

WITHOUT SCRATCHING THE SURFACE: DEPTH PROFILING COMPOSITIONAL ANALYSIS OF ANCIENT EGYPTIAN AND SUDANESE FAIENCE

JULIET V SPEDDING, SAYANI BISWAS, ADRIAN HILLIER

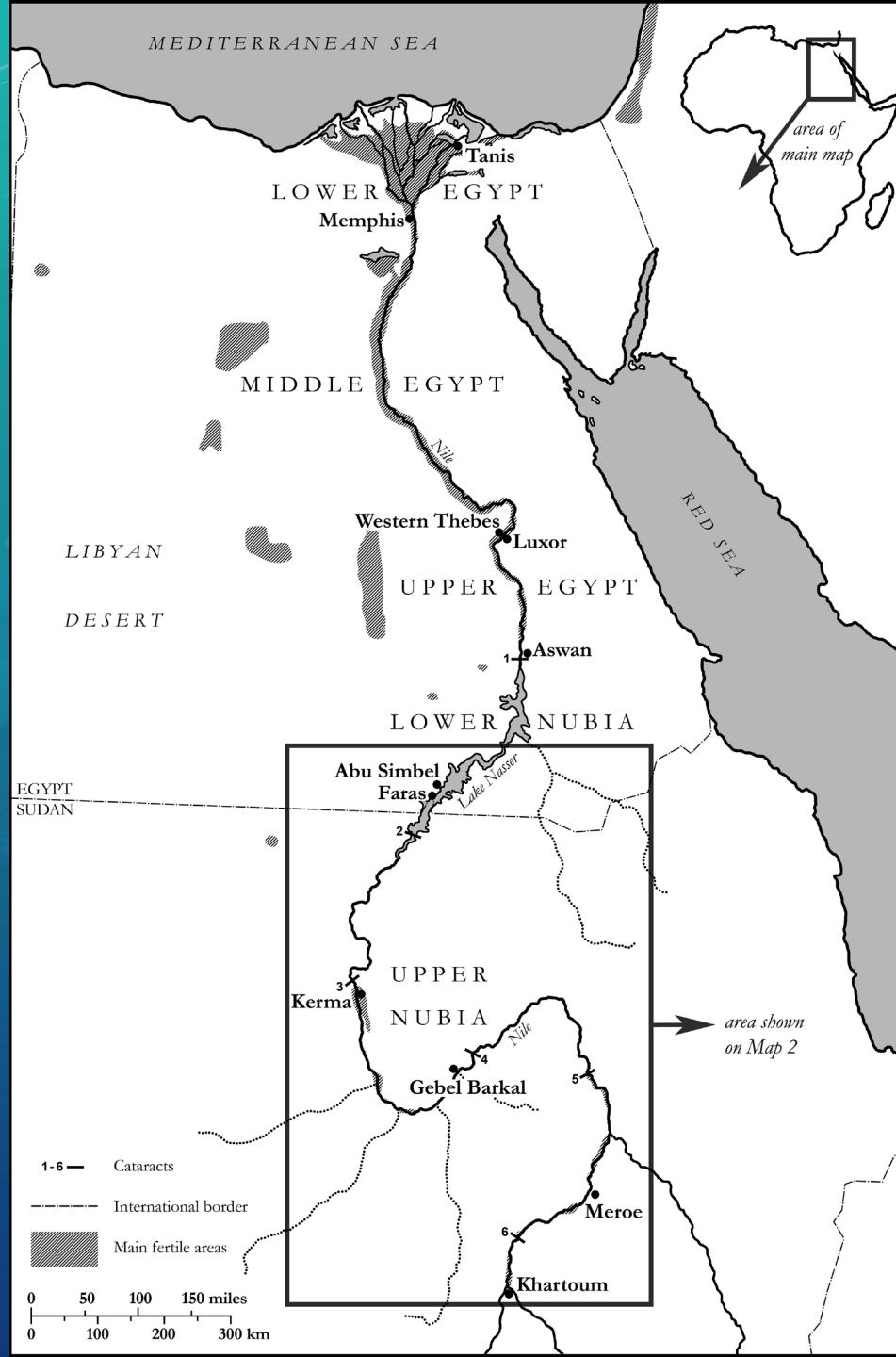
THE 3RD WORKSHOP ON MUON SCIENCE TECHNOLOGY
AND INDUSTRY (MELODY2026)

23RD-26TH OCTOBER 2026

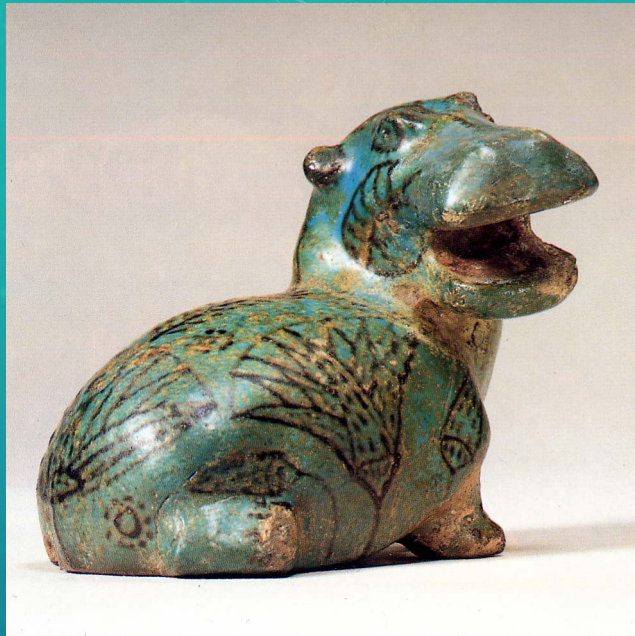
CONTENTS

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- Dataset
- Results
- Initial thoughts

LOWER NUBIAN TIME PERIOD(s)	DATE	UPPER NUBIAN TIME PERIOD(s)	DATE	EGYPTIAN TIME PERIOD(s)	DATE
C-Group Phase Ia	c.2350–2055BCE	Old Kerma	c.2450–2050BCE	First Intermediate Period	c.2160–2055BCE
C-Group Phase Ib-IIa	c.2055–1650BCE	Middle Kerma	c.2050–1750BCE	Middle Kingdom	c.2055–1650BCE
		Classic Kerma	c.1750–1450BCE	Middle Kingdom/Second Intermediate Period/Start of New Kingdom	c.2055–1550BCE
C-GROUP VANISHES	AFTER c.1500BCE	KERMA KINGDOM ENDS	c.1450BCE	NEW KINGDOM	c.1550–1069BCE
Napatan Period	c.747–350BCE	Napatan Period	c.747–350BCE	Third Intermediate Period (including Nubian 25 th Dynasty	c.1069–664BCE
				Late Period	c.664-332BCE
Meroitic Period	c.350BCE–350CE	Meroitic Period	c.350BCE–350CE	Late Period	c.664–332BCE
				Ptolemaic Period	332–30BCE
				Roman Period	30BCE–394CE

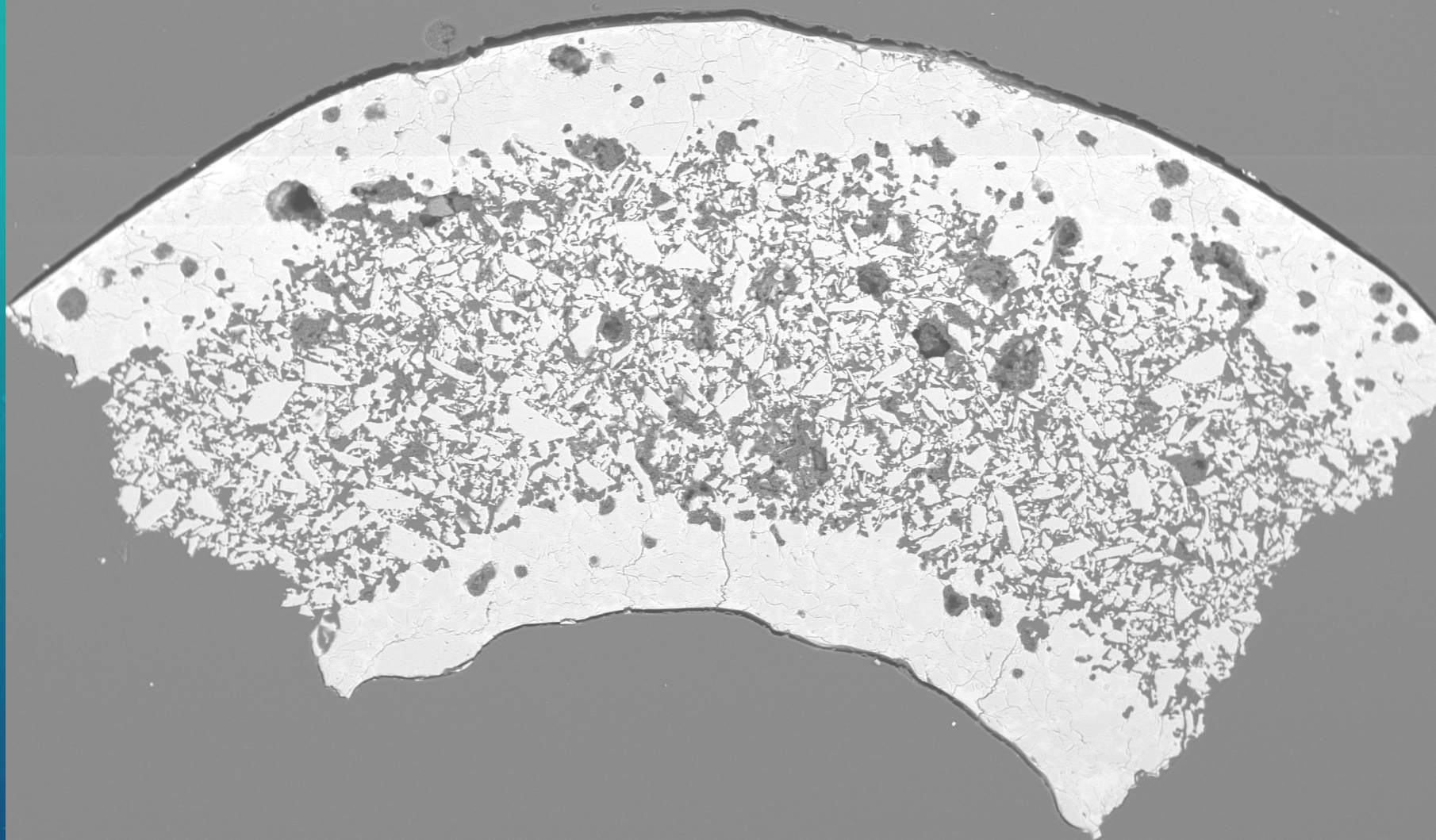


WHAT IS FAIENCE?









