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Metal trade of the Phoenicians in Huelva

ABSTRACT: *This paper, first outlined in the Final Conference of the Leibniz Graduate School RITaK, studies the structures of copper and silver production around the waterways of the Odiel and Tinto rivers in the last phase of the Final Bronze Age /Early Iron Age (late 10th – mid-8th century BC). The evidence suggests that these metals, along with tin, bronze and lead, formed a major focus of Phoenician trade in the port of Huelva during this period.*

KEYWORDS: MINING-METALLURGICAL EXPLOITATION, COAST-HINTERLAND CONNECTIONS, METAL TRADING, PHOENICIANS

Introduction and approach

From its beginning, the port of Huelva was an important centre for Phoenician trans-Mediterranean expansion, with access to copper and argentiferous ores from the surrounding hinterland as well as other locally manufactured metals such as bronze (copper-tin). The Final Bronze Age shows an increased extraction of copper in the northern mining area for bronze production and accordingly a growing need for tin. The demand for tin was fulfilled by the Phoenicians, who had transported it safely from other regions of the northwestern Iberian Peninsula as early as the 10th century BC. The same period also provides evidence for an exponential growth in silver exploitation in the mines of the Sierra Morena, especially at Riotinto, the production of which required lead. It was sometimes necessary to import this from other regions, and it is generally assumed that the Phoenicians participated in its procurement.

The mining-metallurgical exploitation of copper and silver

During the Final Bronze Age copper mining expanded throughout the Andévalo area and northeast of the zone of El Condado. Mining operations were executed to extract minerals like malachite and azurite, the outcrops of which usually occur above copper sulfate with surface copper carbonates (Pérez, 2008). These minerals develop in the process of oxidation and under the weathering phenomena of sulphide ores in later phases –$Cu_2S \rightarrow CuSO_4 \rightarrow CuCO_3$–, and especially when the action of groundwater is related (Tylecote, 1962, p.22). Mining activities in this period were executed in two main areas, that is, either lode structures or the surface of the polymetallic massive sulphide deposits. While lodes usually occur on the surface in oxidized outcrops where copper minerals are associated with quartz veins embedded in slates, the mineralizations of exogenous copper present in the large sulphide masses are precipitated in the form of carbonates in contact with the slates (Hunt, 1992, p.85; Pérez and Rivera, 2012, pp.493-494). In the vicinity of these mineral occurrences, surveys confirm the presence of numerous grooved stone hammers which were used systematically during this period to extract copper by trenches (Pérez, 2013, p. 458) or through well systems (Hunt, 1992, p.85; Hunt, 2003, p.86 fig. 47).

During the transition from the Final Bronze Age to the Orientalizing period, which coincides with the strengthening of Phoenician presence in the southwest, there was a productive reorientation of mining operations. Exploitations were concentrated in the large massive sulphide deposits in order to obtain silver, as in the case of Riotinto which was the main source of the extraction of argentiferous ores during this phase. The Riotinto area is dominated by iron oxide and hydroxide on the surface, i.e. the gossan that develops from the erosion and oxidation of primary sulphides (Velasco, et al., 2013, p.181). Under this iron cap, the action of water and a natural leaching process generated new formations: ores enriched with silver and to a lesser degree, gold. Silver appears in these levels in the form of sulfosalts – antimonides and arsenides – which accumulate forming jarositic ores during the oxidation process: jarosite, argentojarosite and plumbo-jarosite. The silver-bearing jarosites were generally extracted using grooved stone hammers on the earth's surface; another means of accessing the argentiferous jarosites was by the sides of the ores on the slope. This has been documented at Riotinto, whose formations occured 50-70 m below the topographic surface (Pérez and Delgado, 2007, p.290).

