

Appendix 1

Elemental Maps

1. Use images from CGM and delete html.
2. All pictures to go to the appendix
3. Results to show the regions measured
4. as well as comparisons
5. For result description see Carol's PIXE chapter
6. Control??

1. zamx_w290_4-regions-PIXE, WW14 8a North West (West Wits) high Au +Ur).

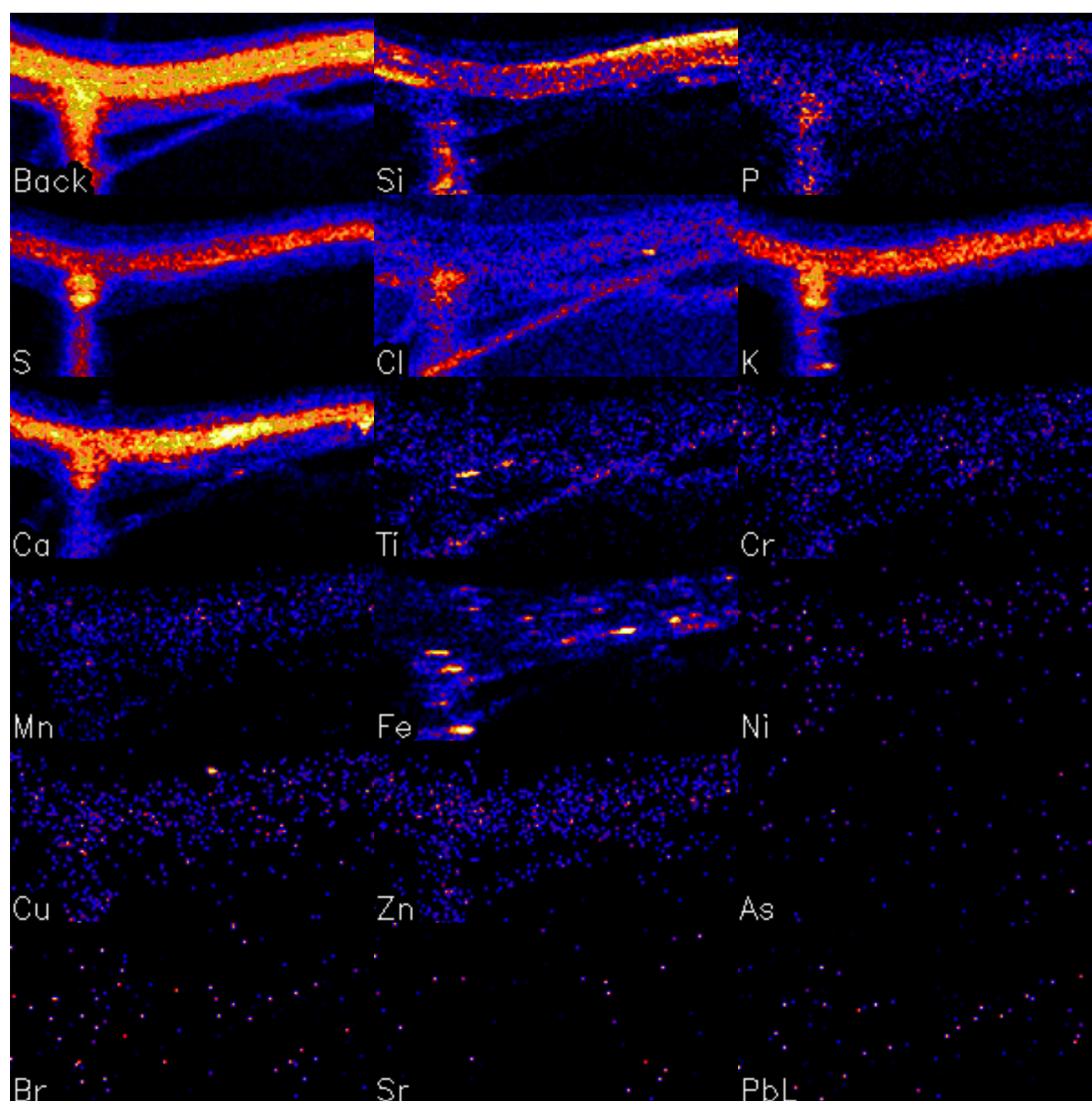
File Name: zamx_w290_4.evt,

Dynamic Matrix: zamx_w290_4q0.dam

Charge: 1568 μC

Scan: X= 834 μm , Y= 423 μm

Pixel: X size: 128, Y Size: 64



Relative Concentration Legend



Fig 3.5.7: zamx_w290_4-regions-PIXE, WW14 8a North West (West Wits) high Au +U).
In this sample, Cl, Fe, K, Ca, Ti, Si, and P were localized in both the root and the external Hyphae.

2. zamx_w290_6-regions-PIXE, WW14 8a, North West (West Wits) high Au +Ur).

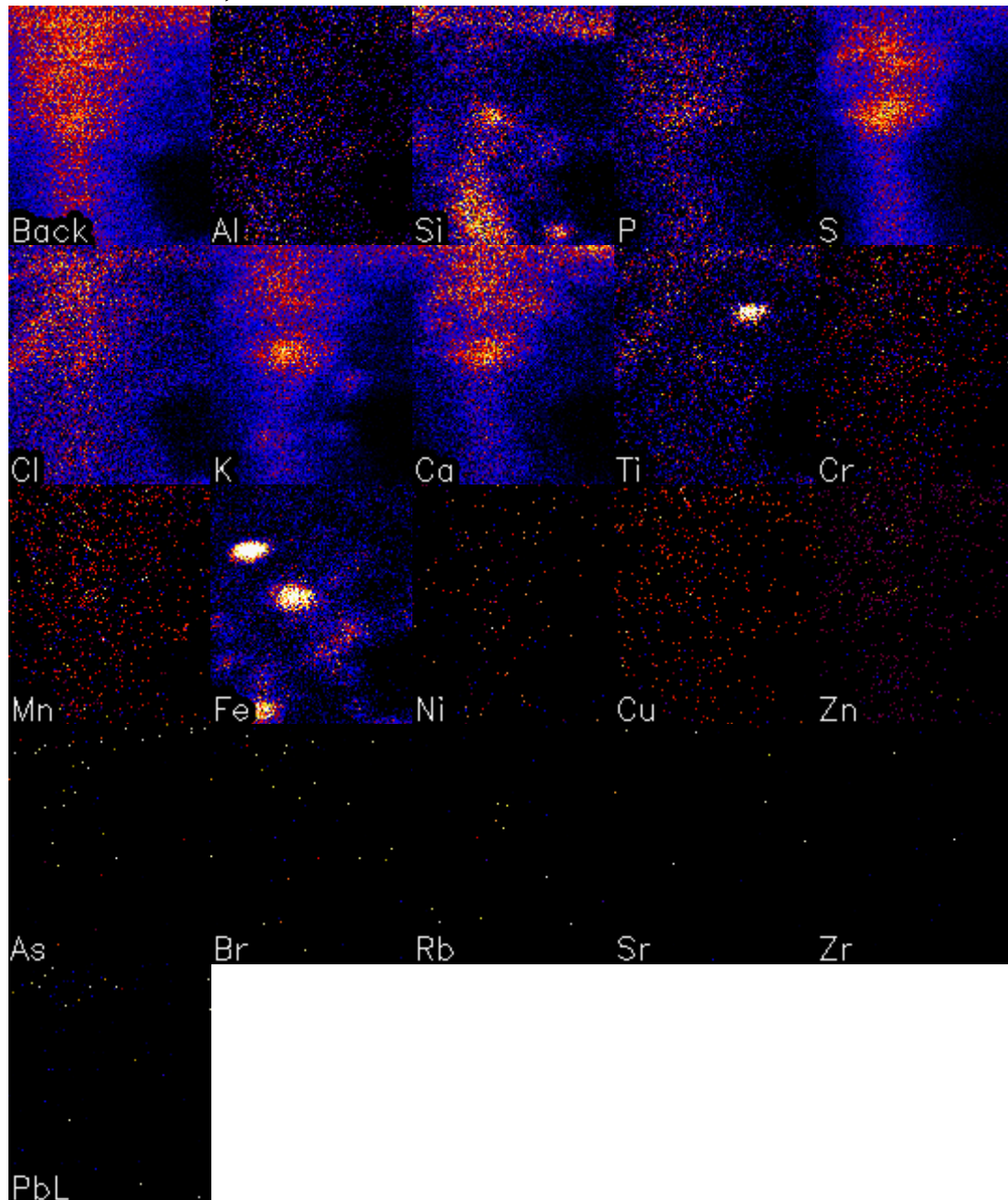
File Name: zamx_w290_6.evt,

Dynamic Matrix: zamx_w290_6q0.dam

Charge: 651 μC

Scan: X= 143 μm , Y= 167 μm

Pixel: X size: 108, Y Size: 128



Relative Concentration Legend



Fig 3.5.8: zamx_w290_6-regions-PIXE, WW14 8a, North West (West Wits) high Au +Ur). Fe, K, Ca, Ti, S and Si were localized in the root AMF Vesicles with Fe

extensively expressed as compared to other elements. These correlate with the elemental concentration shown on the **table 1** (insert Pictures).

3. D1 (MP) 5 East Rand (ER)Metallurgical Plant (MP) Regions 0 -3 (zamx_w290_7-regions-PIXE).

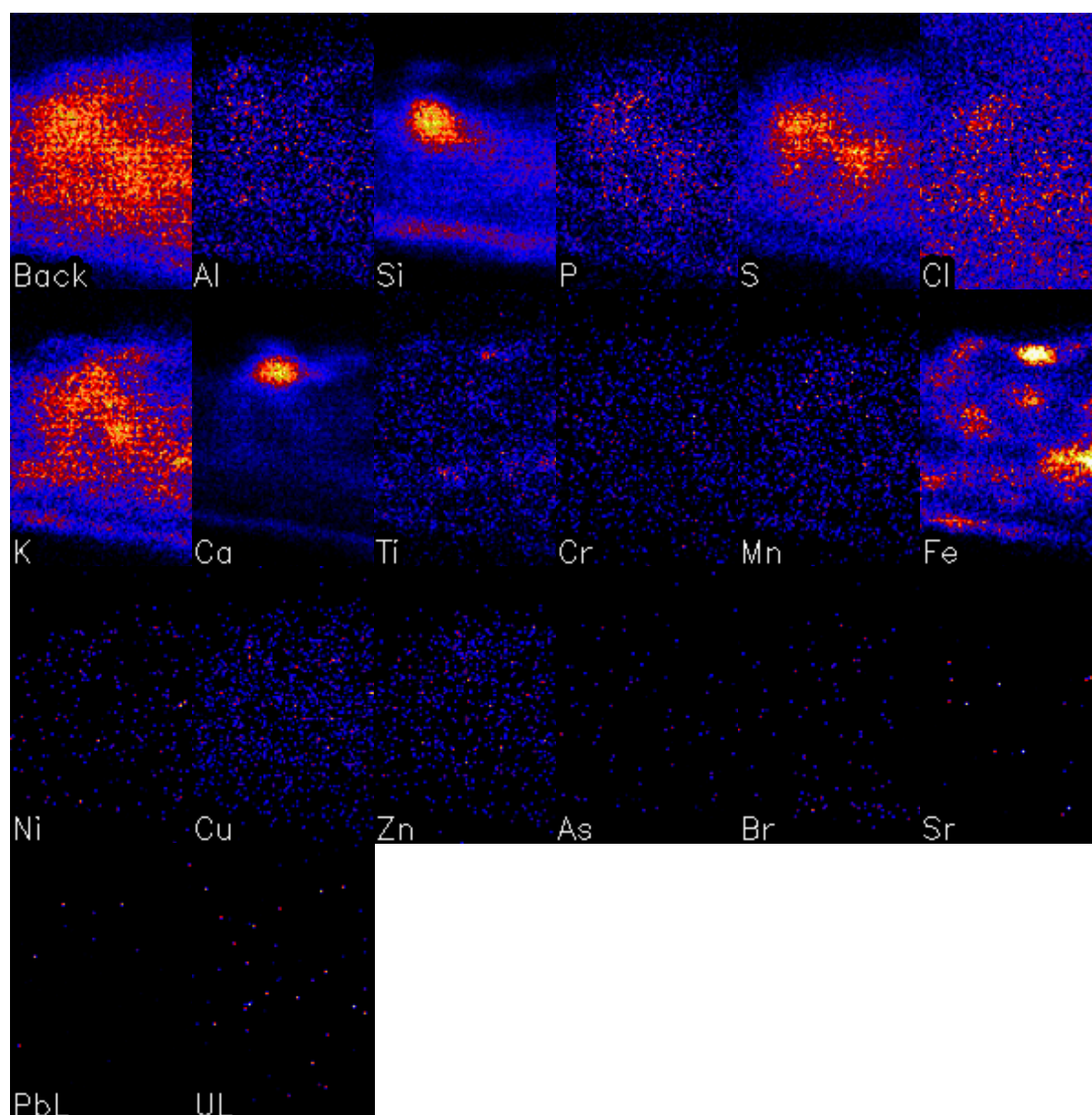
File Name: zamx_w290_7.evt

Dynamic Matrix: zamx_w290_7q0.dam

Charge: 769 μC

Scan: X= 110 μm , Y= 167 μm

Pixel: X size: 84, Y Size: 128



Relative Concentration Legend



Fig 3.5.9: D1 (MP) 5 East Rand (ER)Metallurgical Plant (MP) Regions 0 -3 (zamx_w290_7-regions-PIXE). Ca, Fe, K, S, Ti and Si were localized in the root AMF Vesicles with Fe extensively expressed as compared to other elements.

4. (M15 A2) North West (Vaal Reefs) Au +Ur) Regions 0 -4 (zamx_w290_8-regions-PIXE).

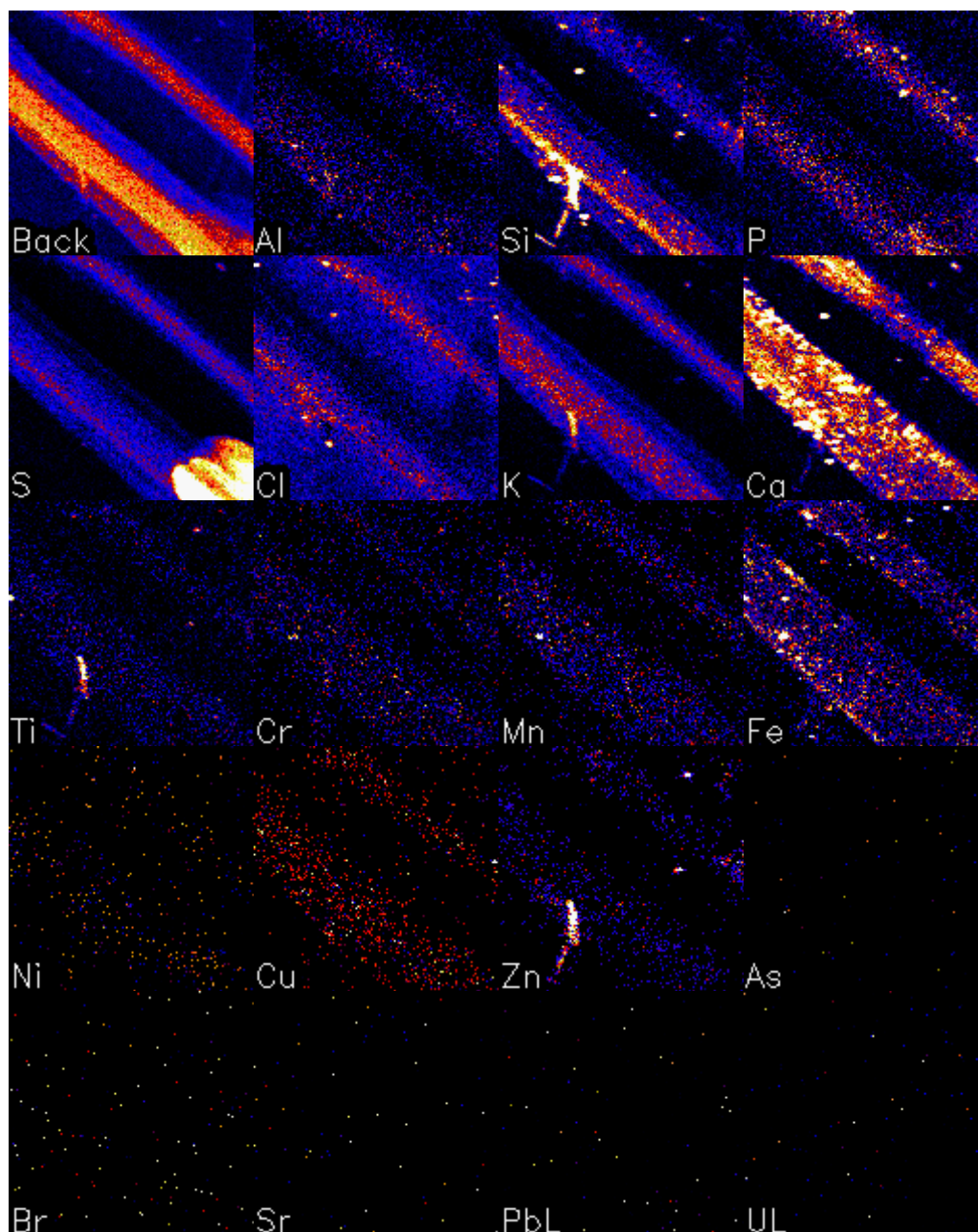
File Name: zamx_w290_8.evt

Dynamic Matrix: zamx_w290_8q0.dam

Charge: 3656 μC

Scan: X= 667 μm , Y= 668 μm

Pixel: X size: 128, Y Size: 128



Relative Concentration Legend



Fig 3.5.10: (M15 A2) North West (Vaal Reefs) Au +Ur) Regions 0 -4 (zamx_w290_8-regions-PIXE). Ca, Cl, Fe, K, P, Si, Zn and Ti, were localized in both roots and Hyphae with Fe and Ca extensively expressed as compared to other elements. Zn, Si, K and Ti were extensively expressed in Hyphae more than in roots itself.

5. Ctr + Myco 8 R1 Rem (Regions 0 -3) (zamx_w290_9-regions-PIXE).

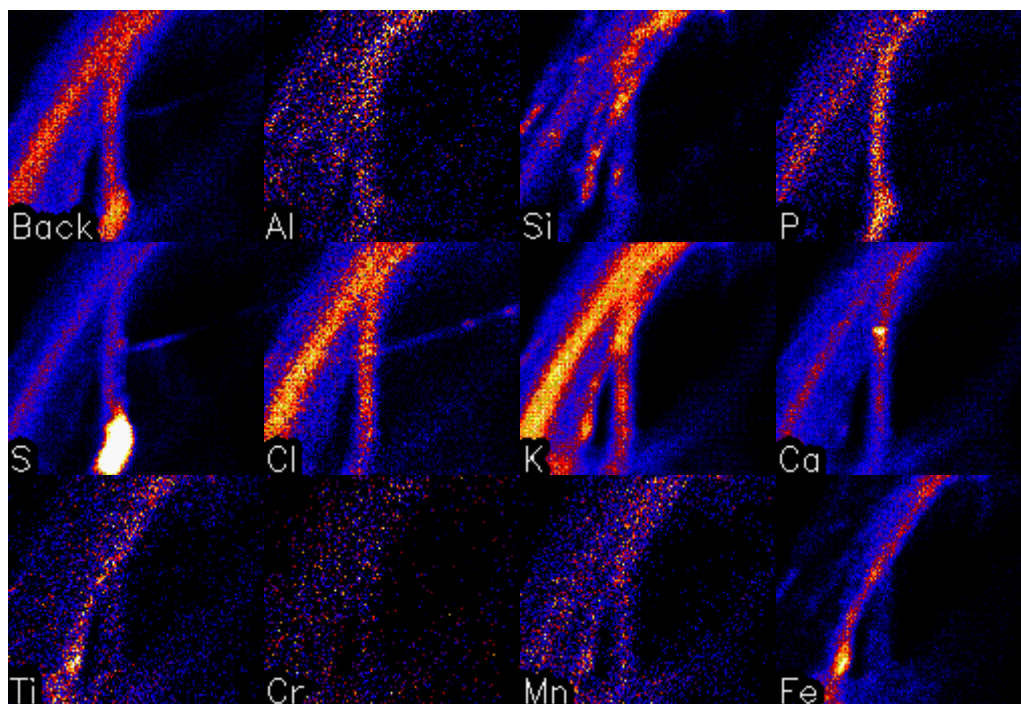
File Name: zamx_w290_9.evt

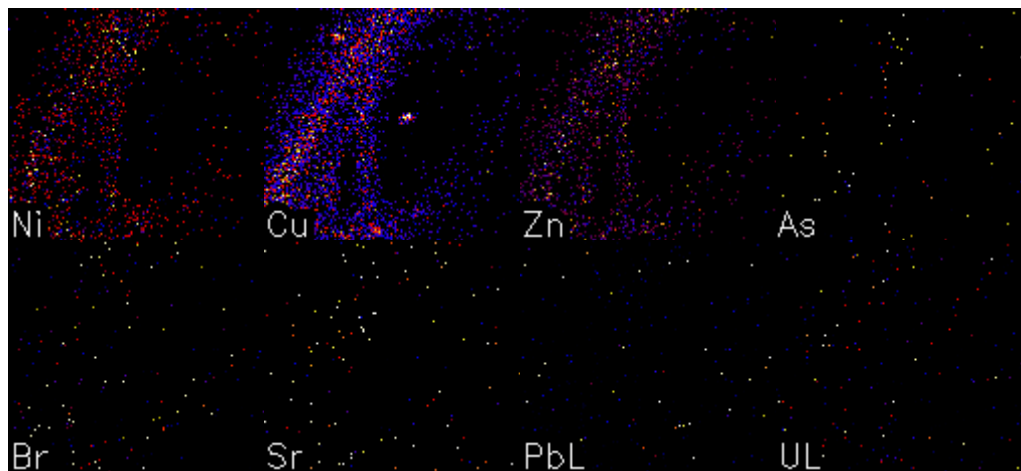
Dynamic Matrix: zamx_w290_9q0.dam

Charge: 1705 μC

Scan: X= 417 μm , Y= 382 μm

Pixel: X size: 128, Y Size: 116





Relative Concentration Legend



Fig 3.5.11: Ctr + Myco 8 R1 Rem (Regions 0 -3) (zamx_w290_9-regions-PIXE). Al, Ca, Cl, Fe, K, P, Si, Cu Mn, Zn, and Ti, were localized in both roots and Hyphae with Cl and K extensively expressed as compared to other elements. Cu and Ti were extensively expressed in AMF structures more than in roots itself.

6. Ctr + Nu R2 (4) (zamx_w295_10-regions-PIXE).

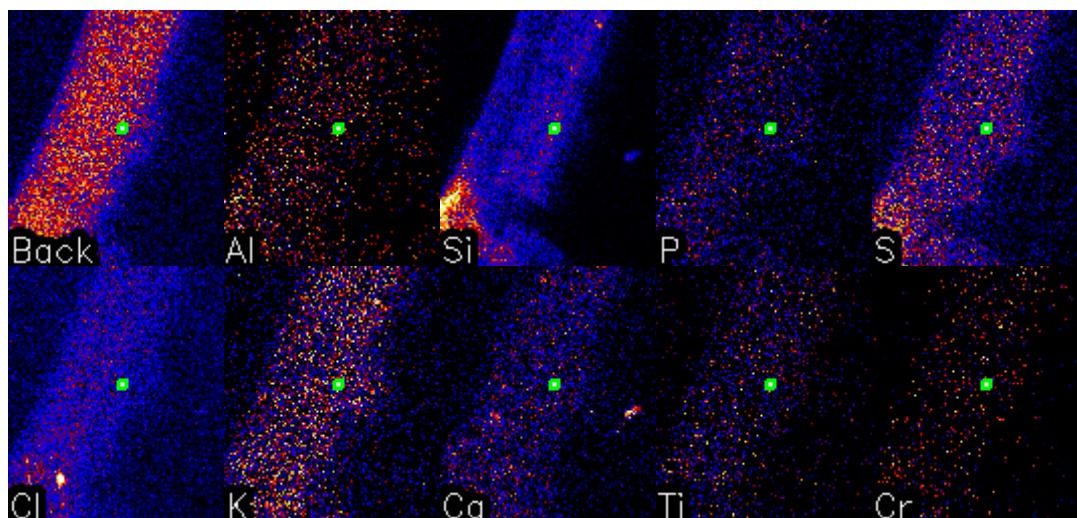
File Name: zamx_w295_10.evt

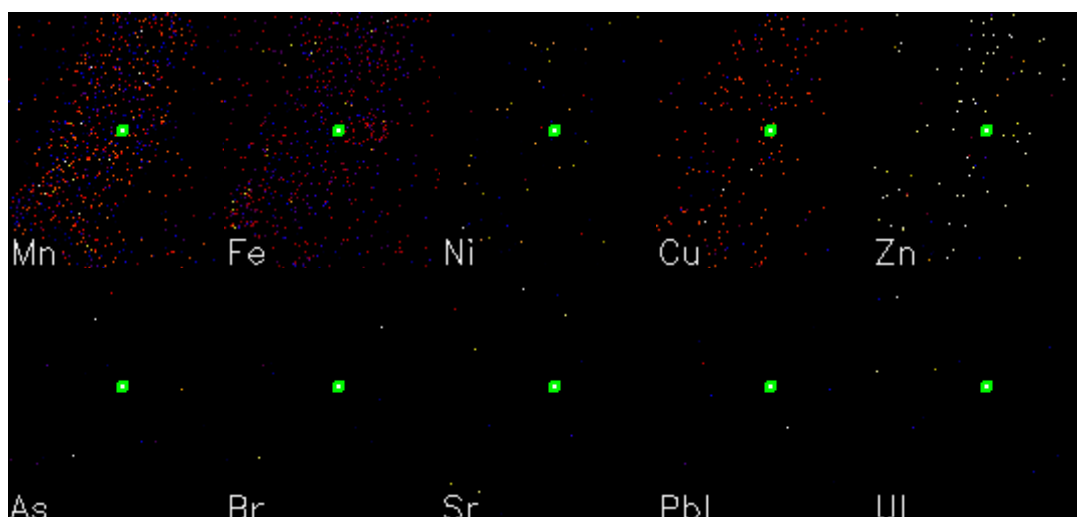
Dynamic Matrix: zamx_w295_10q0.dam

Charge: 459 μ C

Scan: X= 215 μ m, Y= 251 μ m

Pixel: X size: 108, Y Size: 128





Relative Concentration Legend



Fig 3.5.12: Ctr + Nu R2 (4) (zamx_w295_10-regions-PIXE). Al, Ca, Cl, and Si were localized in AMF roots in low amount. This is a control with no spores and elements added. Eragrostis grass was grown in Zeolite and nutrient solution only. Thus less or not elemental concentration is expected.

7. Gauteng Egness Mine ABB5 R2 (5) (zamx_w295_11-regions-PIXE).

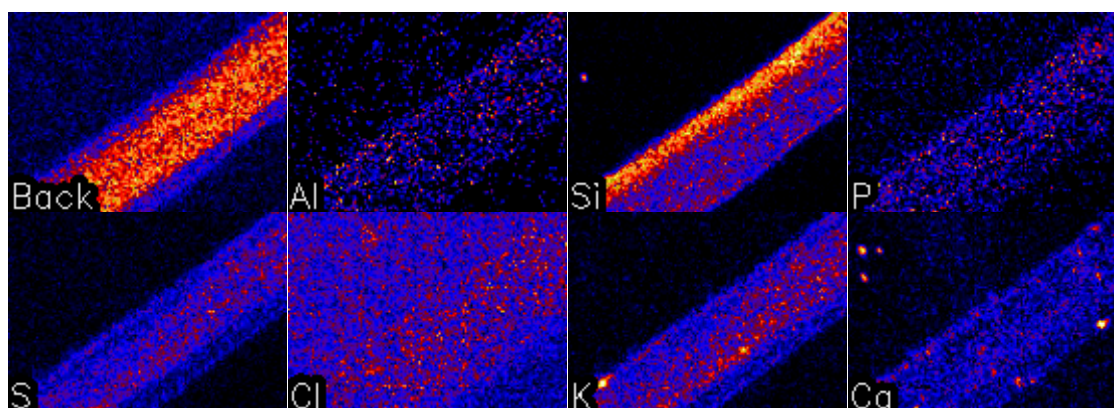
File Name: zamx_w295_11.evt

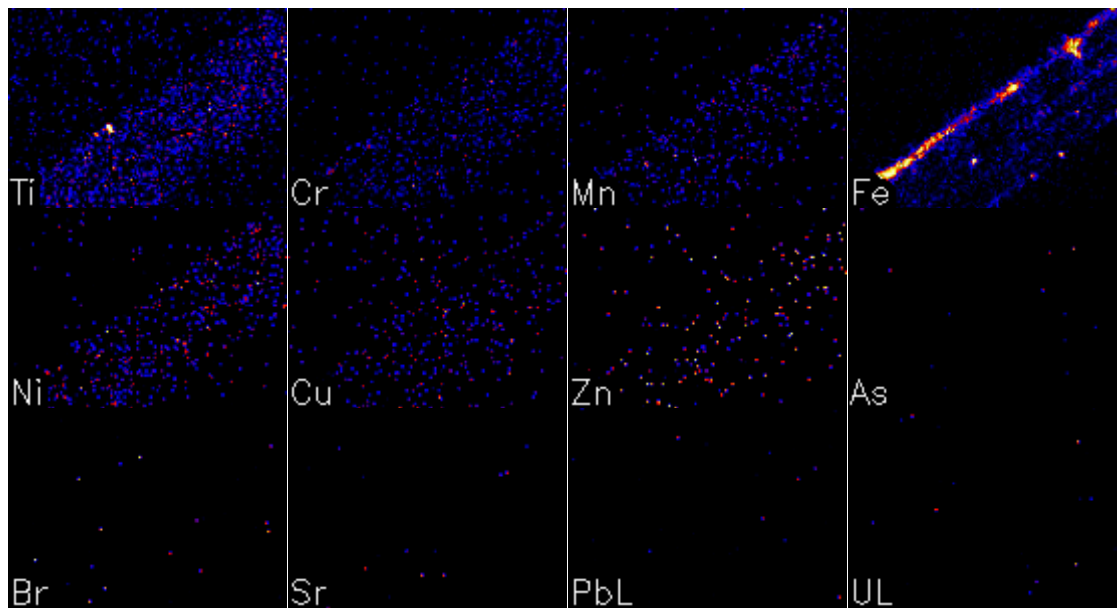
Dynamic Matrix: zamx_w295_11q0.dam

Charge: 698 μC

Scan: X= 250 μm , Y= 180 μm

Pixel: X size: 128, Y Size: 92





Relative Concentration Legend



Fig 3.5.13: Gauteng Egness Mine ABB5 R2 (5) (zamx_w295_11-regions-PIXE). Ca, Fe, K, Si, and Ti, were localized in AMF roots with low concentration. Ti and Ca appear to be in low concentration on the elemental maps.

8. Gauteng Egness Mine ABB5 R2 (5) (zamx_w295_12-regions-PIXE).

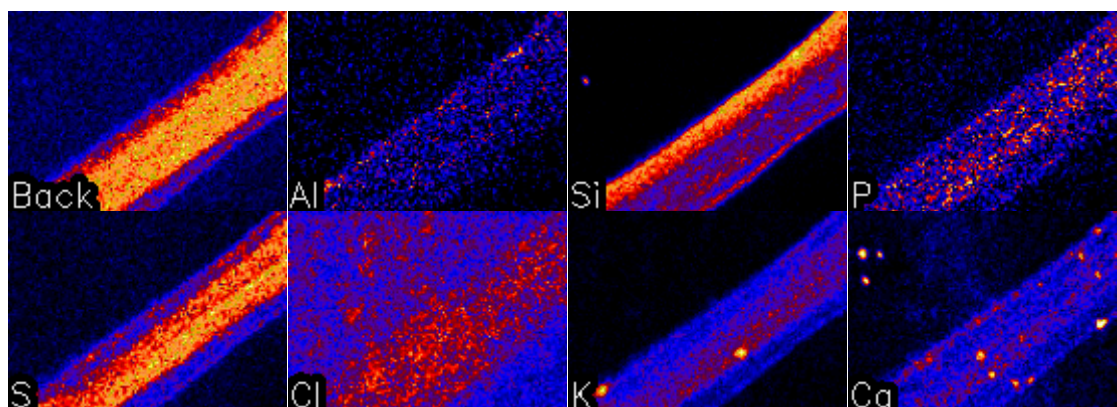
File Name: zamx_w295_12.evt

Dynamic Matrix: zamx_w295_12q0.dam

Charge: 2369 μC

Scan: X= 250 μm , Y= 180 μm

Pixel: X size: 128, Y Size: 92



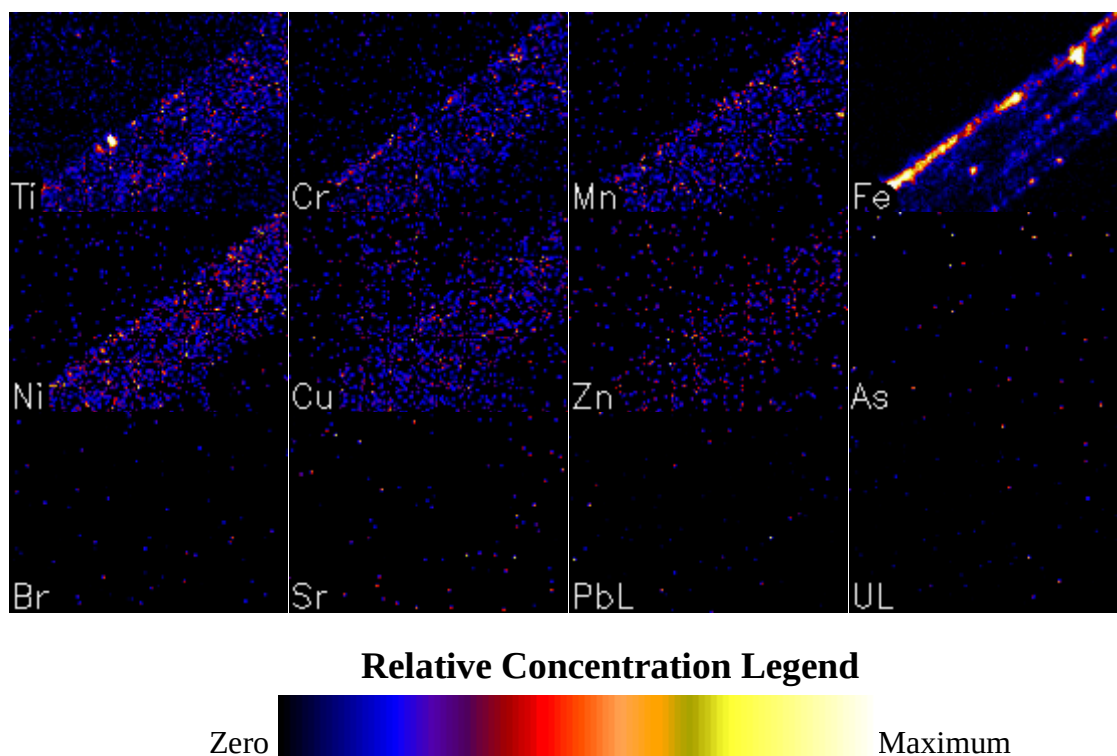


Fig 3.5.14: Gauteng, Agnes Mine ABB5 R2 (5) (zamx_w295_12-regions-PIXE) Repeat of Fig 3.5.12 above . Ca, Cl, Fe, K, P, S, Si, and Ti, were localized in AMF roots with low concentration. Ti and Ca appear to be in low concentration on the elemental maps. Cl , P, S and Si appear to be wide spread across the root. Ca, Fe, Ti and K, appear to be accumulated in vesicles and Hyphae.