BED-S 20.0kV WD10.0mm Std.-P.C.50.0 HighVac. x50

MAN8439(a).1

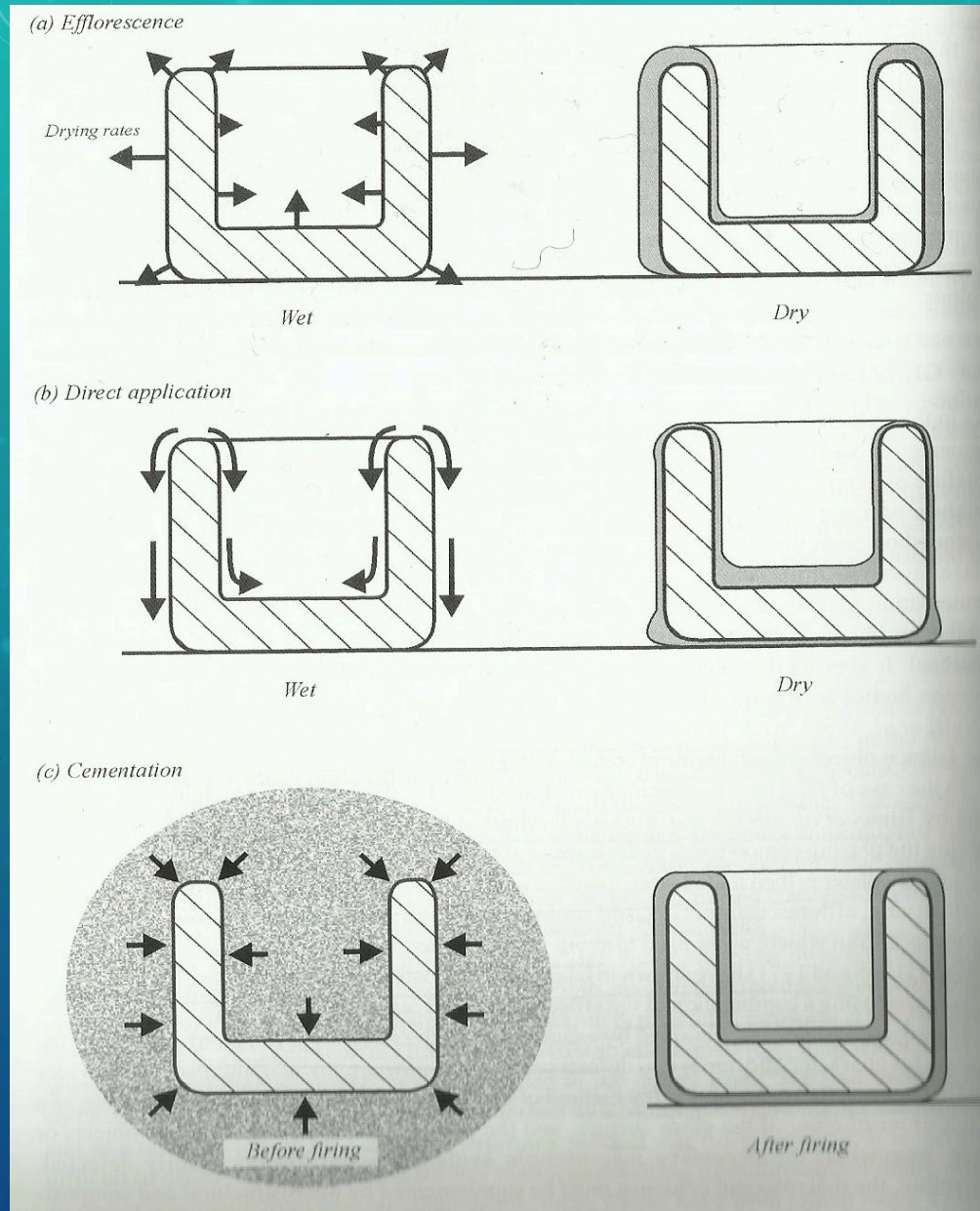
1190

500um

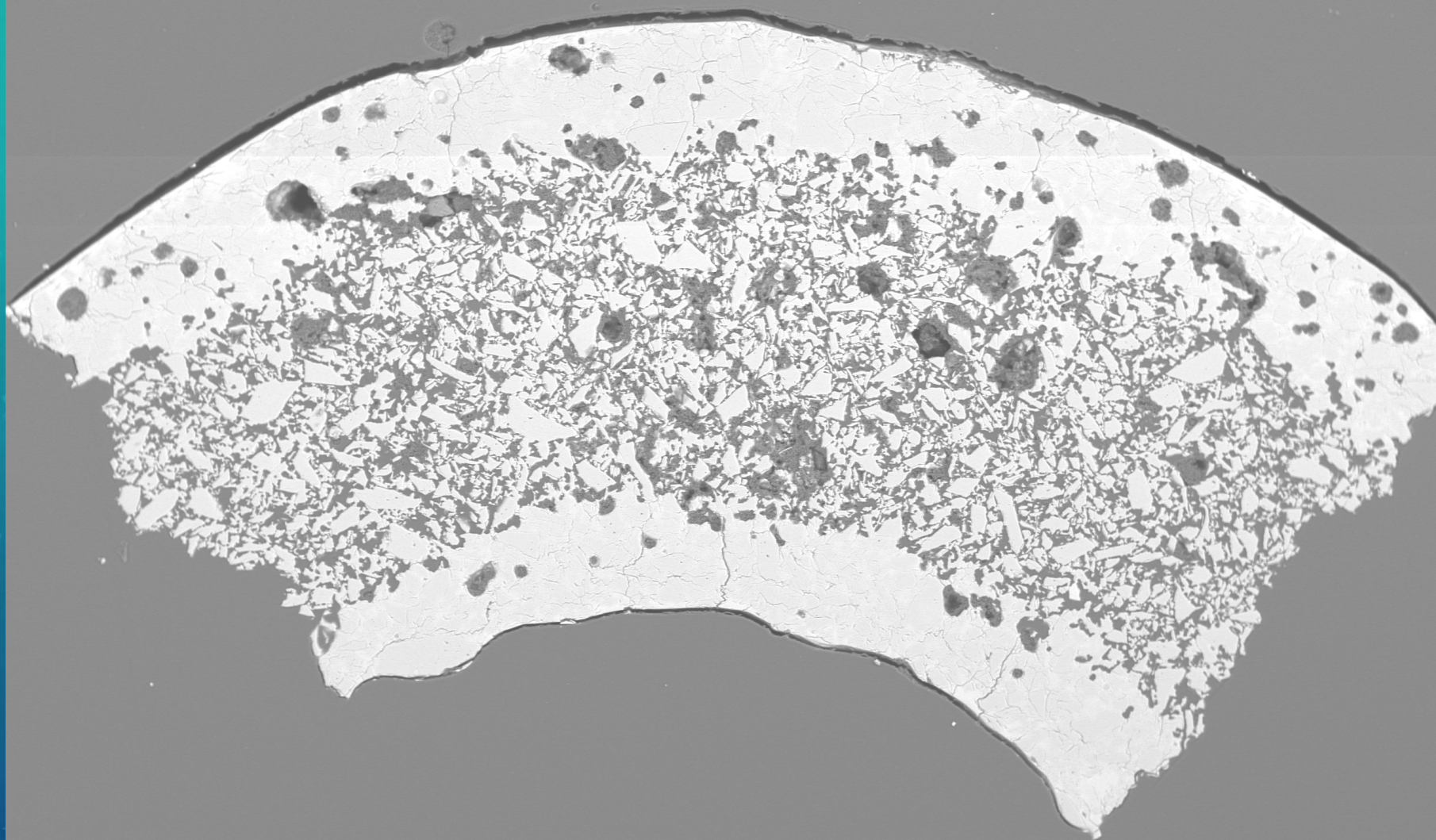
2024 07 30

WHAT IS FAIENCE MADE OF?

