Interim report on large crater mapping
Anton Kearsley (NHM) May 19th

- Two large craters mapped previously: C2009N,1 sent on to Rhonda Stroud; C2086W,1 sent to LLNL.
- Four more large craters described in this report
- One has been finished at NHM and sent to Peter Hoppe (C2086N,1)
- Second crater is ready to be sent back to Frank Stadermann for further NanoSIMS (C2118N,1)
- Much more data to extract in files already acquired from (C2029W,1 and C2091N,1)… especially maps from tilted crater angles and X-ray spectra for quantification.
- Where should these two craters go next?

Stardust foil C2086N,1

Electron imagery

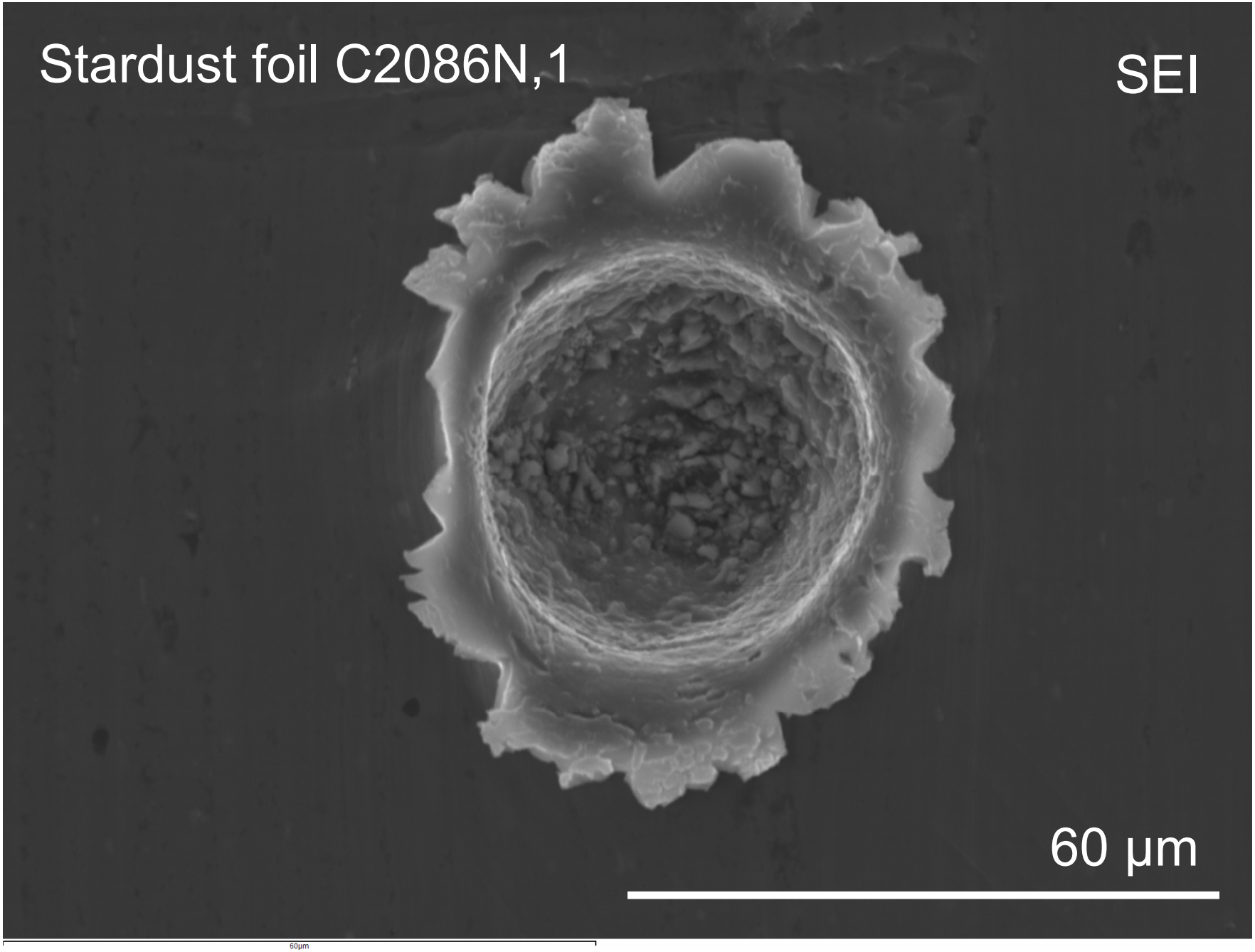
Stereometric reconstruction

X-ray maps

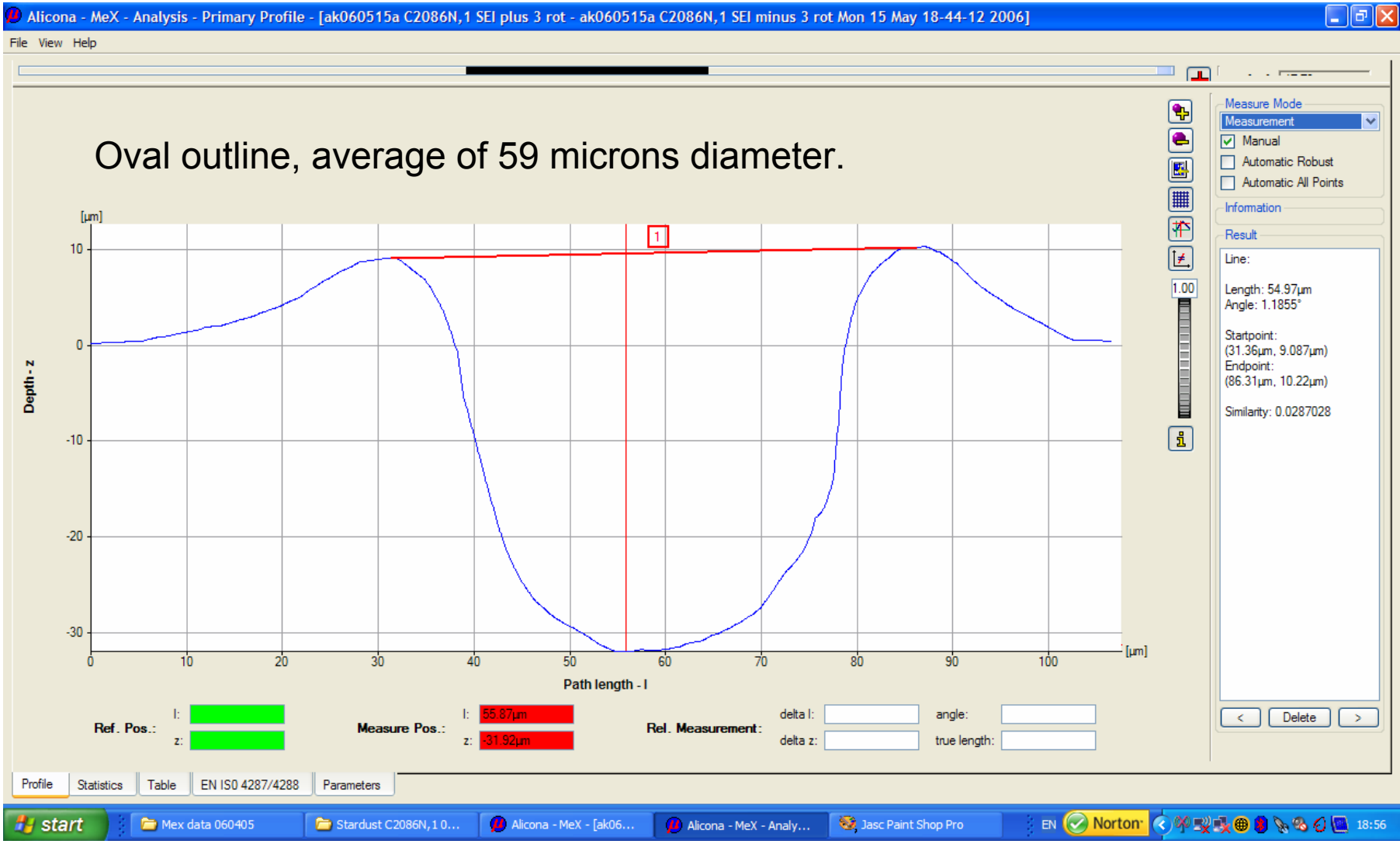
Quantitative Energy Dispersive X-ray analyses

Anton Kearsley, NHM May 2006

Sample sent on to Peter Hoppe (Mainz)


Stardust foil C2086N,1
SEI
60 µm
60µm

Stardust foil C2086N,1



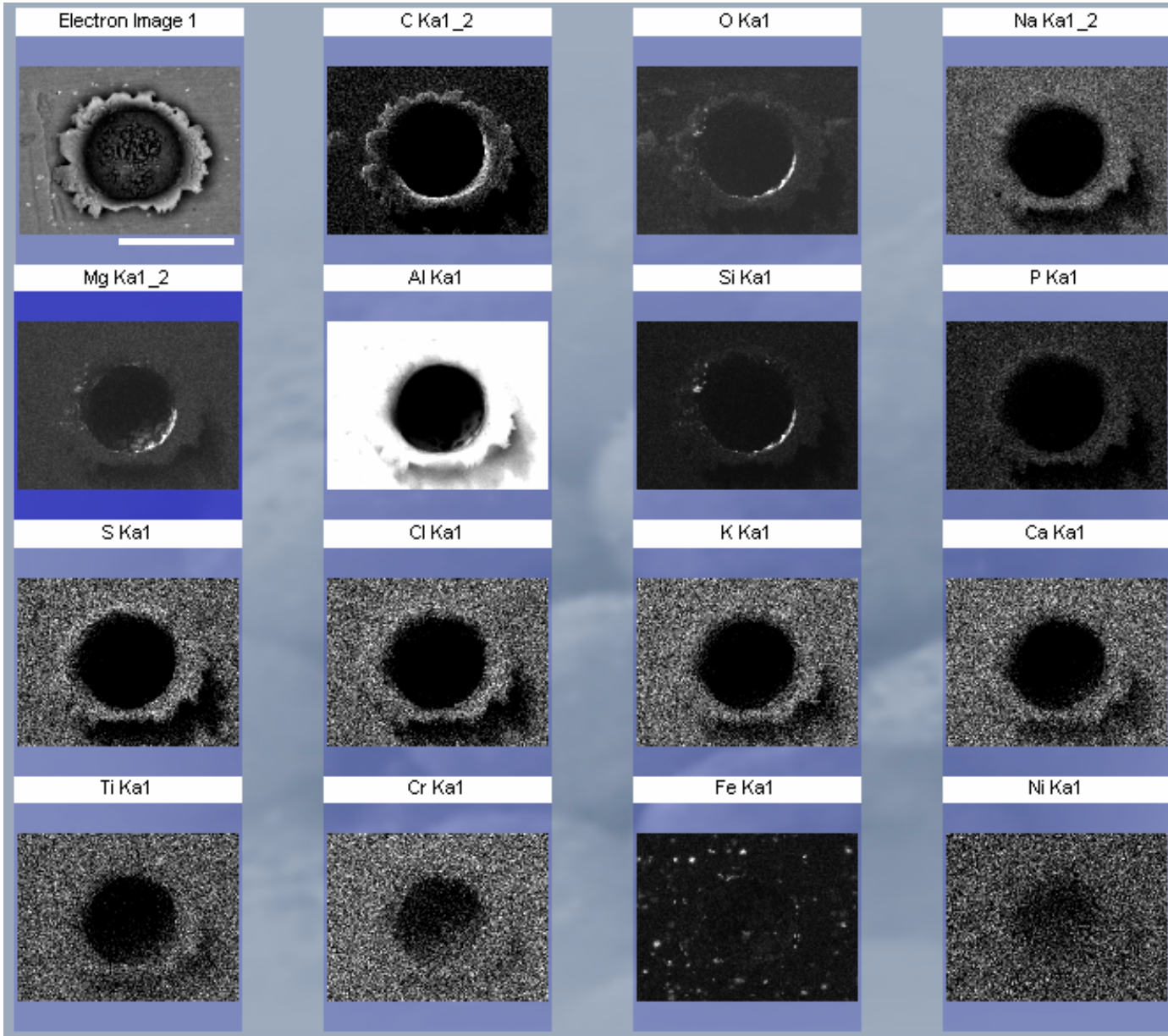
Stardust foil C2086N,1

X-ray maps with beam-normal incidence.

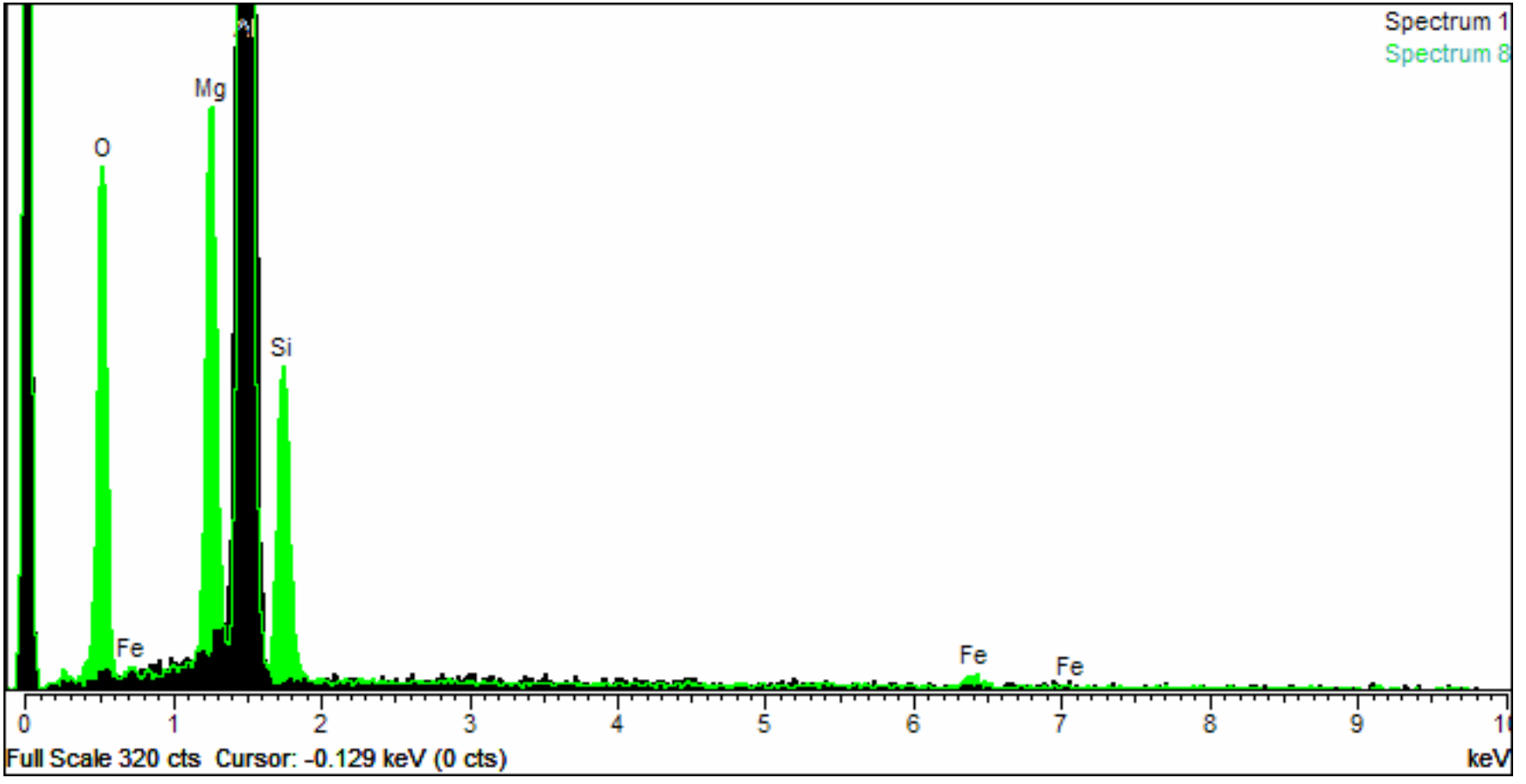
Residue can be located at the crater rim, but not on the walls or floor