9. East Rand (ER)Metallurgical Plant (MP) A2 + A5 R1 (2)(zamx_w295_13-regions-PIXE).

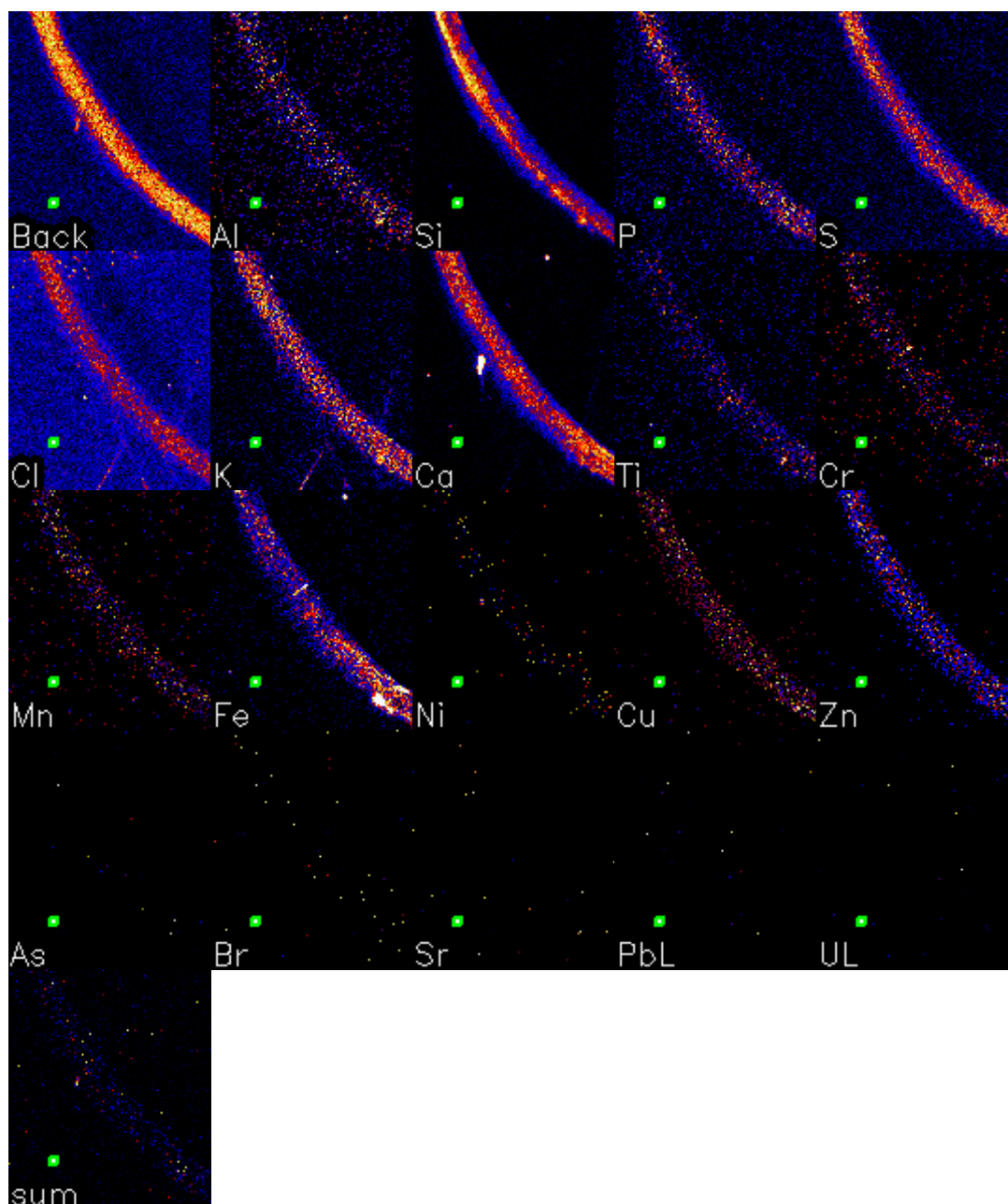
File Name: zamx_w295_13.evt

Dynamic Matrix: zamx_w295_13q0.dam

Charge: 1650 μC

Scan: X= 493 μm , Y= 581 μm

Pixel: X size: 108, Y Size: 128



Relative Concentration Legend



Fig 3.5.15: East Rand (ER)Metallurgical Plant (MP) A2 + A5 R1 (2)(zamx_w295_13-regions-PIXE). Ca, Cl, Fe, Cu, Zn, K, Mn P, S, Ti and Si, were localized in AMF roots with low concentration. Ti and Mn appear to be in low concentration on the elemental maps. Ca, Cl, Cu, Zn, P, S, and Si appear to be wide spread across the root. Fe, Ti and K, appear to be accumulated in vesicles and Hyphae.

10. East Rand (ER)Metallurgical Plant (MP) A2 + A5 R1 (2)(zamx_w295_14-regions-PIXE).

File Name: zamx_w295_14.evt

Dynamic Matrix: zamx_w295_14q0.dam

Charge: 1217 μC

Scan: X= 158 μm , Y= 166 μm

Pixel: X size: 120, Y Size: 128

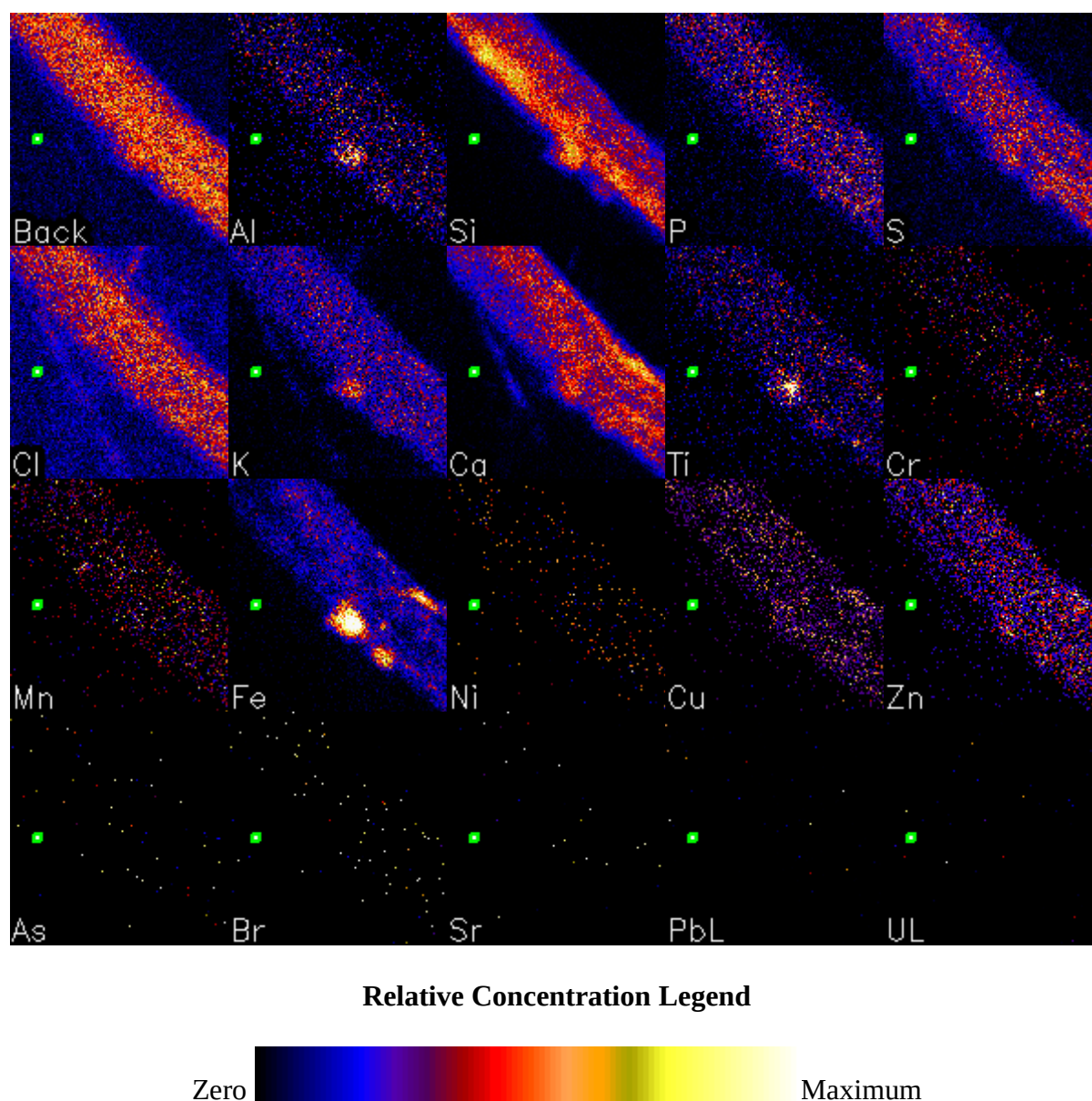


Fig 3.5.16: East Rand (ER)Metallurgical Plant (MP) A2 + A5 R1 (2) (zamx_w295_14-regions-pixe) Al, Ca, Cl, Fe, Mn, P, Cu, Zn, K, S, Cr, Ti and Si, were localized in AMF roots. Cl, S, Cu and Zn appear to be wide spread across the root. Al, Ca, Cr, Mn, Fe, Ti, Si and K, appear to be accumulated in vesicles and Hyphae.

**11.North West (Rustenburg) Lonmin Platinum Mine (L) L1 R2 (5)
(zamx_w295_15-regions-PIXE).**

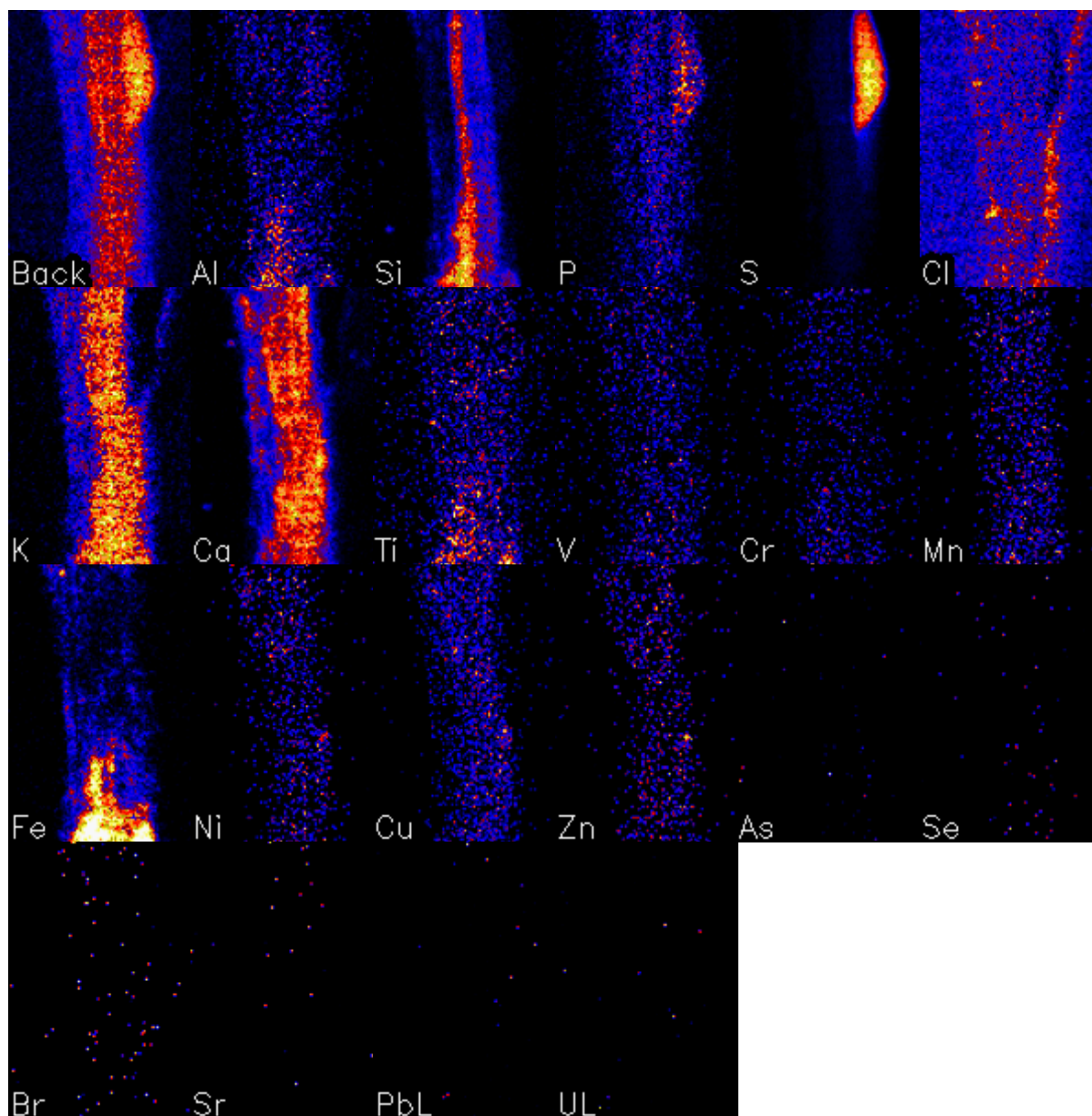
File Name: zamx_w295_15.evt

Dynamic Matrix: zamx_w295_15q0.dam

Charge: 731 μC

Scan: X= 222 μm , Y= 334 μm

Pixel: X size: 84, Y Size: 128



Relative Concentration Legend



Fig 3.5.17: North West (Rustenburg) Lonmin Platinum Mine (L) L1 R2 (5) (zamx_w295_15-regions-PIXE). Al, Ca, Cl, Fe, Ti, K and Si, were localized in AMF roots with low concentration. Fe, Ti and Al appear to be concentrated on one spot in the root elemental maps. Ca, Cl, K and Si appear to be wide spread across the root and localised in the centre of the root.

12.North West (Rustenburg) Lonmin Platinum Mine (L) L1 R2 (5) (zamx_w295_16-regions-PIXE).

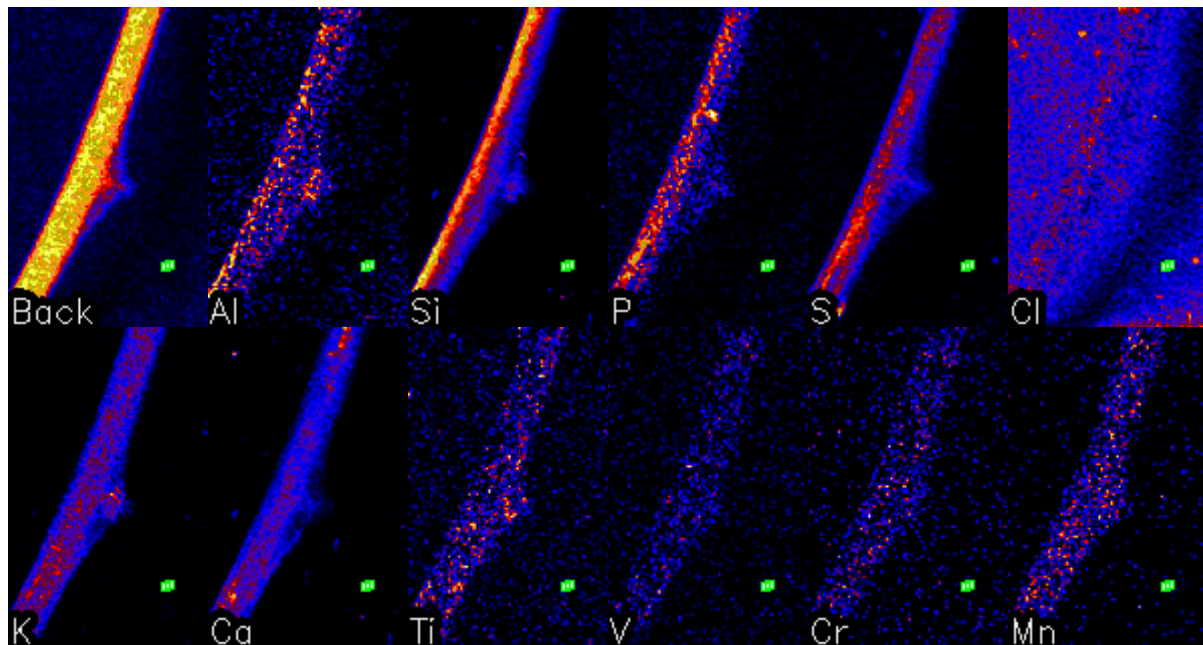
File Name: zamx_w295_16.evt

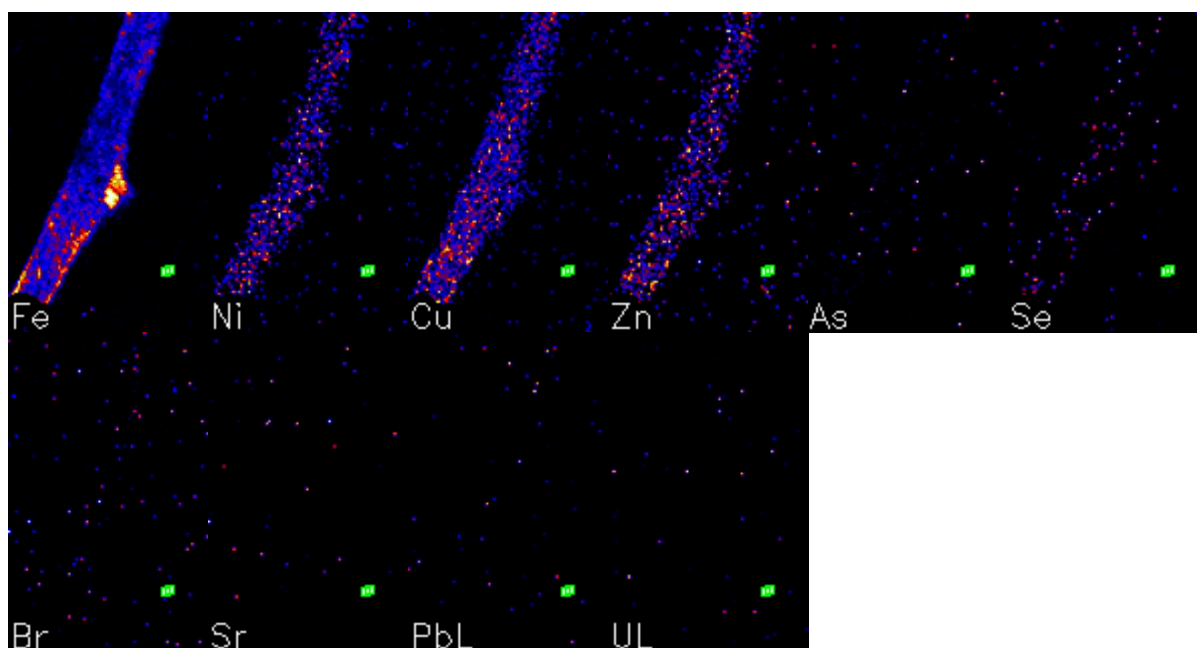
Dynamic Matrix: zamx_w295_16q0.dam

Charge: 2838 μC

Scan: X= 1077 μm , Y= 1168 μm

Pixel: X size: 80, Y Size: 128





Relative Concentration Legend



Fig 3.5.18: North West (Rustenburg) Lonmin Platinum Mine (L) L1 R2 (5) (zamx_w295_16-regions-PIXE). Al, Ca, Cu, Cl, Fe, Mn, Ni, Zn, K, P, S, Si and Ti, were localized in AMF roots with low concentration. Al, Cu, Cl, Mn, Ni, Zn, K, P, S and Si appear to be wide spread across the root and localised in the centre of the root. Fe, Ca and Ti, appear to be accumulated in vesicles and Hyphae.

13.East Rand (ER) Metallurgical Plant (MP) A2 + A5 R1 (1) (zamx_w295_17-regions-PIXE).

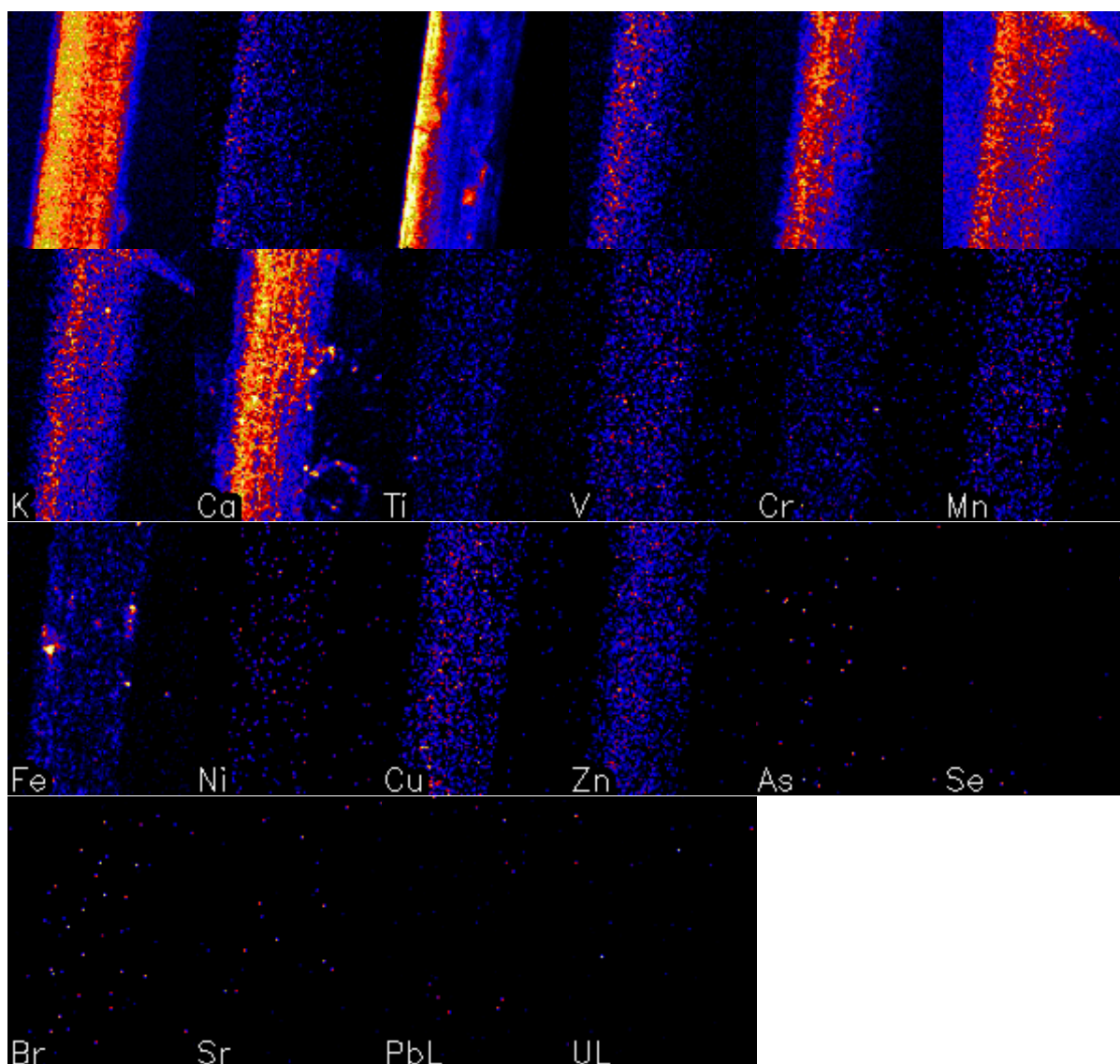
File Name: zamx_w295_17.evt

Dynamic Matrix: zamx_w295_17q0.dam

Charge: 1381 μC

Scan: X= 356 μm , Y= 500 μm

Pixel: X size: 88, Y Size: 128



Relative Concentration Legend



Fig 3.5.19: East Rand (ER) Metallurgical Plant (MP) A2 + A5 R1 (1) (zamx_w295_17-regions-PIXE). Ca, Cl, Cu, Fe, S, K and Si, were localized in AMF roots. Ca, Cl, S, K and Si, appear to be wide spread across the root and localized in the centre of the root. While Fe and Cu, appear to be accumulated in vesicles and Hyphae.

14.Ctr + Nu R2 (4) (zamx_w295_18-regions-PIXE).

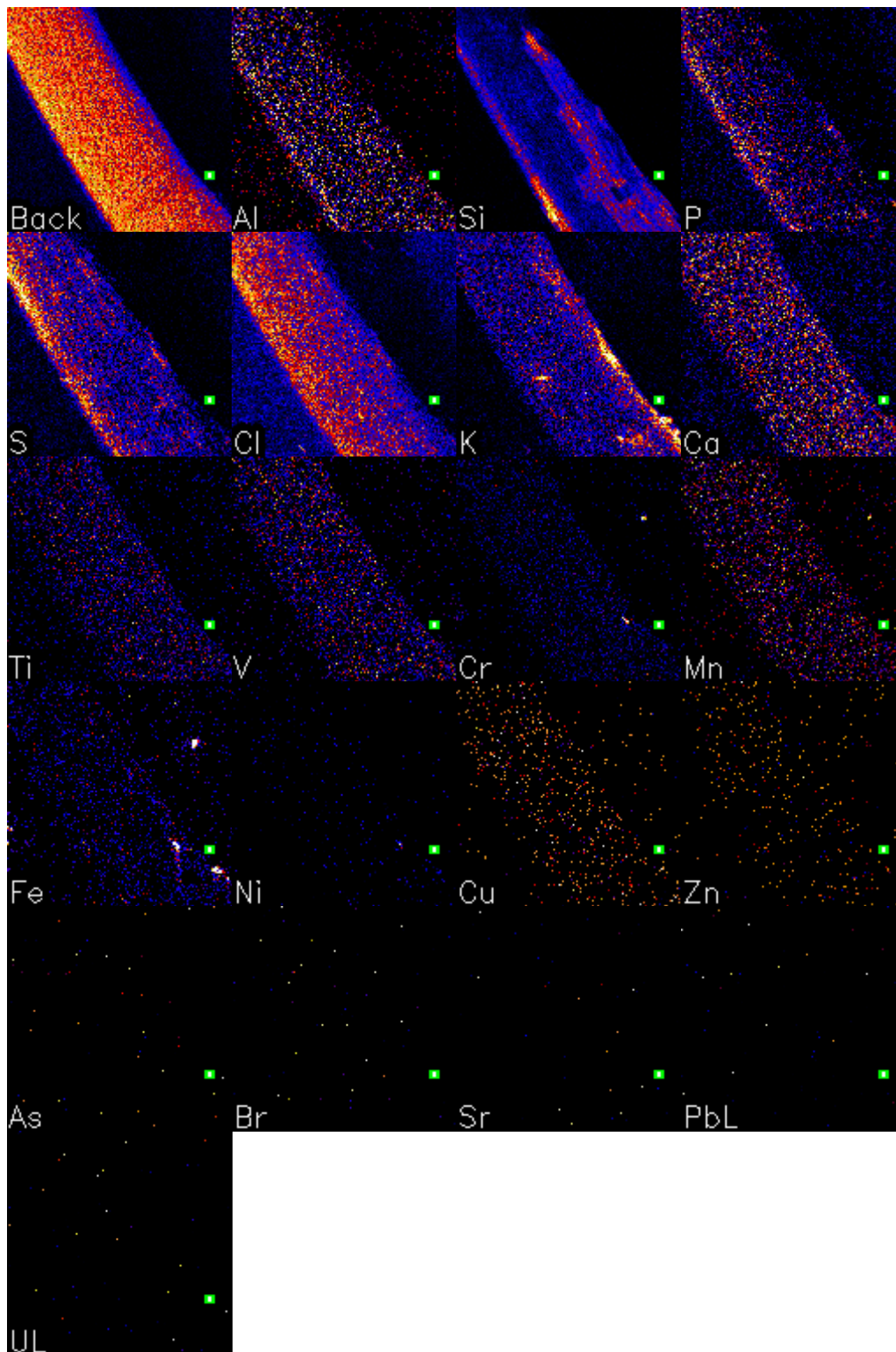
File Name: zamx_w295_18.evt

Dynamic Matrix: zamx_w295_18q0.dam

Charge: 1415 μC

Scan: X= 584 μm , Y= 584 μm

Pixel: X size: 128, Y Size: 128



Relative Concentration Legend



Fig 3.5.20: Ctr + Nu R2 (4) (zamx_w295_18-regions-PIXE). Al, Ca, Cl, Cr, Fe, P, S, K and Si, were localized in AMF roots with low concentration. Cl, Cr, Fe, S, K and Si, appear to be wide spread across the root and localized in the centre of the root. While Fe, Cr, K, appear to be accumulated in some parts of the root.

15.Gauteng, Agnes Mine ABB5 R2 (5) Reg 0 -1 (zamx_w295_19-regions-PIXE).

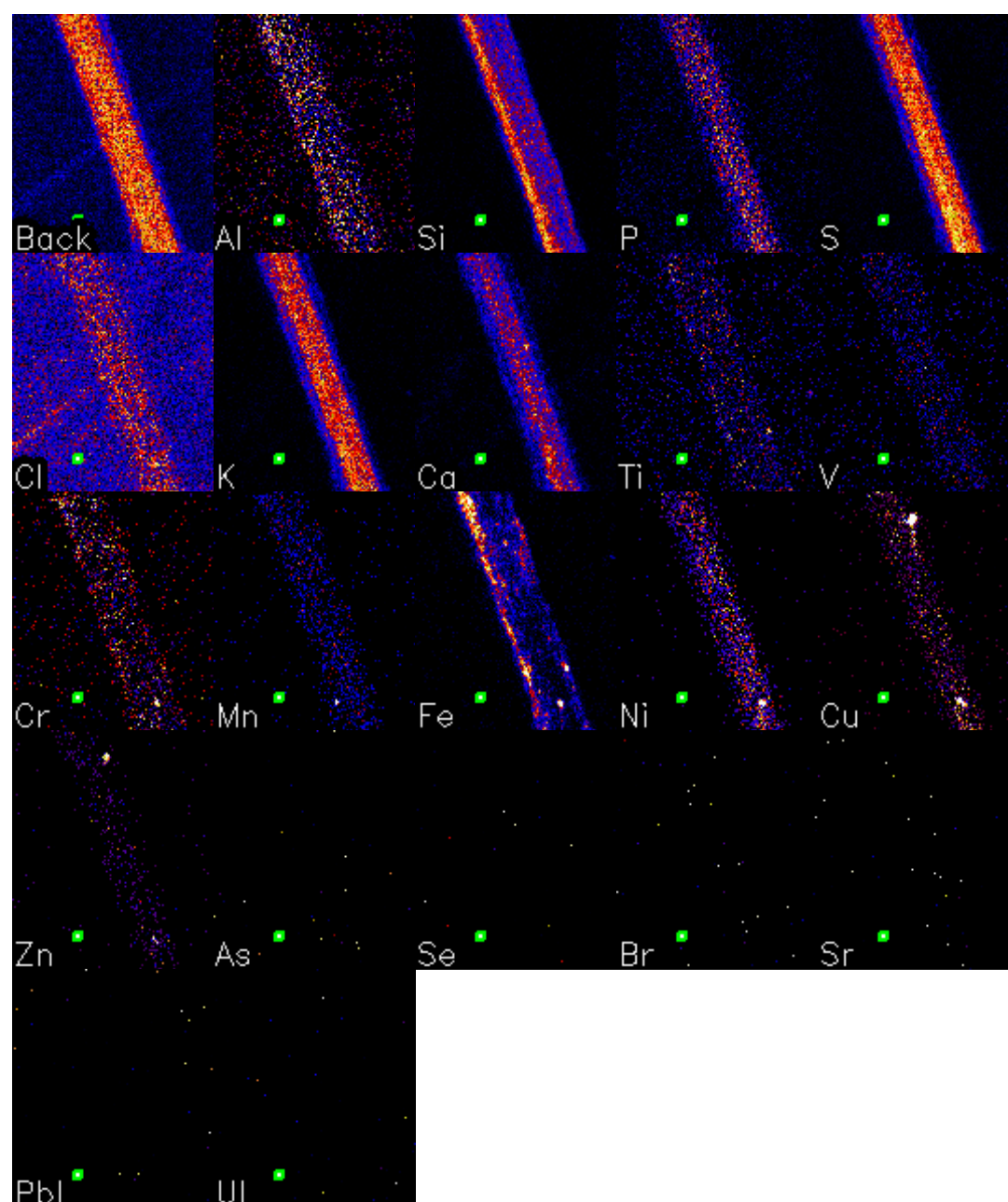
File Name: zamx_w295_19.evt

Dynamic Matrix: zamx_w295_19q0.dam

Charge: 1509 μ C

Scan: X= 287 μ m, Y= 333 μ m

Pixel: X size: 108, Y Size: 128



Relative Concentration Legend



Fig 3.5.21: Gauteng, Agnes Mine ABB5 R2 (5) Reg 0 -1 (zamx_w295_19-regions-PIXE).

