Application of micro-XRF to characterise diamond drill-core from lithium-caesium-tantalum pegmatites

By Dr Naomi Potter

Co-author: Dr Nigel Brand

AEGC Conference 04/09/19

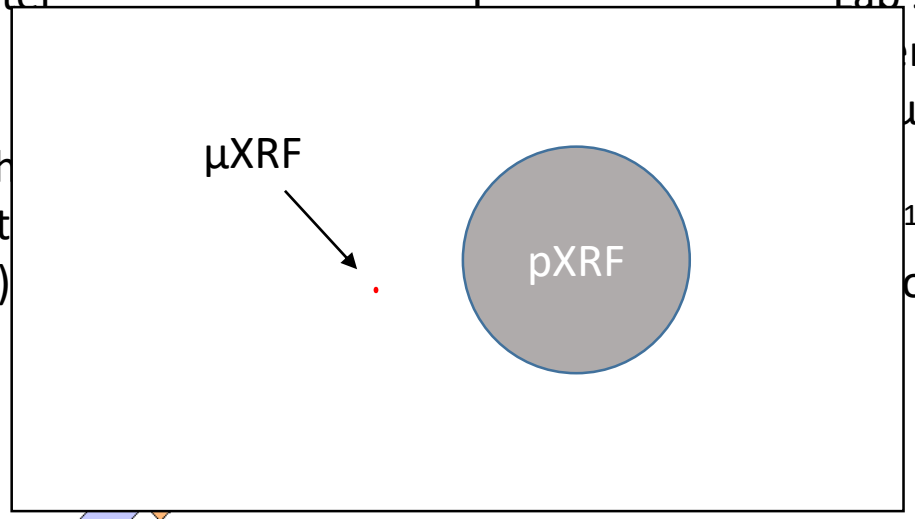
Reminder about XRF

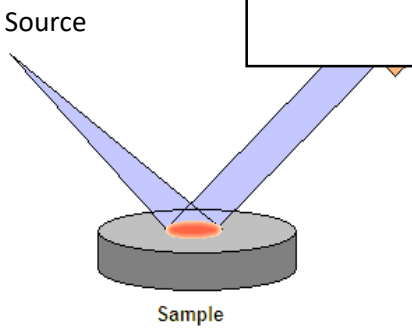
Portable XRF

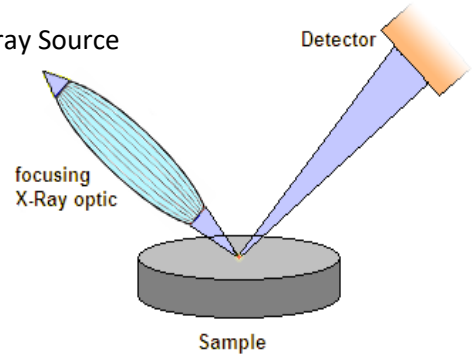
- Portable spectrometer
- Open beam
- 8 mm, 5 mm, 3 mm
- Samples should be h
- Focus on quantificat
- Na^{11} to U^{92}(TRACER)
- Mg^{12} to U^{92} (TITAN)

Micro-XRF

- Lab spectrometer
- rlocked system
- µm spot size
- quantify but focused on 2D maps
- ^{1} to U^{92} (M4)
- o U^{92} (M4 Plus)





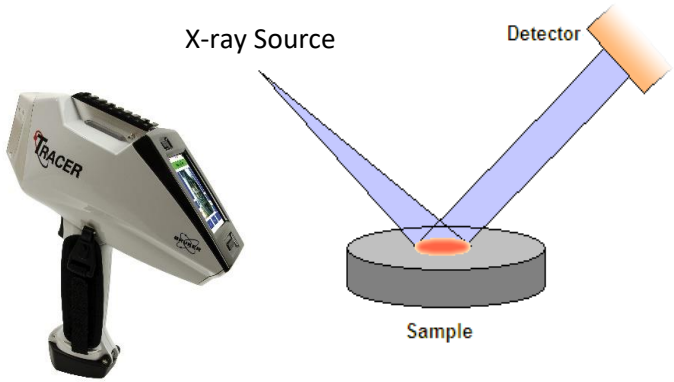


Courtesy of J.Knapp

Reminder about XRF

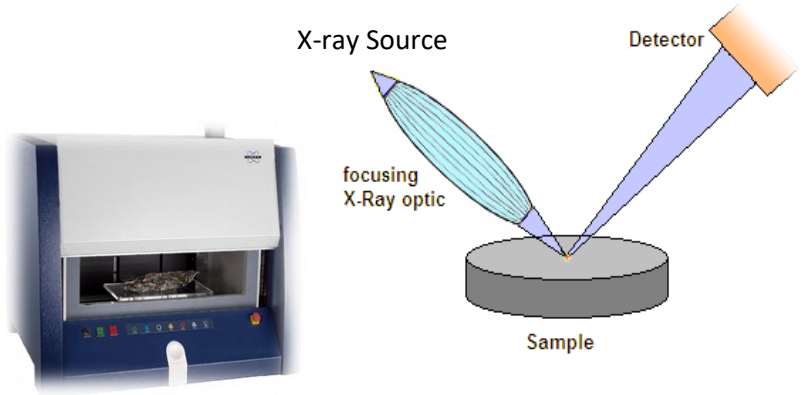
Portable XRF

- Portable spectrometer
- Open beam
- 8 mm, 5 mm, 3 mm spot size
- Samples should be homogenized*
- Focus on quantification in 1D
- Na^{11} to U^{92}(TRACER)
- Mg^{12} to U^{92} (TITAN)

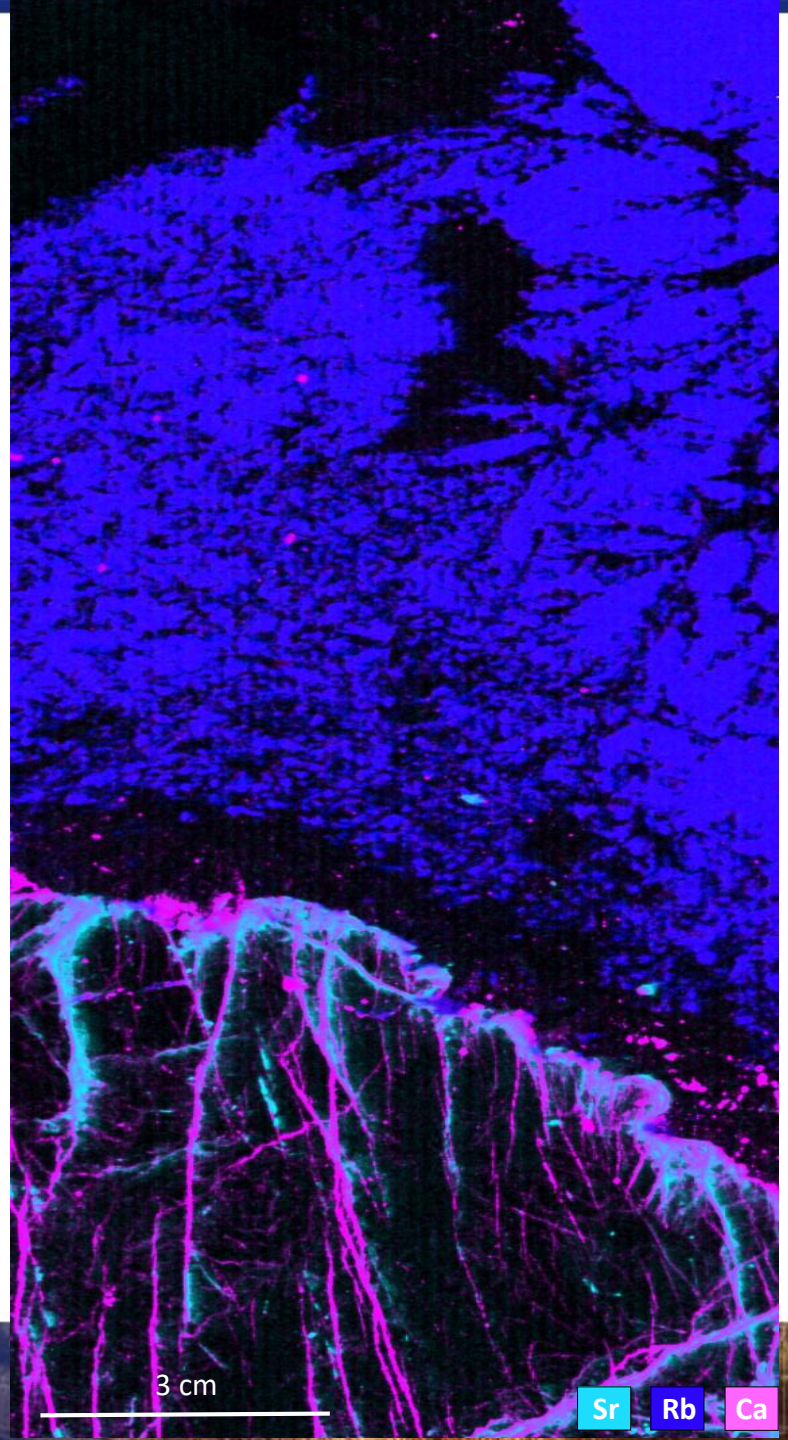


Micro-XRF

- Lab spectrometer
- Interlocked system
- 25 µm spot size
- Can quantify but focused on 2D maps
- Na^{11} to U^{92} (M4)
- C^{6} to U^{92} (M4 Plus)



