ISSN: 0514-7336 — ISSN electrónico: 2386-3943
DOI: https://doi.org/10.14201/zephyrus2020853752

PHOENICIAN-INFLUENCED METALLURGY IN CENTRAL PORTUGAL. THREE SOCKETED ARROWHEADS WITH SPUR FROM MONTE FIGUEIRÓ (ANSIÃO)

La metalurgia de influencia fenicia en el centro de Portugal. Tres puntas de flecha de arpón lateral de Monte Fiegueiró (Ansião)

Raquel Vilaça*, Carlo Bottaini** and Ana Margarida Arruda***

** Instituto de Arqueologia. Faculdade de Letras. CEAACP. Univ. de Coimbra (Portugal). Rua de Sub-Ripas 3000-395 Coimbra (Portugal). Correo-e: rvilaca@fl.uc.pt. ID ORCID: https://orcid.org/0000-0003-0019-7256*
*** HERCULES Laboratory. Univ. of Évora (Portugal). Palácio do Vimioso. Largo Marquês de Marialva, 8. 7000-809 Évora. Correo-e: carlo@uevora.pt. ID ORCID: https://orcid.org/0000-0003-2464-468X*
**** UNIARQ-Centro de Arqueologia. Univ. de Lisboa, Faculdade de Letras. Alameda da Universidade. 1600-214 Lisboa (Portugal). Correo-e: a.m.arruda@letras.ulisboa.pt. ID ORCID: https://orcid.org/0000-0002-7446-1104*

Recepción: 1/02/2020; Revisión: 05/03/2020; Aceptación: 30/03/2020

Abstract: This paper presents the results of a study carried out on three previously unpublished Iron Age socketed arrowheads with spur from Monte Figueiró –Central Portugal–, a site located between the Tagus and Mondego rivers. This region is of the utmost importance to understanding how Mediterranean influences penetrated along the Iberian Atlantic coast and up to the inland Portuguese territories, through Phoenician traders, since the Early Iron Age –8th century BC–. The socketed arrowheads with spurs, originally produced in the South-eastern end of Europe, namely in the Black Sea area, are virtually unseen in the Portuguese territory, where only another similar item has been found at Castro Marim –South Portugal–, in contrast with Spain, more specifically with the Guadalquivir region, where they are quite frequently found. Therefore, the occurrence of the three socketed arrowheads from Monte Figueiró is a challenging discovery, since Central Portugal is a peripheral area with respect to the Iberian regions that underwent an actual Phoenician colonisation. Based on this assumption, this paper will not focus just on typological and technological issues, but it will go a bit further, also reflecting on what these three artefacts can reveal about the interaction between indigenous inland communities from Central Portugal and Phoenician traders.

Key words: Central Portugal; Early Iron Age; socketed arrowheads with spur; Phoenicians; Orientalizing world; archaeometallurgy.

Resumen: El presente artículo da a conocer los resultados del estudio de tres puntas de flecha de arpón lateral de la Edad del Hierro inéditas procedentes de Monte Figueiró –Centro de Portugal–, un yacimiento entre los ríos Tajo y Mondego, en una región de importancia capital para la comprensión de la difusión de las influencias mediterráneas a lo largo de la costa atlántica ibérica y hasta el territorio interior portugués, a través de los mercaderes fenicios desde la I Edad del Hierro –s. VIII a. C.–. Las puntas de flecha de arpón lateral, producidas originalmente en el extremo sureste de Europa, concretamente en el área del Mar Negro, son casi desconocidas en el territorio portugués, donde solo se había hallado una pieza semejante en Castro Marim –Sur de Portugal–. Sin embargo, son muy comunes en el Sur y Sureste de España, región en la que se difundieron a raíz de los contactos

con el mundo fenicio. La presencia de tres puntas de flecha de arpón lateral en Monte Figueiró representa un dilema complejo, ya que el Centro de Portugal constituye un área periférica respecto a las regiones ibéricas en las que se produjo una colonización fenicia propiamente dicha. A partir de esta suposición, este artículo no se centrará solo en el tema tipológico y tecnológico, yendo un poco más lejos y reflexionando sobre lo que estos tres artefactos pueden revelar sobre la interacción entre las comunidades indígenas del centro interior portugués y los mercaderes fenicios.

Palabras clave: Portugal Central; I Edad del Hierro; puntas de flecha de cubo con arpón; mundo fenicio; Orientalizante; arqueometalurgia.

1. Introduction[1]

Arrowheads, made of stone –mainly silex– or copper-based alloys and used either for hunting or combat, are very common artefacts in the late prehistory. During the Bronze Age of Western Iberia, however, the growing multiplication and diversity of metal weapons were accompanied by a decreasing importance of arrowheads that became almost residual from the Late Bronze Age, when swords and spears reached their peak of occurrence, particularly in hoards or settlements. In the next period, i.e. Iron Age, the situation did not change much, and arrowheads remained very rare in the Portuguese territory. It should be noted that even in the central-south regions of Portugal, i.e. the areas with greater contact with the Phoenician and Oriental worlds, arrowheads are virtually unknown.

Socketed arrowheads with spur are usually considered of Oriental origin, specifically from the northern coasts of the Black Sea area (García Guinea, 1967: 69; Lorrio *et al.*, 2016: 60). However, they are also found in other regions of the Mediterranean, namely in Iberia (Giardino, 1995: 230), where they rank among the most iconic metal types associated with the Phoenician presence/influence in the Western Mediterranean.

The three socketed arrowheads from Monte Figueiró represent the westernmost occurrence of this specific kind of artefacts known in Europe so far. It should be also stressed that in the Portuguese territory, only another socketed arrowhead with spur is known, having been found at Castro Marim, Southern Portugal[2], in the mouth of the Guadiana river, in an area that was geographically and culturally closer to the core geography of Phoenician influence in the Iberian Peninsula (Arruda, 1999-2000, 2014).

Thus, and notwithstanding the lack of archaeological information on the three arrowheads from Monte Figueiró, their presence in inland Central Portugal is a highly relevant data contributing to a better understanding of the process that lead to the penetration of Mediterranean influences along the Atlantic coast of Iberia.

2. Monte Figueiró

Monte Figueiró, municipality of Ansião, Leiria district, also known as Cabeço de Trás de Figueiró,

[1] We are deeply grateful to J. E. dos Reis Coutinho for letting us use the materials that, for many years, remained deposited at the Archaeology Institute of the Department of History, European Studies, Archaeology and Arts of the School of Humanities of the Univ. of Coimbra. We are grateful to V. H. Correia, former Director of the Conimbriga Monographic Museum, for his support and his help in the processing the pieces studied in this paper. We also thank M. I. Cunha e Silva, Director of the D. Diogo de Sousa Museum, at Braga, and the restoration experts V. Hugo and I. Marques for their restoration work of the three arrowheads, after removal of the samples. The analytical study was supported by the Portuguese Foundation for Science and Technology (FCT) by FEDER funds through COMPETE 2020, Portugal 2020 and by National Funds through FCT under projects UID/Multi/04449/2018 (POCI-01-0145-FEDER-007649) (HERCULES Lab/UE).

[2] Pereira, T.: *Os artefactos metálicos do Castelo de Castro Marim na Idade do Ferro e Época Romana. Metalurgia em transição: a amostra numa análise de conjunto.* Unpublished Master Thesis, defended in 2008 in the Univ. of Lisbon.

or Cruzeiro, is a hilltop settlement located in Central Portugal, south of the Mondego river, right at the Western Meso-Cenozoic edge, between the limestone mountains of Sicó, to the West, and the dolomitic hills[3]. It rises at 375 m above sea level, joining the following geographical coordinates, *Datum* WGS84: -844027 Longitude and 3997527 Latitude (Fig. 1A). Its orography is peculiar, having a trapezoidal profile (Fig. 1B), with an accentuated unevenness between the mesa-like hilltop and the bottom, a rather steep northeast slope and a smoother ramp-like south slope. The mount, composed of poor rocky soils, is characterised by the irregular mesa-type limestone pavement, typical of karst landscapes[4]. Currently, vegetation is scarce, prevailing shrubs of kermes oak and prickly broom, rosemary, thyme, and white thyme among others.

The site has ample views over the entire adjoining plain, also allowing its control of the so-called Rabaçal slump, accompanying the route of the Caráglio Seco –or Rio Mouros– rivulet valley, which runs west of the archaeological site. This natural corridor extends as far as Conímbriga, 18 km north (Fig. 2). Today the mount looks harsh and inhospitable, almost wild, despite the changes occurred throughout time, particularly in the last 30 years: first, the in-depth agricultural works, meanwhile abandoned, destroyed the structures and exposed many archaeological materials; secondly, the installation of a telecom tower and antennas also damaged the archaeological levels.