60 μm

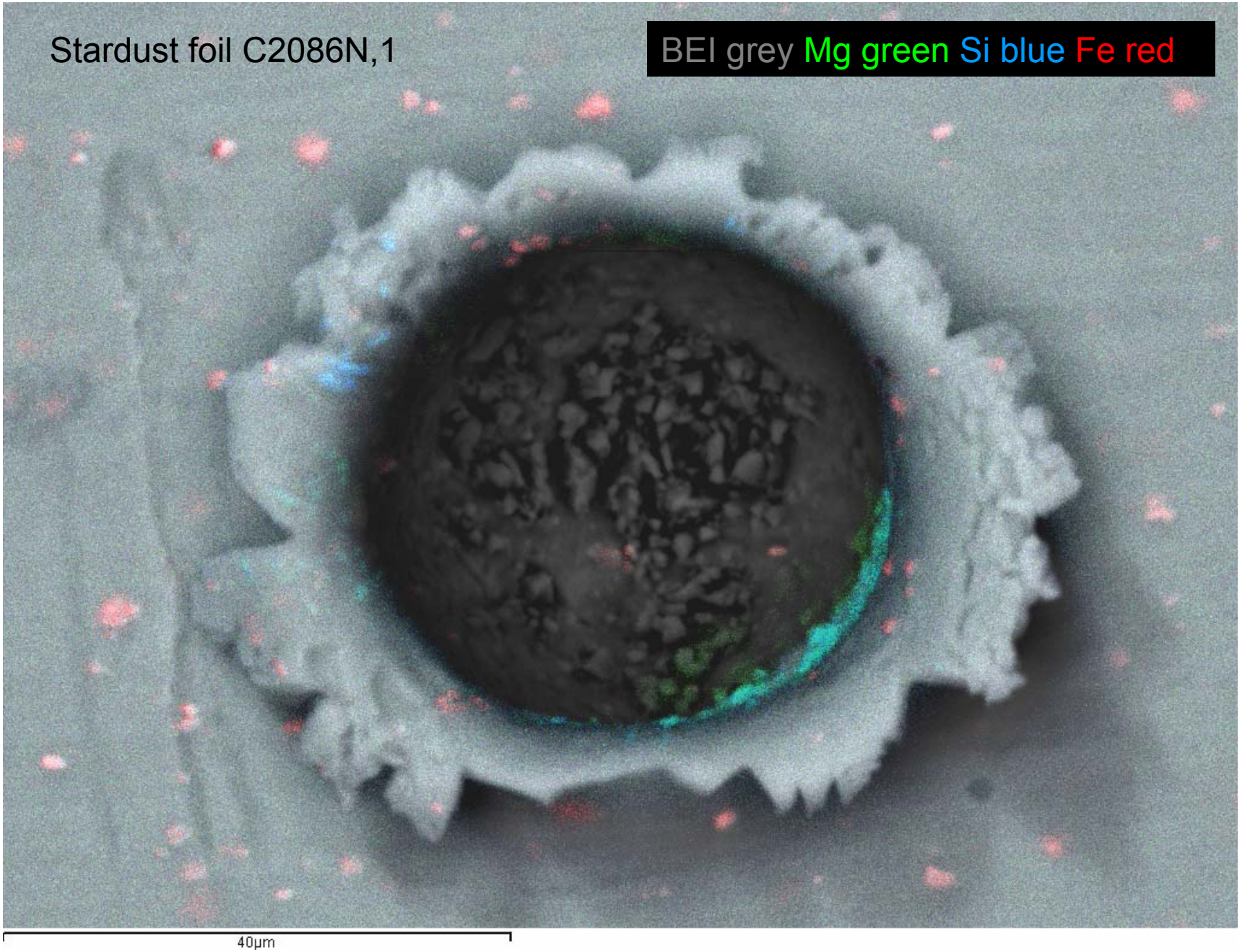
scalebar

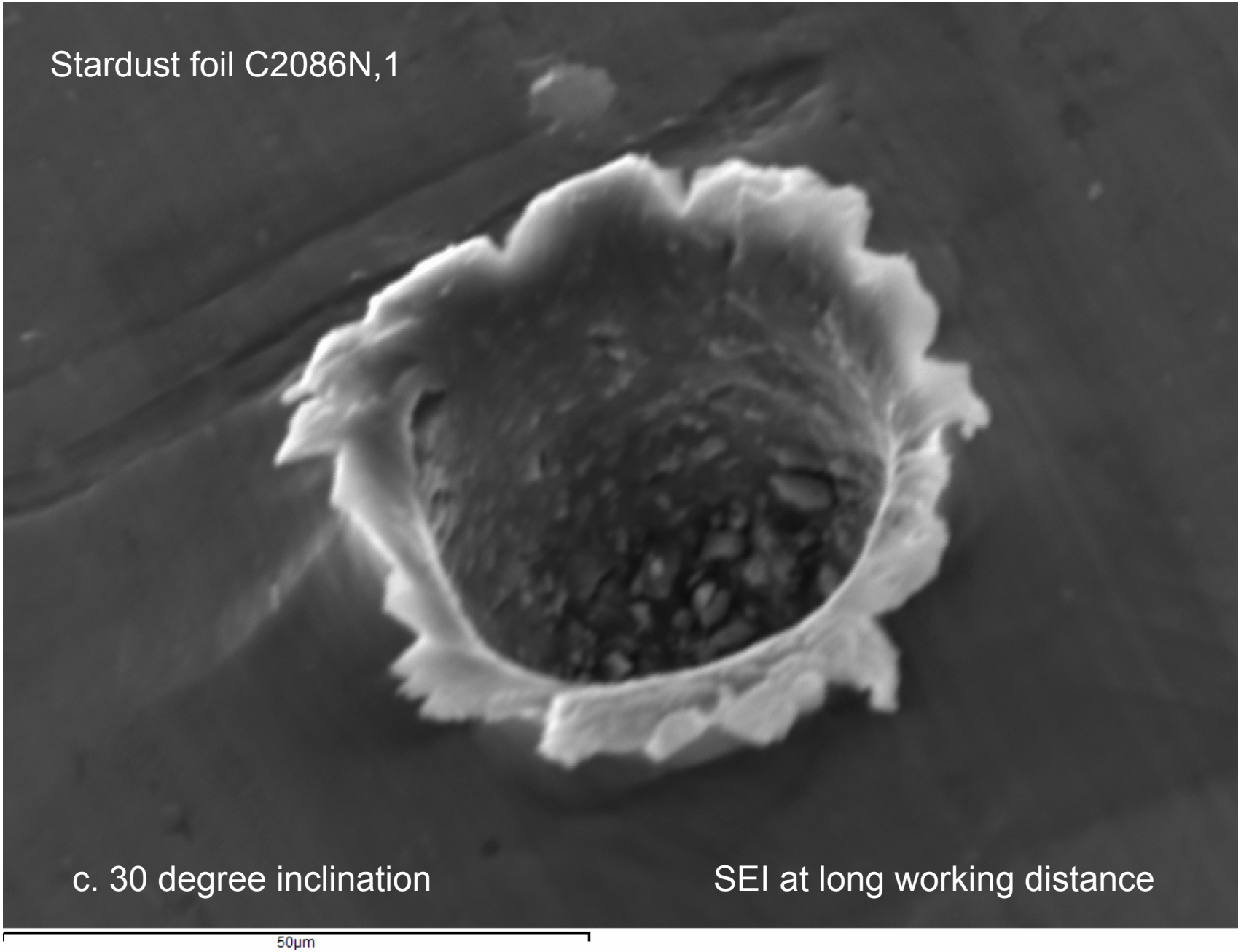


Stardust foil C2086N,1

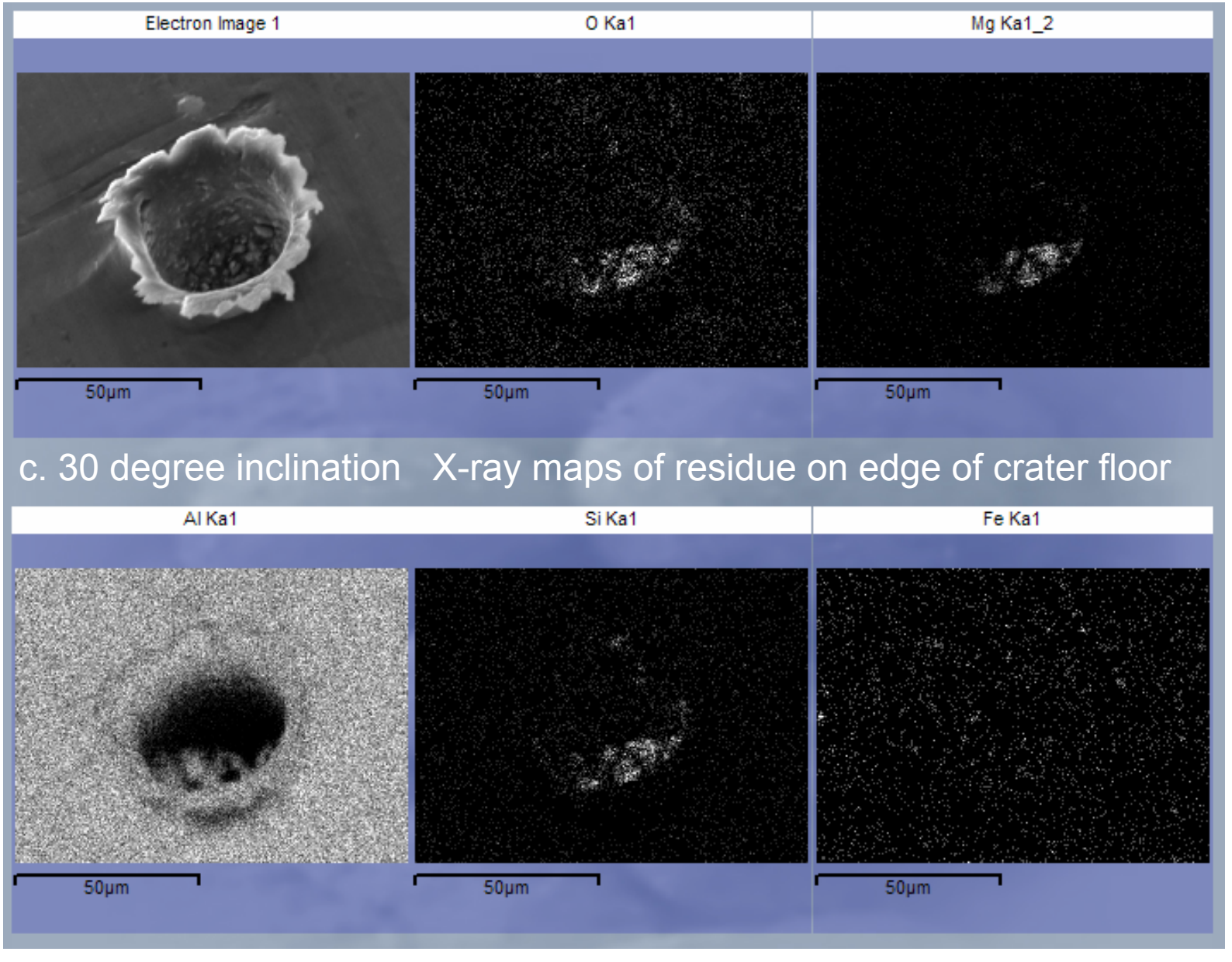


Typical EDS X-ray spectrum of residue on crater lip (green) superimposed on spectrum of nearby aluminium alloy surface. Mg-rich olivine.


Stardust foil C2086N,1
BEI grey Mg green Si blue Fe red
40µm

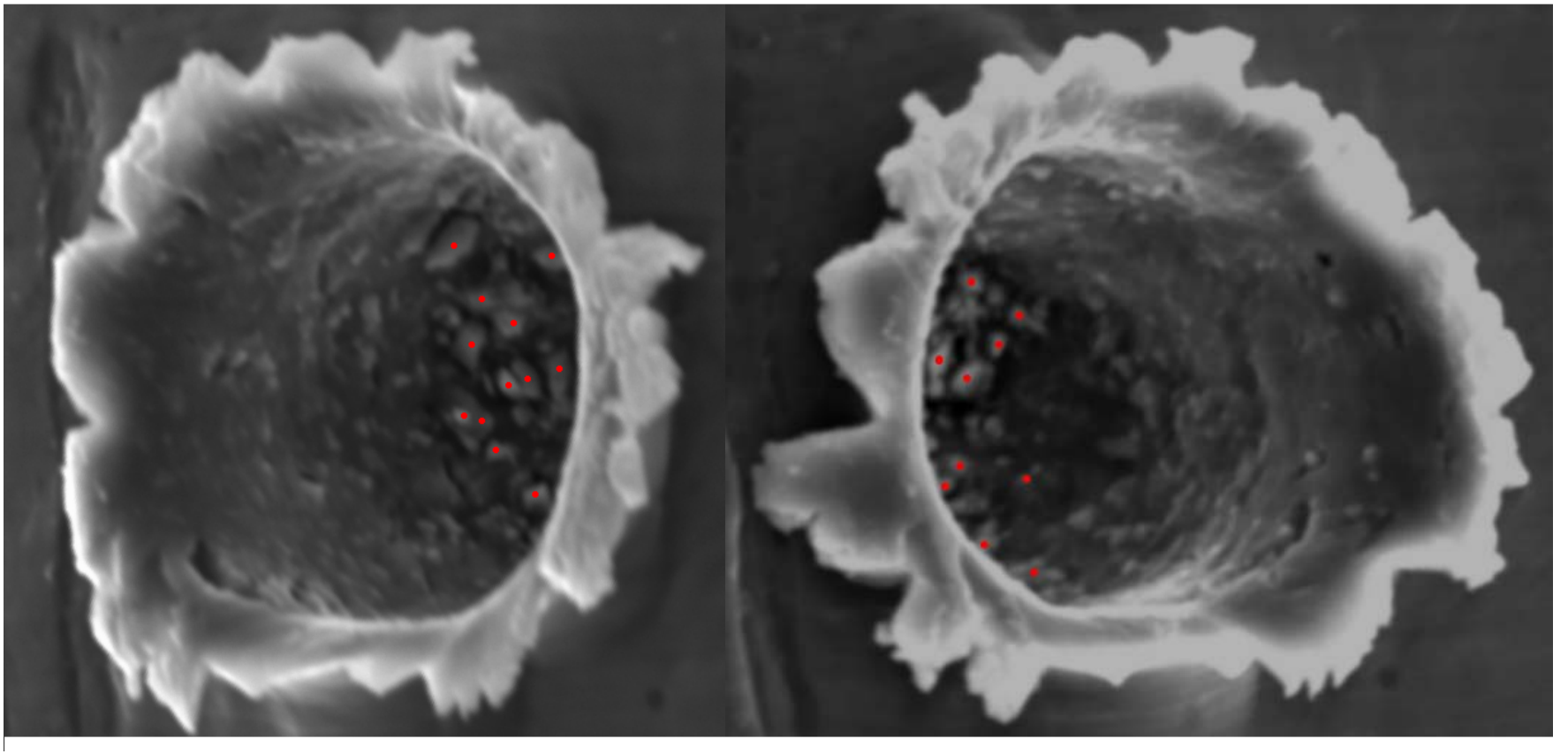

Stardust foil C2086N,1
c. 30 degree inclination
SEI at long working distance
50µm