It has been suggested that the Riotinto deposits, whose jarositic layer could contain up to 3110 ppm Ag, were deficient in lead (Dutrizac et al., 1983, pp.79-80). Therefore, lead must have been brought into this region and/or imported from other places in order to smelt it together with the jarosite: the former acted as a collector to cupel the silver (Craddock, 1995, p.217). This conclusion was recently verified by a chemical and isotopic analysis of the remains of silver-bearing slags from the stratigraphic section RT-25 of Corta Lago. Evidence at Corta Lago may suggest that in the absence of plumbo-jarosite in the ore, extra lead was added during the smelting process from the Final Bronze Age to at least the 2nd century AD (Anguilano et al., 2011, pp.274-275). This would also explain the discovery of Roman lead ingots stamped with *Nova Carthago* that originated in Cartagena (Domergue, 1987, p.241). However, evidence for litharge in the stratigraphic section RT-26A corresponding to the Orientalizing Final Bronze Age, whose isotopic signature is consistent with the Iberian Pyrite Belt, appears to demonstrate a local presence of lead and also use of nearby available resources (Craddock et al., 1985, p.209; Stos-Gale, 2001, p.57).

Micro-regional study of productive organisation and distribution

At the beginning of the 1st millennium BC, settlement patterns were forged in response to economic needs. Sites were chosen based on mining-metallurgical and farming possibilities (see Fig. 1); they were often situated along riverbanks to facilitate distribution and trading (Ruiz Mata, 1990, p.394). Most of copper extraction sites and silver production centres were located in the basins of the rivers Tinto and Odiel, the riverbeds of which were navigable at that time and less silted than they are today; the Tinto led to Niebla and the Odiel to Gibraleón (Campos et al., 1990, p.90). The interior land routes lay along both rivers, and the disposition of these roads closely coincides with the routes known later in the Roman era (Ruiz Acevedo, 1999). Such land routes were important communication means by which raw materials were brought to the polynuclear settlement of Huelva which itself was the site of skilled artisanal workshops and the metallurgical productions of which were involved in Phoenician trade.

Therefore, prior to the arrival of the Phoenicians, there is strong evidence for population establishment in the southwest from the Final Bronze Age which maximized the mining-metallurgical resources that were available (Gómez, 2006, p.27 fig. 1 and pp.38-40). Copper production was largely carried out in mining-metallurgical seasonal camps. Superficial works in form of trenches have been identified at these sites, with ceramics dating to the Final Bronze Age and copper slags, suggesting that copper ores received an initial treatment at the pithead. There is also a large number of extraction sites where grooved stone hammers were found; these are chronologically assigned to the Final Bronze Age, because of the absence of ceramics of Phoenician typology. Thus, the evidence suggests an intensification of copper production, primarily for local or domestic supply (Pérez, 1996, p.167), although some of the goods were probably produced for outside markets and taken to the port of Huelva. At Huelva in the lower zone between Plaza de las Monjas 12 and Calle Méndez Núñez 7-13, copper sulfide ores, crucibles and copper smelting slags have been documented (González de Canales et al., 2004, pp.145-154).

In the same period, the extraction of argentiferous ores was concentrated mainly on the massive sulphide masses at Riotinto, where the mining population smelted silver-bearing jarosites *in situ*, as evidenced in the stratigraphic sections RT-26A and RT-25 of Corta Lago (Rothenberg et al., 1989, p. 62; Pérez, 1996, pp.79-97). The presence of litharge at the beginning of the stratum in RT-26A (Pérez Macias, 1999, p.78), a sub-product resulting from the cupellation (Hunt, 2003, p.369), highlights the existence of a entire mining-metallurgical process of silver recovery which was destined directly for trade and distribution. From Riotinto must have also left untreated argentiferous jarosites as raw material toward the settlements located in the lowlands and port area of Huelva, considering the amount of free silica slags, associated with ceramics from Final Bronze Age, found around the municipalities of Bonares and Lucena del Puerto (Fig. 1). The walled *oppidum* of Niebla must have played a key role as an inner harbour for transporting argentiferous productions from Riotinto to the coast, and as a redistribution centre supplying the jarosite ores smelted in satellite settlements and/or workshops and other places connected to Huelva, such as Los Bojeos, strategically situated on the bank of the Tinto river (Pérez, 2007, pp.253-254).