Al, Ca, Cl, Cr, Cu, Ni, P, Zn, and Fe, with exception of Si, S, K, were localized in AMF roots with low concentration. Al, Ca, Cl, Cr, P, S K and Si, appear to be wide spread across the root and localized in the centre of the root. While Fe, Cu, Ni and Zn appear to be accumulated in vesicles and Hyphae.

16.North West (Vaal Reefs) Au +Ur) S11 R2 (2) (zamx_w295_20-regions-PIXE).

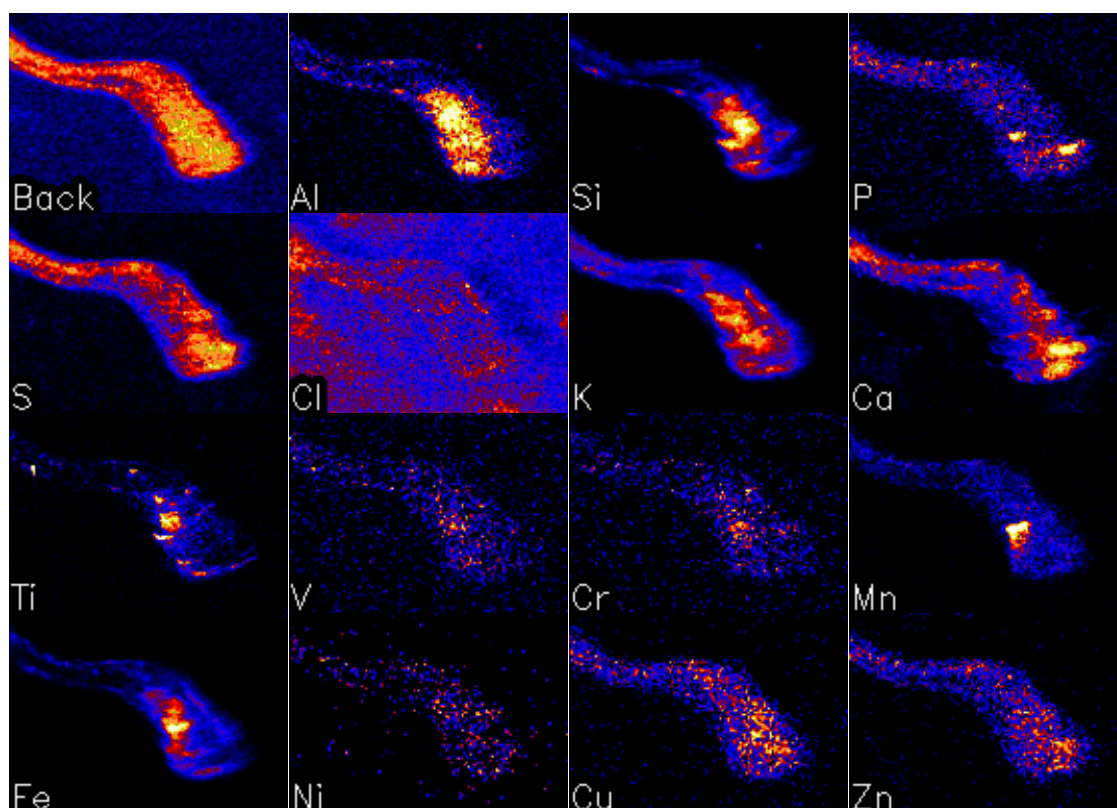
File Name: zamx_w295_20.evt

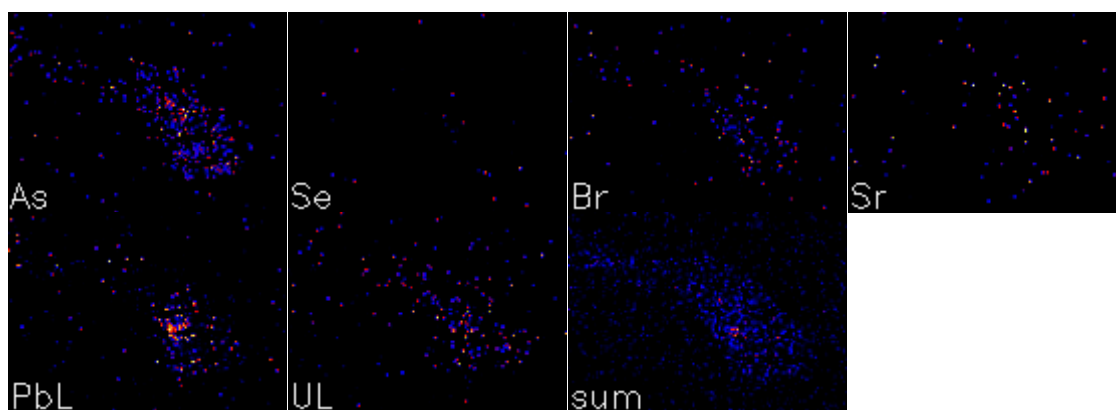
Dynamic Matrix: zamx_w295_20q0.dam

Charge: 3066 μC

Scan: X= 584 μm , Y= 429 μm

Pixel: X size: 128, Y Size: 92





Relative Concentration Legend



Fig 3.5.22: North West (Vaal Reefs) Au +Ur) S11 R2 (2) (zamx_w295_20-regions-PIXE).

Al, Ca, Cl, Cr, Cu, Mn, P, Fe, K, S, Si, Zn, V, T, PbL and Ul were localized in AMF roots with low concentration. S, and Ul appear to be wide spread across the root and localized in the centre of the root. While Al, Ca, Cl, Cr, Cu, Mn, P, Fe, K, S, Si, Zn, V, T, PbL and Ul appear to be accumulated in vesicles and Hyphae.

17.Gauteng, Agnes Mine ABB5 R1 (8) (zamx_w295_21-regions-PIXE) root cross-section..

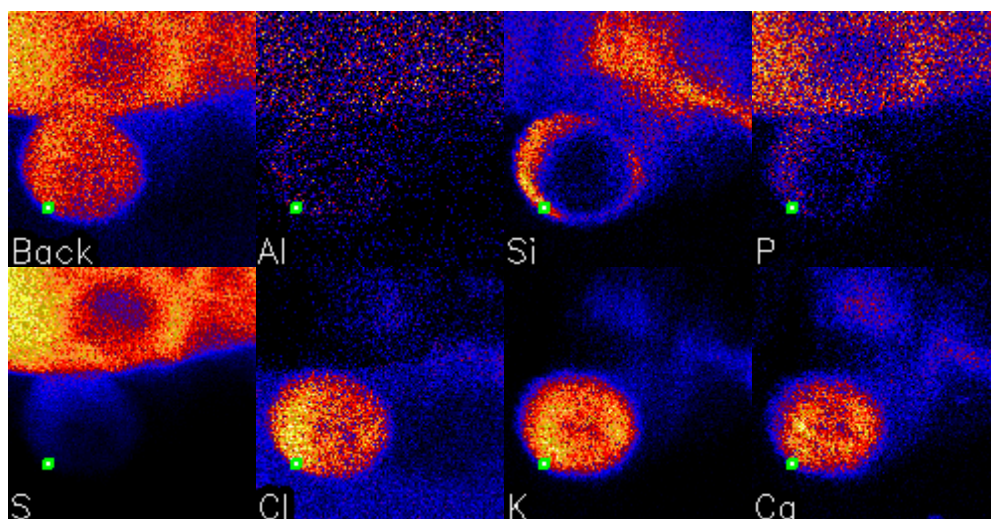
File Name: zamx_w295_21.evt

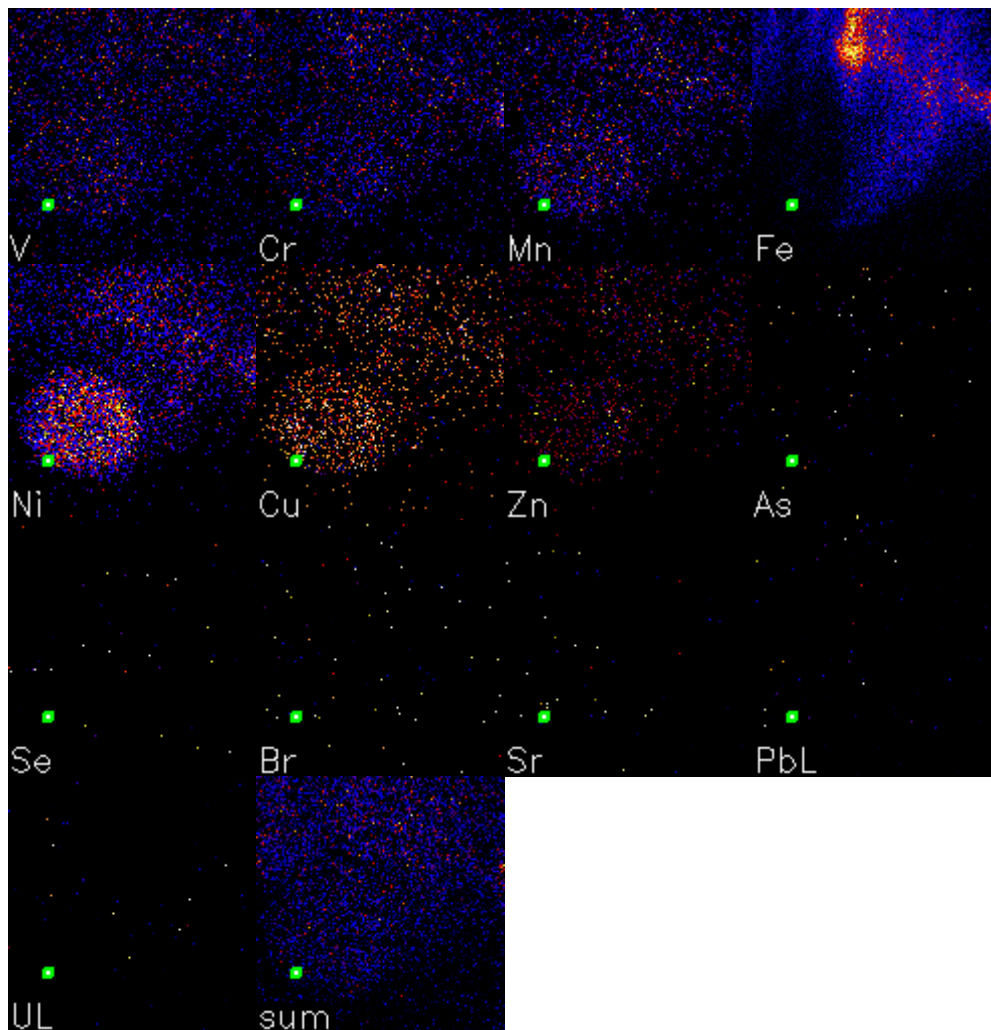
Dynamic Matrix: zamx_w295_21q0.dam

Charge: 1886 μC

Scan: X= 329 μm , Y= 334 μm

Pixel: X size: 124, Y Size: 128





Relative Concentration Legend



Fig 3.5.23: Gauteng, Agnes Mine ABB5 R1 (8) (zamx_w295_21-regions-PIXE) root cross-section. Ca, Cl, K, and Si, except Ni, Cu, and Zn were localized in AMF roots with high concentration.

18.East Rand (ER) Metallurgical Plant (MP) D1 R1 (6) (1) (zamx_w295_22-regions-PIXE) root cross-section

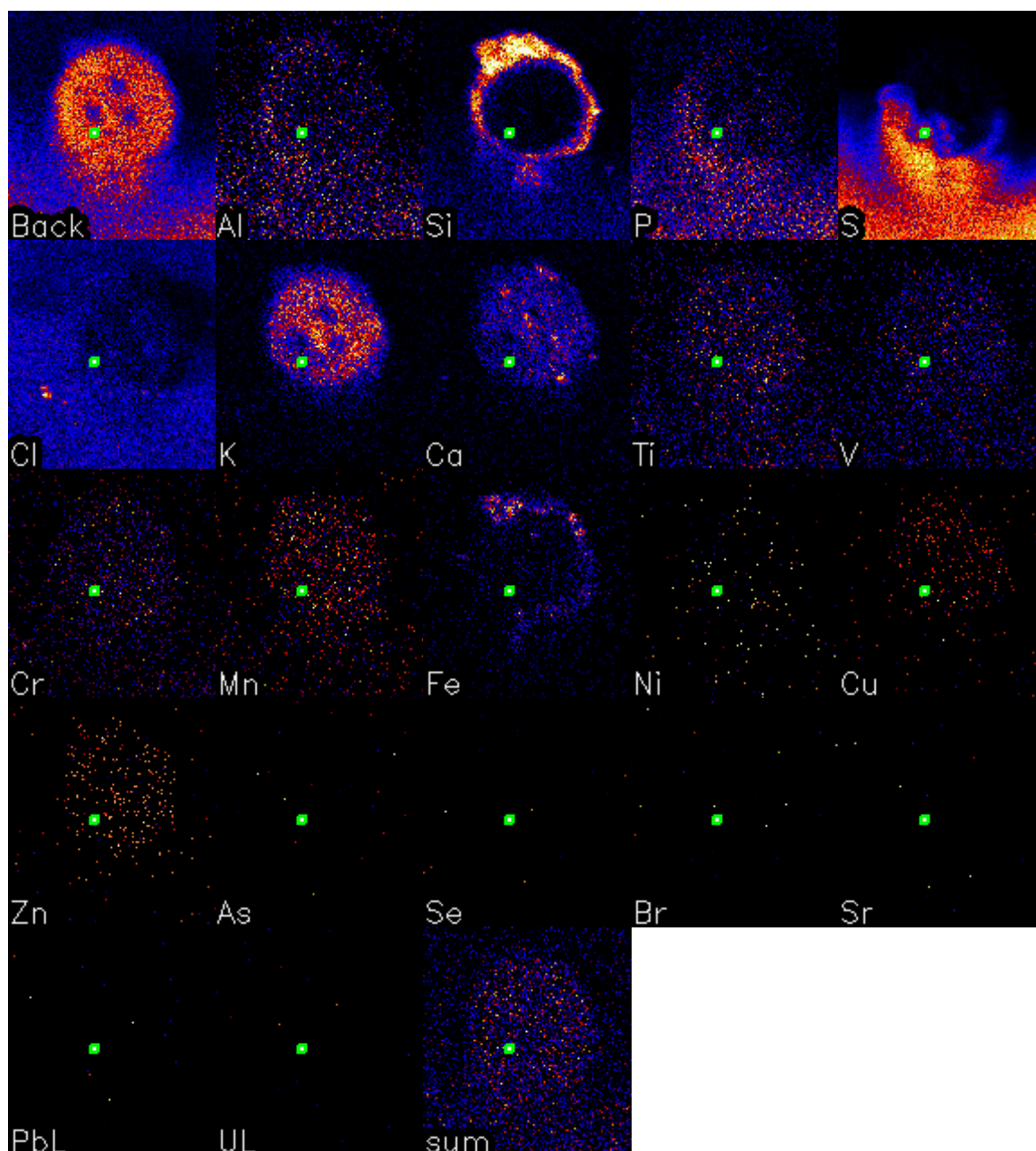
File Name: zamx_w290_22.evt

Dynamic Matrix: zamx_w295_22q0.dam

Charge: 1159 μC

Scan: X= 461 μm , Y= 500 μm

Pixel: X size: 116, Y Size: 128



Relative Concentration Legend



Fig 3.5.24: East Rand (ER) Metallurgical Plant (MP) D1 R1 (6) (1) (zamx_w295_22-regions-PIXE) root cross-section. Ca, Fe, K, and Si, were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae, except K which is spread across the root cross-section.

19.East Rand (ER) Metallurgical Plant (MP) D1 R1 (6) (1)
(zamx_w295_23-regions-PIXE) root cross-section.

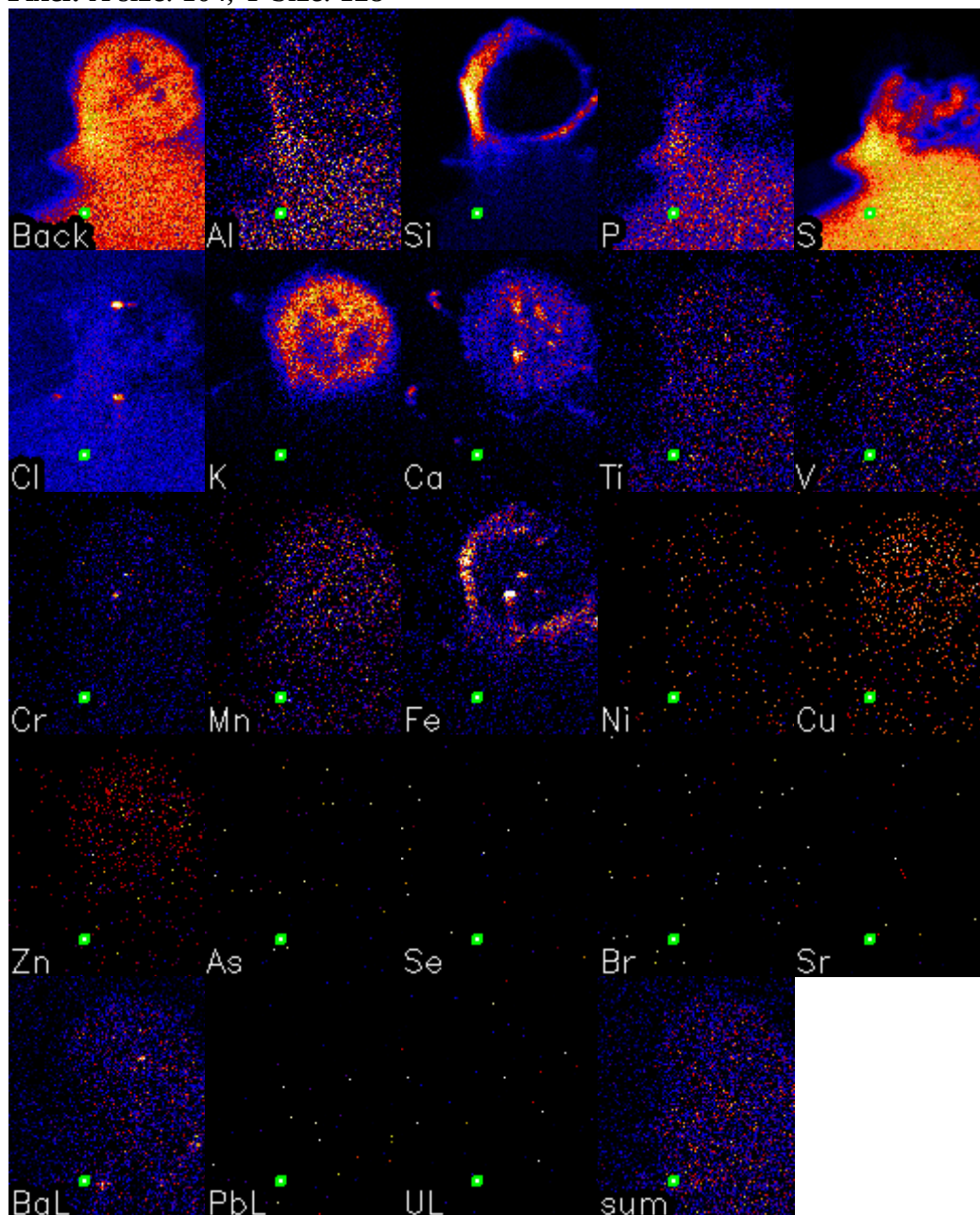
File Name: zamx_w290_23.evt

Dynamic Matrix: zamx_w295_23q0.dam

Charge: 2212 μC

Scan: X= 411 μm , Y= 501 μm

Pixel: X size: 104, Y Size: 128



Relative Concentration Legend



Fig 3.5.25: East Rand (ER) Metallurgical Plant (MP) D1 R1 (6) (1) (zamx_w295_23-regions-PIXE) root cross-section. Ca, Cl, Fe, K, Si and Cr, were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae, except K which is spread across the root cross-section.

20. Gauteng, Agnes Mine ABB5 R1 (5) B (zamx_w295_24-regions-PIXE) root cross-section.

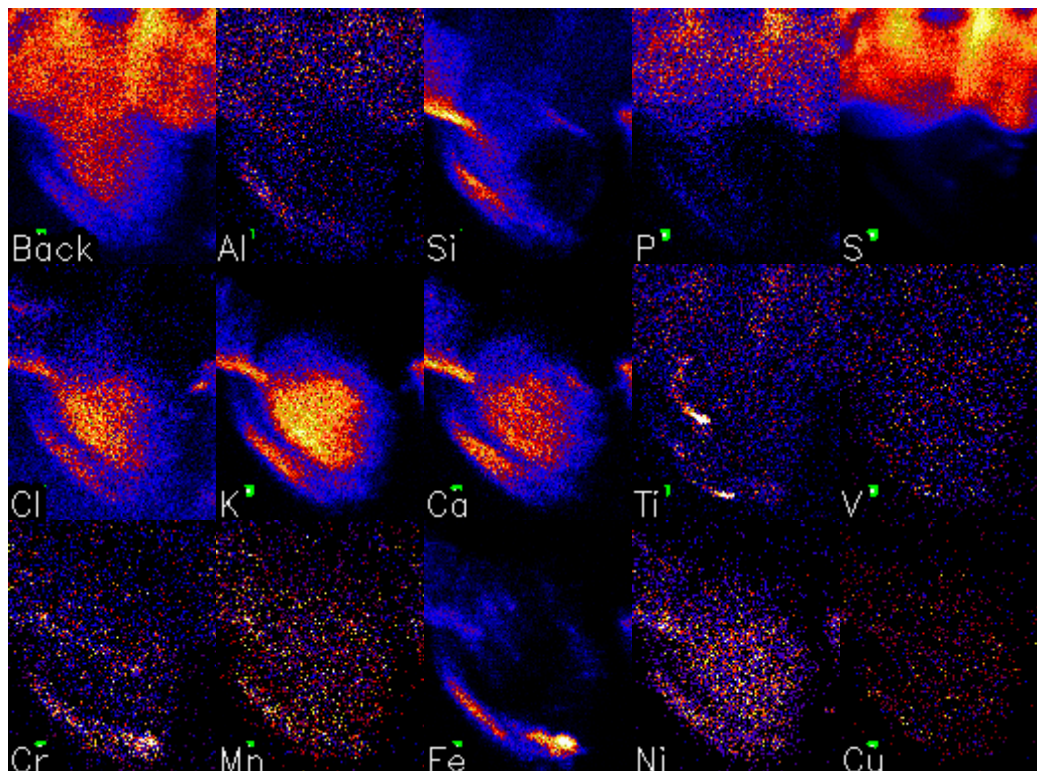
File Name: zamx_w290_24.evt

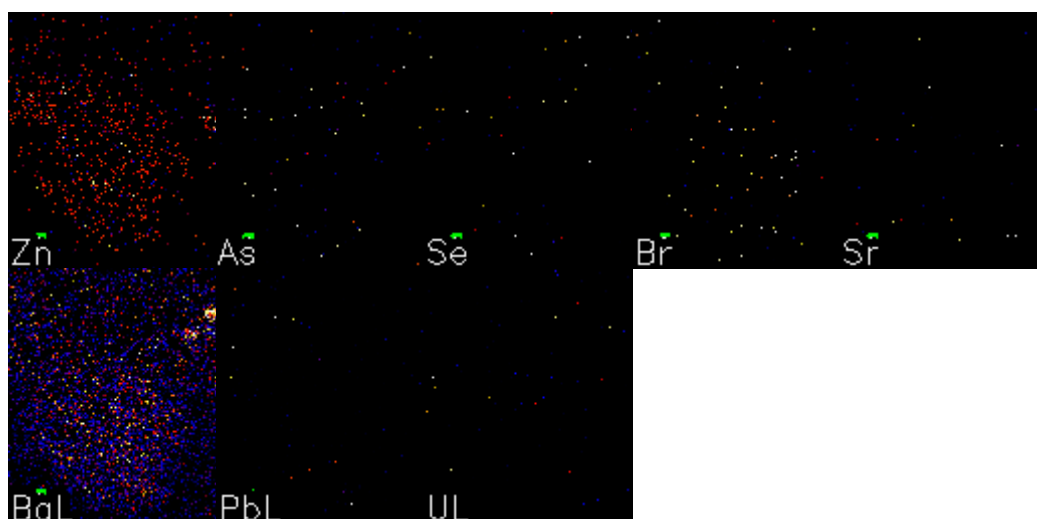
Dynamic Matrix: zamx_w295_24q0.dam

Charge: 1173 μC

Scan: X= 348 μm , Y= 417 μm

Pixel: X size: 104, Y Size: 128





Relative Concentration Legend



Fig 3.5.26: Gauteng, Agnes Mine ABB5 R1 (5) B (zamx_w295_24-regions-PIXE) root cross-section. Ca, Cl, Fe, K, Si, BaL, Ti and Cr, were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae, except K which is spread across the root cross-section. Surprisingly, the average concentration of BaL is below the detection limit but it appears to be in the vesicles in the elementary Maps.

21.East Rand (ER) Metallurgical Plant (MP) D1 R1 (6) B (zamx_w295_25-regions-PIXE) root cross-section.

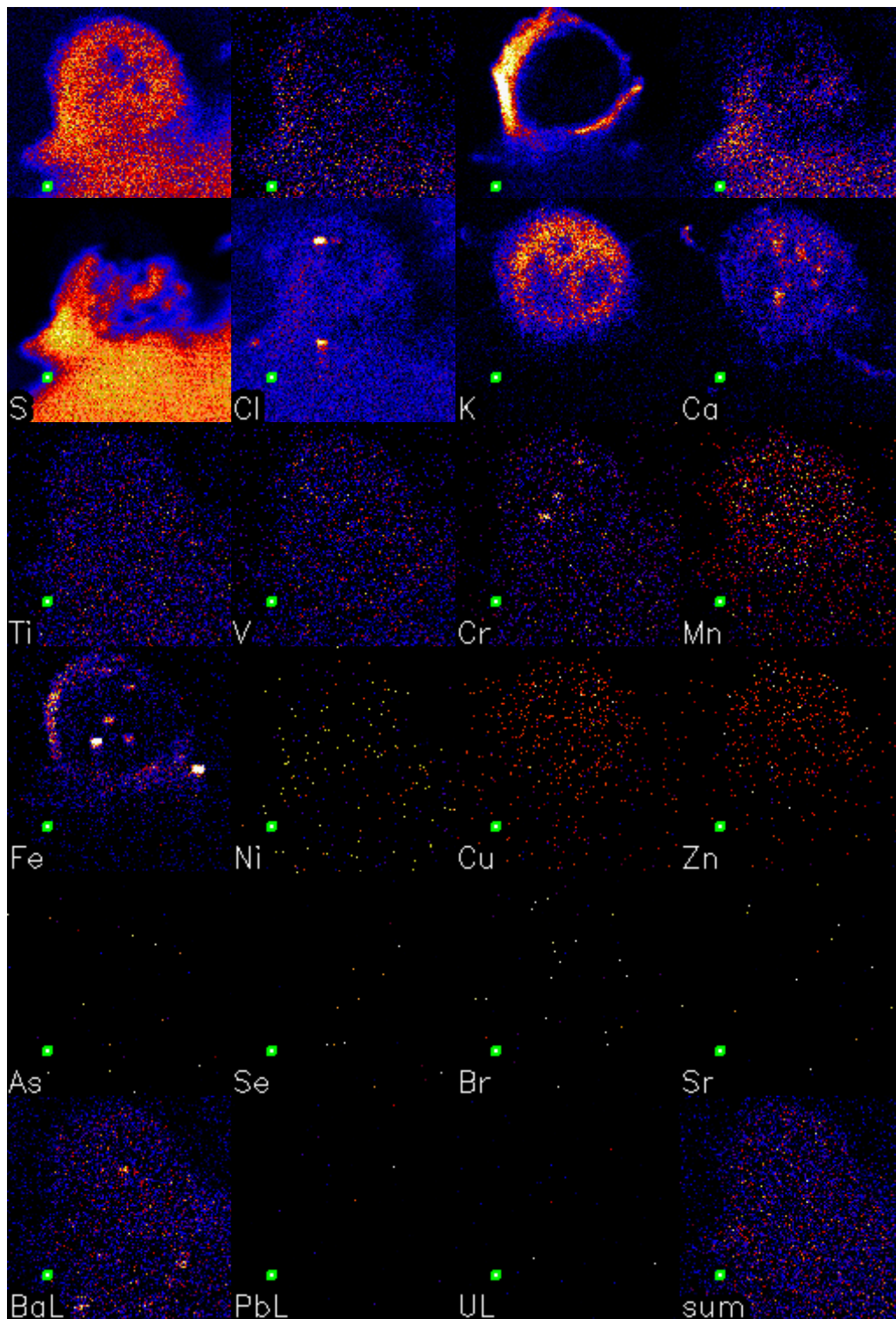
File Name: zamx_w295_25.evt

Dynamic Matrix: zamx_w295_25q0.dam

Charge: 1347 μC

Scan: X= 417 μm , Y= 417 μm

Pixel: X size: 128, Y Size: 128



Relative Concentration Legend



Fig 3.5.27: East Rand (ER) Metallurgical Plant (MP) D1 R1 (6) B (zamx_w295_25-regions-PIXE) root cross-section. Ca, Cl, BaL Cr, Fe, K, and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae, except K which is spread across the root cross-section. Same thing has been noticed about BaL as stated in **Fig 3.5.27** above, the average concentration of BaL is below the detection limit but it appears to be in the vesicles in the elementary Maps.

22.East Rand (ER) Metallurgical Plant (MP) D1 R1 (6) C (zamx_w295_26-regions-PIXE) root cross-section.

