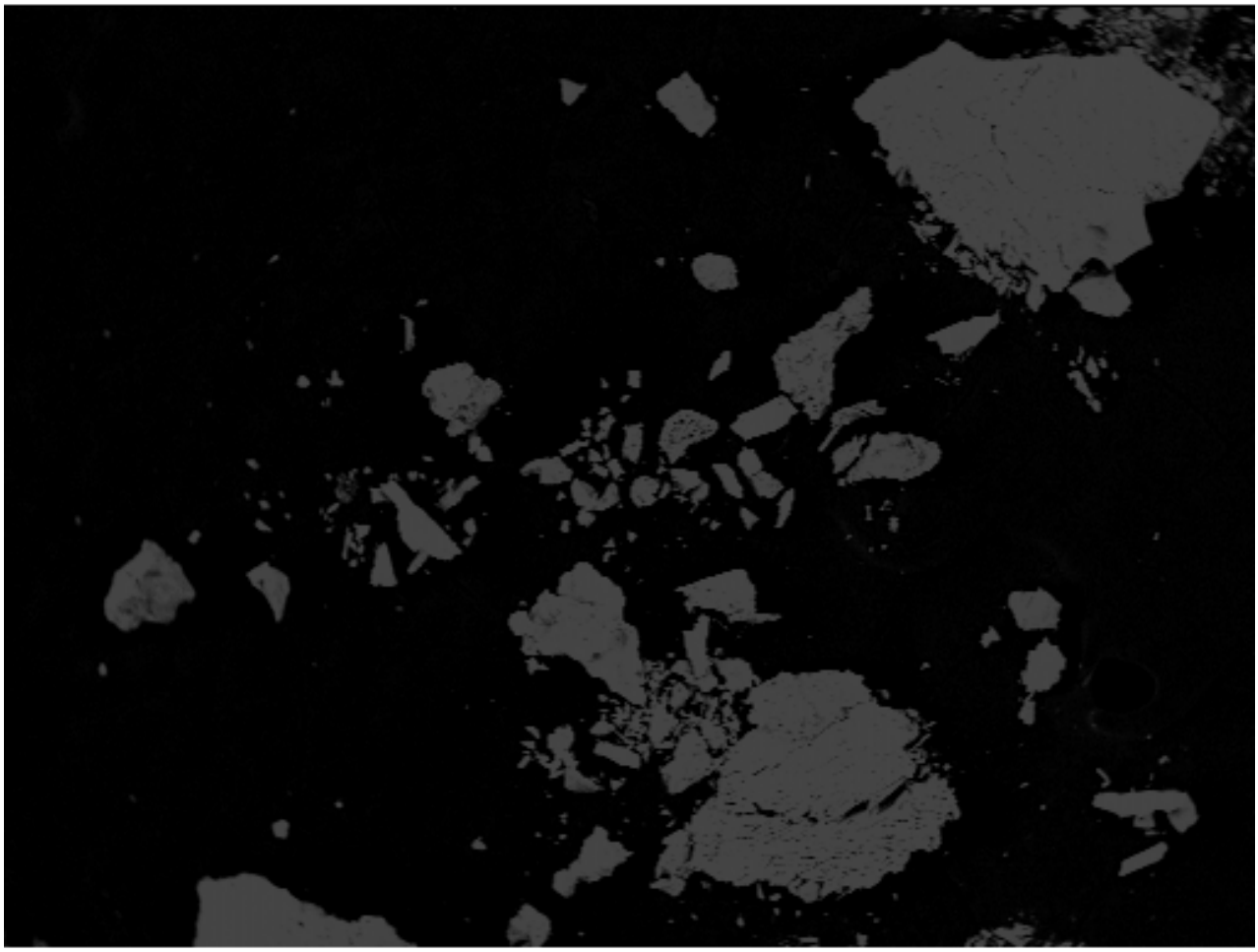

Fe Ka1

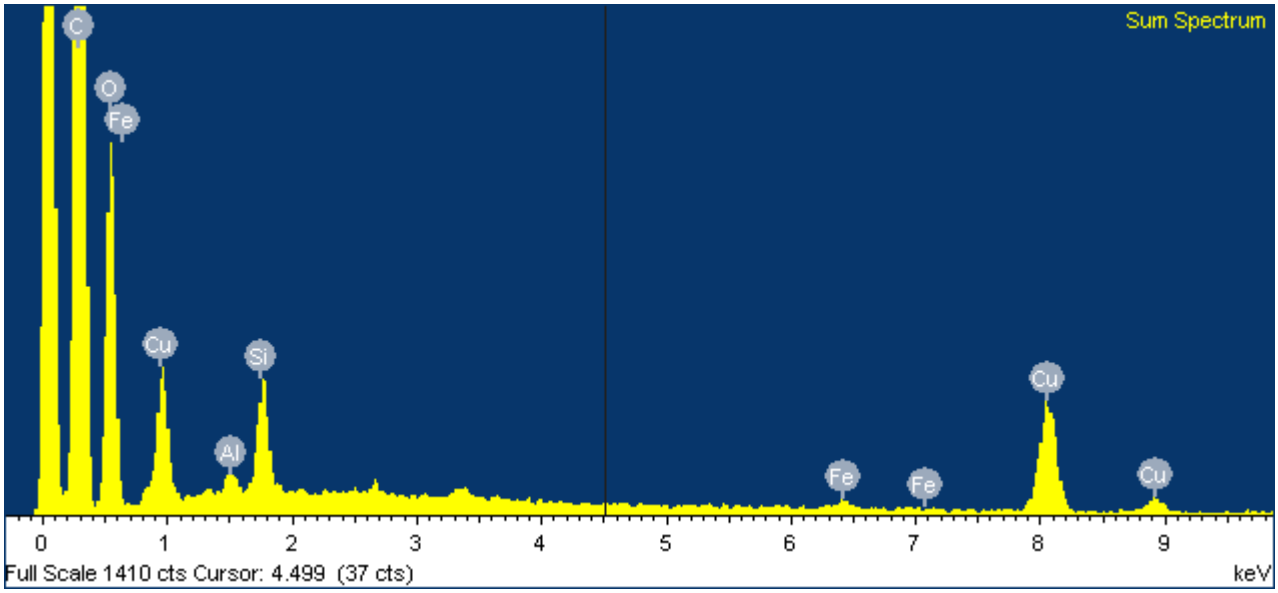

Cu Ka1

Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Copper particles

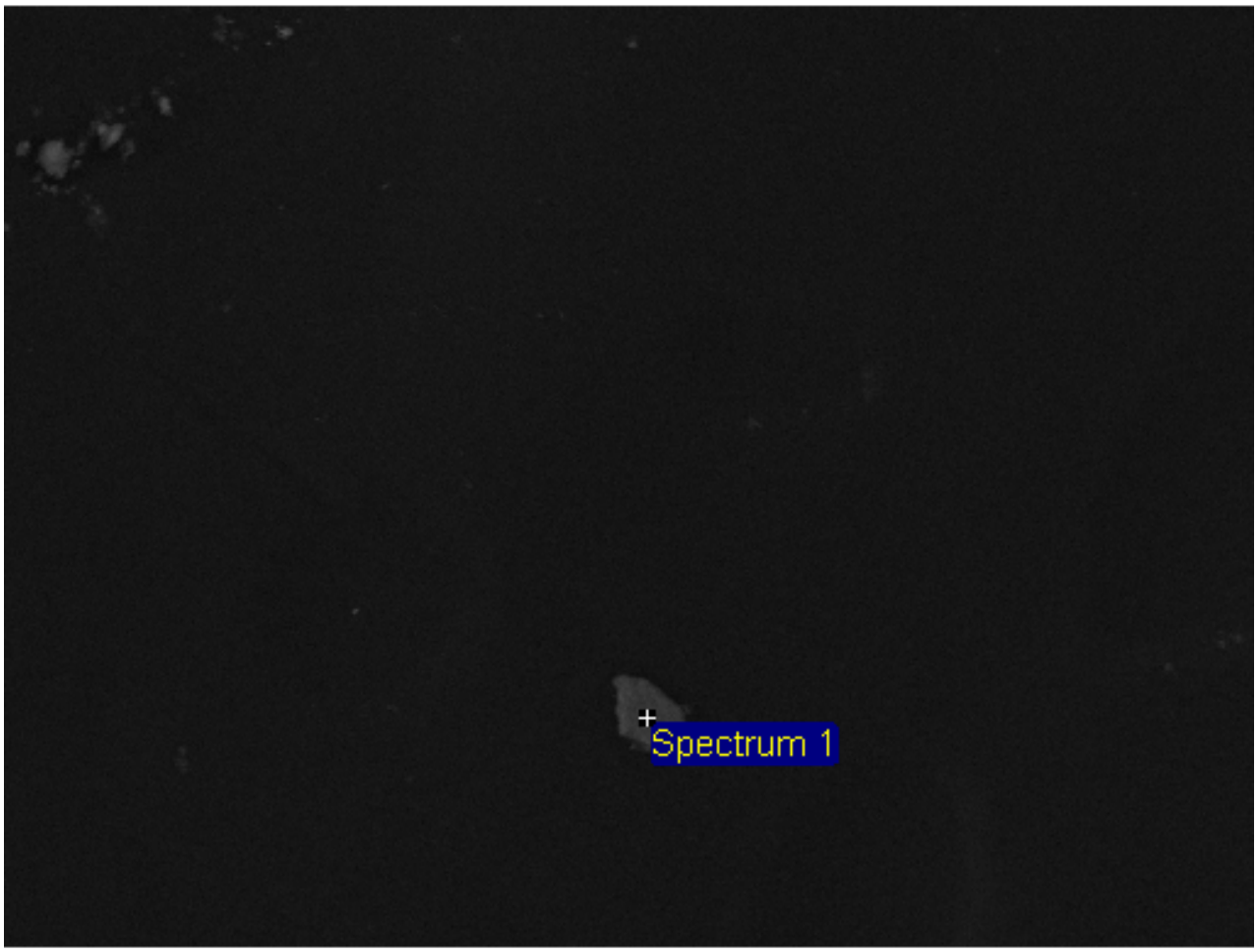
IST Area Results

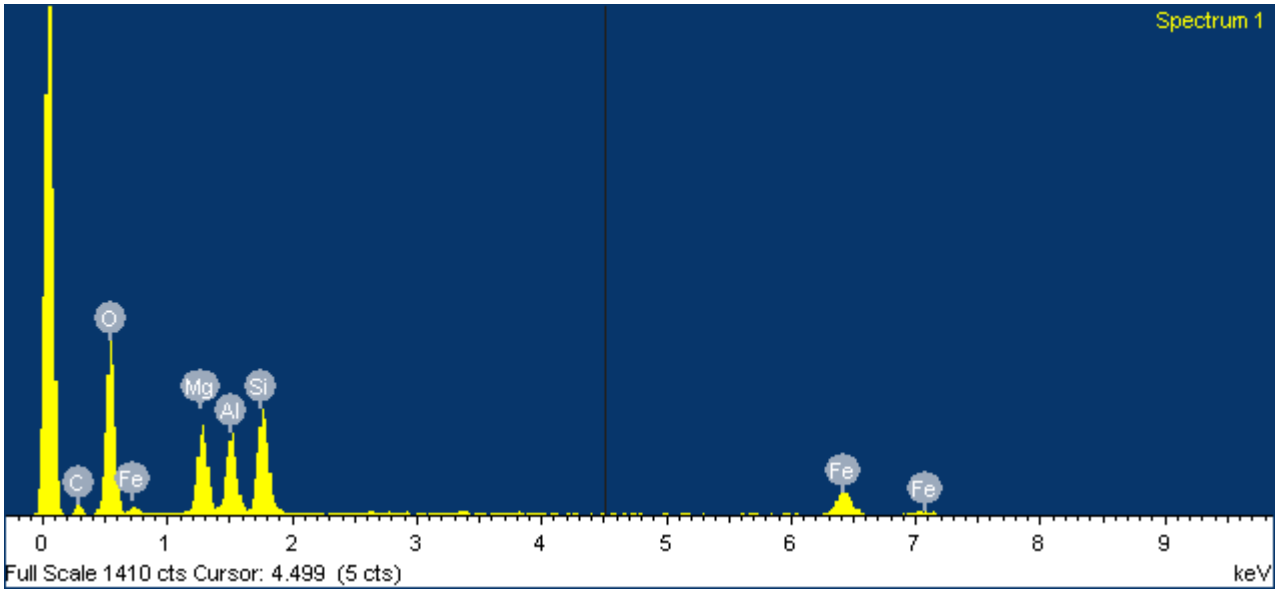
07/11/2013 13:00:06



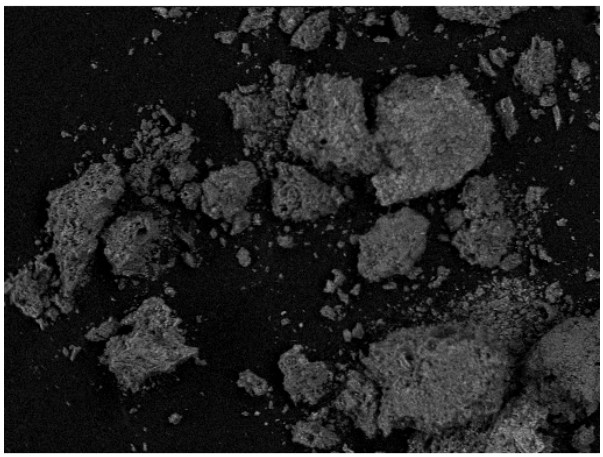


Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Copper particles





Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1



Electron Image 1



Hg La1

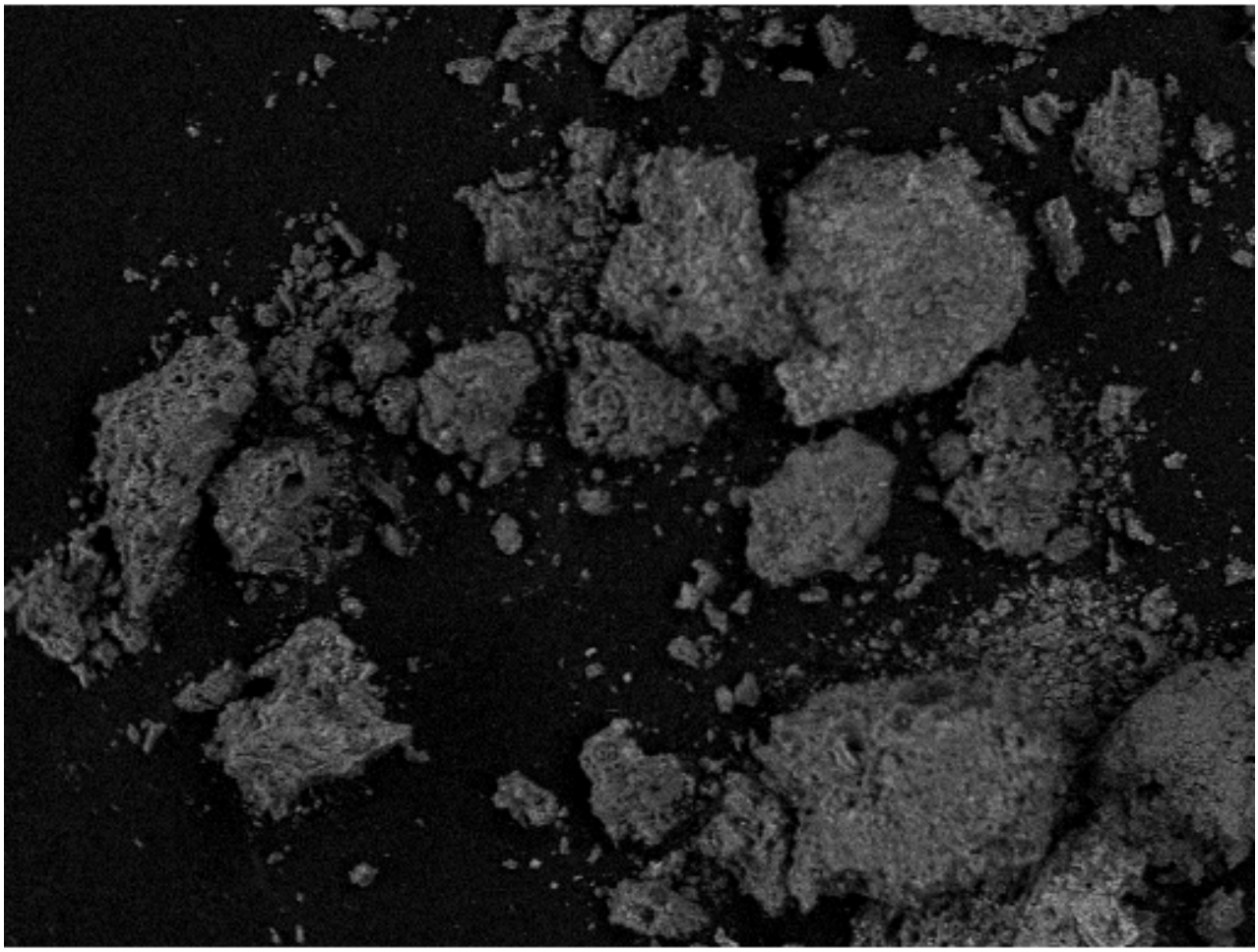


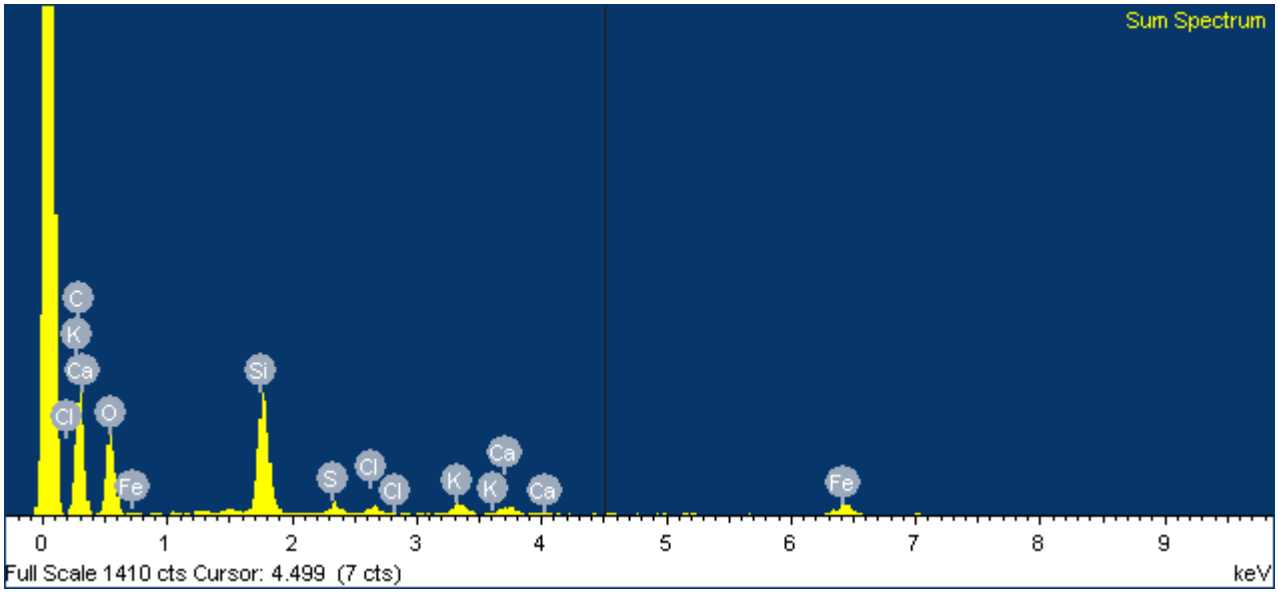
S Ka1



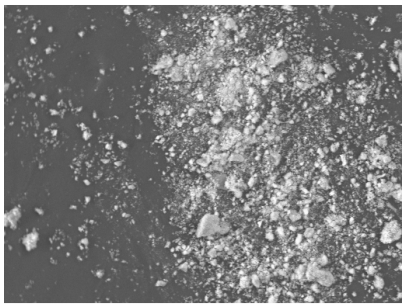
Fe Ka1