Courtesy of J.Knapp



Benefits of µXRF

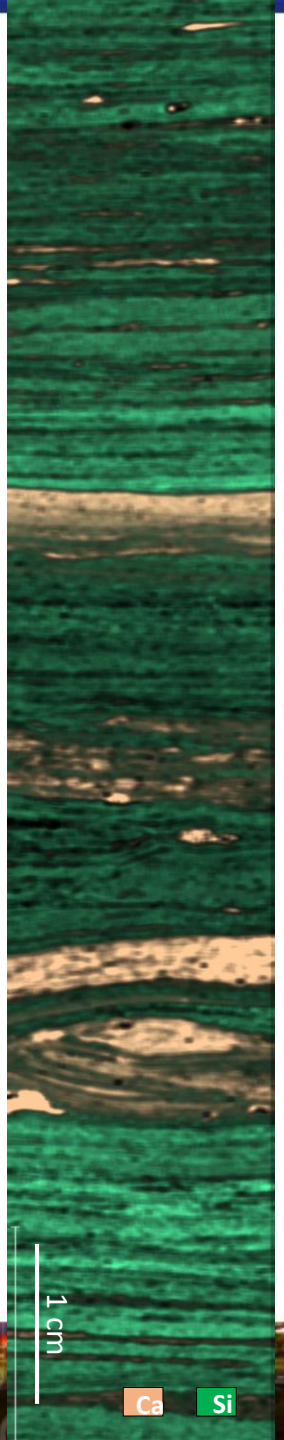
- Non-destructive
- Minimal sample preparation required
- No carbon coating (e.g. SEM)
- Versatile range of sample types
- Mapping size up to 16 x 19 cm
- Detection limits down to ppm levels
- Qualitative and quantitative analysis
- Mineral maps

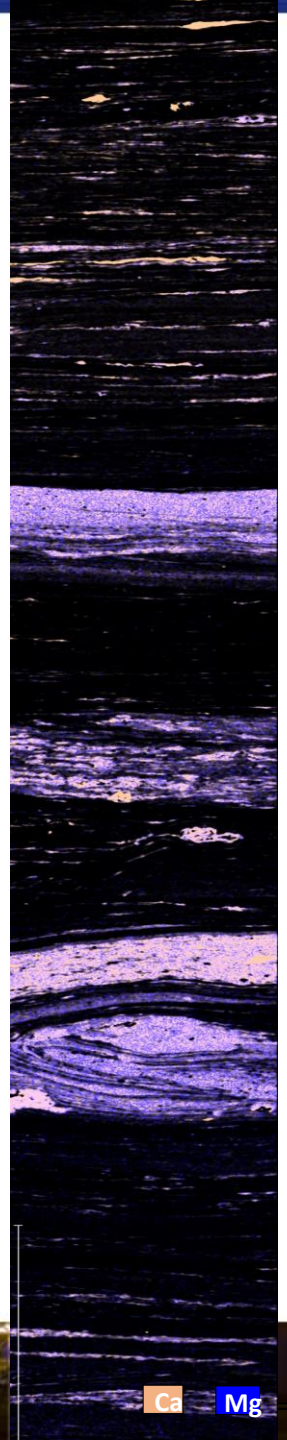
Courtesy of Bruker

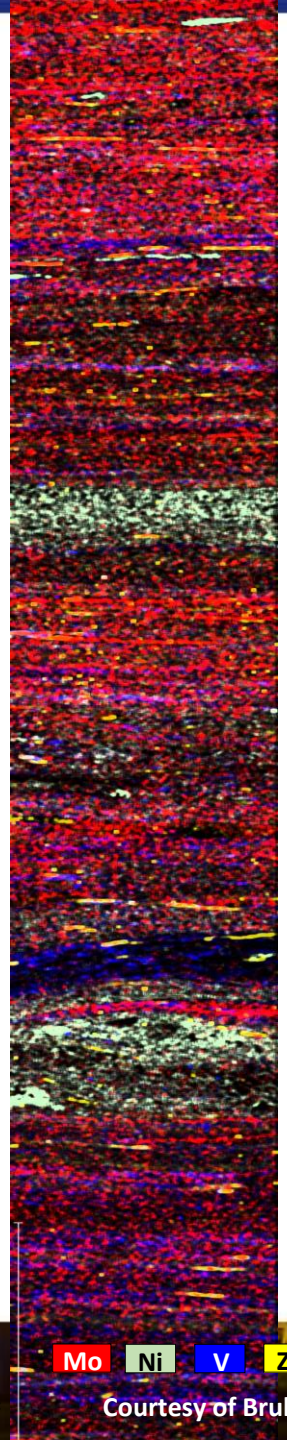
Element compositional maps

- Full X-ray spectrum for each pixel
- “On-the-fly” measurements
- Quantitative and qualitative

- Element distribution and relationships
- Alteration and weathering textures
- Fluid pathways

