THE METROLOGICAL SYSTEM OF THE FINAL BRONZE AGE BALANCE WEIGHTS AND THE PRE-ROMAN COINAGE OF ATLANTIC IBERIA: A SHARED SYRIAN STANDARD?

Abstract: The study departs from recent suggestions that locally produced balance weights from settlement sites in central Portugal, dated to the Final Bronze Age (1200-900 BCE) are based on a Late Bronze Age Syrian/Ugaritic metrological system (13th-12th c. BCE). These proposals have been based on the comparative studies of the weights of these Atlantic objects, but have not been examined rigorously in comparison with Near Eastern metrological systems, despite the claims they make. This has repercussions for the conclusions drawn so far.

The present study has a threefold aim. First, it examines this hypothesis of a Syrian derivation of metrological systems underlying the local production of balance weights in Atlantic Iberian settlements (ca. 1200-900 BCE). Secondly, it investigates whether these local balance weights bear any metrological relationship to the balance weights of Phoenician typologies encountered in Atlantic Iberian sites of the colonial period (8th-6th c. BCE). Thirdly, taking as a case study the better documented evidence from Alcácer do Sal, it examines for the first time whether these metrological systems, in use for centuries in Atlantic Iberia, underly the metrologies of the earliest, pre-Roman, locally-minted coinage, which follows Phoenician iconography but is struck using the syllabary of the indigenous languages, developed in the 8th c. BCE as an adaptation of the Phoenician script. The study suggests that the dating of the earliest group of balance weights needs to be lowered. In addition, it documents a likely derivation of the metrological system of coinage from the Phoenician milieu of Iberia, rather than the 3rd c. BCE Carthaginian metrologies, as advocated so far. This is supported by the metrological continuity between balance weights and coinage, and the latter's iconography, as the present study documents.

Keywords: *Mediterranean, Early Iron Age colonization, literacy, balance weights, coinage, Phoenician, Carthaginian*

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INTRODUCTION[1]

A recurring question in the archaeology of Atlantic Iberia in the Final Bronze Age (henceforth: FBA), dated to the 12th-9th c. BCE, concerns the putative Ugaritic, Hittite or Egyptian origin of the metrological systems of balance weights found in central-southern Portugal and Extremadura, in western Spain (Fig. 1).[2] These are objects of local production and typologies. Their chronology is based on the radiocarbon dating of

[1] Only toponyms common in English are used in an Anglicized version (e.g. *Andalousia*, not *Andalucía*).

[2] e.g. VILAÇA 2011; RUIZ GÁLVEZ-PRIEGO 2008; 2014.

associated contexts or sites. The postulation of underlying Near Eastern or Egyptian metrologies for these balance weights has led to suggestions of late 2nd millennium BCE connections between central Portugal and the Near East, that is the period of the FBA in Atlantic Iberia.

Nonetheless, the lack of substantial studies on the metrology of Iron Age Near Eastern balance weights remains an obstacle to such postulations. Given the lack of large-scale data sets that could confirm contacts between the eastern Mediterranean and the Atlantic at the end of the 2nd millennium BCE, the issue requires scrutiny. Relevant data on metrological systems in the Near East need to be examined, and any comparisons with the Atlantic metrologies should take into account the current knowledge on early interregional contacts.

A second, related topic of study has been the examination of typologically Near Eastern weights found in Atlantic Iberian sites, considered Phoenician trading posts or Orientalising settlements, during the period of Phoenician colonization (800-600 BCE). These balance weights come from sites located along the Sado and Tagus rivers (south-central Portugal). Unfortunately, the few specimens reported in the literature have not been published in excavation reports and thus their exact contexts require reconstruction based on what information there is available.