Although no archaeological excavations have been carried out at Monte Figueiró, the site has provided a large collection of materials –namely metals, pottery and lithic– that unequivocally reveal a long-duration occupation of the site, from the Chalcolithic until the Middle Ages (Coutinho, 1994: 113; Coutinho, 1995)[5]. However, the archaeological context of these objects is completely unknown. Some of those materials were partly collected by Father Eduardo dos Reis Coutinho, namely during the December ploughing and the wheat harvesting season, in the Summer. Other materials were donated (Coutinho, 1994: 113)[6]. According to the information available in the site of the Portuguese Directorate-General for Cultural

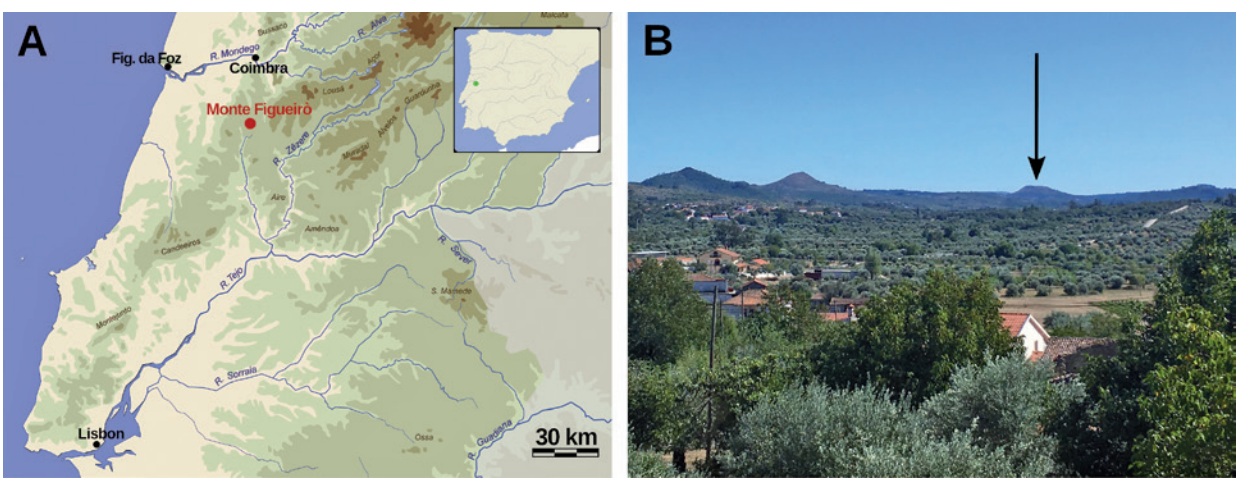

FIG. 1. *A) Location of Monte Figueiró within Central Portugal; B) the mount where Monte Figueiró is located.*

[3] Cunha, L. (1988): *As Serras Calcárias de Condeixa-Sicó-Alvaiázere. Estudo de Geomorfologia*. Unpublished PhD Thesis. Coimbra presented in 1988 in the Univ. of Coimbra.

[4] Cunha, *op. cit.*, n. 2, p. 171 and print XXIV.

[5] Coutinho, J. E. R.: *Idade do Ferro e Romanização do Monte Figueiró. Perspectivas e problemas existentes*. Unpublished document deposited in 1999 in the Instituto de Arqueologia, Coimbra.

[6] Coutinho, *op. cit.*, n. 4, p. 28.

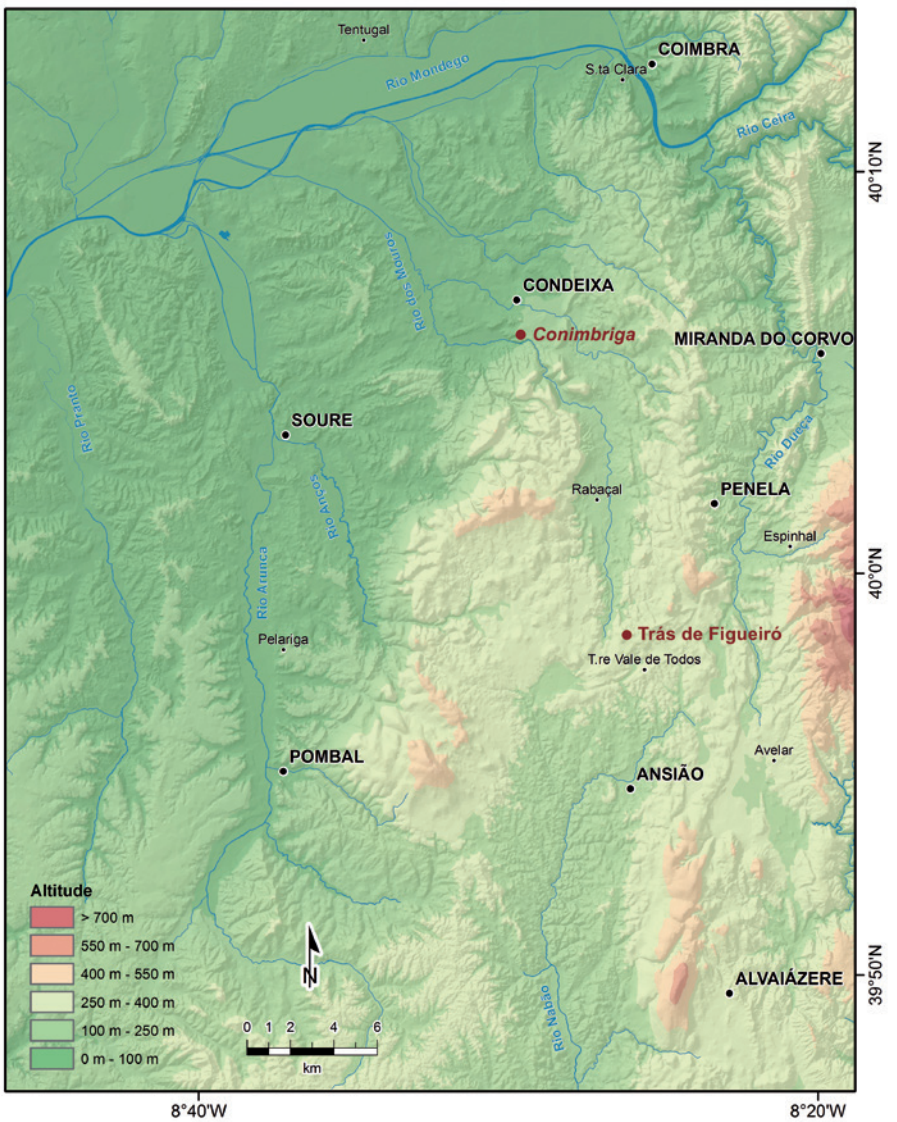

Fig. 2. *Route of the Rio dos Mouros or Caráglio Seco river, running between* Conimbriga *and Trás de Figueiró, over the so-called Rabaçal slump.*

Heritage[7], archaeological surveys were carried out in the area in 2001 and 2010 but apparently they did not provide any further material or information about the site.

As for Late Prehistory and Protohistory, archaeological materials from Monte Figueiró clearly belong to two different periods. The first one, documented by chisels, rings, fragments of a sickle possibly of the Rocanes type, of carp's tongue swords, of *tranchet* and of socketed axes dates back to the Late Bronze Age –12th-8th centuries BC– (Coutinho, 1994; Vilaça, 2012: 27)[8]. The second one is composed by materials typologically belonging to the Early Iron Age –7th-6th centuries BC–. It consists of the three socketed arrowheads presented in this paper, ceramics –pots, cups, grey pottery, with graffiti in one case–, spindle whorls, glass beads, a fragment of *xorca*, an iron blade (Coutinho, 1994)[9] and an unpublished omega-shaped bracelet *–brazalete acorazonado–*. This is a rare type of adornment also found, for example, at Santa Olaia and Chões –in Central Portugal– (Rocha, 1971: est. VI-47, XXXVII-460) and whose production would start in the 7th century BC (Jiménez Ávila, 2006: 95).

3. The arrowheads. Typology, chronology and distribution

The circumstances in which the three socketed arrowheads from Monte Figueiró were found are

[7] https://arqueologia.patrimoniocultural.pt/index.php?sid=sitios&subsid=2212036 [accessed on 2nd May 2020].

[8] Coutinho, *op. cit.*, n. 4.

[9] Coutinho, *op. cit.*, n. 4.