Finally, the suggestion that jarositic minerals smelted in the Huelva port area were extracted mainly in Riotinto is made because of the presence of archaeometallurgical evidence in datable contexts of the Orientalizing Final Bronze Age in the periphery, the hillocks and the low-lying zones of the city (Fig. 1). In the periphery of Huelva free silica slags and remains of ashes were identified, which might correspond to melting furnaces at the site of Pozancón (Pérez, 1996, pp.129-130; Gómez, 1997, pp.213-214; Gómez, 2002, p.21); besides, uncovered in the settlement of Vista Alegre were free silica slags, pottery with scorification adhered inside and colanders, which reveal the existence of silver production areas at the household level (De Haro et al., 2009, p. 1788; Gómez et al., 2013). With respect to the hillocks of Huelva, free silica slags were documented in the levels 5a and 5b of the San Pedro Hill (Blazquez et al., 1989, pp.16-17) and the sublayer 3b of the section on the western slope of La Esperanza Hill (Fernández, 1990, p. 106). At the foot of La Esperanza, in two zones located on the corner of Fernando el Católico/San Salvador and San Salvador 2,

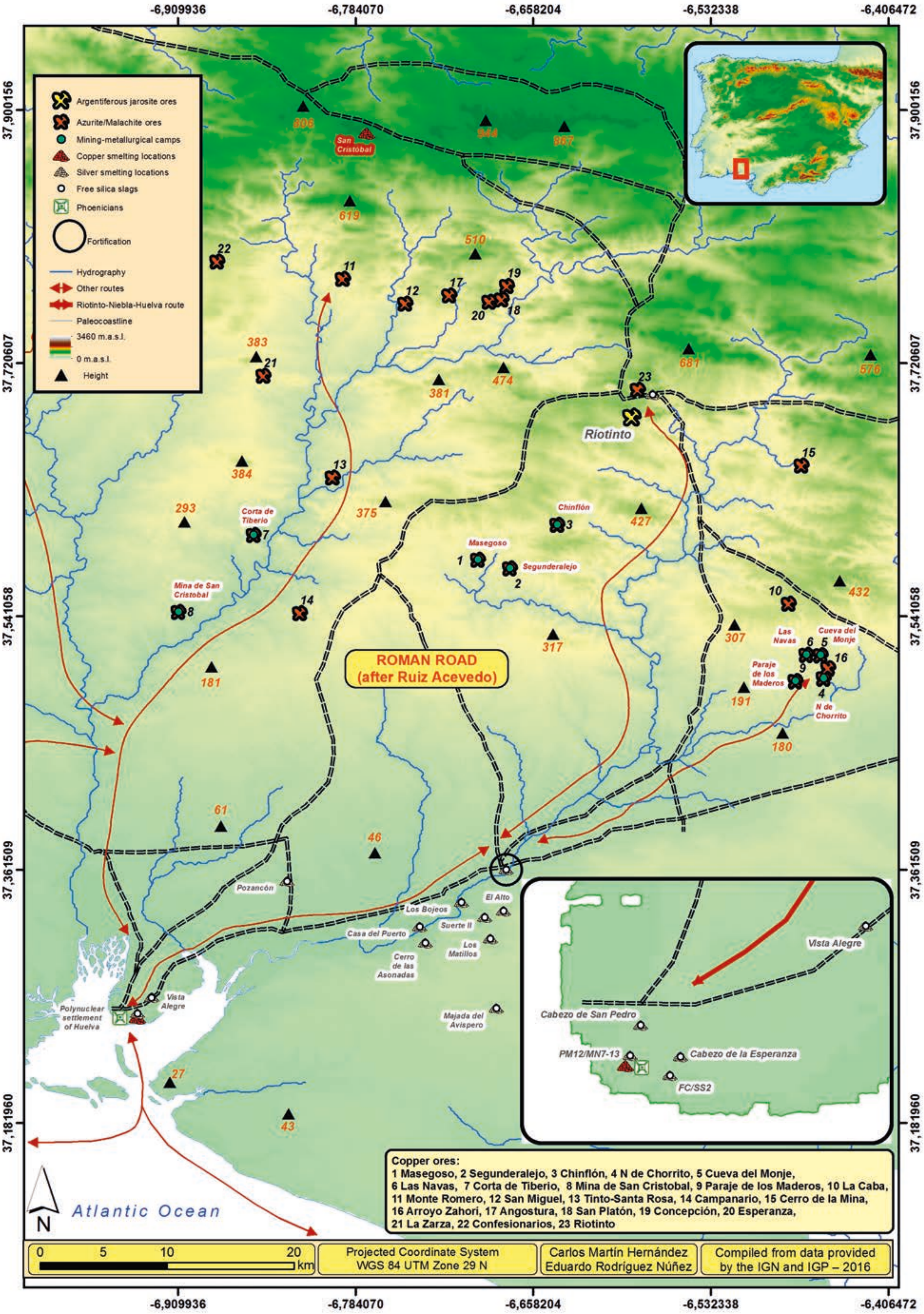

Fig. 1. Metallurgical production and distribution in the hinterland of the Tartessian southwest between late 10th - mid-8th century BC (graphic: Carlos Martín Hernández and Eduardo Rodríguez Nuñez).

free silica slags were found which date to older stratigraphic levels around the middle of the 8th century BC composed mostly of materials dragged from the top of the aforementioned hill (López et al., 2002, p.314; Gómez et al., 2002, pp.316-317). Lastly, it should be noted that cylindrical and cubic tuyeres, lead sheets and drips, free silica slags and a fragment of galena were identified in an assemblage recovered in the area between Plaza de las Monjas 12 and Calle Méndez Núñez 7-13 (González de Canales et al., 2004, pp.145-156). Thus, there is strong evidence for the importance of Huelva, not only as a commercial port but also as metallurgical production centre from as early as the most archaic phase of documented Phoenician presence.