Stardust foil C2086N,1



c. 30 degree inclination X-ray maps of residue on edge of crater floor

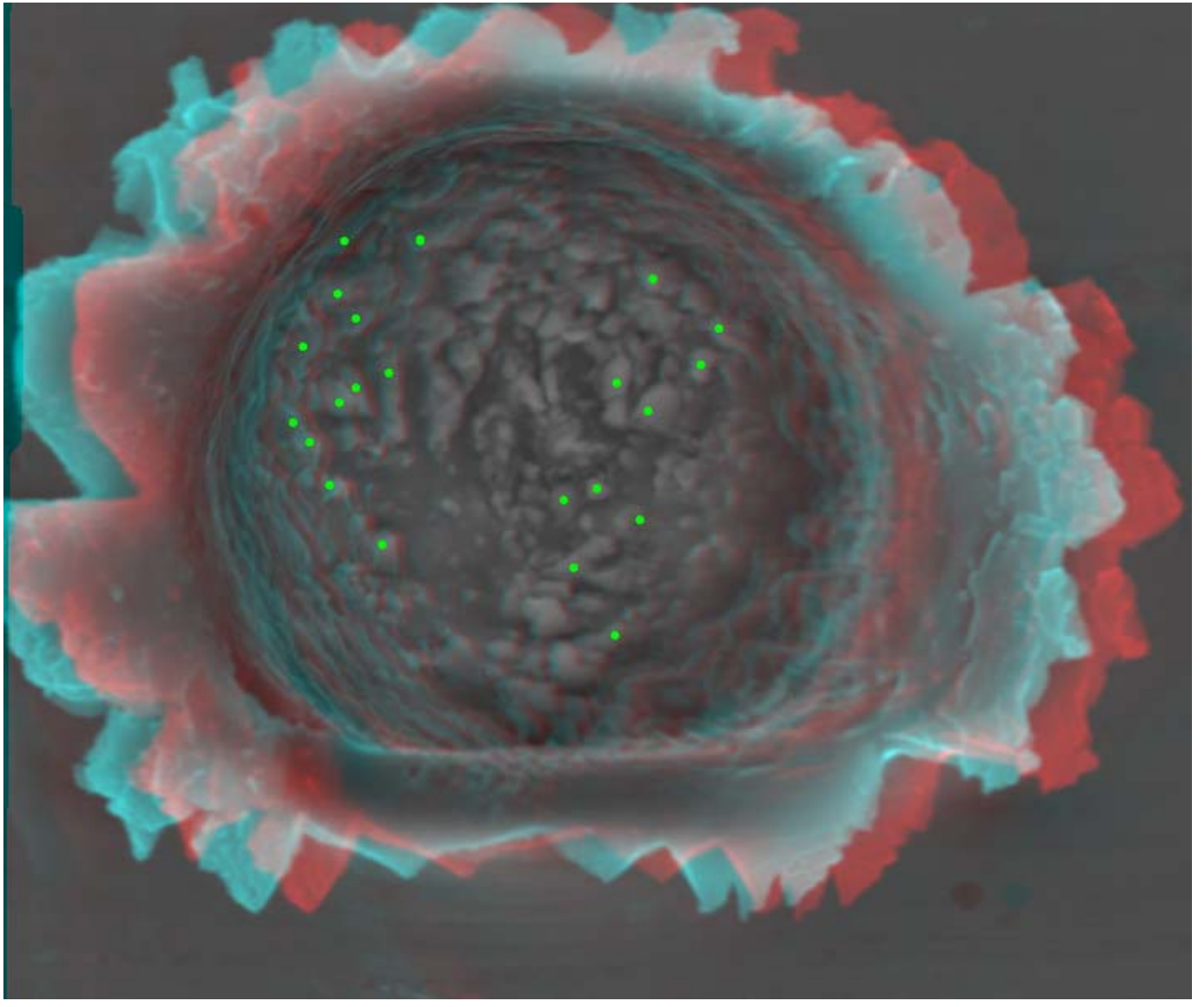
Stardust foil C2086N,1



Red points all yielded indistinguishable analyses of high-Mg olivine, with good stoichiometry and Fo:Fa c. 97:3%.

Stardust foil C2086N,1 stereo anaglyph

Locations of olivine analyses shown as green dots



Sample: C2086N,1

Processing option : Oxygen by stoichiometry (Normalised)

All results in atomic%

	Mg	Si	Fe	O	Fo%
Spectrum 1	27.9	14.3	0.7	57.1	97.6
Spectrum 2	28.1	14.2	0.6	57.1	97.8
Spectrum 3	27.7	14.3	0.9	57.1	96.9
Spectrum 4	28.1	14.1	0.7	57.1	97.5
Spectrum 5	27.6	14.3	0.9	57.2	96.8
Spectrum 6	27.8	14.3	0.7	57.2	97.6
Spectrum 7	27.9	14.4	0.6	57.2	98.0
Spectrum 8	28.0	14.2	0.7	57.1	97.5
Spectrum 9	28.4	13.8	0.9	56.9	97.0
Spectrum 10	28.5	13.7	0.9	56.9	96.8
Spectrum 11	27.9	14.3	0.7	57.1	97.5
Spectrum 12	30.9	12.8	0.0	56.4	100.0
Spectrum 13	28.4	13.9	0.8	56.9	97.2
Average	28.2	14.0	0.7	57.0	97.5
Std Deviation	0.8	0.4	0.2	0.2	0.8

Stardust foil C2086N,1 summary

A bowl-shaped crater of 59 microns top-lip average diameter, similar depth to lab. impacts of olivine grains under the same velocity conditions.

Impact by a single dense grain of one mineral species?

Density-scaled crater diameter calibration suggests: particle diameter c. 11 μm, and mass c. 2 ng.

There is abundant residue on crater walls and floor

All analyses of residue by EDS are very similar, showing olivine with good stoichiometry of c. 97 Fo %.

Stardust foil C2118N,1

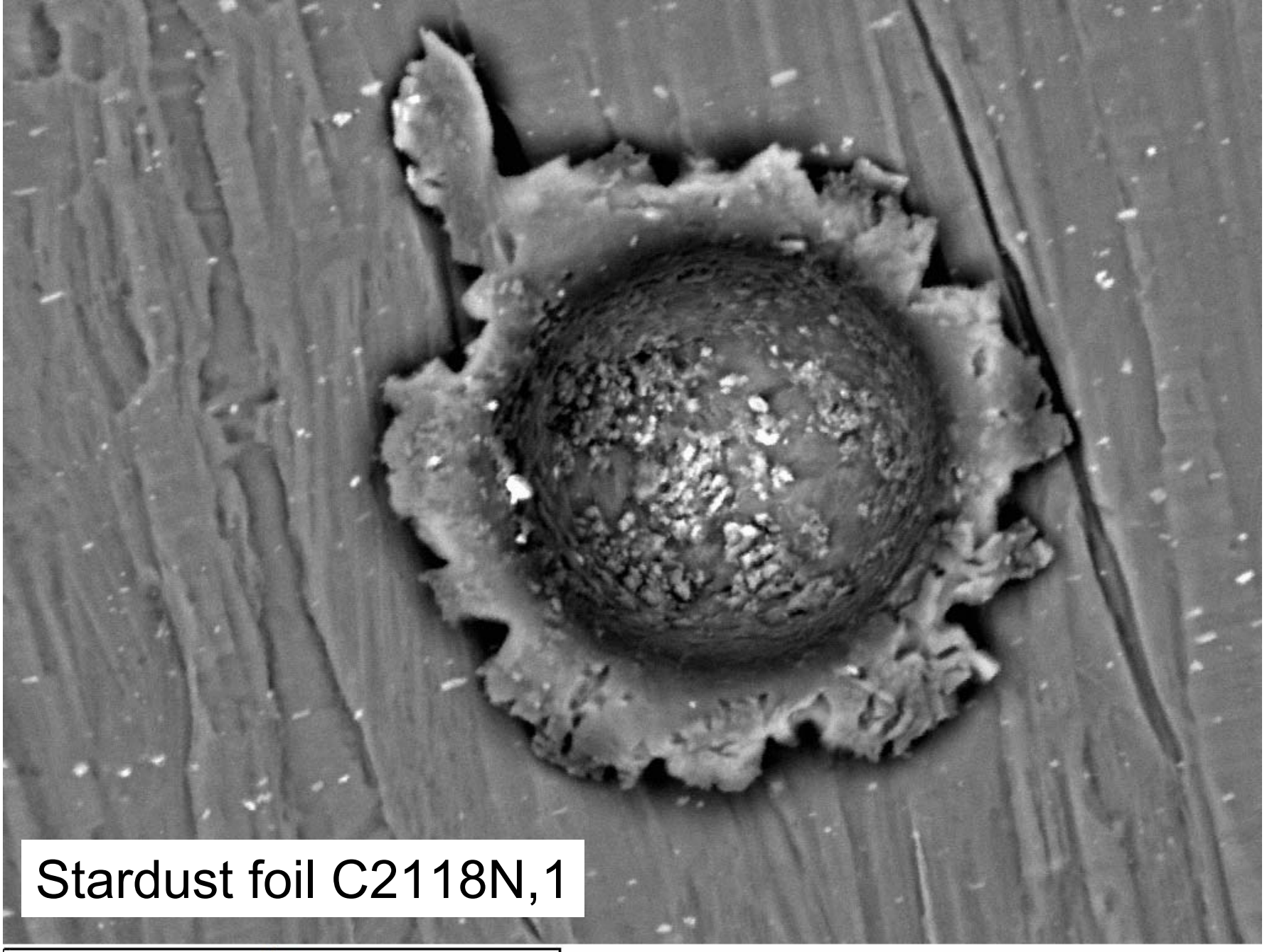
A simple, bowl shaped crater, but with several compositional components. Na- and Ca-rich Mg silicate residue, iron sulfides, carbonate?

Electron imagery, Stereometric reconstruction, X-ray maps, Energy Dispersive X-ray spectra