A third line of investigation has opened up in recent years regarding the metrological systems of coinage minted by indigenous polities in southern-central Portugal prior to the Roman conquest. Local mints issued coinage bearing the names of local magistrates in a variant of the indigenous script that had developed several centuries earlier (ca. 800-700 BCE). Knowledge on the coinage minted by polities in the region is generally fragmented, but the town of Alcácer do Sal (Alentejo), on the Sado estuary, has yielded representative data sets of coins issued from the beginning of the mint up to the integration of the town into the Roman administrative system. The investigation into this mint adopted a diachronic perspective.[3]

The above three areas of research have so far been examined separately, yet their shared analogous and possibly homologous traits require a diachronic investigation. Firstly, the postulation of Near Eastern metrologies underlying Atlantic FBA balance weights has arisen within trends in scholarship that favour pre-colonial contacts across the Mediterranean at the end of the 2nd millennium BCE (by agents other than the Phoenicians). Secondly, the study of the metrological systems of balance weights vis-à-vis the coinage metrologies, despite a general consensus on the interrelation between them in the field of numismatics, has not attracted any attention in this case. This leaves open the possibility that the metrology of the earliest, pre-Roman coinage was based on the metrological systems of balance weights used in the same region, introduced earlier.

The present paper examines pre-Roman metrological systems in the Atlantic Iberian region from 1200 BCE up to the Roman conquest, in south-central Portugal. It uses all the published data sets of Atlantic FBA balance weights for the pre-colonial period and of Iron Age I (henceforth: IA I) balance weights for the colonial period, as well as the most representative dataset for the pre-Roman coinage. The study region is not arbitrary. The territory was occupied by populations with shared cultural characteristics, in the material culture, social organization and language. Epigraphic studies on the language spoken in this territory suggest an Indo-European language family, distinct from the non-Indo-European family of languages spoken on the Mediterranean region of southern Spain.

The aim here is threefold, to: i) examine the postulation of Near Eastern metrological systems underlying the indigenous Atlantic FBA balance weights, ii) investigate whether a metrological continuity can be evinced between the *indigenous* balance weights of the FBA–IA I and the stylistically *Phoenician* balance weights from IA I Orientalizing sites on the Atlantic, and to iii) compare the metrologies of the earliest coinage of Alcácer do Sal in conjunction with the metrologies of IA I balance weights from the same site, with the view of testing whether a continuity in metrological systems can be established from the 7th-5th c. BCE balance weights to the 3rd c. BCE coinage, within the same settlement. The spatial congruence of the data is tight and aims for overlapping across the different three periods where evidence permits. Thus, the balance weights of Alcácer do Sal are studied in connection with the earliest coinage of Alcácer do Sal. The final part is a discussion of the evidence, taking into account a broader and more detailed, temporal and spatial perspective than so far has been attempted in reconstructions of alleged 2nd millennium BCE interconnections.

The first section summarizes first the evidence for early contacts between the eastern Mediterranean and the Atlantic and secondly, current understandings on monetization in the Iberian Peninsula. The second section presents the evidence for metrological systems in use in Atlantic Iberia: all published FBA and IA I balance weights and a representative sample of the pre-Roman coinage issued by Alcácer do Sal, along with clarifications on their contexts. The third section provides the analysis of this evidence within the spatial and temporal context, taking into account recent research on these topics in Near Eastern and Mediterranean archaeology.

THE HISTORICAL AND ARCHAEOLOGICAL CONTEXT OF COMMERCIAL EXCHANGES AND METROLOGICAL SYSTEMS

Mediterranean trade in FBA Atlantic?

Studies on the contacts between Iberia and the eastern Mediterranean/Near East in the late 2nd millennium BCE have been resurfacing for decades. They concern imported material culture and technology (potter's wheel), local copies and the iconography of alleged eastern Mediterranean objects on stone stelae.[4] The evidence is difficult to date conventionally, while the high absolute dates of the radiocarbon method have been contested on methodological grounds).[5]

[3] CORREIA 2004.

[4] ALMAGRO 2001; NIKOLOPOULOS 2012.