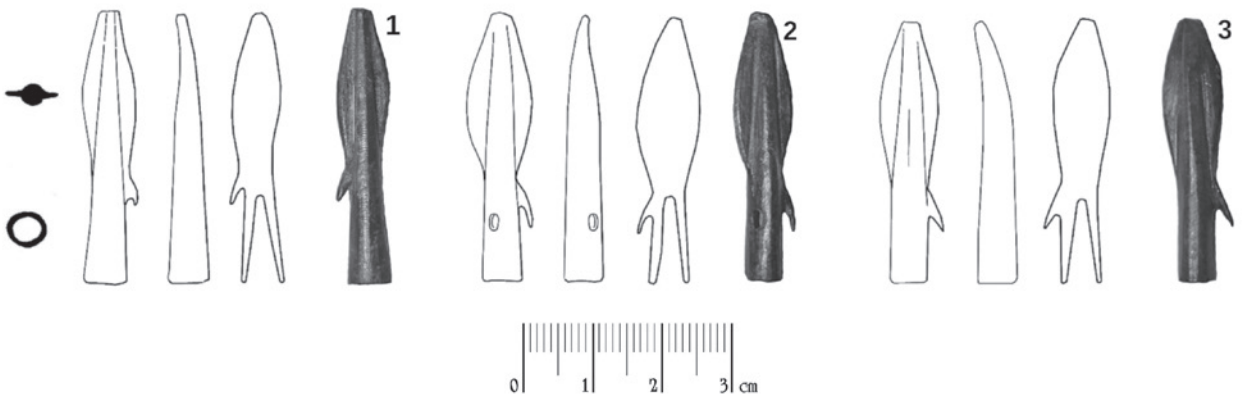

Fig. 3. *The three arrowheads from Monte Figueiró (photos and drawings by J. L. Madeira and J. Venceslau).*

	Max. length	Lenght of the blade	Max widht of the blade	Max. thickness of the blade	Diameter of the socket	Weight
Arrowhead 1	4	2,2	0,7	0,25	0,6	5 g
Arrowhead 2	3,9	2,4	1	0,4	0,6	6 g
Arrowhead 3	3,9	2,5	0,8	0,3	0,6	7 g

Fig. 4. *Dimensions (cm) and weight (g) of the three socketed arrowheads.*

uncertain[10]. One single arrowhead was displayed on occasion of a temporary exhibition at the Santos Rocha Municipal Museum, Figueira da Foz (Coutinho, 1994: 114)[11]. The other two arrowheads came to our attention a few years later[12].

In terms of the morphology, the three arrowheads, covered by a dark-green patina, have a double-edge lanceolate shape, with convex, blunt and bent blades, central vein, and tube-shaped handle with a sub-circular section (Fig. 3). They are very similar and well-preserved. According to Fig. 4, there is a minimum variation in body and spurs, while the socket size is identical, i.e. 0.6 cm, as in most Iberian arrowheads of this type (Ferrer, 1995: 94-95).

The spur, also referred to as *arpón*, *anzuelo*, or *barbillon* (García Guinea, 1967: Ferrer, 1996), is a characteristic element of this type of arrowheads. In the artefacts from Monte Figueiró, spurs are placed in the interface between the blade and the socket, as observed in most of the Iberian Iron Age socketed arrowheads (Lorrio *et al.*, 2016: 26). In operating terms, the spurs have a specific function, i.e. to make more difficult, if not impossible, to extract the arrow from the target (Quesada, 1989: 165; Kaiser, 2003: 79; Lorrio *et al.*, 2016: 26). This new solution clearly breaks away with the tradition of arrowheads with a peduncle and fins, made of metal or stone, used throughout recent Prehistory. Quesada (1989: 164) also underlines the greater efficiency of the socketed arrowheads, particularly those fitted with a hole –as found in item no. 2 from Monte Figueiró–, versus the thousands-year-old solution

[10] The three arrowheads, together with other metal artefacts, ceramic and lithic objects, were temporarily provided to the first author of this text by José Eduardo dos Reis Coutinho, the priest that found or received as donation the material from Monte Figueiró.

[11] Coutinho, *op. cit.*, n. 4, p. 29, fig. 7, no. 1.

[12] Venceslau, J.: *Pontas de seta orientalizantes do Monte Figueiró, Ansião*. Unpublished document, deposited in 2013 in the Univ. of Coimbra.

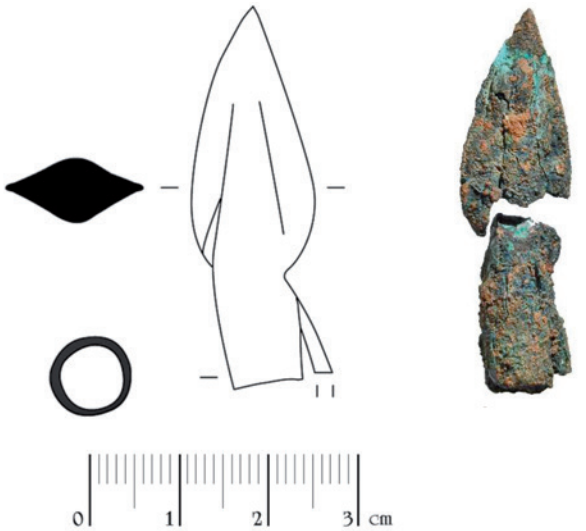

Fig. 5. *The arrowhead from Castro Marim (drawn by A. M. Arruda, adapted from Pereira, 2008).*

of a peduncle simply embedded in, or attached to, the shaft.

Due to their morphology, one can insert the three arrowheads from Monte Figueiró in form 1, type 11a, according to Ramón (1983), or type VII according to Kaiser (2003: 83). This is a very common type in the Iberian Peninsula (Quesada, 1989: 171), found, for example, at Coria del Río (Rodríguez Cordones, 1996), Pancorvo (Mancebo and Ferrer, 1988-1989), Priego de Córdoba (Kaiser, 2003: 83; Quesada, 1989: 173), Peña Negra, La Fonteta (Renzi *et al.*, 2009), El Castellar de Meca (Lorrio *et al.*, 2016), and El Palomar (Rovira *et al.*, 2005: 1234).

The socketed arrowhead from Castro Marim (Fig. 5) has a slightly different shape when compared with the three artefacts from Monte Figueró. The connection between the double-edge lanceolate leaf with convex edges and the hollow sub-cylindrical socket that links it to the handle –0.5 cm diameter– is broken. The spur, placed in the transition between the leaf and the socket, is fractured in its proximal extremity. Although these circumstances do not allow for a safe typological definition, the short central vein in the leaf's lower tier apparently shows two side openings. Consequently, this arrowhead could be incorporated into Ramón's group 2, form 12A (1983), particularly represented in Andalucía (Quesada, 1988; Ferrer, 1995, 1996) and Southeast Iberia, namely Peña Negra (Lorrio *et al.*, 2016: 32, fig. 11).

Due to the circumstances in which the arrowheads from Monte Figueiró were found, it is difficult to establish their exact time frame. Indeed, this type of weapon has a wide chronology, dating back from the 7th-6th century BC (Ferrer, 1995: 91; Lorrio *et al.*, 2016: 60). Their existence, although scarce, lasted until the 5th- 4th century BC (Quesada, 1988: 3). In turn, Kaiser (2003: 89) argues that this the only type of arrowhead that lasted throughout the entire Iron Age, first associated with the Phoenicians, who introduced it in Iberia, and then the Punic.

The socketed arrowhead from Castro Marim provided a radiocarbon dating which points at the second half of the 6th century BC (Arruda *et al.*, 2013), also confirmed by the material found at the same levels, more specifically red slip ceramics –bowls and plates–, pottery with painted stripes –*pithoi* and Cruz del Negro type–, grey pottery –bowls–, hand-made ceramics, and, among metals, an Acebuchal-type fibula and the clasp from a 'Tartessian' type belt buckle (Arruda *et al.*, 2017).

