LIBS methodology for analysis of ancient artworks made of copper-based alloys*

O. De Pascale[1], A. De Giacomo[2], M. Dell'Aglio[1],

R. Gaudiuso[1], A. Santagata[3], [1]G.S. Senesi

[1]CNR-IMIP Bari, Via Amendola 122/D, 70126 Bari, Italy

[2]Università degli Studi di Bari, Dip. Chimica, Via Orabona 4, 70126 Bari, Italy

[3]CNR-IMIP Potenza, Zona Industriale di Tito Scalo, 85050 Tito Scalo (PZ), Italy

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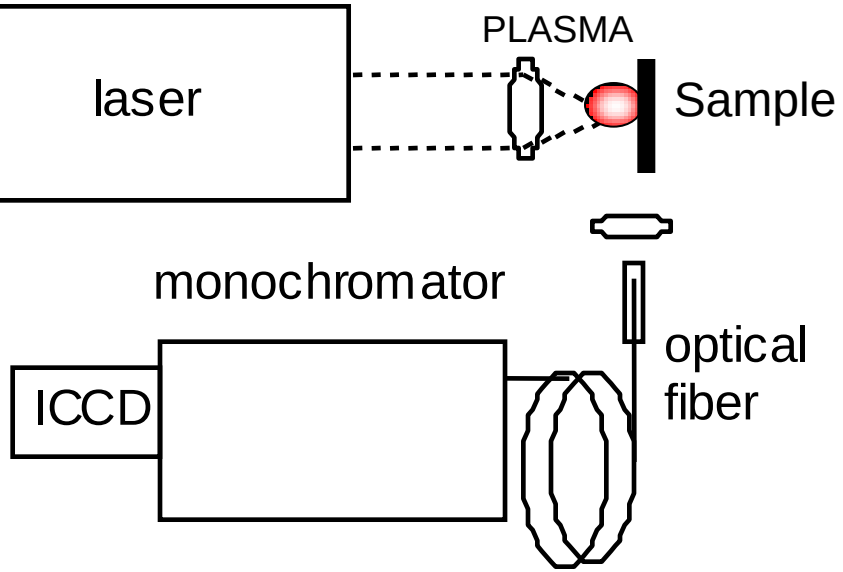
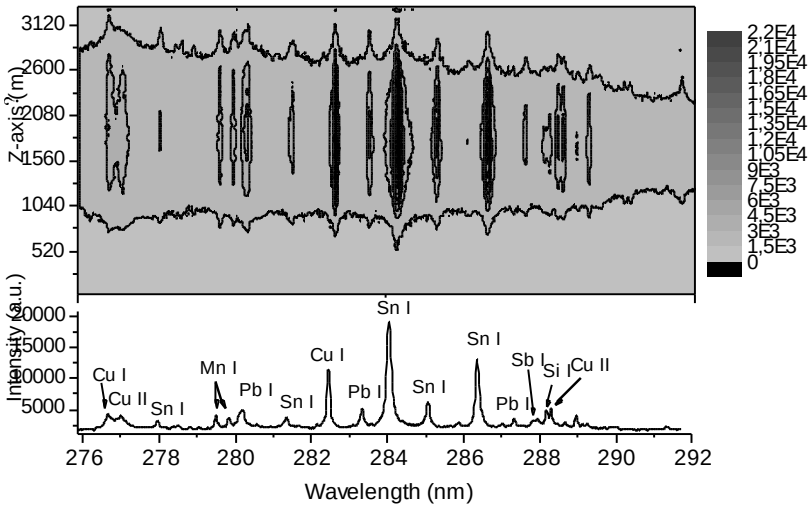
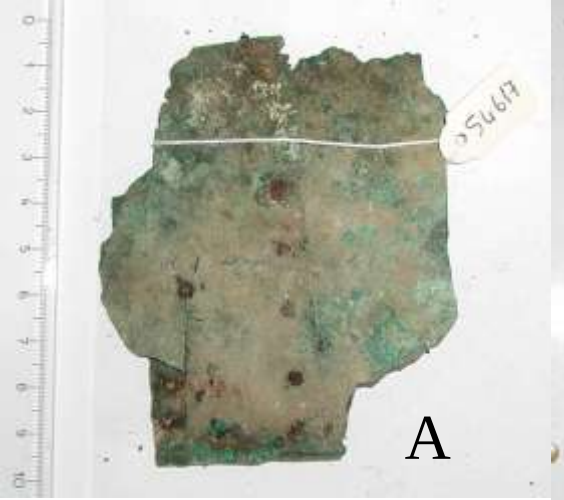
Experimental set-up

LIBS technique is based on the optical emission spectroscopy of the plasma produced by the laser pulse irradiation of the sample.





Although the experimental set-up is really simple and flexible, preliminary experiments are required to select the optimal detection time (delay from the laser pulse and gate width) and the element spectral lines (avoiding self absorption) for the quantitative analysis.



(w%) 15%	**Sn**	**Pb**	**Zn**	**Fe**	**Ni**	**Sb**	**Si**	**As**	**Mg**	**Cu**
A *(Belt)*	17.8	3.7	n	n.d.	n.d.	n.d.	1.40	n	y	balance
B *(Bacin)*	7.63	0.17	n	0.07	0.47	0.28	0.03	n	y	balance
C *(Fibula)*	27.7(>30)	4.27	n	0.16	0.23	0.04	0.64	n	y	balance
D *(Helm)*	16.8	0.60	n.d.	n.d.	n.d.	0.42	0.3	n	y	balance
E *(Pendant)*	38.9(>40)	26.7(>25)	0.94	0.26	1.56	0.21	3.09	n	y	balance

RESULTS