

## PRE-ROMAN COINS FROM NORTHERN ITALY: CHARACTERIZATION WITH NEUTRON DIFFRACTION ANALYSIS AND FIRST RESULTS

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The pre-Roman silver coinage from northern Italy (or “Celtic coins from the Po valley”) represents a topic with many unsolved problems concerning chronology, attributions, relationships within series and emissions [1-3]. Most of these coins are characterized by the imitation of the iconography of Massalia’s heavy drachm, produced in the late IV century B.C., bearing a lion with the ethnic ΜΑΣΣΑ on reverse and the head of Artemis on the obverse. The pre-Roman coinage is organized in many types of drachmas (Fig. 1), whose different style and discovery area have been used to group the coins and to propose attribution to specific people settled in northern Italy. In order to provide new data for numismatics studies, our archaeometric approach lied on the physical characterization of a representative selection of specimens coming from the Biandrate (NO), Serra Riccò (GE) and Balzola (AL) hoards. The main interest at this step of the project was the quantification of the silver content, in order to verify either the presence or the absence of a silver debasement among the several emissions, dated by numismatists to different periods and attributed to different tribes.



Fig. 1. The original heavy drachm of Massalia and Celtic imitations. From left to right: original Massilia drachm, Massa-A type, “naturalistic lion” type, “scorpion lion” type and “wolf lion” type. All the coins bears the same figures, but with different stylistic issues depicting the lion: the grouping in different typologies has been precisely made on the base of the lion features.

To overcome problems linked to the silver surface enrichment phenomenon, occurring quite often in ancient coins [4-5], we decided to perform neutron diffraction measurements at the ISIS facility (Rutherford Appleton Laboratory, Chilton-Didcot, UK). The instrument used was the TOF diffractometer of the Italian Neutron Experimental Station (INES), equipped with 144 <sup>3</sup>He squashed detectors, which allows a wide d-spacing range (0.4 to 12 Å) to be measured [6]. The analysis of diffraction patterns has been carried out with the GSAS software [7] and the EXPGUI interface to determine phase weight fractions through the Rietveld refinement. Then, thanks to literature data [8] obtained on certified samples, the relationship between d-spacing and composition of  $\alpha$  and  $\beta$  phases (respectively, copper-rich

and silver-rich phases) has been investigated in order to estimate the elemental composition and finally to obtain a silver/copper ratio useful for numismatics studies.

The results we are presenting here, obtained on the above-mentioned coins, allow to trace a clear silver debasement (Fig. 2) occurring between the first and latter drachmas emissions (IV-II century B.C.), due to inflation processes which can be related with the increasing economic power of Roman republic in the Po valley. The silver loss can be also used to establish a relative chronology between the different emissions, in agreement with stylistic differences and the few dating data available from archaeological research. Finally, these first results are providing new fundamental elements for the study of metrological relationships with the contemporary Roman republican currency, in a period of strong Roman influence followed by the military conquest of northern Italy.

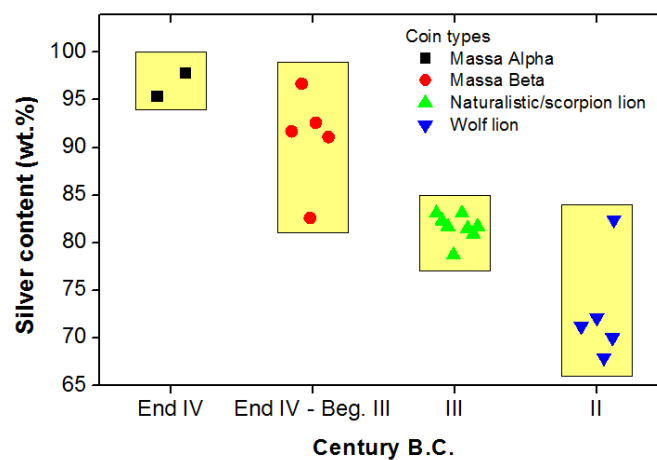


Fig. 2. Silver content decreasing in different Celtic coins typologies in relation to dating.

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