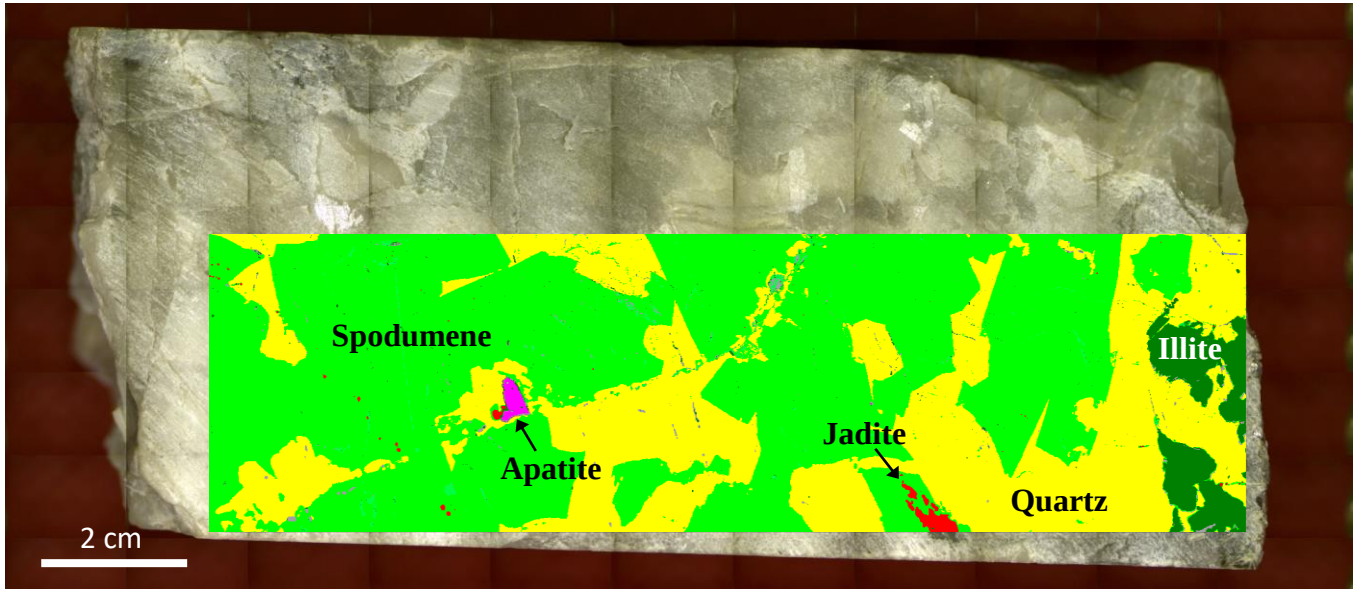




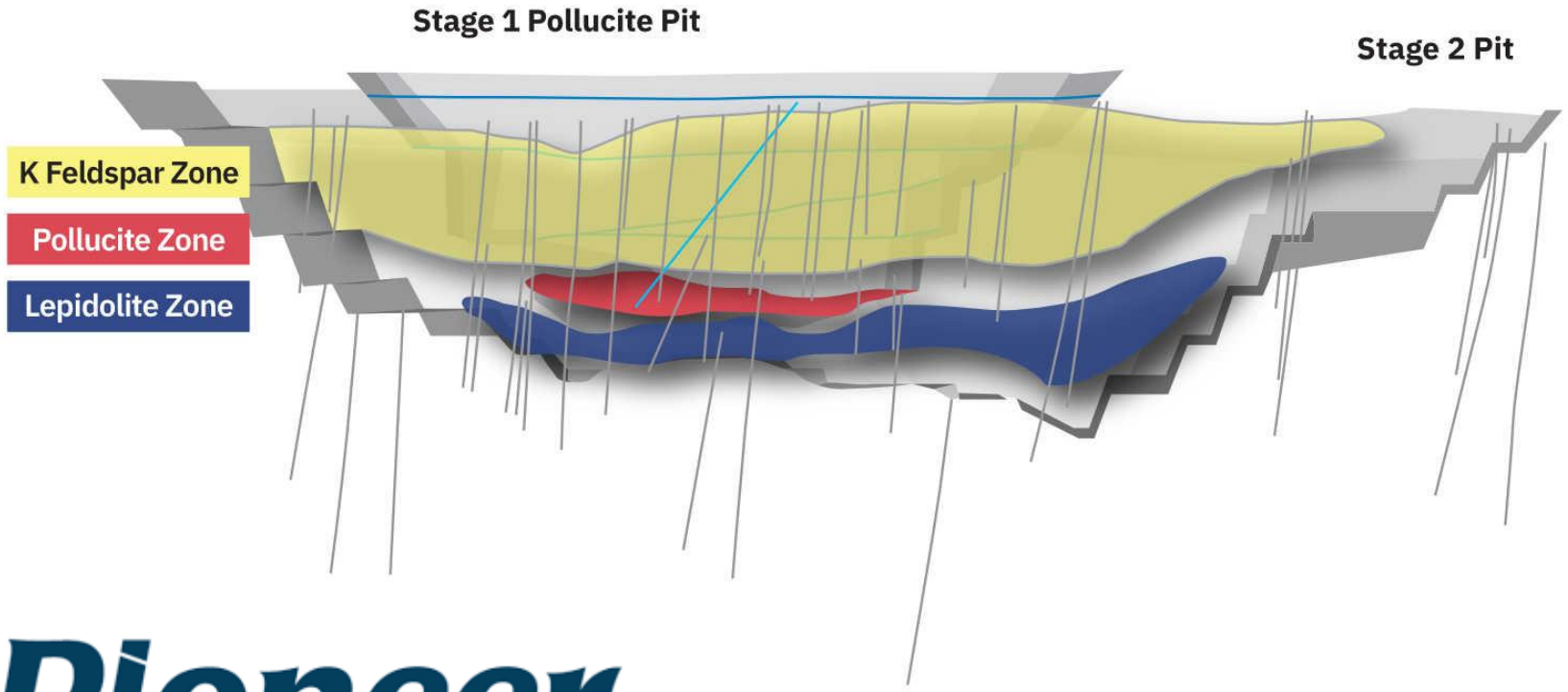


Mineral mapping

- Digital images and surface profiles
- Mineral identification, abundance and texture
- Particle and grain size distributions