[5] PAPPA 2015a, fig. 1; PAPPA 2012. Absolute dates are contested, depending on whether dating relies on the radiocarbon dating or ceramic artefacts. Chronological phasing remains partly site-dependent in the scholarship - that is, contacts with the colonial world, for example, may classify one site as

The earliest Mediterranean finds in Iberia date to the 11th c. BCE. They concern fragments of Cypriot or Mycenaean pottery found in stratified levels at Montoro (Cordova), dated by radiocarbon. Other evidence is provided by the Mediterranean-style objects found at the site of Baiões (S. Pedro do Sul, Viseu),[6] dated stylistically to the 10th c. BCE. They reflect influences on local metalwork or improvisations by mobile craftsmen.[7] Few objects considered Mediterranean were documented at the funerary complex of Roça de Casal do Meio (Calhariz, Sesimba) in the Tagus valley.[8] Originally considered a *tholos* tomb with a *dromos* in imitation of Mycenaean or Late Cypriot funerary architecture, the complex proved to be a Bronze Age megalithic monument, reused in the early 1st millennium BCE. Cypriot agents or contacts via the central Mediterranean have been suggested.[9] Nonetheless, none of the above betrays systematic commercial contacts between Atlantic regions and the eastern Mediterranean at the end of the 2nd millennium BCE.

Systematic contacts are only documented in Huelva, and are dated to the last third of the 9th c. BCE at the earliest.[10] By the 7th c. BCE, two foundations attributed to Phoenician commercial were established in coastal Algarve and Alentejo: the large settlement Balsa in Tavira on the palaeo-estuary of the Séqua/Gilão river,[11] and Abul, a small trading post-sanctuary, on the Sado estuary.[12] The commercial model of Phoenician expansion in modern Portuguese territory is different than in Andalousia. Nevertheless, deep influences on the material culture, religious customs and technology are attested from the 8th c. BCE onwards, including a large-scale fortification (casemate walls with bastions) at Balsa.

The toponyms of several settlements are attested epigraphically, numismatically and through the Greco-Roman sources. Toponyms ending in *–briga* are considered indigenous, while those with endings in *–ipo* (e.g. *Olissipo*, Lisbon) are attributed to populations of a different linguistic sub-stratum originating in western Andalusia. This has led to a model of colonization of south-central Portugal by groups from the Orientalized populations of the so-called Tartessos, identified with western Andalusia.[13]

In the 3rd c. BCE, these towns issue city-based coinage inscribed with the names of local magistrates in the indigenous script, a pseudo-syllabary inspired by the Phoenician script ca. 800-700 BCE.[14] The language was a variant of Celtic.[15] Roman-period epigraphic and literary sources document several ethnonyms, e.g. Cantabri, Astures, Gallaeci, Lusitani, Turdetani, the Iberi of the Levantine coast and the Iberi north of the Ebro River, the Celtiberi and the Celte. *Kynetes* are associated with Algarve, from the Sagres promontory to the upper Guadiana,[16] while the *Celtici* are placed in Alentejo. According to Pliny and Pomponius Mela, the so-called *Turduli Oppidani* (not to be confused with the *Turduli* of western Andalousia), occupied the coastal region between the Tagus and the Douro estuaries. In the northernmost segment of this stretch, they were referred to as *Turduli Veteres*. The *Lusitani* were situated in the inland regions of this coastal strip between the Tagus and the Douro.

Thus, from north to south, the region under study here was thought in the Roman period to have been occupied by the *Turduli Oppidani* and *Veteres* (Tagus estuary), the *Celtici* (Sado estuary) and the *Kynetes*. These Roman-period divisions may reflect earlier affiliations. On present knowledge, the inland Algarve and the Alentejo regions show limited contacts with Phoenician civilization, while most of the diffused Phoenician/Orientalising evidence comes from the region associated territorially in Roman times with the *Turduli Oppidani*.[17]

The complex ethno-linguistic make-up of the pre-Roman Iberia, reflected in Greco-Roman sources of different dates, may have several explanations. The multiplicity of ethnonyms attested in archaic Greek texts may indicate city-based identities, as well as broader socio-cultural/tribal affiliations of the early process of Phoenician colonization.[18] Additionally, the variety of ethnonyms in Roman-period Greek and Latin texts is the outcome of historiographers transliterating ethnonyms from one language to the other, without translating. This resulted in several variants for the same name.[19] The above do not obliterate the possibility that some of these ethnonyms may betray historical group affiliations.

