LONDON'S GLOBAL UNIVERSITY

London, 18th April 2015

Analysis SEM-EDS of the pendant MV13 from Mirasiviene, Seville.

Description

Length: 2.5 cm; Width (max): 1.7cm.

Copper alloy fitting that may be part of a broken pendant. The fitting has two protruding (broken) ends and a hole passing through the flattened section. The hole becomes wider at the back (Fig. 1). There are slight indentations on the front that form a pattern of a circle divided into four quarters.

According to the conservation report, remains on the surface suggest that the object may have had a thin coating of silver.

SEM-EDS superficial analyses were conducted in order to confirm this possible silver coating.

Fig. 1. Front and back of the MV13 pendant.

University College London, Gower Street, London WC1E 6BT
Tel: +44 (0)20 7679 2000
email@ucl.ac.uk
www.ucl.ac.uk

Methodology

The pendant was analysed by scanning electron microscopy with energy-dispersive spectrometry (SEM-EDS), which were performed with a Philips XL30 with an Oxford Instruments x-sight EDS at the UCL Institute of Archaeology's Wolfson Archaeological Science Laboratories. The SEM-EDS system used an accelerating voltage of 20 kV, a working distance of 10 mm, a spot size of 5.3, and a process time of 5, corresponding to a dead time of c. 30 %; acquisition time was 100 s. The certified arsenic copper standard BCR 691-C from the European Commission was used to monitor the reliability of the analyses. Data was processed by INCA spectrometer software, outputting data as elements for metal phases, although results show compounds of superficial corrosion and soil remains. No sample was taken for analytical purposes, the pendant was placed in the SEM chamber and analysed on surface. Superficial analyses will not reflect the bulk composition of the pendant and must be taken as qualitative, but will allow us to confirm the presence of silver coating.

Results

Area analyses were conducted on the front of the pendant (Fig. 2).

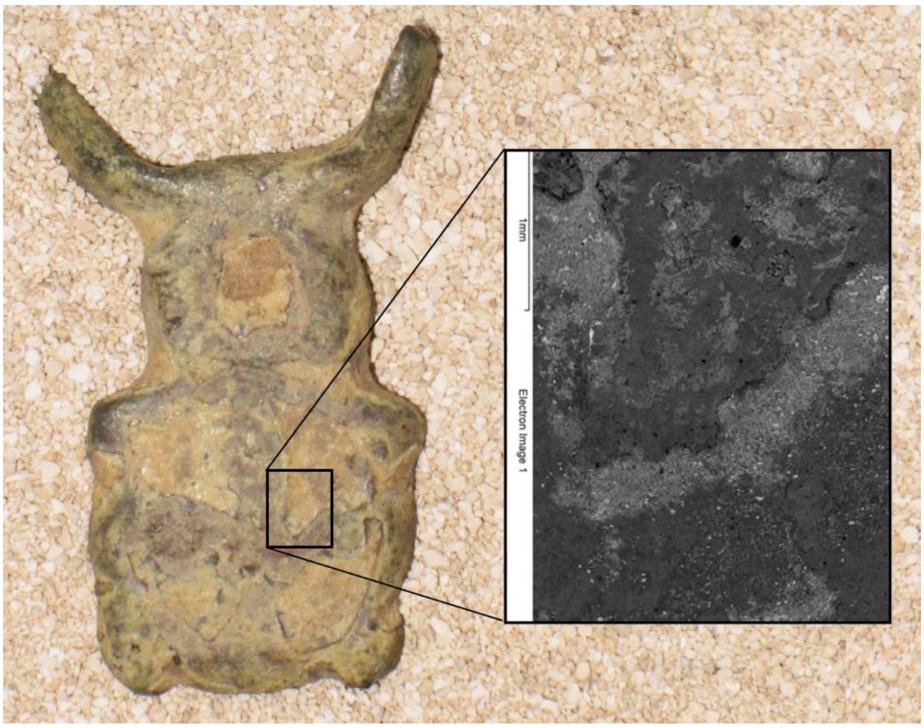

Fig. 2 Area selected for superficial analysis.