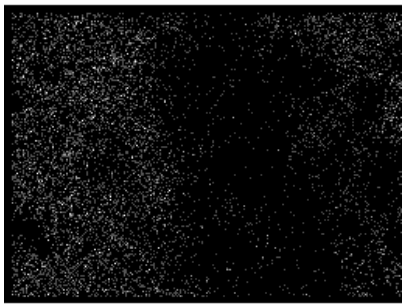
Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1

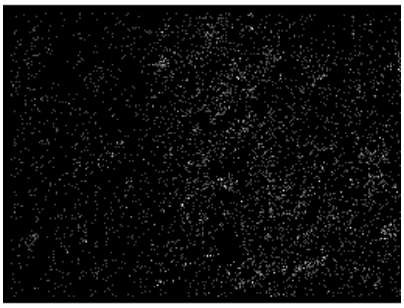


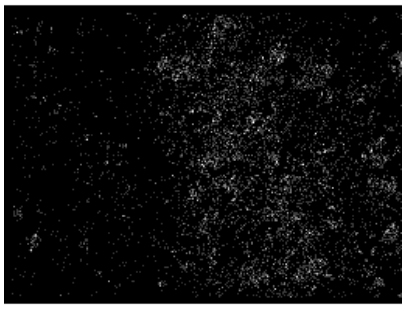


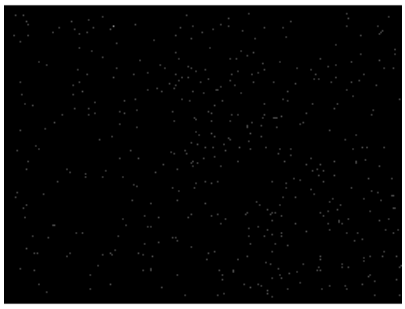
Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1

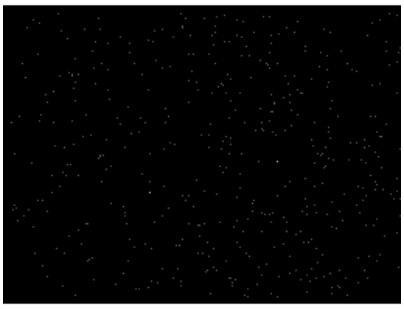

Electron Image 1

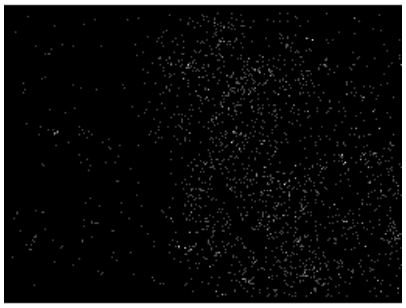

C Ka1_2


O Ka1

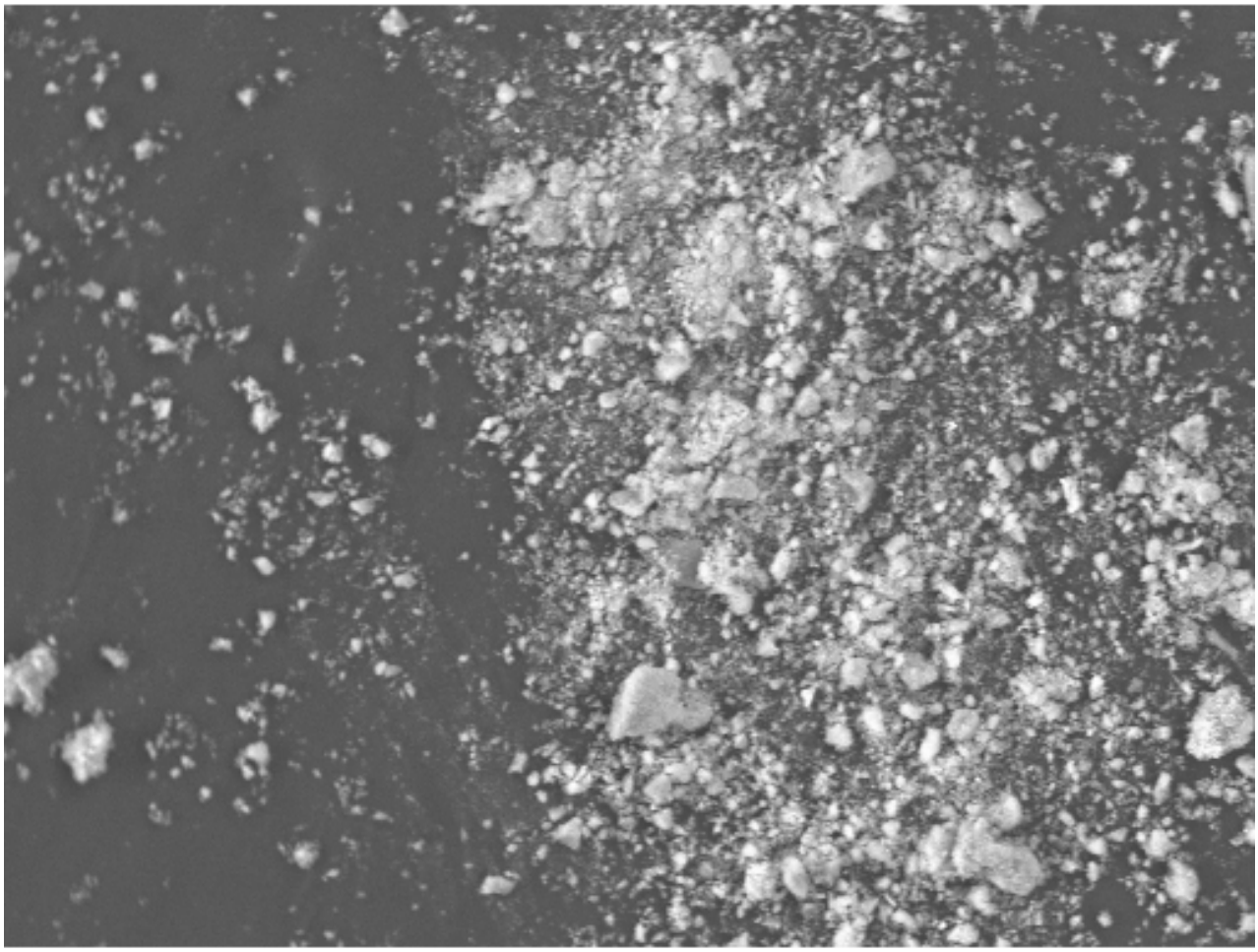

Si Ka1

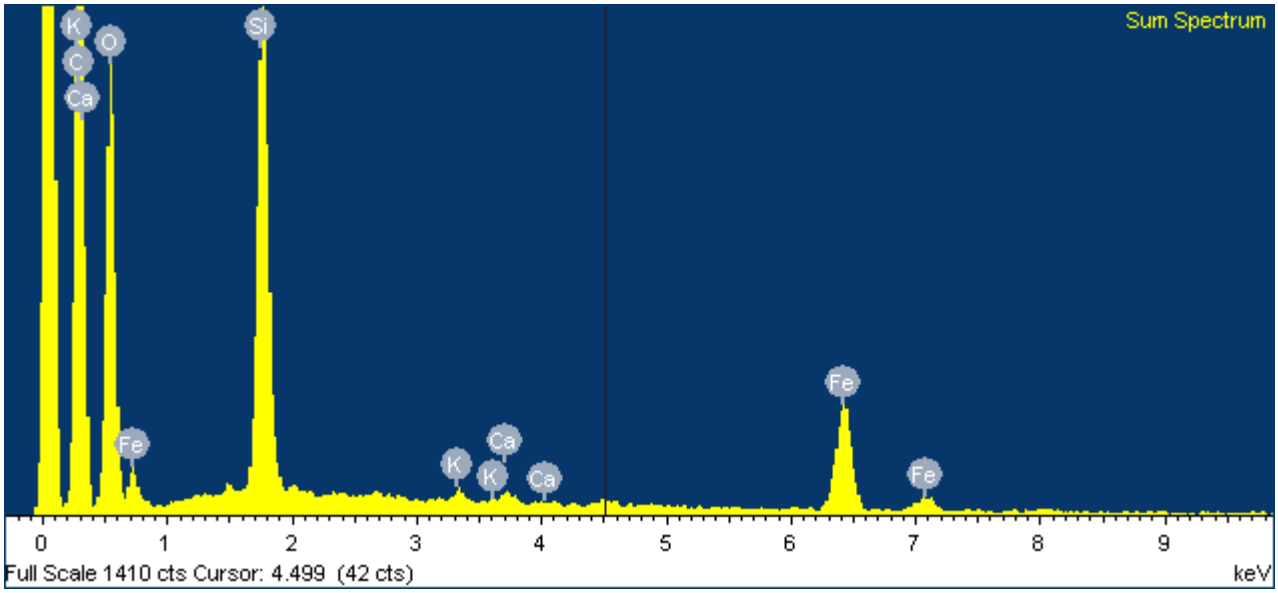

K Ka1


Ca Ka1

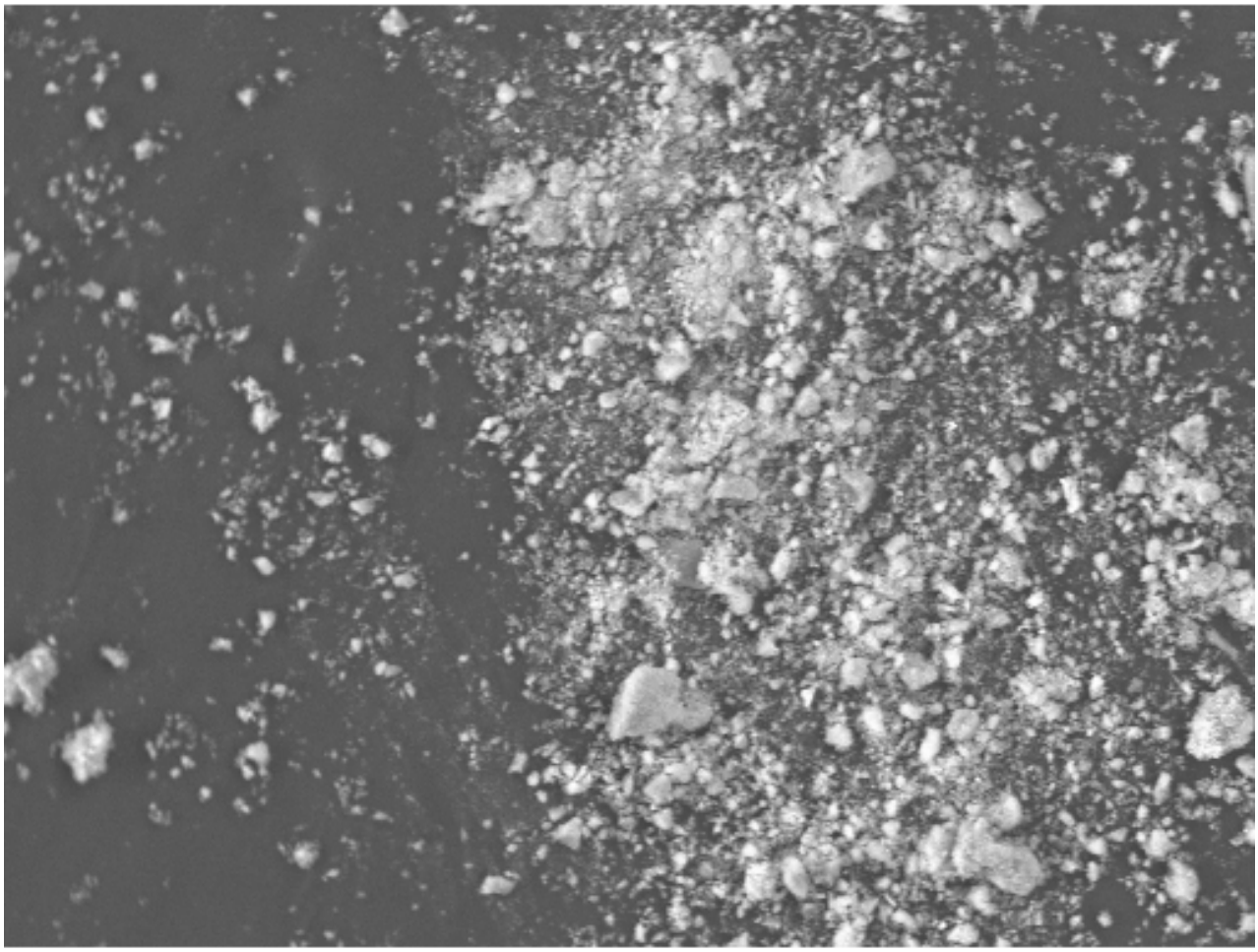

Fe Ka1

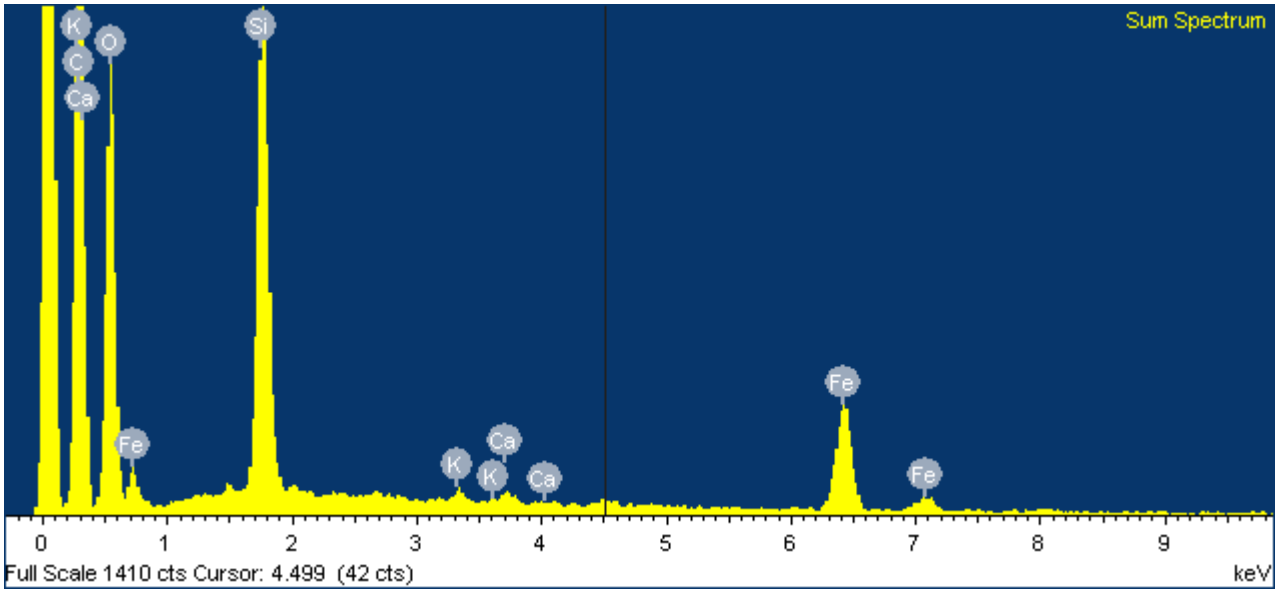
Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1