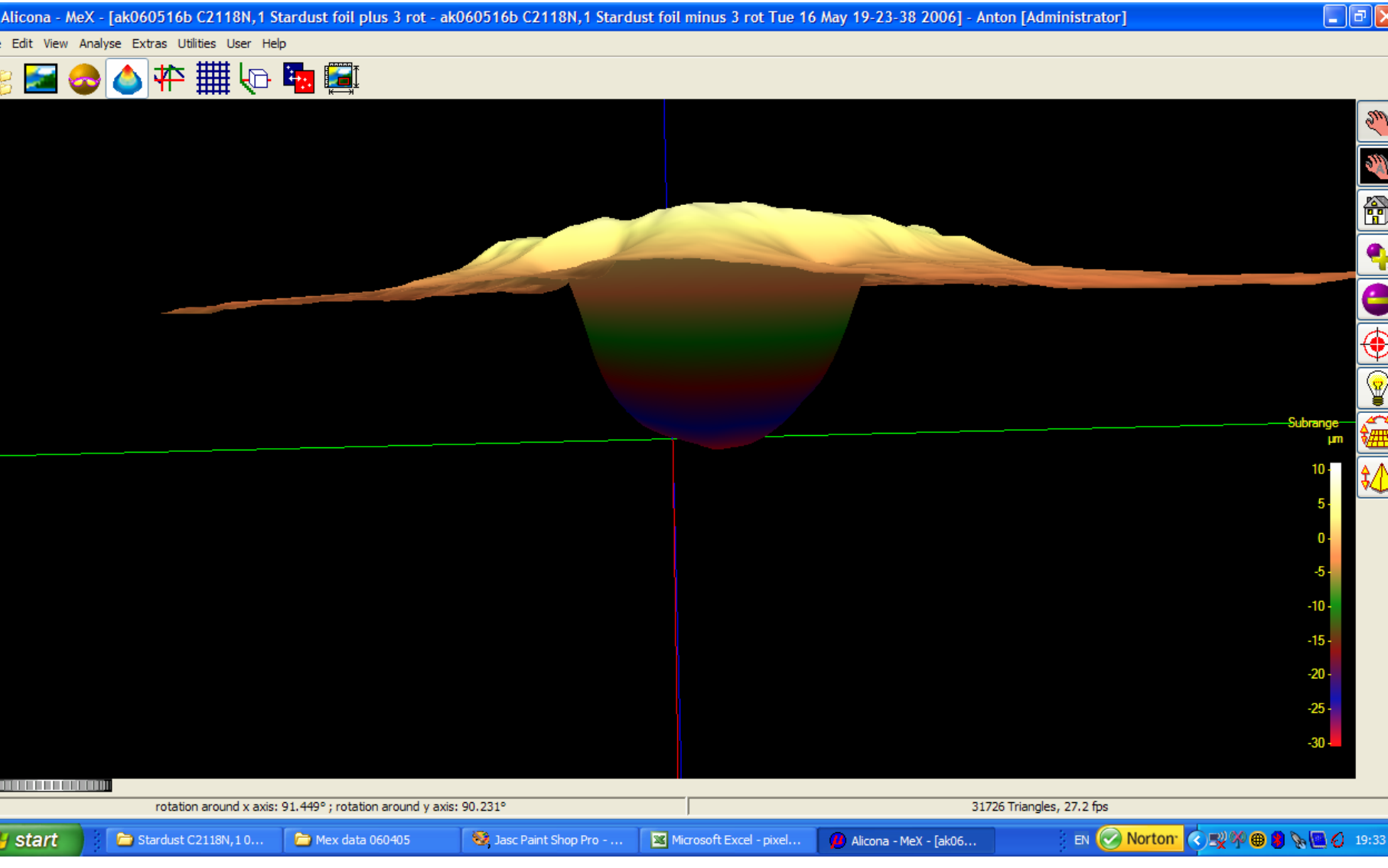
Anton Kearsley

NHM May 2006

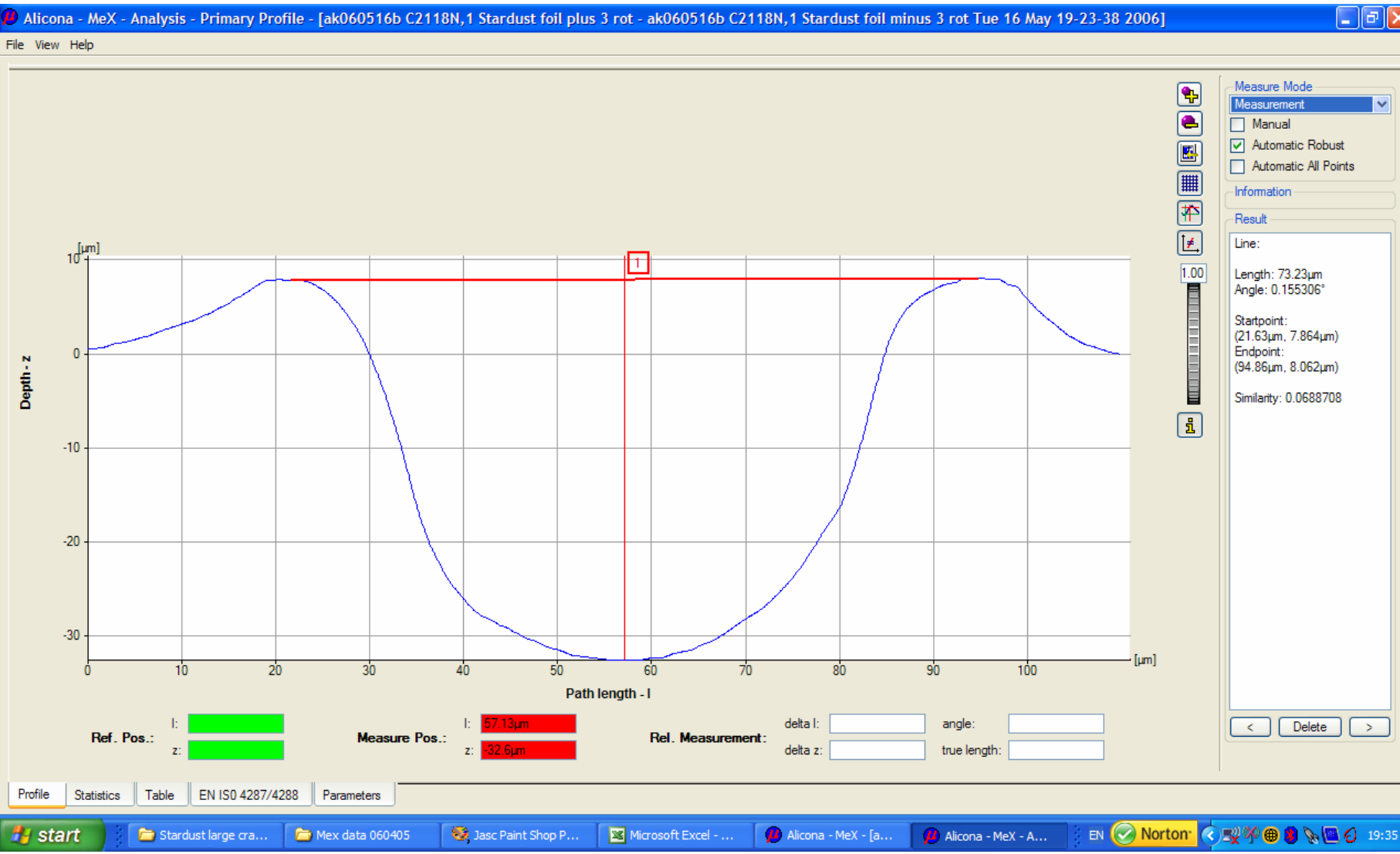
Sample to be returned to Frank Stadermann


Stardust foil C2118N,1
70µm

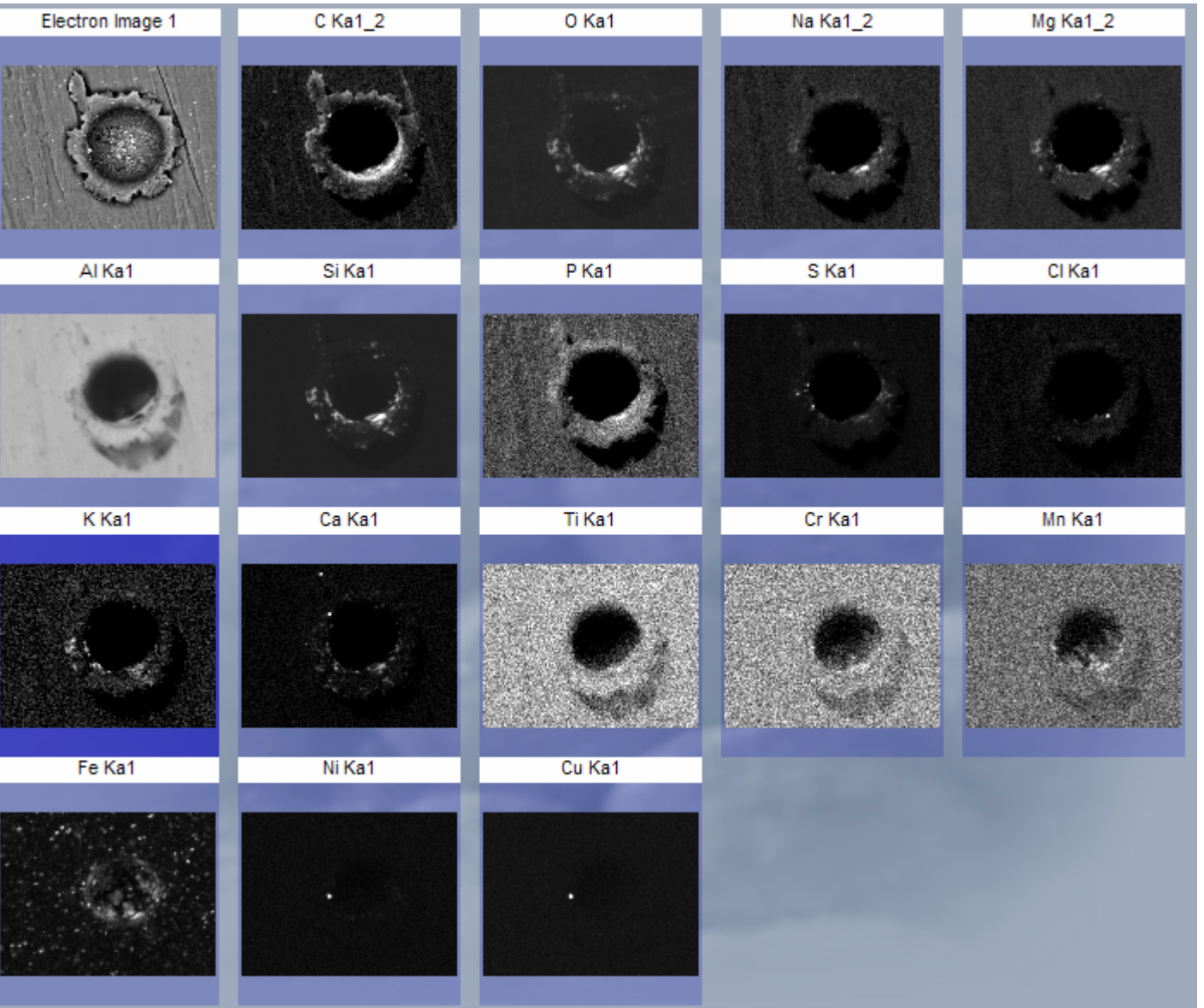
Stardust foil C2118N,1 depth model



Stardust foil C2118N,1 depth profile

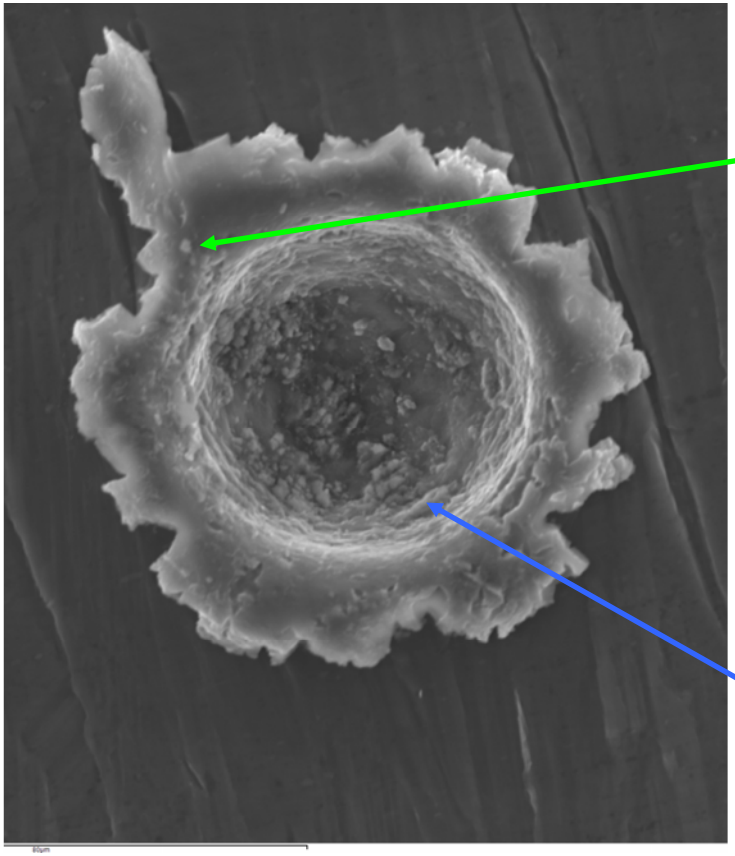


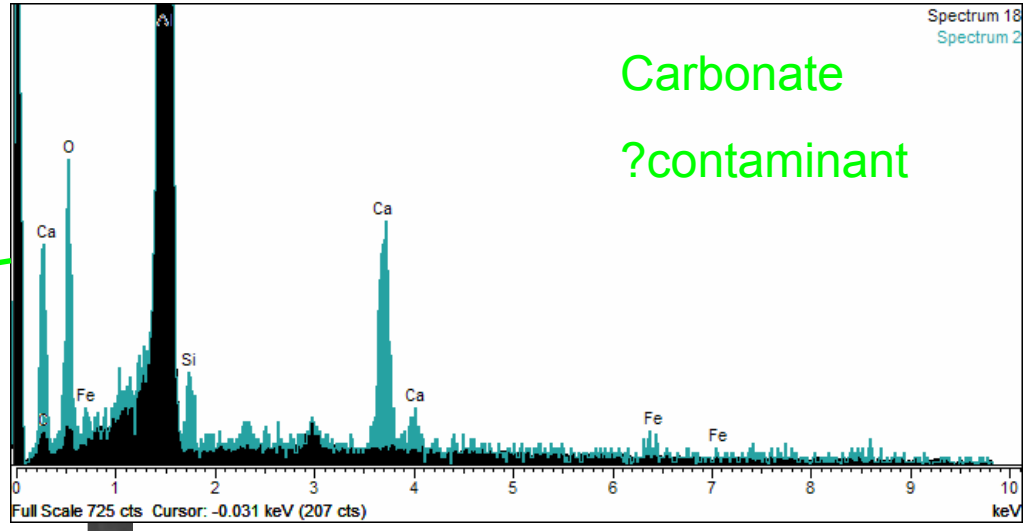
Stardust foil C2118N,1

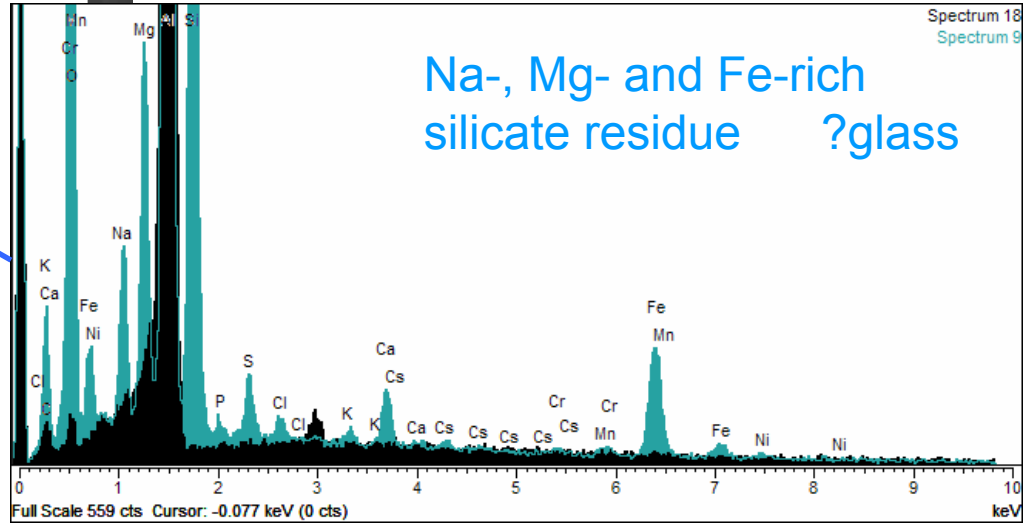


X-ray maps from beam normal incidence reveal abundant residue around crater lip, walls and floor