- Vitreous
- Silica
- Soda
- Lime
- Colourant



Schematic diagram illustrating the three methods used for glazing faience. (Fig 3.1 from Tite and Shortland, 2008, 48)



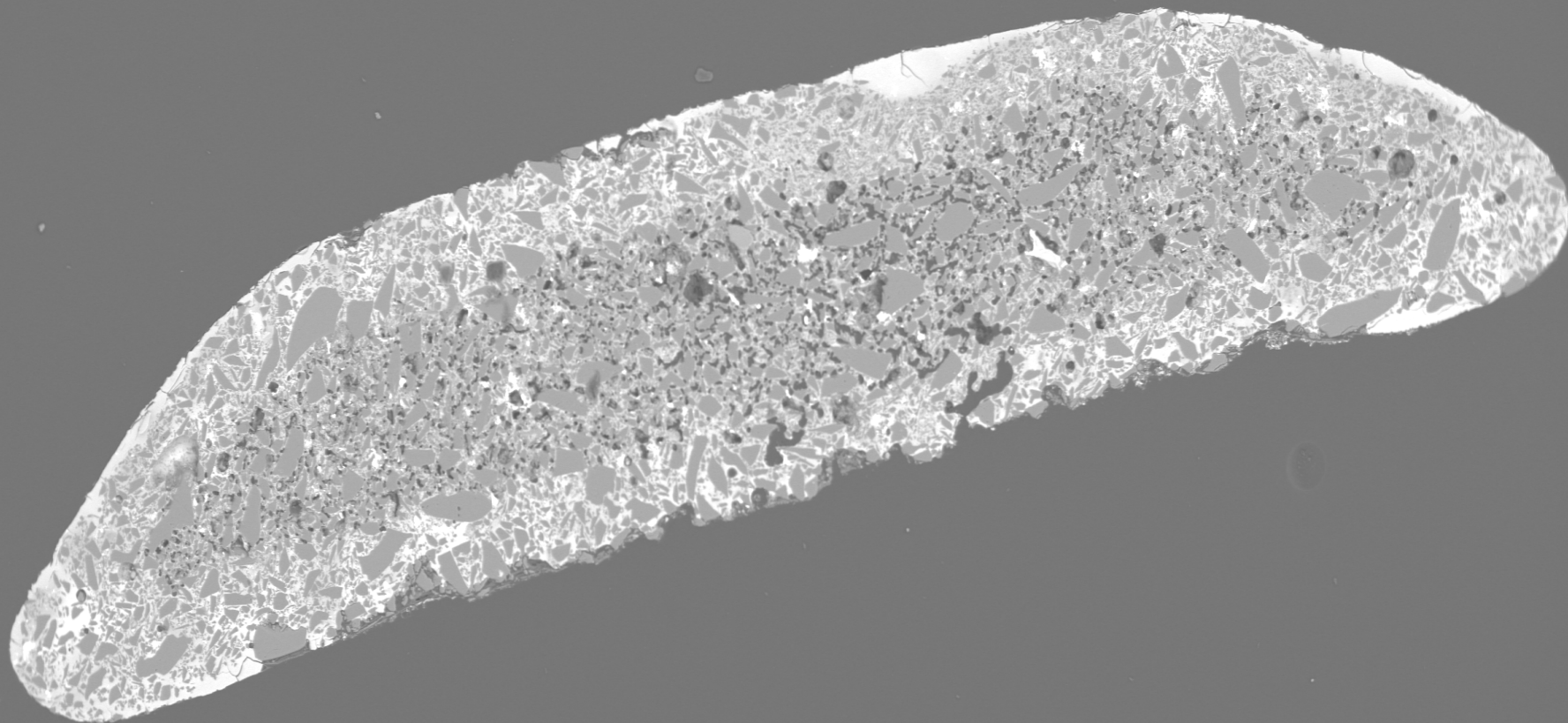
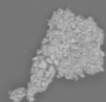
BED-S 20.0kV WD10.0mm Std.-P.C.50.0 HighVac. x50

MAN8439(a).1

1190

500um

2024 07 30



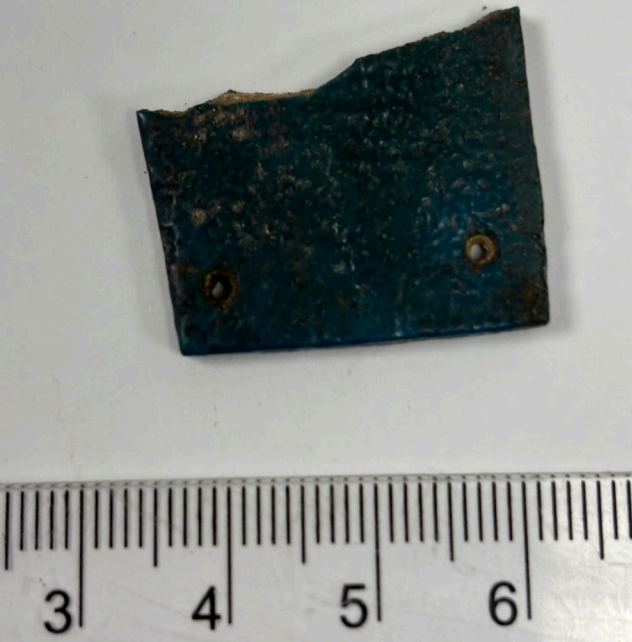
BED-S 20.0kV WD10.8mm Std.-P.C.50.0 HighVac. x40

MAN6513.1

500um

1204

2024 07 31



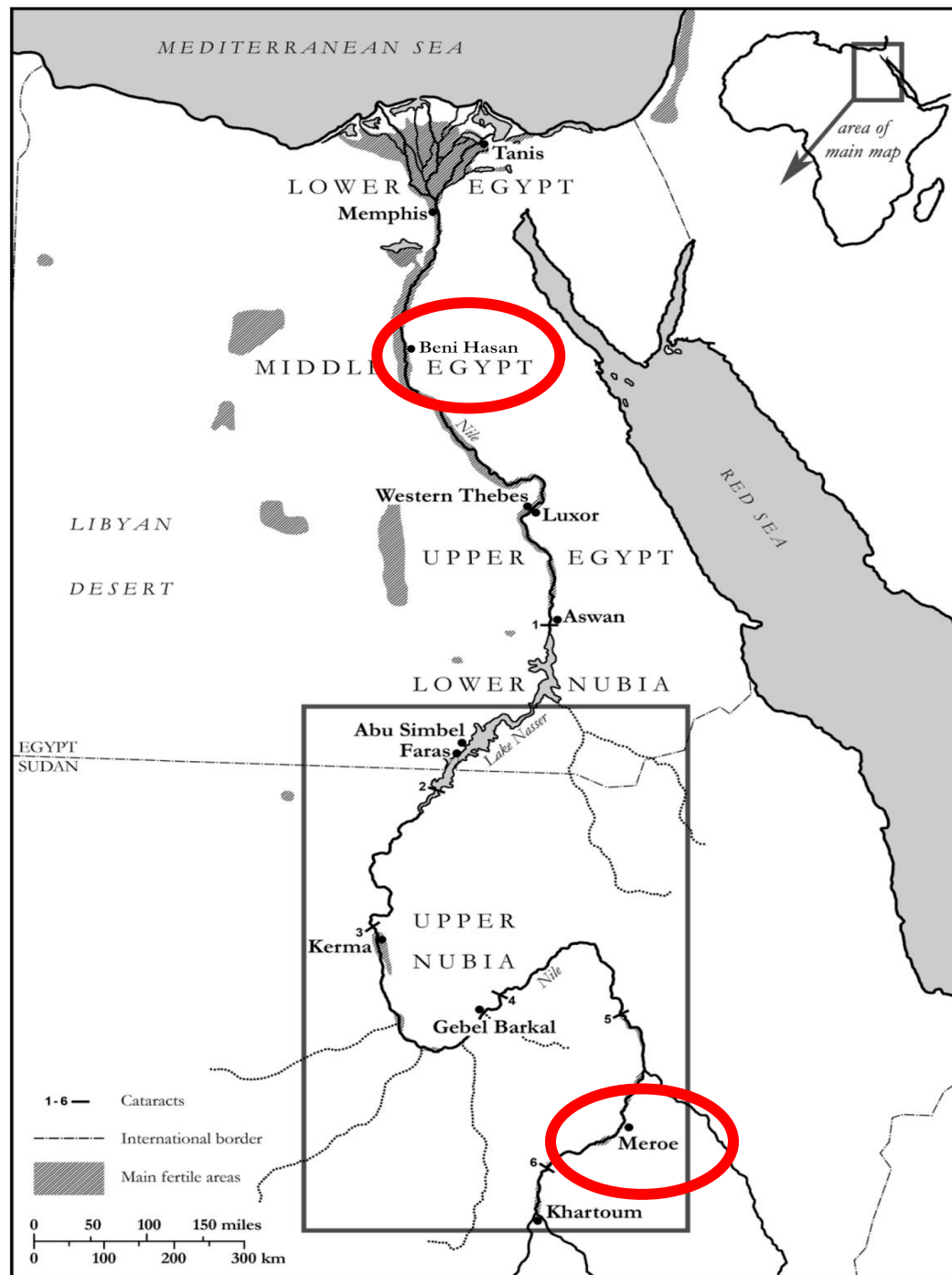
E.164, Tile?