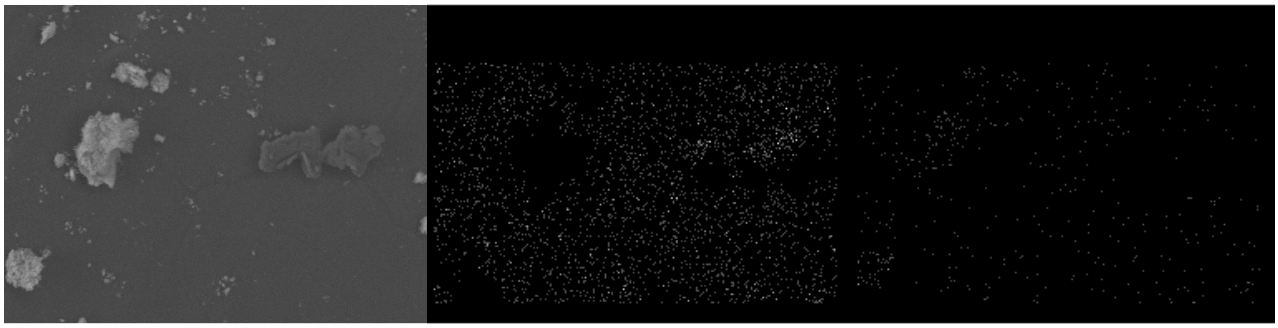


Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1





Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1

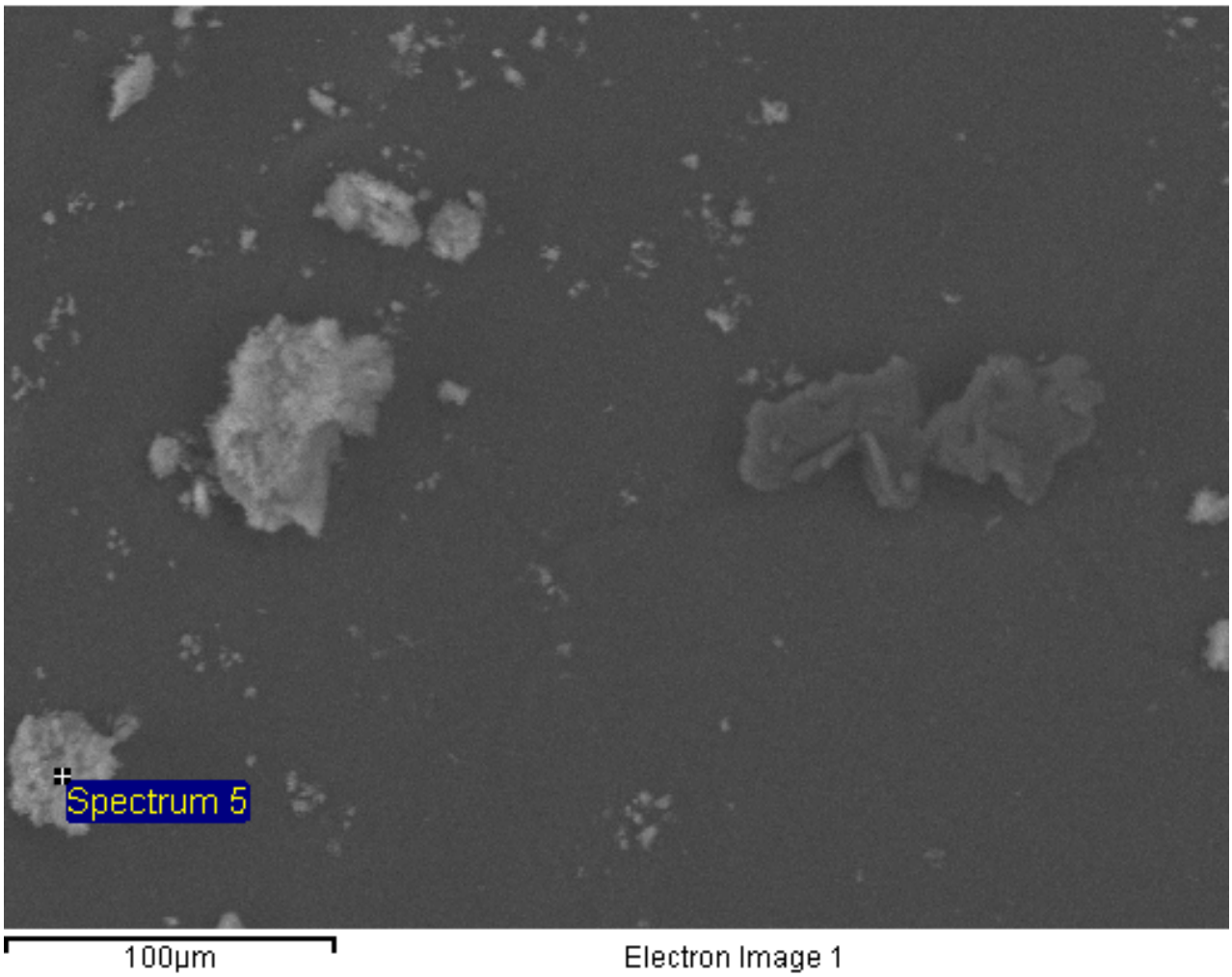


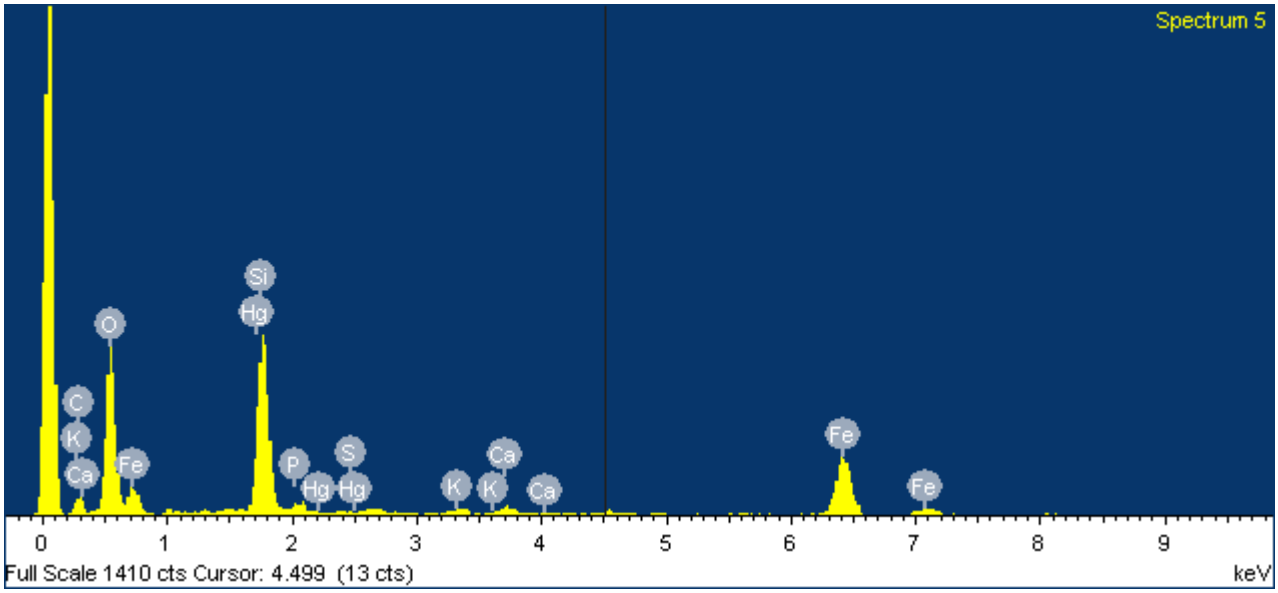
Electron Image 1 | C Ka1_2 | O Ka1



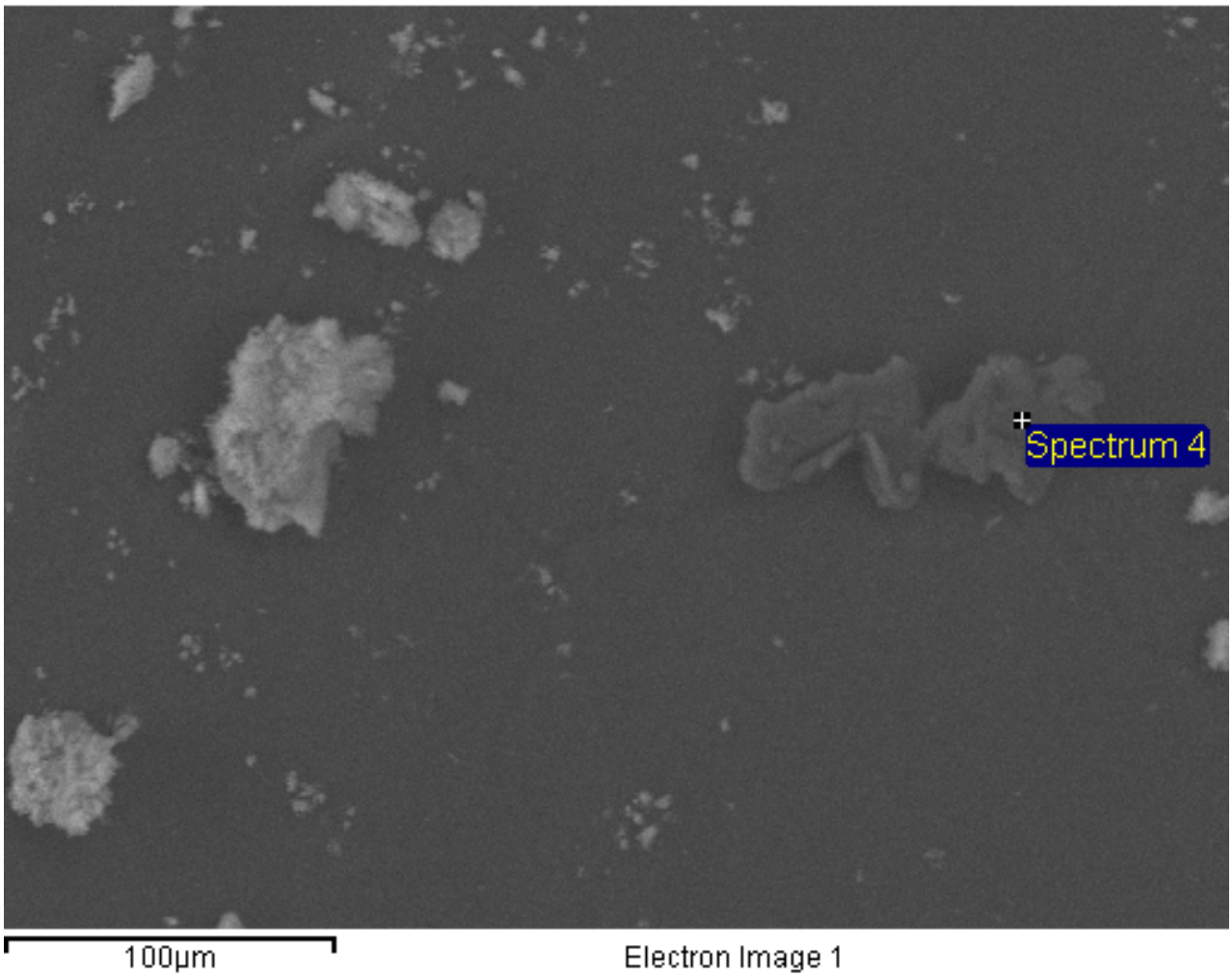
Si Ka1 | Fe Ka1 | Hg La1

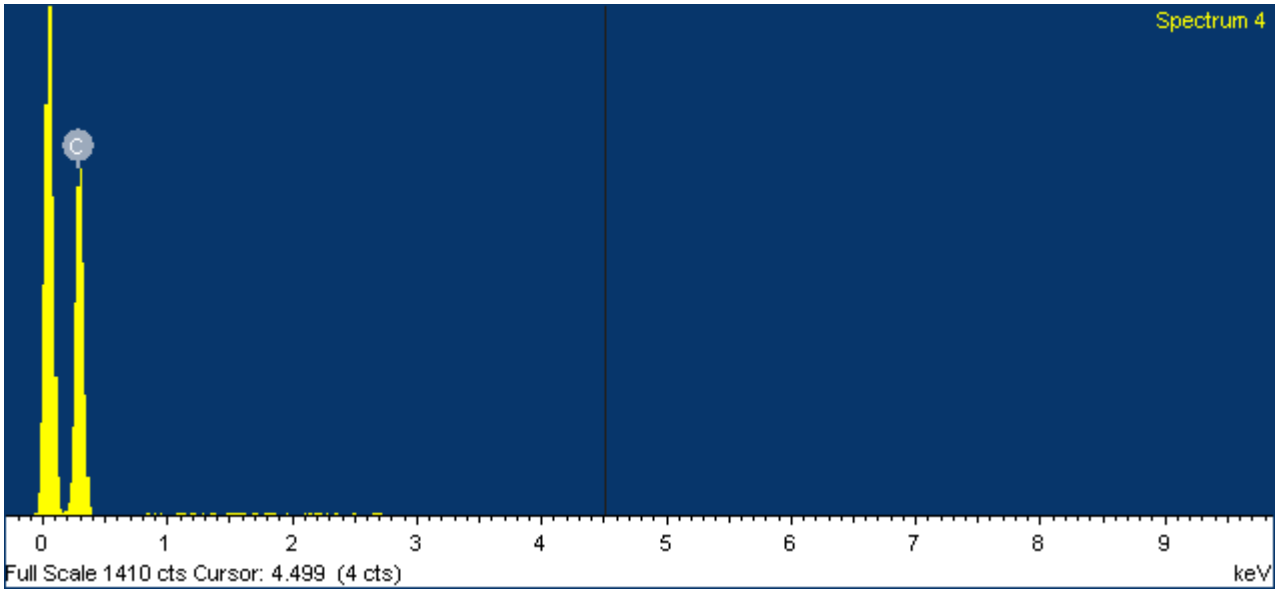
Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
C, O, Si, Fe, Hg



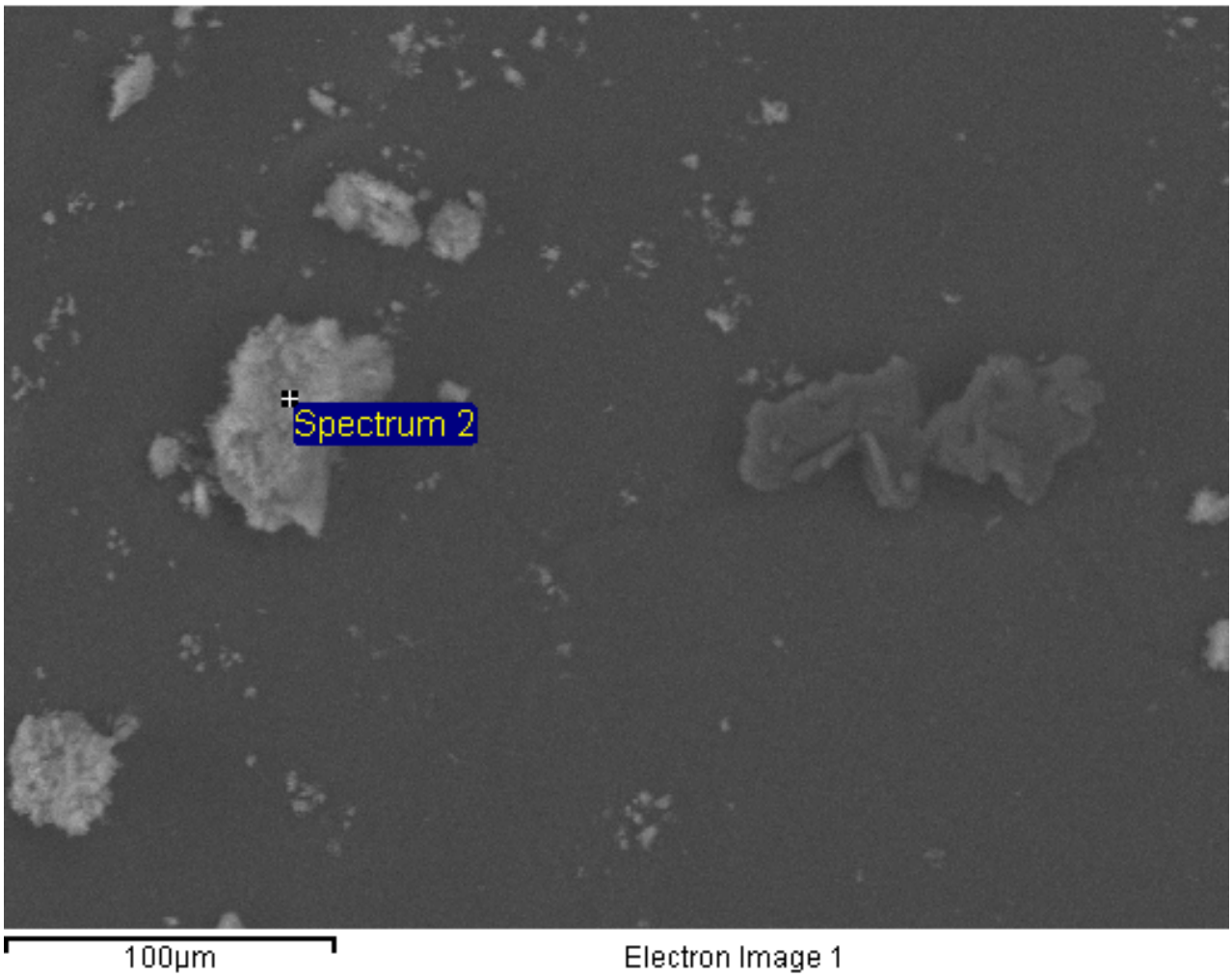


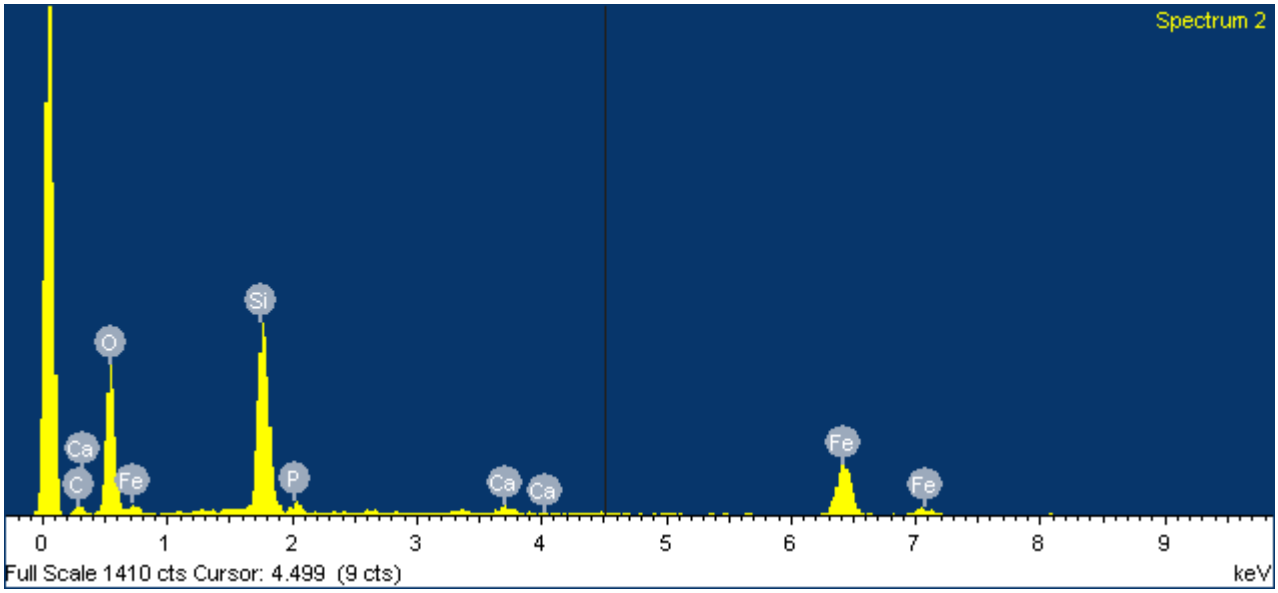
Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1



