Nuclear Instruments and Methods in Physics Research B 306 (2013) 236–240

Contents lists available at SciVerse ScienceDirect

Nuclear Instruments and Methods in Physics Research B

journal homepage: www.elsevier.com/locate/nimb

The earrings of Pancas treasure: Analytical study by X-ray based techniques – A first approach

I. Tissot [a,*], M. Tissot [a,b], M. Manso [c], L.C. Alves [d], M.A. Barreiros [e], T. Marcelo [e], M.L. Carvalho [c], V. Corregidor [d], M.F. Guerra [f]

[a] Archeofactu – Rua do Cerrado das Oliveiras, No. 14, 2°Dto., 2610-035 Alfragide, Portugal
[b] Museu Nacional de Arqueologia – Praça do Império, 1400-206 Lisboa, Portugal
[c] Centro de Física Atómica da Universidade de Lisboa, Av., Prof. Gama Pinto 2, 1649-003 Lisboa, Portugal
[d] IST/ITN, Univ. Técnica de Lisboa, E.N. 10, UFA-LFI, 2686-953 Sacavém, Portugal
[e] LNEG, I.P., Estrada do Paço do Lumiar 22, 1649-038 Lisboa, Portugal
[f] Centre de Recherche et de Restauration des Musées de France and UMR8220 CNRS - 14, quai François Mitterrand, 75001 Paris, France

ARTICLE INFO

Article history:
Received 5 September 2012
Received in revised form 25 October 2012
Accepted 24 November 2012
Available online 18 January 2013

Keywords:
Gold
Earrings
Iberian
PIXE
XRF
SEM–EDS

ABSTRACT

The development of new metallurgical technologies in the Iberian Peninsula during the Iron Age is well represented by the 10 gold earrings from the treasure of Pancas. This work presents a first approach to the analytical study of these earrings and contributes to the construction of a typological evolution of the Iberian earrings. The manufacture techniques and the alloys composition were studied with three complementary X-ray spectroscopy techniques: portable EDXRF, μ-PIXE and SEM–EDS. The results were compared with earrings from the same and previous periods.

1. Introduction – the Iberian earrings

The *Pancas* treasure, conserved nowadays at the National Museum of Archaeology (NMA) in Lisbon, was found in 1979 in *Quinta das Pancas* (Alenquer-Lisbon), and consists on 3 silver necklaces, 1 silver smelting drop, 10 gold earrings and 136 silver denarii from the Roman Republic period, giving a *terminus post quem* of 1st c. BC [1]. The earrings (Fig. 1) are representative of the development of technological traditions in the Iberian Peninsula during the Iron Age: the change from a massive casting, characteristic of the Late Bronze Age, to a *repoussé* work decorated with wires and granulation and the use of hard soldering [2].

Fig. 2 proposes a chronological evolution of the Iberian earrings, which starts with a single casted round ring typical of the Late Atlantic Bronze Age gold work and of the North European traditions. The arrival of new technologies and cultural influences from the Eastern Mediterranean [3] brings the application of granules joined by solder to the main ring (Au171), in different patterns (Au169), and finally the introduction of twisted wire and *repoussé* work (Au833 typologically close to the earrings of Serradilla, Cáceres [4]), typical of the orientalising period and the Etruscan traditions.

Very few studies consider the identification of the goldsmith's technologies and the gold base alloys used in the Iberian Peninsula in the Bronze and Iron Ages [5,6]. This work is the first analytical study by SEM–EDS, EDXRF, μ-PIXE of the Pancas earrings and aims not only to characterise the manufacturing techniques and the gold alloys, but also to compare these results with data published for equivalent objects from southern Spain and 3 earrings (Au169, Au171, Au577), from the NMA collection excavated in Cabeça de Vaiamonte, located at Monforte, a region below the Tagus River. In order to search for a possible chronological continuity of technologies and supplies in one area of production the results were also compared with the analyses of 3 earrings (Au11, Au196, Au571) of earlier productions in the Lisbon region, also belonging to NMA collection.

2. Methods and instrumentation

The earrings were studied using EDXRF, micro PIXE and SEM–EDS.

* Corresponding author.
E-mail addresses: isabel.tissot@archeofactu.pt (I. Tissot), matthias.tissot@archeofactu.pt (M. Tissot), marta974@gmail.com (M. Manso), luisa@cii.fc.ul.pt (L.C. Alves), alexandra.barreiros@lneg.pt (M.A. Barreiros), teresa.marcelo@lneg.pt (T. Marcelo), lcalves@itn.pt (M.L. Carvalho), vicky.corregidor@itn.pt (V. Corregidor), maria.guerra@culture.gouv.fr (M.F. Guerra).

0168-583X/$ - see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.nimb.2012.11.054