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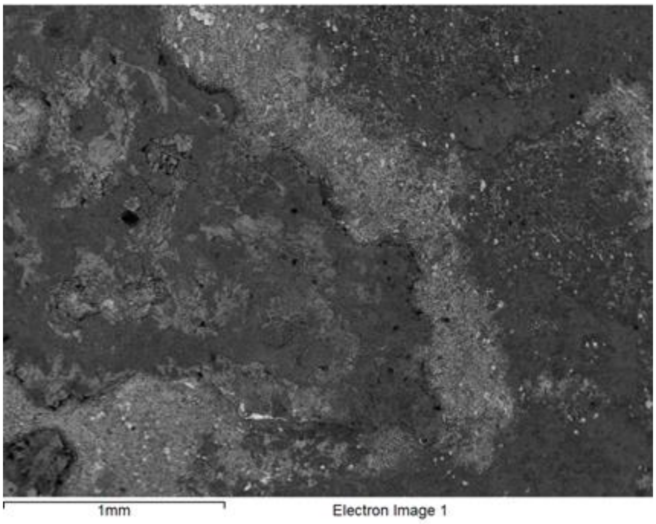
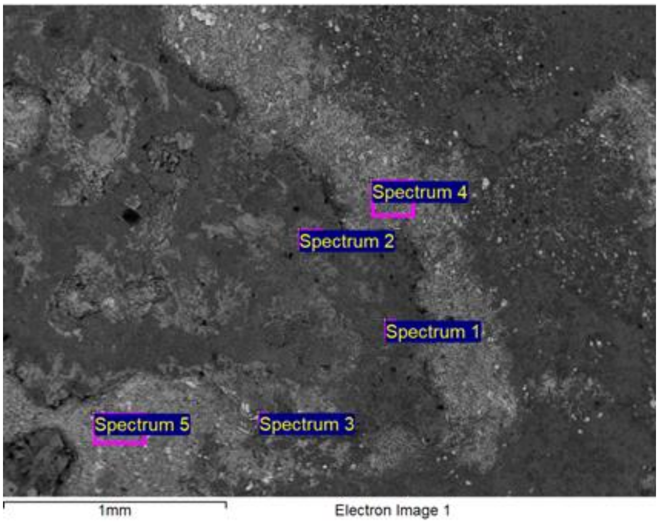
Results showed a copper composition (oxygen and impurities due to surface oxidation and corrosion) without any other alloying element such as arsenic, tin or zinc (see spectra 4 and 5). Analyses of the areas inside the quarters evidenced copper corrosion and soil (spectra 1 and 2).
Bright features in the metallic area evidenced the presence of silver amalgam in which elements of the superficial corrosion (Mg, Al, Si, Cl, Ca, Fe) were also detected (spectrum 3).

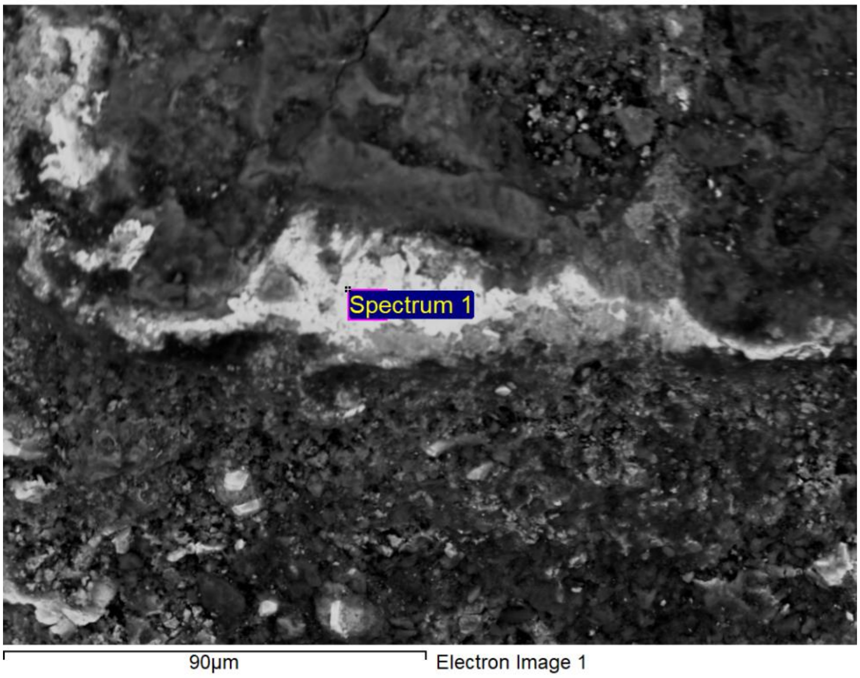


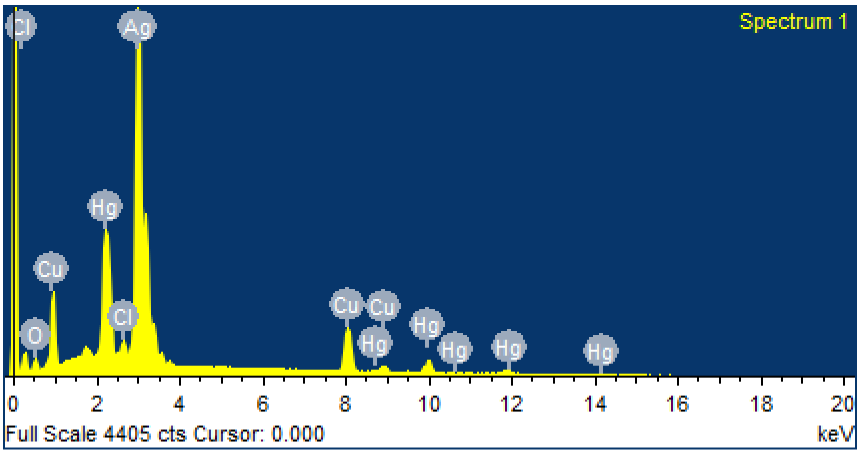


Spectrum	O		Al2O3	SiO2		CaO	FeO	CuO		
1			5.1	18.7		34.1	3.2	38.8		
2				100						
Spectrum	O	Mg	Al	Si	Cl	Ca	Fe	Cu	Ag	Hg
3	31.6	0.3	0.4	2.2	0.3	2.0	0.5	38.3	18.5	5.2
4	38.2		2.5	5.1	1.1			53.0		
5	39.8							60.1		

Results presented normalised in wt%. Spectra 3-5 presented in elements as these correspond to metallic areas although high levels of oxygen evidence they are oxidised. Remains of superficial corrosion are also detected.