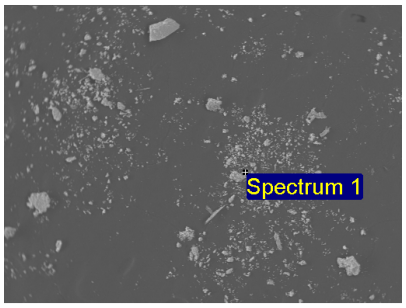


Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1

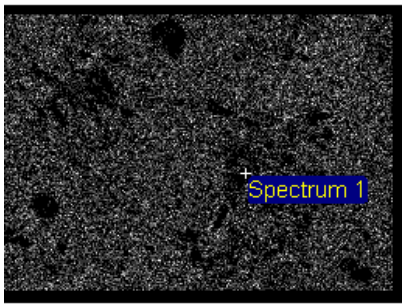




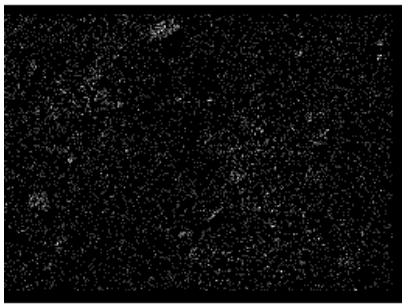
Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1

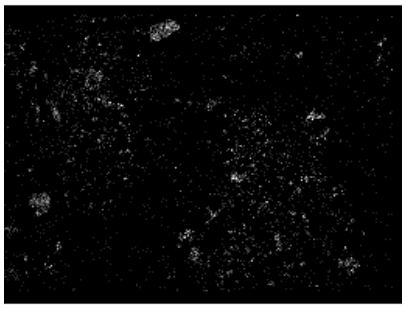


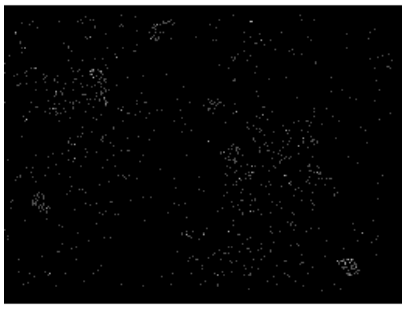
Electron Image 1



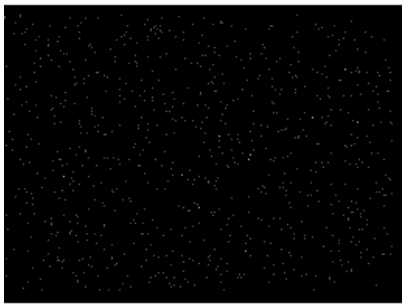
C Ka1_2


O Ka1


Si Ka1

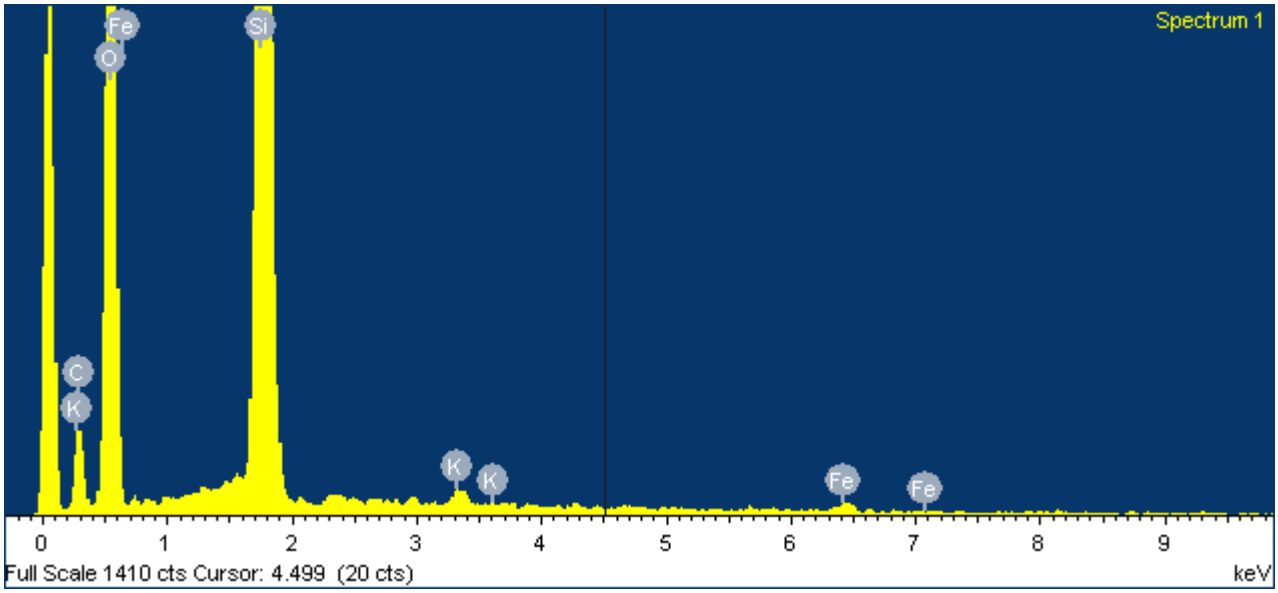

Fe Ka1


Hg La1

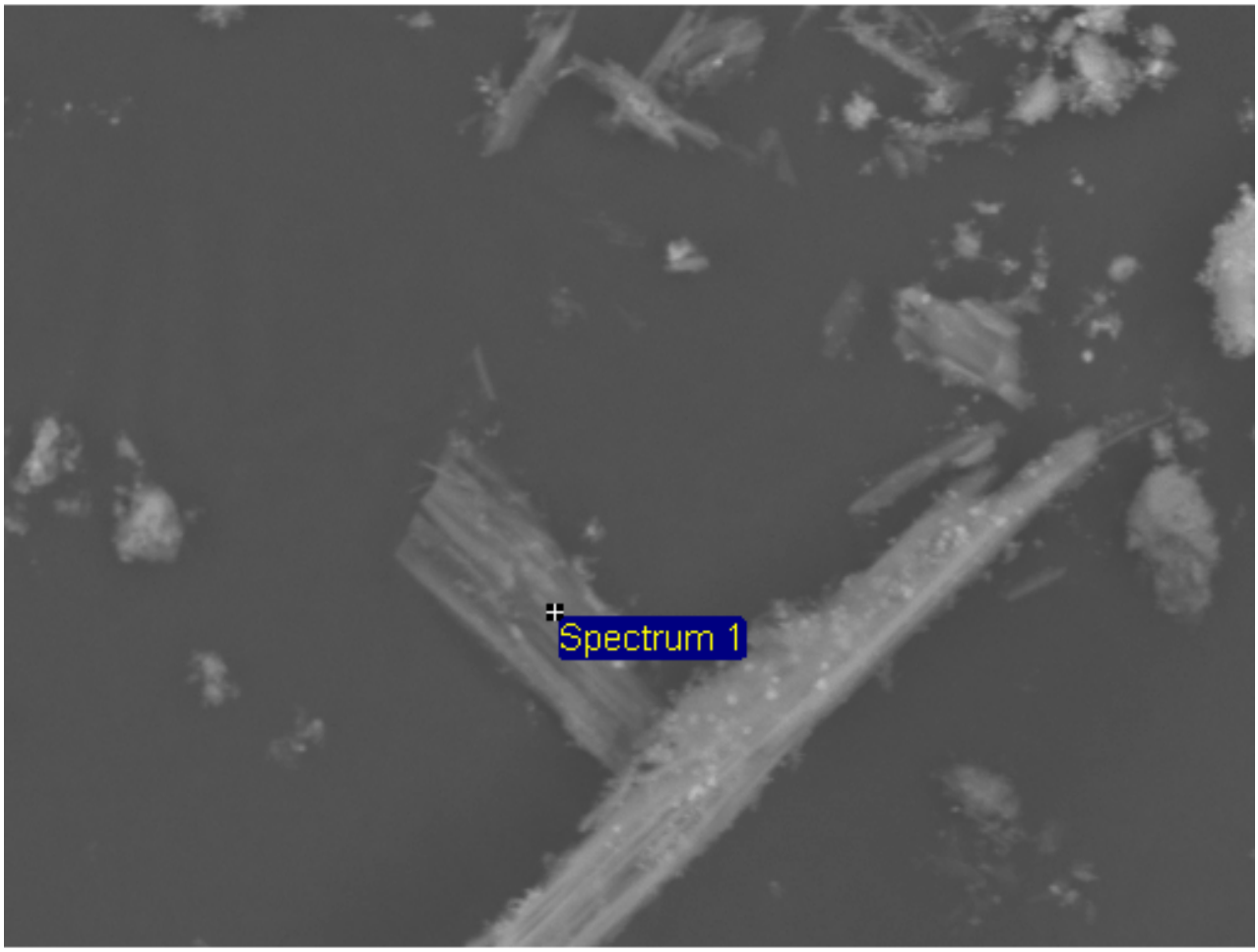

S Ka1

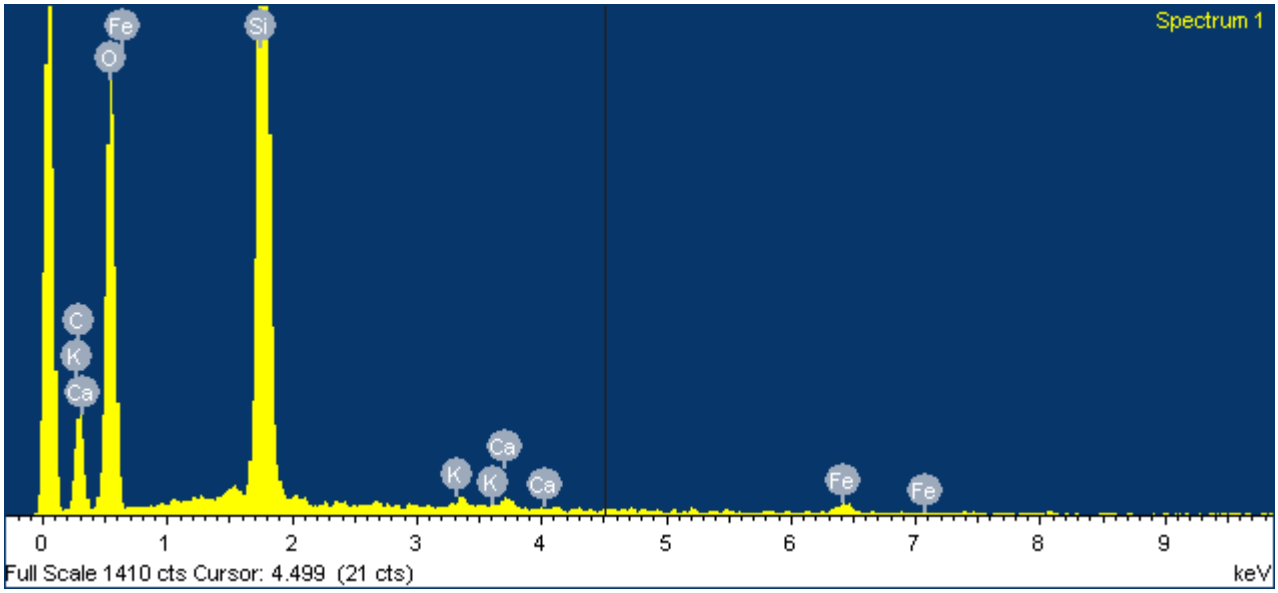
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
C, O, Si, Fe, Hg, S



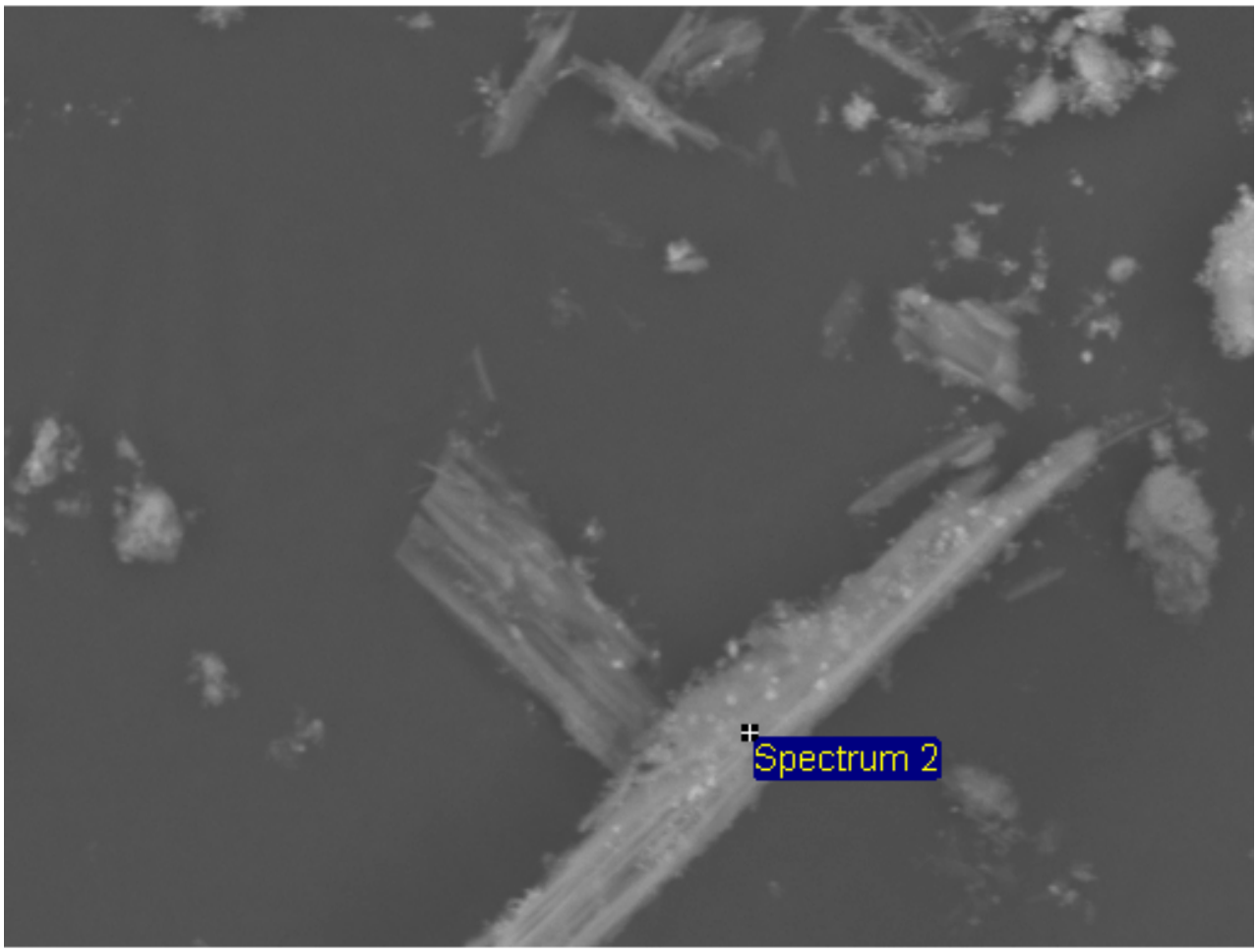


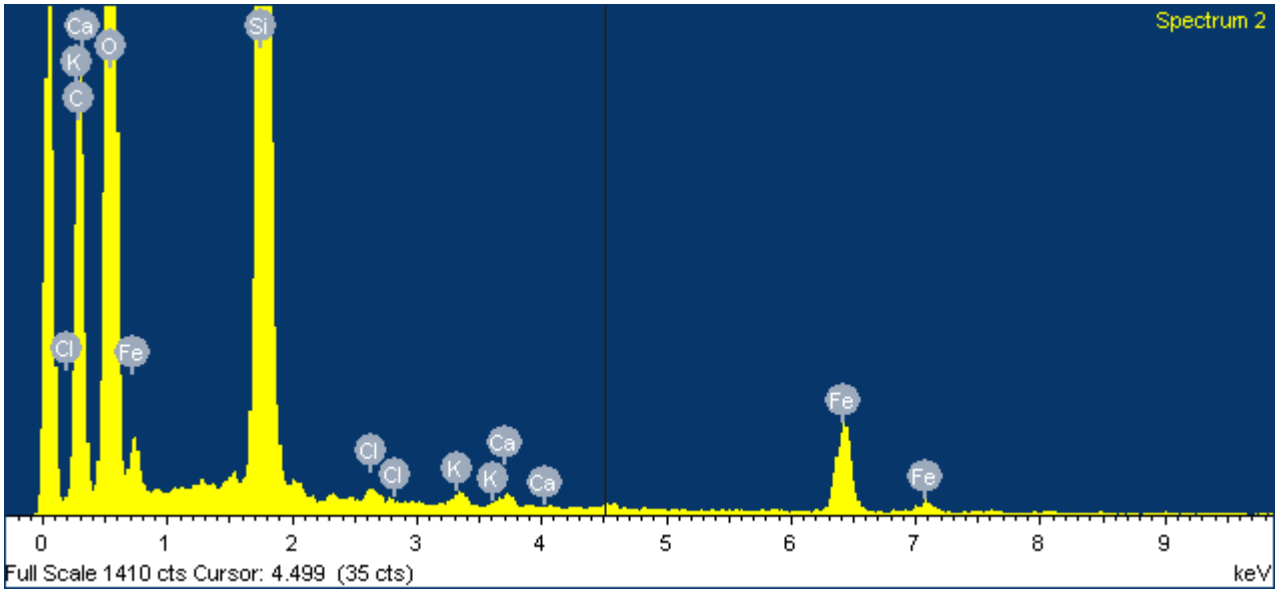
Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1