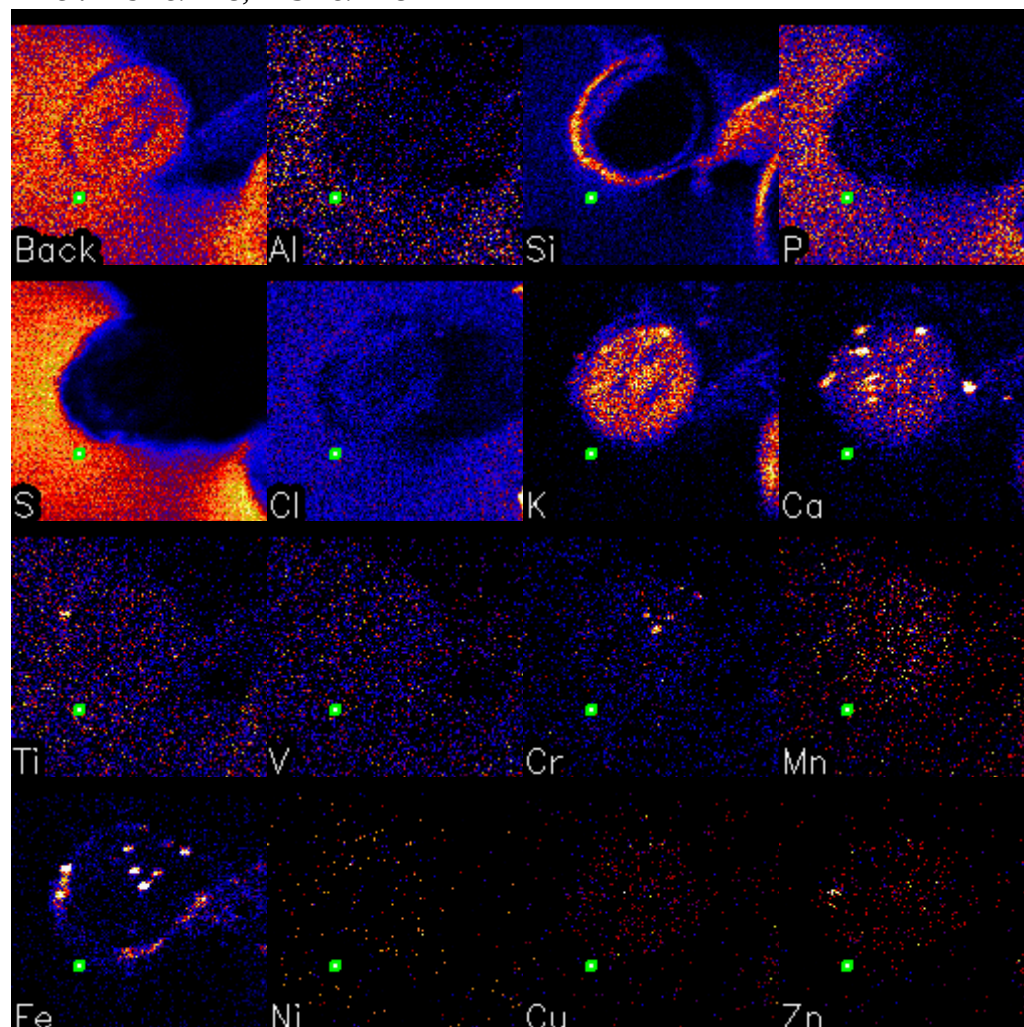
File Name: zamx_w295_26.evt

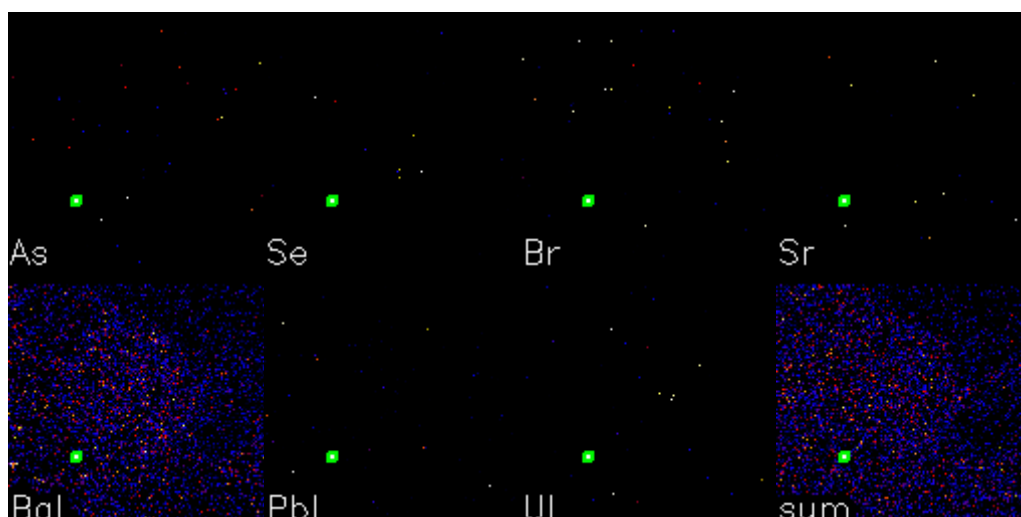
Dynamic Matrix: zamx_w295_26q0.dam

Charge: 1112 μC

Scan: X= 500 μm , Y= 470 μm

Pixel: X size: 128, Y Size: 128





Relative Concentration Legend



Fig 3.5.28: East Rand (ER) Metallurgical Plant (MP) D1 R1 (6) C (zamx_w295_26-regions-PIXE) root cross-section. Ca, Cr, Fe, K, Zn Ti and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae, except K which is spread across the root cross-section.

23.East Rand (ER) Metallurgical Plant (MP) D1 R1 (6) D (zamx_w295_27-regions-PIXE) root cross-section.

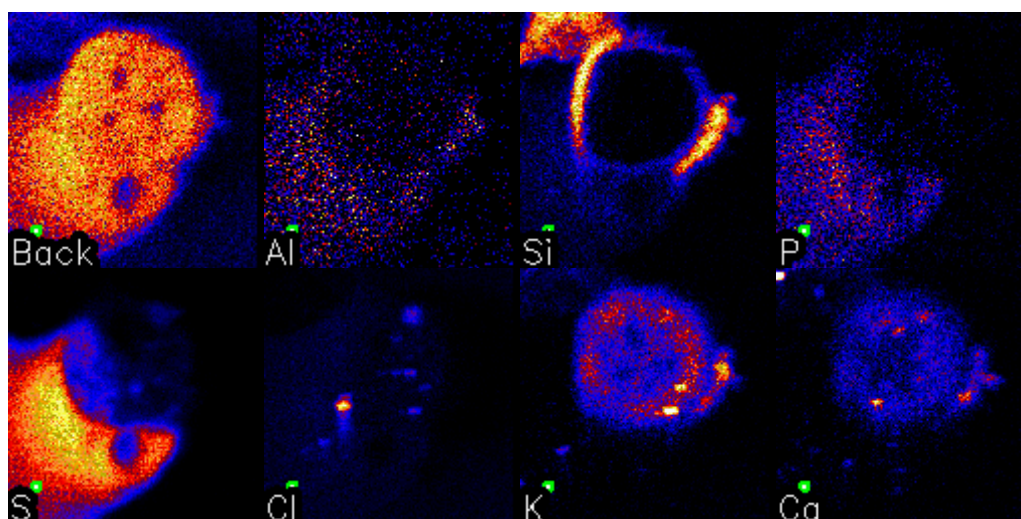
File Name: zamx_w295_27.evt

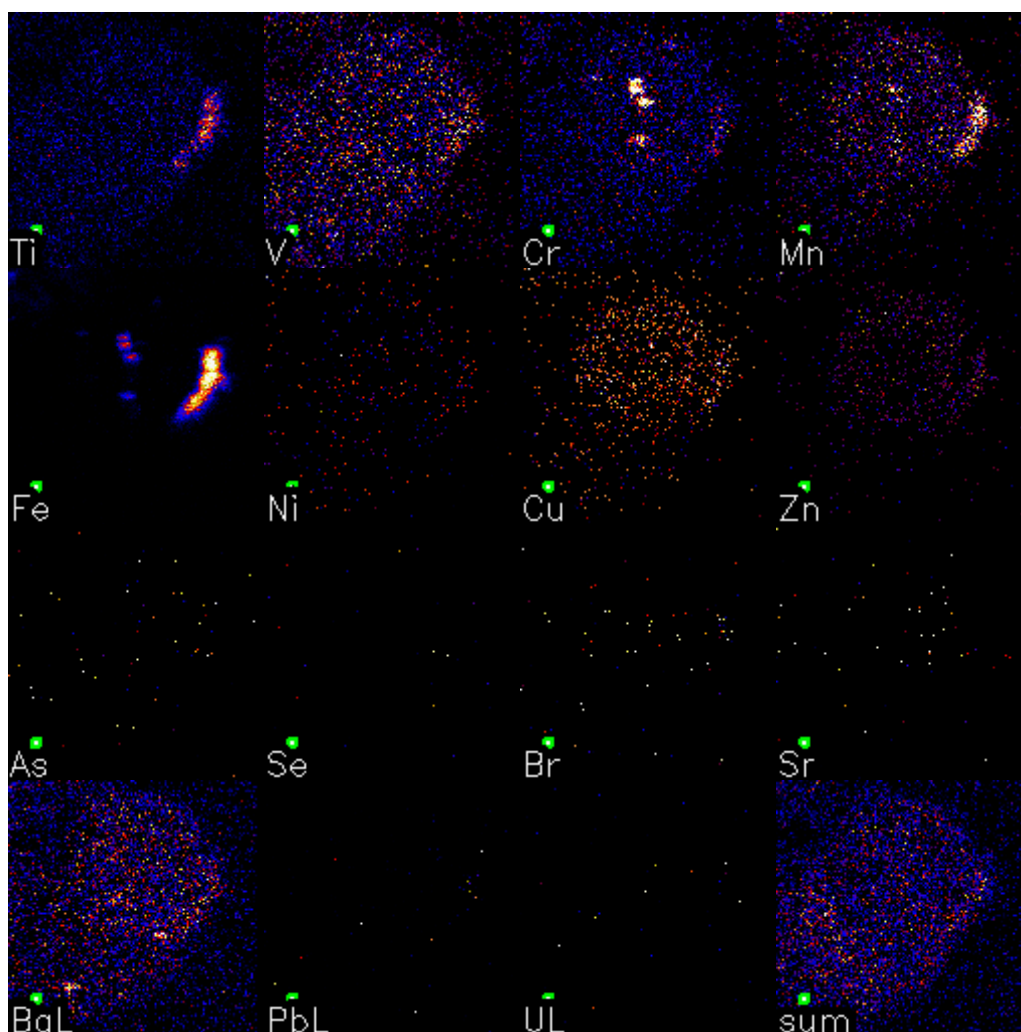
Dynamic Matrix: zamx_w295_27q0.dam

Charge: 1977 μC

Scan: X= 407 μm , Y= 417 μm

Pixel: X size: 128, Y Size: 128





Relative Concentration Legend



Fig 3.5.29: East Rand (ER) Metallurgical Plant (MP) D1 R1 (6) D (zamx_w295_27-regions-PIXE) root cross-section. Ca, Cl, BaL Cr, Fe, K, Mn Ti, and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. Same thing has been noticed about BaL as stated in **Fig 3.5.27 & Fig 3.5.28** above, the average concentration of BaL is below the detection limit but it appears to be in the vesicles in the elementary Maps.

24.L4 R1 4A - North West (Rustenburg) Lonmin Platinum Mine (L) (zamx_w295_28-regions-PIXE) root cross-section.

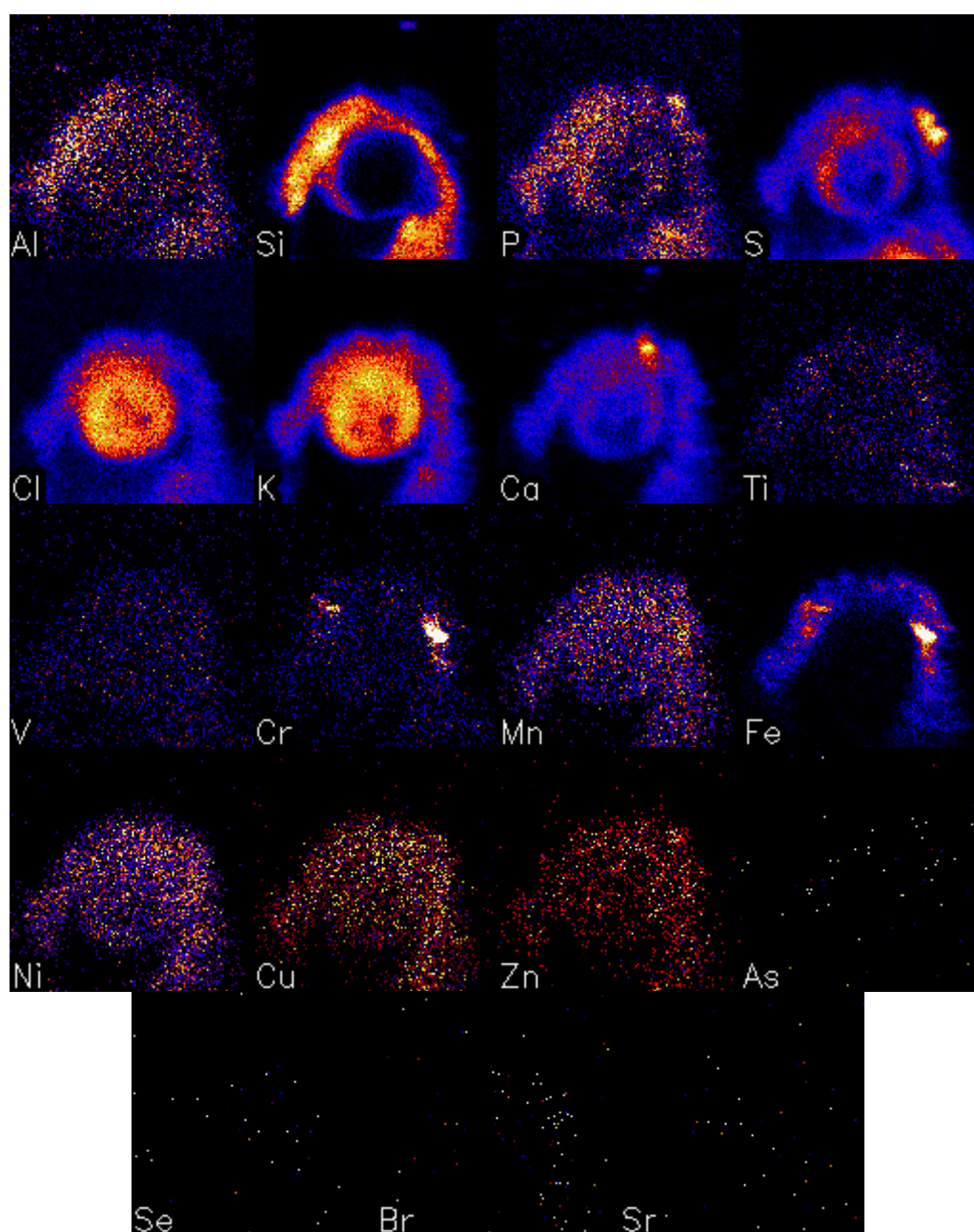
File Name: zamx_w295_28.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 1852 μC

Scan: X= 334 μm , Y= 334 μm

Pixel: X size: 128, Y Size: 128



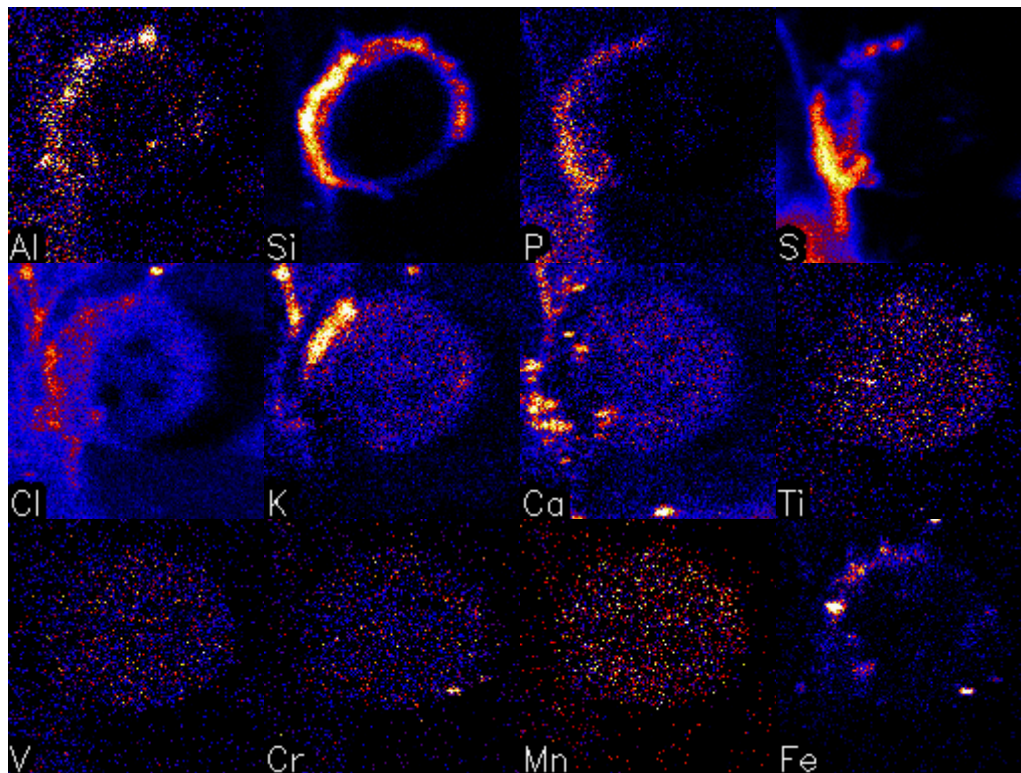
Relative Concentration Legend

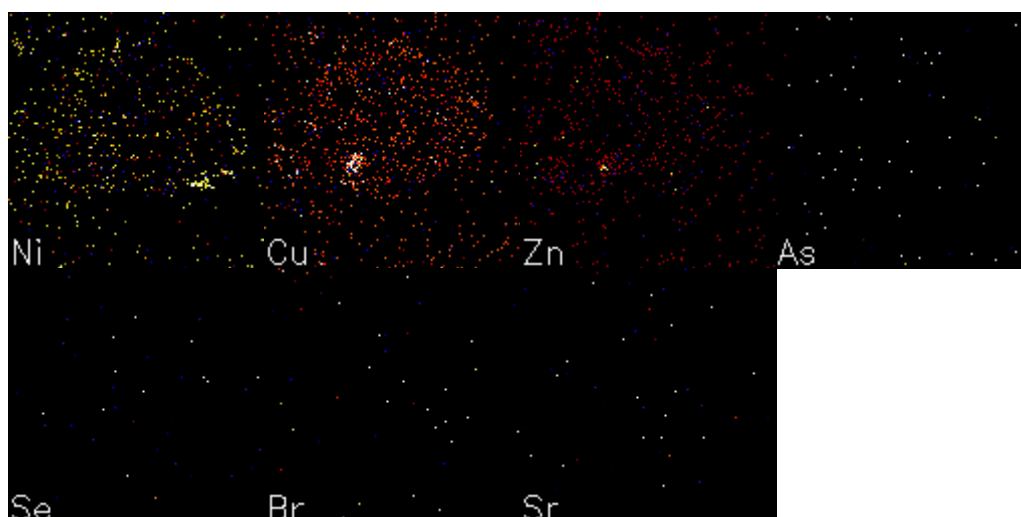


Fig 3.5.30: L4 R1 4A - North West (Rustenburg) Lonmin Platinum Mine (L) (zamx_w295_28-regions-PIXE) root cross-section. Ca, Cr, Fe, S and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae, While Cl, K, Mn, Cu, Zn, Ni and P appear to be spread across the root cross-section. *Except for K, and Cl, accumulation of elements has been observed largely in the peel; this might indicate that most AMF structures are located in the peel of the plant.*

25.L4 R1 4A - North West (Rustenburg) Lonmin Platinum Mine (L) REM14 (zamx_w295_29-regions-PIXE).

File Name: zamx_w295_29.evt
Dynamic Matrix: zamx_w295_19.dam
Charge: 2055 μC
Scan: X= 417 μm , Y= 417 μm
Pixel: X size: 128, Y Size: 128





Relative Concentration Legend



Fig 3.5.31: L4 R1 4A - North West (Rustenburg) Lonmin Platinum Mine (L) REM14 (zamx_w295_29-regions-PIXE). Al, Cl, Ca, Cr, Cu, Fe, K, Mn, Ni, P, S, Zn, Ti and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. *It is also true for this sample, Accumulation of elements has been observed largely in the epidermal outer cortical layer (peel or bark) of the root crosssections. This might indicate that most AMF structures are located in the epidermal layer of the plant.*

26.L4 R1 4A - North West (Rustenburg) Lonmin Platinum Mine (L) REM15 (zamx_w295_32-regions-PIXE).

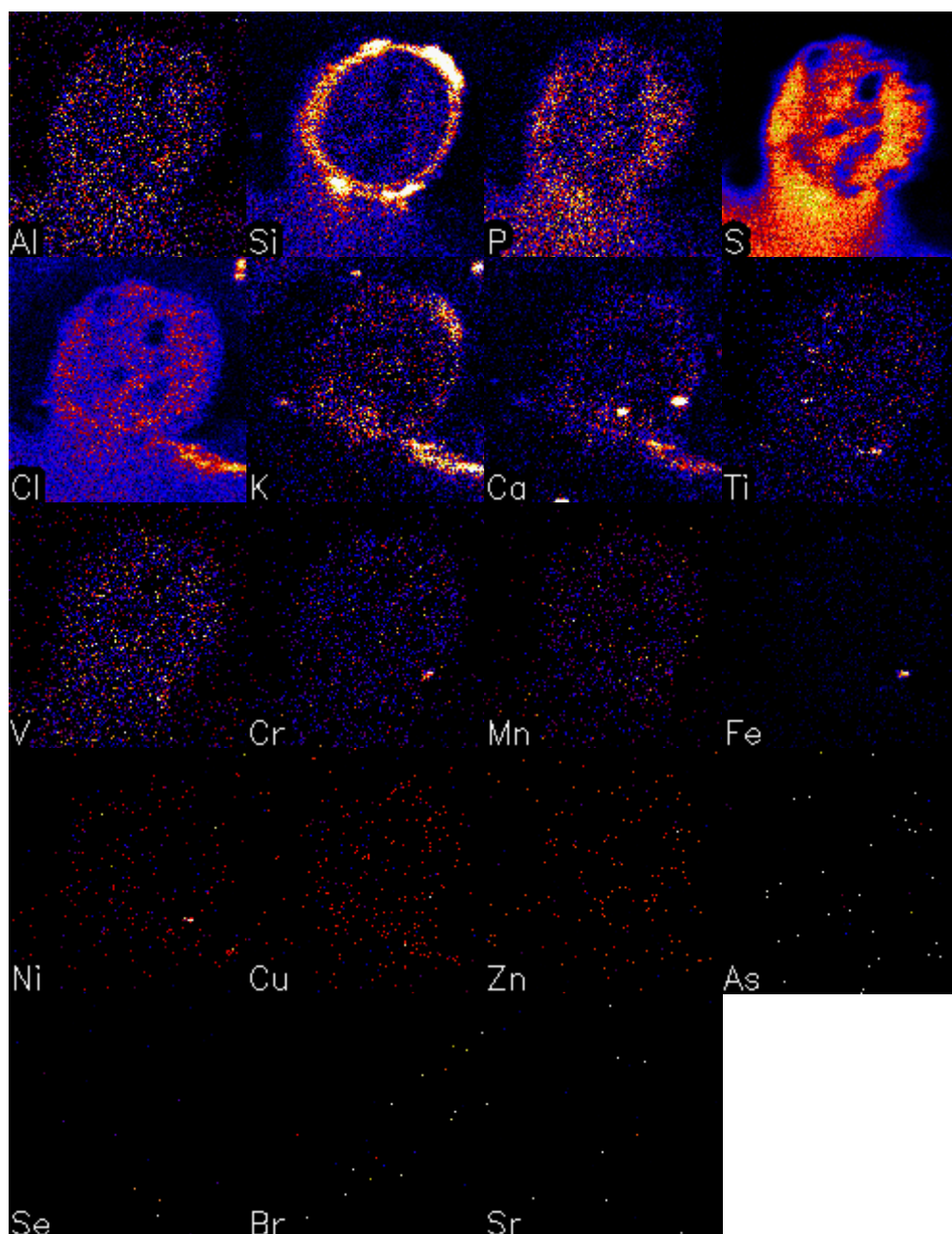
File Name: zamx_w295_32.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 1185 μ C

Scan: X= 351 μ m, Y= 417 μ m

Pixel: X size: 124, Y Size: 128



Relative Concentration Legend



Fig 3.5.32: L4 R1 4A - North West (Rustenburg) Lonmin Platinum Mine (L) REM15 (zamx_w295_32-regions-PIXE). Ca, Cr, Fe, Ti, K and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Cl, S and P appear to be spread across the root cross-section. The average concentration of Ti is below the detection limit but it appears in the vesicles in the elementary Maps. *It is also true*

for this sample, Accumulation of elements has been observed largely in the epidermal outer cortical layer of the root crosssections.

**27. L4 R1 4A - North West (Rustenburg) Lonmin Platinum Mine (L) REM16
(zamx_w295_33-regions-PIXE).**

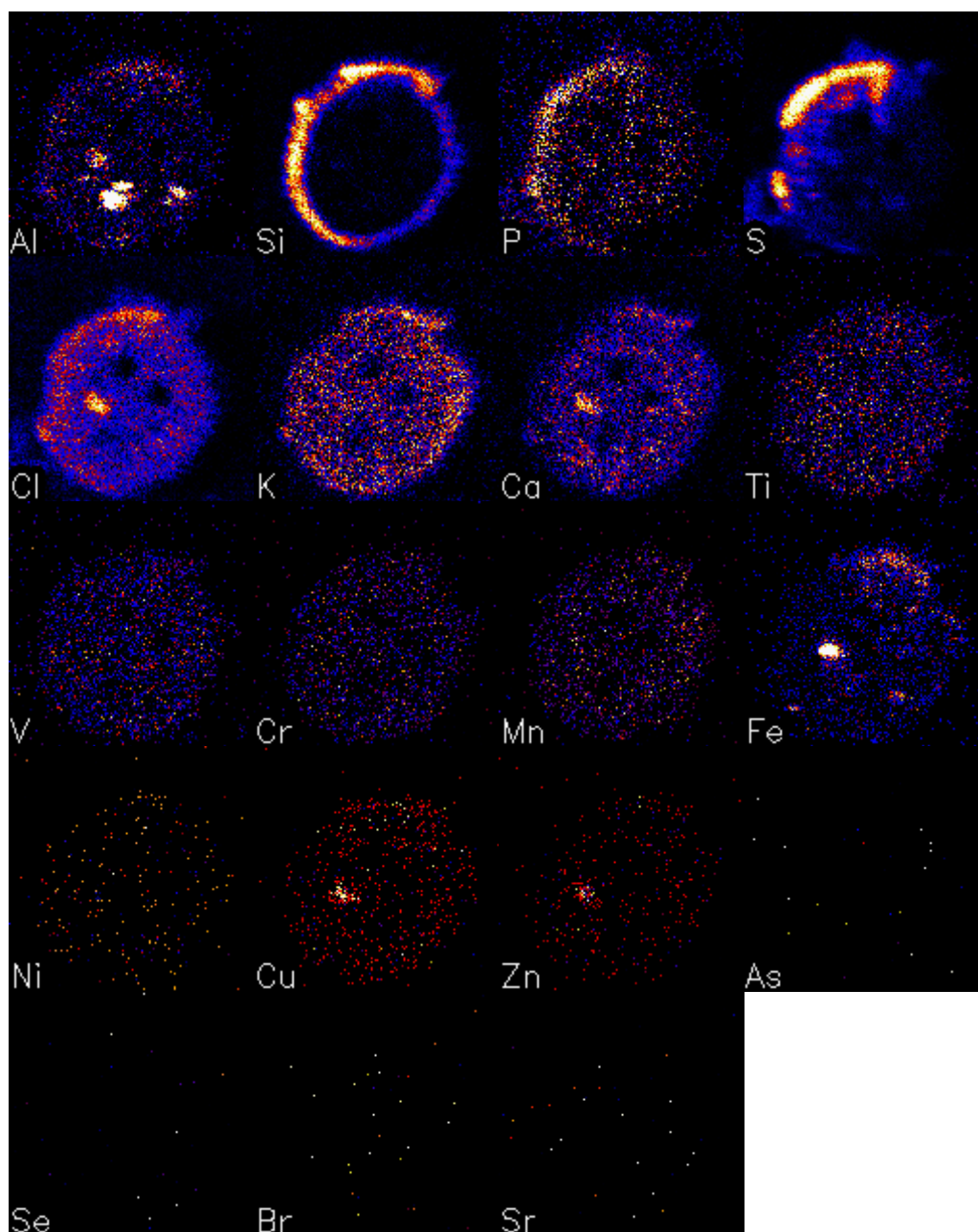
File Name: zamx_w295_33.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 1205 μC

Scan: X= 334 μm , Y= 333 μm

Pixel: X size: 128, Y Size: 128



Relative Concentration Legend



Fig 3.5.33: L4 R1 4A - North West (Rustenburg) Lonmin Platinum Mine (L) REM16 (zamx_w295_33-regions-PIXE). Al, Ca, Cl, Cu, Fe, S, Zn, and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While K and P appear to be spread across the root cross-section.

28. WW14 (7a) R1 Cross – West Wits (Gauteng) high Au +Ur Reg 0 -3 REM17 (zamx_w295_34-regions-PIXE).

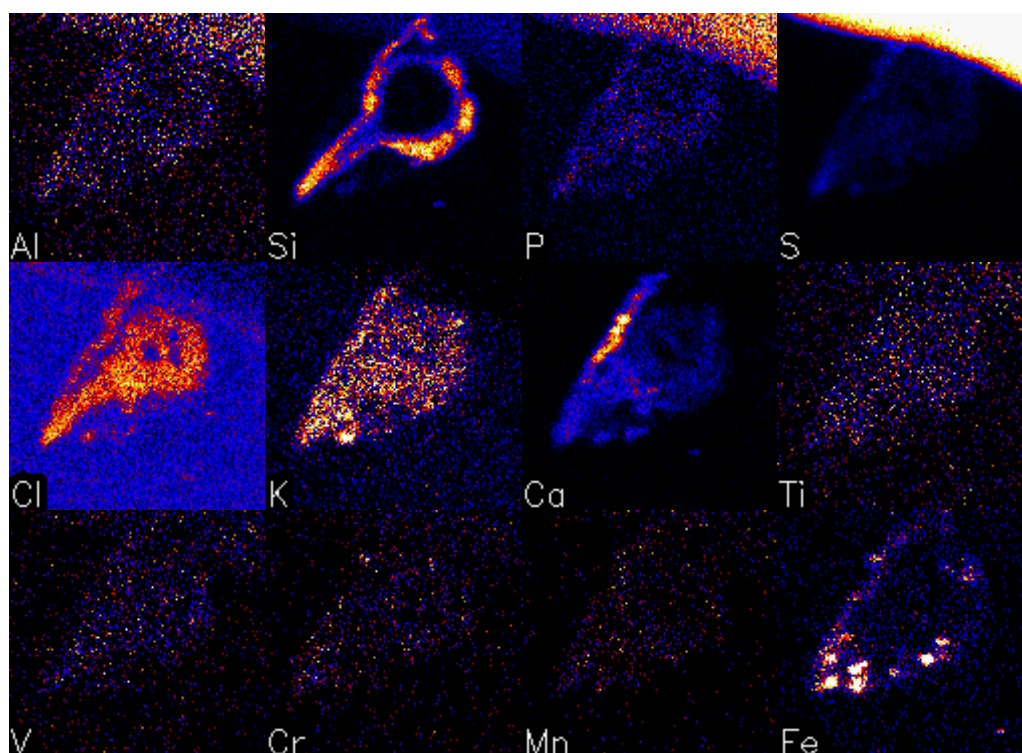
File Name: zamx_w295_34.evt

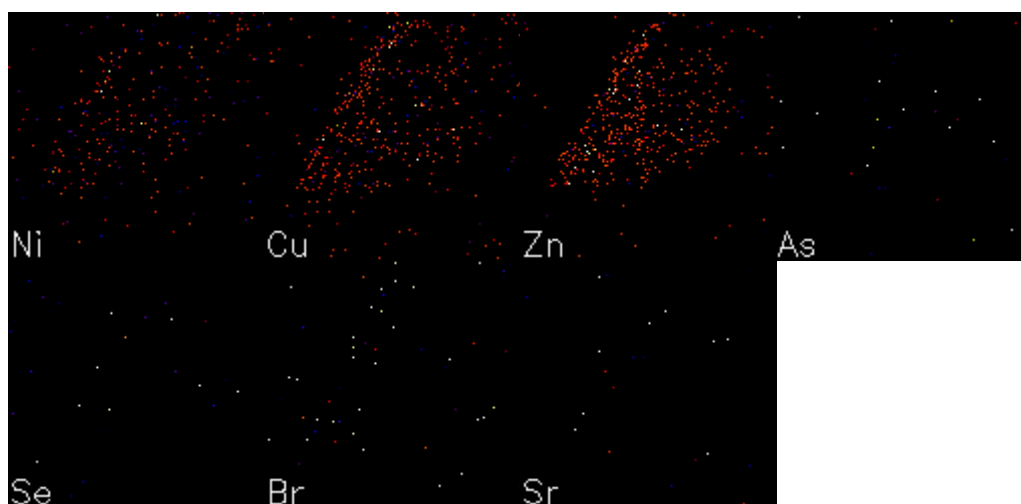
Dynamic Matrix: zamx_w295_19.dam

Charge: 1802 μC

Scan: X= 417 μm , Y= 407 μm

Pixel: X size: 128, Y Size: 124





Relative Concentration Legend



Fig 3.5.34: WW14 (7a) R1 Cross – West Wits (Gauteng) high Au +Ur Reg 0 -3 REM17 (zamx_w295_34-regions-PIXE). Ca, Fe, and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Cl, and K appear to be spread across the root cross-section.