Sinclair Caesium Deposit



Pioneer
RESOURCES LIMITED

Workflow

Collect Core Samples

Portable XRF

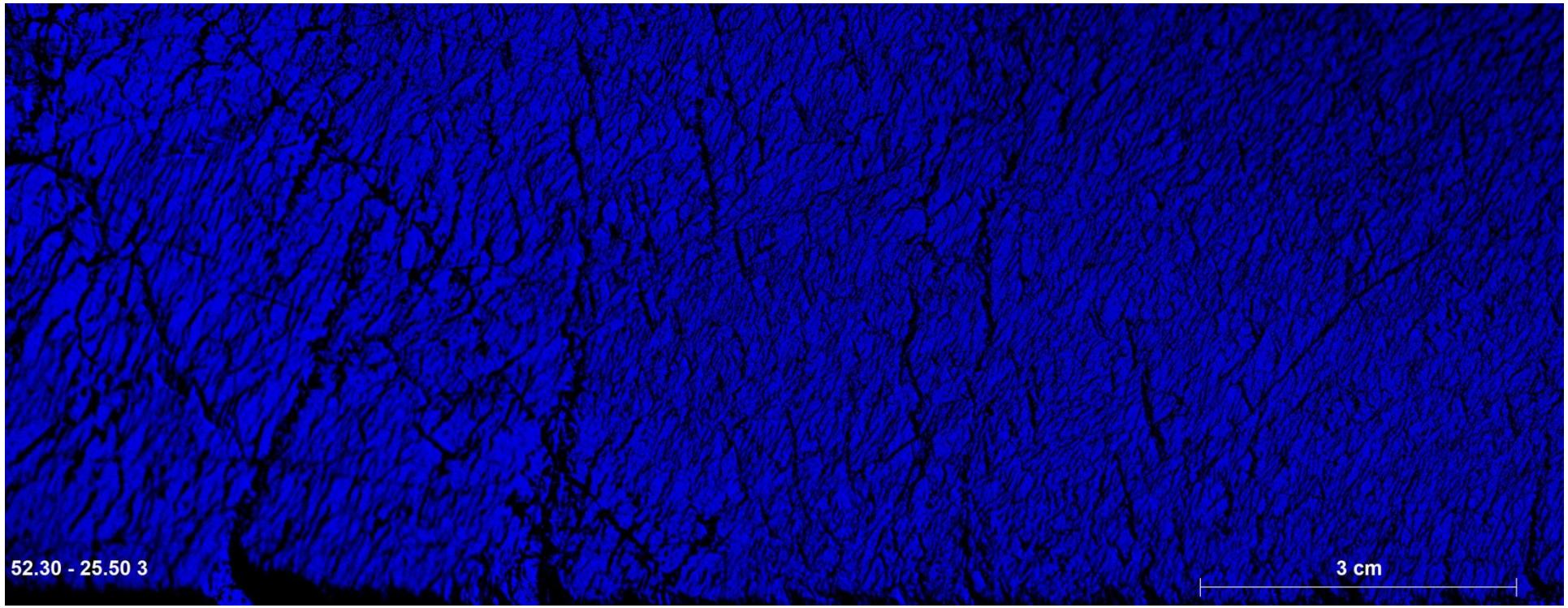
Raman

Micro-XRF
Selective Scanning

Microcline

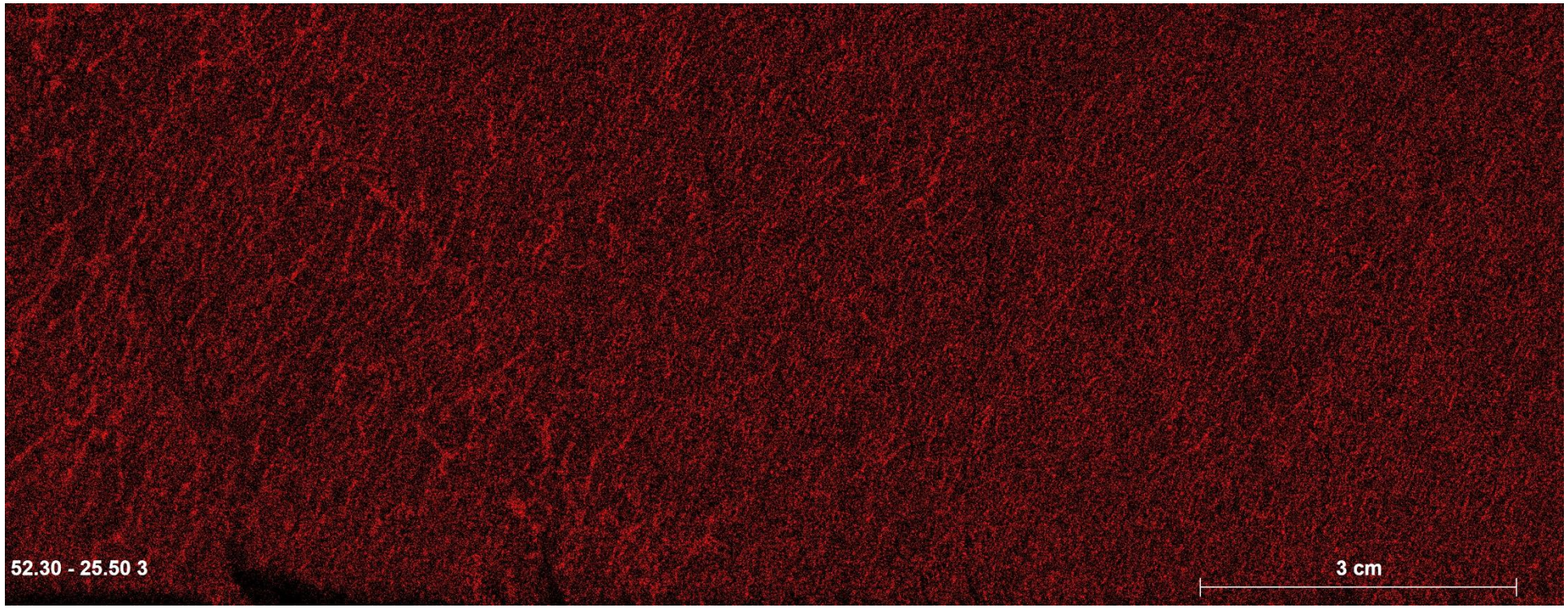
15 cm

K

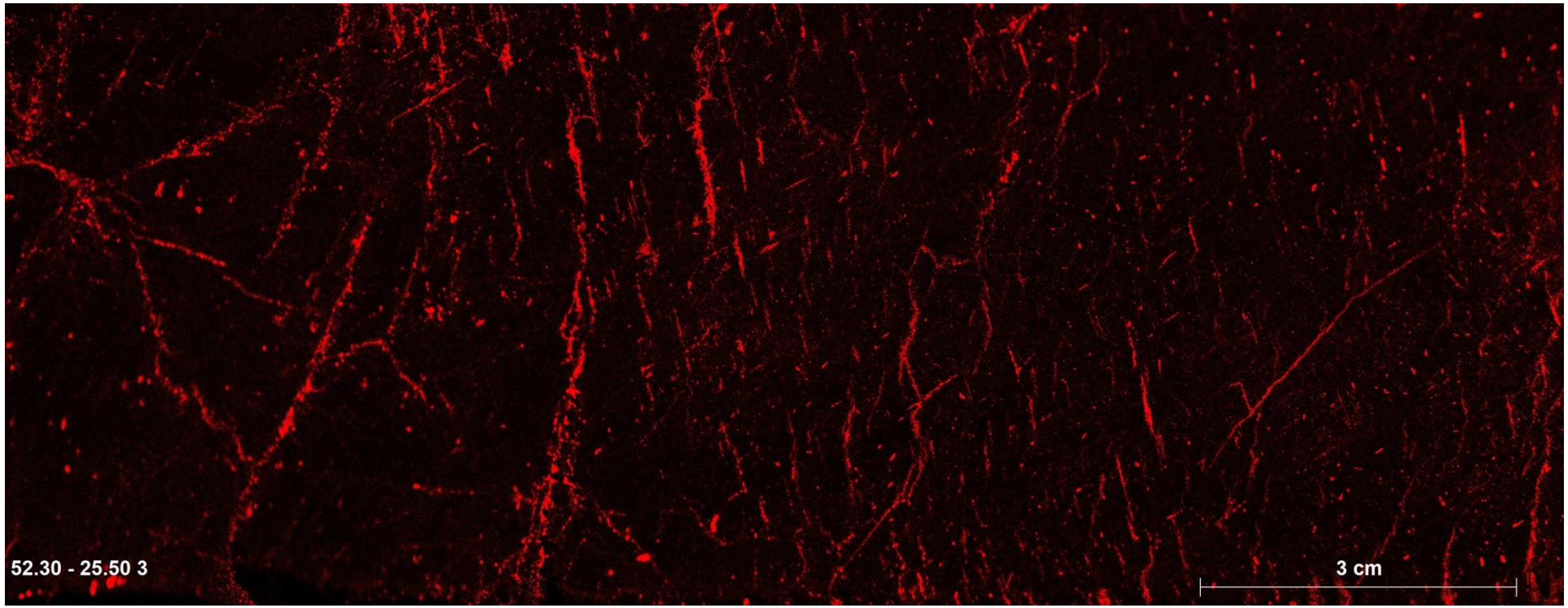