Stardust foil C2118N,1

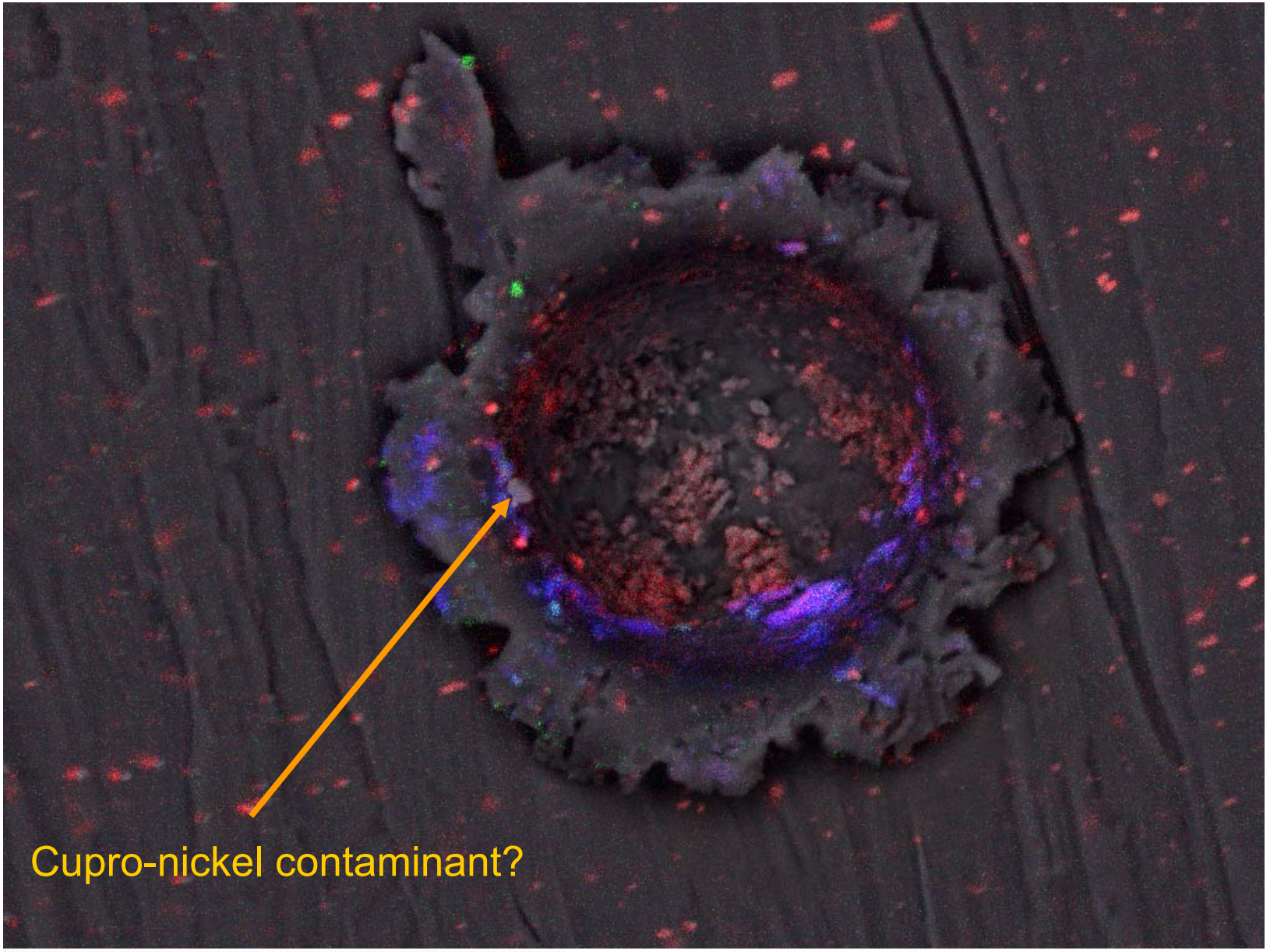




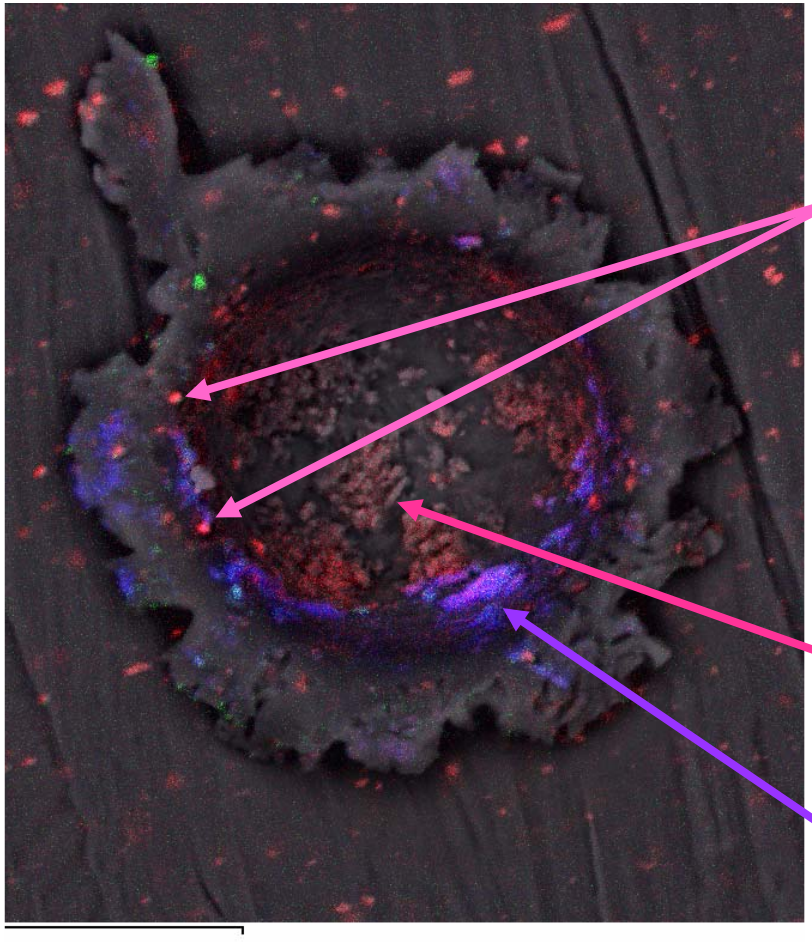


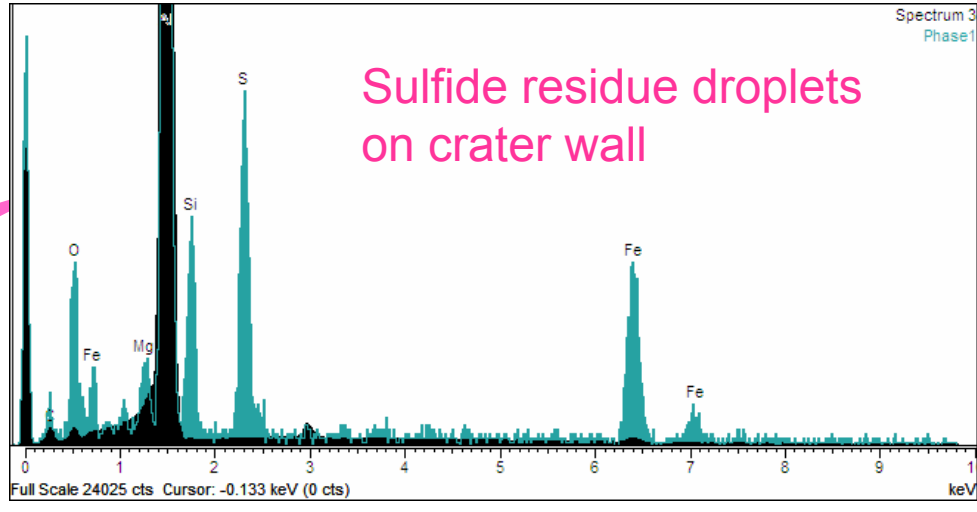
Quantitative analyses to follow

Stardust foil C2118N,1 BEI grey Si blue Ca green Fe red



Stardust foil C2118N,1





Pink areas on crater floor show Fe Ka X-rays from the silicate residue are able to escape from the ‘shadow’, but the Mg Ka and Si Ka cannot.

Purple areas show all Mg Ka, Si Ka and Fe Ka emitted from silicate residue on the crater wall.

Maps from tilted images to follow

Stardust foil C2091N,1

A complex crater? Two overlapped craters? Residue of Mg silicate, with (Mg+Fe) : Si ratio very close to 3 : 2. Minor Fe sulfide too?

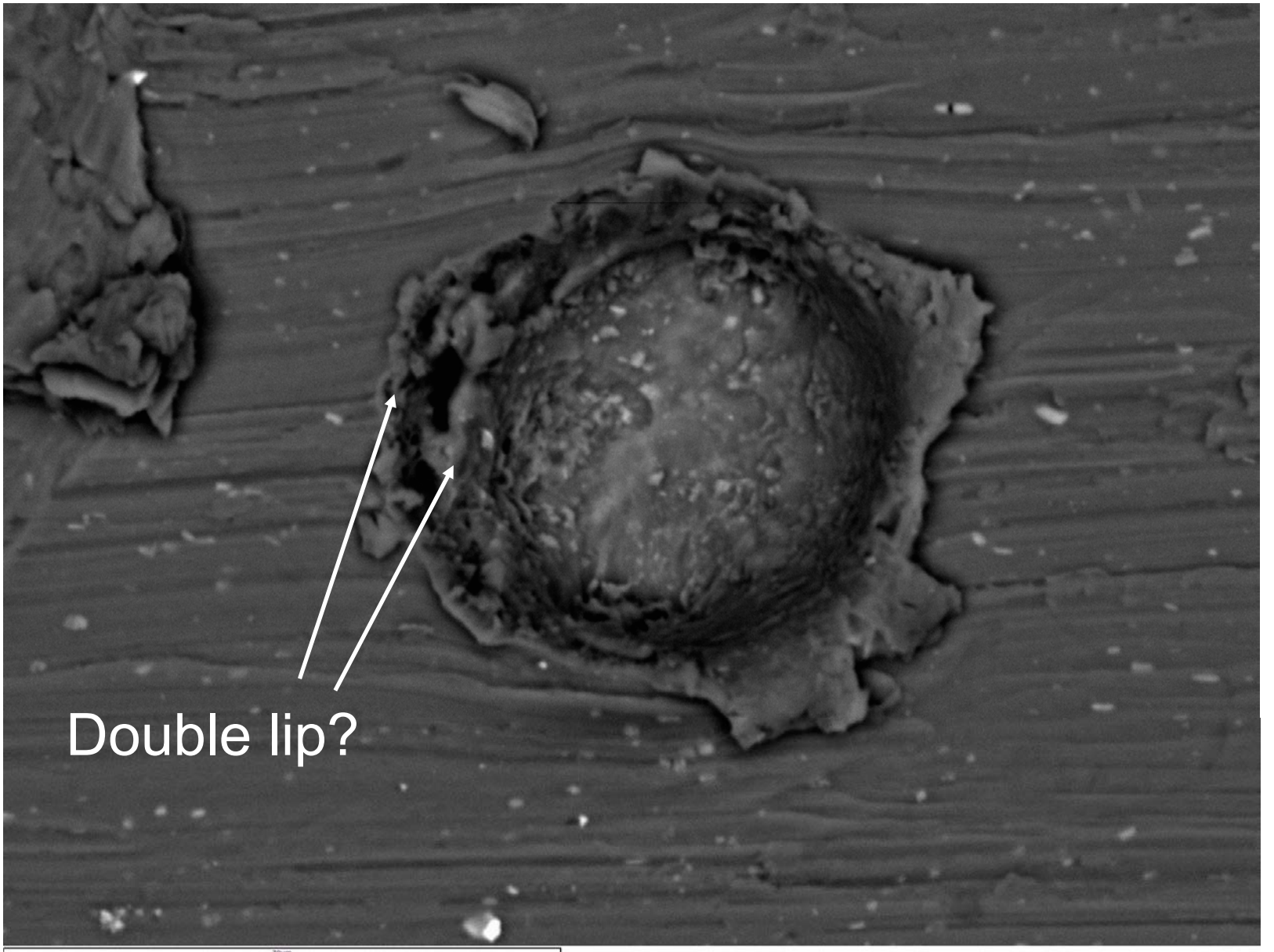
Electron imagery, Stereometric reconstruction, X-ray maps