Even if Fig. 6 is just a non-exhaustive approach to the available data, it shows the geographical distribution of socketed arrowheads with spur in the Iberian Peninsula, highlighting that they are mostly concentrated in those areas with stronger interconnections with the Phoenician world, i.e. South and Southeast of Spain (Ferrer, 1995: 91; Giardino, 1995: 227-230; Kaiser, 2003: 89; Quesada *et al.*, 2014: 371-372; Lorrio *et al.*, 2016: 9-10). On the contrary, their presence appears to be much scarcer outside this area, in particular in Central and South of Portugal and Spanish Extremadura, through which these arrowheads may have reached Monte Figueiró, following the 'Ruta de la Plata' –Silver Road– and the Tagus corridor. This is a mere working hypothesis based on the affinities, already found before the Late Bronze Age, between archaeological material from the Spanish Extremadura and

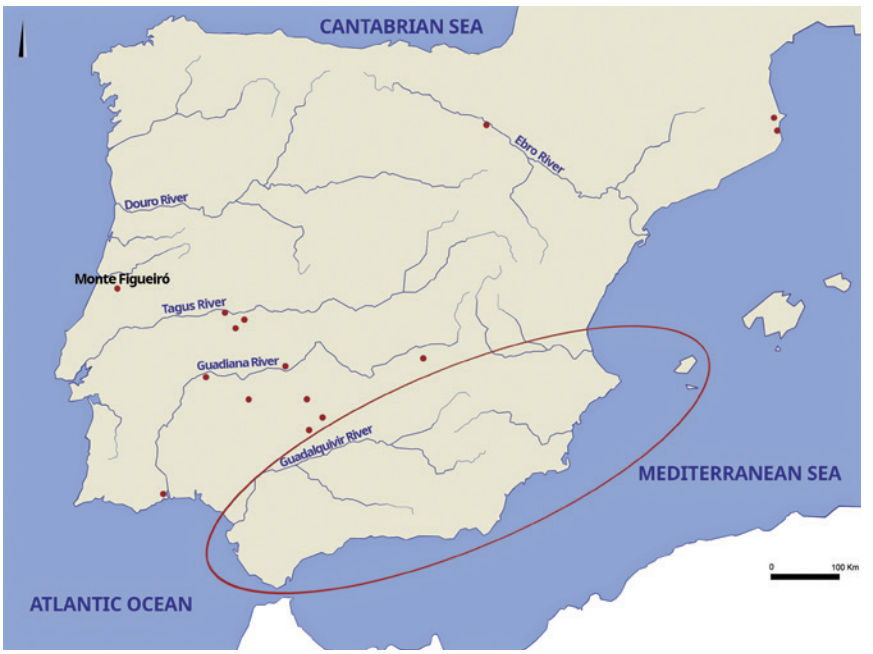

Fig. 6. *Geographical distribution of socketed arrowheads with spur in the Iberian Peninsula, namely concentrated in South and Southeast of Spain (area inside the red circle).*

Central Portugal, and on the presence of Mediterranean elements in the South and Central Portugal from the end of the 2nd millennium onwards (v.g. Arruda, 2008; Vilaça, 2008, 2013).

4. Analytical methodology

The three arrowheads from Monte Figueiró were analysed adopting a multi-analytical approach aimed to: a) determine their chemical composition, using x-Ray Fluorescence –XRF– and Scanning Electronic Microscope coupled with Energy Dispersive x-Ray Spectrometer –SEM-EDS–; and b) identify the manufacturing process –operating chain– used in their production, by Optical Microscope –OM–. The analyses were carried out at the HERCULES Lab –Univ. of Evora, Portugal– using the following equipment:

1) Portable XRF spectrometer, Bruker Tracer III-SD model, equipped with a rhodium anode tube and a Silicon Drift Detector. Working conditions; 60 second acquisition time; 40 kV, 12.5μA; Al/Ti filters –304.8 μm aluminium/25.4 μm titanium–. Quantification was carried out through BCR-691 reference standards[13].
2) SEM-EDS Hitachi S-3700N equipped with an energy dispersive x-Ray spectrometer Bruker Xflash Silicon Drift Detector –SDD–. Data was acquired by means of the Bruker Esprit v.1.9 software.
3) OM Leica DM2500P, equipped with a digital MC170HD Leica camera, coupled with a computer with LAS v4.4.0 software.

Analyses by OM and SEM-EDS were performed on samples of about 3 mm² mechanically removed from each artefact, mounted in resin, grounded and polished. Metallographic observation, by OM, was carried out after etching the samples with ferric chloride and hydrochloric in a solution of ethanol (Scott, 1991). After being analysed, the artefacts were restored, chemically stabilized and consolidated by restoration experts from the D. Diogo de Sousa Museum, Braga.

5. Results and discussion

According to XRF analysis (Fig. 7), the three arrowheads are produced with leaded copper, i.e. a metal made of copper (Cu) and lead (Pb) as major elements and tin (Sn), iron (Fe), nickel (Ni) and zinc (Zn) as minor components. The presence of these impurities does not exceed 2% of the total. The

[13] Ingelbrecht, C.; Adriaens, A. and Maier, E. (2001): *Certification of arsenic, lead, zinc and tin (mass fractions) in five copper alloys, BCR 691 Report EUR 19778/1*. Brussels: General Directorate for Research.

	Cu	Sn	Pb	Fe	Ni	Zn
Arrowhead 1	89.02	1.05	9.57	0.12	0.06	0.16
Arrowhead 2	88.41	1.72	9.58	0.12	0.05	0.12
Arrowhead 3	88.68	1.32	9.72	0.13	0.01	0.14

Fig. 7. *Elemental composition of the three socketed arrowheads (wt%).*

difference among concentrations of both major and minor elements is so neglectable that one could also speculate about the possibility that the three arrowheads were produced in the same melting process.

In comparative terms, few data on Orientalizing metals found in Central and Northern Portugal are available so far. The analyses of a collection of objects attributed to the Late Bronze Age and considered of Phoenician origin from Fraga dos Corvos –inland North Portugal–, for example, has shown that they are mostly made of bronze (Cu + 8-13% Sn) with Pb fewer than 2% (Figueiredo *et al.*, 2009). These results agree with the binary metallurgy from the Late Bronze Age and Early Iron Age known for the Portuguese territory, generally characterised by bronze alloys (Cu + 8-15% Sn) with low concentrations of other chemical elements (Figueiredo *et al.*, 2010; Bottaini *et al.*, 2016).

Leaded coppers remain quite rare in Western Iberia, being known, for example, in a chisel found at Castro do Cabeço de Argemela, Fundão (Vilaça *et al.*, 2011: 444) and in a palstave from North-East of Portugal (Bottaini *et al.*, 2012: 26). Traditionally, the occurrence of leaded copper alloys with poor tin content has been documented in sites from the Iron Age of Iberian Levante, such as for example, Llano de la Espesura (Almería) (Montero-Ruiz,

Site	Province	Cu	Sn	Pb	Fe	As	Ni	Sb	Ag	Bibliography	Alloy type
Almanzora	Córdoba	76.66	0.918	21.05	1.092	0	0	0.205	0.076	(1)	Cu + Pb
Cerro Cebero	Córdoba	93.99	0.811	4.235	0.814	0	0	0.1	0.04	(1)	Cu + Pb
Cerro Cebero	Córdoba	73.27	4.888	20.89	0.379	0	0.248	0.258	0.072	(1)	Cu + Sn + Pb
Cerro Cebero	Córdoba	93.02	0.131	6.48	0.136	0	0	0.155	0.08	(1)	Cu + Pb
Unknown	Unknown	78.27	0.269	19.94	1.108	0	0.179	0.142	0.077	(1)	Cu + Pb
Unknown	Unknown	76.95	10.5	11.31	0.675	0	0.141	0.39	0.049	(1)	Cu + Sn + Pb
El Monastil	Alicante	85.89	14.11	0	0	0	0	0	0	(3)	Cu + Sn
El Palomar	Badajoz	83.5	14.27	1.53	0.41	0.21	0	0.008	0.019	(2)	Cu + Sn
La Bobadilla	Jaén	92.67	0.857	5.922	0.317	0	0	0.155	0.072	(1)	Cu + Pb
La Bobadilla	Jaén	90.85	0.21	7.91	0.811	0	0	0.083	0.071	(1)	Cu + Pb
La Bobadilla	Jaén	72.35	3.805	22.5	0.661	0	0.249	0.342	0.009	(1)	Cu + Sn + Pb
Montoro	Córdoba	66.81	5.8	23.45	0.7	0.77	0.1	0.08	0.003	(4)	Cu + Sn + Pb
Peña Negra 2	Alicante	90.5	8.6	0	0.15	0.28	0	0	0	(3)	Cu + Sn
Peña Negra 3	Alicante	90.2	7.5	1.3	0.42	0	0	0	0	(3)	Cu + Sn
Peña Negra 5	Alicante	93.8	4.9	1.1	0.11	0	0	0	0	(3)	Cu + Sn
Priego	Córdoba	96.47	0.86	1.599	0.752	0	0	0.158	0.158	(1)	Cu
Priego	Córdoba	95.98	0.614	2.733	0.463	0	0	0.123	0.072	(1)	Cu + Pb
Priego	Córdoba	94.66	0.644	3.824	0.678	0	0	0.109	0.064	(1)	Cu + Pb
Priego	Córdoba	97.13	0.192	2.126	0.264	0	0.212	0.049	0.06	(1)	Cu + Pb
Torre Alta	Córdoba	78.0	15.55	5.232	0.617	0	0.24	0.246	0.118	(1)	Cu + Sn + Pb
Torre Alta	Córdoba	70.82	26.24	1.271	1.245	0	0.213	0.102	0.086	(1)	Cu + Sn
Torre Alta	Córdoba	75.34	21.8	1.862	0.588	0	0.232	0.077	0.082	(1)	Cu + Sn
Torre Alta	Córdoba	96.85	0.984	1.756	0.268	0	0	0.082	0.049	(1)	Cu
Villajoyosa	Alicante	84.0	12.0	3.0	0	0	0	0	0	(1)	Cu + Sn + Pb