Monetization in the Iberian Peninsula

Monetization in Iberia was a slow and patchy process in Iberia lasting several centuries. While the earliest coinage was issued in the 6th c. BCE by the Phocaean Greek colony of Emporion (Catalonia), full monetization in the peninsula does not predate the 1st c. CE.[20] Different monetary practices and exchange systems (for establishing prices, means of payment and storing wealth) were used across the peninsula in the 1st millennium BCE, including payment by silver, scrap metal, ingots and coinage. Proximity to the Greek and Phoenician colonial centres heavily influenced surrounding settlements in monetary practices.

Emporion introduced Phocaean metrologies in its minted coinage of ca. 6th c. BCE, followed by the other

pertaining to the IA I, while its neighboring settlements that exhibit no such contacts are considered FBA for the very same chronological period. Here the distinction between FBA and IA I is strictly chronological and not site-dependent so as to avoid ambiguity and chronological muddling: that is, a site or phase of a site is characterised as IA I if it dates from the 9th c. BCE onwards, regardless of contacts with the Phoenician/colonial world or not.

[6] DA SILVA/DA SILVA/LOPES 1984.

[7] NIKOLOPOULOS 2009, 158-159.

[8] SPINDLER/VEIGA FERREIRA 1973-4.

[9] For a summary of views, see PAPPA 2015a; PAPPA 2013, 27-29.

[10] GILBOA/SHARON/BOARETTO 2008.

[11] PAPPA 2015B; MAIA 2003; 2006

[12] MAYET/DA SILVA 2004; MAYET 1997.

[13] TORRES ORTIZ 2005.

[14] VALÉRIO 2016.

[15] KOCH 2013.

[16] KOCH 2013.

[17] PAZ GARCÍA-BELLIDO (137-136) suggested that the ending *–uli* (Turduli, Bastuli etc) signified that earlier cultures of the Peninsula (Turdetani, Bastetani) were "impregnated" by Punic culture, which implies the Carthaginian presence in the region. But in fact, *Turduli* is an ethnonym that characterizes western Andalusian populations too, that is, those settled in the region previously associated with the Phoenician presence in Tartessos. These latter *Turduli* are separated from the *Turduli Oppidani* by the *Celtici* and the *Lusitani*, regions where Phoenician presence was predominant. It can be tentatively suggested then that this spatial fragmentation of the 'Turduli' ethnonym may in fact be related to the presence of Phoenician cultural elements.

[18] ÁLVAREZ MARTÍ-AGUILAR/FERRER ALBELDA 2009.

[19] CELESTINO PÉREZ/LÓPEZ RUIZ 2016, 55-58.

[20] GARCÍA-BELLIDO 2011.

Phocaean colony to its south, Rhode (Rosas, Girona) at ca. 300 BCE. Indigenous centres in proximity to the old Greek and Phoenician colonies of Spain were familiar with the concept of coinage-based transactions. Nonetheless, indigenous mints become diffused across Iberia upon the arrival of the Carthaginian Barcids in the Peninsula in 237/8 BCE and the Second Punic war (218-201 BCE). In regions physically removed from the colonial world, no coinage was used until the Roman conquest, such as for example in Oretania, save for a few Carthaginian foundations (e.g. Castulo) during the Second Punic War.[21]