Quantitative Energy Dispersive X-ray analyses to follow

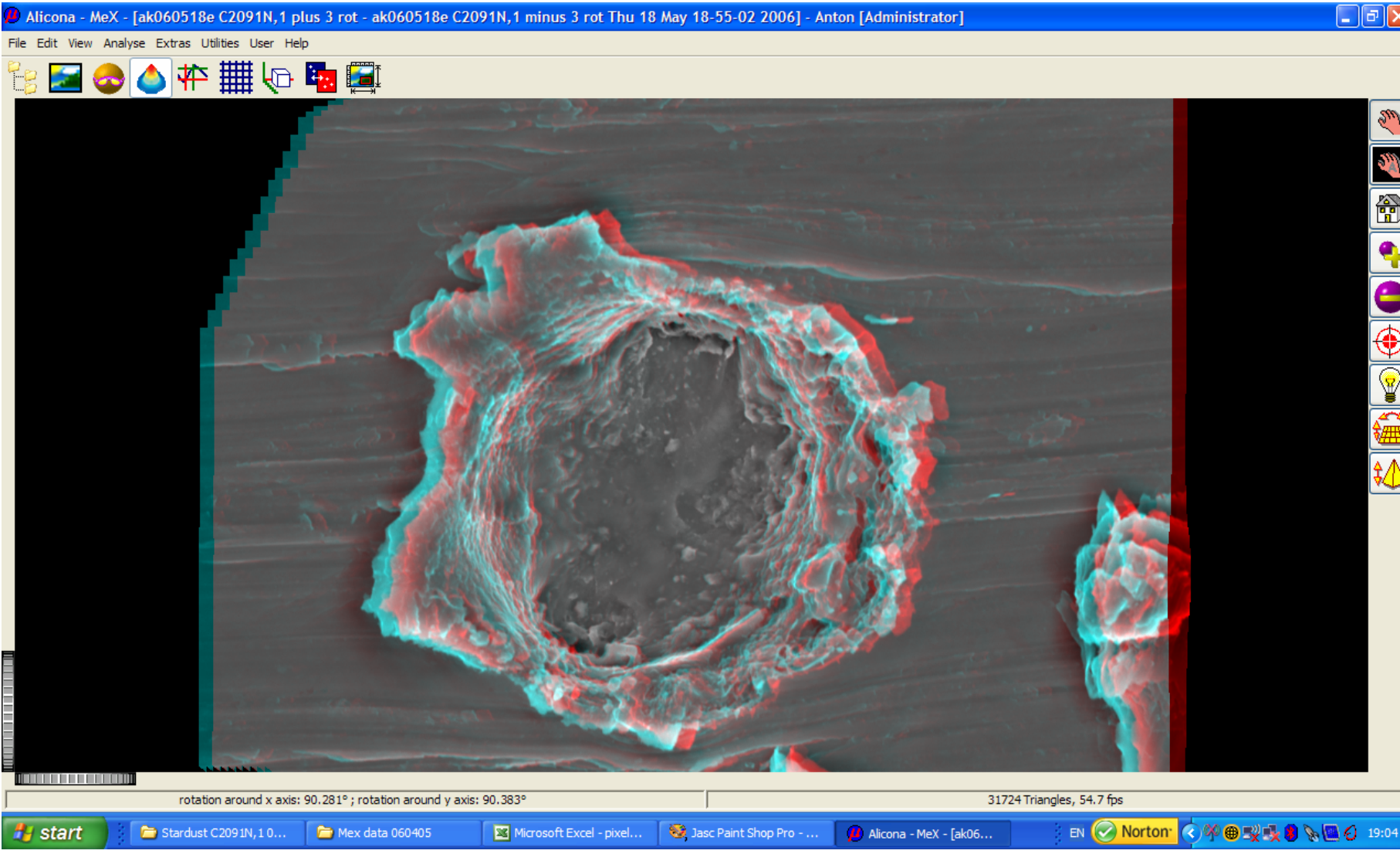
Preliminary report

Anton Kearsley, NHM May 2006

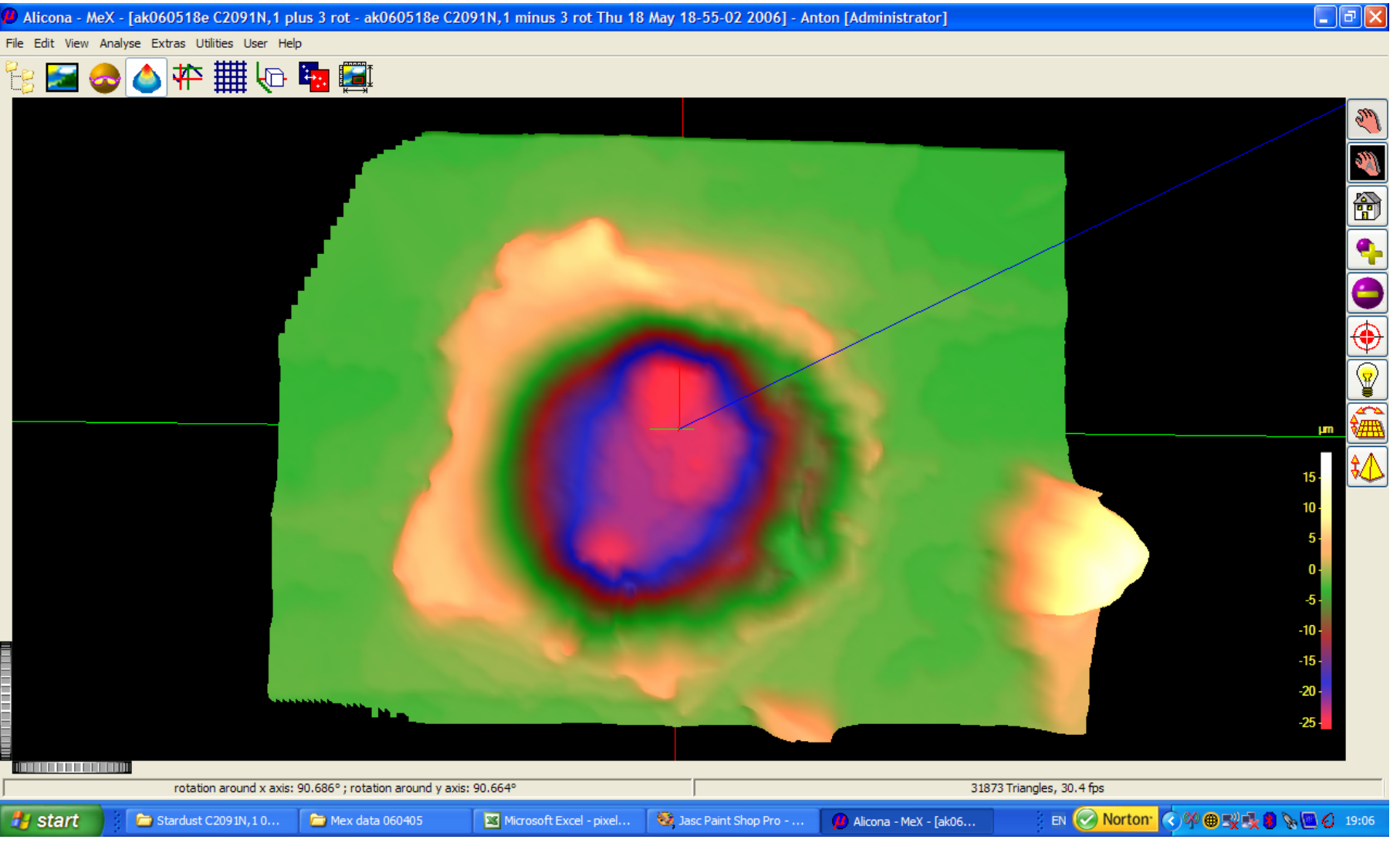
Stardust foil C2091N,1



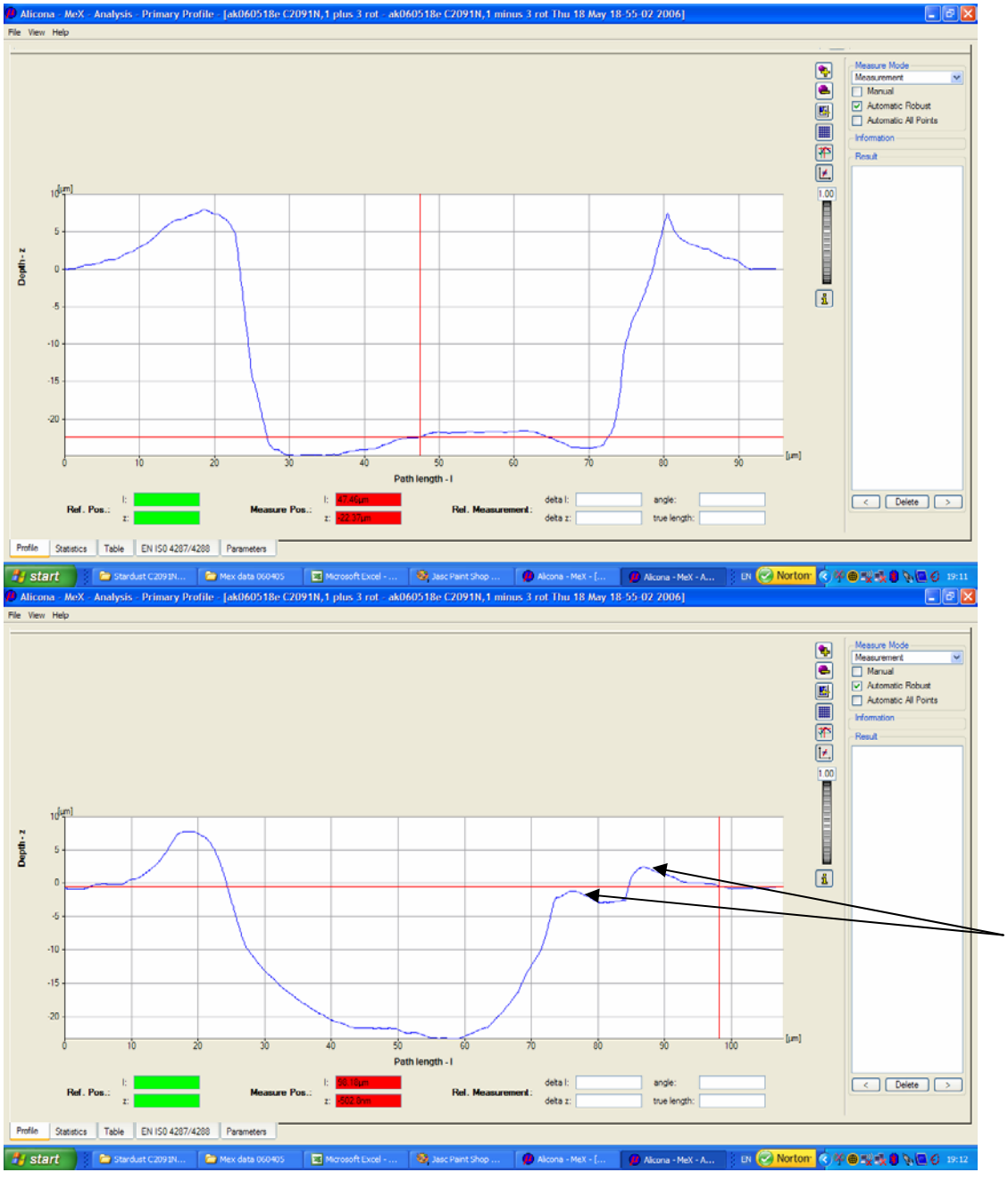
Stardust foil C2091N,1 stereo anaglyph



Stardust foil C2091N,1 depth model



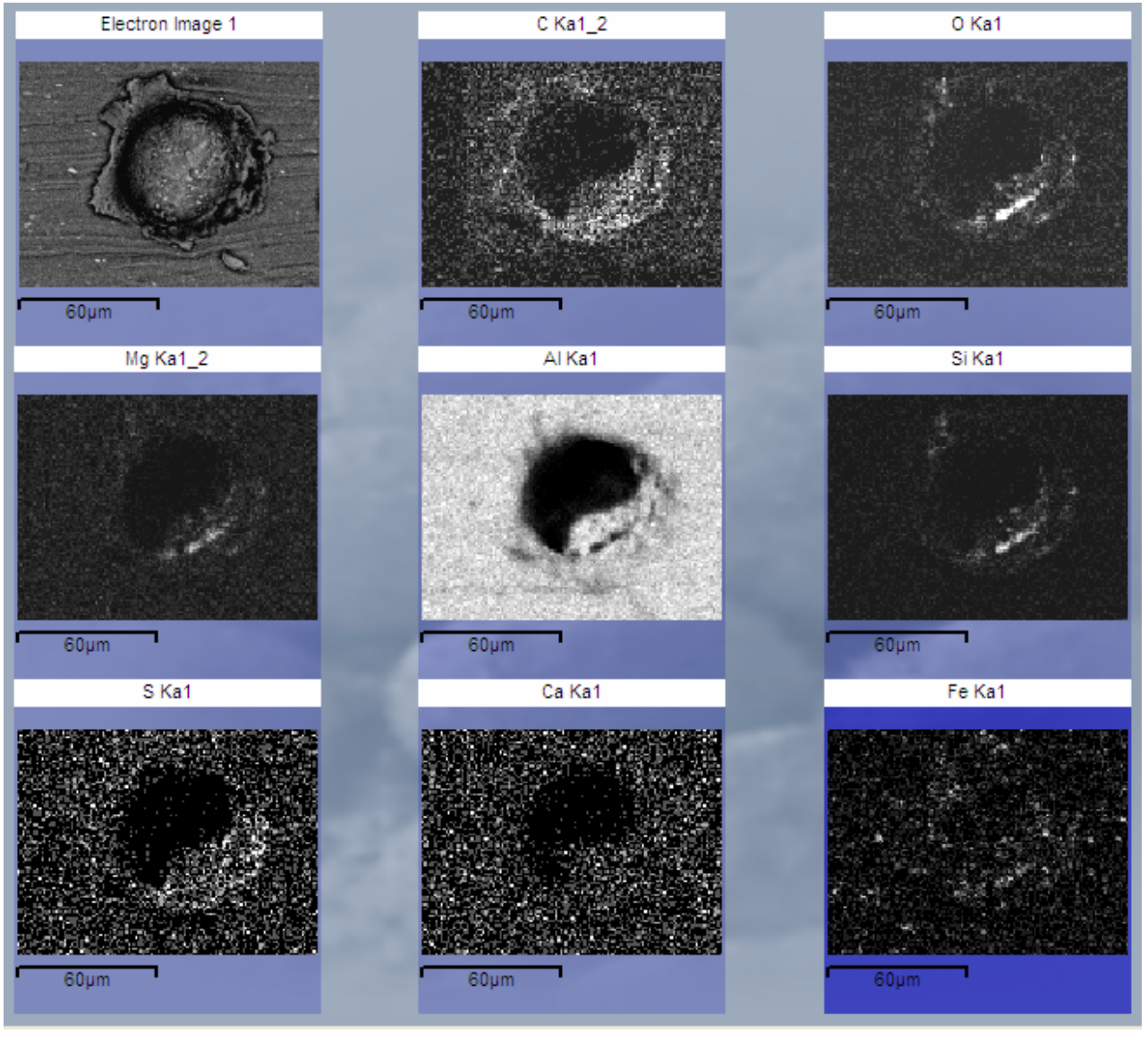
Stardust foil C2091N,1



Complex and shallow depth profiles, from an aggregate of smaller particles?

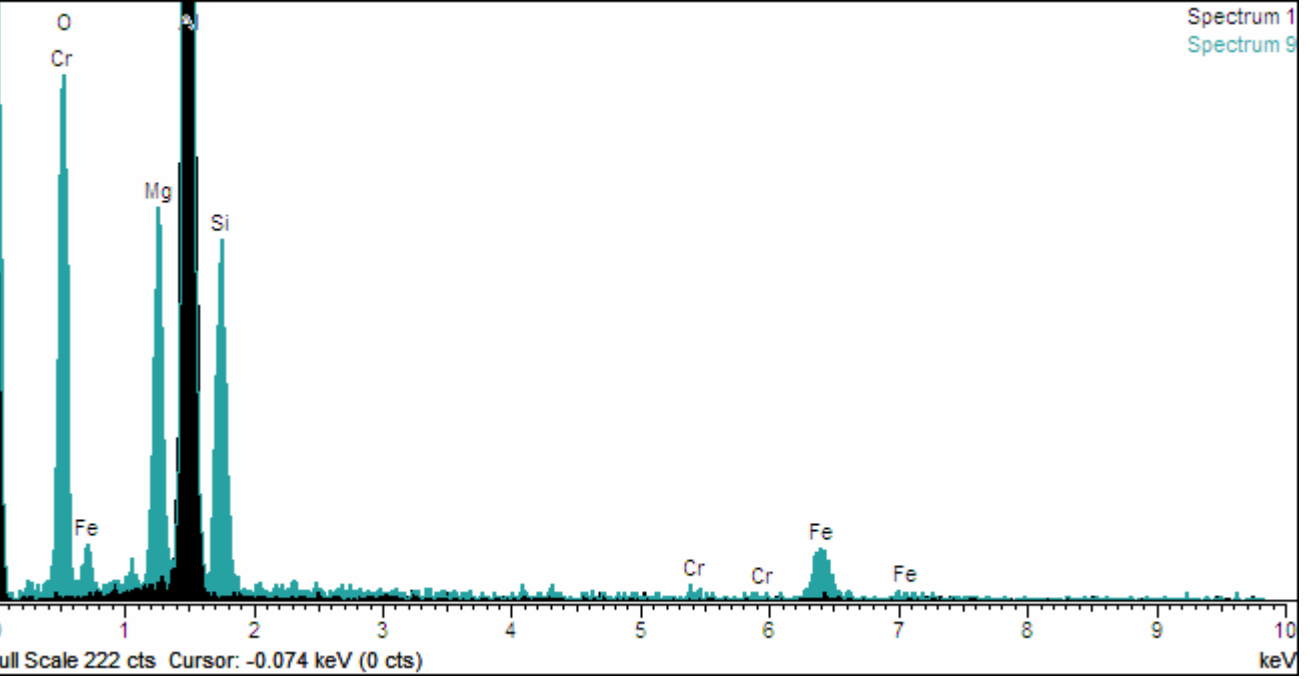
Double lip may indicate two impacts from parts of an aggregate impactor

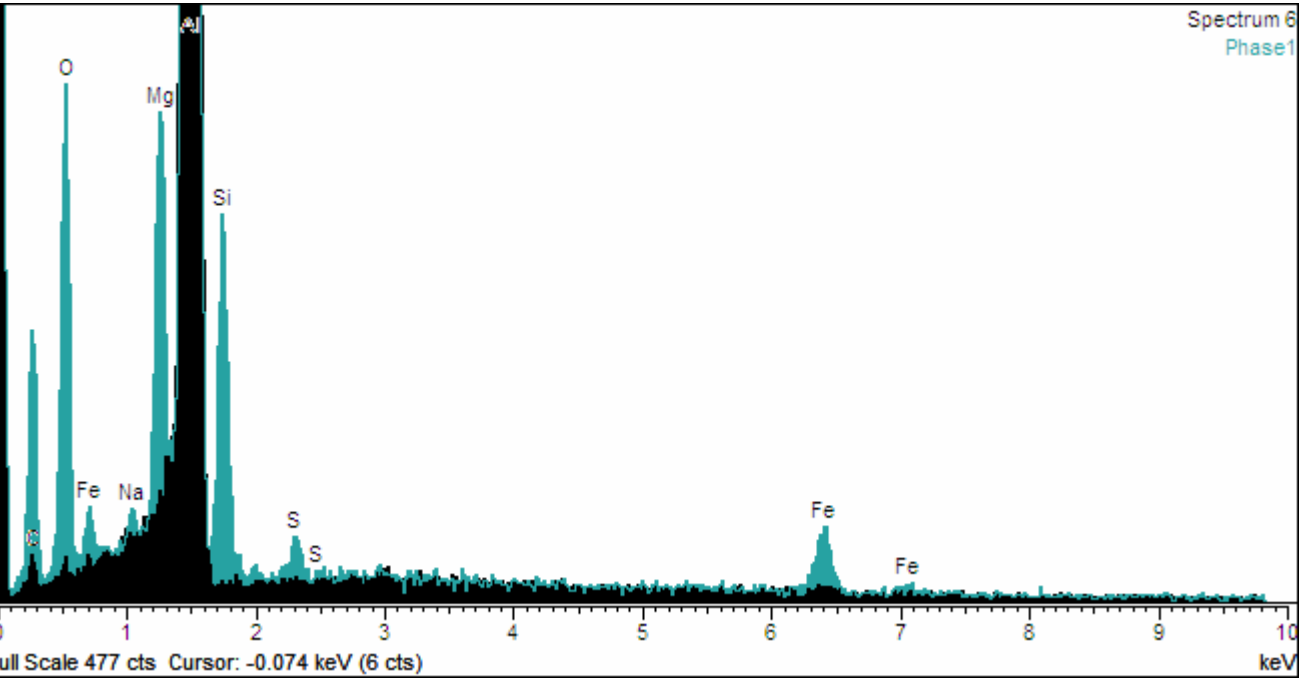
Stardust foil C2091N,1



X-ray maps reveal concentration of Mg silicate residue

(more maps taken, still to be processed)





Stardust foil C2091N,1

Mg silicates dominate in this crater

EDS X-ray analyses show

(Mg+Fe) : Si

is very close to

3 : 2

as is found in serpentines?