Fig. 8. *Elemental composition of socketed arrowheads from Iberian Peninsula (wt%). Bibliography: (1) Martín Ruiz, 2012; (2) Rovira* et al.*, 2005; (3) Lorrio* et al.*, 2016; (4) Quesada, 1989.*

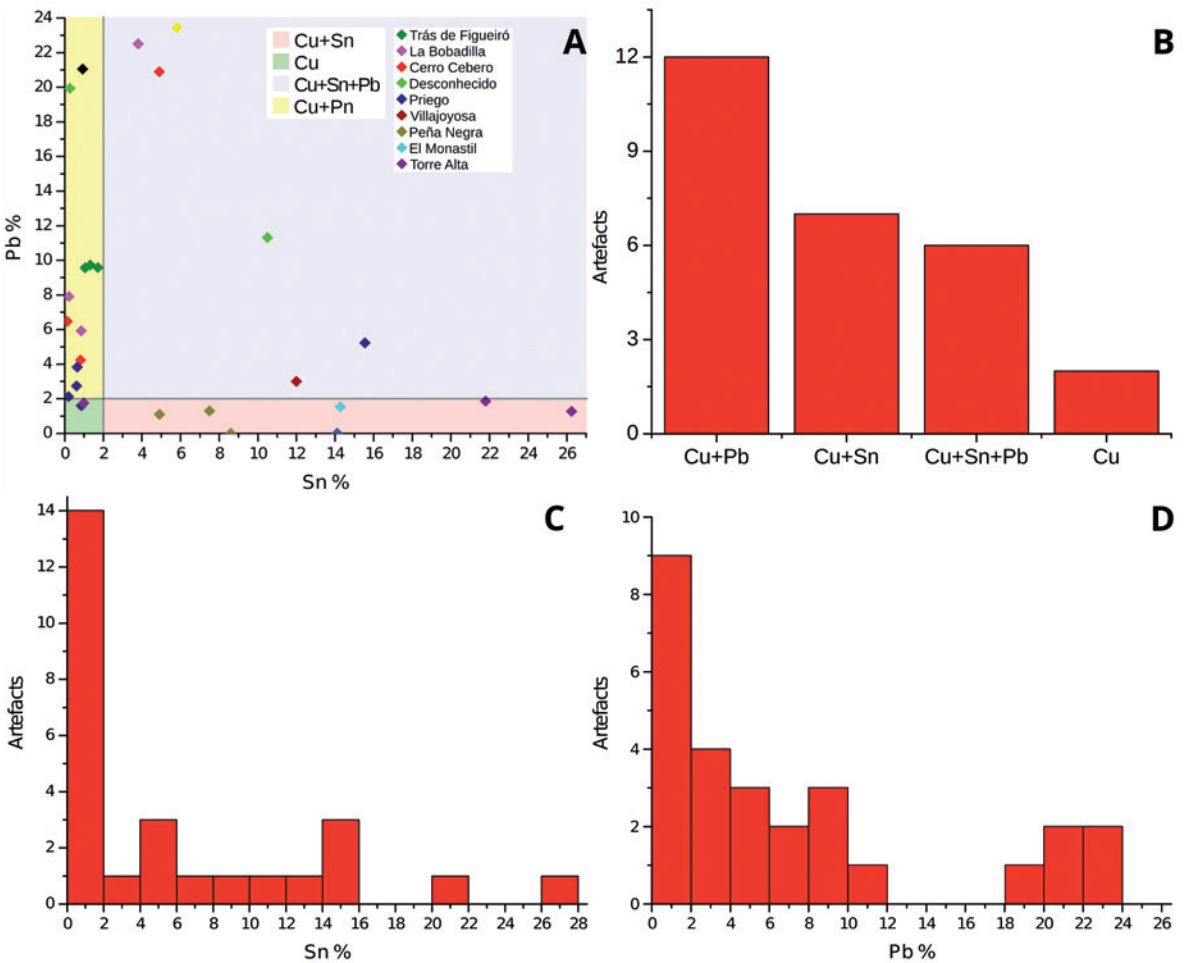

Fig. 9. *A) bivariate scatterplot displaying Pb and Sn variation values within the available data on Early Iron Age Iberian socketed arrowheads with spurs; B) histogram with the distribution of alloy types; C) frequency of Sn and Pb; (D) in the whole collection of socketed arrowheads from Iberian Peninsula.*

2008: 511), Morro de Mezquitilla (Málaga) (Montero-Ruiz, 2008: 502), Peña Negra (Renzi, 2010: 142), La Alcudia (Renzi, 2010: 142), La Fonteta (Alicante) (Renzi *et al.*, 2009: 2588; Renzi, 2010: 143), and Sant Jaume Mas d'en Serrà (Tarragona) (Garcia i Rupert, 2007; Montero-Ruiz *et al.*, 2010-2011). In this regard, one can observe a partial geographical overlap between the area with the highest incidence of leaded copper artefacts, the region with the highest concentration of socketed arrowheads with spur, and the area with a strongest Phoenician presence.

Not all the socketed arrowheads with spur from Iberia were produced with leaded copper (Fig. 8), and different alloys were used, i.e. bronze (Cu + > 2% Sn), copper with a low impurity content (Cu + < 2% Sn + < 2% Pb), leaded copper (Cu + > 2% Pb), and leaded bronze (Cu + > 2% Sn + > 2% Pb) (Fig. 9A). According to the data, 12 objects can be considered as made of leaded copper, 6 in leaded bronzes, 7 in bronze, and 2 artefacts are pure coppers (Fig. 9B). Sn is below 2% in 14 of the 27 pieces (Fig. 9C), while percentages of Pb higher than 2% are found in 18 of the 27 analysed arrowheads (Fig. 9D).

As known, when Pb is mixed with copper, the melting temperature lowers and the metal becomes more fluid. Above a certain percentage, however, Pb renders the metal more fragile, due to the formation of inclusions scattered in the metal (Fig. 10). With respect to the arrowheads, it has been suggested that the presence of Pb increased the arrowhead's penetration capability and made it more effective, although reducing its range (Consuegra, 1987, in Quesada, 1989: 172). In contrast, Quesada (1989: 172) has rejected this hypothesis, arguing that the reason for adding Pb could be its capability to reduce the melting temperature, thus making the production process easier.

Observation by optical microscope revealed a dendritic-type micro-structure that suggests that none of the arrowheads was subjected to any post-casting processing –annealing or plastic deformation, after being removed from the mould– (Fig. 11). Arrowheads were molten in moulds, likely composed of different parts, such as suggested by a complex mould found at Mosul (Quesada, 1989: 164, fig. 2). Given the large number of arrowheads, it is rather surprising that moulds are so rarely found in the Iberian Peninsula. Perhaps, it should be also admissible that the mass and standardized production of this kind of artefacts was made from wax models, composed by various parts that were subsequently molten with the same technique.

6. The arrowheads from Monte Figueiró within their chronocultural framework

Despite the lack of information about their archaeological context, the three socketed arrowheads from Monte Figueiró shed some light on the role that this site had during the penetration of Mediterranean elements along the Atlantic coast of Iberia, starting from around the 8th century BC. Indeed, according to the material recovered –particularly the socketed arrowheads and the omega-shaped bracelet– and taking into consideration the strategic location of the site, Monte Figueiró played a key role in the regional dynamics of human settlement in the mid-first millennium BC. Important reference sites are well-known in this area, such as Santa Olaia, where exogenous populations settled (Arruda, 1999-2000: 253), and several sites of indigenous matrix, especially Crasto de Tavarede