Spot pXRF K2O: 9.67wt%

Na

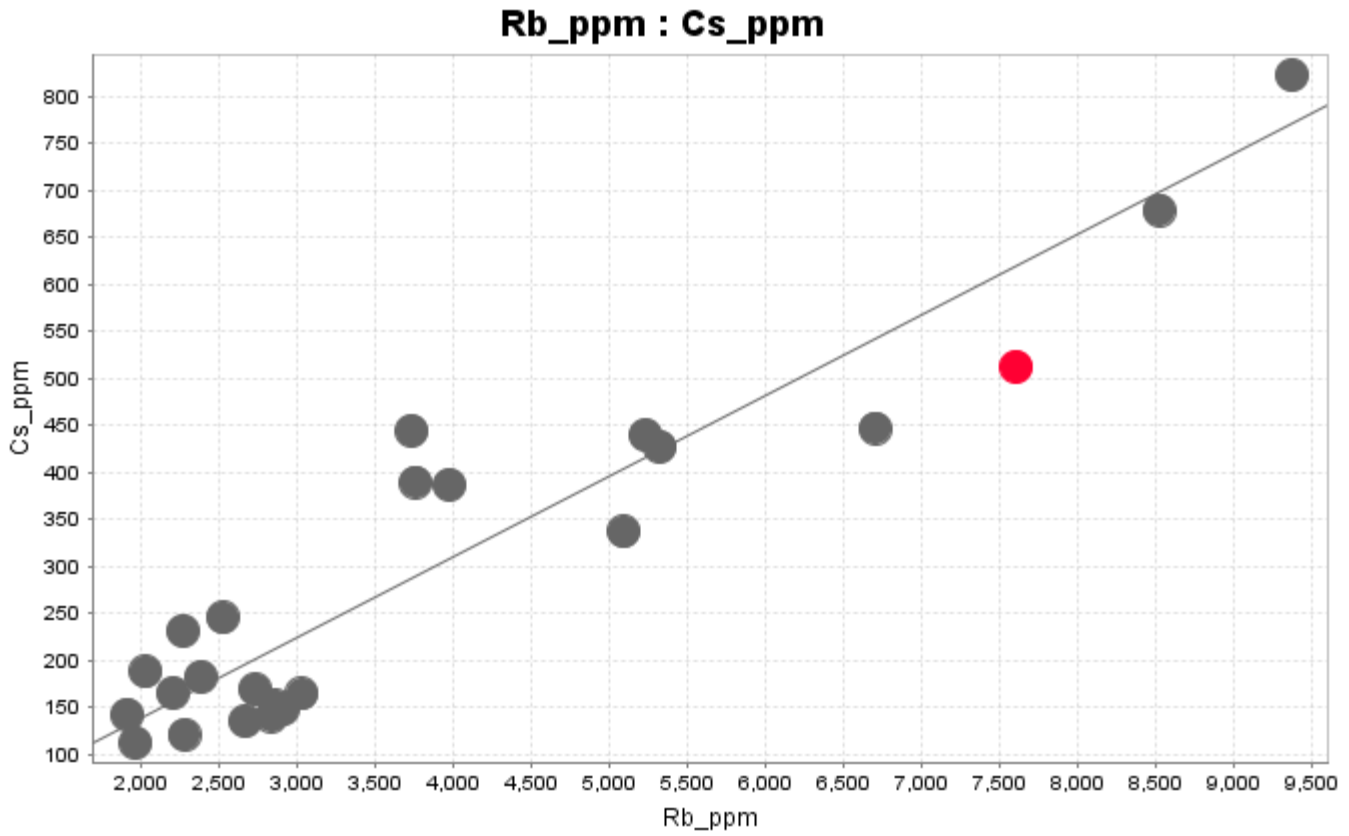


Fe

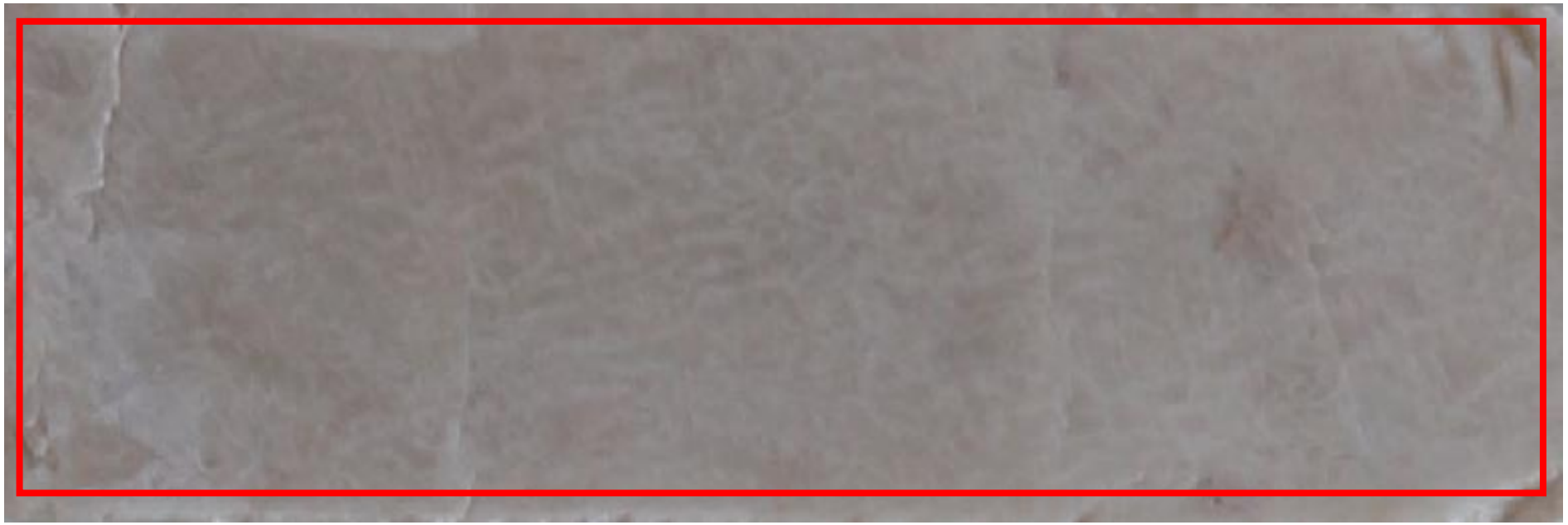


Spot pXRF Fe: 7040 ppm

Next question…

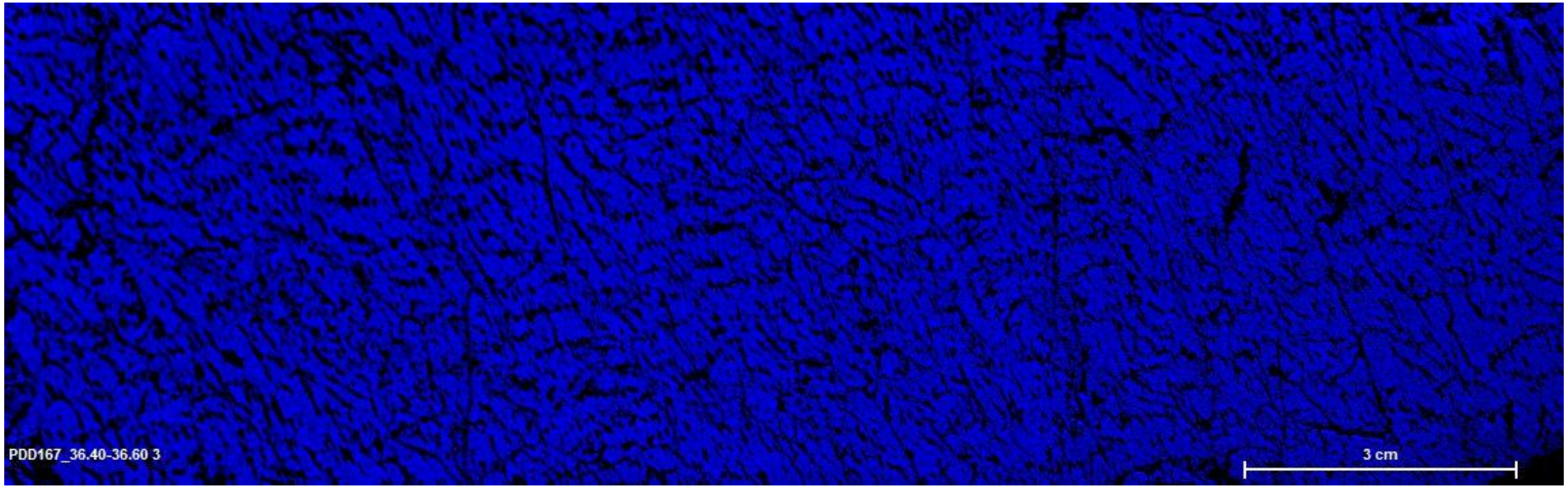


Microcline

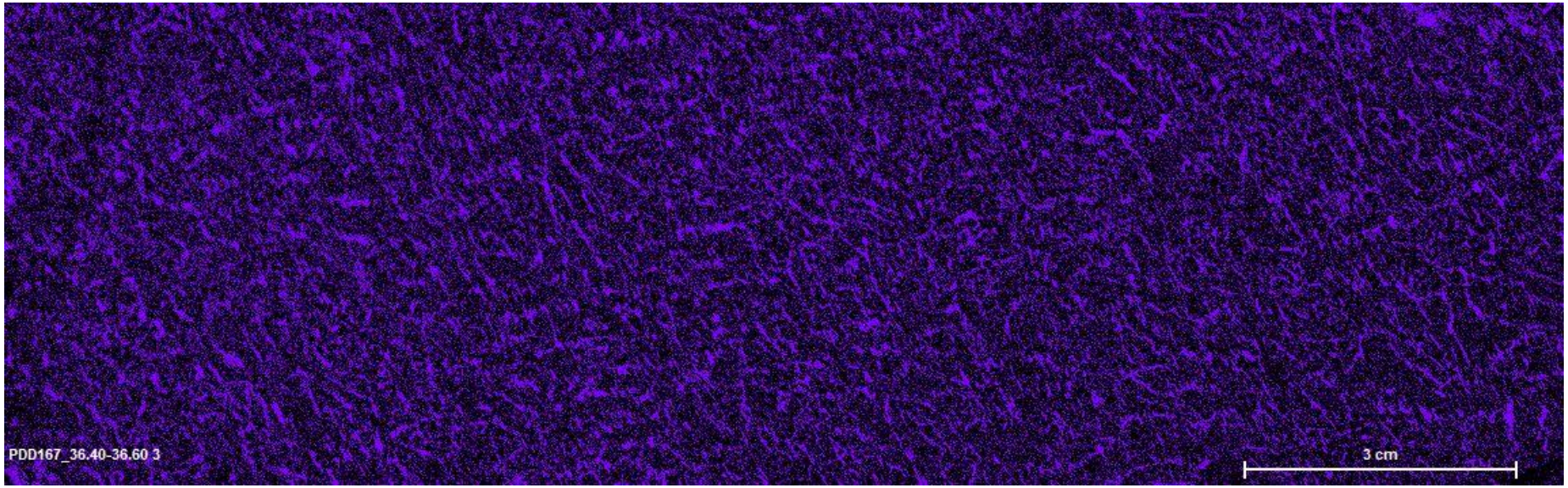