Bronzes and tin circulation in the Atlantic and the Mediterranean during the Pre-colonial period

The last phase of the Final Bronze Age, dated to 940-750 BC (Ruiz-Gálvez, 1995, p.82) documents a period of transition in the Southwest which was characterized by a strategical change in mining-metallurgical production: the extraction of surface copper carbonates decreased, and by contrast, the recovery of silver-bearing jarosites present in oxidized outcrops at the gossan intensified (Pérez, 2007, p.252). This process must be contextualized and understood within the dynamics of the trade of copper-based objects and tin, which took place in the Atlantic region throughout the Late Bronze Age (Vilaça, 2007, pp.136-137). These trade exchanges must have been motivated by the advent of the Phoenicians, who were fundamental players in supplying and redistributing prestige goods and all kinds of wares throughout the Mediterranean basin from 1st millennium BC. From the Anatolian (Dercksen, 1996, pp.79-80) and Assyrian archives (ARAB, I, § 44 and 223) it can be deduced that both copper or bronze and silver formed part of the capitalization system and were used in tax operations and as currency in commercial transactions in the Near East during the Neo-Assyrian period (Radner, 1999, p.128). Copper supply sites in the Levant (Hauptmann and Löffler, 2013, pp.77-80) and Cyprus (Kassianidou, 2012, pp.230-237) or Anatolia (Wagner and Öztunali, 2000, p.47) remained in operation during this period, invalidating the suggestion that the main incentive of Phoenician expansion into the far west was the acquisition of this metal, although it is possible that they were interested in finding tin and already manufactured objects of bronze (Pérez, 2013, p.461). This should be understood in the context of the beginning of the Assyrian interests in western Syrian-Palestinian territory from the 10th century BC and the disrup-