Analyses of the bright features were also conducted at high magnifications, where remains of silver amalgam were better detected.





Spectrum	O	Cl	Cu	Ag	Hg
1	9.6	0.3	18.7	52.7	18.6

Results presented normalised in wt%.

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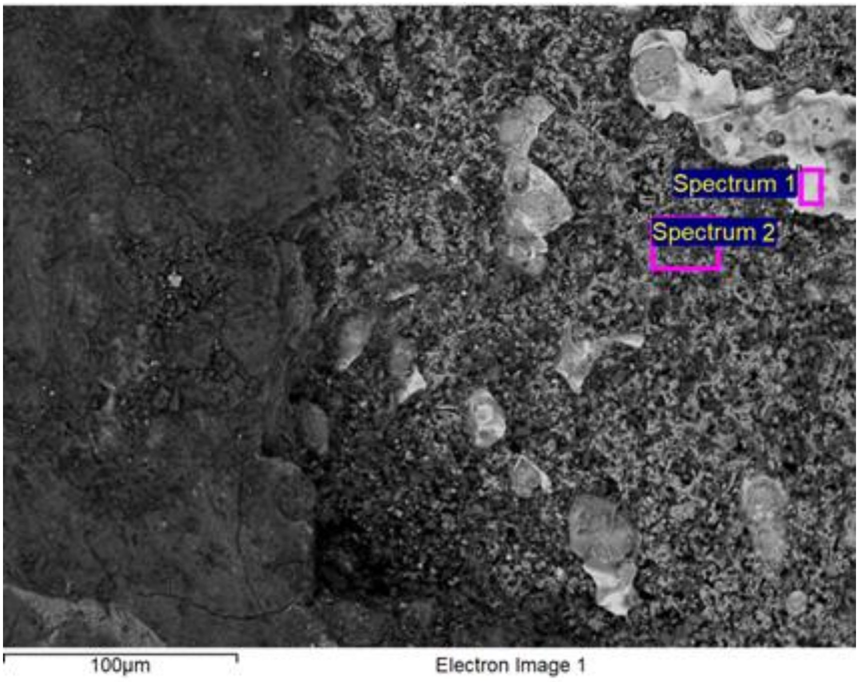
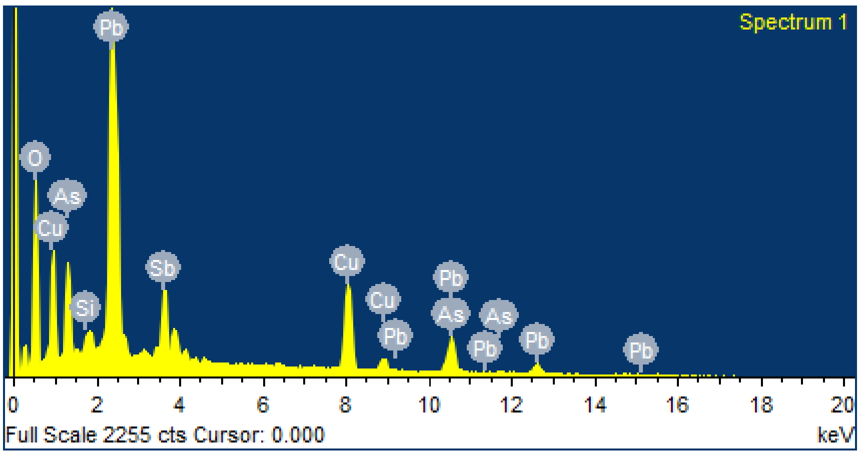
Other analyses on the metallic areas evidenced impurities of lead, arsenic and antimony which were not detected on general analyses.





Spectrum	O	Al	Si	Cl	Ca	Fe	Cu	As	Sb	Pb
1	34.1		0.6				15.1	7.5	8.9	33.7
2	30.5	1.1	2.7	0.3	0.6	0.5	64.3			

Results presented normalised in wt%. Spectra presented in elements as these correspond to metallic areas although high levels of oxygen evidence they are oxidised. Remains of superficial corrosion are also detected in spectrum 2.

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Superficial qualitative SEM-EDS analyses of the pendant confirmed it was a copper fitting possibly exhibiting some silver decoration, as remains of silver amalgam have been detected on its surface.

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