Spectrum 1
60µm
Electron Image 1

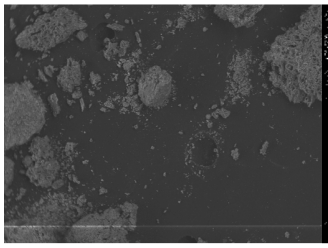

Spectrum 1
Fe
O
Si
C
K
Ca
Ca
K
K
Ca
Fe
Fe
0
1
2
3
4
5
6
7
8
9
Full Scale 1410 cts Cursor: 4.499 (21 cts)
keV

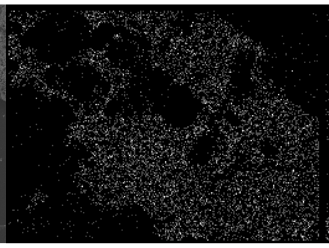
Comment:

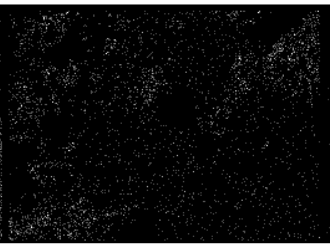

Spectrum 2
60µm
Electron Image 1


Spectrum 2
Ca
O
K
C
Si
Cl
Fe
Cl
Cl
K
K
Ca
Ca
Fe
Fe
0
1
2
3
4
5
6
7
8
9
Full Scale 1410 cts Cursor: 4.499 (35 cts)
keV

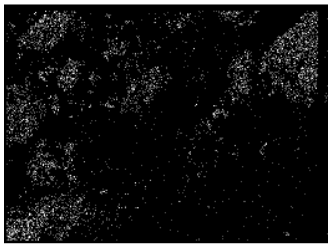
Comment:

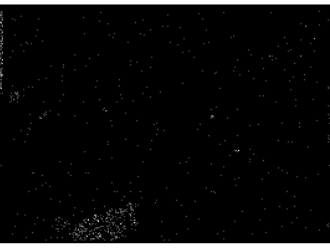

Electron Image 1

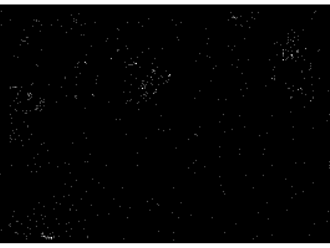

C Ka1_2

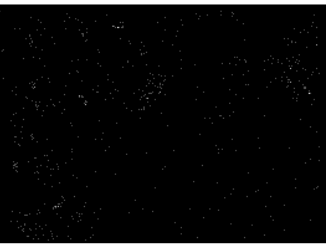

O Ka1

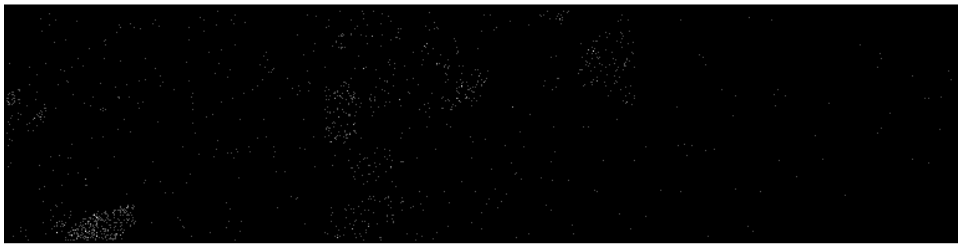

Na Ka1_2


Si Ka1


S Ka1


Cl Ka1

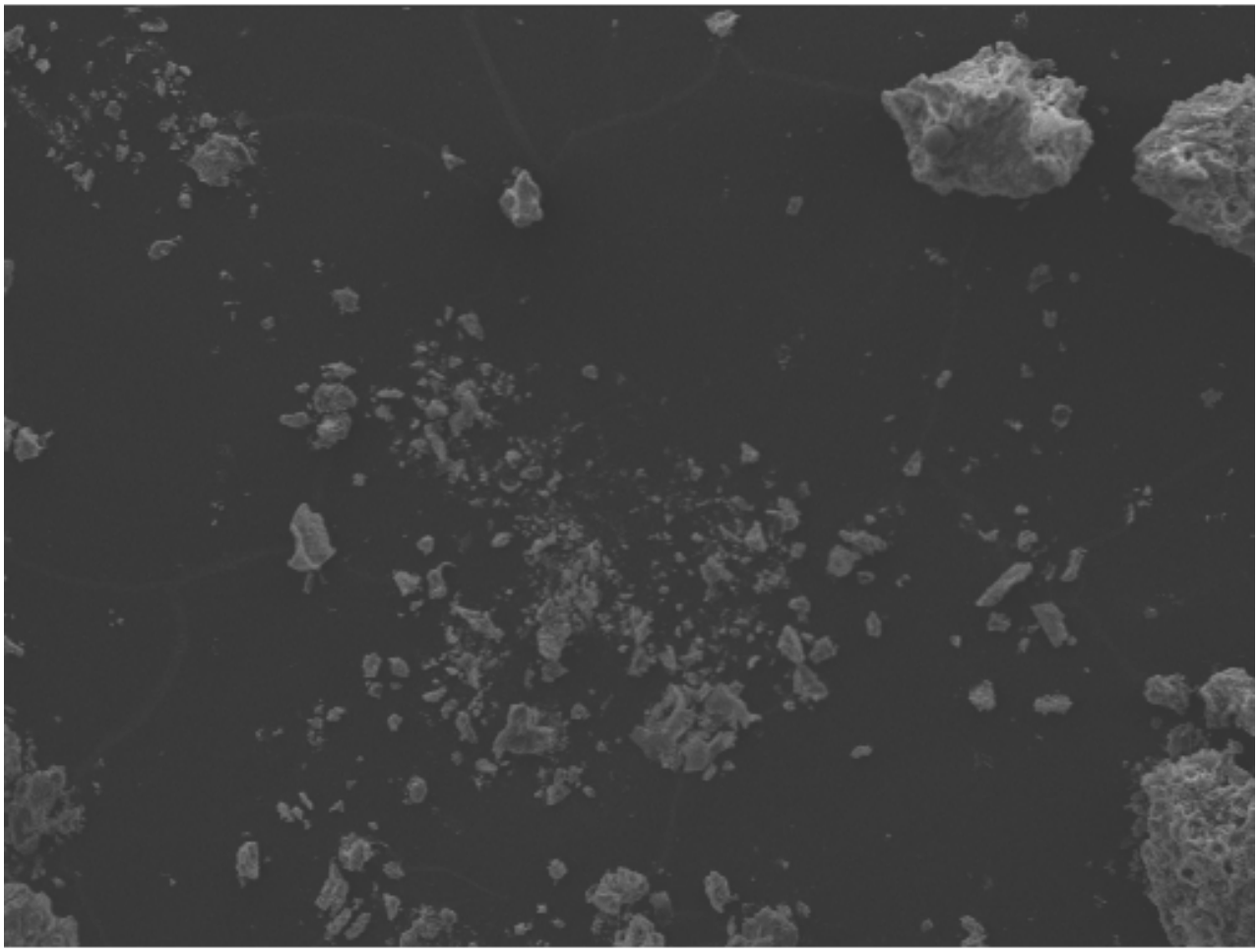

K Ka1

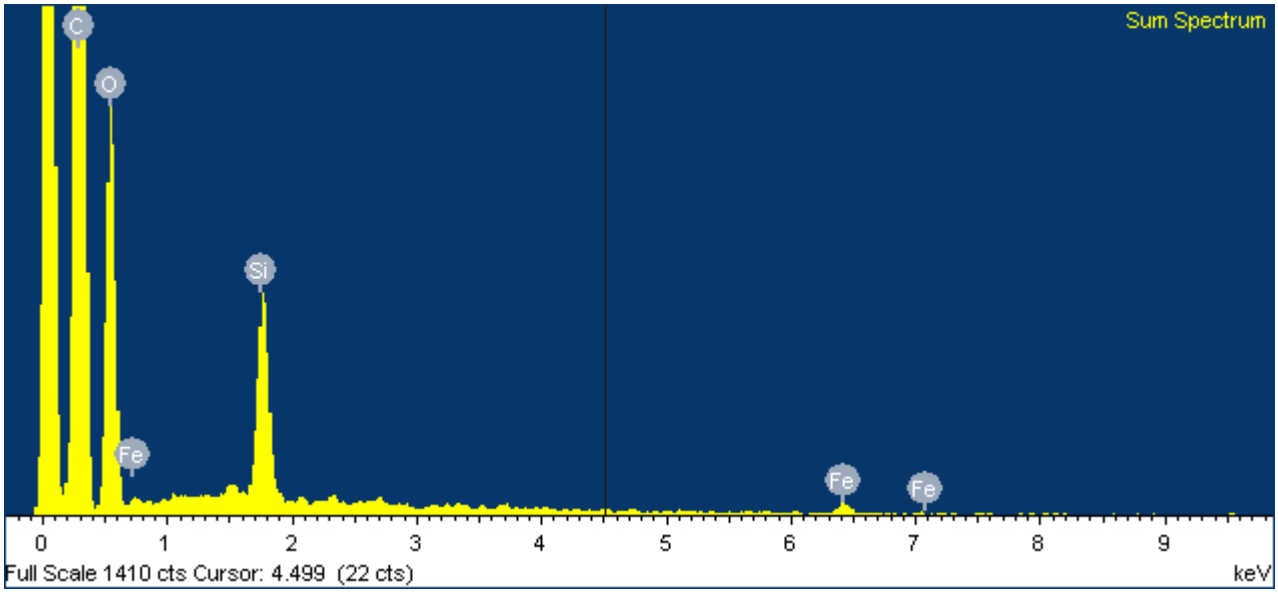

Ca Ka1

Fe Ka1

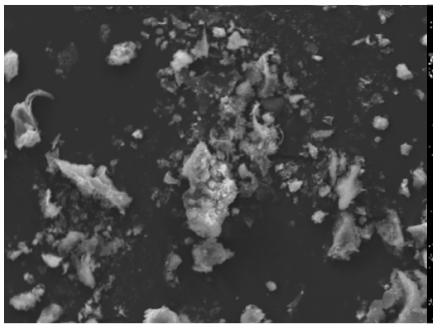
Br Ka1

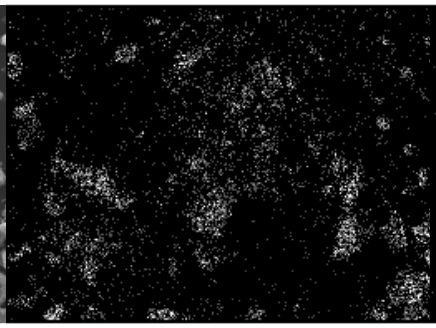
Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
C, O, Na, Si, S, Cl, K, Ca, Fe, Br

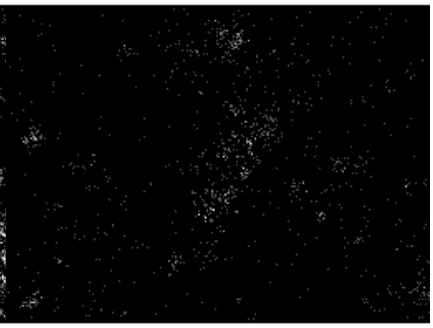


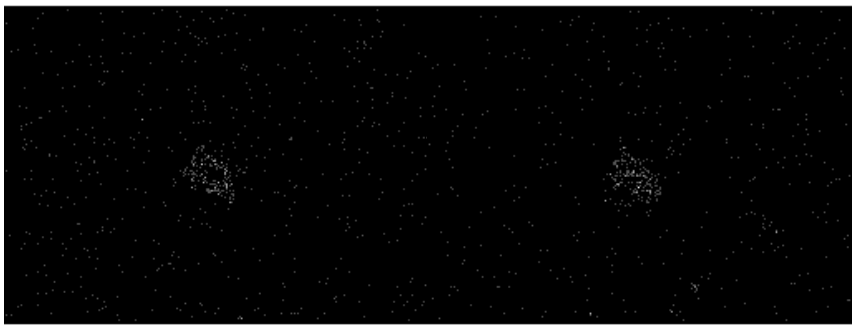


Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1


Electron Image 1

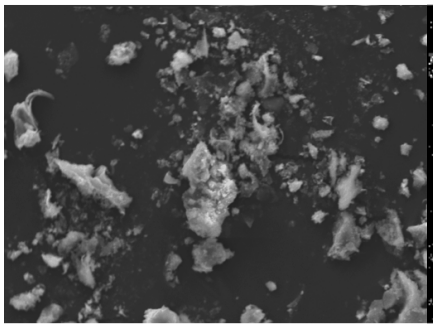

Si Ka1


Fe Ka1

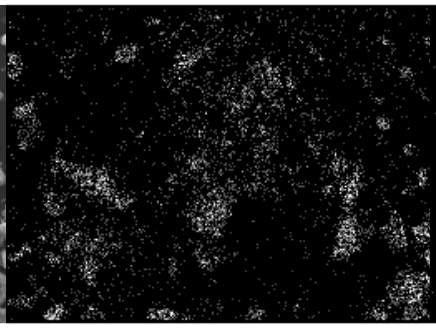

S Ka1

Ca Ka1

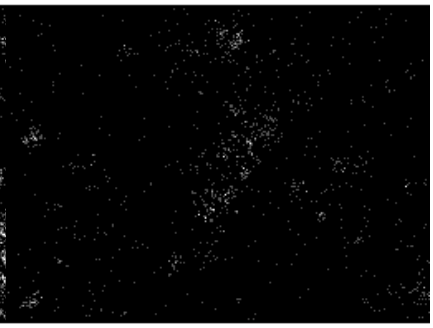
Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1