E.8070, Bead



E.8510,
Sistrum
handle



RESULTS

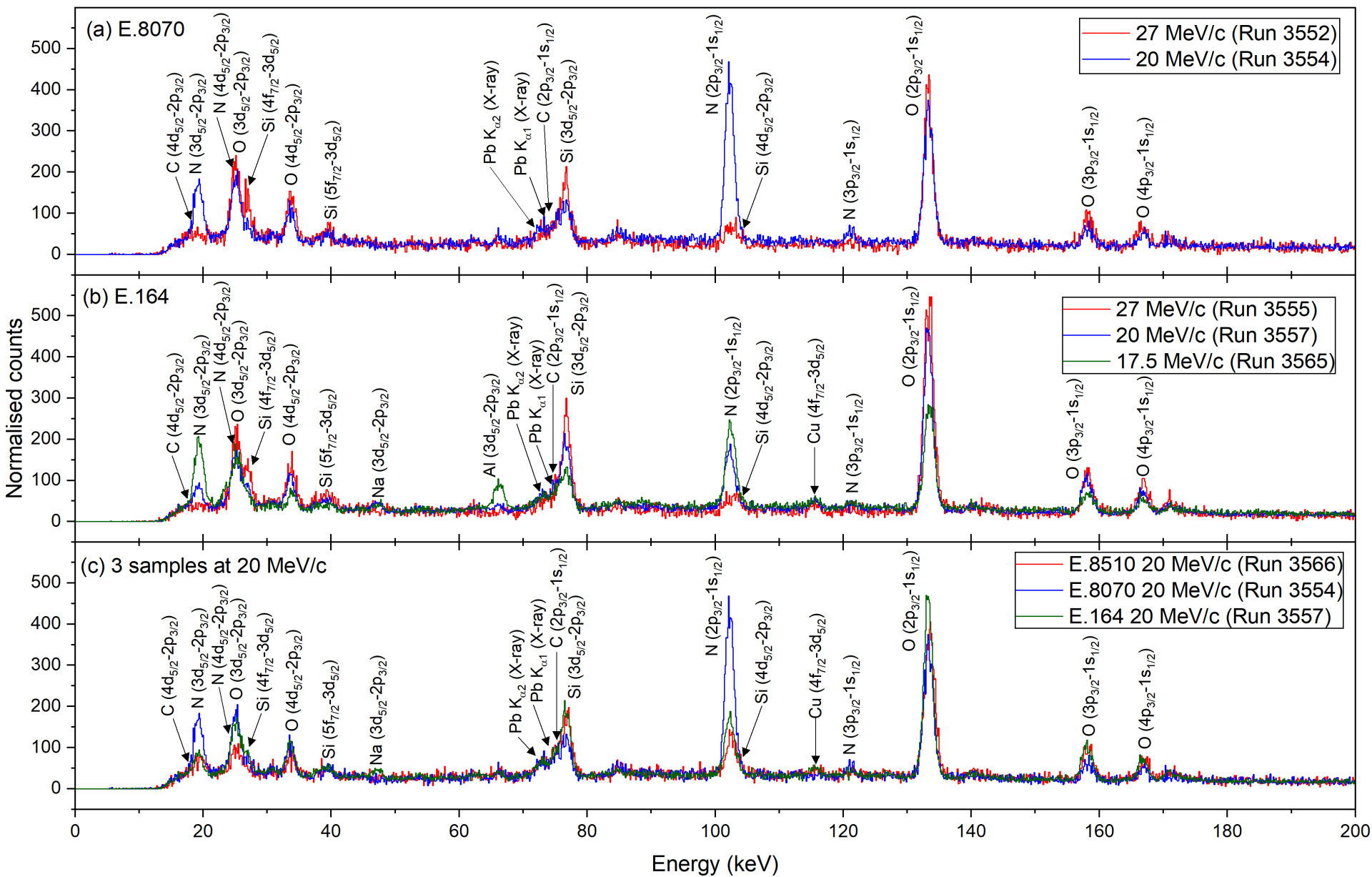


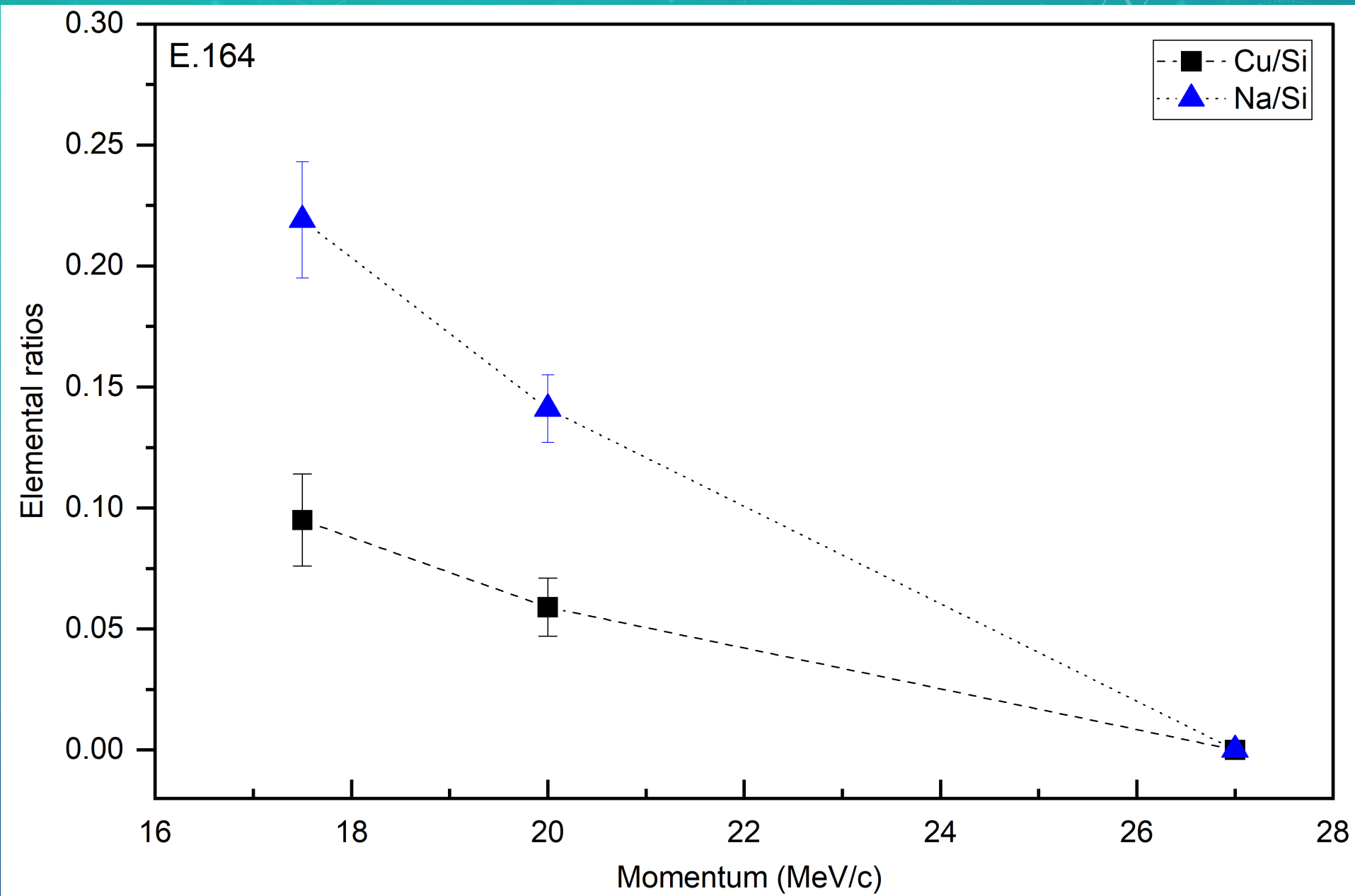
The background features a gradient from teal at the top to dark blue at the bottom, with a field of white dots of varying sizes. Faint white circular patterns are visible: a small circle in the top left, a large circular scale with degree markings (0 to 210) in the top right, a circular arrow pattern in the bottom right, and a partial circular arrow pattern in the bottom left.

FIRST ANALYSIS



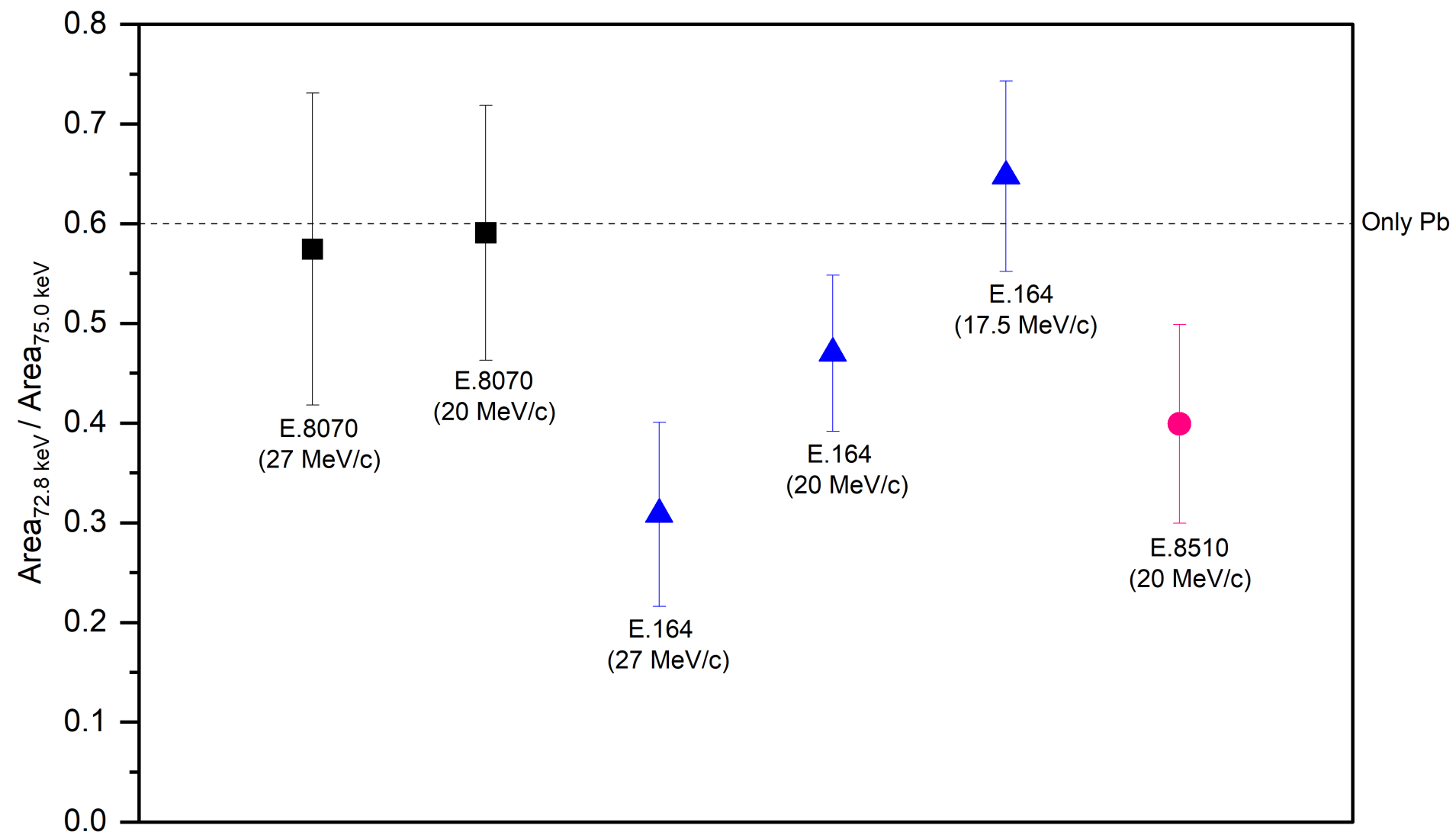
SAMPLE No.	RUN No.	MOMENTUM (MeV/c)	TOTAL RUN TIME (HOURS)
E.8070	3552	27.00	2
	3554	20.00	6
E.164	3555	27.00	2
	3557	20.00	6
	3565	17.50	12
E.8510	3566	20.00	4