18 cm

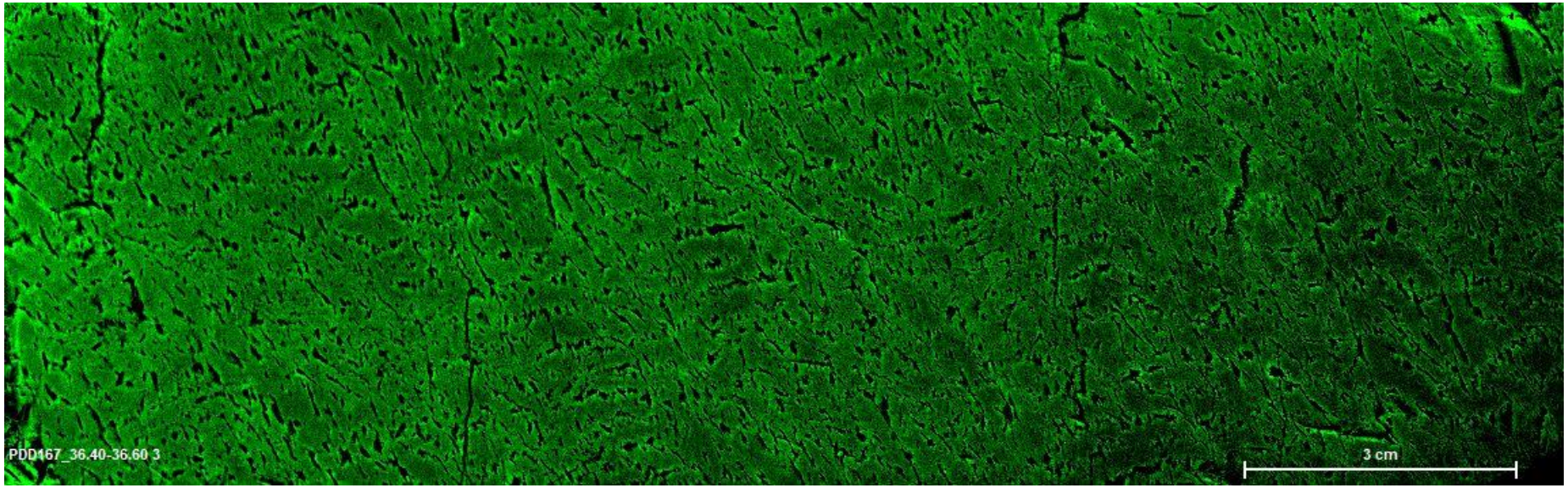
K



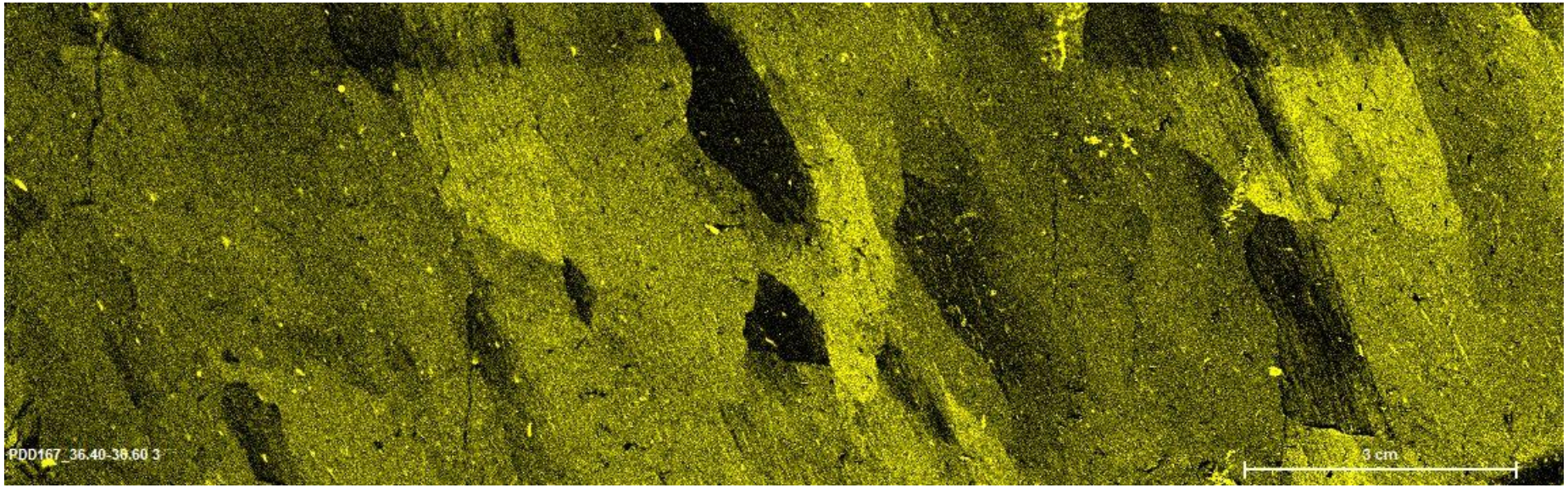
Na



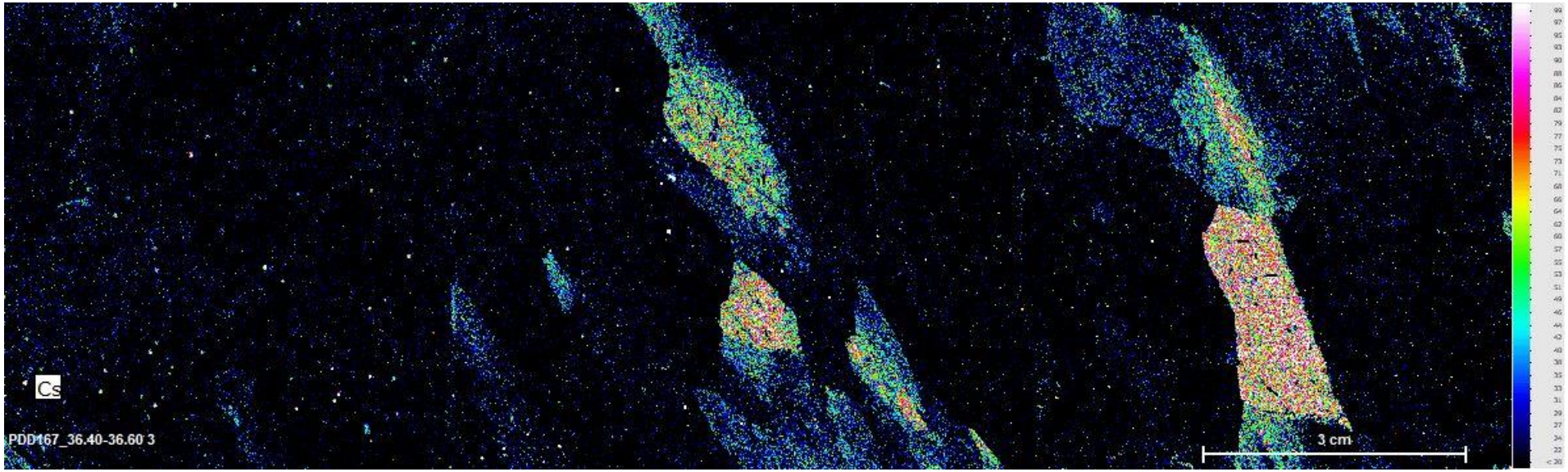
Rb



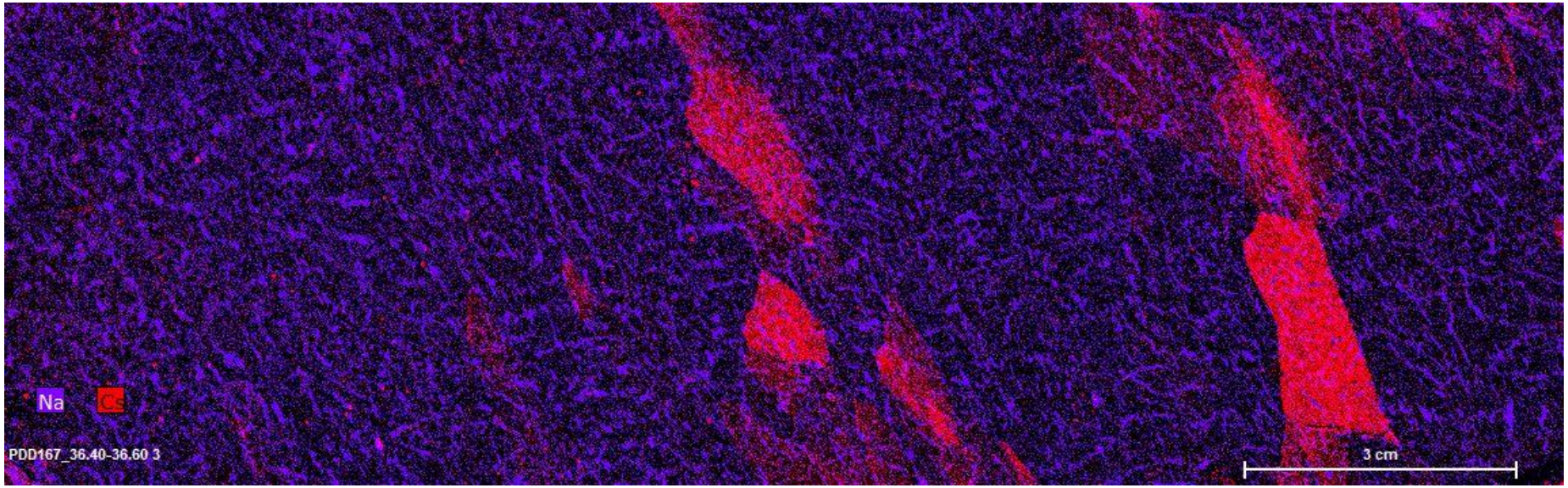
Mn



Cs



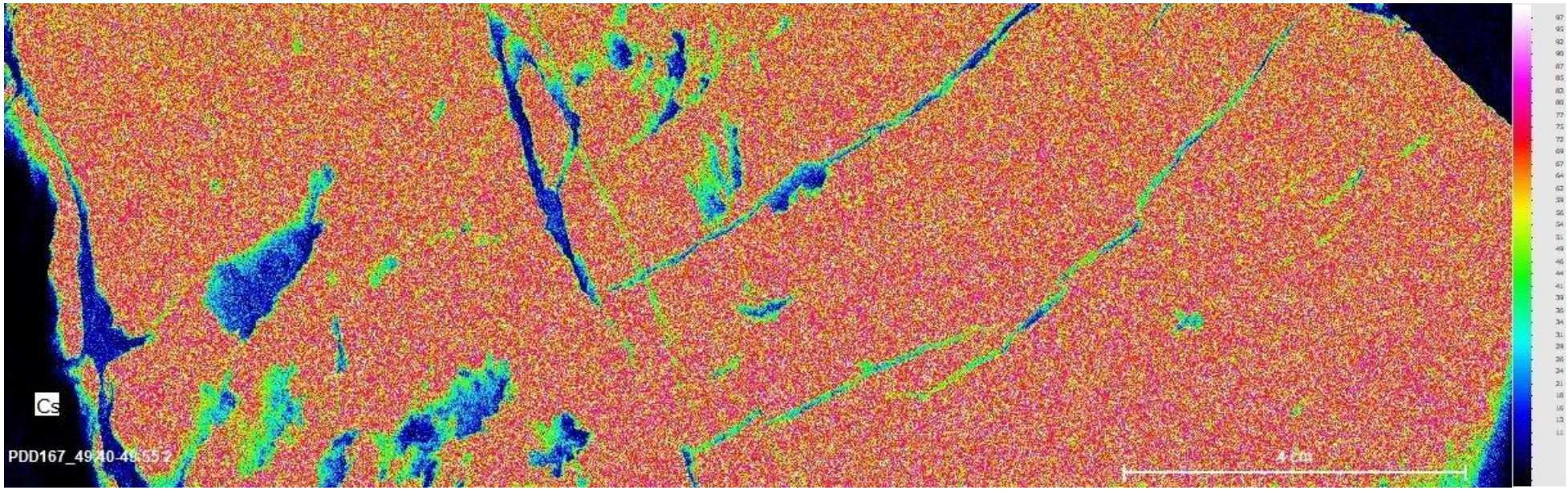
Cs - Na