29. WW14 (7a) R1 Cross – West Wits (Gauteng) high Au +Ur Reg 0 -3 REM18 (zamx_w295_35-regions-PIXE).

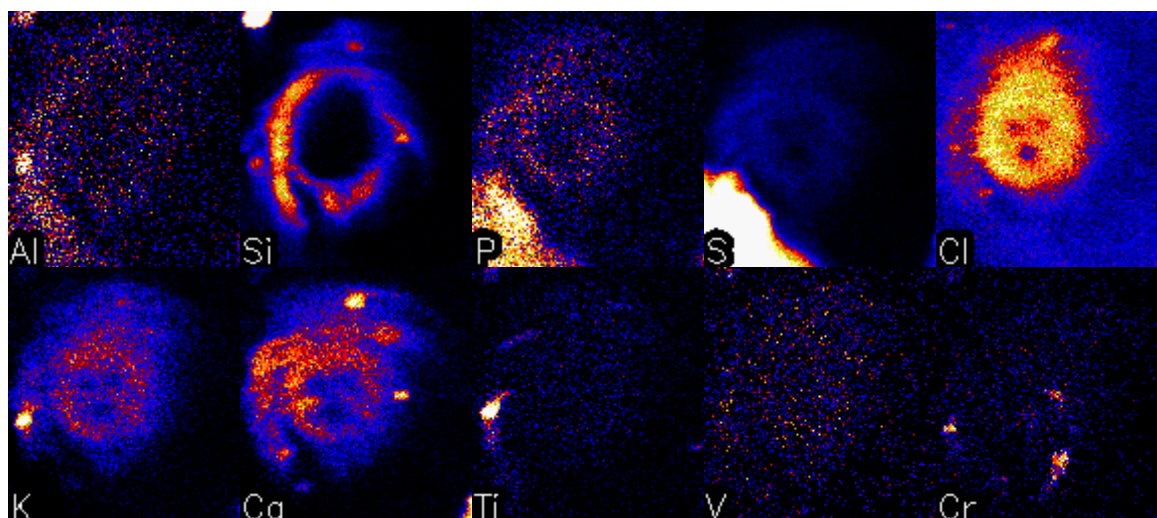
File Name: zamx_w295_35.evt

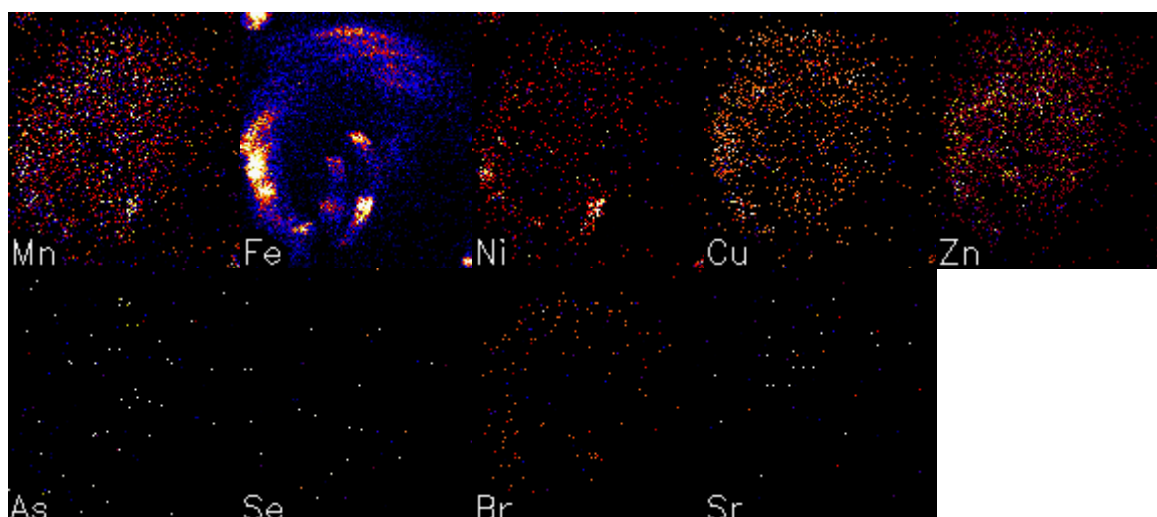
Dynamic Matrix: zamx_w295_19.dam

Charge: 2467 μC

Scan: X= 302 μm , Y= 334 μm

Pixel: X size: 116, Y Size: 128





Relative Concentration Legend



Fig 3.5.35: WW14 (7a) R1 Cross – West Wits (Gauteng) high Au +Ur Reg 0 -3 REM18 (zamx_w295_35-regions-PIXE). Al, Ca, Cr, Fe, K, Mn, Ni, Ti, and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Cl, Cu, and Zn, appear to be spread across the root cross-section.

30.WW14 (7a) R1 Cross – West Wits (Gauteng) high Au +Ur Reg. 0 -3 REM19 (zamx_w295_36-regions-PIXE).

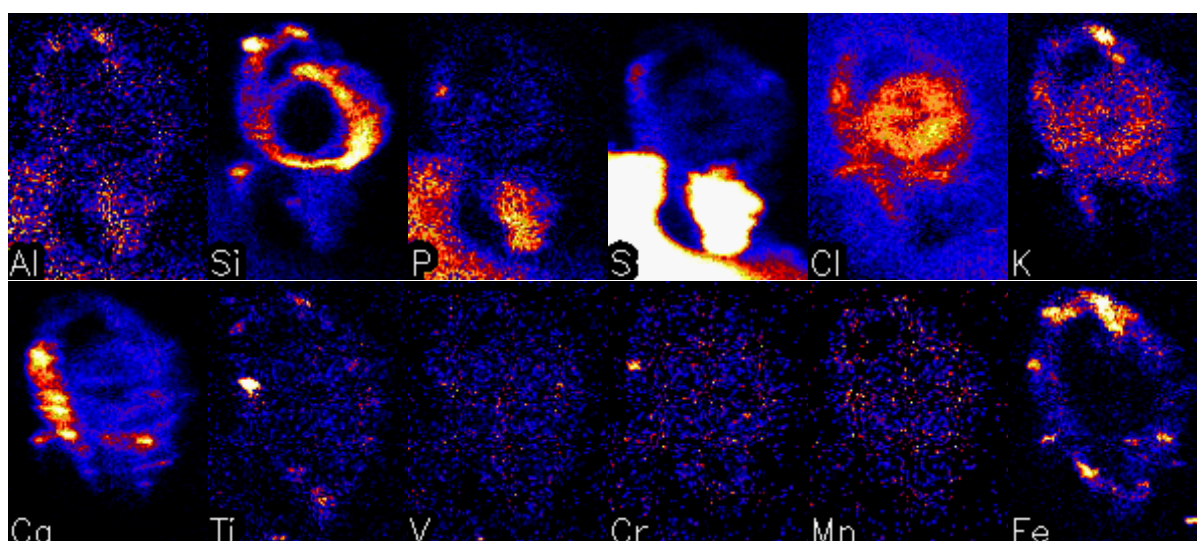
File Name: zamx_w295_36.evt

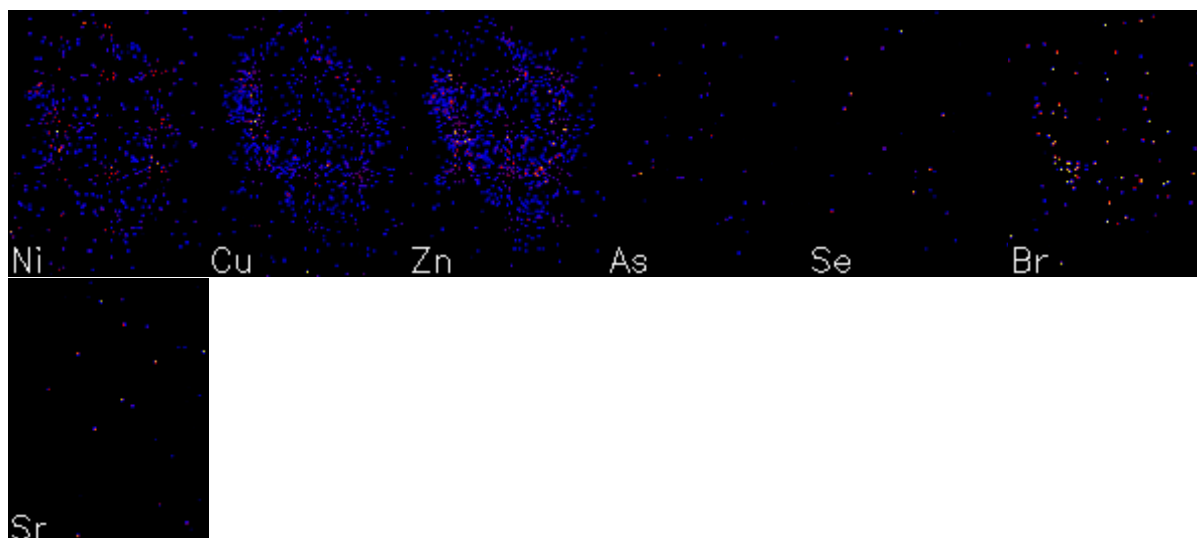
Dynamic Matrix: zamx_w295_19.dam

Charge: 1391 μC

Scan: X= 319 μm , Y= 417 μm

Pixel: X size: 96, Y Size: 128





Relative Concentration Legend



Fig 3.5.36: WW14 (7a) R1 Cross – West Wits (North West) high Au +Ur Reg. 0 -3 REM19 (zamx_w295_36-regions-PIXE). Al, Ca, Cr, Fe, Mn, P, Ti, and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Cl, and K appear to be spread across the root cross-section.

31.WW14 (7a) R1 Cross – West Wits (North West) high Au +Ur Reg. 0 -3 REM20 (zamx_w295_37-regions-PIXE).

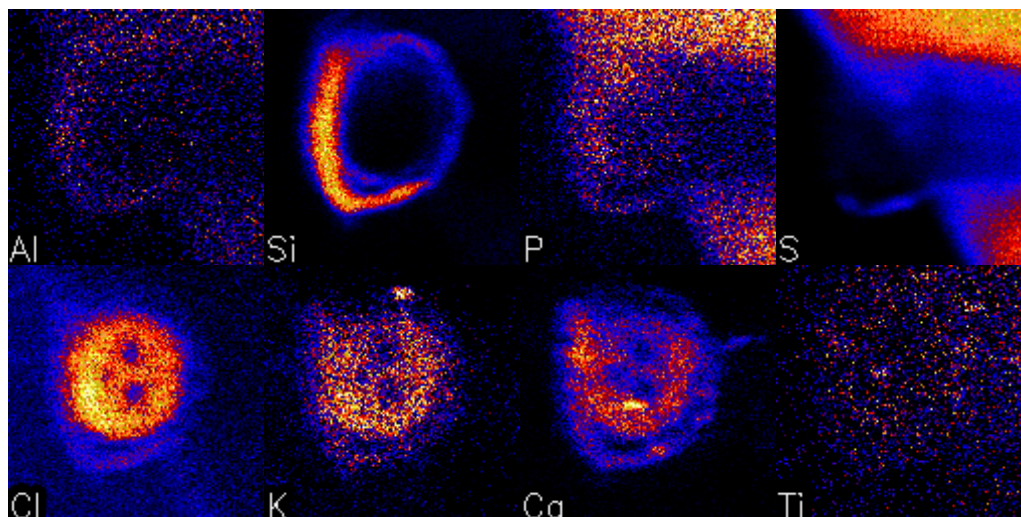
File Name: zamx_w295_37.evt

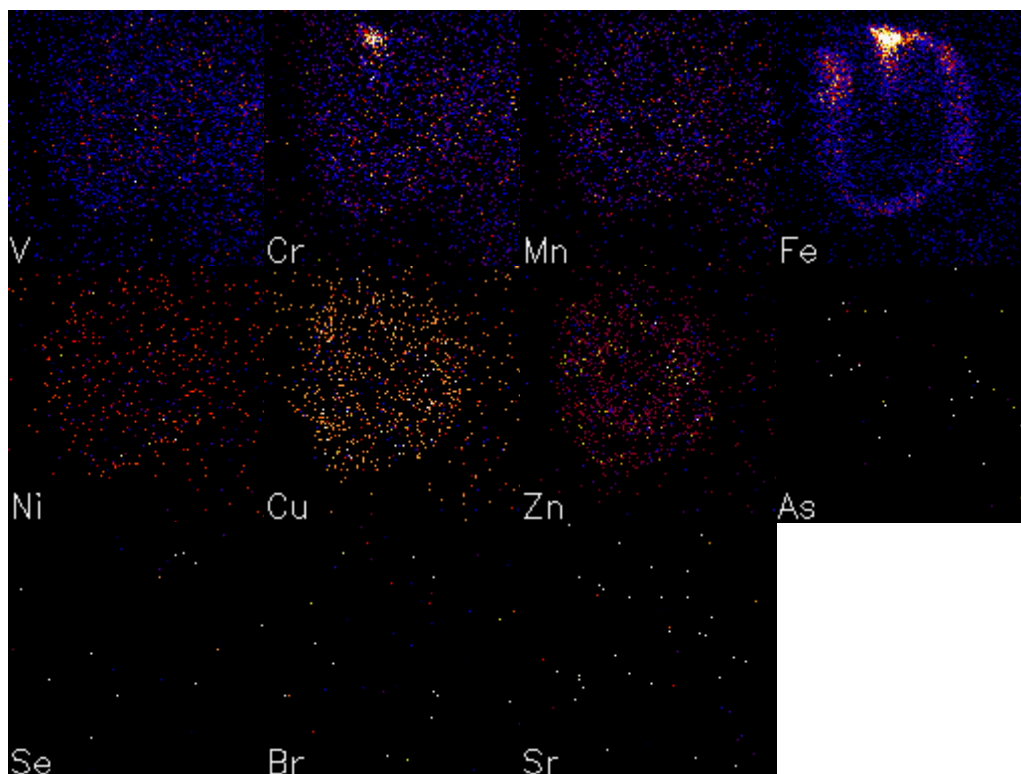
Dynamic Matrix: zamx_w295_19.dam

Charge: 1352 μC

Scan: X= 251 μm , Y= 250 μm

Pixel: X size: 128, Y Size: 128





Relative Concentration Legend



Fig 3.5.37: WW14 (7a) R1 Cross – West Wits (North West) high Au +Ur Reg. 0 -3 REM20 (zamx_w295_37-regions-PIXE). Ca, Cr, Fe, K, Ti, and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Cl, and K, appear to be spread across the root cross-section.

32.Ctr + Nu R2 (4) Cross Rem 21 (zamx_w295_38-regions-PIXE).

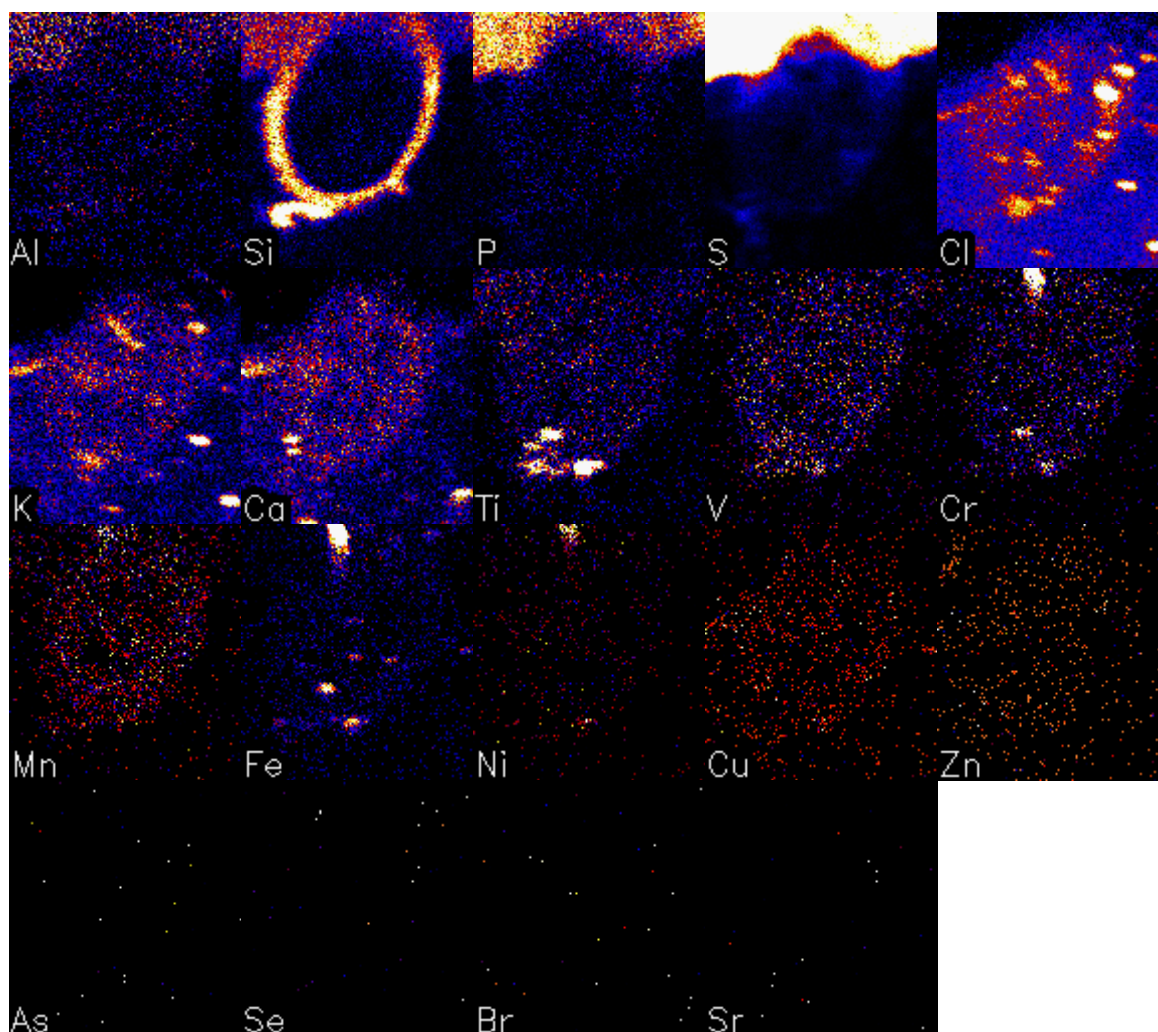
File Name: zamx_w295_38.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 1822 μC

Scan: X= 303 μm , Y= 334 μm

Pixel: X size: 116, Y Size: 128



Relative Concentration Legend



Fig 3.5.38: Ctr + Nu R2 (4) Cross Rem 21 (zamx_w295_38-regions-PIXE). Ca, Cl, Cr, Fe, K, Ni, Ti, and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. *Since this sample is a control with no AMF spores added, metal concentration was not expected. Thus the presence of AMF structures observed is a surprise.*

33.Ctr + Nu R2 (4) Cross Rem 22 (zamx_w295_40-regions-PIXE).

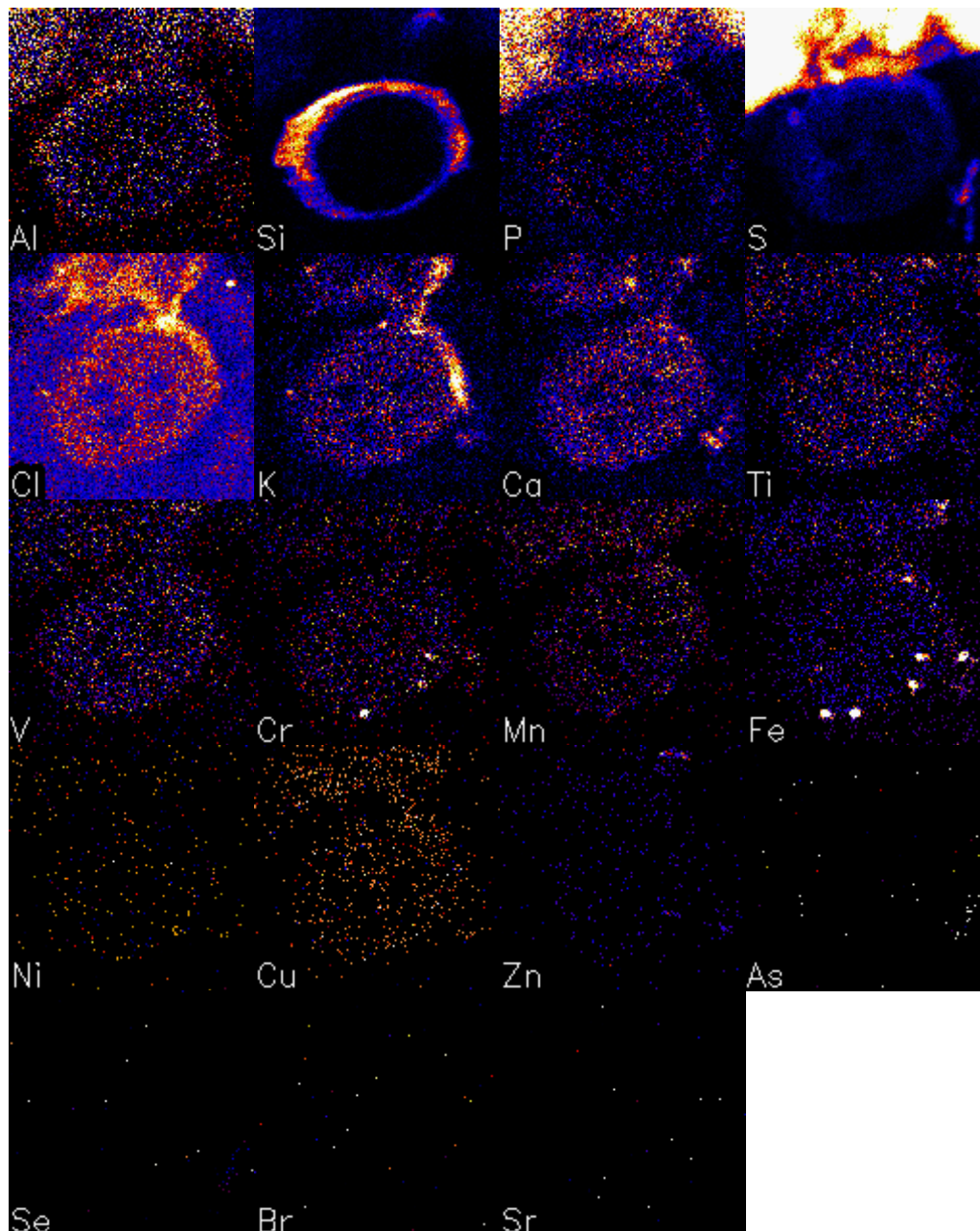
File Name: zamx_w295_40.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 1250 μC

Scan: X= 417 μm , Y= 417 μm

Pixel: X size: 128, Y Size: 128



Relative Concentration Legend

Zero  Maximum

Fig 3.5.39: Ctr + Nu R2 (4) Cross Rem 22 (zamx_w295_40-regions-PIXE). Ca, Cl, Cr, Fe, K, and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. *Since this sample is a control with no AMF spores added, metal concentration was not expected. Thus the presence of AMF structures observed is a surprise.*

34. *Ctr + Nu R2 (4) Cross Rem 23 (zamx_w295_41-regions-PIXE).*

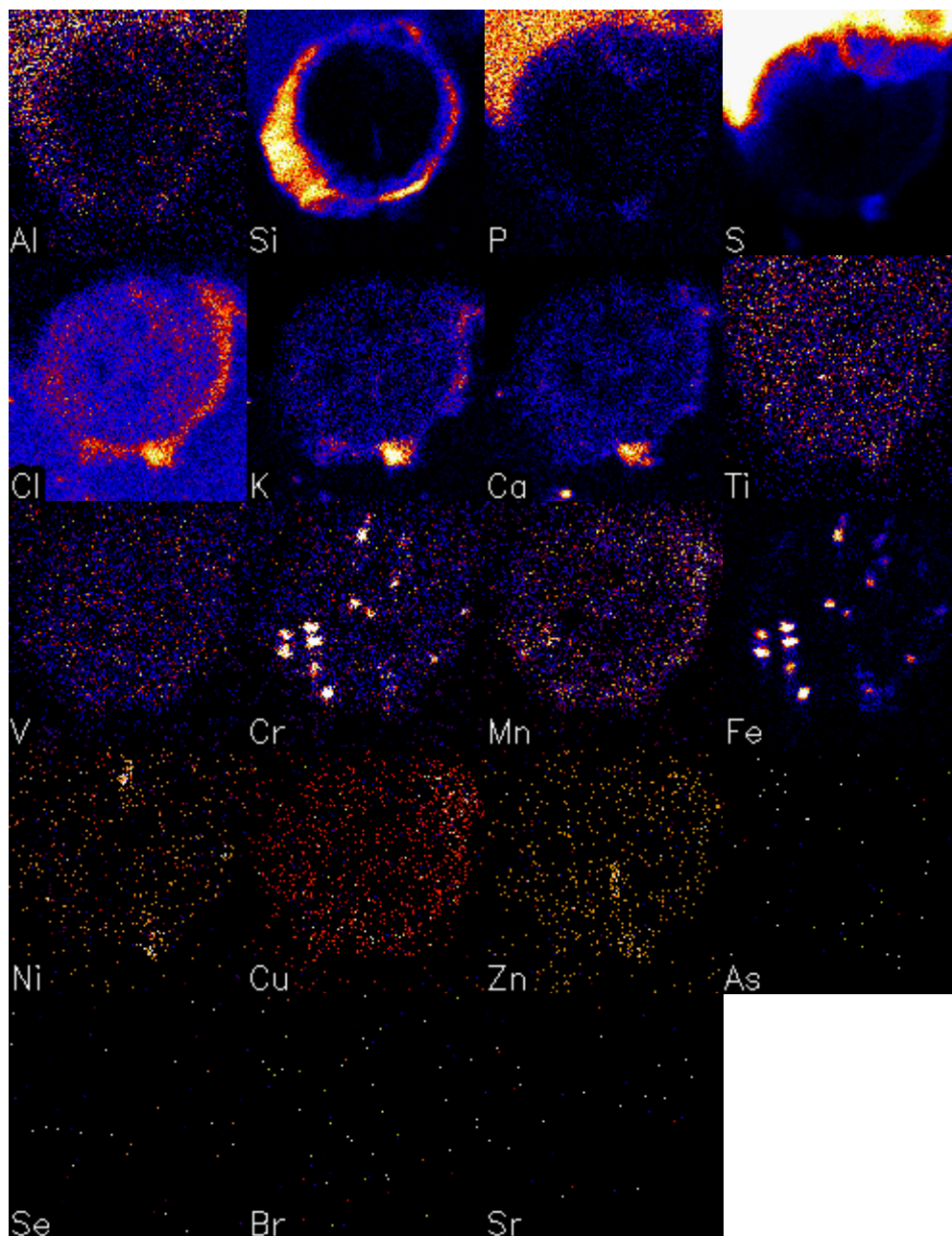
File Name: zamx_w295_41.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 1664 μC

Scan: X= 328 μm , Y= 333 μm

Pixel: X size: 124, Y Size: 128



Relative Concentration Legend



Fig 3.5.40: Ctr + Nu R2 (4) Cross Rem 23 (zamx_w295_41-regions-PIXE). Ca, Cl, Cr, Fe, K, Mn, Ni, Ti and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. *Since this sample is a control with no AMF spores added, metal concentration was not expected. Thus the presence of AMF structures observed is a surprise.*

35. Ctr + Myco 8 R1 Rem 24 (zamx_w290_42-regions-PIXE).

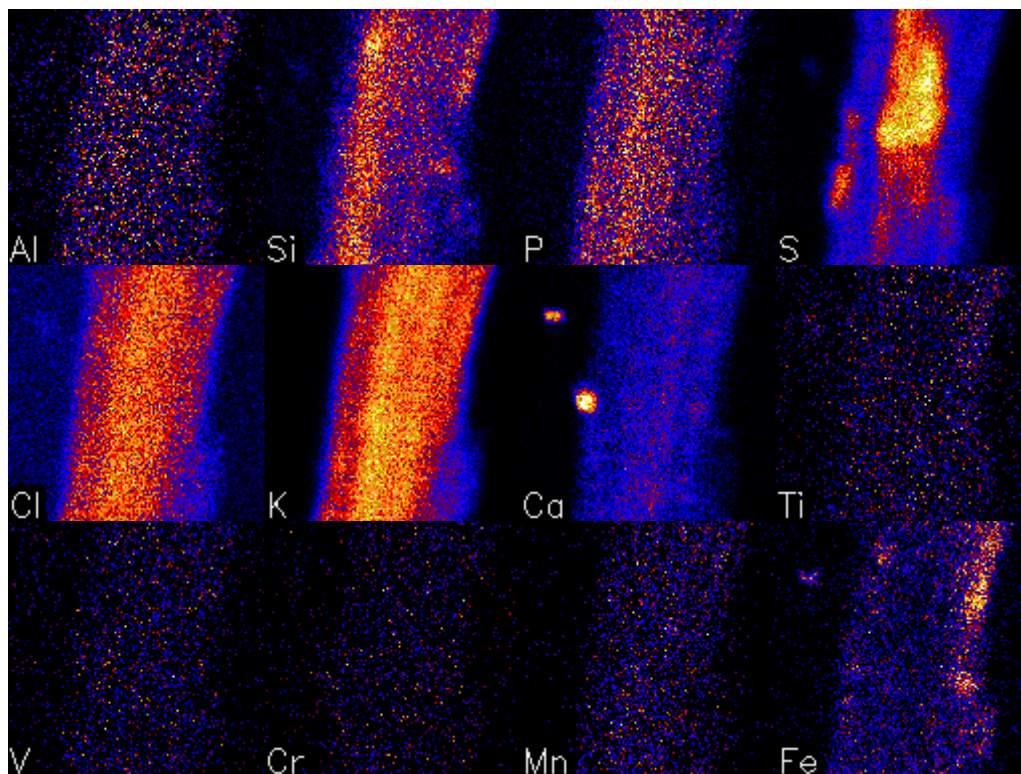
File Name: zamx_w295_42.evt

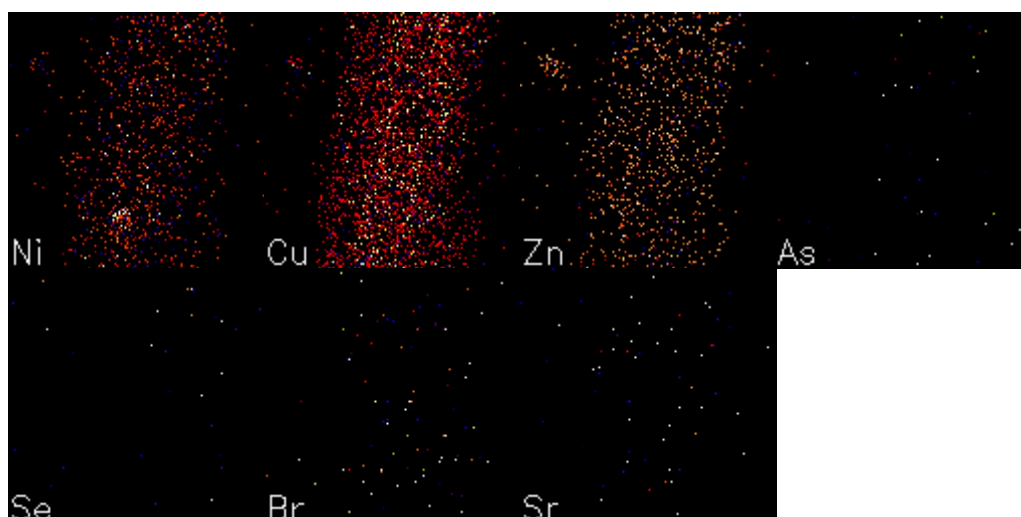
Dynamic Matrix: zamx_w295_19.dam

Charge: 1142 μC

Scan: X= 226 μm , Y= 250 μm

Pixel: X size: 128, Y Size: 128





Relative Concentration Legend



Fig 3.5.41: Ctr + Myco 8 R1 Rem 24 (zamx_w290_42-regions-PIXE). Ca, Fe, and Ni, were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Cl, S, P, Si and K, appear to be spread across the root cross-section. *More accumulation of elements in the AMF structures was expected since this sample was inoculated with mycorrhizae, but the elemental concentration appears to be lesser than Ctr + Nu*

36. North West (Vaal Reefs) Au +Ur) S11 R2 (2) Rem 25 (zamx_w295_43-regions-PIXE).

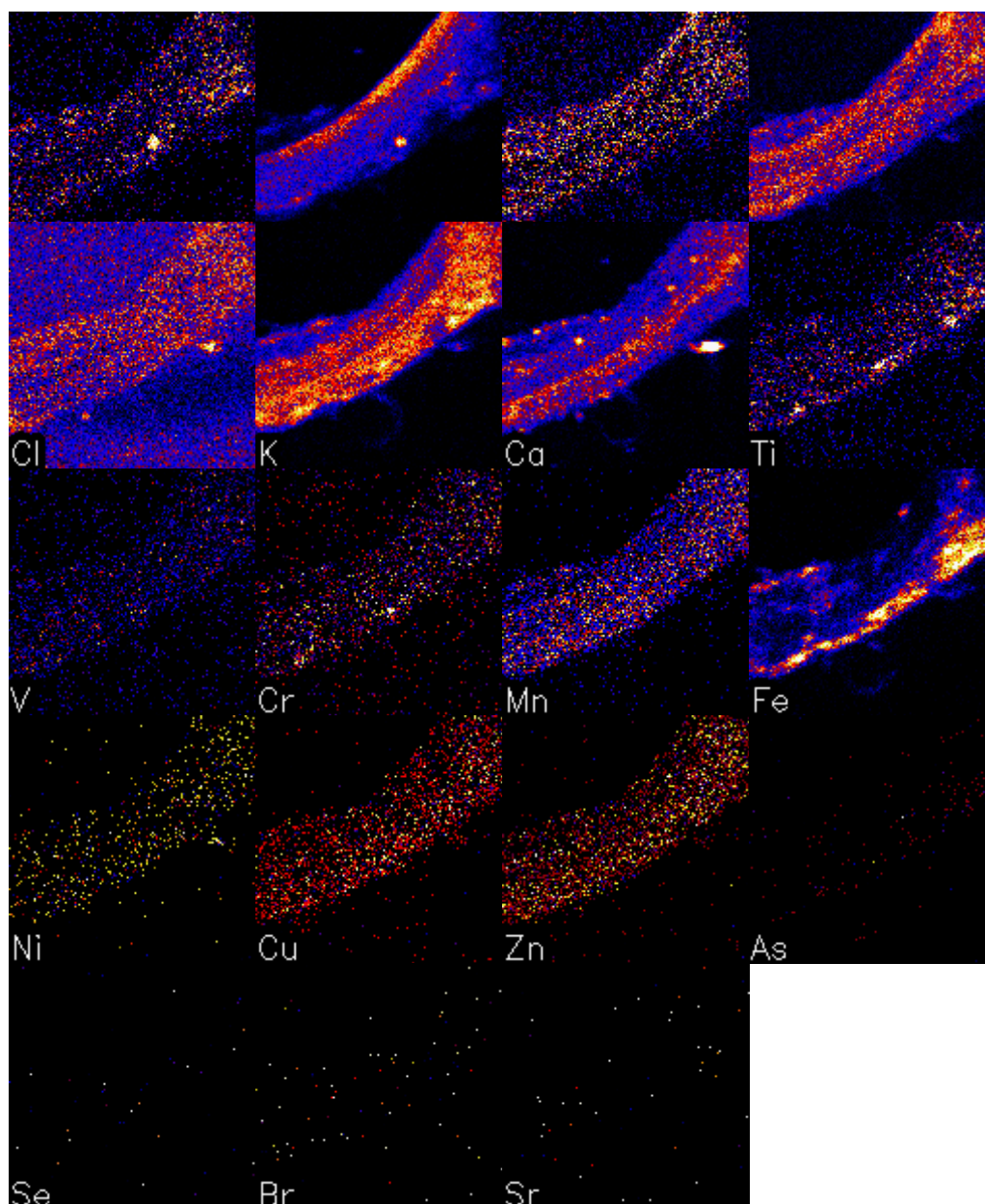
File Name: zamx_w295_43.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 1545 μC

Scan: X= 417 μm , Y= 417 μm

Pixel: X size: 128, Y Size: 128



Relative Concentration Legend



Fig 3.5.42: North West (Vaal Reefs) Au +Ur) S11 R2 (2) Rem 25 (zamx_w295_43-regions-PIXE). Al, Ca, Cr, Fe, Mn, Ti, and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Cl, Cu, P, K, S, and Zn, appear to be spread across the root cross-section.