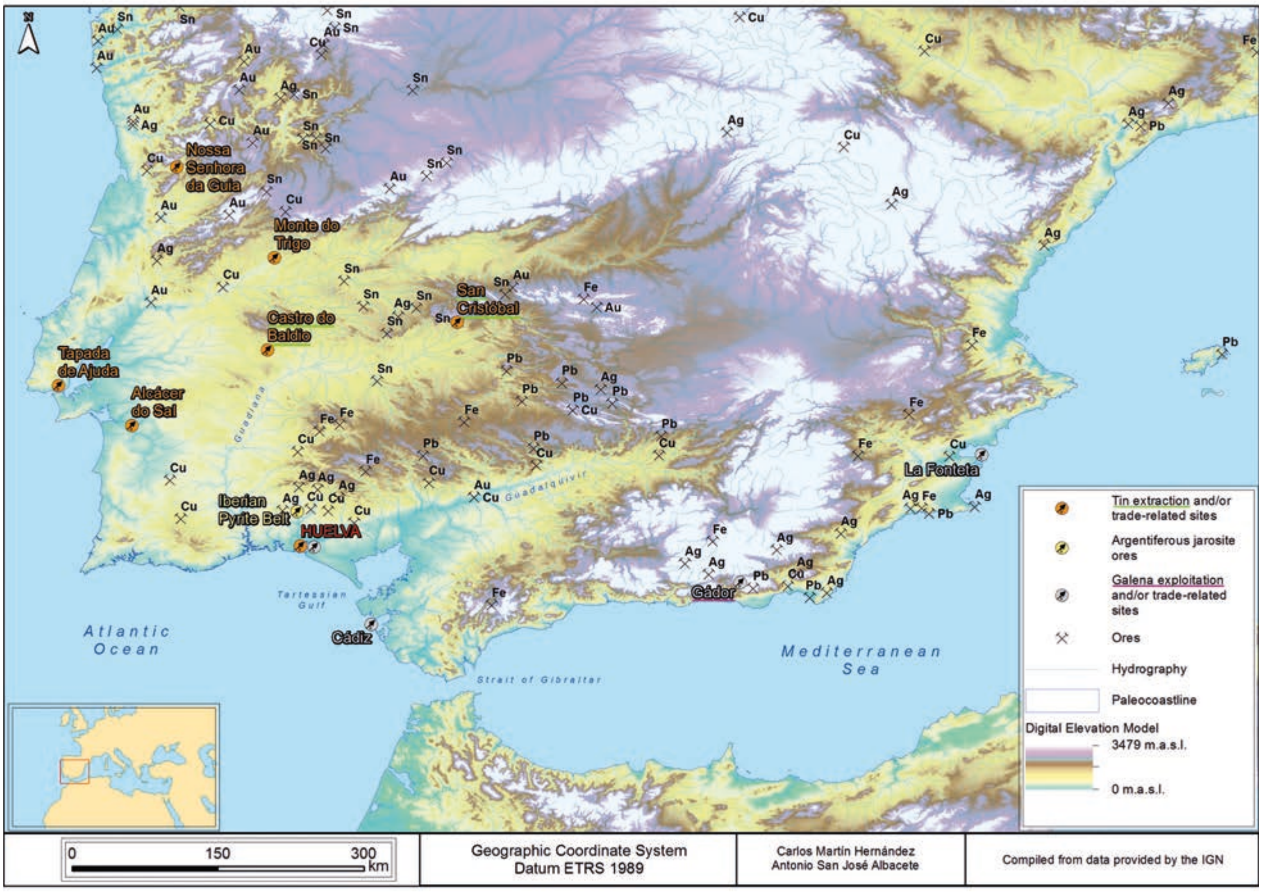

Fig. 2. Primary mining deposits and sites related to the mining and trade of tin/lead on the Iberian Peninsula Map (graphic: Carlos Martín Hernández and Antonio San José Albacete).

Fig. 3. Finds from Ría de Huelva associated with and/or originating in the Eastern Mediterranean (illustrated by Alvaro Martín Martín).

tion of the supply of Iranian tin towards the Levant and Cypriot coast, which thereafter the Phoenicians provided having brought it from the western Mediterranean (Zaccagnini, 1990, p.498).