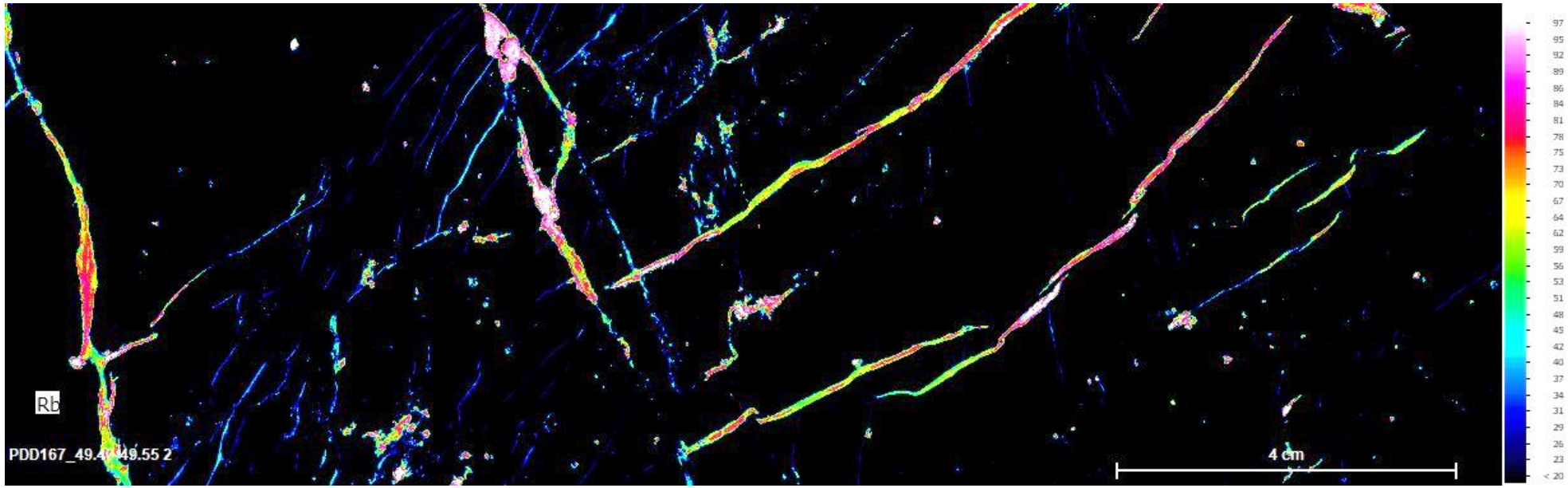
Pollucite

17.5 cm

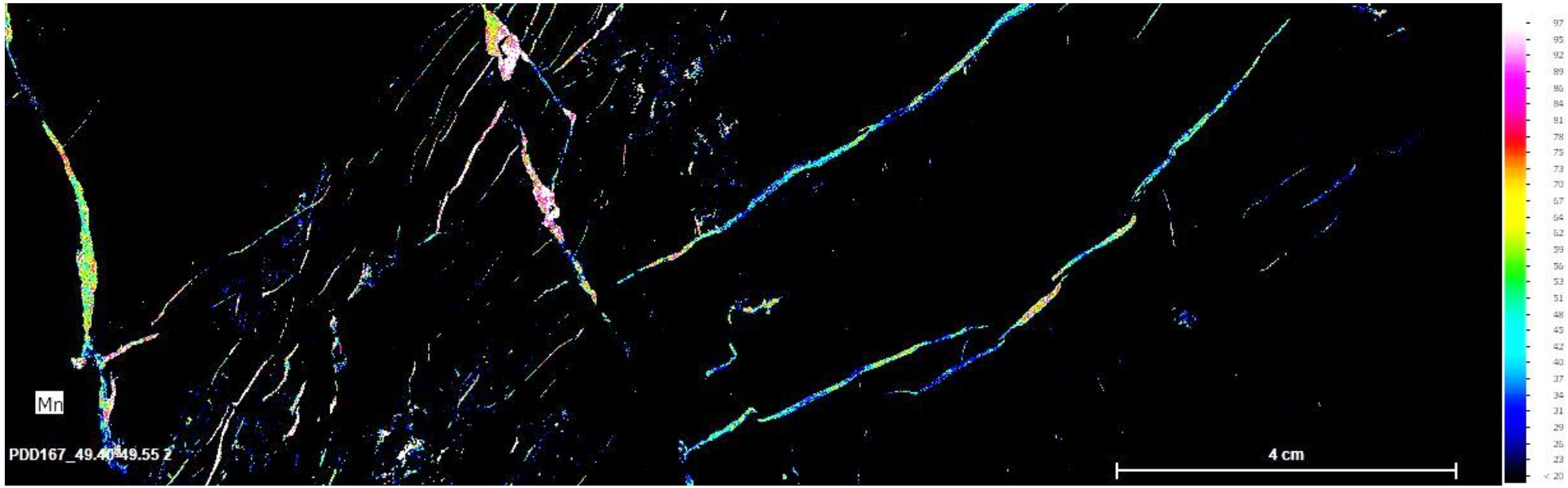
Cs



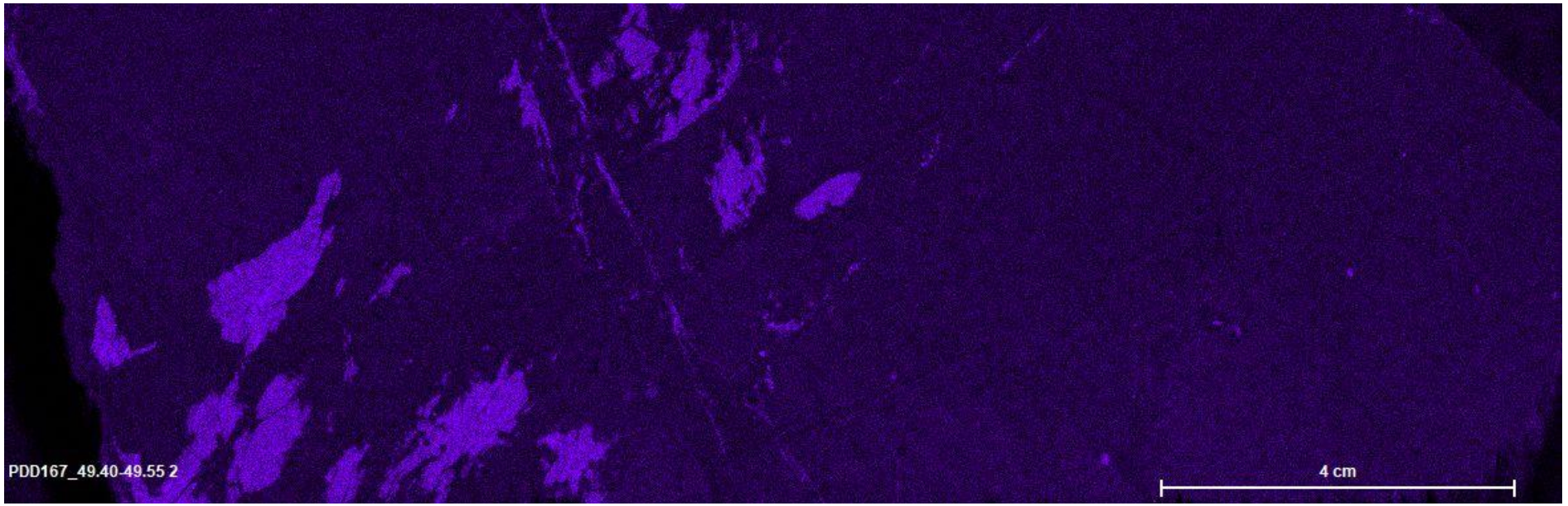
Rb


Rb
PDD167_49.4 49.55 2
4 cm
97
95
92
89
86
84
81
78
75
73
70
67
64
62
59
56
53
51
48
45
42
40
37
34
31
29
26
23
< 20