**37. North West (Vaal Reefs) Au +Ur) S11 R2 (2) Rem 8 Repeat of Fig 3.5.44
(zamx_w295_47-regions-PIXE).**

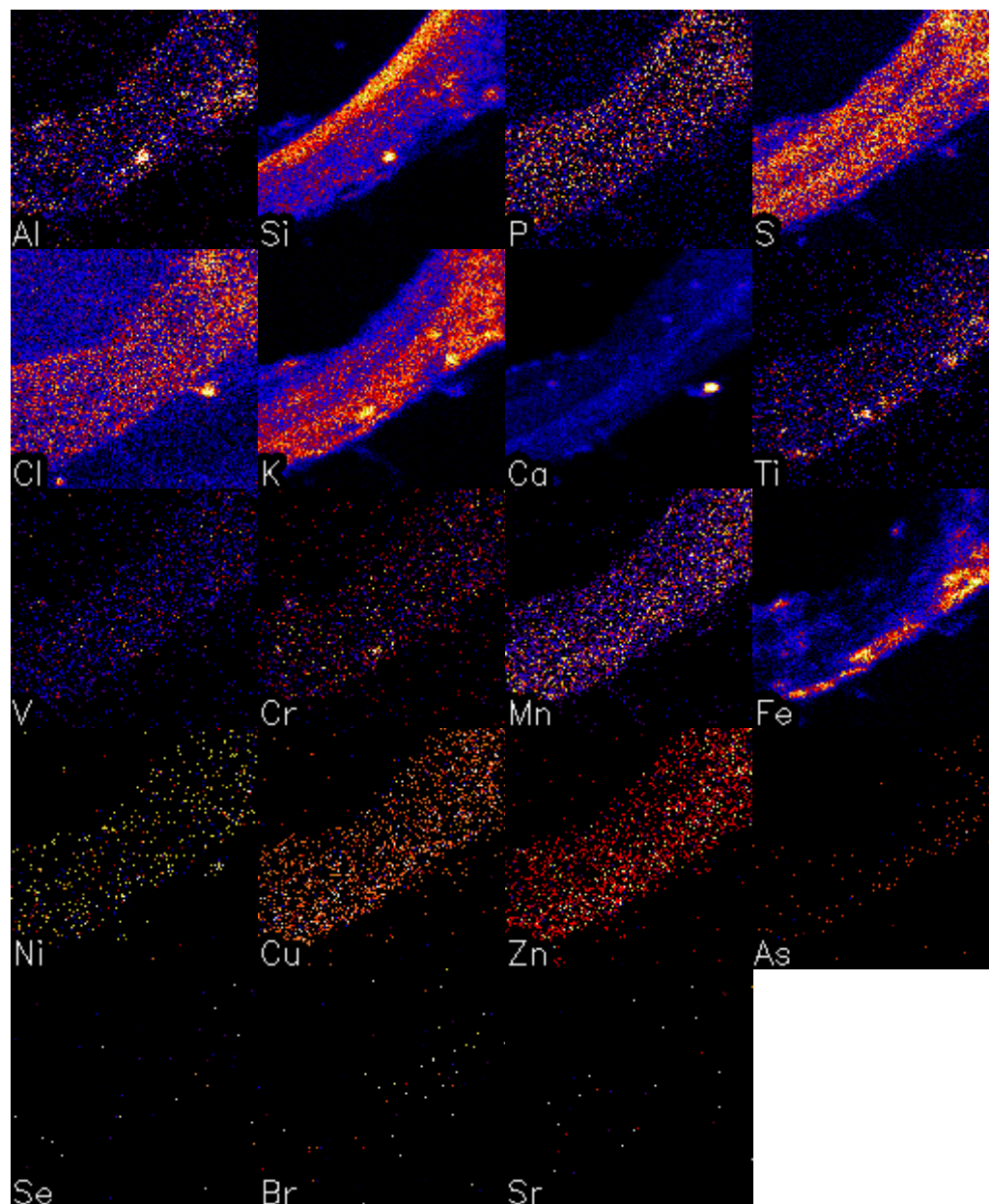
File Name: zamx_w295_47.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 884 μC

Scan: X= 334 μm , Y= 323 μm

Pixel: X size: 128, Y Size: 124



Relative Concentration Legend



Fig 3.5.43: North West (Vaal Reefs) Au +Ur) S11 R2 (2) Rem 8 Repeat of Fig 3.5.44 (zamx_w295_47-regions-PIXE). Al, Ca, Cr, Fe, Mn, Ti, and were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Cl, Cu, P, K, S, Si and Zn, appear to be spread across the root cross-section.

38. WW14 (3) R1 Cross – West Wits (Gauteng) high Au +Ur Reg 0 -2 REM9 (zamx_w295_48-regions-PIXE).

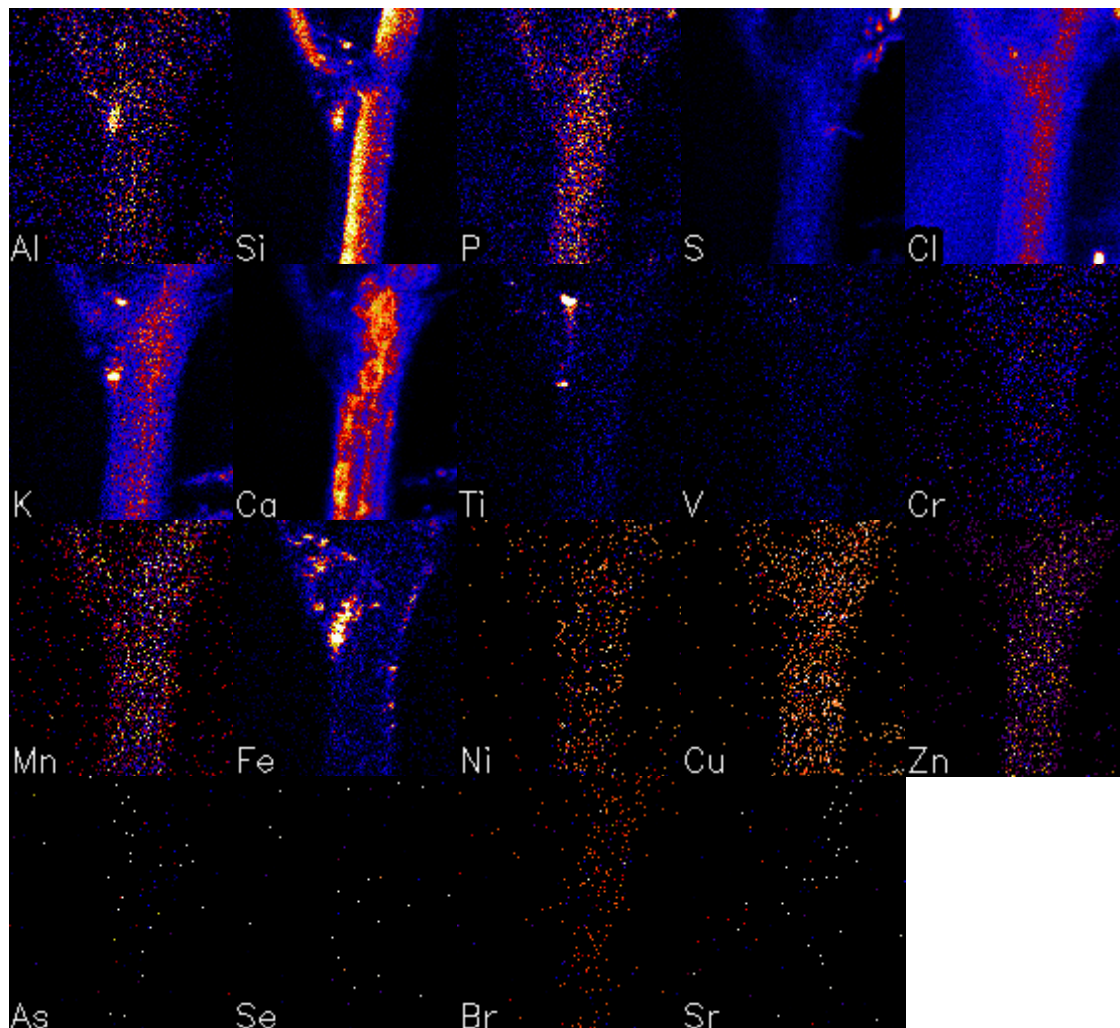
File Name: zamx_w295_48.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 2280 μC

Scan: X= 450 μm , Y= 501 μm

Pixel: X size: 112, Y Size: 128



Relative Concentration Legend



Fig 3.5.44: WW14 (3) R1 Cross – West Wits (North West) high Au +Ur Reg 0 -2 REM9 (zamx_w295_48-regions-PIXE). Al, Ca, Fe, Mn, S, V and Ti, were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Cl, Cu, P, K, Si and Zn, appear to be spread across the root cross-section.

39. East Rand (ER) Metallurgical Plant (MP) A2 + A5 R1 Rem 10 (1) (zamx_w295_49-regions-PIXE).

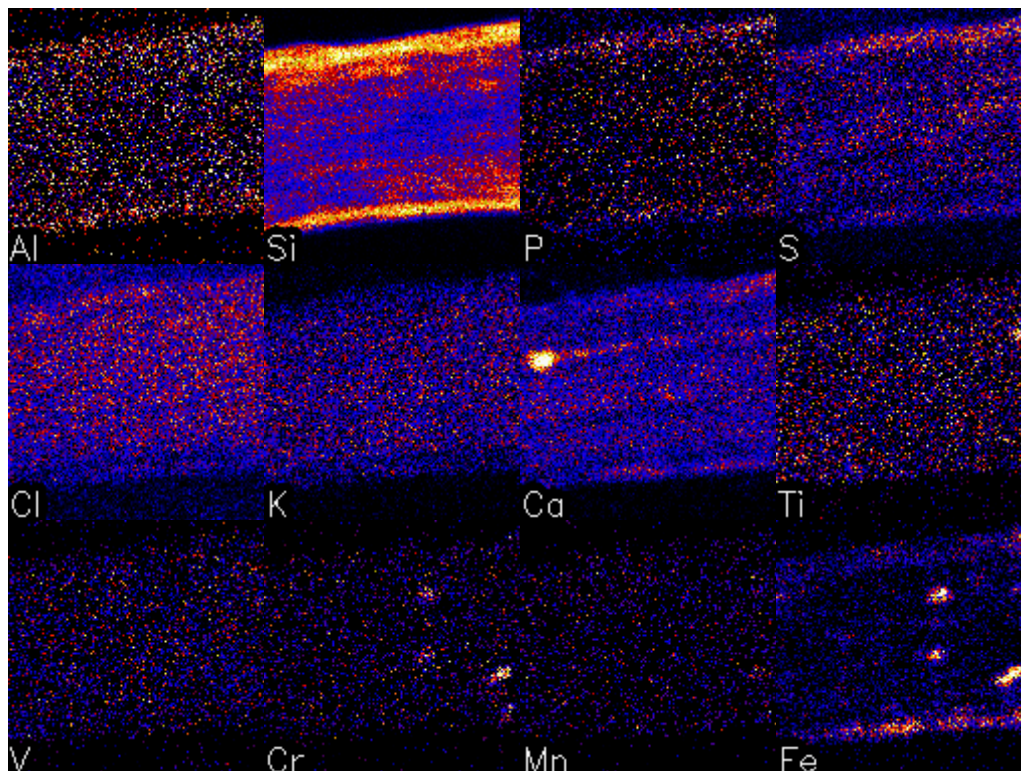
File Name: zamx_w295_49.evt

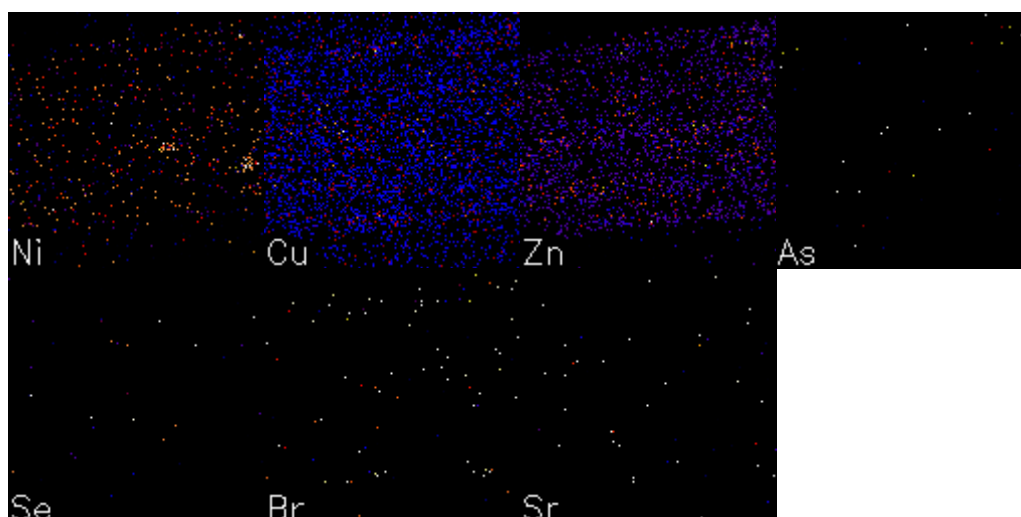
Dynamic Matrix: zamx_w295_19.dam

Charge: 1134 μC

Scan: X= 250 μm , Y= 250 μm

Pixel: X size: 128, Y Size: 128





Relative Concentration Legend



Fig 3.5.45: East Rand (ER) Metallurgical Plant (MP) A2 + A5 R1 Rem 10 (1) (zamx_w295_49-regions-PIXE). Ca, Cr, Fe, and Mn, were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Cl, K, and Si appear to be spread across the root cross-section.

40. East Rand (ER) Metallurgical Plant (MP) A2 + A5 R1Reg 0 - 2 Rem 11 (1) (zamx_w295_50-regions-PIXE).

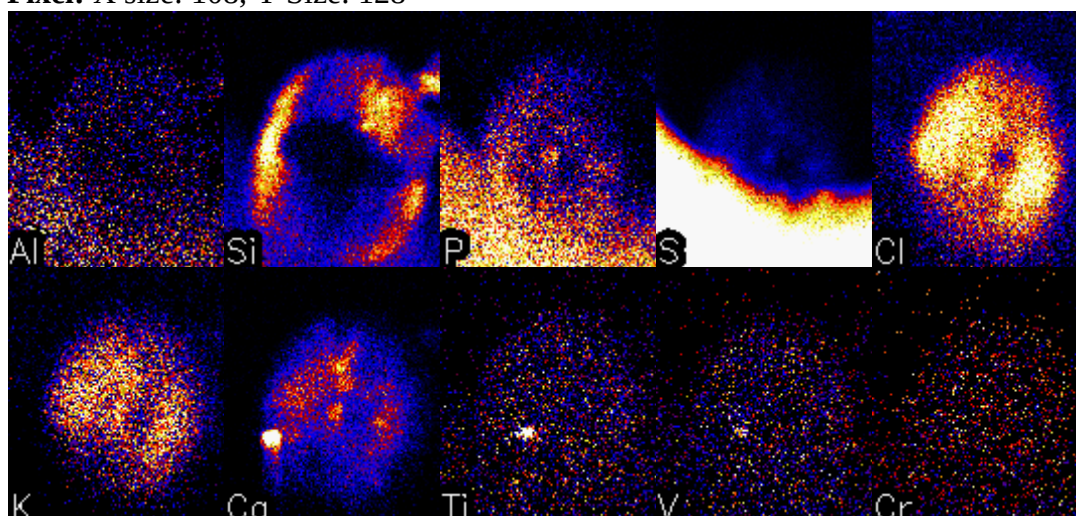
File Name: zamx_w295_50.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 1104 μC

Scan: X= 213 μm , Y= 250 μm

Pixel: X size: 108, Y Size: 128



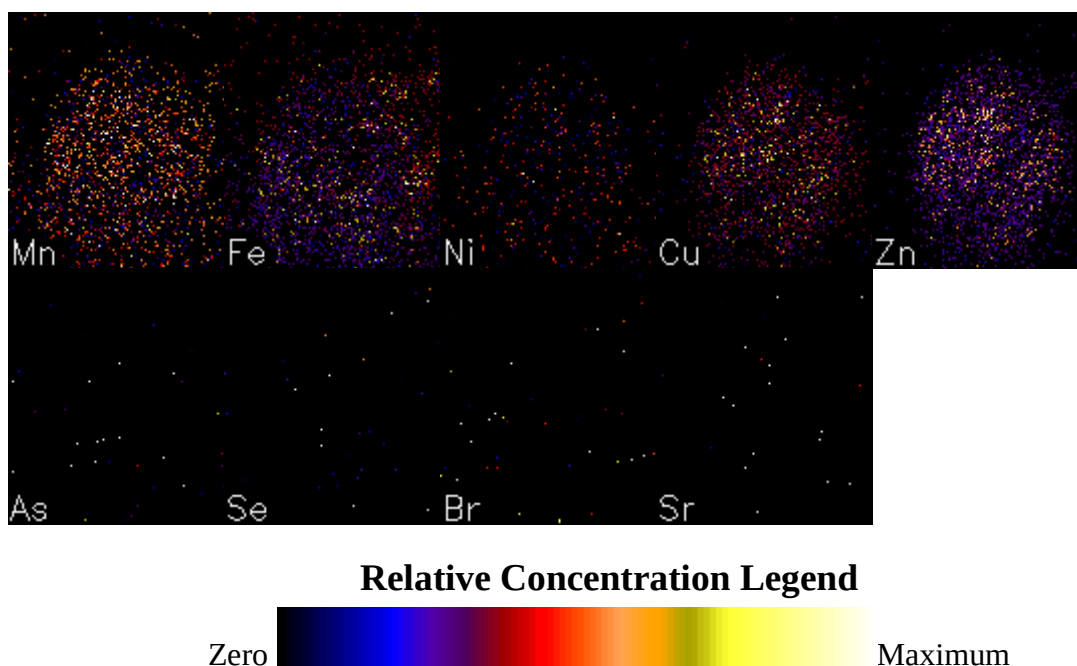


Fig 3.5.46: East Rand (ER) Metallurgical Plant (MP) A2 + A5 R1Reg 0 - 2 Rem 11 (1) (zamx_w295_50-regions-PIXE). Ca, Ti and V, were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Cl, K, P and Si appear to be spread across the root cross-section.

41. East Rand (ER) Metallurgical Plant (MP) A2 + A5 R1Reg 0 - 3 Rem 12 (1) (zamx_w295_51-regions-PIXE).

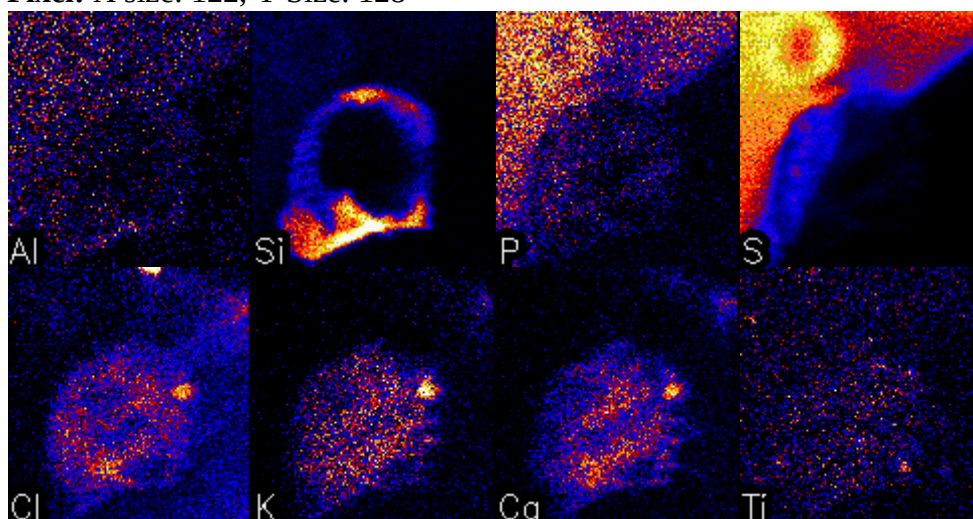
File Name: zamx_w295_51.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 1356 μC

Scan: X= 321 μm , Y= 333 μm

Pixel: X size: 122, Y Size: 128



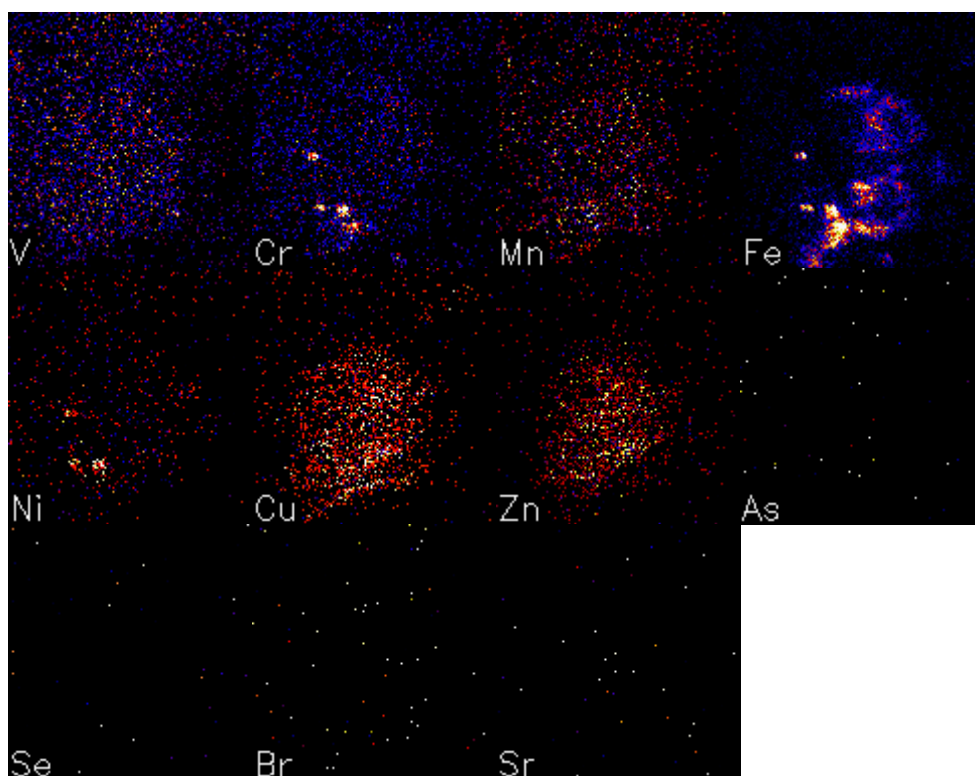


Fig 3.5.47: East Rand (ER) Metallurgical Plant (MP) A2 + A5 R1Reg 0 - 3 Rem 12 (1) (zamx_w295_51-regions-PIXE). Cr, Fe, Ni, Ti and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Ca, Cl, Mn, Cu, K, and Zn appear to be spread across the root cross-section.

**42. M15 VR R (7)) North West (Vaal Reefs) Au +Ur) Reg 0 -1 Rem 14 Cross
(zamx_w295_52-regions-PIXE).**

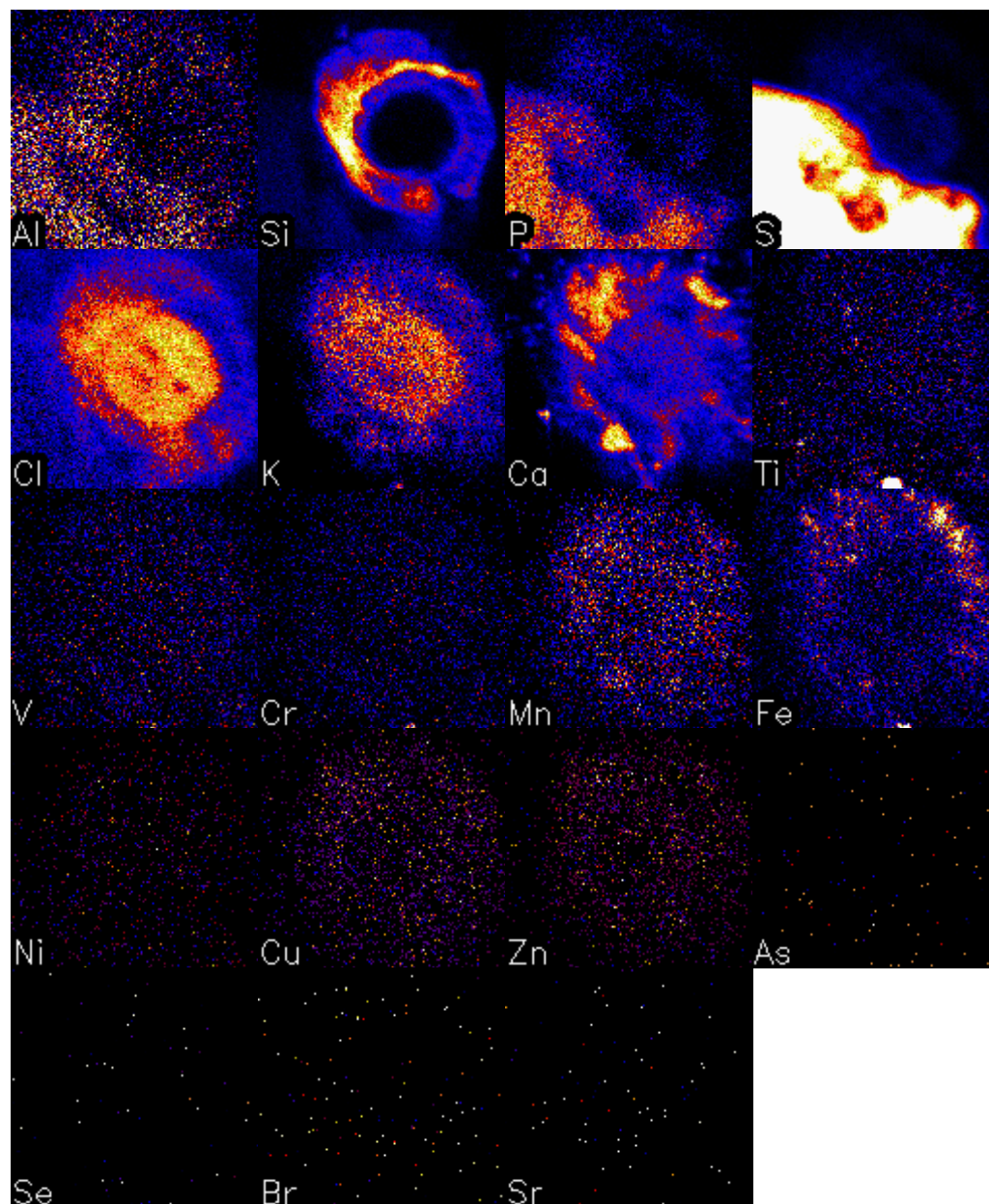
File Name: zamx_w295_52.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 2848 μC

Scan: X= 295 μm , Y= 328 μm

Pixel: X size: 128, Y Size: 124



Relative Concentration Legend



Fig 3.5.48: (M15 VR R (7)) North West (Vaal Reefs) Au +Ur) Reg 0 -1 Rem 14 Cross (zamx_w295_52-regions-PIXE). Ca, Fe, Mn, and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Cl, Cu, Zn and K appear to be spread across the root cross-section.

43. (M15 VR R (7)) North West (Vaal Reefs) Au +Ur) Reg 0 -2 Rem 15A Cross (zamx_w295_53-regions-PIXE).

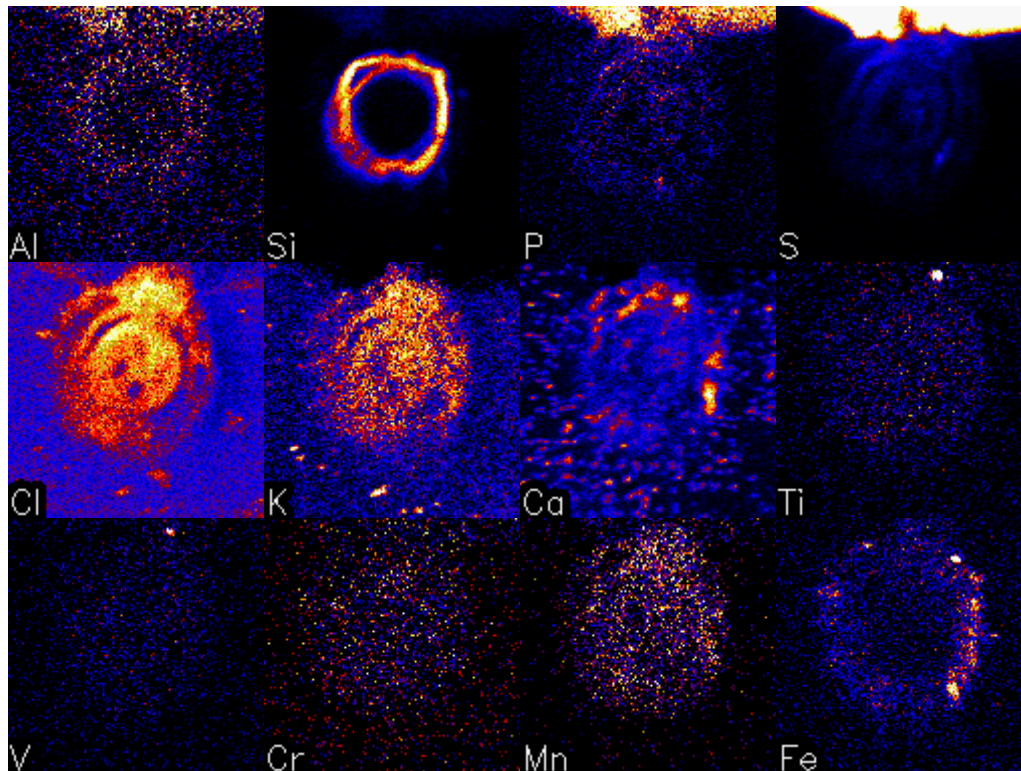
File Name: zamx_w295_53.evt

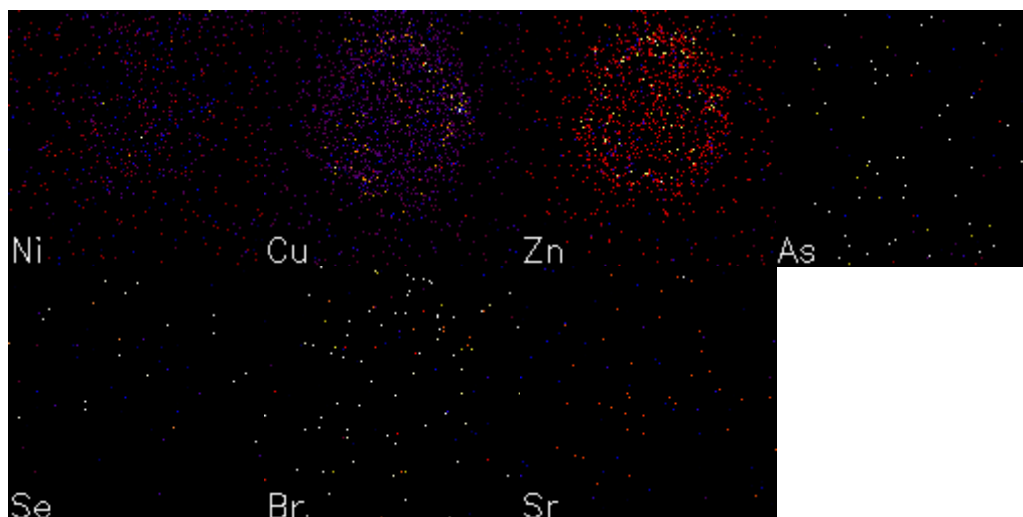
Dynamic Matrix: zamx_w295_19.dam

Charge: 3225 μC

Scan: X= 417 μm , Y= 417 μm

Pixel: X size: 128, Y Size: 128





Relative Concentration Legend



Fig 3.5.49: (M15 VR R (7)) North West (Vaal Reefs) Au +Ur) Reg 0 -2 Rem 15A Cross (zamx_w295_53-regions-PIXE). Ca, Fe, Ti and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Cl, Mn, Cu, Zn and K appear to be spread across the root cross-section.

44. (M15 VR R (7)) North West (Vaal Reefs) Au +Ur) Reg 0 -1 Rem 15B Cross (zamx_w295_54-regions-PIXE).