The Iberian Peninsula was in this sense a privileged place concerning the exploitation of tin. With respect to its production and use, there are some testimonies of great interest (Fig. 2), for example the find of a tin sheet with perforations associated with the preparatory work of bronze, identified in the stratum with Phoenician materials of oldest chronologies in Huelva (González de Canales et al., 2004, pp.150-151). This may be related to the development of a new bronze metallurgy involving the alloy of metallic copper and tin, a procedure verified in objects from Carmona in an Orientalizing context (Rovira, 2007, p.21 and pp.31-33). Within the same set, typical carenated bowls of the Cogotas I horizon and bowls with pseudo-grooved decorations were also identified, with parallels in Extremadura and Portuguese regions; this refers to the establishment of relationships with areas being rich in stanniferous resources (González de Canales et al., 2004, p.129; 191). Other significant finds come from another port context in Tapada de Ajuda at Lisbon where tin slags were registered (Bettencourt, 1998, p.26). Smelting furnaces and copper slags have also come to light in Castro do Baldio in Arroches dating to moments of the Final Bronze Age, an area where there are substantial enrichments of cassiterite in alluvium (Gamito, 1996, p.40). Another relevant centre where the exploitation of cassiterite developed was identified in the Cerro de San Cristóbal of Logrosán, which should be assigned chronologically to the transition stage from the Final Bronze Age to the Orientalizing period. Here, a complex of workshop-cabins with accompanying important mining tools was documented, permitting the assessment of the operational chain for the treatment of cassiterite, the raw production of which should be associated primarily with the Peninsula's southwest in light of finds related to Tartessian area; the significant absence of slag and smelting furnaces, which have not been detected thus far, would corroborate this (Rodríguez et al., 2013, p.102 and 105). The hypothesis suggesting Phoenician involvement in the tin trade is also supported by archeological evidence: weights of the Syrian Ugaritic standard *c*.9,4 g datable to the Final Bronze Age on Portuguese territory. Examples of this type of weight were found at Nossa Senhora da Guia of Baiões and Monte do Trigo, both of which are close to areas rich in tin deposits, and Castelo de Alcacer do Sal, sited in a key strategic position for the control of the paleo-mouth of the Sado River (Vilaça, 2011, p.140; 147).

Regarding bronze production and its commercial aspect, research of the material evidence from the Ría de Huelva deposit has been fundamental. Bronzes here constitute 36% of those dated to this period on the whole Iberian Peninsula (Jiménez, 2002, p.31). The majority of these pieces are products following the Atlantic Bronze Age tradition based on the seriation of calibrated ^{14}C dates (Ruiz-Gálvez, 1995, p.79) which suggest the first three quarters of the 10th century BC (Torres, 2008, p. 64). These dates coincide with the chronological typology assigned for the carp's-tongue swords (Brandherm, 2007, p.16; Brandherm and Moskal-del Hoyo, 2010, pp. 433-437) and Elbow fibulae of Huelva type (Carrasco et al., 2012, p.322), both of which are present in the hoard and reaffirm the idea that most of these objects were deposited in a single act, also suggested by the typological ascription of most swords (Brandherm, 2007, p. 76). With respect to strictly technical criteria, the bronzes are not very leaded and contain considerable quantities of tin that exceeds 10% (Rovira, 1995a, p.500 fig. 6). Their manufacture has often been attributed to a production centre located in the southwest (Rovira, 1995b, p. 56). The lead isotope studies rule out the use of mineral resources from the Iberian Pyrite Belt, but confirm the possibility that the origin lies in other deposits located in Ossa Morena, Valle de Alcudia and even the island of Sardinia (Montero et al., 2007, p. 95; 207). This would signal the existence of intense relations between the Tartessian area and other peripheral zones of the interior which extended to other parts of the central Mediterranean in the prelude widespread Phoenician presence in the southwest. Other evidence in the deposit has been unnoticed until now and suggests some kind of connection to the Eastern Mediterranean (Fig. 3), whatever the use of these bronzes later was, the deposition of which refers to symbolic or ritual functions (Brandherm, forthcoming). Besides, the well-known conical helmet which is linked to Assyrian, Cypriot and Urartian archetypes from 9th-7th centuries BC (Schauer, 1983, pp.185-187), the presence of a weight with a biconical feature weighting 16,45 g has recently come into consideration (Vilaça, 2011, p.152). Taking into account the loss of some weight compared to its original state, it must be twice the weight of the *c*.9,4 g shekel from Syrian Ugaritic standard, one of the dominant units at the Syrian-Palestinian coast from the Early Iron Age (Parise 2006, p.19).

Exchange of lead and silver in the transition Final Bronze Age-Orientalizing period

An imposing set of finds recovered at the site located between the Plaza de las Monjas 12 and Calle Méndez Núñez 7-13 at Huelva suggests that Phoenician expansion into the far west began in the 10th - 9th centuries BC (González de Canales et al., 2004), and furthermore that Huelva connected the Atlantic region to the economic and commercial channels of the Phoenicians in the Mediterranean. If this is the case, the quote of 1 K 10, 22 which seems to mention westbound navigations in the Meditarranean and specifically the Iberian Peninsula (Koch, 2003, p.46, pp.190-196 and pp.223-236) suggests that the first commercial ventures destined for the western end of the Mediterranean began in the context of relations between the kings Hiram of Tyre and Solomon of Israel.