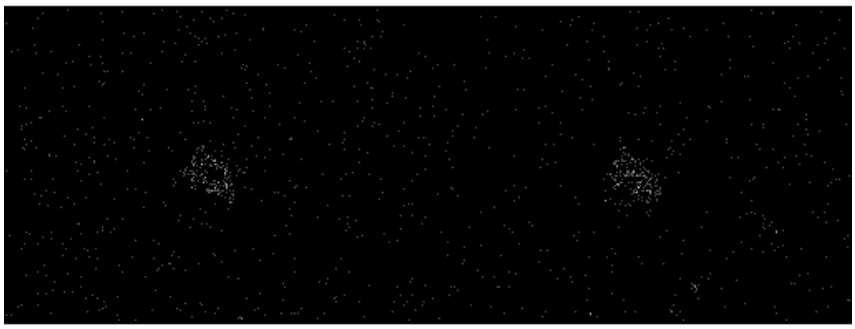
Electron Image 1



Si Ka1



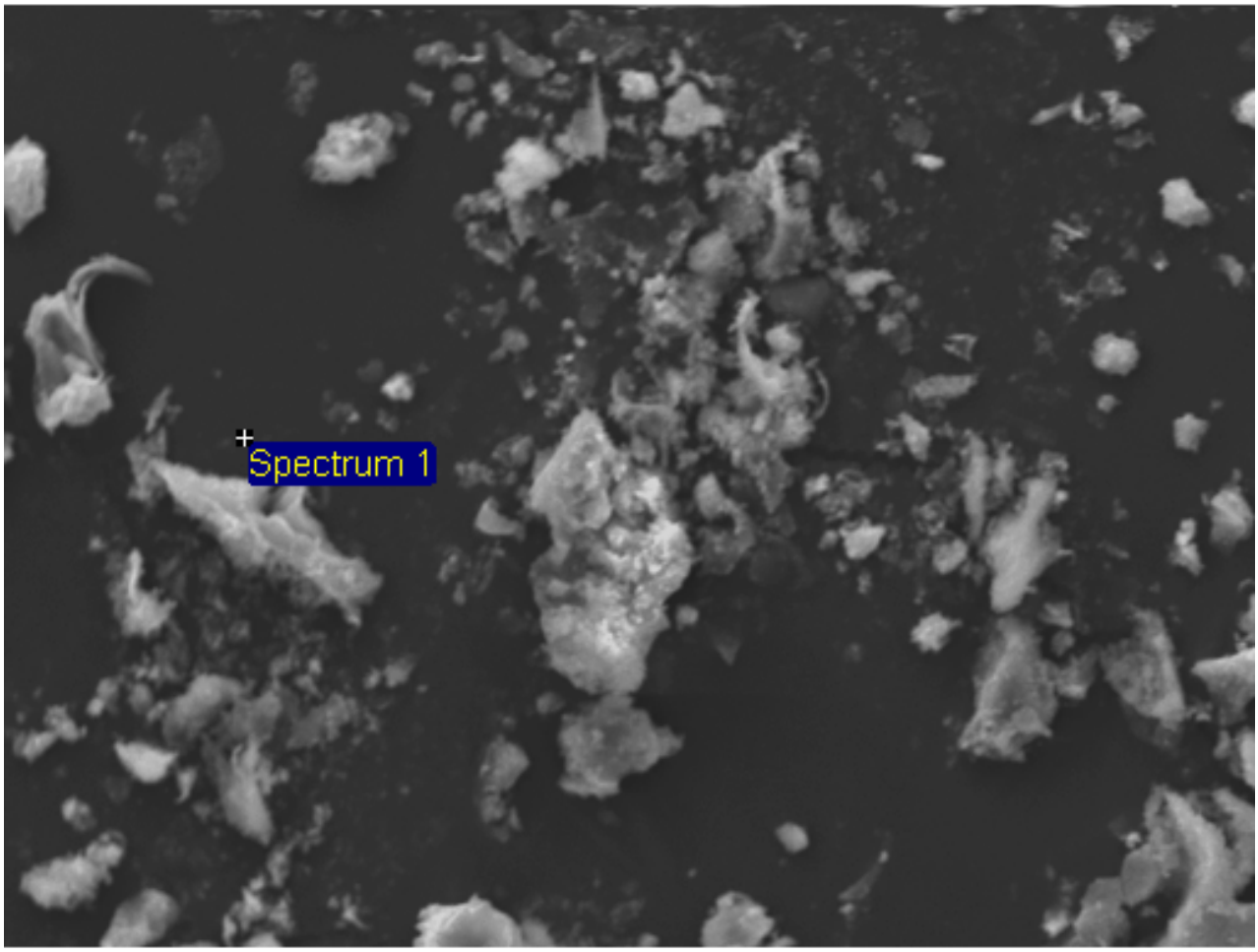
Fe Ka1

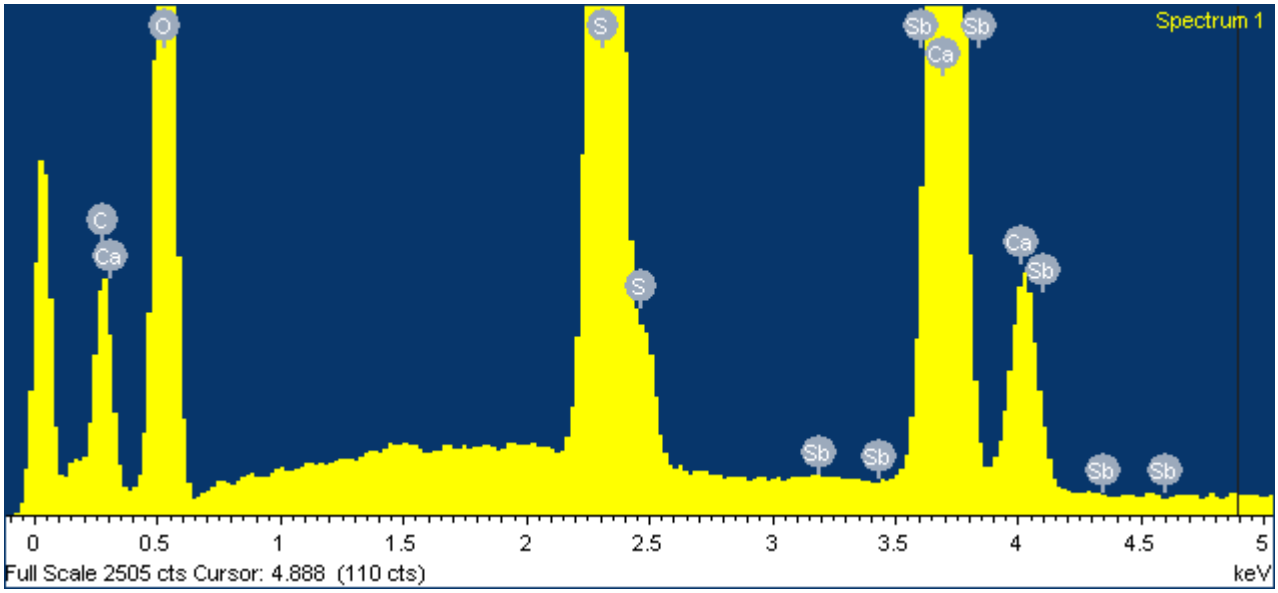


S Ka1

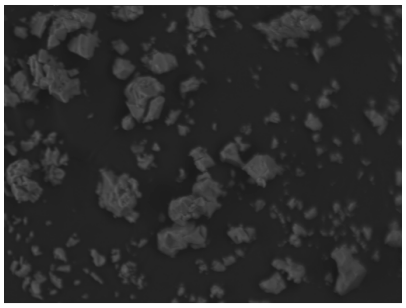
Ca Ka1

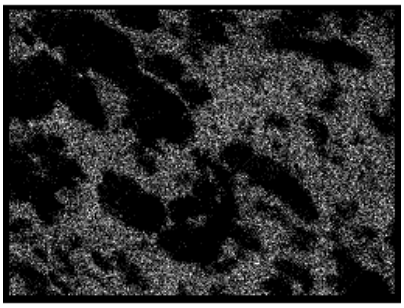
Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1

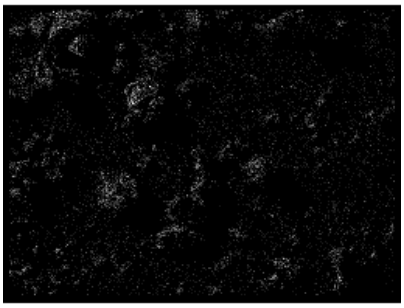


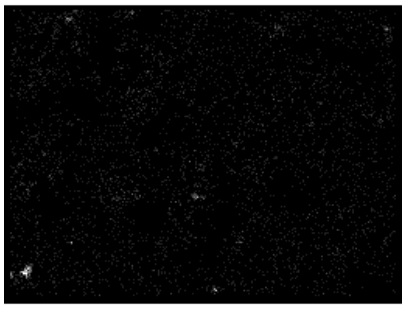


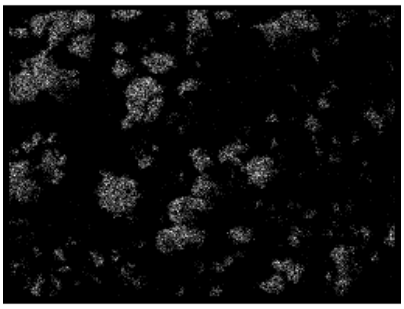
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1

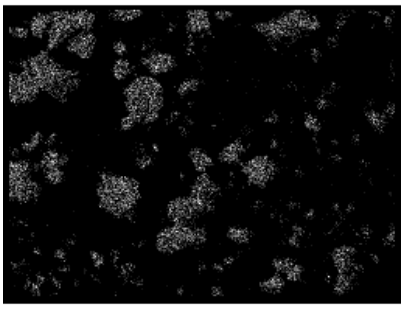

Electron Image 1

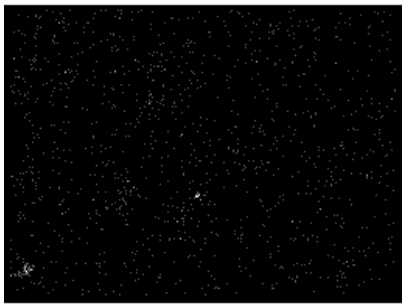

C Ka1_2


O Ka1

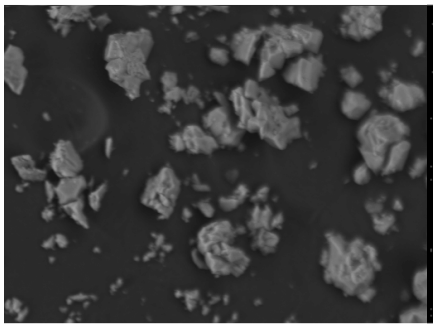

Si Ka1


S Ka1

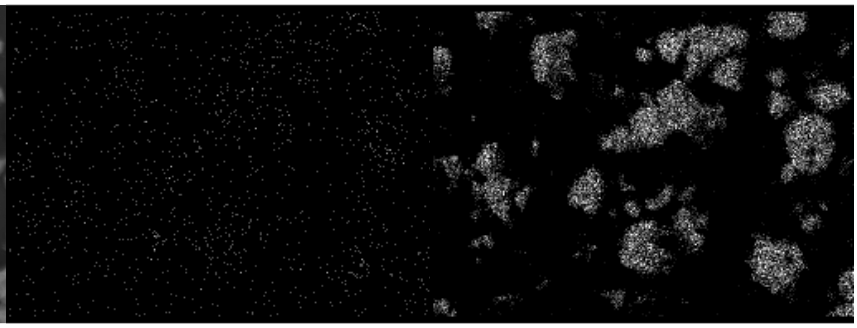

Ca Ka1


Fe Ka1

Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
C, O, Si, S, Ca, Fe

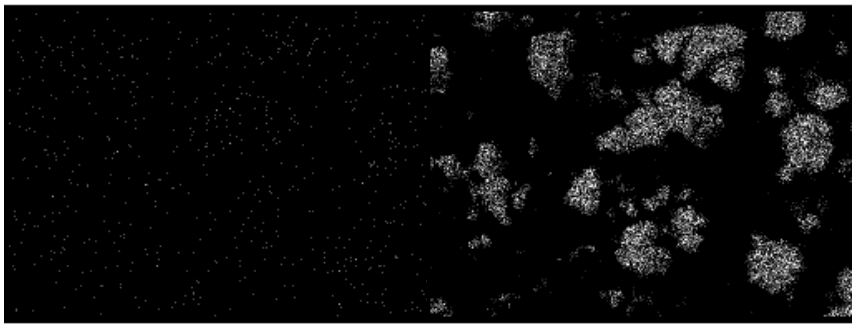


Electron Image 1



Fe Ka1

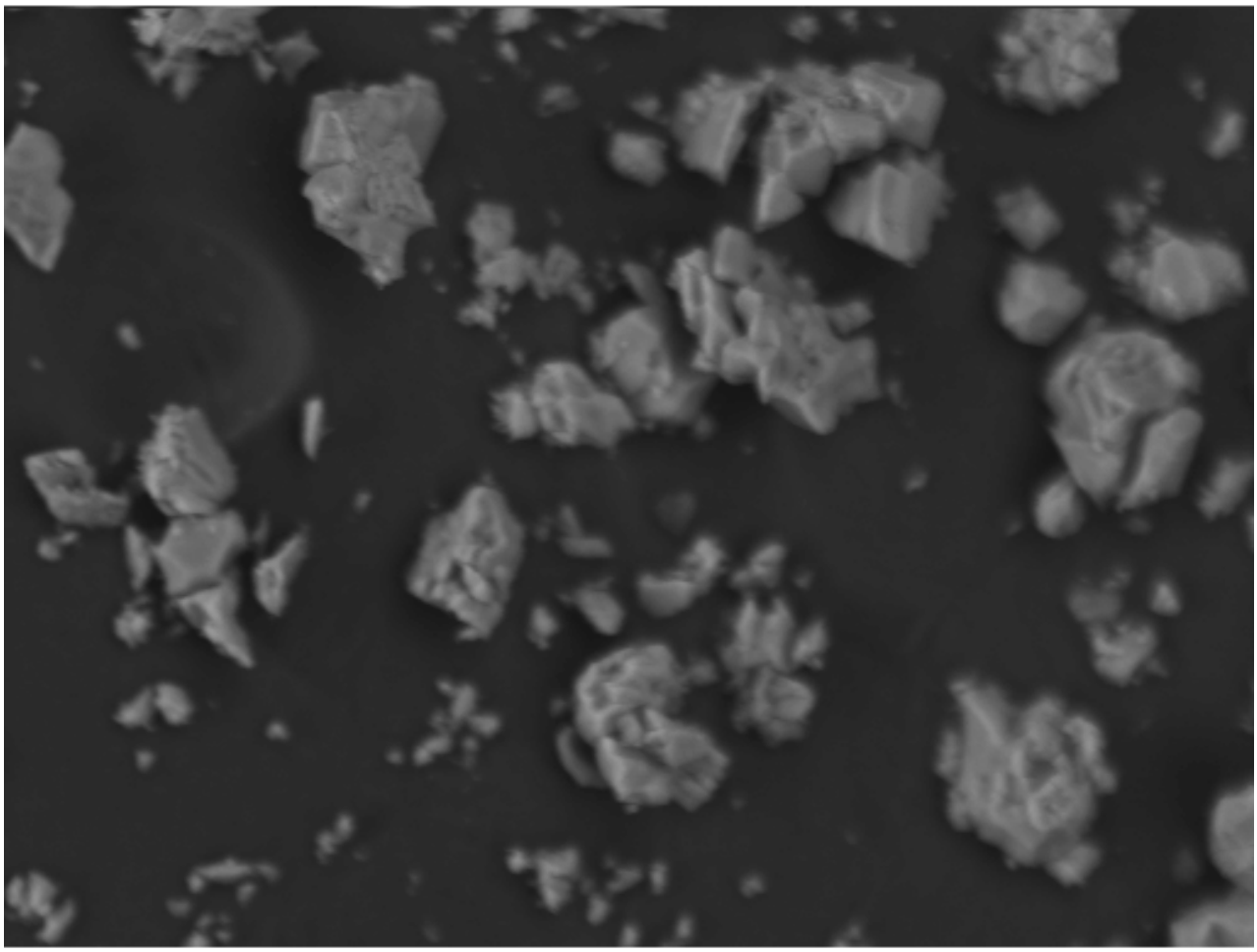
S Ka1

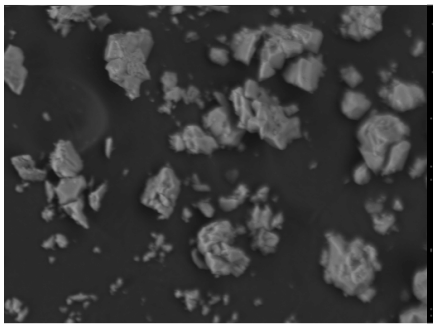


Hg La1

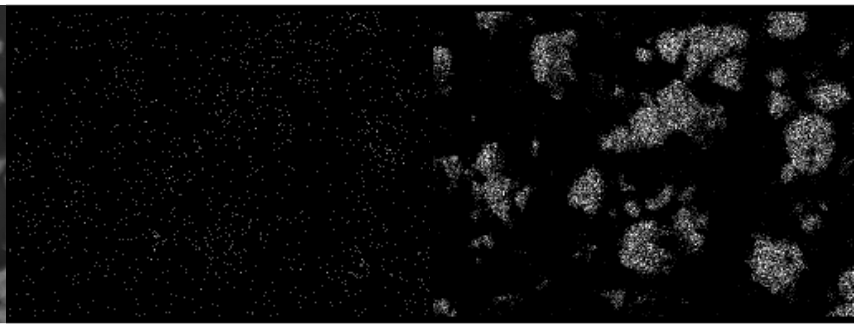
Ca Ka1

Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
Fe, S, Hg, Ca


100µm
Electron Image 1

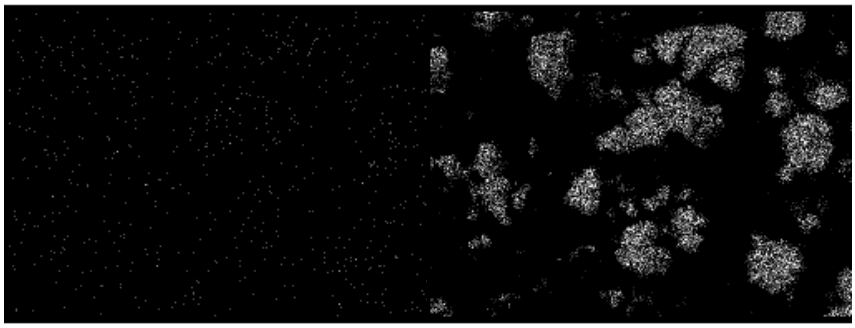


Electron Image 1



Fe Ka1

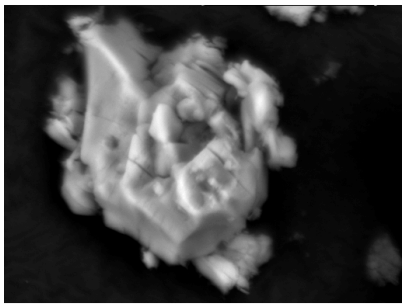
S Ka1

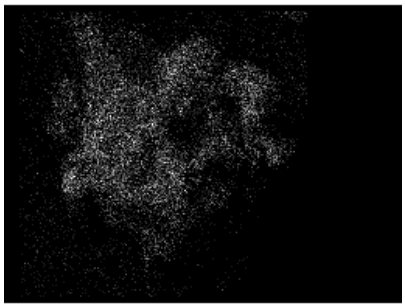


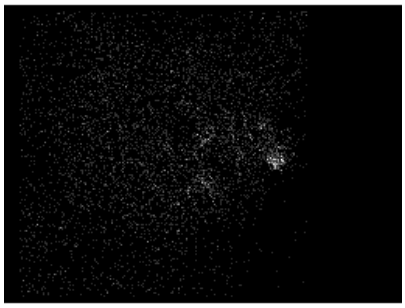
Hg La1

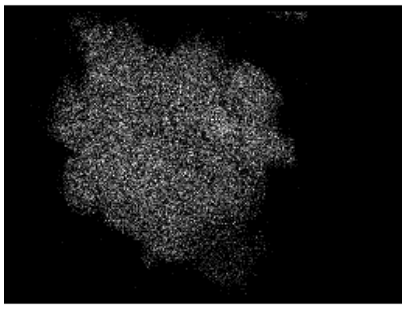
Ca Ka1

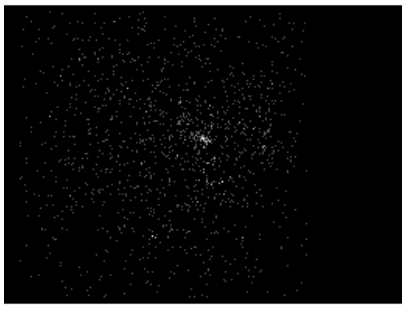
Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1