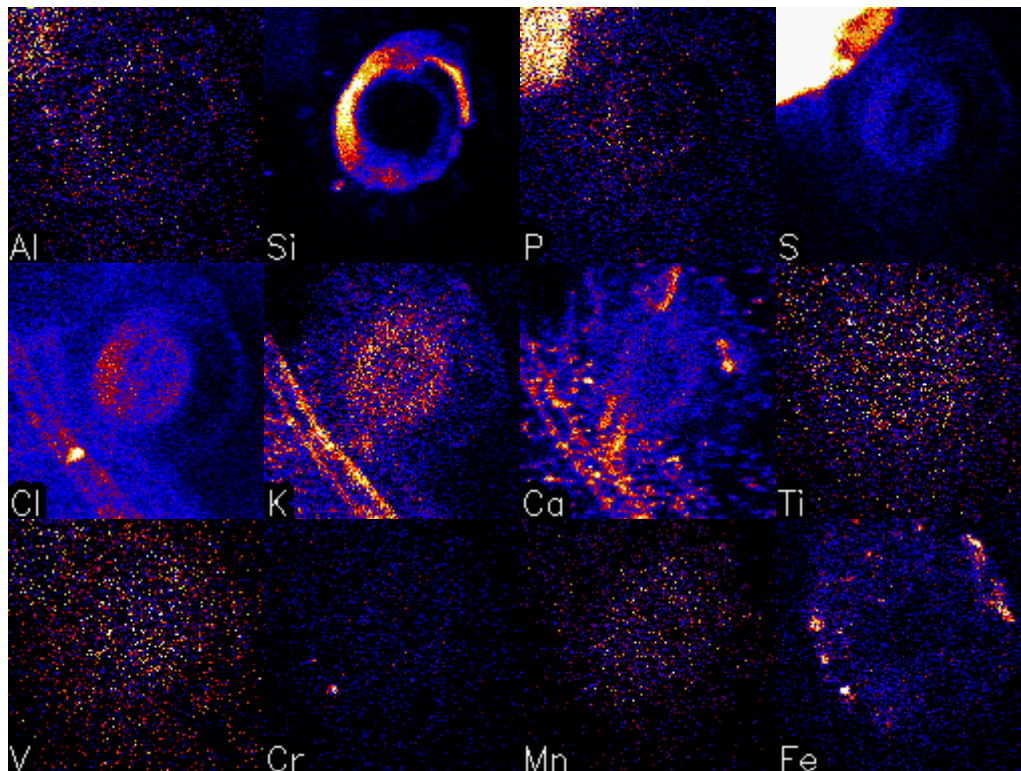
File Name: zamx_w295_54.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 1368 μC

Scan: X= 417 μm , Y= 417 μm

Pixel: X size: 128, Y Size: 128



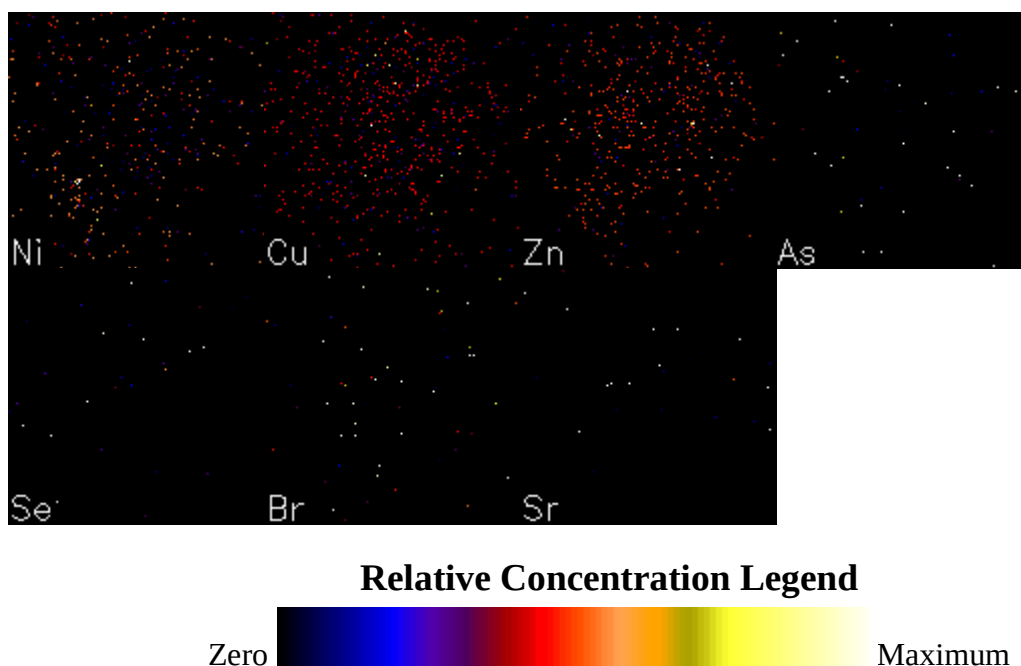


Fig 3.5.50: (M15 VR R (7)) North West (Vaal Reefs) Au +Ur) Reg 0 -1 Rem 15B Cross (zamx_w295_54-regions-PIXE). Ca, Cr, Fe, Cl and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While, Mn, Ti and K appear to be spread across the root cross-section.

45.Ctr + Mycorroot Reg 0 -3 Rem 16 Long Root (zamx_w295_55-regions-PIXE).

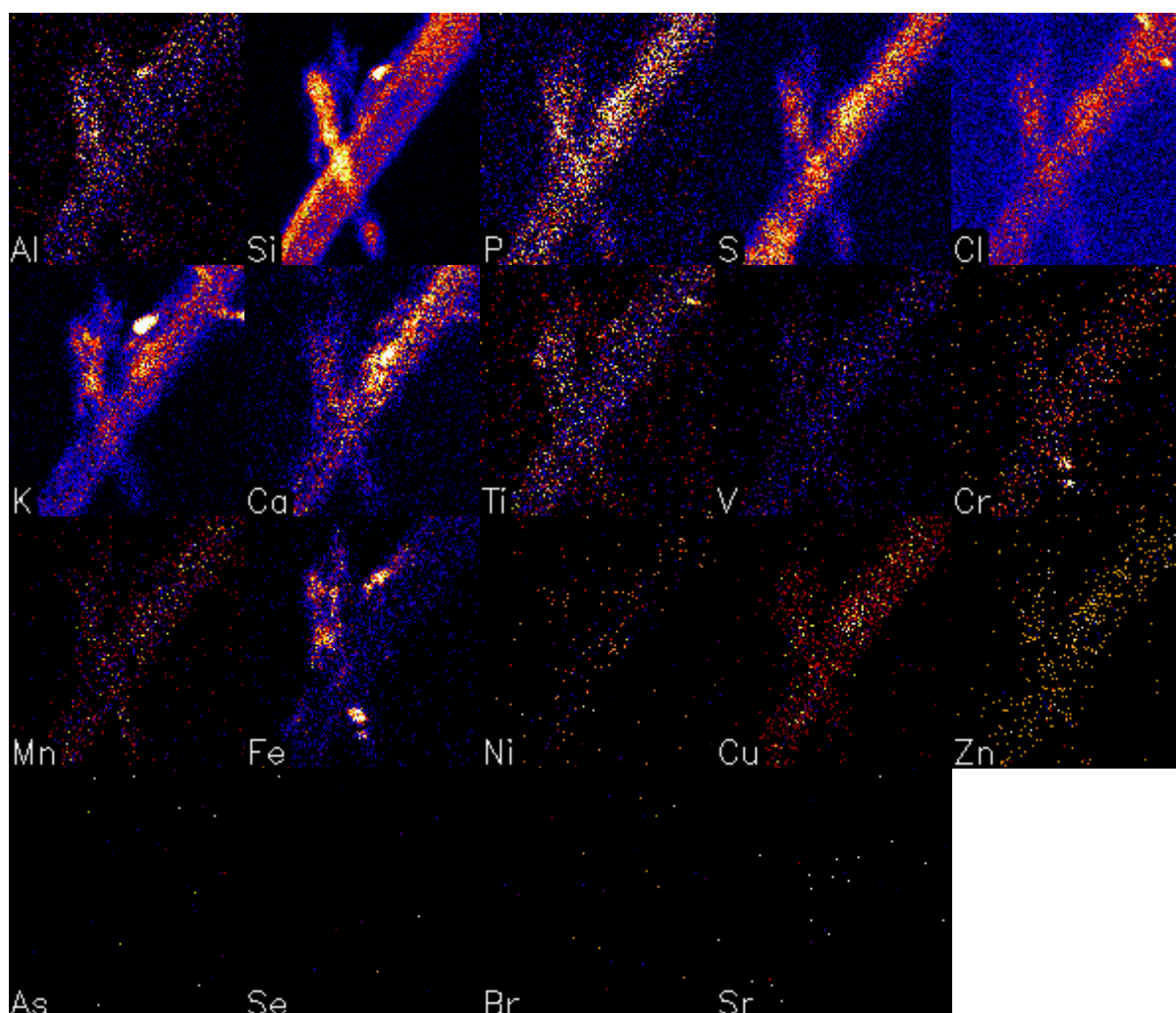
File Name: zamx_w295_55.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 1138 μC

Scan: X= 318 μm , Y= 341 μm

Pixel: X size: 120, Y Size: 128



Relative Concentration Legend



Fig 3.5.51: Ctr + Mycorroot Reg 0 -3 Rem 16 Long Root (zamx_w295_55-regions-PIXE).

Ca, Cr, Fe, Ti, and K were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Al, Cl, P, S, and Si appear to be spread across the root cross-section.

46.Ctr + Mycorroot Reg 0 -3 Rem 17cross (zamx_w295_56-regions-PIXE).

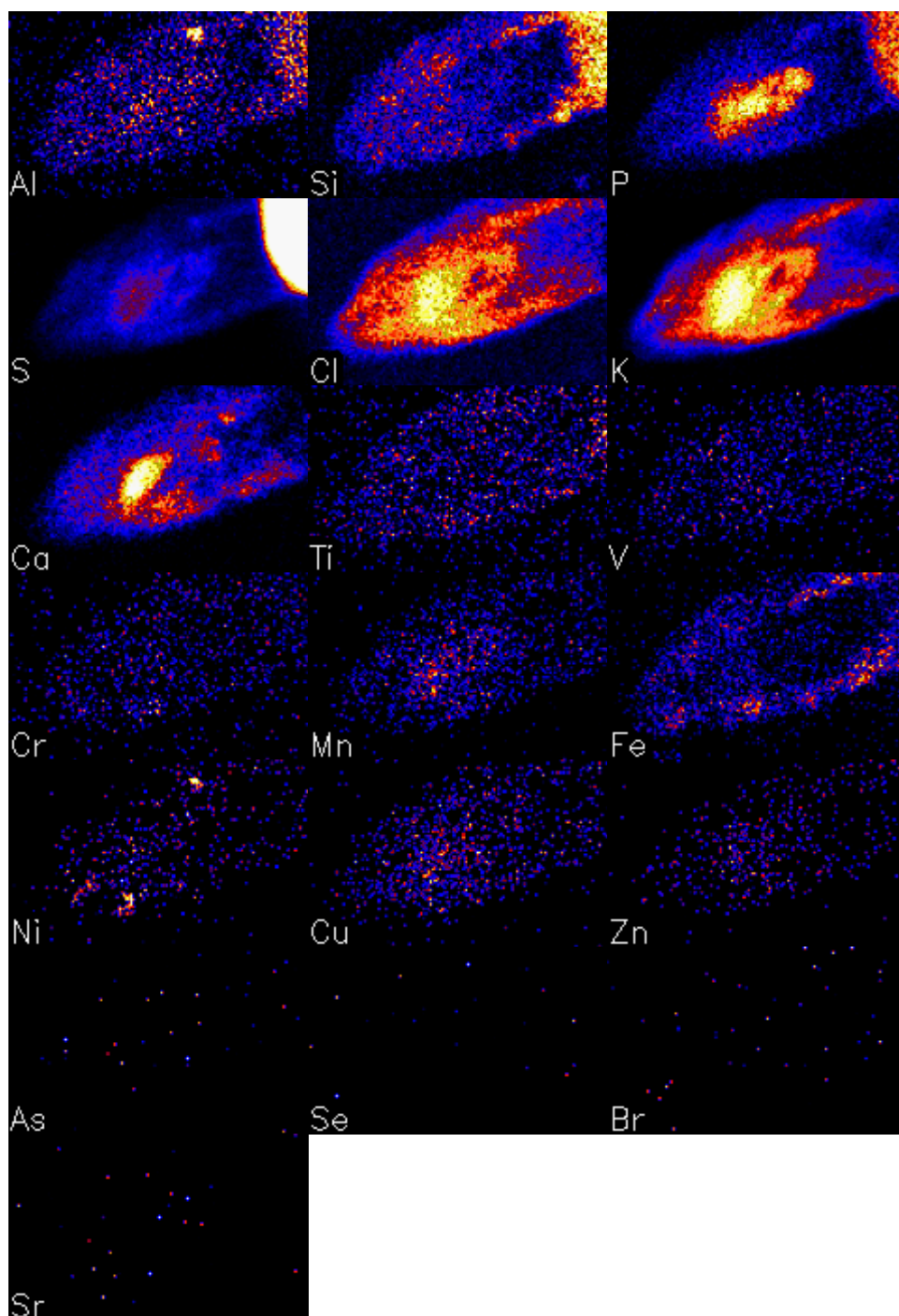
File Name: zamx_w295_56.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 1226 μC

Scan: X= 334 μm , Y= 216 μm

Pixel: X size: 128, Y Size: 80



Relative Concentration Legend

Zero  Maximum

Fig 3.5.52: Ctr + Mycorroot Reg 0 -3 Rem 17cross (zamx_w295_56-regions-PIXE). Al, Ca, Fe, and Ni, were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Cl, P, Cu, K and, Si appear to be spread across the root cross-section.

47.Ctr + Mycorroot Reg 0 -3 Rem 19 cross (zamx_w295_57-regions-PIXE).

File Name: zamx_w295_57.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 2015 μC

Scan: X= 250 μm , Y= 215 μm

Pixel: X size: 128, Y Size: 108

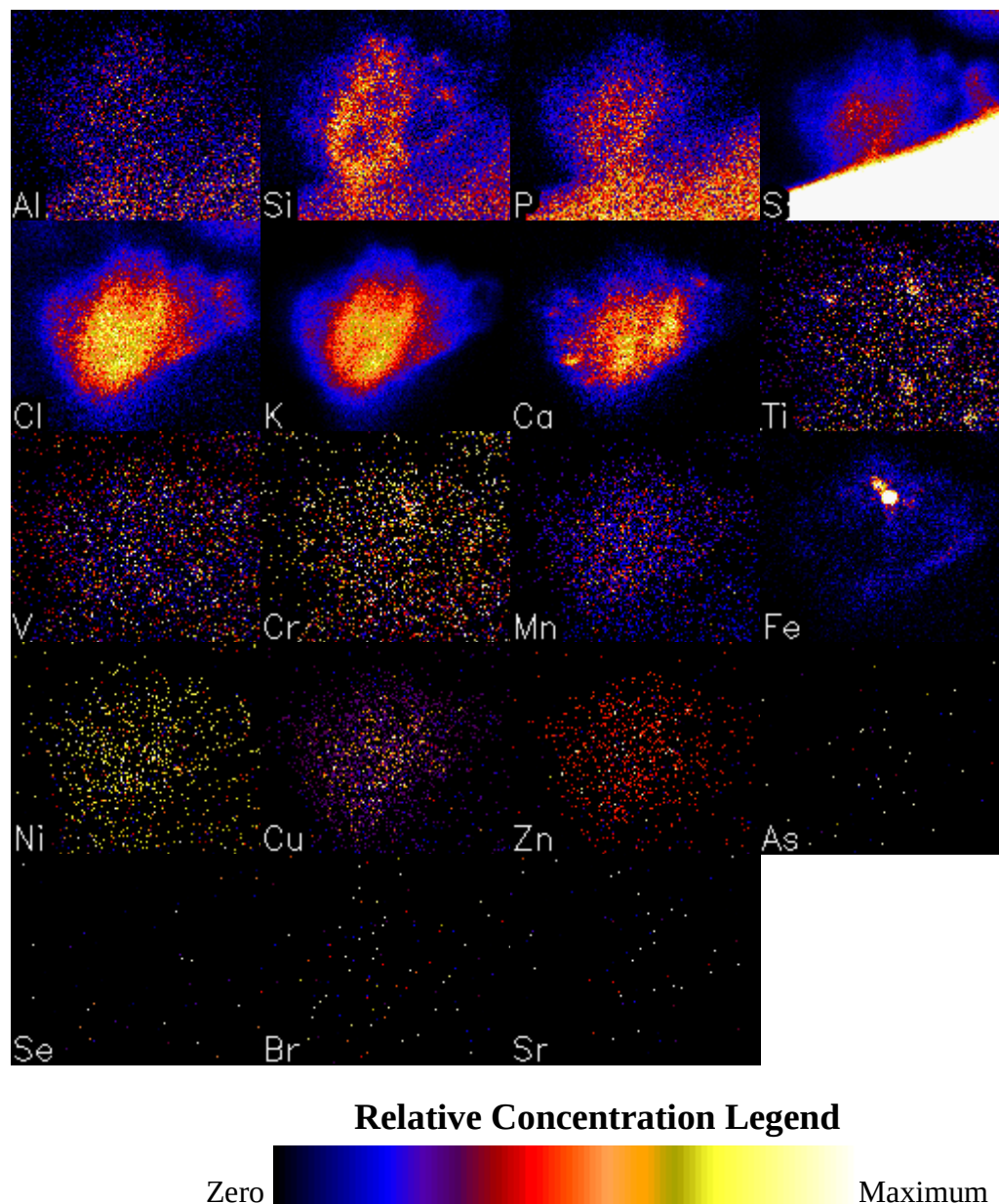


Fig 3.5.53: Ctr + Mycorroot Reg 0 -3 Rem 19 cross (zamx_w295_57-regions-PIXE). Fe, and Ti, were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Ca, Cl, P, Mn, Cu, K and, Si appear to be spread across the root cross-section.

**48. East Rand (ER) Metallurgical Plant (MP) D1 R1 (6) (1) Reg 0 -3 Rem 20
long root (zamx_w295_58-regions-PIXE).**

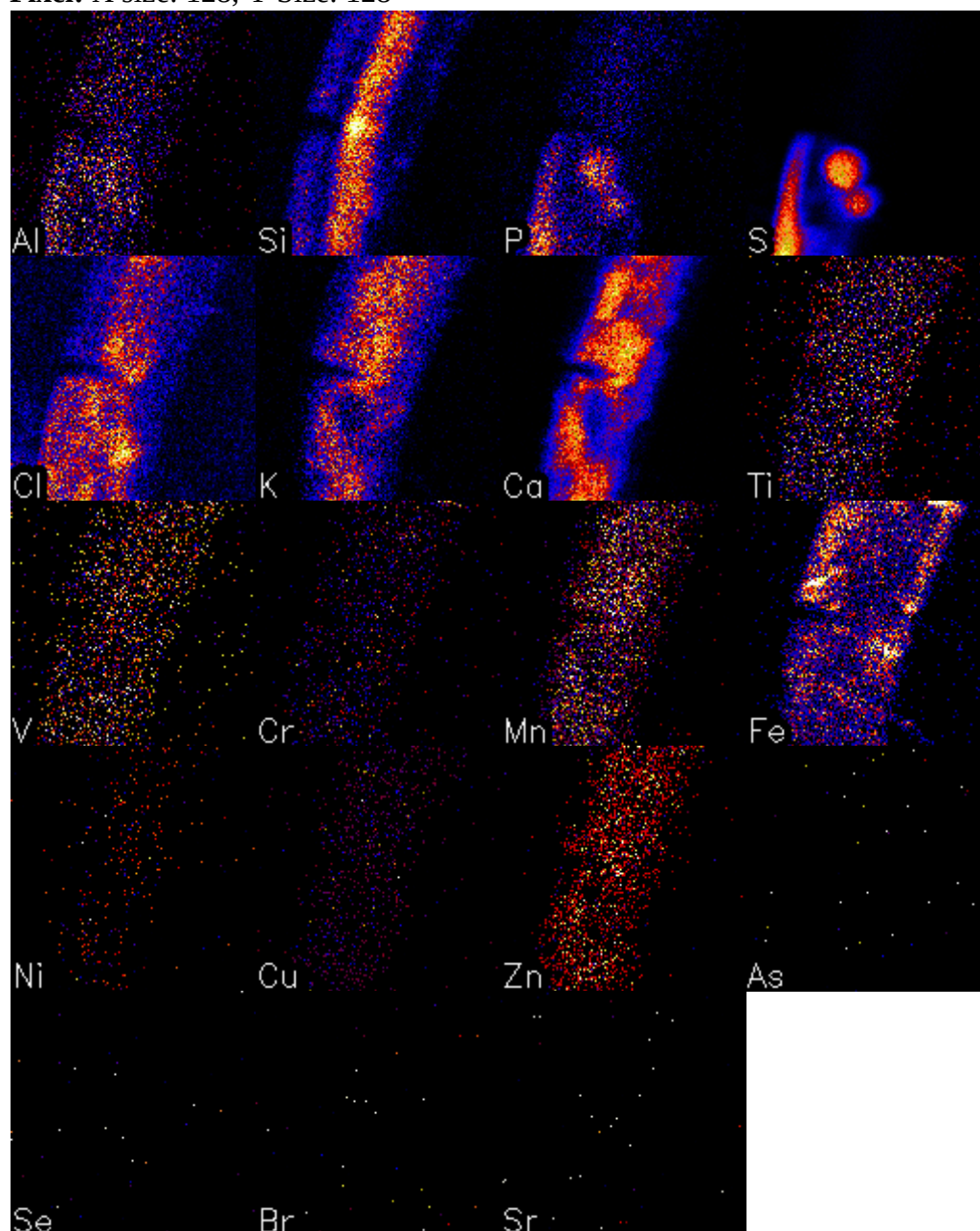
File Name: zamx_w295_58.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 899 μC

Scan: X= 334 μm , Y= 334 μm

Pixel: X size: 128, Y Size: 128



Relative Concentration Legend



Fig 3.5.54: East Rand (ER) Metallurgical Plant (MP) D1 R1 (6) (1) Reg 0 -3 Rem 20 long root (zamx_w295_58-regions-PIXE). Ca, Cl, Fe, P, and S, were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Al, Mn, K, Zn, and, Si appear to be spread across the root cross-section.

49. East Rand (ER) Metallurgical Plant (MP) D1 R1 (6) (1) Reg 0 -3 Rem 21 Long Root (zamx_w295_59-regions-PIXE).

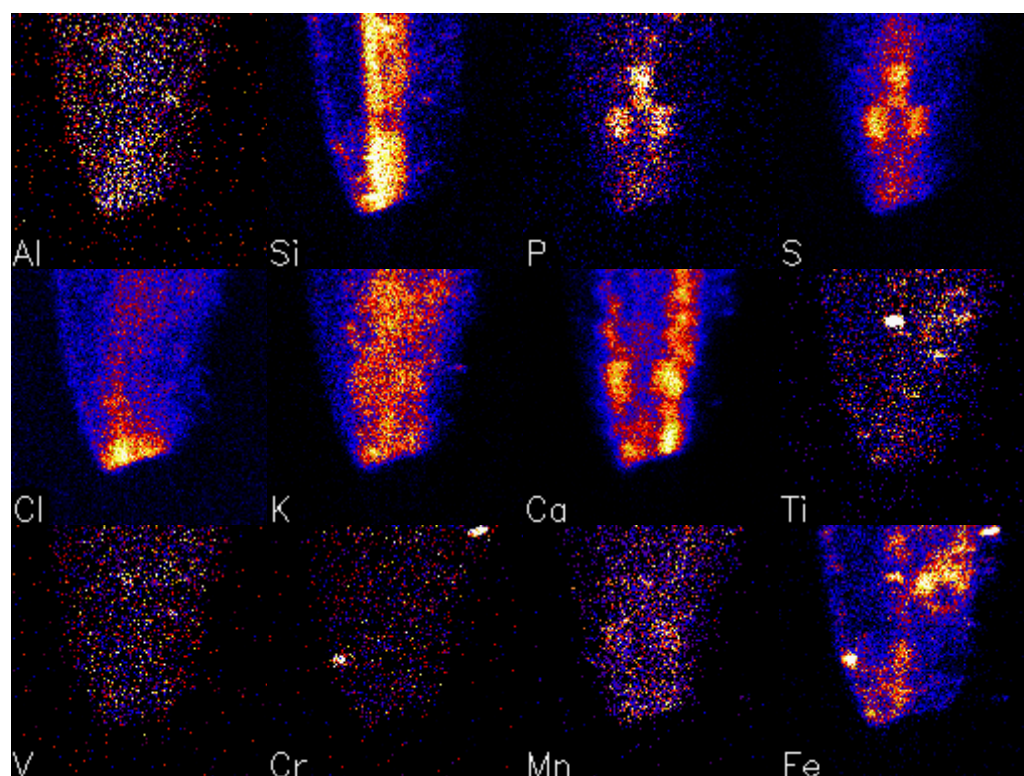
File Name: zamx_w295_59.evt

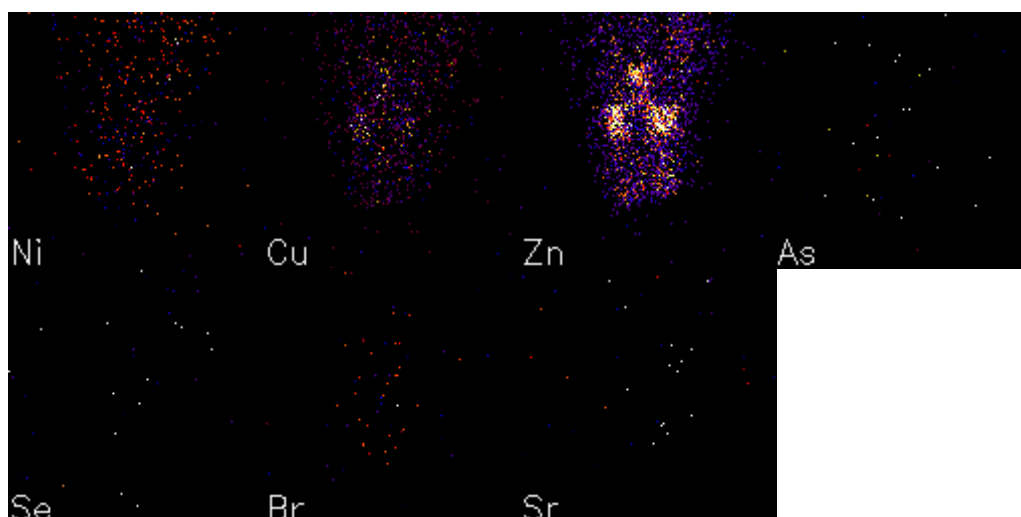
Dynamic Matrix: zamx_w295_19.dam

Charge: 1165 μC

Scan: X= 334 μm , Y= 334 μm

Pixel: X size: 128, Y Size: 128





Relative Concentration Legend



Fig 3.5.55: East Rand (ER) Metallurgical Plant (MP) D1 R1 (6) (1) Reg 0 -3 Rem 21 Long Root (zamx_w295_59-regions-PIXE). Ca, Cl, Cr, Cu, Fe, Mn, P, Ti, Zn, and S, were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Al, K and, Si appear to be spread across the root cross-section.

50.WW14 (3) R1 Long root – West Wits (North West) high Au +Ur Reg 0 -2 REM8 (zamx_w295_60-regions-PIXE).

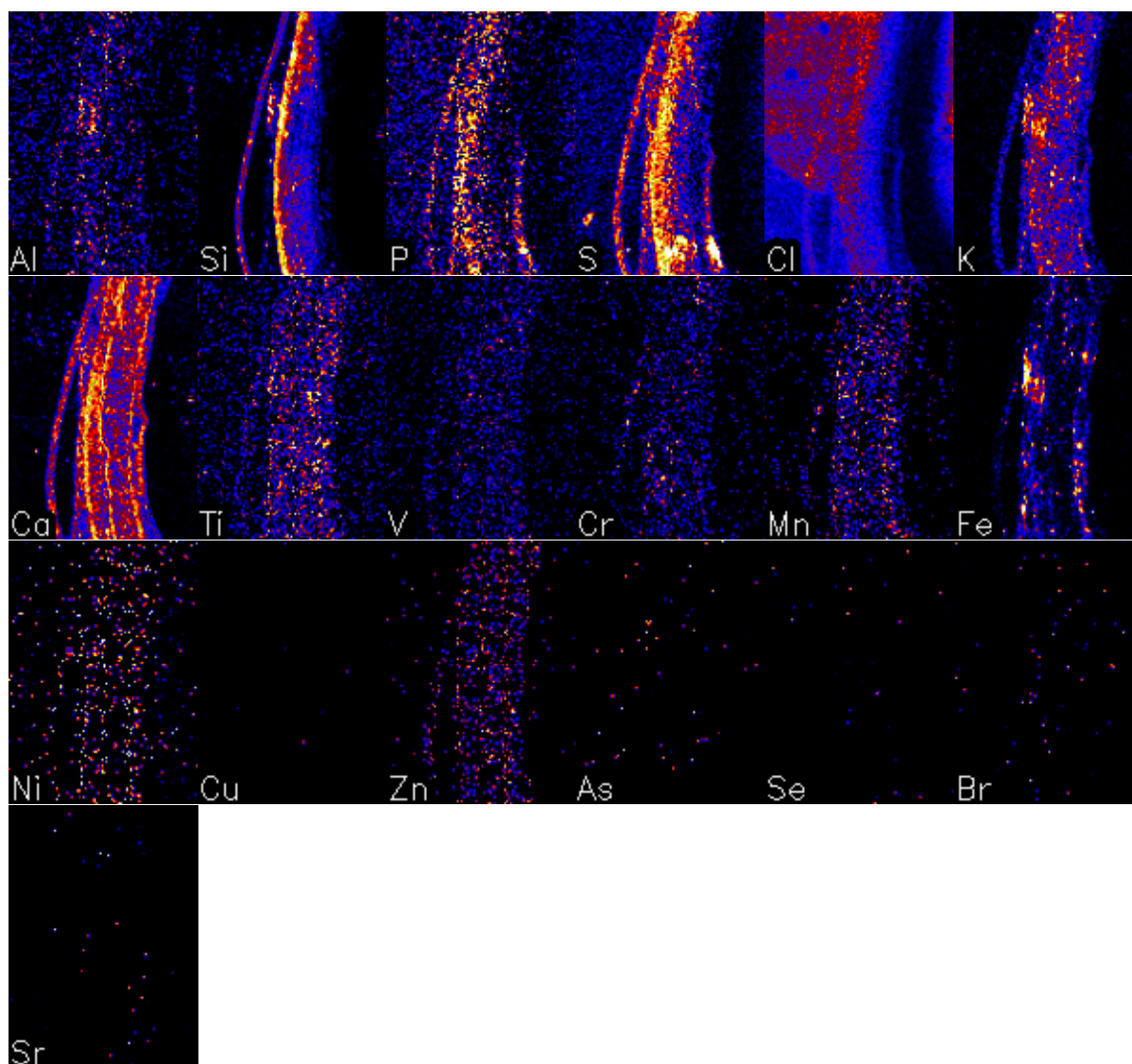
File Name: zamx_w295_60.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 1272 μC

Scan: X= 1053 μm , Y= 1418 μm

Pixel: X size: 92, Y Size: 128



Relative Concentration Legend



Fig 3.5.56: WW14 (3) R1 Long root – West Wits (North West) high Au +Ur Reg 0 -2 REM8 (zamx_w295_60-regions-PIXE). Ca, Cr, Fe, K, Mn, P, Ti, Si and S, were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Al, Cl, and, Zn, appear to be spread across the root cross-section.