In the case of Huelva, archaeology suggests that the site is contemporary with the reign of Ittoba'al I and Omride dynasty in Israel (Lipinski, 2010, p.265), based on the *terminus post quem* date proposed for the most recent Phoenician ceramics found in the greyish-black stratum which can be related to pieces found in stratum IV of Tyre (González de Canales et al., 2004, p.196). Therefore, it is obvious that Phoenician presence in Huelva became standard in the mid-9th century BC, a fact that can be judged from a large number of quality ceramics of the *Fine Ware* type, with parallels in the so-called 'Salamis horizon' in Cyprus dated *c*.850-750 BC (González de Canales et al., 2006, pp.15-16). These containers must have been exports that probably came directly from the metropolis and were destined for local partners who were able to offer products in return, such as silver and, to a lesser extent, copper, used as materials for bronze alloy. Furthermore, one should not rule out the possibility that such productions were manufactured by highly skilled Phoenician artisans who were already established at Huelva (Maass-Lindemann, 2008, p.194), thus guarding their original function as introductory gifts in order to build relationships.

According to the archaeological evidence detected in the port area, Huelva became one of the most important metallurgical centres of the West in the 9th century BC. Argentiferous jarosite from Riotinto mining complex ended up here. Obtaining silver from this type of ore required the use of lead, which acts as collector for silver so that slag is not dispersed during the smelting process (Renzi and Rovira, 2015, p.121). That is why lead became an indispensable element. Due to its harbor, Huelva must have been an import center for gathering this metal from other regions. The lead isotope ratios analyzed from a fragment of galena found in the Phoenician context of Plaza de las Monjas 12-Calle Méndez Núñez 7-13 are consistent with the mining deposits at Gádor (González de Canales et al., 2004, p. 145; Murillo, 2013, p.357 and 365), where materials were exploited and distributed by Phoenician intermediation with other sites such as La Fonteta and Cádiz (Fig. 2). About the most archaic phase of La Fonteta – AFI – which dates from the first half of the 8th century BC, it has been confirmed that at least one nodule of galena – F41567 –, as well as two lead elements – F41536; F41722 – are consistent with Gádor (Renzi et al., 2009, pp.2591-2592). From the archaeological site of Cine Cómico at Cádiz some drops of lead were also characterized isotopically. These lead drops that pertain to Phase II – dated between the late 9th and first half of 8th century BC – are also congruent with the Gádor mining district (Murillo, 2013, pp.365-366). The Phoenician involvement in the trade of galena is archaeologically certified, at least from the late 7th century BC, by the presence of argentiferous galena that was documented in the wreck of Bajo de la Campana (Pinedo and Polzer, 2011, p.93). The wreck is located along a route that must have connected the southeast and the southwest of the Iberian Peninsula, since the end of the 9th century BC.

Silver production in the city of Huelva was certainly oriented towards commerce in the Eastern Mediterranean (Martín, forthcoming). The set of weights of the Syrian Ugaritic standard *c*.9,4 g found here also attest to this (González de Canales et al., 2004, pp.154-155). The close link between the weight *c*.9,4 g and the silver quantification is suggested by the evidence in Riotinto of at least two weights that correspond to twice this number rescued in excavations of Cerro Solomón and kept today in the Archaeological Museum of Seville (Jiménez, 2002, p.306 and lám. XIV, pp.176-177). A parallel of this weight with identical value was found in an industrial area where the sanctuary of the Carambolo stood in the 7th century BC, where excavators identified 14 furnaces associated with metallurgical activities for obtaining bronzes, iron and silver (Hunt et al., 2010, pp.272-273). All this evidence suggests, on the one hand, that silver production in Riotinto was adapted for market conditions established by the city and port of Huelva, and, on the other hand, that the survival of this reference weight unit is related to the acquisition of silver and other metals during the Orientalizing period.

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