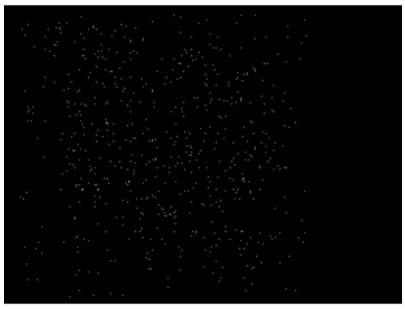

Electron Image 1

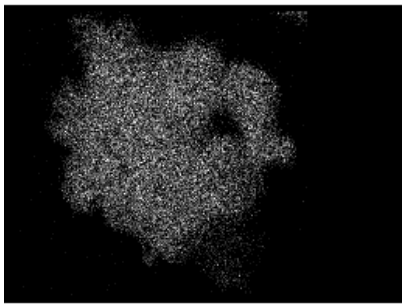

O Ka1

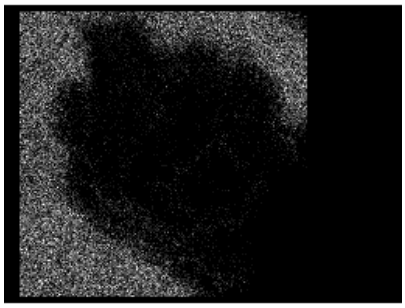

Si Ka1


Ca Ka1

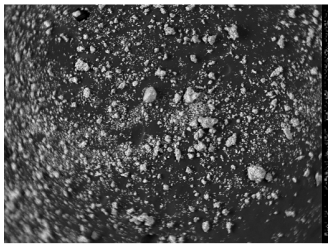

Fe Ka1

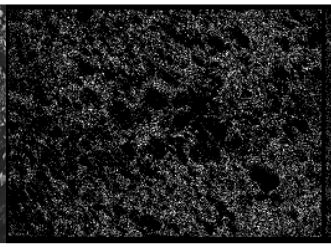

Hg La1

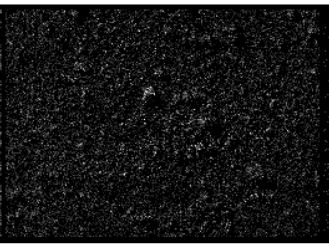

S Ka1

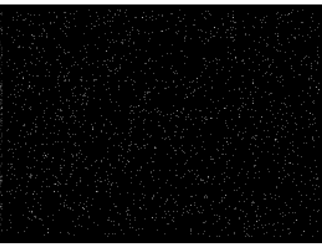

C Ka1_2

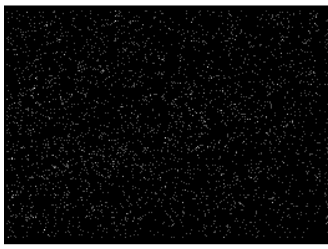
Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
O, Si, Ca, Fe, Hg, S, C

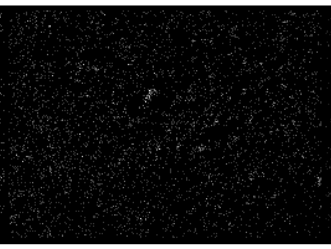

Electron Image 1

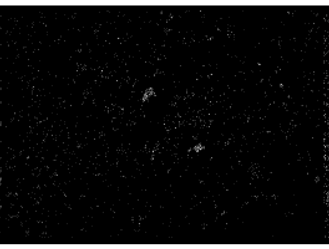

C Ka1_2

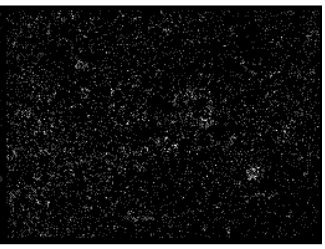

O Ka1

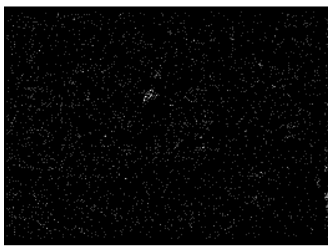

Na Ka1_2

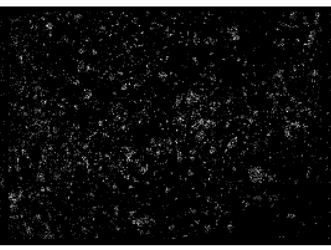

Mg Ka1_2


Al Ka1


Si Ka1

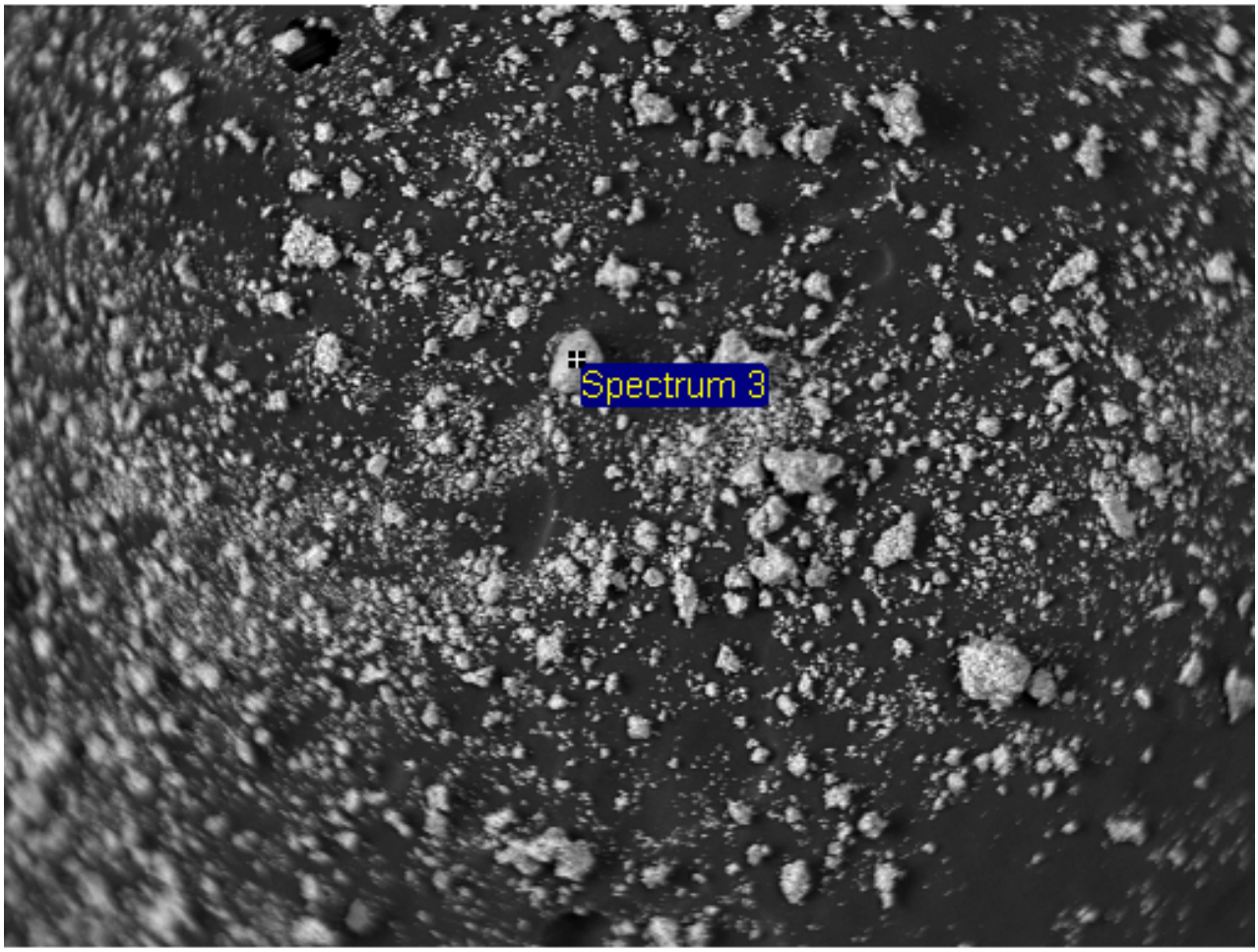

P Ka1

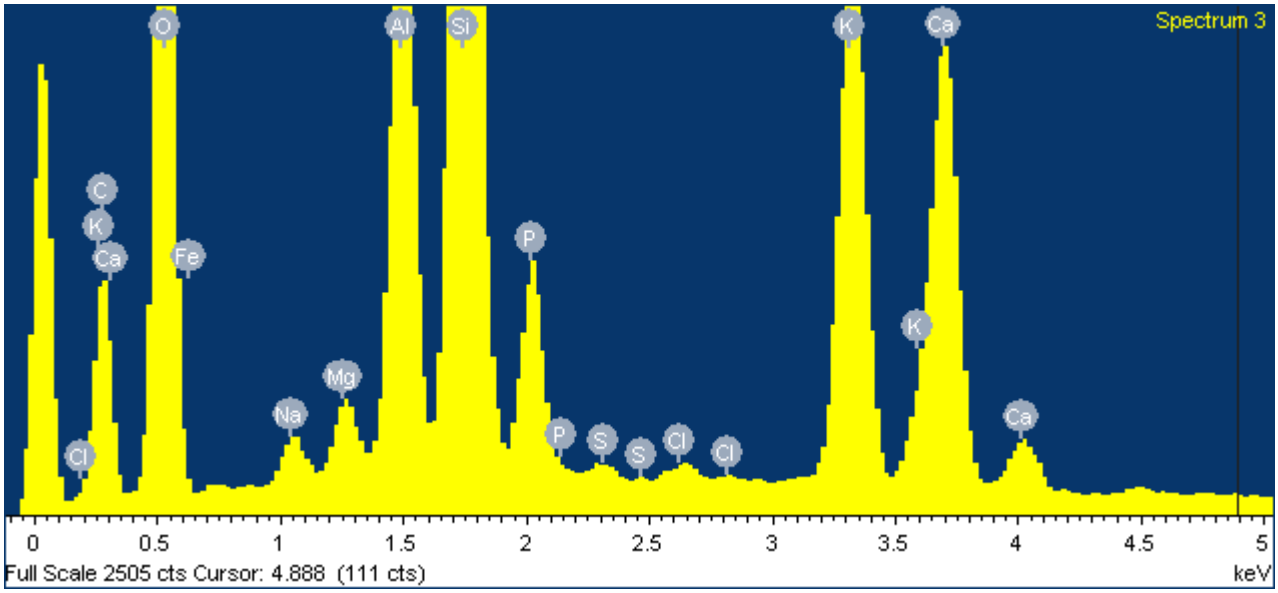

K Ka1


Ca Ka1

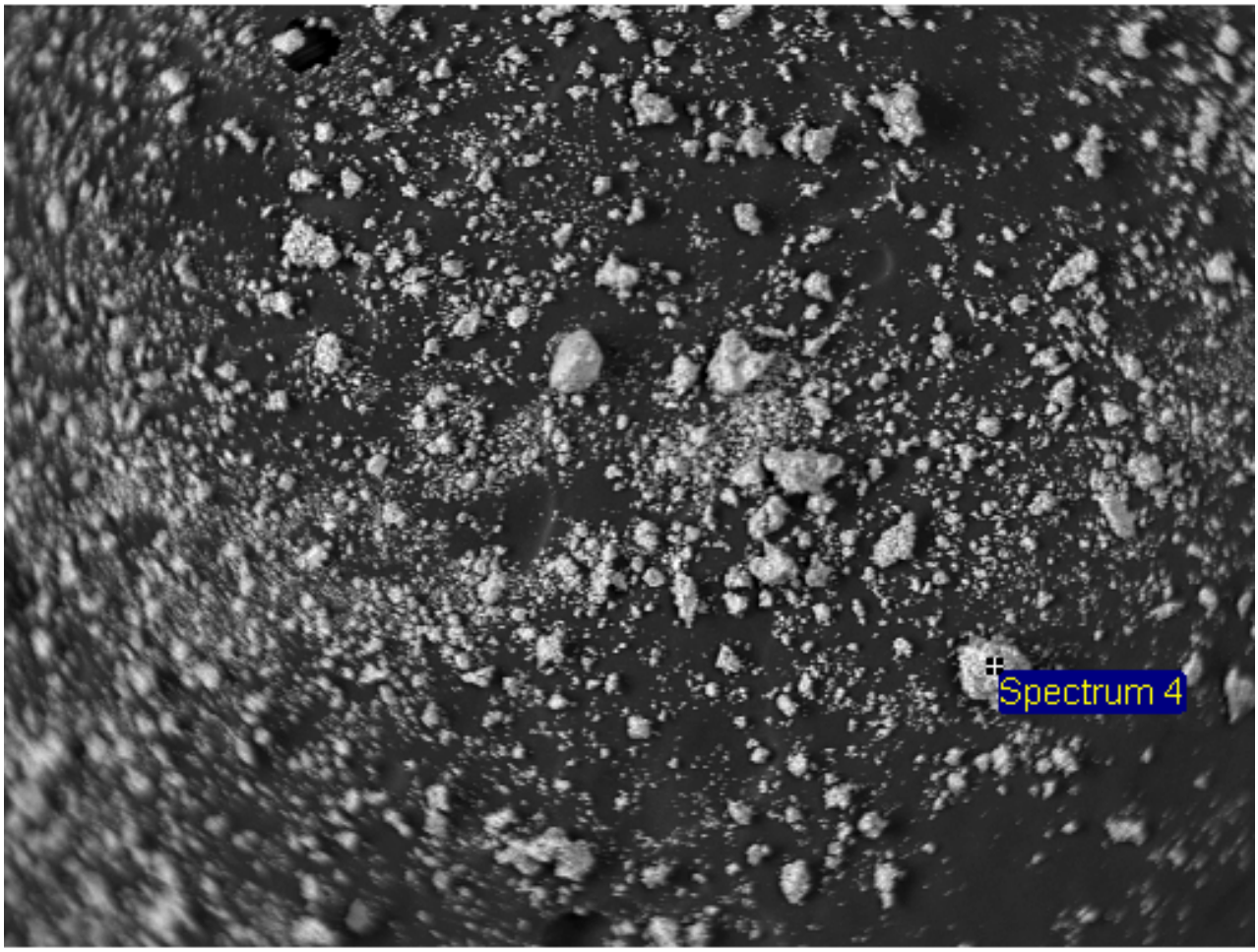

Fe Ka1

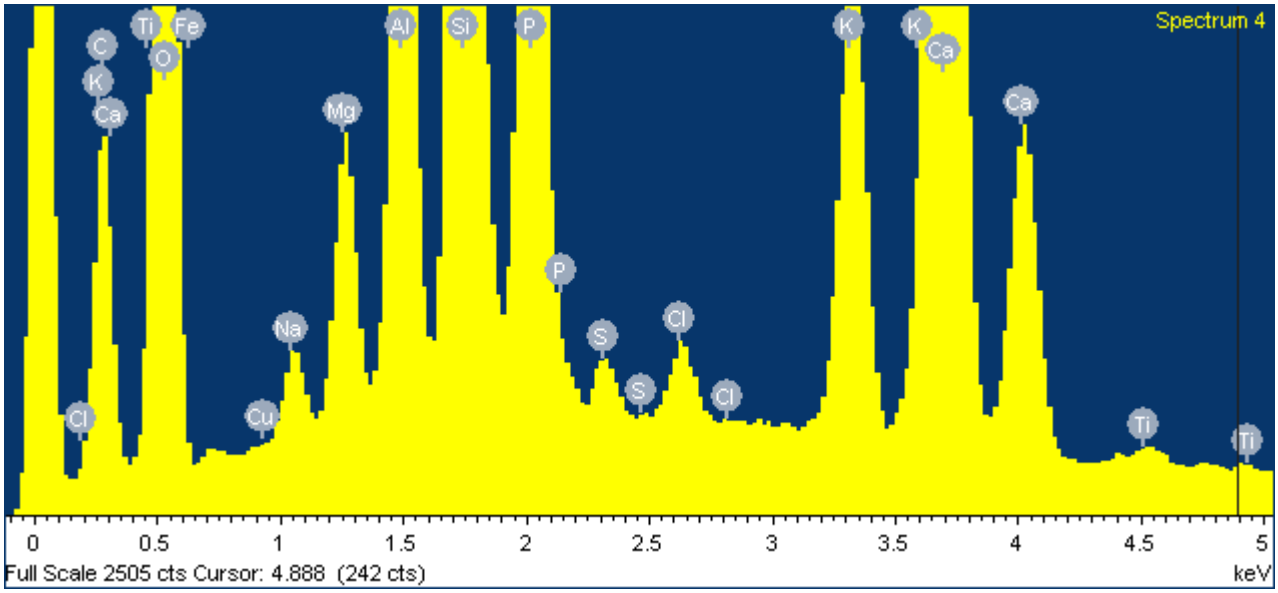
Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
C, O, Na, Mg, Al, Si, P, K, Ca, Fe