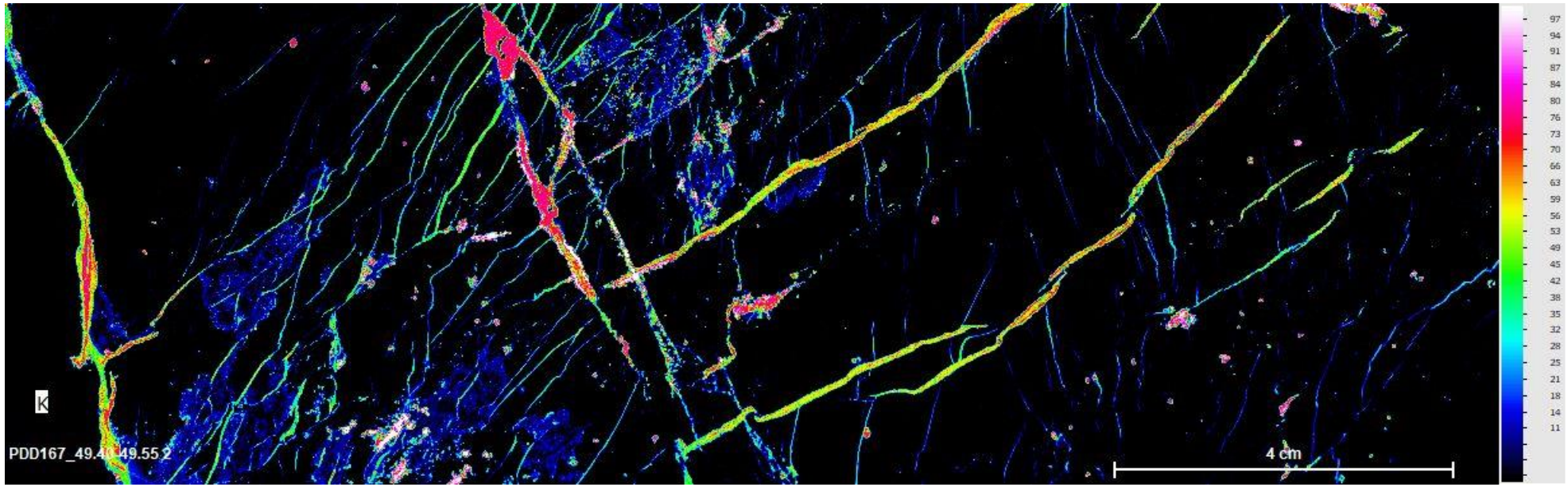
Mn



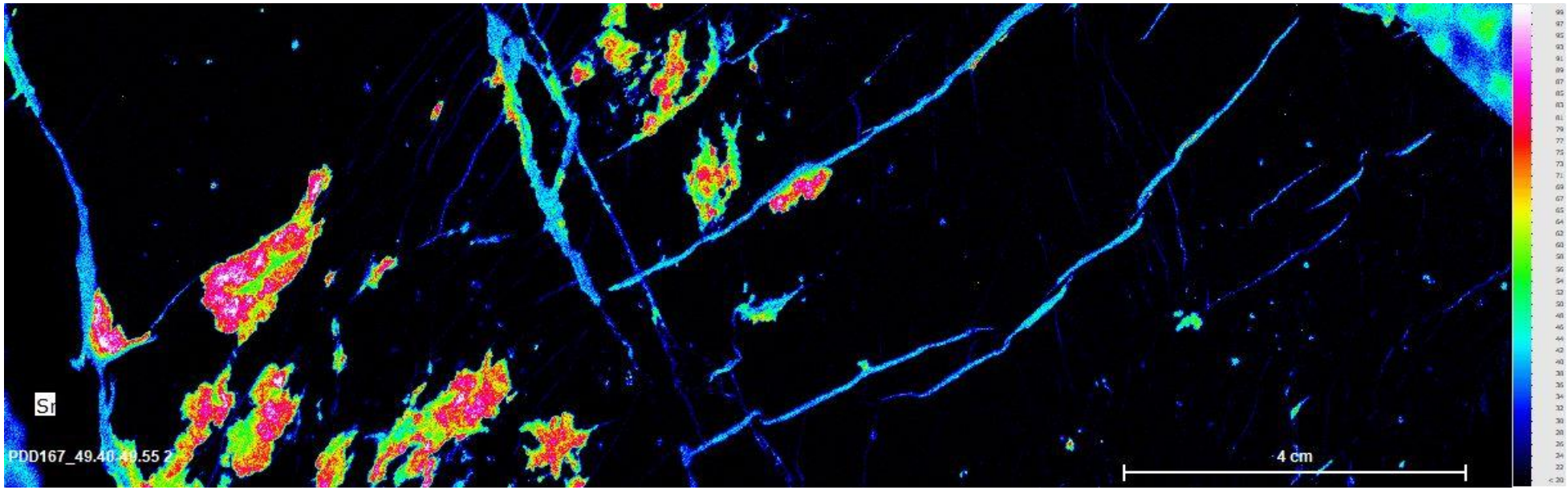
Na



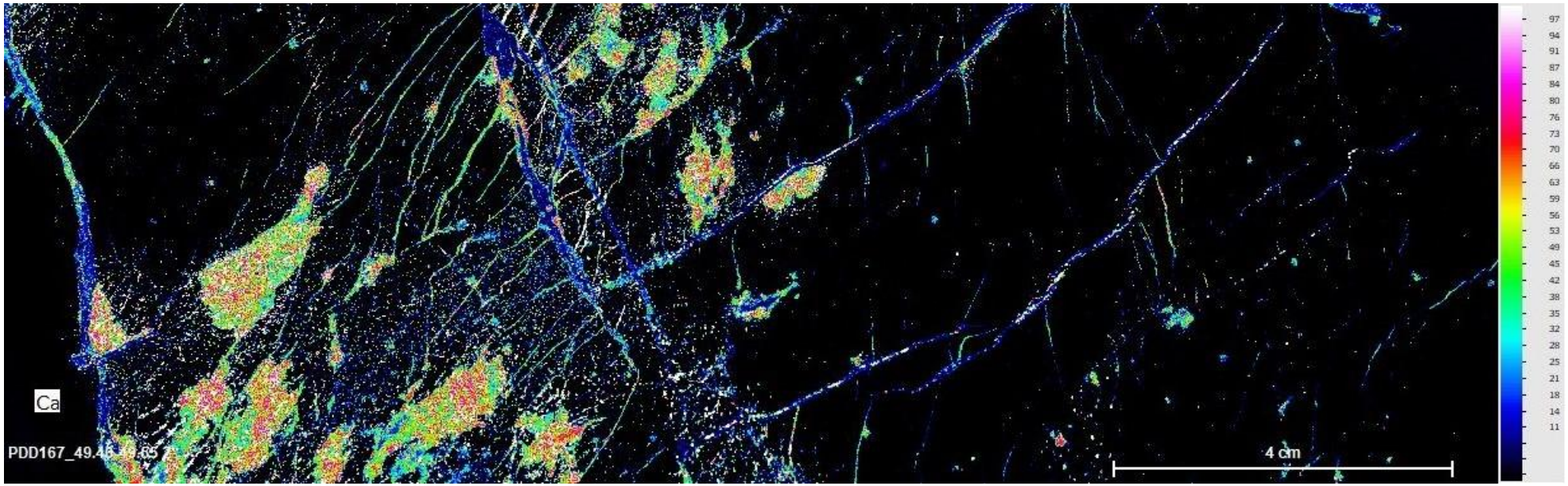
K


K
PDD167_49.4 49.55.2
4 cm
97
94
91
87
84
80
76
73
70
66
63
59
56
53
49
45
42
38
35
32
28
25
21
18
14
11

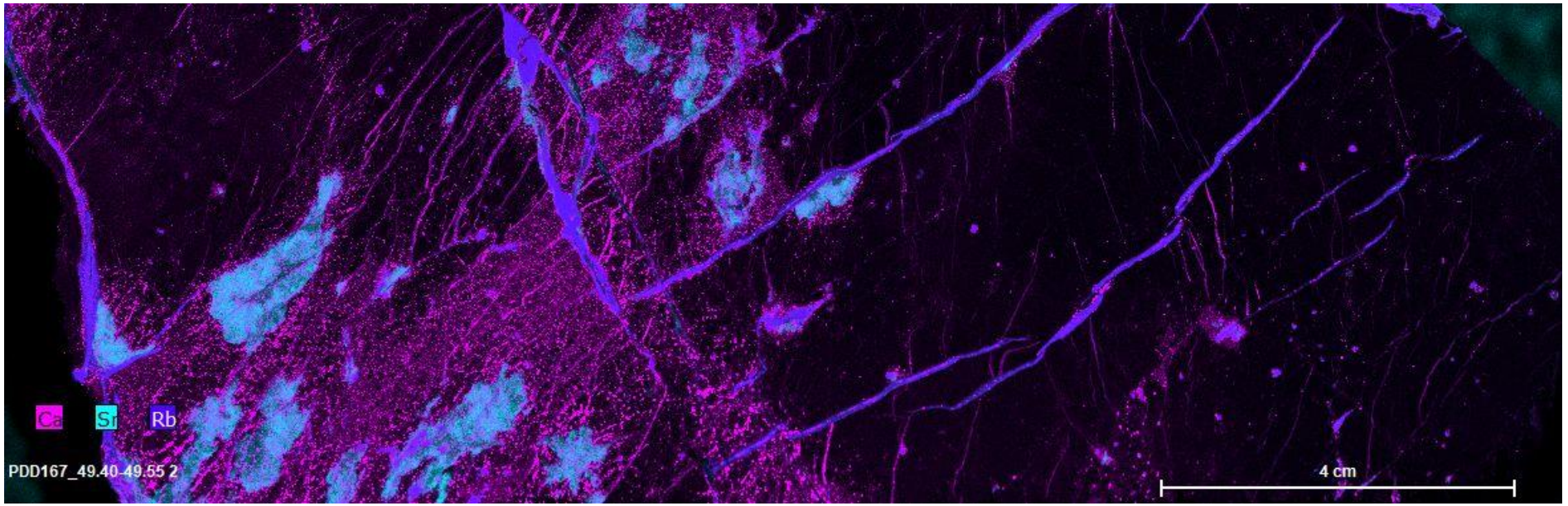
Sr

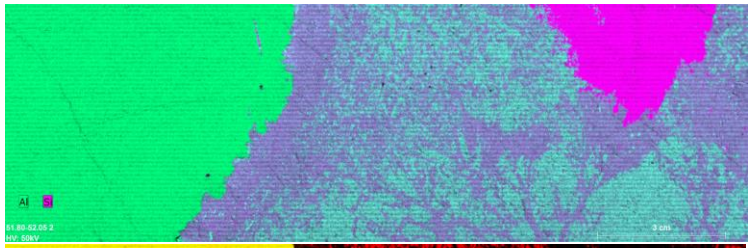


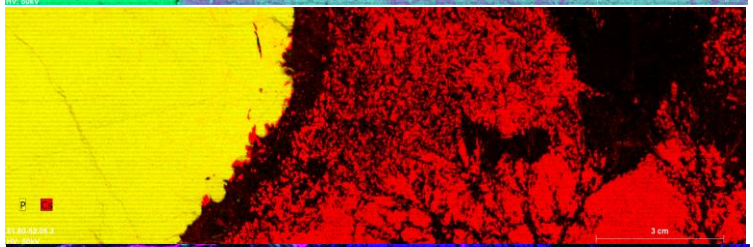
Ca

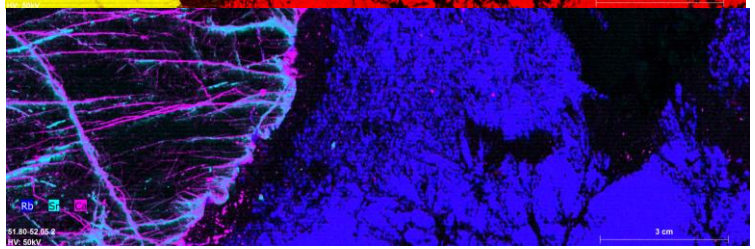

Ca
4 cm
97
94
91
87
84
80
76
73
70
66
63
59
56
53
49
45
42
38
35
32
28
25
21
18
14
11

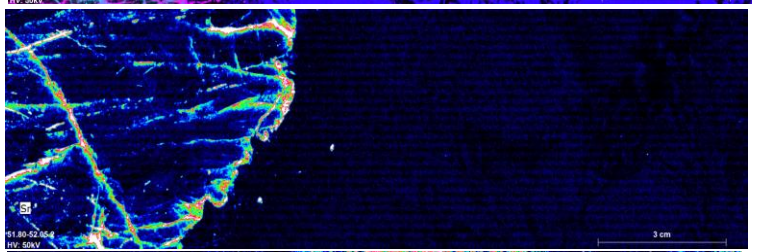
Ca-Sr-Rb

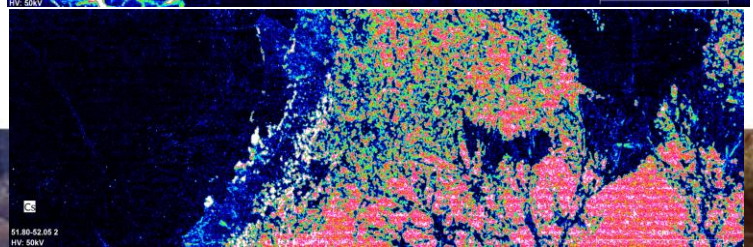












Summary

- Rapid, non-destructive technique
- Versatile sample types and sizes
- Element distribution and mineral maps

Suited for rapid studies to investigate the micromorphology, chemical variability and mineral alteration in samples

Courtesy of Bruker

Acknowledgements

For more information visit: www.portaspecs.com