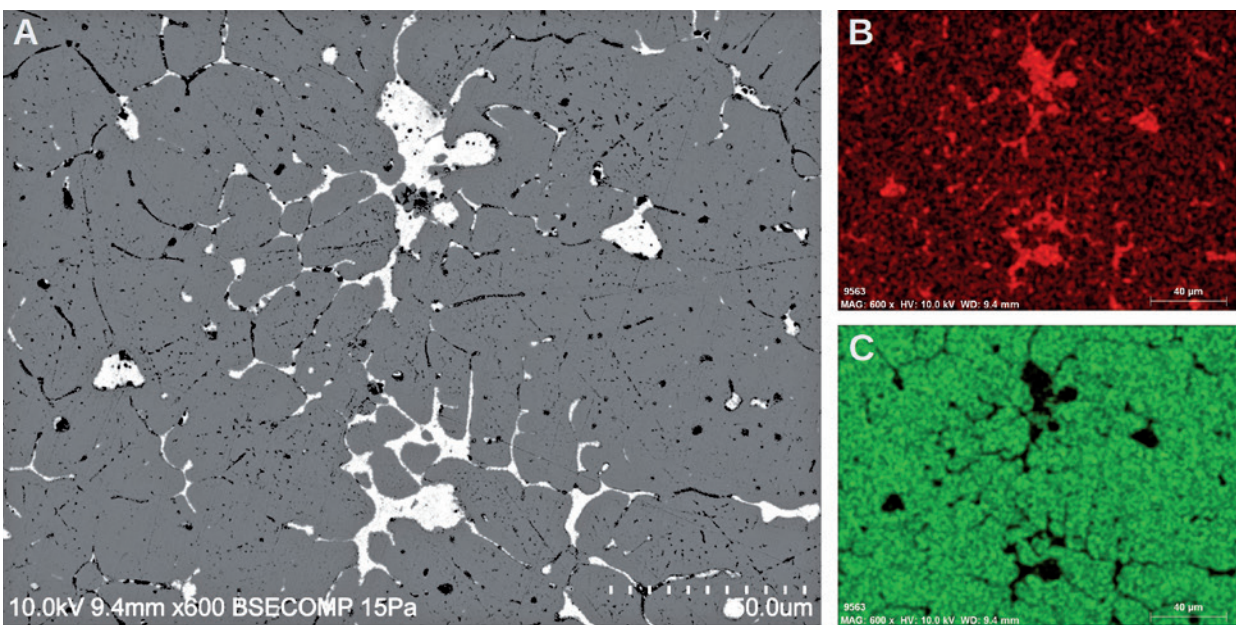

Fig. 10. *A) SEM-BSE image showing the presence of Pb inclusions; B) EDS distribution map of Pb; C) EDS distribution map of Cu.*

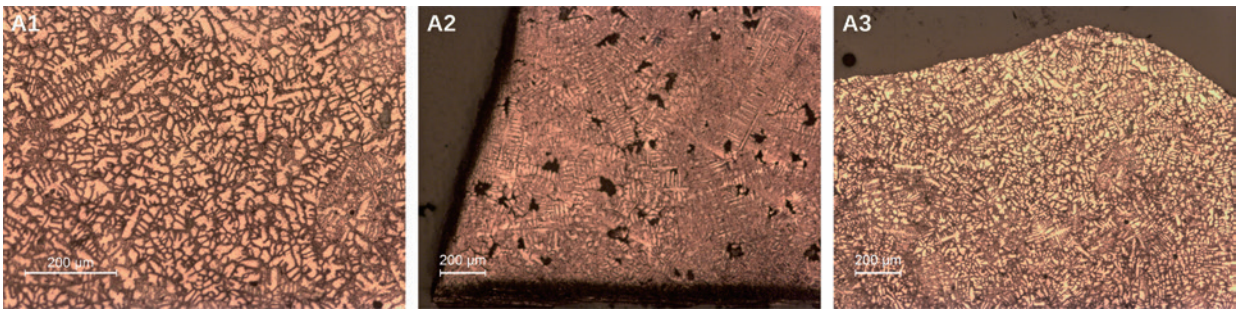

Fig. 11. *Optical microscopy image showing the dendritic micro-structure of the three socketed arrowheads from Monte Figueiró (A1: arrowhead 1; A2: arrowhead 2; A3: arrowhead 3;* cf. *Fig. 3).*

(Neves, 2013)[14] and *Conimbriga* –Condeixa-a-Nova– (Correia, 1993), just to mention the most famous, which certainly capitalized on the organization of small-sized territories. Other small-scale farming sites, scattered throughout what is today the municipality of Figueira da Foz, such as Chões, Pardieiros or Fonte de Cabanas are equally known since the late 19th century (Pereira, 1993-94; Arruda, 1999-2000: 244-245).

Situated close to the Mondego river, that flows at about 25 km away from the site, and no further than 50 km from the Atlantic coast, Monte Figueiró took advantage from this strategic position, in a crossroads between two important circulation axis. The east-west axis, running along the Mondego river, linked the Atlantic coast with the inland territories and was the natural route for the supply of metal resources exploited in the Beira Interior –Central Portugal– (Arruda, 1999-2000: 254; Pereira, 2009). Perpendicularly, manufactured artefacts, namely metals, circulated along the north-south axis, running along the Atlantic coast. This route, which crossed the Rabaçal slump, between *Conimbriga* and Monte Figueiró, was one of the two branches of the so-called 'Estrada Coimbrã' –Coimbra Road– of historical times (Vilaça, 2016: 131-132, fig. 11).

The existence of these two axes is known at least since the first half of the 1st millennium BC, as proved by the significant connection among the three main regional sites, i.e. *Conimbriga* (Correia, 1993), Monte Figueiró and Castro de Alvaiázere (Félix, 2006). These sites must have played a pivotal role in the settlement organization along this route since the Late Bronze Age. Monte da Pega –Zambujal, Condeixa-a-Nova–, a fourth site possibly occupied at the same time, considering some ceramics picked up at the surface, has a strategic location as well, providing a view of the entire Rabaçal slump valley, looking over Monte Figueiró.

With the arrival of the Phoenician traders along the Atlantic coast, in the 8th century BC, a reorganization of the regional settlement pattern took place. At the transition between Late Bronze Age and Early Iron Age, Monte Figueiró, became less important than in the Late Bronze Age (Vilaça, 2015: 39-40), while *Conimbriga* started to increase its crucial position (Alarcão, 1999). Castro de Alvaiázere was another important node that structured these axes of circulation, and special reference should be made to the existence of several metal deposits in its periphery, which eloquently illustrate its importance in the Late Bronze Age and the transition to the Iron Age. In any case, the reason why this settlement seems to have been abandoned after the 8th century BC is still unclear.

Even if the impact of Phoenicians is still to be evaluated, the three socketed arrowheads from Monte Figueiró with their Orientalizing style and a chemical composition so different from the local metallurgical tradition suggest that these artefacts were incorporated in the material repertoire of the

[14] Neves, S.: *O Crasto de Tavarede (Figueira da Foz) no quadro das problemáticas da I Idade do Ferro no Baixo Mondego*. Unpublished Master Thesis defended in 2013 in the Univ. of Coimbra.

local communities, being also possible that they were produced locally. In this regard, the presence of a mould for socketed arrowheads likely found at Ampurias (Sánchez Mesenguer, 1974: 101; González Prats, 1982: 260; Lorrio *et al.*, 2016: 60) proves that the Iberian Peninsula was a manufacturing centre of this type of artefacts, also demonstrating that local metalworkers had the required skills for producing these exogenous artefacts.

Even if this paper does not aim to discuss the function of the Iron Age arrowheads, this aspect could be crucial for a better understanding of how this incorporation happened, also shedding light on the actual relationships between foreign people and local communities. For example, is the occurrence of this kind of artefact incidental? Or may it suggest some any kind of conflict between the local communities and the newly arrived people? And how were these novelties assimilated?

Even when other functions were also critically discussed –i.e. measurement units for trading (Ferrer, 1995)–, most researchers think these arrowheads were clearly high-value weapons, revealing the introduction of a new fighting technique, strongly influenced by Oriental military art, in which archers would have had a relevant role, fighting side by side with the lancers (Torres, 2002: 266, 270; Lorrio *et al.*, 2016: 62). Thus, arrowheads would be linked to war and violence rather than to hunting (Ferrer, 1995; Kaiser, 2003: 79, 89; Lorrio *et al.*, 2016: 61).

Around that same period, fauna contexts point at the widespread and prevailing consumption of domesticated species, such as *Sus domesticus*, *Capra hircus*, *Ovis aries* and *Bos taurus* prevailed (Cardoso, 1996 and 2004: 240). Hunting probably acquired a particular status, more social and symbolic, associated with the male elite as seen in the hunting with bow scene depicted on the standing stelae of São Martinho II –Castelo Branco– (Almagro Basch, 1966).

In the absence of data confirming the exclusive use of Iron Age socketed arrowheads in a war theatre, it should be stressed that the three artefacts from Monte Figueiró bear marks of violent use, namely bent tips resulting from strong impacts that could have only been caused by hitting a highly resistant obstacle. Analysis of a statistically more representative sample of arrowheads from the Iberian confirmed the presence of deformation and fragmentation in more than half of the items (Ferrer, 1995: 94). On the contrary, the arrowhead from Castro Marim has a well-preserved distal extremity, therefore with no traces of use. However, it was found in an area adjacent to the bunker wall identified in the castle of Castro Marim (Arruda *et al.*, 2017: 453, fig. 8).

In this regard, the possibility that these artefacts were related to war-making activities represents a crucial point to discuss how the Phoenician colonisation took place in the Western Mediterranean, and whether this process was characterized by integration or conflict with the indigenous communities. According to Kaiser (2003: 87), for example, if one accepts the use of arrowheads as weapons, the pacifism invoked to describe the relations between the indigenous and the Phoenicians would lose credibility.