TO SUMMARISE

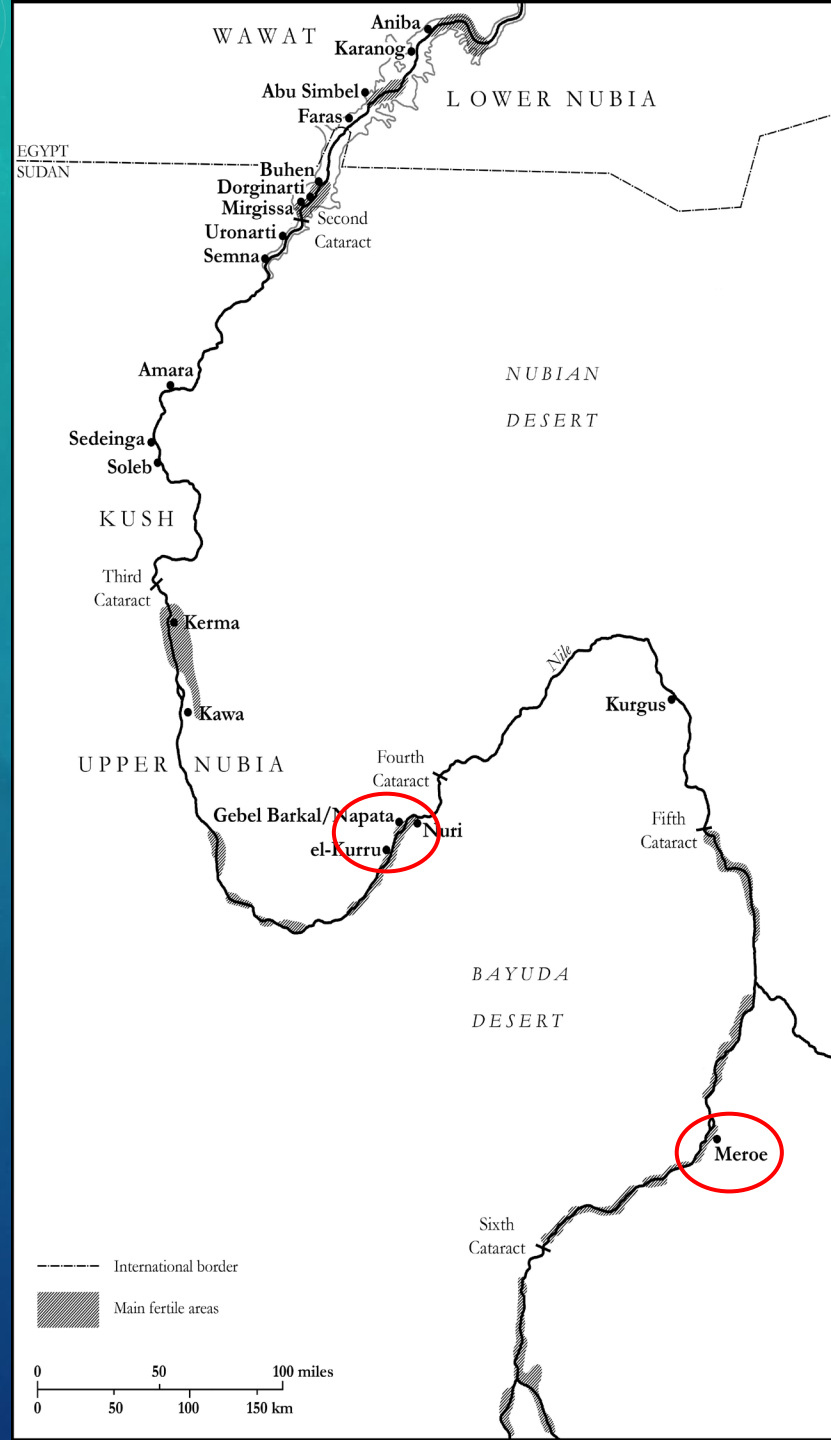
- E.164 – efflorescence glazing (seen with both SEM-EDS and muons)
- Nitrogen in all samples and not just at the surface which could be due to the nitrogen in the air.
- Carbon present in two of the samples but not the two from the same site.



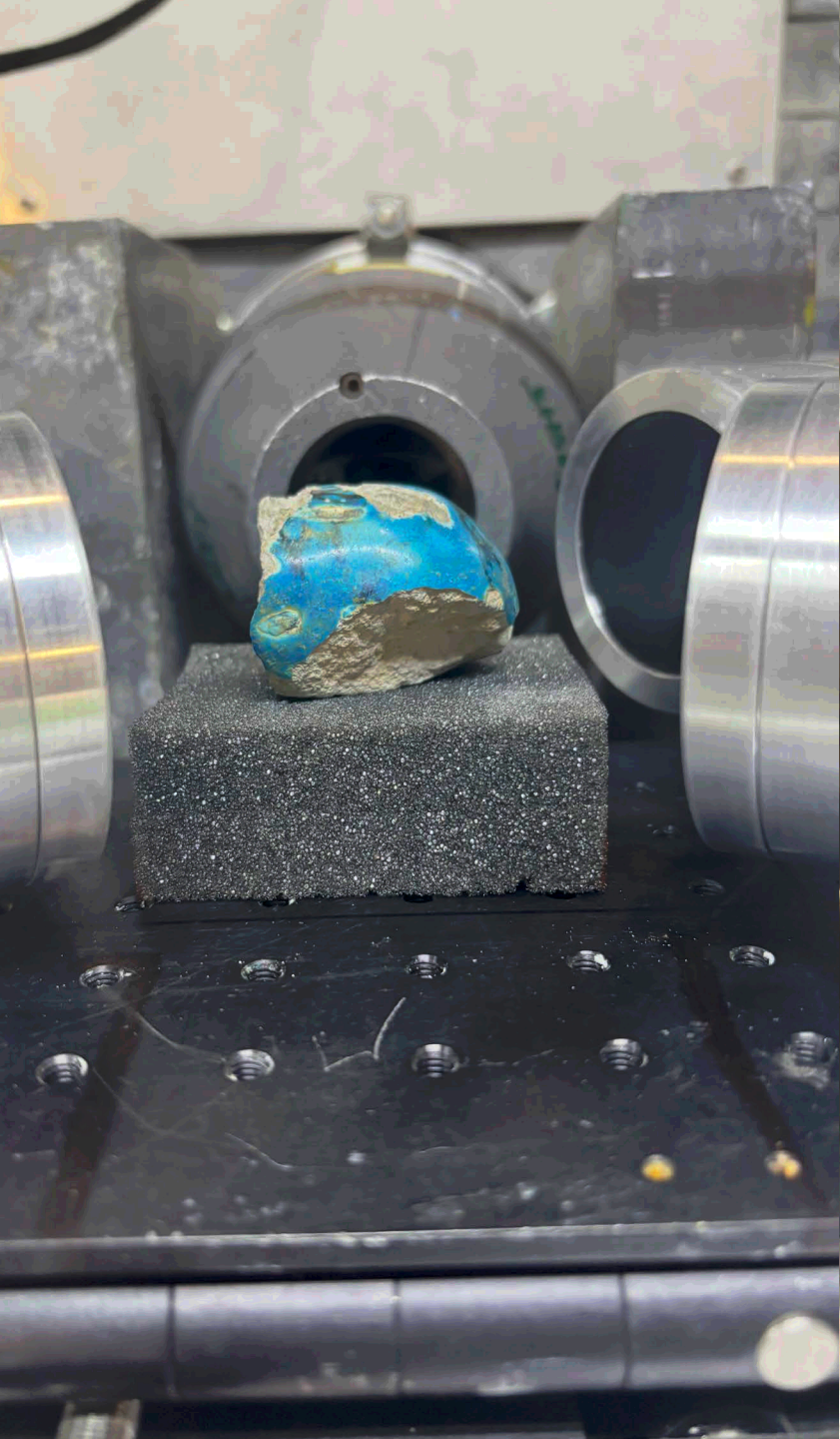
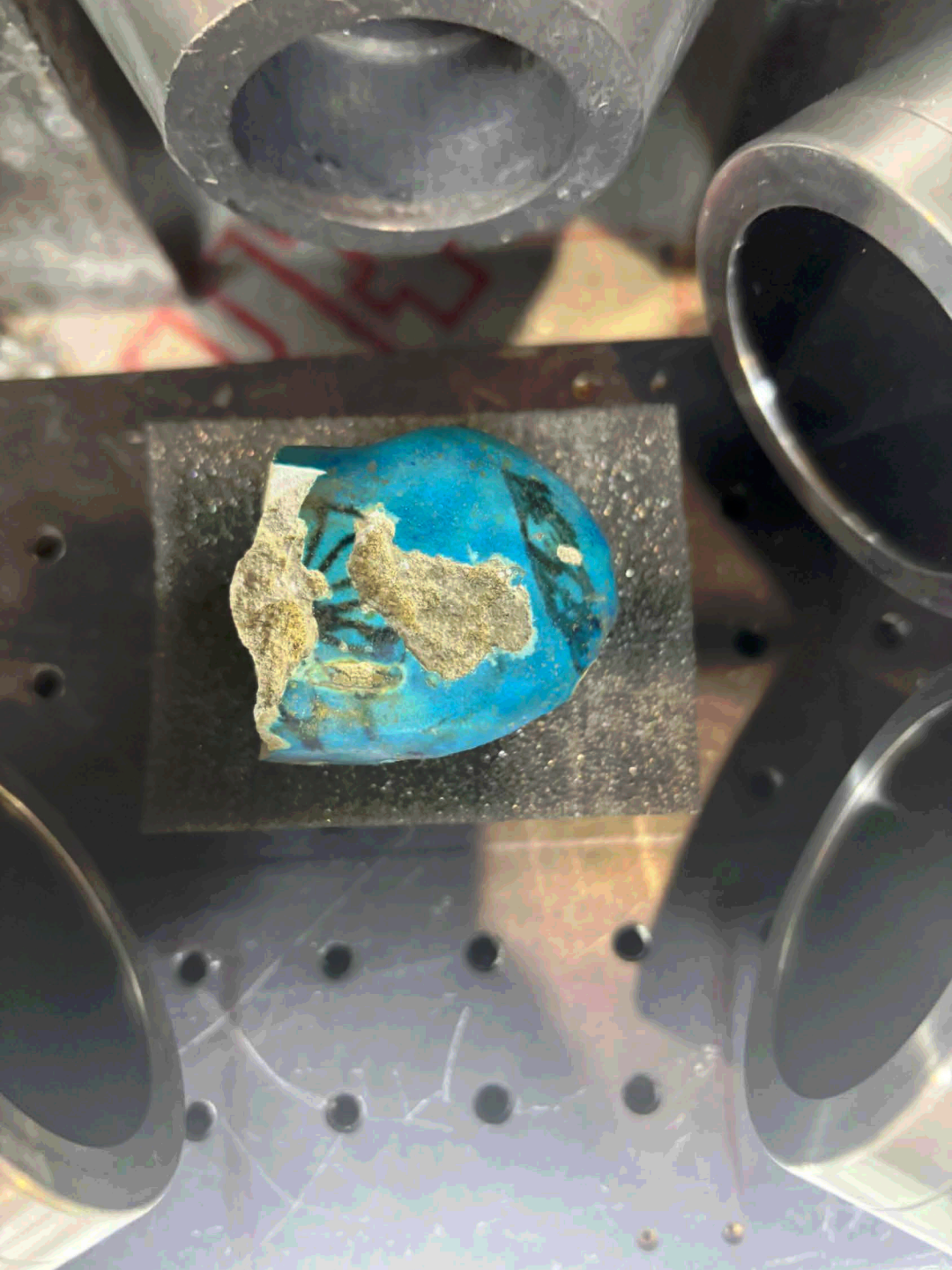
WHAT COULD THE CARBON AND NITROGEN MEAN?