(Quantitative analyses to follow)

Stardust foil C2029W,1

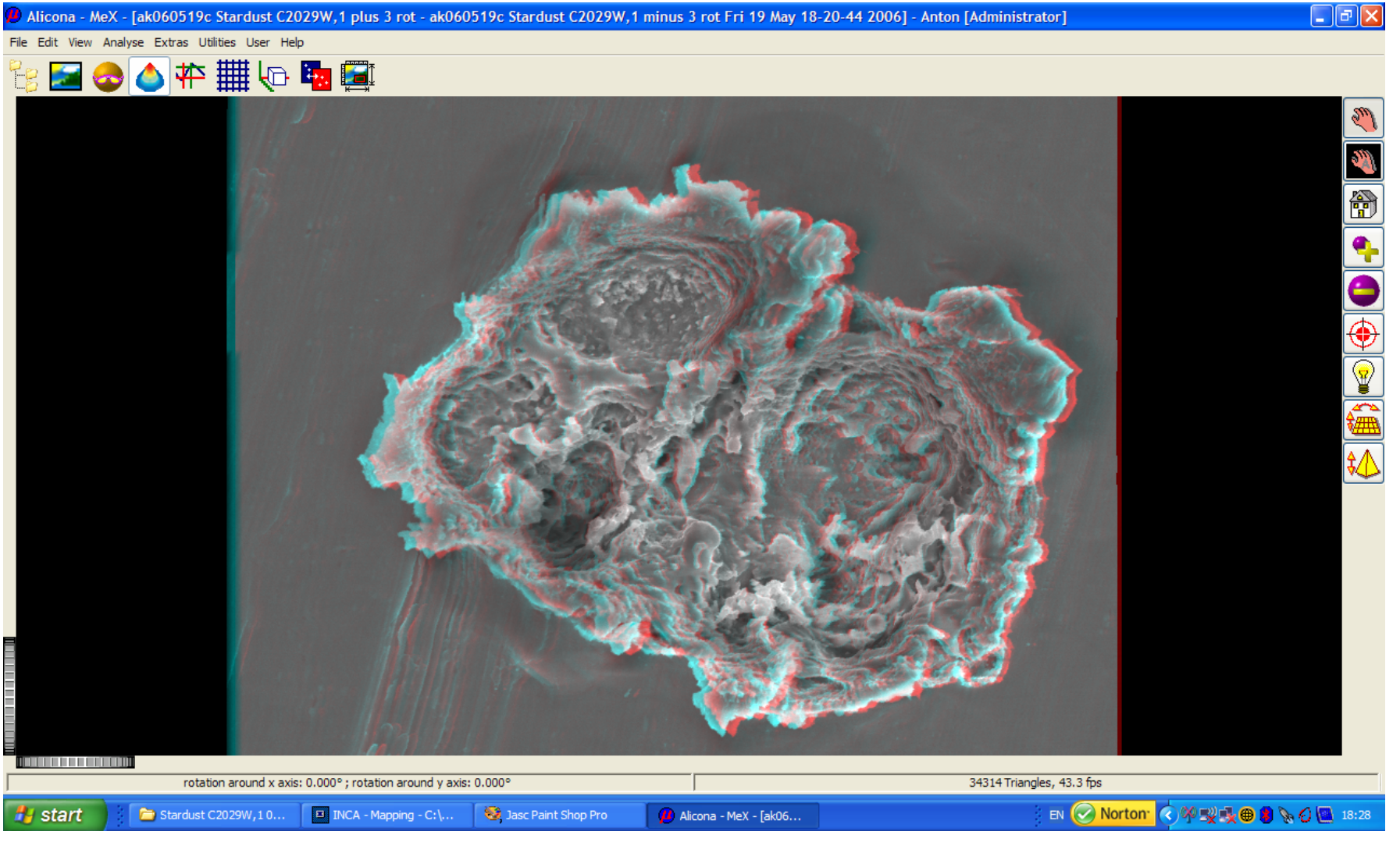
Broad, shallow and irregular patch of overlapped craters. Impact by a cluster of grains? Dominated by non-stoichiometric Mg silicate and Fe Ni sulfides. Carbon-rich material at crater edge

Electron imagery, Stereometric reconstruction, X-ray maps from first aspect (more to follow)

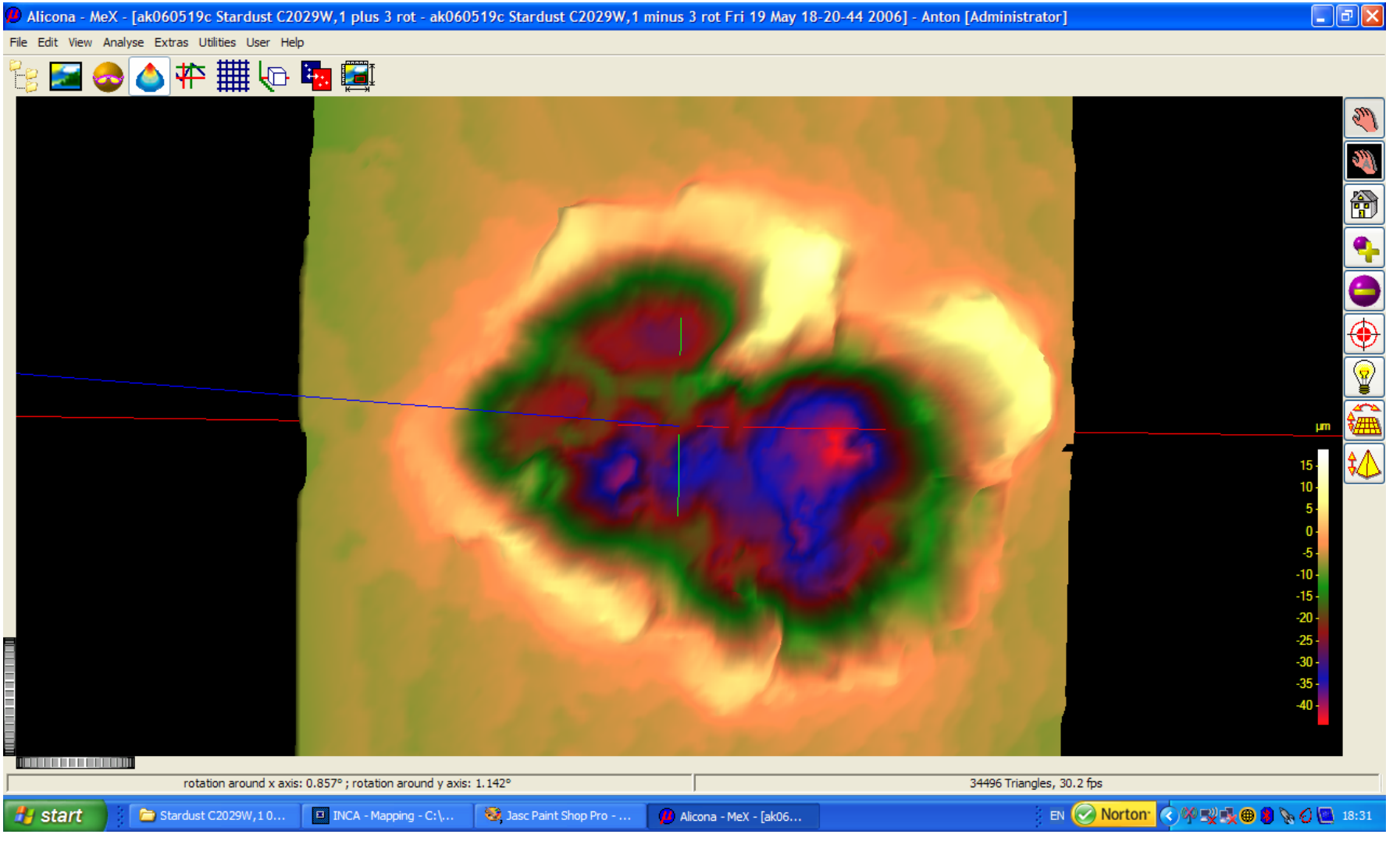
Energy Dispersive X-ray spectra (Quantitative EDS analyses to follow)