Furthermore, the presence of defensive walls at Santa Olaia, in the lower course of River Mondego, used to protect the urban fabric and the 'industrial' areas, or even in other Orientalizing contexts from Portuguese territory, such as Castro Marim, Tavira –South Portugal– and Almaraz –Central Portugal–, at the mouth of the Tagus river, could testify some concern in keeping settlements safe from external threats. However, on the other hand, the absence of such weapons in certain key Phoenician-founded sites, or in indigenous sites where the Phoenicians prevailed or were absorbed, could suggest a more complex process, with different degrees of integration or confrontation.

Unfortunately, archaeological information from Monte Figueiró is mostly unknown and rather inconsistent, and no further considerations can be added in this regard. However, some clues such as: a) the strategic position of the site in a region allowing east-west and north-south contacts between Mediterranean and Atlantic, on one side, and Atlantic coast to inland, on the other; b) the dominant position in the landscape of Monte Figueiró,

providing a wide visual control over the surrounding area; and c) the archaeological materials attesting its prolonged occupation, allows to infer the importance of this site as a place from which local communities managed contacts –through integration or clash– with foreign communities.

7. Final remarks

Despite being a small collection with no information about the archaeological context of discovery, the three socketed arrowheads with spur from Monte Figueiró are a very interesting discovery. Indeed, their presence allows to address issues on the role that this settlement had within the regional population dynamics following the early contacts with Phoenician traders since the 8th century BC in Central Portugal and on the mechanisms allowing Phoenician/Mediterranean elements to penetrate and spread along the Atlantic coast of Iberia and, by east-west circulation axis, until inland regions.

Some points about the arrowheads from Monte Figueiró should be further highlighted, namely:

a) they belong to a type virtually unknown in the Portuguese territory, appearing in a region quite distant from its core location (i.e. South and South-East of Spain);
b) they are made of leaded copper, i.e. a type of alloy very scarcely diffused in Central and Northern Portugal, while their dendritic micro-structures suggest that arrowheads were likely mass-produced and post-casting treatments were not necessarily applied;
c) they show signs of violent use, compatible with their respective, and effective function, thus giving some clues to evaluate the conflicting or peaceful nature of the contacts the indigenous communities and the Phoenicians;
d) they prove the existence of a connection between Central Portugal and the Phoenician/Orientalizing world of Iberia.

The presence of these three weapons at a site located in Central Portugal, constitutes another important contribution for the study of the Phoenician expansion along the Atlantic coast of Iberia. Other materials from Monte Figueiró, and other surrounding sites as those of the Mondego estuary, had previously indicated that the Phoenician expansion clearly went beyond its traditionally accepted geographical boundaries. Nevertheless, the new data, precisely due to their intrinsic meaning, provides a more accurate picture of this process. In turn, the relatively inland location of Monte Figueiró hints at the penetration of Mediterranean influence by land, along a route running parallel to the coast which had been previously used. Such road was an alternative route, though less complete, to the usual maritime route.

Furthermore, the fact that these artefacts were related to war-making activities and the presence of defensive walls in sites founded by the Phoenicians, or inhabited by people of Phoenician descent, such as, for example, Santa Olaia, Castro Marim, Tavira and Almaraz suggests that the settlement of exogenous populations in previously occupied territories triggered some tension between the two human groups operating in those areas. Unfortunately, the absence of chronological data for the Monte de Figueiró wall does not allow to assess whether this structure corresponds to the 'Orientalizing' occupation of the site.

Bibliography

Alarcão, J. (1999): *Conimbriga. O chão escutado*. Lisboa: Edicarte.

Almagro Basch, M. (1966): *Las estelas decoradas del Suroeste Peninsular*. Bibliotheca Praehistorica Hispana, VIII. Madrid: CSIC.

Arruda, A. M. (1999-2000): *Los fenicios en Portugal: Fenicios y mundo indígena en el centro y sur de Portugal*. Cuadernos de Estudios Mediterránea, 5-6. Barcelona: Univ. Pompeu i Fabra.

Arruda, A. M. (2008): "Estranhos numa terra (quase) estranha: os contactos pré-coloniais no sul do território actualmente português". In Celestino, S.; Rafael i Fontanals, N. and Armada, X.-L. (eds.): *Contacto cultural entre el Mediterráneo y el Atlántico*

(siglos XII-VIII ane): la precolonización a debate. Madrid: CSIC, pp. 355-370.

Arruda, A. M. (2014): "Intercultural Contacts in the Far West at the Beginning of the 1st millennium BC: through the looking-glass". In Babbi, A.; Bubenheimer-Erhart, F.; Marín-Aguilera, B. and Muhl, S. (eds.): *The Mediterraneam Mirror. Cultural contacts in the Mediterranean Sea between 1200 and 750 B.C.* Heidelberg: Schnell & Steiner, pp. 269-283.

Arruda, A. M. (2019): "Phoenicians in Portugal". In Doak, B. R. and López-Ruiz, C. (eds.): *The Oxford Handbook of the Phoenician and Punic Mediterranean*. Oxford: OUP, pp. 603-616.

Arruda, A. M.; Oliveira, C. and Freitas, V. T. (2017): "Castro Marim entre indígenas, fenícios e tartésicos". In Jiménez Ávila, J. (ed.): *Sidereum Ana III. El río Guadiana y Tartessos*. Mérida: CSIC, pp. 445-466.

Arruda, A. M.; Soares, A. M.; Freitas, V. T.; Oliveira, C. F.; Martins, J. M. and Portela, P. (2013): "A cronologia relativa e absoluta da ocupação sidérica do Castelo de Castro Marim", *Saguntum*, 45, pp. 101-114.

Bottaini, C.; Giardino, C. and Paternoster, G. (2012): "Estudo de um conjunto de machados metálicos do Norte de Portugal". In Dias, M. I. and Cardoso, J. L. (eds.): *Actas IX Congresso Ibérico de Arqueometria (Lisboa, 2011)*. Estudos Arqueológicos de Oeiras, 19. Oeiras: Câmara Municipal de Oeiras, pp. 19-34.

Bottaini, C.; Vilaça, R.; Schiavon, N.; Mirão, J.; Candeias, A.; Bordalo, R.; Paternoster, G. and Montero-Ruiz, I. (2016): "New insights on Late Bronze Age Cu-metallurgy from Coles de Samuel hoard (Central Portugal): A combined multi-analytical approach", *Journal of Archaeological Science: Reports*, 7, pp. 344-357.

Cardoso, J. L. (1996): "Bases de subsistência em povoados do Bronze Final e da Idade do Ferro do território português. O testemunho dos mamíferos". In Alarcão, J. and Palma, I. (eds.): *De Ulisses a Viriato. O primeiro milénio a. C.* Lisboa: Museu Nacional de Arqueologia, pp. 160-170.

Cardoso, J. L. (2004): *A Baixa Estremadura dos finais do IV milénio a. C. até à chegada dos Romanos: um ensaio de História Regional*. Oeiras: Estudos Regionais de Oeiras.

Correia, V. H. (1993): "Os materiais pré-romanos de Conímbriga e a presença fenícia no Baixo vale do Mondego". In Tavares, A. (ed.): *Os Fenícios no Território Português*. Estudos Orientais, IV. Lisboa: Instituto Oriental, pp. 229-283.

Coutinho, J. E. R. (1994): "Monte Figueiró". In Pereira, I. (ed.): *Idade do Ferro. Catálogo*. Figueira da Foz: Câmara Municipal, pp. 113-115.

Coutinho, J. E. R. (1995): "Moedas hispano-romanas do Monte Figueiró", *Conimbriga*, XXXIV, pp. 191-204.

Félix, P. (2006): "O final da Idade do Bronze e os inícios da Idade do Ferro no Ribatejo Norte (Centro de Portugal): uma breve síntese dos dados arqueográficos", *Conimbriga*, XL, pp. 65-92.

Ferrer, E. (1995): "Sobre la hipotética función premonetal de las puntas de flecha orientalizantes de la Península Ibérica". In García-Bellido, M. P. and Centeno, R. (eds.): *Actas I Encuentro Peninsular de Numismática Antigua. Anejos de Archivo Español de Arqueología*, XIV, pp. 91-95.

Ferrer, E. (1996): "Sistematización de las puntas de flecha orientalizantes, aspectos terminológicos y tipológicos", *Antiquitas*, 7, pp. 45-52.

Figueiredo, E.; Senna-Martínez, J. C.; Silva, R. J. C. and Araújo, M. F. (2009): "Orientalizing Artifacts from Fraga dos Corvos Rock Shelter in North Portugal", *Materials and Manufacturing Processes*, 24 (9), pp. 949-954.