**51.WW14 (3) R1 Long root – West Wits (North West) high Au +Ur Reg 0 -4
REM9 (zamx_w295_61-regions-PIXE).**

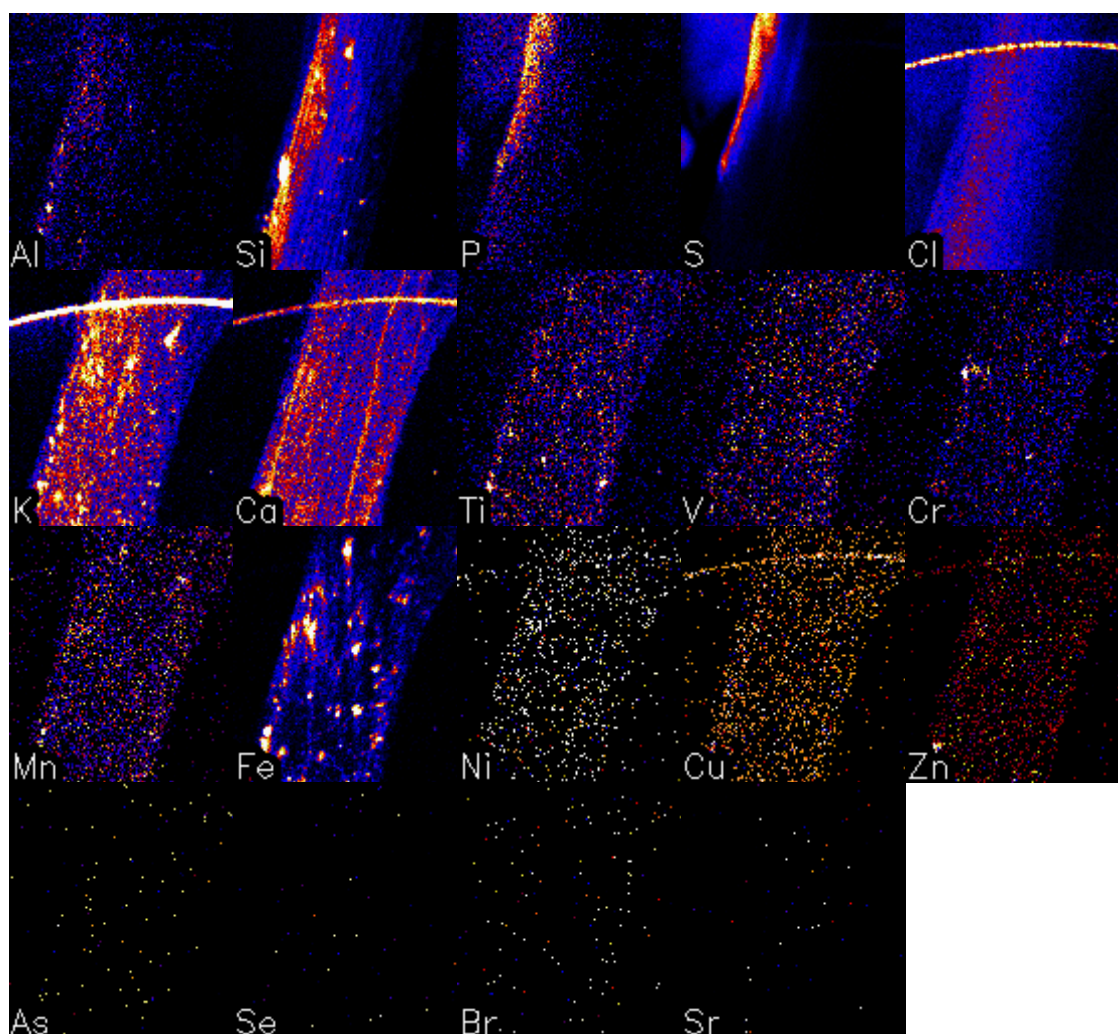
File Name: zamx_w295_61.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 1907 μC

Scan: X= 516 μm , Y= 583 μm

Pixel: X size: 112, Y Size: 128



Relative Concentration Legend



Fig 3.5.57: WW14 (3) R1 Long root – West Wits (North West) high Au +Ur Reg 0 -4 REM9 (zamx_w295_61-regions-PIXE). Al, Ca, Cr, Fe, K, Mn, Ti, and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Cl, P, S, Cu and, Zn, appear to be spread across the root cross-section.

52. Ctr + Nu R2 (6) Long Root Reg 0 -2 Rem 10 (zamx_w295_62-regions-PIXE)

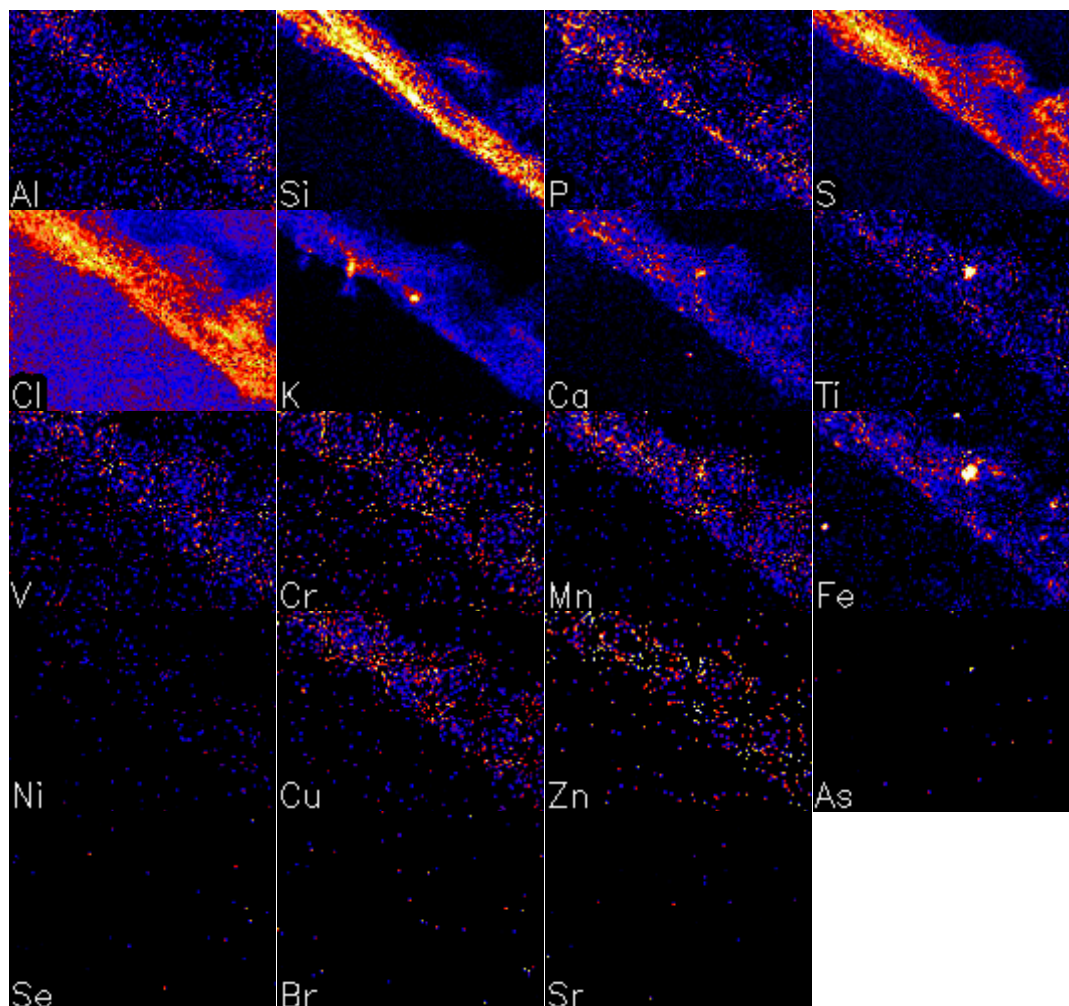
File Name: zamx_w295_62.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 1199 μC

Scan: X= 500 μm , Y= 376 μm

Pixel: X size: 128, Y Size: 96



Relative Concentration Legend



Fig 3.5.58: Ctr + Nu R2 (6) Long Root Reg 0 -2 Rem 10 (zamx_w295_62-regions-PIXE).

Ca, Cr, Fe, K, Mn, Ti, and were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While Cl, P, S, Cu, Si and, Zn, appear to be spread across the root cross-section.

53. Ctr + Nu R2 (6) Long Root Reg 0 -1 Rem 11 (zamx_w295_63-regions-PIXE) Stopped.

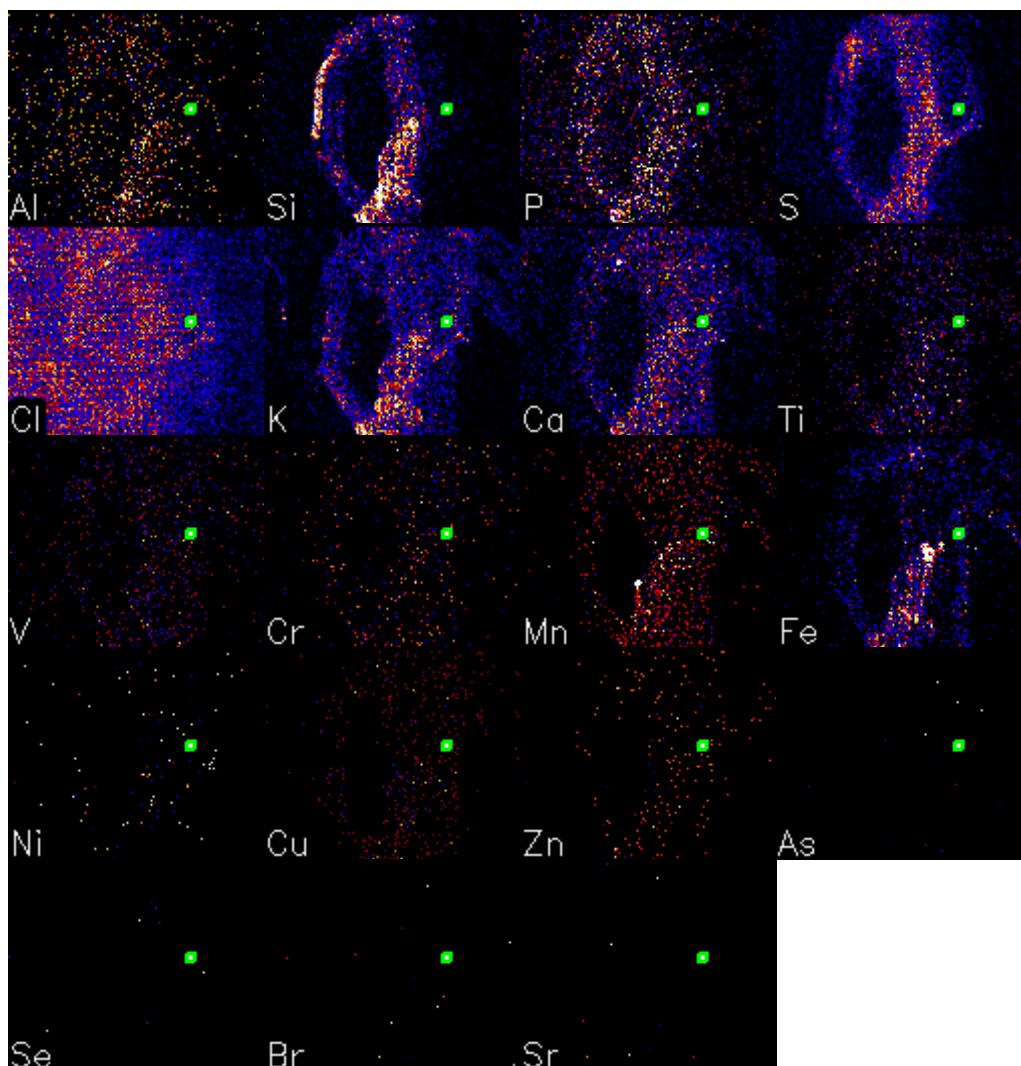
File Name: zamx_w295_63.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 221 μC

Scan: X= 918 μm , Y= 746 μm

Pixel: X size: 128, Y Size: 106



Relative Concentration Legend



Fig 3.5.59: Ctr + Nu R2 (6) Long Root Reg 0 -1 Rem 11 (zamx_w295_63-regions-PIXE)

Stopped. Fe, K, Mn, Si, and Ti were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While, Al, Ca, Cl, P, S, Cu, and, Zn, appear to be spread across the root cross-section.

54. Ctr + Nu R2 (6) Long Root Reg 0 -3 Rem 11 (zamx_w295_64-regions-PIXE) Repeat.

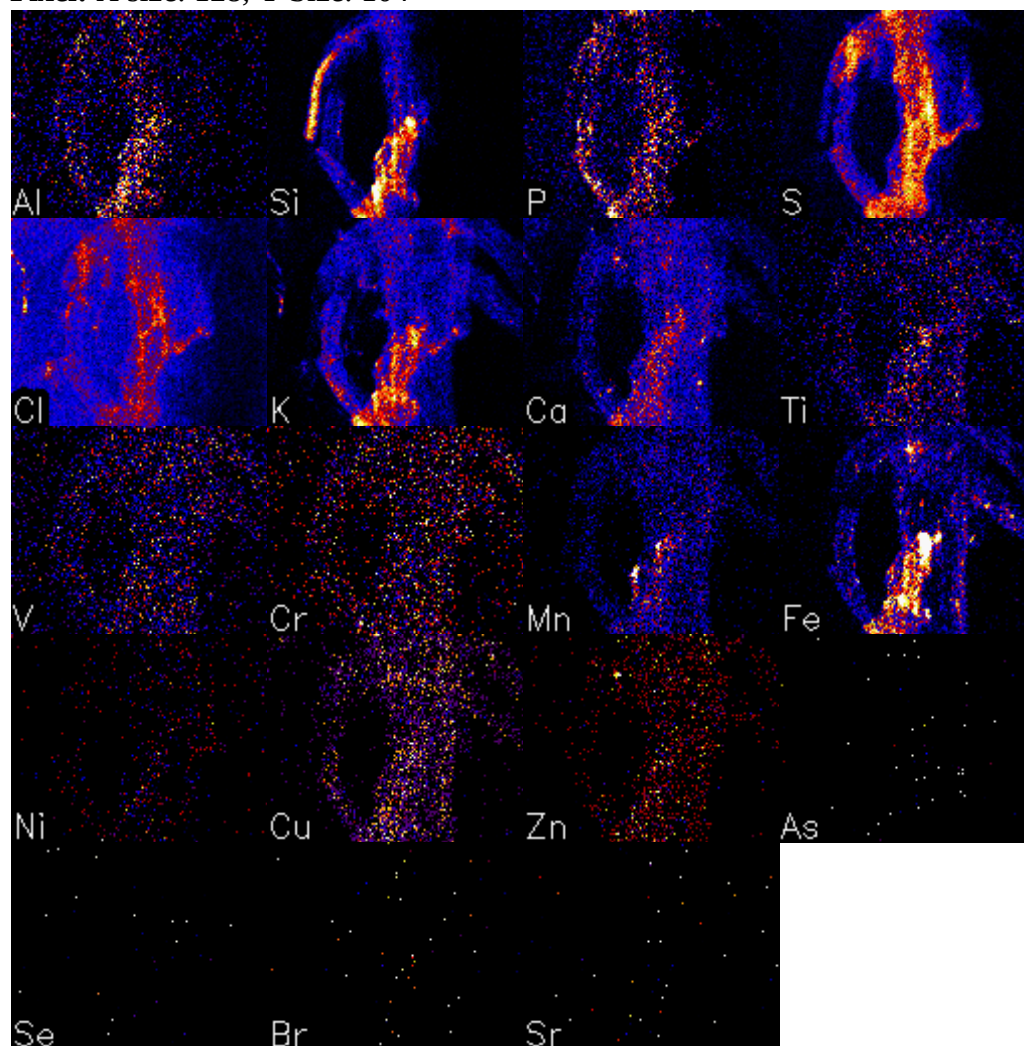
File Name: zamx_w295_64.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 1572 μC

Scan: X= 918 μm , Y= 746 μm

Pixel: X size: 128, Y Size: 104



Relative Concentration Legend



Fig 3.5.60: Ctr + Nu R2 (6) Long Root Reg 0 -3 Rem 11 (zamx_w295_64-regions-PIXE)

Repeat. Fe, Si, K, Mn, and Ti, were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While, Al, Ca, Cl, P, S, Cu and Zn, appear to be spread across the root cross-section.

55. 4.1ER R2 (6) Reg 0 -2 Rem 12 (zamx_w295_65-regions-PIXE)

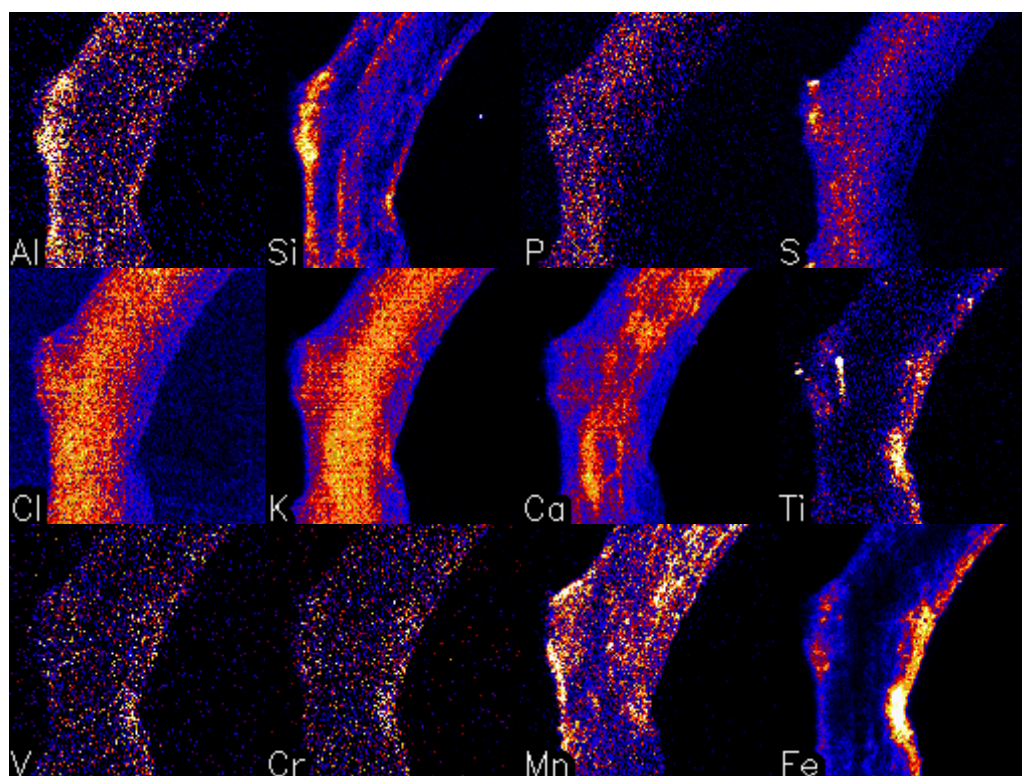
File Name: zamx_w295_65.evt

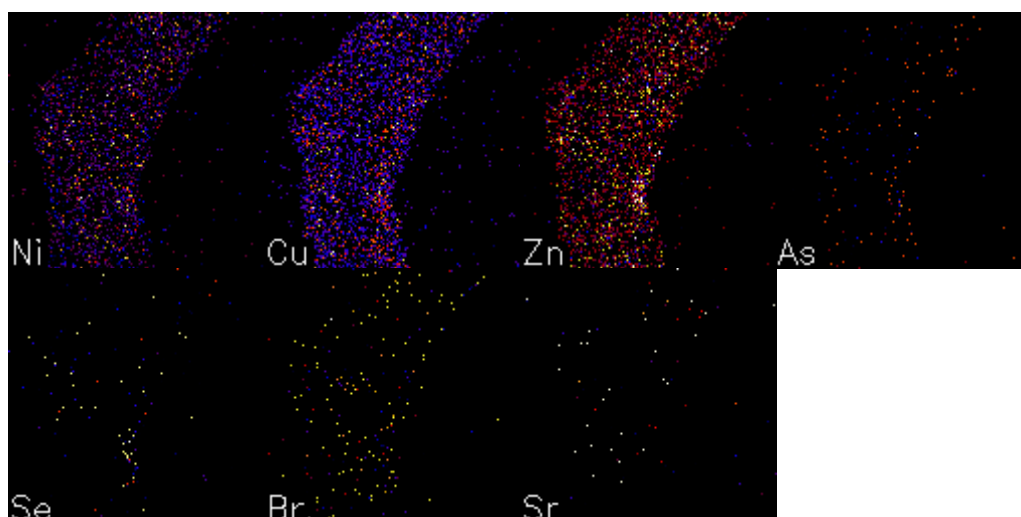
Dynamic Matrix: zamx_w295_19.dam

Charge: 2195 μ C

Scan: X= 584 μ m, Y= 583 μ m

Pixel: X size: 128, Y Size: 128





Relative Concentration Legend



Fig 3.5.61: 4.1 ER R2 (6) Reg 0 -2 Rem 12 (zamx_w295_65-regions-PIXE)

Al, Fe, Mn, S, Si and Ti, were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While, Ca, Cl, P, K, Cu and, Zn, appear to be spread across the root cross-section.

56. 4.1 ER R2 (6) Reg 0 -1 Rem 13 (zamx_w295_66-regions-PIXE)

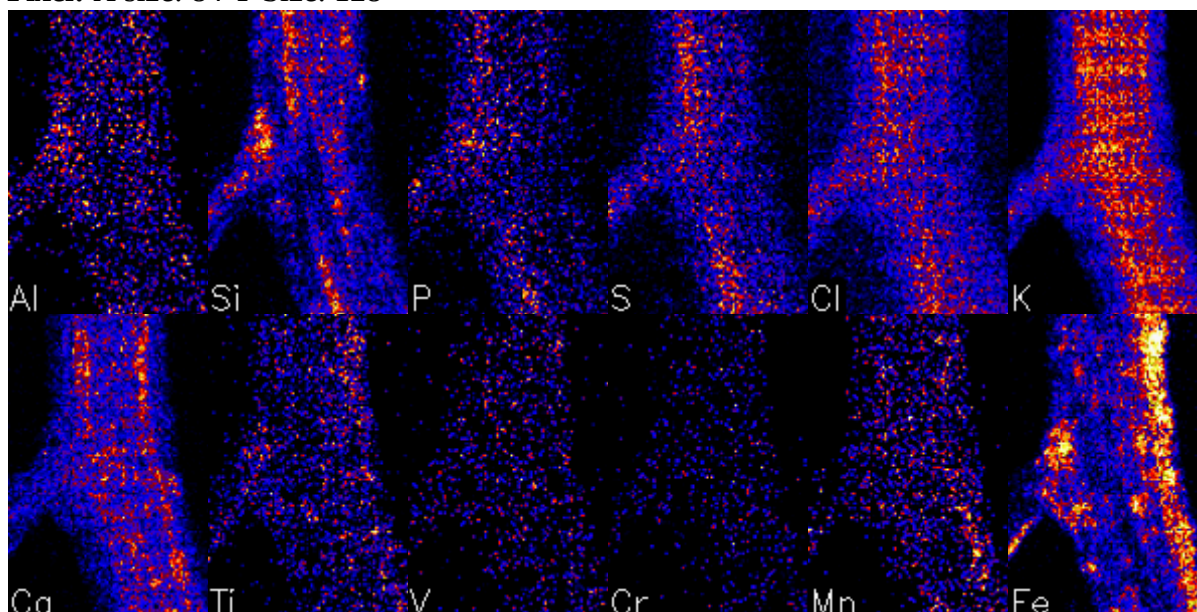
File Name: zamx_w295_66.evt

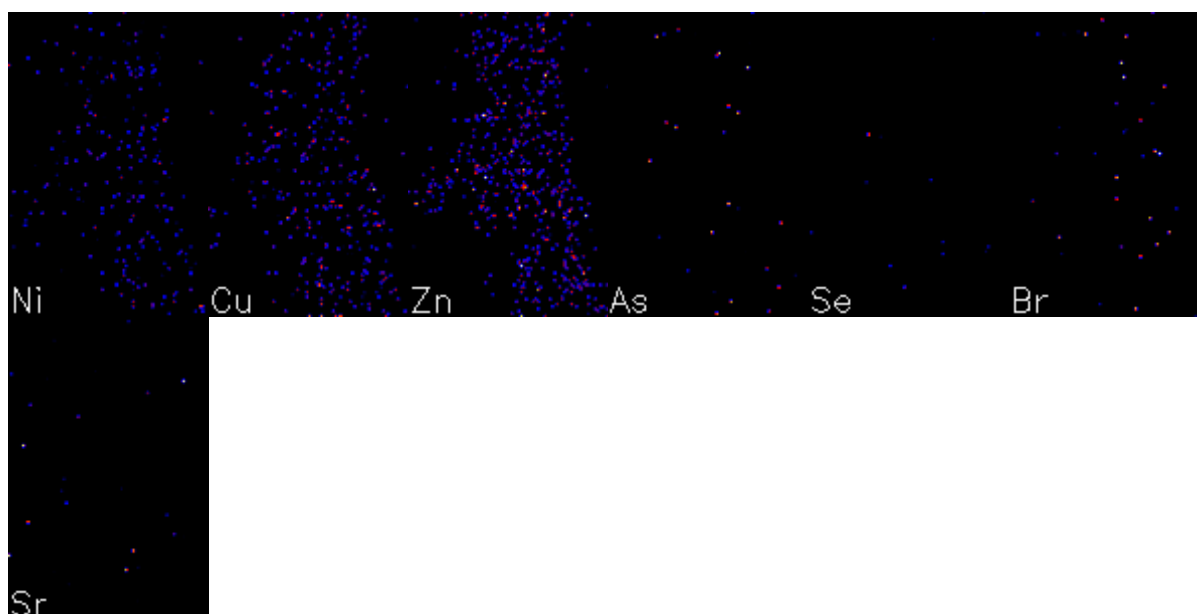
Dynamic Matrix: zamx_w295_19.dam

Charge: 235 μC

Scan: X= 336 μm , Y= 501 μm

Pixel: X size: 84 Y Size: 128





Relative Concentration Legend



Fig 3.5.62: 4.1 ER R2 (6) Reg 0 -1 Rem 13 (zamx_w295_66-regions-PIXE) (*Beam went down- $Q=235nC$*). Fe, Mn, and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While, Al, Ca, Cl, P, S, Ti and, K, appear to be spread across the root cross-section.

57. ER R2 (6) Reg 0 -2 Rem 13 (zamx_w295_67-regions-PIXE) (Repeat $Q=1856nC$).

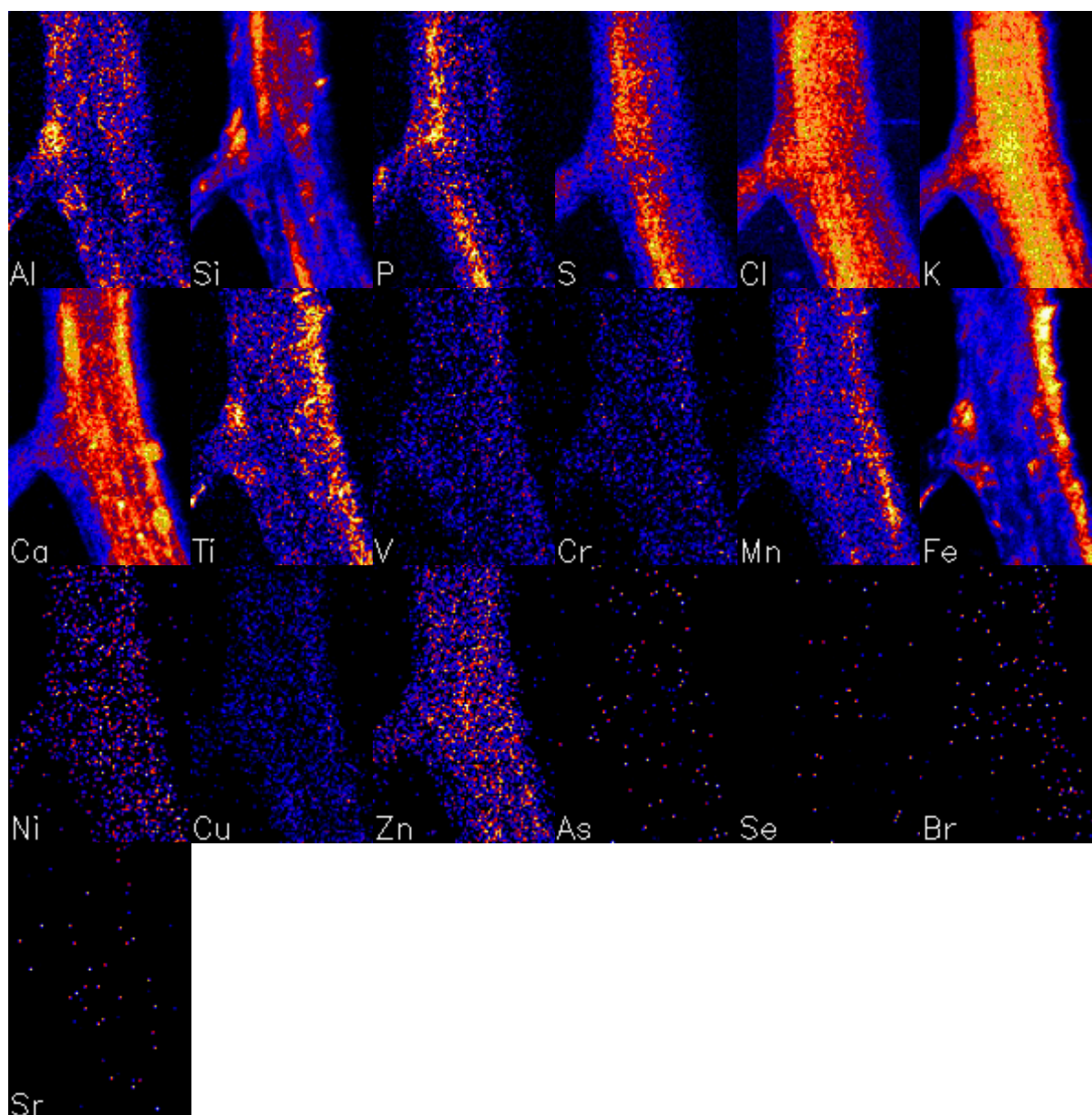
File Name: zamx_w295_67.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 1856 μC

Scan: X= 336 μm , Y= 501 μm

Pixel: X size: 84 Y Size: 128



Relative Concentration Legend

Zero  Maximum

Fig 3.5.63: 4.1 ER R2 (6) Reg 0 -2 Rem 13 (zamx_w295_67-regions-PIXE) (Repeat Q=1856nC). Al, Ca, Fe, Mn, Ti, and Si were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While, Cl, S, P, Zn and, K, appear to be spread across the root cross-section.

58. Gauteng Agnes Mine ABB5 R1(8) B Rem 14 (zamx_w295_68-regions-PIXE).

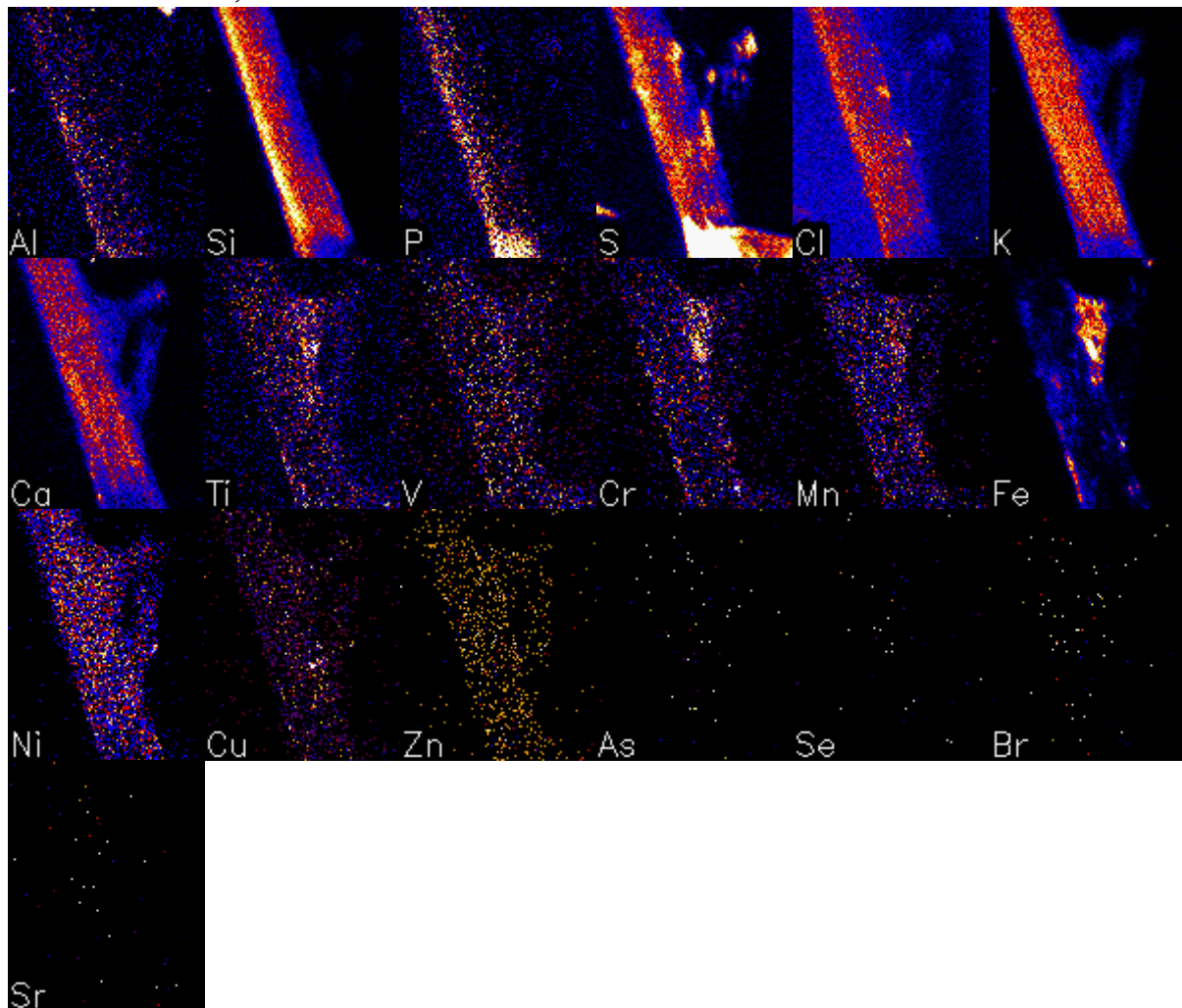
File Name: zamx_w295_68.evt

Dynamic Matrix: zamx_w295_19.dam

Charge: 1852 μC

Scan: X= 532 μm , Y= 667 μm

Pixel: X size: 100, Y Size: 128



Relative Concentration Legend



Fig 3.5.64: Agnes Mine ABB5 R1(8) B Rem 14 (zamx_w295_68-regions-PIXE). Cr, Cu, Fe, Ti, and S were localized in AMF roots with low concentration and they appear to be accumulated in vesicles and Hyphae. While, Al, Ca, Cl, Mn, Ni, P, Zn, Si and, K, appear to be spread across the root cross-section.