- These are things we don't really look for – carbon coating.
- A binding agent – gum Arabic?
- Charcoal?
- From a mineral alkali?
- All of the above?

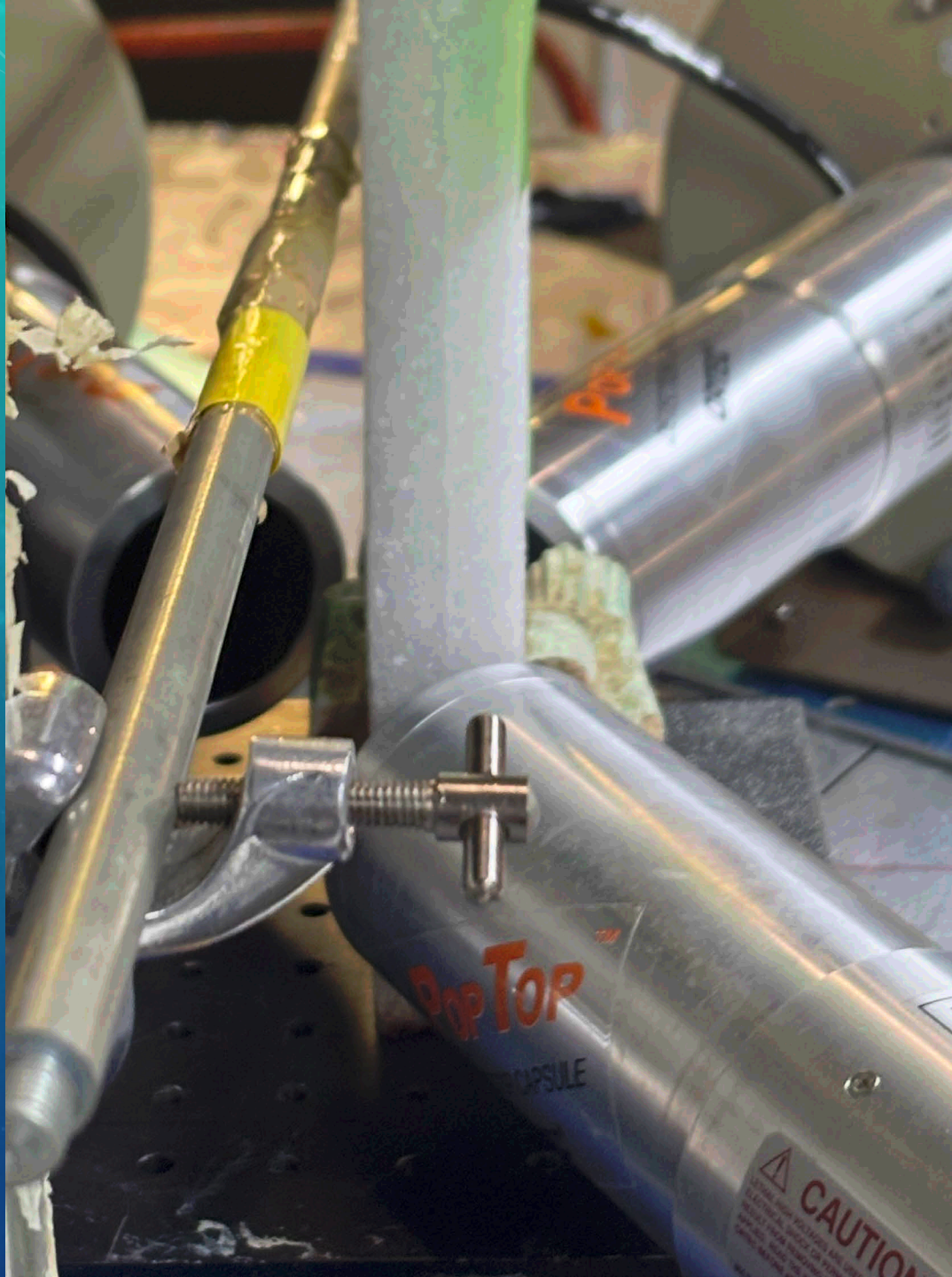
SECOND AND THIRD ANALYSES