Figueiredo, E.; Silva, R. J. C.; Senna-Martínez, J. C.; Araújo, M. F.; Fernandes, F. M. B. and Vaz, J. L. I. (2010): "Smelting and recycling evidences from the Late Bronze Age habitat site of Baiões (Viseu, Portugal)", *Journal of Archaeological Science*, 37 (7), pp. 1623-1634.

García Guinea, M. A. (1967): "Las puntas de flecha con anzuelo y doble filo y su proyección hacia Occidente", *Archivo Español de Arqueología*, 40, pp. 69-87.

Garcia i Rubert, D.; Gracia, F.; Montero-Ruiz, I.; Moreno, I. and Rovira, M. C. (2007): "Estudio de composición mediante ED-XRF de materiales metálicos del asentamiento Protohistórico de Sant Jaume Mas D'en Serrà (Alcanar, Montsià, Tarragona)". In Molera, J.; Farjas, J.; Roura, P. and Pradell, T. (eds.): *Actas VI Congreso Ibérico de Arqueometría*. Gerona: Univ. de Gerona, pp. 145-152.

Giardino, C. (1995): *Il Mediterraneo occidentale fra il XVI e l'VIII sec. a. C. Cerchie minerarie e metallurgiche - West Mediterranean between 14th and 8th century B.C. Mining and metallurgical spheres*. BAR Intern. Ser., 612. Oxford: Archaeopress.

González Prats, A. (1982): "Las puntas de flecha con arpón de la Sierra de Crevillente (de protohistoria alicantina, i)", *Ampurias*, 44, pp. 257-262.

Jiménez Ávila, J. (2006): "Los objetos de bronce y hierro". In Jiménez Ávila, J. (ed.): *El conjunto orientalizante de Talavera la Vieja (Cáceres)*. Memorias del Museo de Cáceres, 5. Cáceres: Junta de Extremadura, pp. 89-108.

Kaiser, J. M. (2003): "Puntas de flecha de la Edad del Bronce en la Península Ibérica. Producción, circulación y cronología", *Complutum*, 14, pp. 73-106.

Lorrio, A.; Pernas, S. and Torres Ortiz, M. (2016): "Puntas de flecha orientalizantes en contextos urbanos del Sureste de la Península Ibérica: Peña Negra, La Fonteta y Meca", *Cuadernos de Prehistoria y Arqueología de la uam*, 42, pp. 9-78.

Mancedo, J. and Ferrer, E. (1988-1989): "Aproximación a la problemática de las puntas de flecha en el período orientalizante. El yacimiento de Pancorvo (Montellano, Sevilla)", *Zephyrus*, xli-xlii, pp. 315-330.

Martín Ruiz, J. A. (2012): "Importaciones fenicias en la provincia de Córdoba durante el Período Orientalizante", *Antiquitas*, 24, pp. 153-161.

Montero-Ruiz, I. (2008): "Ajuares metálicos y aspectos tecnológicos en la metalurgia del Bronce Final-Hierro en el Sudeste de la Península Ibérica". In Lorrio, A. J.: *Qurénima. El Bronce Final del Sureste de la Península Ibérica*. Alicante: rah/Univ. de Alicante, pp. 499-516.

Montero-Ruiz, I.; Santos, M.; Rovira, M. C.; Renzi, M.; Murillo-Barroso, M.; Hunt, M.; Gener, M. and Castanyer, P. (2010-2011): "Lingotes plano-convexos de cobre en la primera mitad del i milenio a. C. en la Península Ibérica", *Boletín de la Asociación Española de Amigos de la Arqueología*, 46, pp. 99-119.

Pereira, I. (1993-94): "Casais agrícolas da Idade do Ferro na Foz do Mondego, Figueira da Foz", *Conimbriga*, xxxii-xxxiii, pp. 75-85.

Pereira, I. (2009): "As actividades metalúrgicas na iª e iiª Idade do Ferro em Santa Olaia, Figueira da Foz", *Conimbriga*, xlviii, pp. 61-79.

Quesada, F. (1988): "Nuevas puntas de flecha de anzuelo en Andalucía Occidental", *Ariadna*, 5, pp. 3-15.

Quesada, F. (1989): "La utilización del arco y las flechas en la Cultura Ibérica", *Trabajos de Prehistoria*, 46, pp. 161-201.

Quesada, F.; Casado, M. and Ferrer, E. (2014): "El armamento". In Fernández Flores, A.; Rodríguez Azogue, A.; Casado, M. and Prados, E. (eds.): *La necrópolis de época tartésica de la Angorrilla, Alcalá del Río, Sevilla.* Sevilla: Univ. de Sevilla, pp. 351-378.

Ramón, J. (1983): Puntas de flecha de bronce fenicio-púnicas halladas en Ibiza: algunos materiales inéditos. In Fernández-Miranda, M. (ed.): *Homenaje al Prof. M. Almagro Basch*, ii. Madrid: Ministerio de Cultura, pp. 309-323.

Renzi, M. (2010): "La producción de 'lingotes-hacha' en el Levante peninsular: nueva valoración a partir de los materiales de La Fonteta (Guardamar del Segura, Alicante)", *Revista d'Arqueología de Ponent*, 20, pp. 127-143.

Renzi, M.; Montero-Ruiz, I. and Bode, M. (2009): "Non-ferrous metallurgy from the Phoenician site of La Fonteta (Alicante, Spain): a study of provenance", *Journal of Archaeological Science*, 36 (11), pp. 2584-2596.

Rocha, A. S. (1971): *Memórias e Explorações Arqueológicas. Vol. ii. Estações pré-romanas da Idade do Ferro nas vizinhanças da Figueira*. Acta Universistatis Conimbrigensis. Coimbra: Univ. de Coimbra.

Rodríguez Cordones, M. R. (1996): "Dos ejemplares de puntas de flecha de época orientalizante em Coria del Río (Sevilla)", *Spal*, 5, pp. 225-231.

Rovira, S.; Montero-Ruiz, I.; Ortega, J. and Jiménez Ávila, J. (2005): "Bronce y trabajo del bronce en el poblado orientalizante de 'El Palomar' (Oliva de Mérida, Badajoz)". In Celestino, S. and Jiménez Ávila, J. (eds.): *El Periodo Orientalizante*. Anejos de AEspA, xxxv. Mérida: csic, pp. 1231-1240.

Sánchez Meseguer, J. (1974): "Nuevas aportaciones al tema de las puntas a barbillón", *Cuadernos de Prehistoria y Arqueología de la uam*, 1, pp. 71-101.

Scott, D. A. (1991): *Metallography and Microstructure in Ancient and Historic Metals.* Oxford: oup.

Torres, M. (2002): *Tartessos*. Madrid: rah.

Vilaça, R. (2008): "Reflexões em torno da presença mediterrânea no Centro do território português, na charneira do Bronze para o Ferro". In Celestino, S.; Rafael i Fontanals, N. and Armada, X.-L. (eds.): *Contacto cultural entre el Mediterráneo y el Atlántico (siglos xii-viii a.n.e.): la precolonización a debate*. Madrid: csic, pp. 371-400.

Vilaça, R. (2012): "Arqueologia do Bronze no Centro-Sul da Beira Litoral e Alta Estremadura (ii-i milénios a. C.)". In Emerita-Empresa Portuguesa de Arqueologia (eds.): *Actas Colóquio Olhares sobre a História, a Arqueologia e a Geologia de Vila Nova e da*

Serra da Lousã. Vila Nova/Miranda do Corvo: Junta de Freguesia de Vila Nova, pp. 16-32.

Vilaça, R. (2013): "Late Bronze Age: Mediterranean impacts in the Western End of the Iberian Peninsula (actions and reactions)". In Aubet, M. E. and Pau, S. (eds.): *Interacción social y comercio en la antesala del colonialismo: los metales como protagonistas*. Cuadernos de Arqueología Mediterránea, 21. Barcelona: Univ. de Barcelona, pp. 13-30.

Vilaça, R. (2015): "Dados e Reflexões sobre a Arqueologia Pré-Romana da Região de Penela". In Neto, M. S. (ed.): *Penela. Um Percurso pelo Tempo*. Penela: Palimage, pp. 21-50.

Vilaça, R. (2016): "A Idade do Bronze na Alta Estremadura: depósitos metálicos e sua conexão com o espaço". In *I Congresso de História e Património da Alta Estremadura*. Ourém: Centro do Património da Estremadura, pp. 113-137.

Vilaça, R.; Almeida, S.; Bottaini, C.; Marques, J. N. and Montero-Ruiz, I. (2011): "Metalurgia do castro do Cabeço da Argemela (Fundão): formas, conteúdos, produções e contextos". In Martins, C. M. B.; Bettencourt, A. M.; Martins, J. I. and Carvalho, J. (eds.): *Actas 1.º Congresso Internacional. Povoamento e Exploração de Recursos Mineiros na Europa Atlântica Ocidental*. Braga: citcem, pp. 427-452.