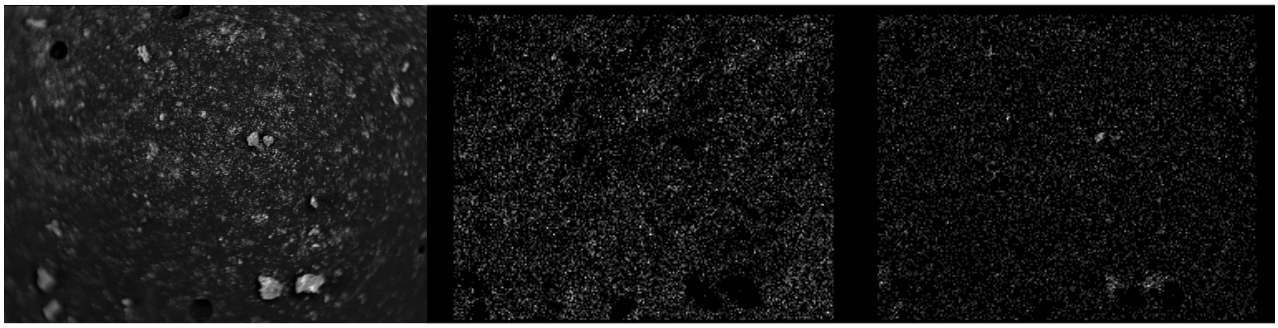


Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1

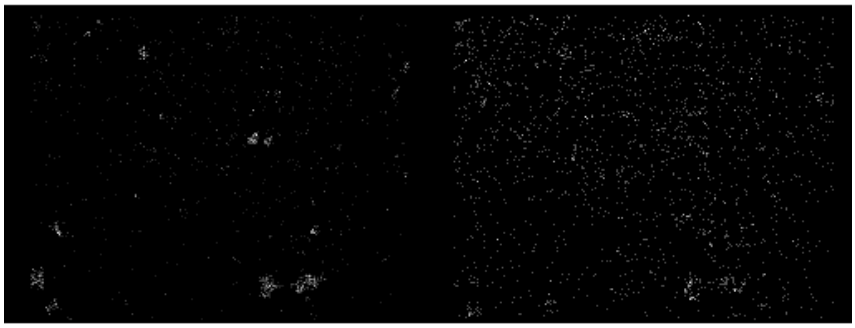




Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1

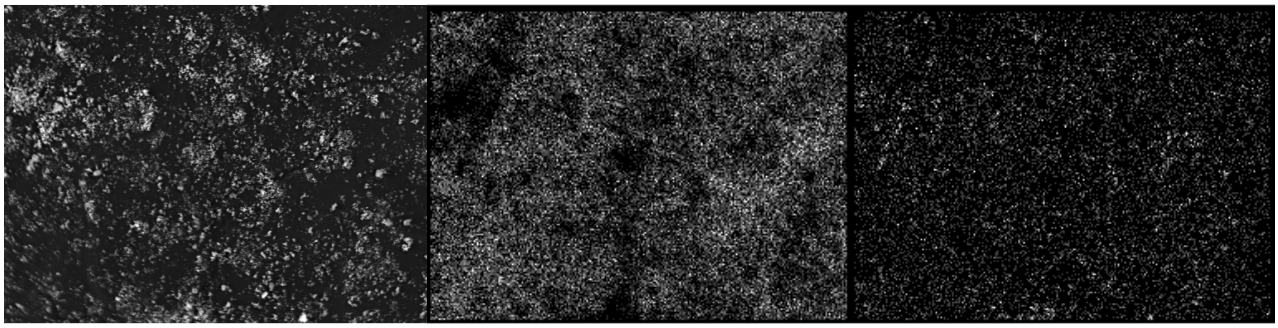


Electron Image 1 | C Ka1_2 | O Ka1

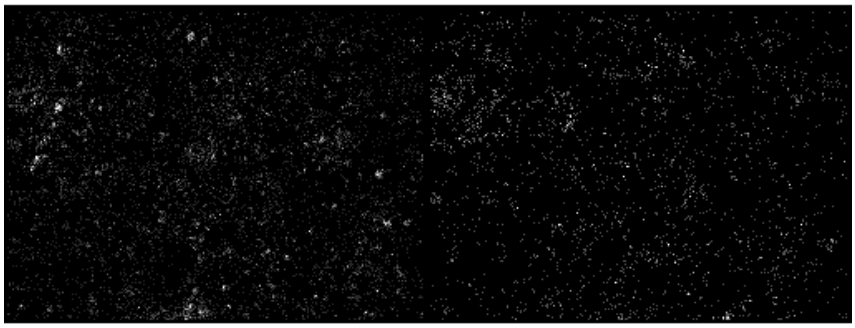


Si Ka1 | Fe Ka1

Comment:12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1

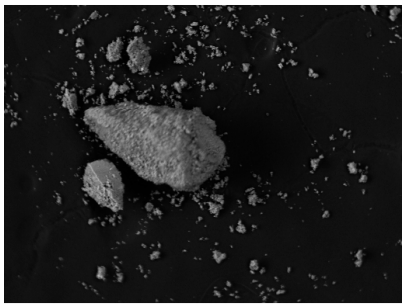


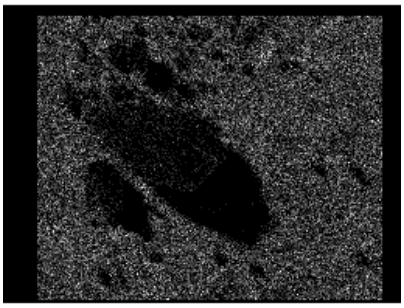
Electron Image 1 | C Ka1_2 | O Ka1

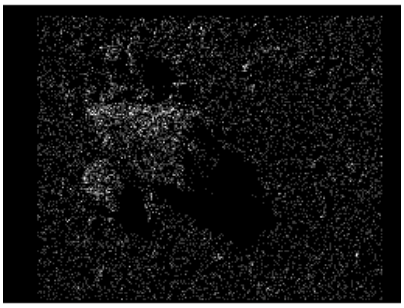


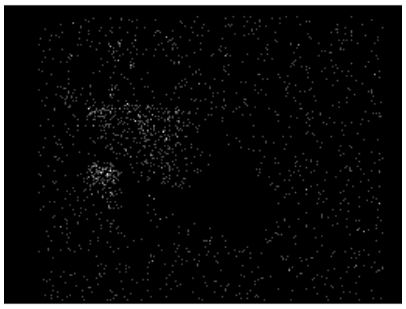
Si Ka1 | Fe Ka1

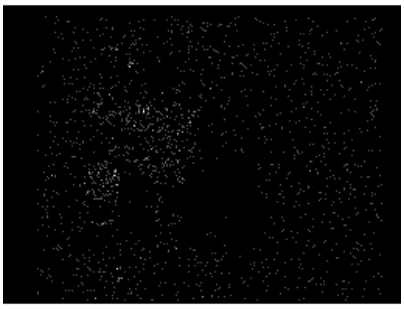
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 1
C, O, Si, Fe

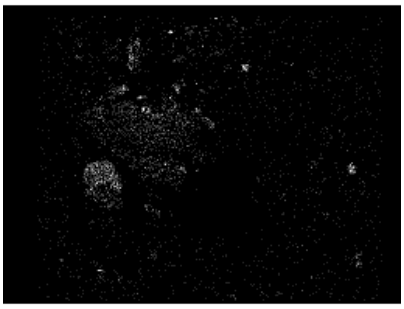

Electron Image 1

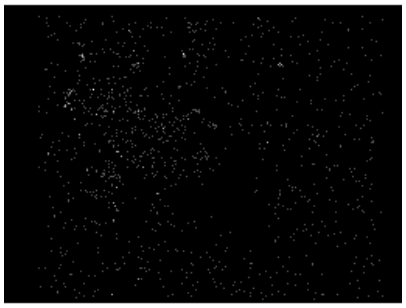

C Ka1_2

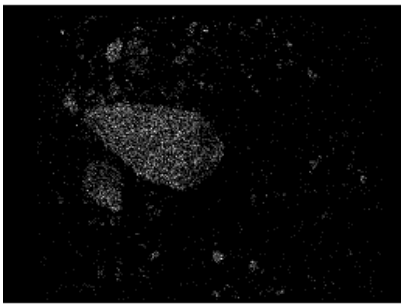

O Ka1

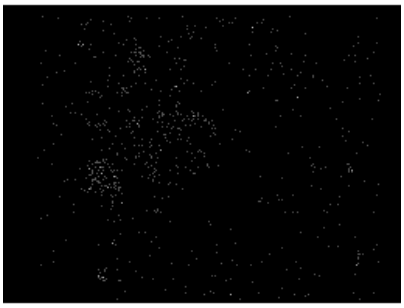

Mg Ka1_2


Al Ka1


Si Ka1


K Ka1


Ca Ka1

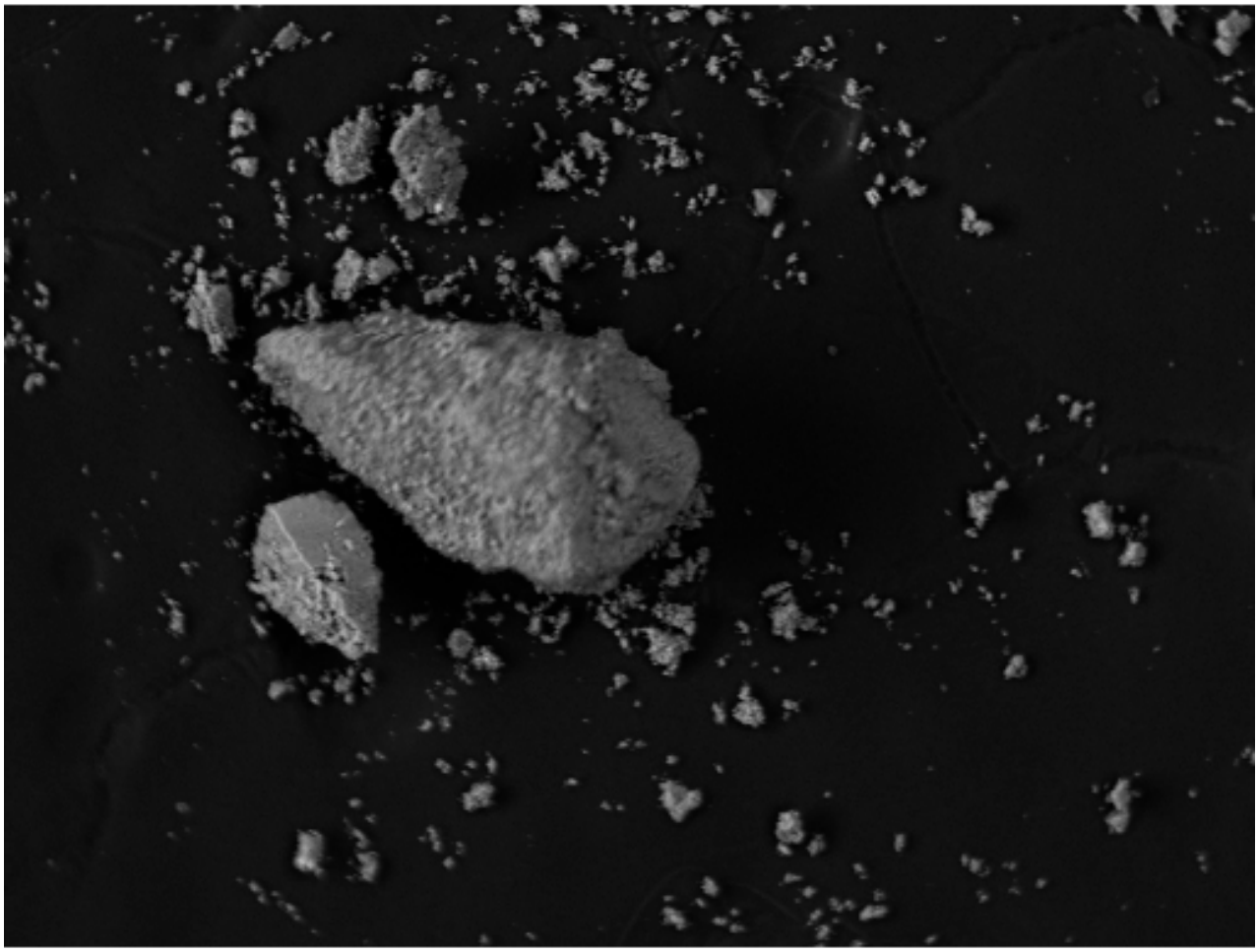

Fe Ka1

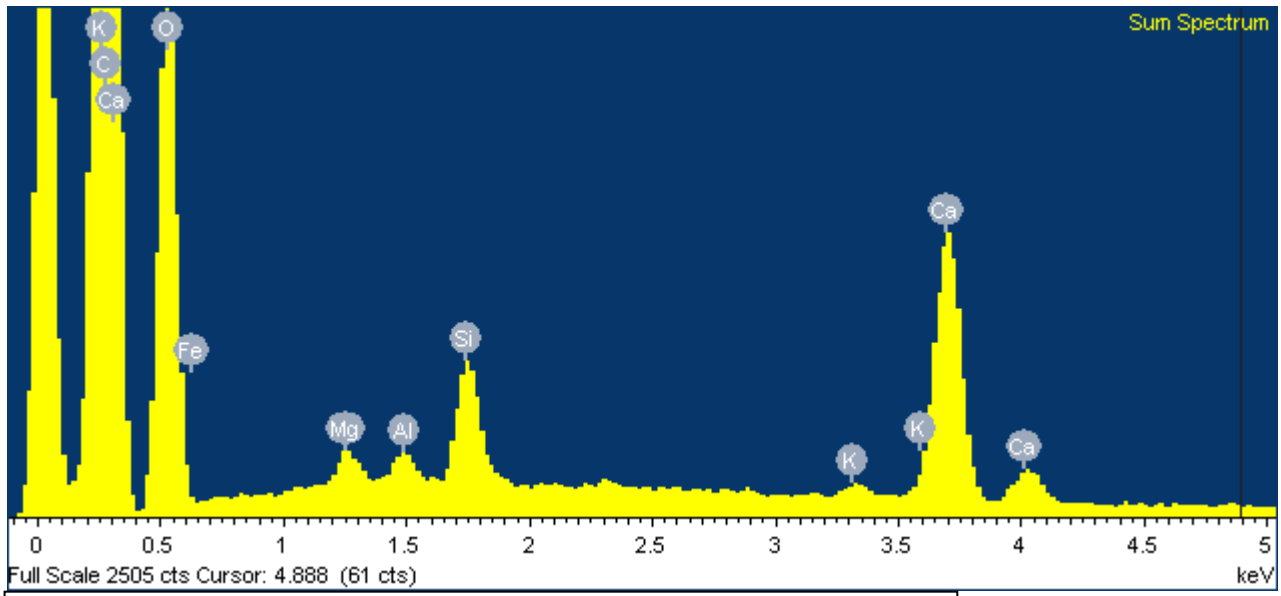
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 2
C, O, Mg, Al, Si, K, Ca, Fe

IST Area 2

IST Area 2 Results

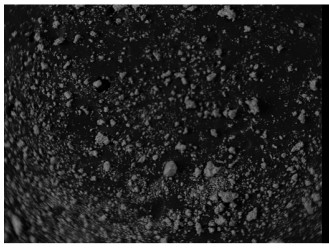
07/11/2013 13:29:01

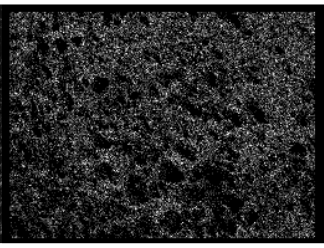


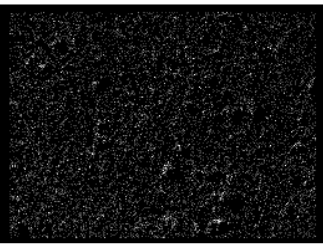


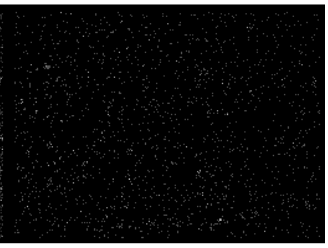
Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 2

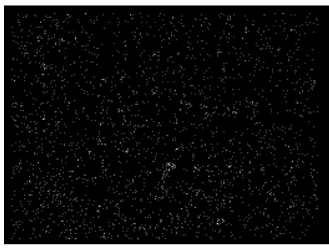
INCA

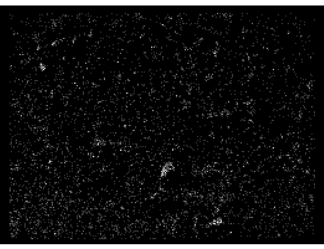

Electron Image 1

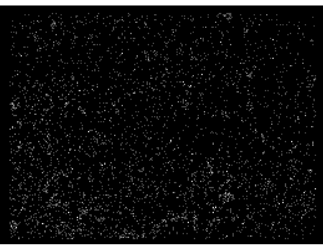

C Ka1_2

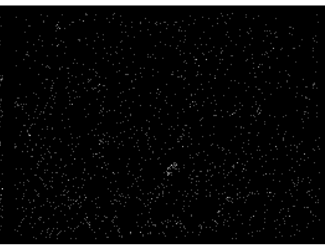

O Ka1

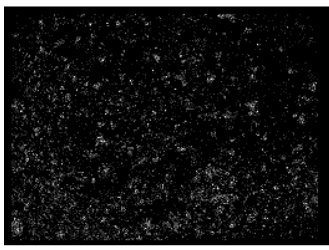

Mg Ka1_2


Al Ka1


Si Ka1


P Ka1


K Ka1


Ca Ka1


Fe Ka1

Comment: 12487 s.7, 12456, 11862 s.6, 11862 s.9.
Area 3
C, O, Mg, Al, Si, P, K, Ca, Fe