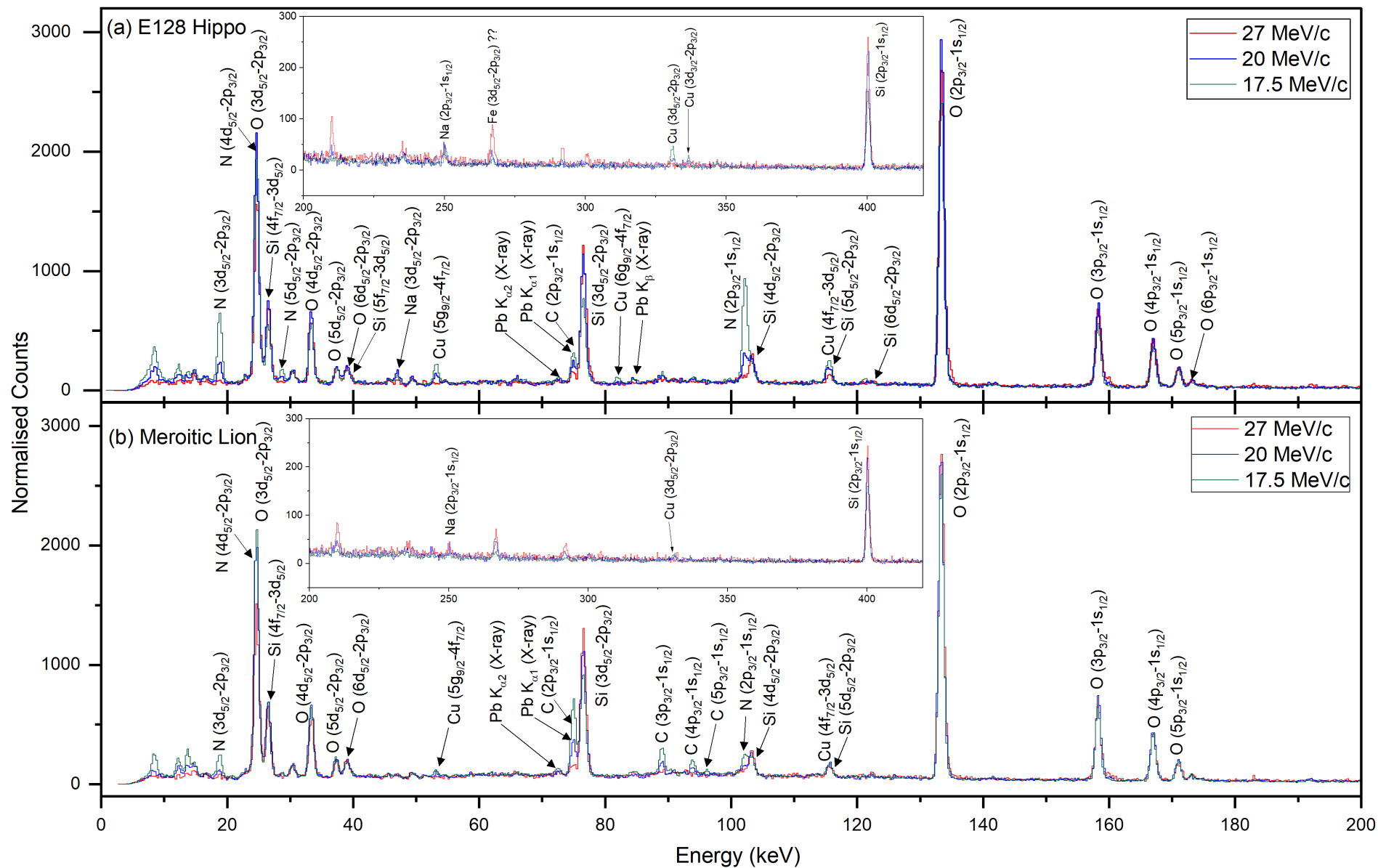


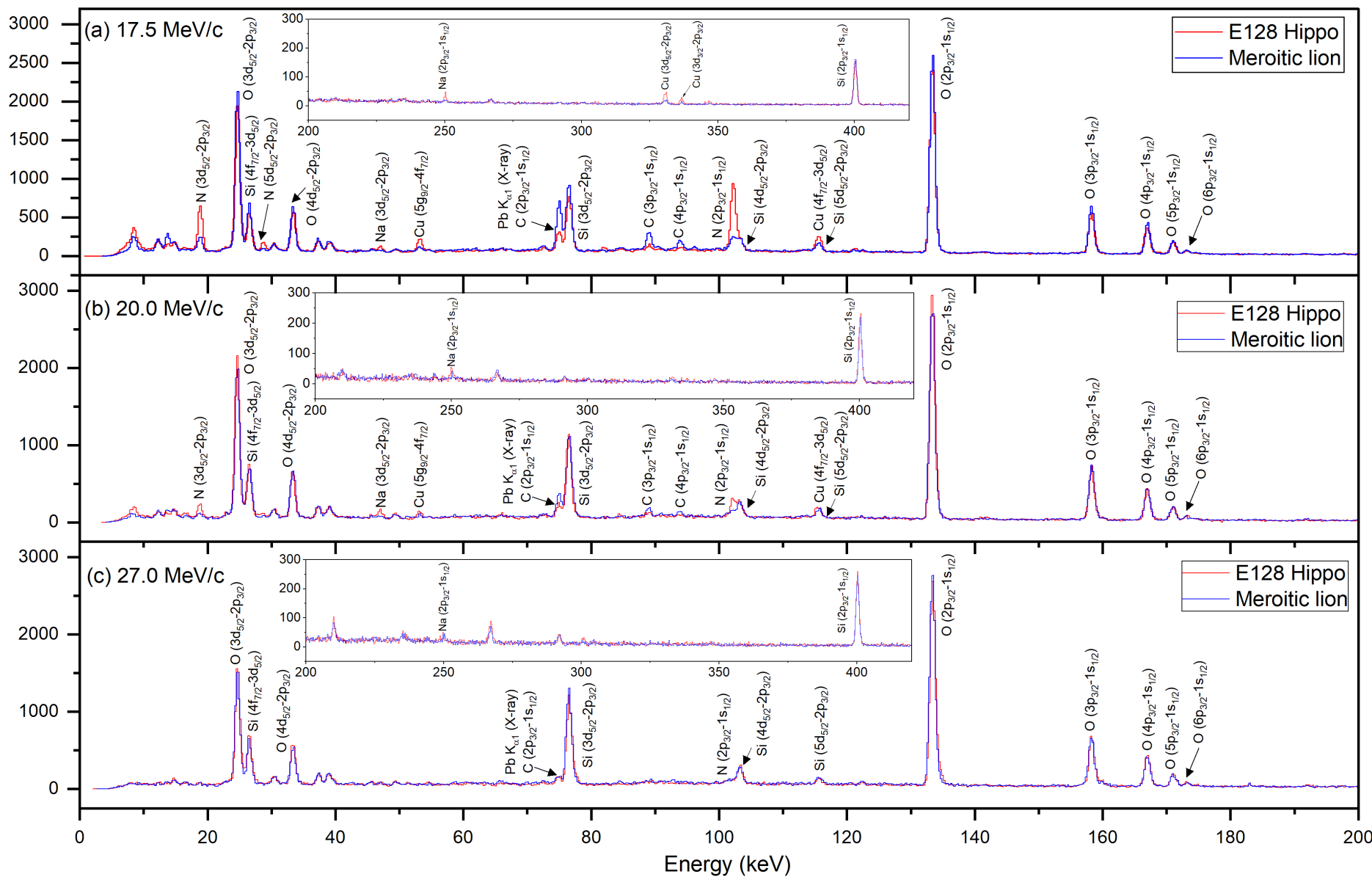


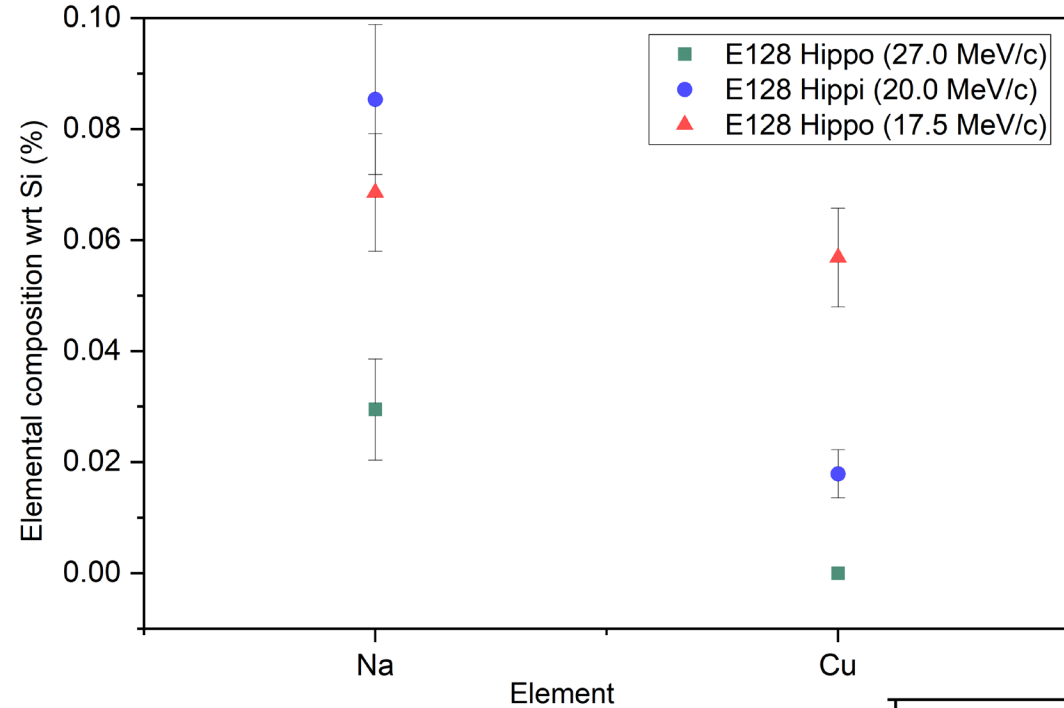
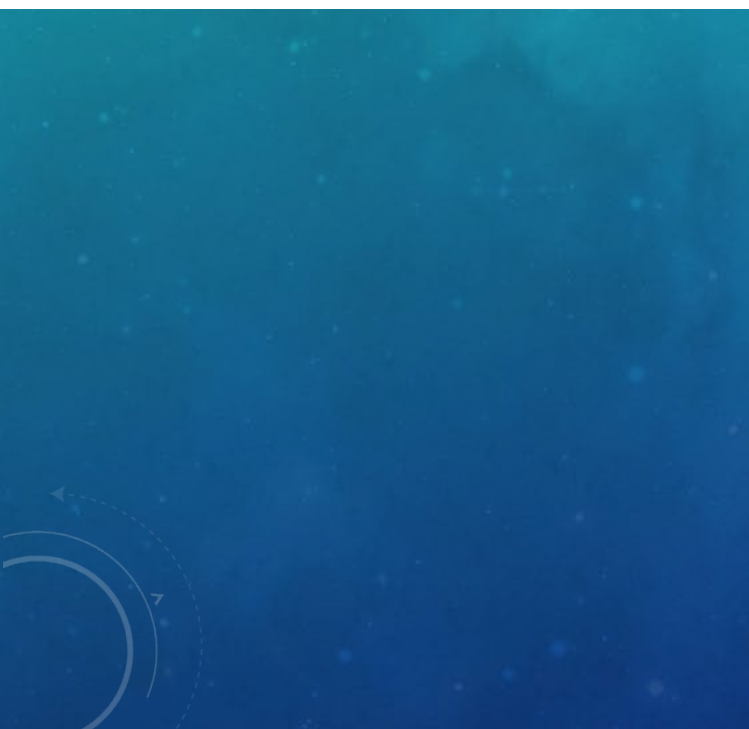
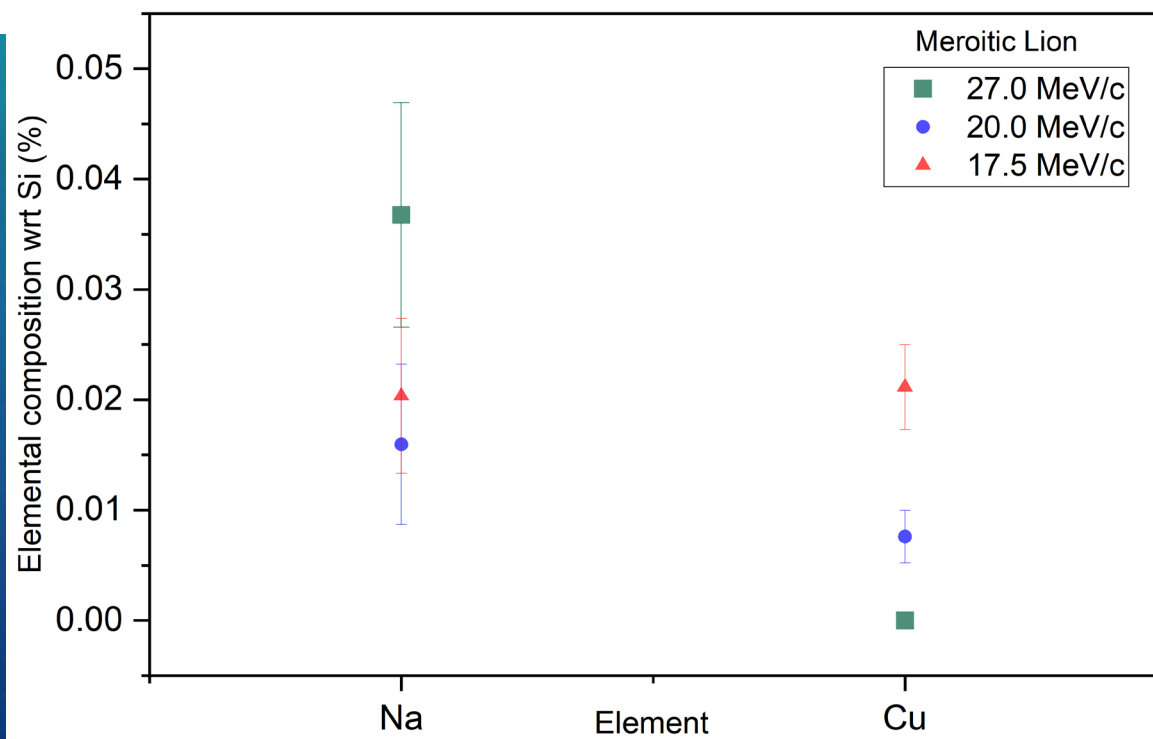