Preliminary report Anton Kearsley, NHM May 2006

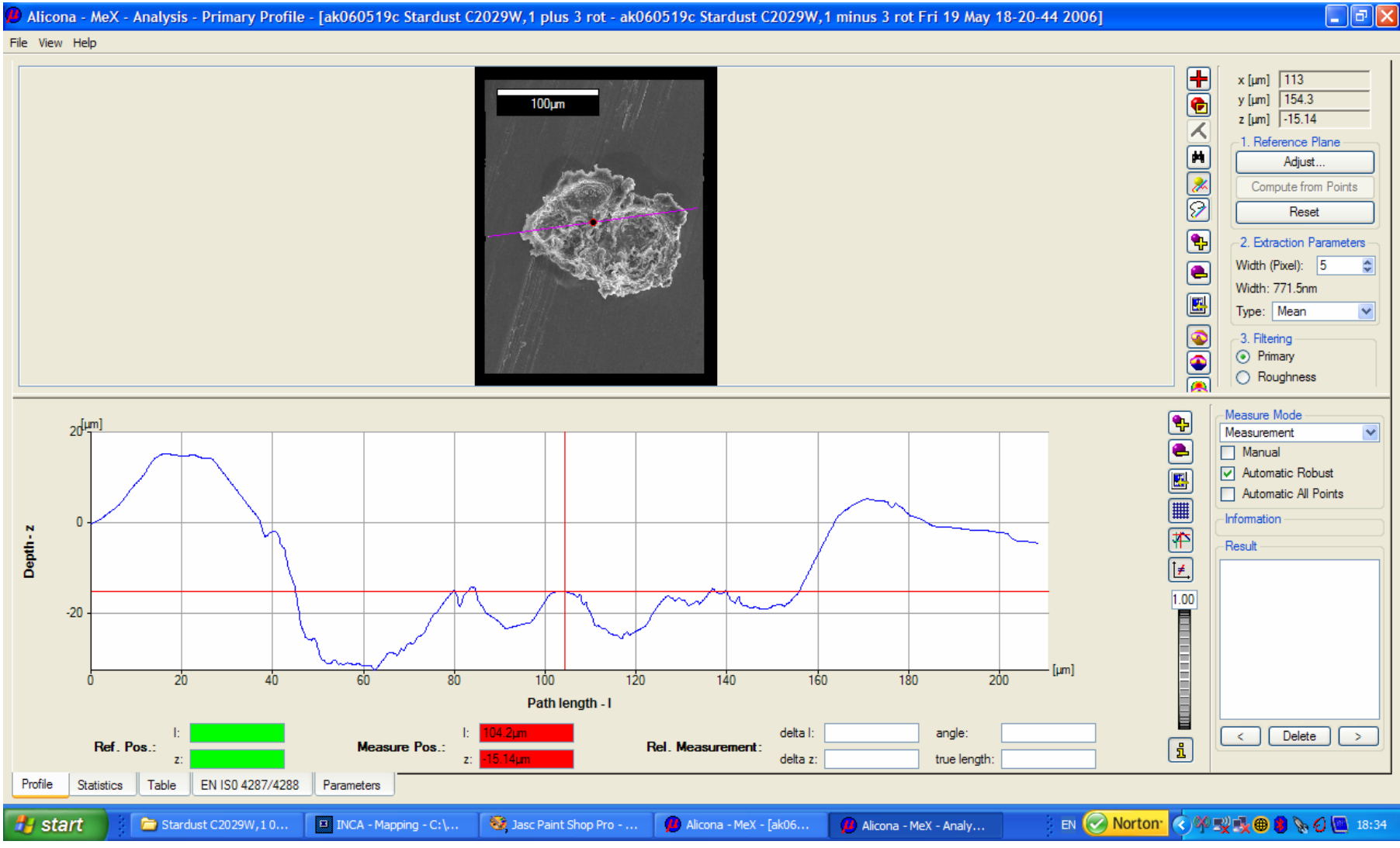
Stardust foil C2029W,1 stereo anaglyph



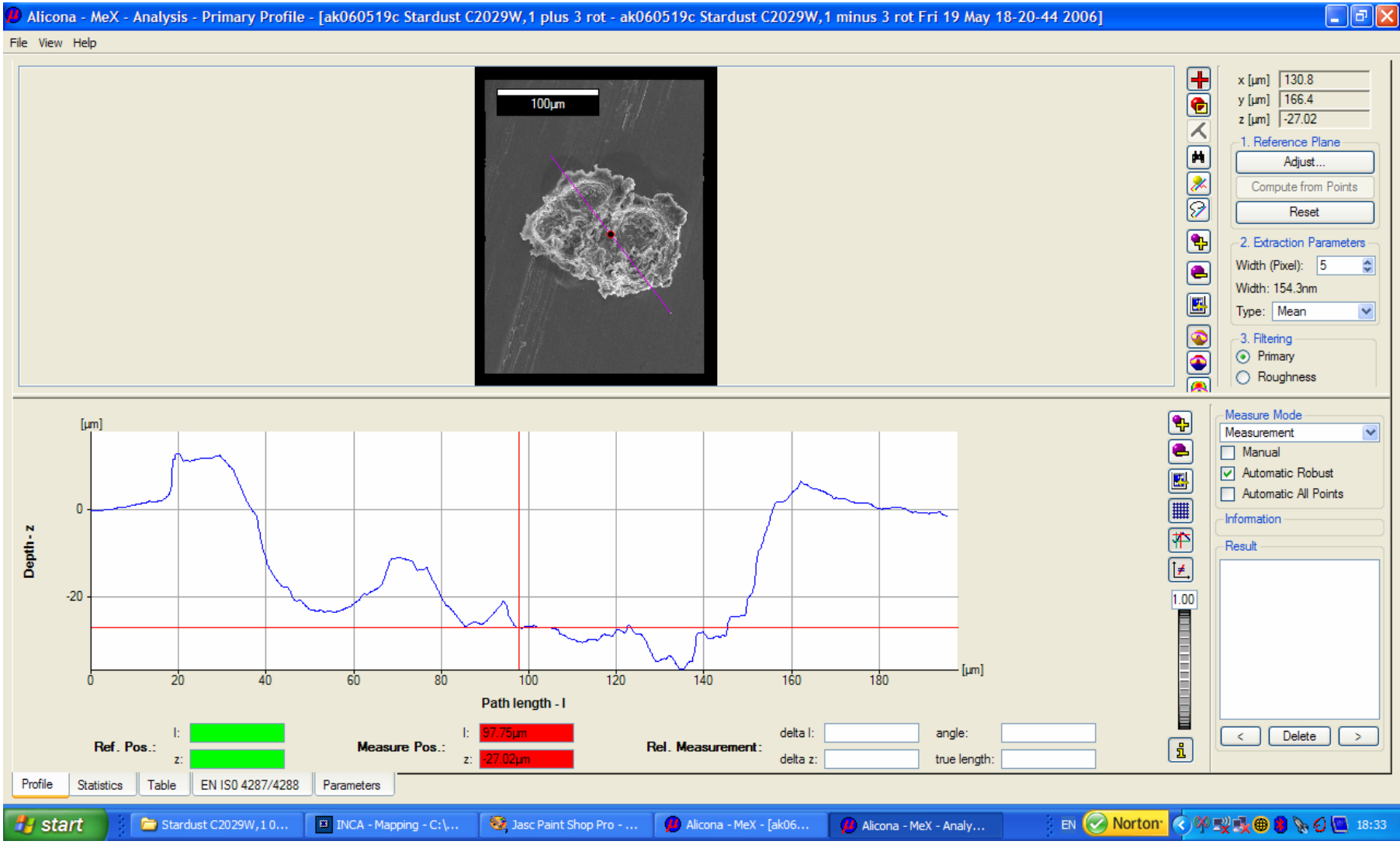
Stardust foil C2029W,1 depth model



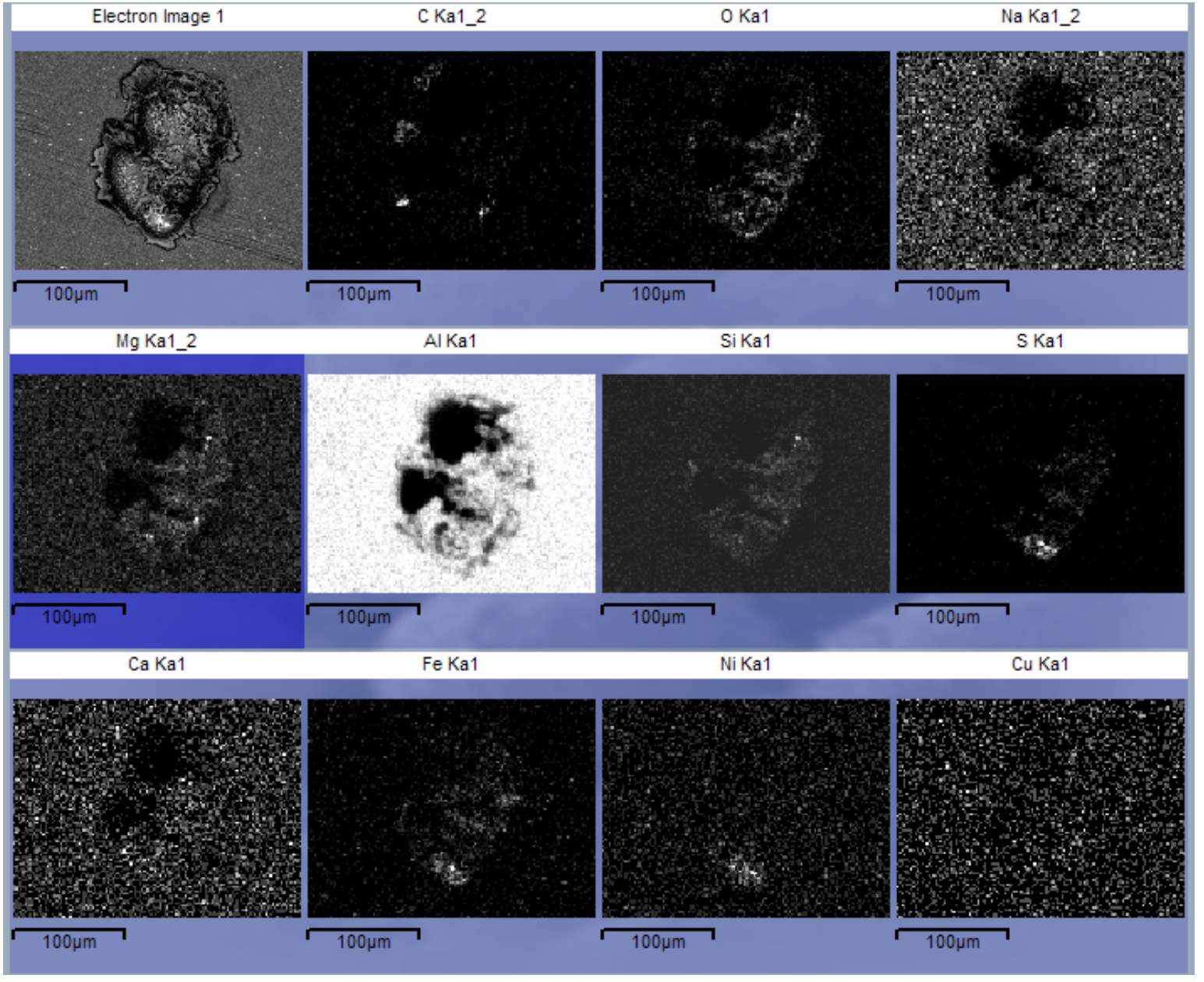
Stardust foil C2029W,1 depth profile 1



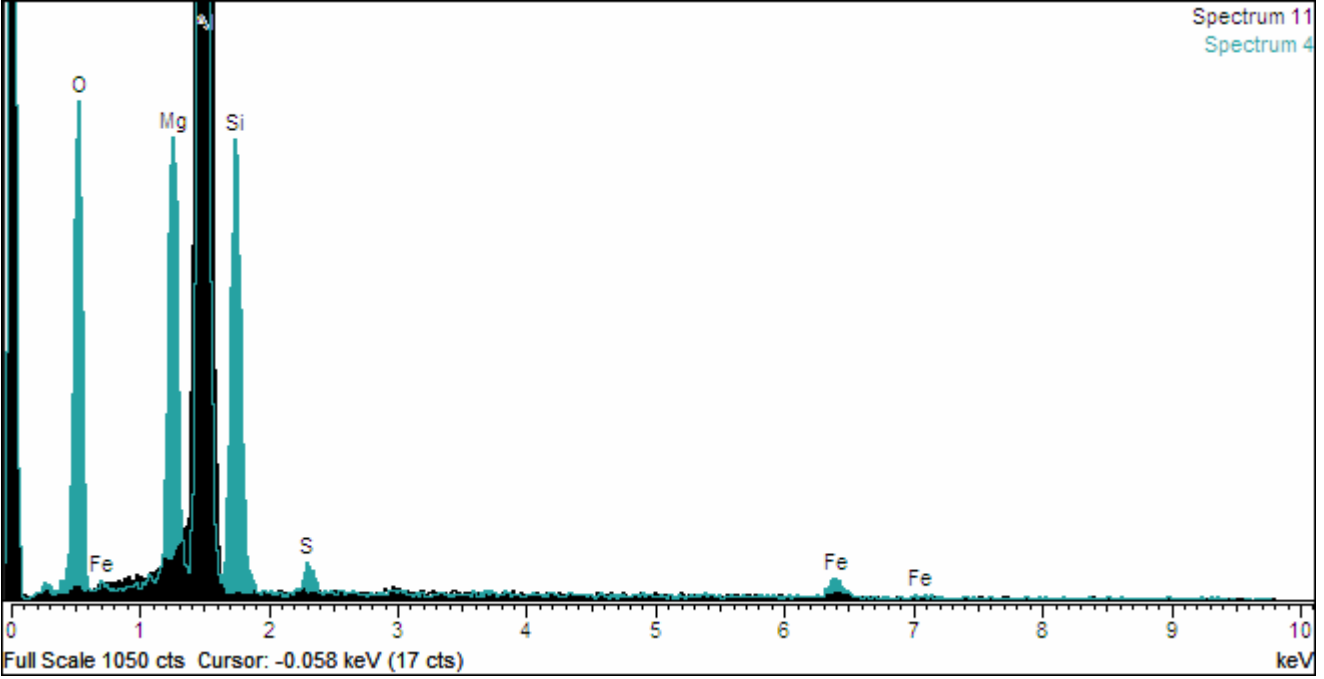
Stardust foil C2029W,1 depth profile 2



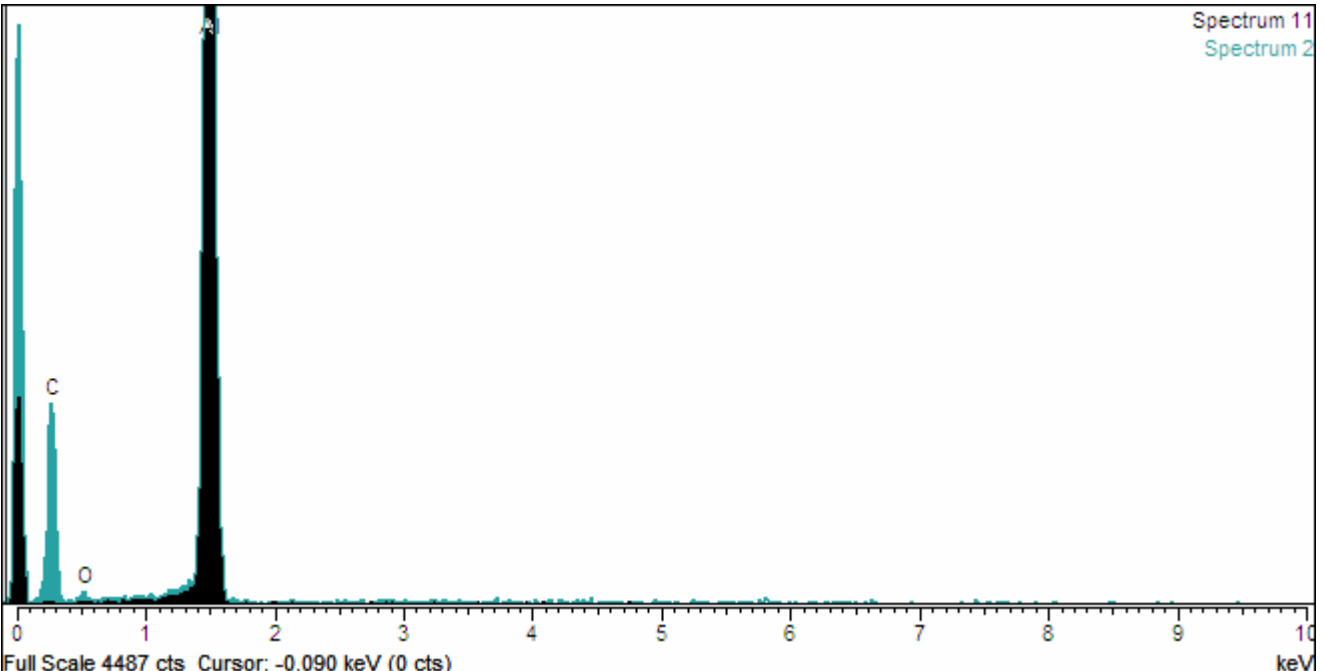
Stardust foil C2029W,1 X-ray maps



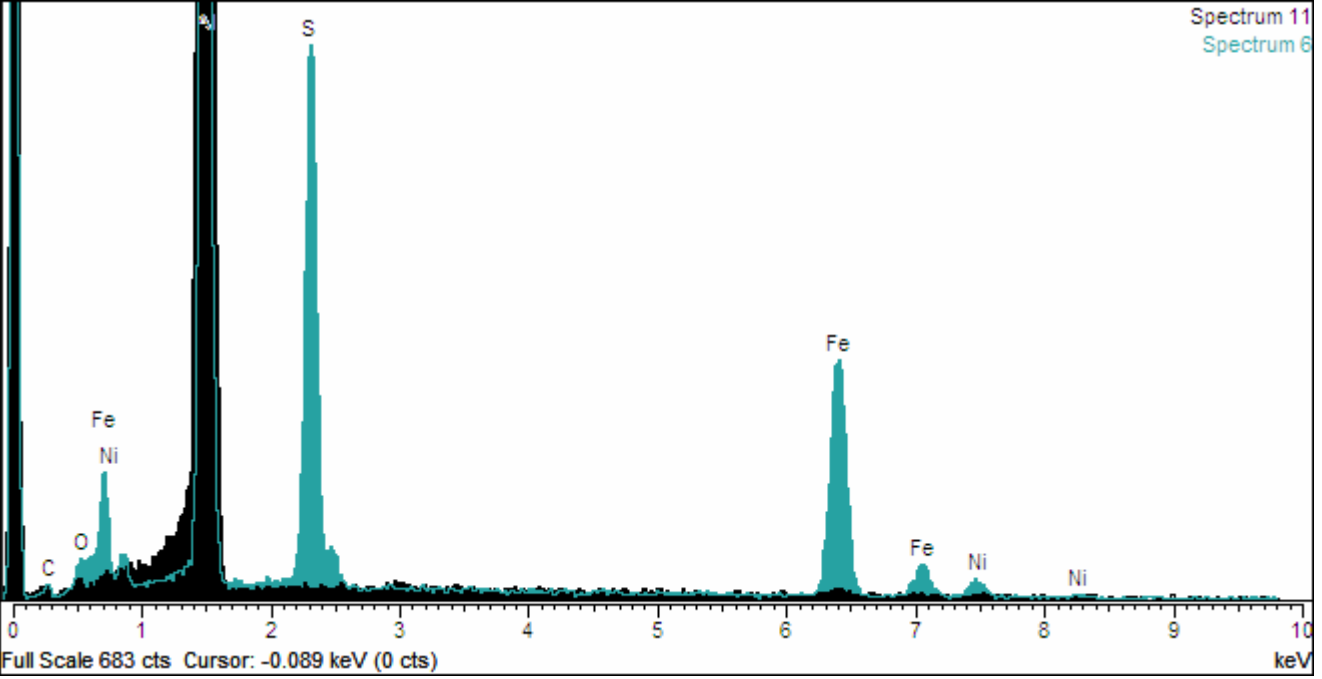
Stardust foil
C2029W,1



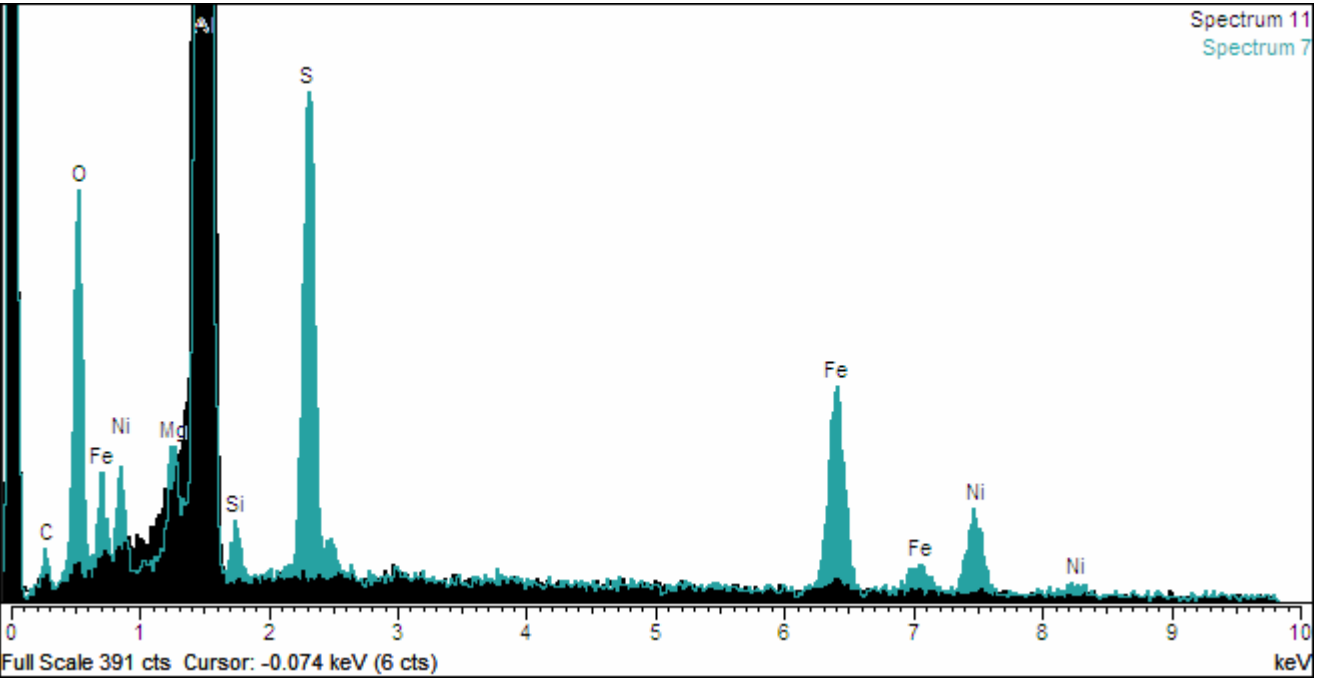
Mg-rich silicate dominates



Carbon rich residue or contaminant?



Stardust foil
C2029W,1



Fe sulfides
with
variable Ni