Exterior



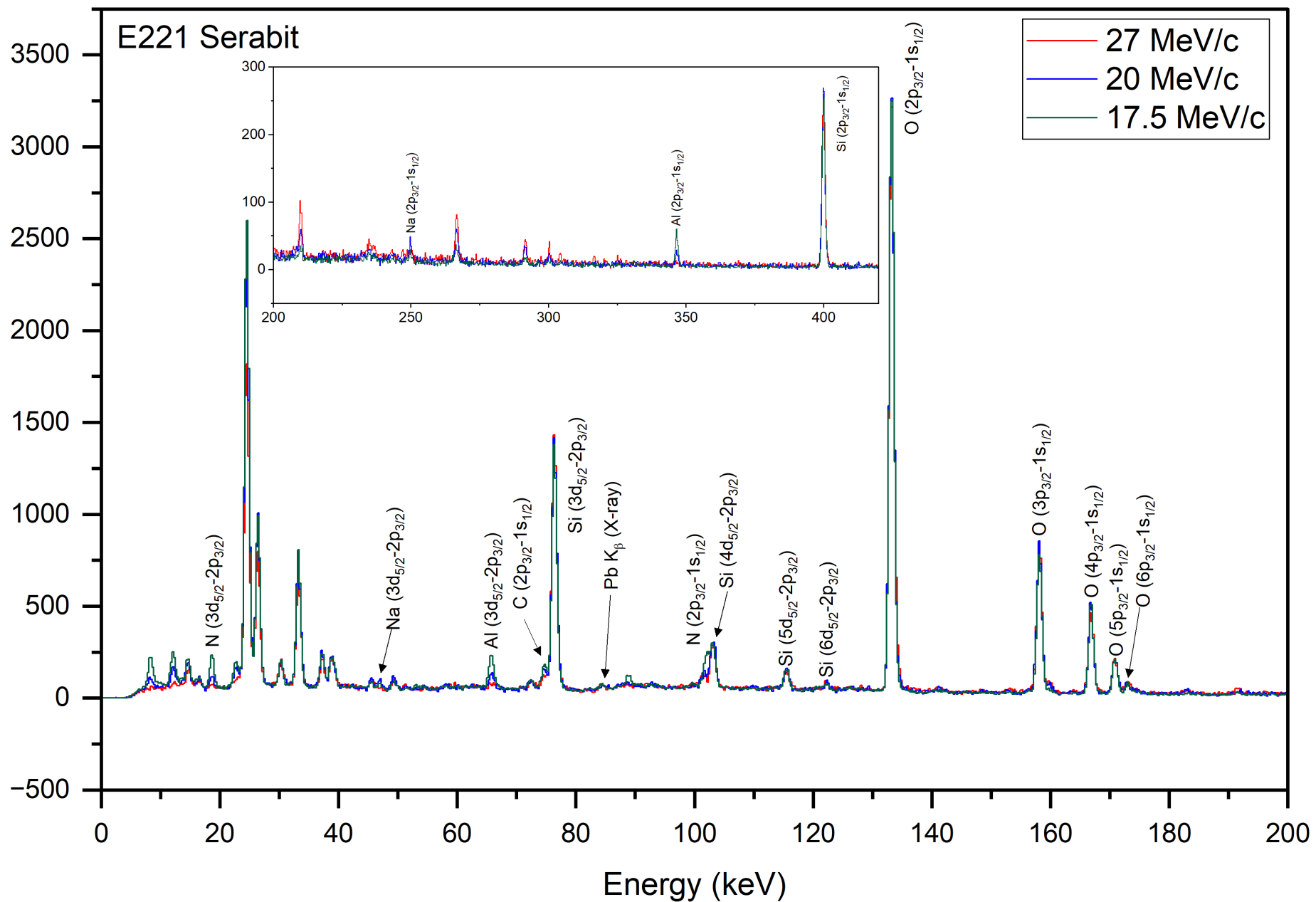
Interior

E.221 Faience from Serabit el Khadim



Serabit el Khadim

Amarna





E.214 New Kingdom



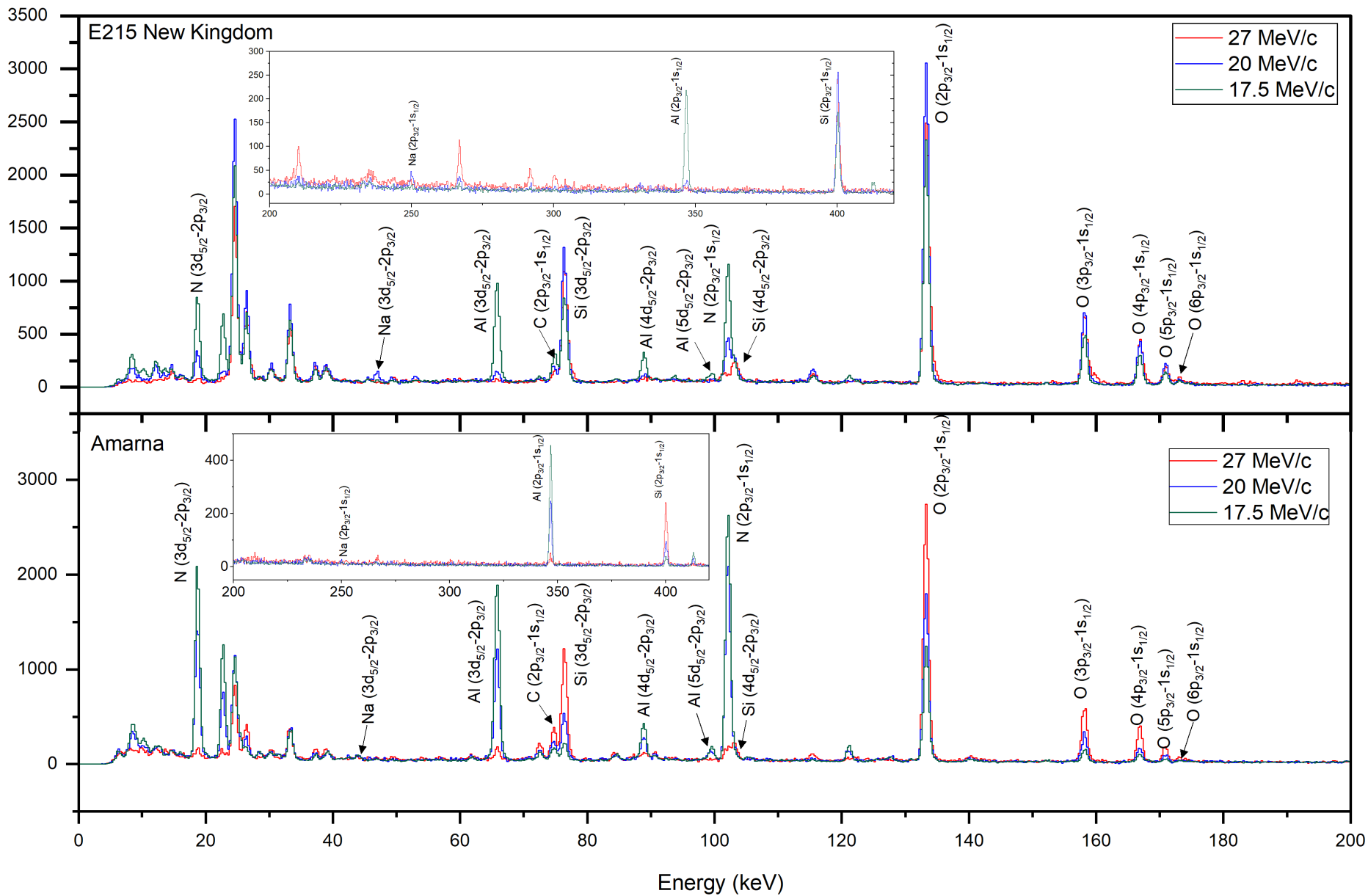
Yellow faience from the site of
Amarna also New Kingdom in
date



Serabit el Khadim

Amarna





INITIAL THOUGHTS

- The second and third analyses were quantitative.
- Continues to show the value of this technique for examining faience without having to destructively sample to identify glazing technique.
- Variations in values for the Cu between objects as well as the Na = different traditions, raw materials?
- Quality of raw materials used relates to finished product/use of finished product?

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- Sayani Biswas



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