The identification of hoarded metal objects and scrap metal objects in hoards for a period of centuries across Iberia, as well as balance weights from a number of sites and elements of scales, suggests that payment with silver pieces by weight was used for part of the exchanges, following Near Eastern practice. Prior to the introduction of coinage, different objects held monetary value, while exchanges depended on cultural systems of exchange, often imported and adapted from the eastern Mediterranean. Aspects of the functions that money has (store of wealth, means of value and means of exchange) have been postulated for the objects making up the hoards found in south-central Iberia, often with no known original archaeological contexts, e.g. the Villena (Rambla de Panadero, Alicante) and the Berzocana (Cáceres) hoards. Hoarded objects, such as torcs, are not considered only stores of wealth, but are thought to correspond to specific monetary values determined by metrological systems in use. The two golden torques (necklaces of Atlantic typologies, in the form of bend tapering rods, usually worn by male warriors) found in the 8th -7th c. BCE Berzocana hoard were postulated to reflect a Hittite metrology, as 6.5 and 8 times multiples of the 11.75 g. Hittite shekel respectively.[22]

The metrological systems attested to by balance weights found at Phoenician and Orientalising settlements are considered derivations from the Near East. For example, the balance weights from the 6th-4th c. BC sanctuary at Cancho Roano (Zalamea de la Serana, Badajoz) are considered to follow a Tyrian metrology used in Gadir.[23]

That the metrology of coinage issued in Phoenicia may underly metrological systems of balance weights used earlier has been suggested by Elayi and Elay.[24] As to Iberia, it is conceivable too that the earliest coinage minted in the old Phoenician colonies of Iberia during the 3rd c. BCE would have relied on the metrology of balance weights used during earlier centuries. So far, this metrological relationship is seen in coinage and balance weights that are contemporaneous. For example, five small, cubic, bronze balance weights from a 3rd c. BCE market context near an anchorage point in the city of Malaga, the location of the old Phoenician colony *Malaca,* correspond to coinage minted by the city.[25] In parallel, García-Bellido argued that the coinage minted by the *Edetani* (Murcia) and the *Contestani* (Valencia) relied on autochthonous metrological systems.[26]

[21] PAZ GARCÍA-BELLIDO 2000, 124.
[22] RUIZ-GÁLVEZ 2014, 171.
[23] PAZ GARCÍA-BELLIDO 2000, 127.
[24] ELAYI/ELAY1997, 323.
[25] MORA SERRANO 2011.
[26] GARCÍA-BELLIDO 2011

The earliest coinage of Iberia that spread from Greek and Phoenician colonial centres to indigenous ones is characterized by different metrological systems, which may underlie the metrological systems of balance weights used earlier. Current research views the first mints of the Phoenician-Punic milieu of southern Iberia as a Carthaginian intervention. It remains unclear whether Carthaginian influence in the Peninsula in the late 4th c.- 3rd c. BCE and up to the arrival of the Barcids extended to some level of political control, or whether similarities should be sought within the context of commercial relations and shared cultural-linguistic background.

In the interior of Andalusia, few mints were active, most notably those of Orientalising towns, such as *Carmo* (Carmona), which issued coinage in Punic script. Other mints that issued in Punic script included *Ituci* and *Olont*, situated north-west of the *Lagus Ligustinus*, and *Urso*, associated with the Turdetani. Mints of that period are expressly connected to the activities of the Carthaginian Barcids in the Peninsula and for that reason, they are often designated as *Hispano-Carthaginian*.[27] This is paralleled elsewhere in the Peninsula. The Iberian towns in the north-east of Iberia began minting their first coins, in silver, perhaps to cover military expenditure of uprisings, at a time when quantities of bronze coins were imported by the Roman Carthaginian armies invading the Peninsula.[28]

The old Phoenician colonies of *Gadir/Gades* (Cádiz), *Ebusus* (Ibiza) and *Malaca* (Malaga) began to mint coins in the 4th c. BCE, which coincides chronologically with the beginning of the city mint of Carthage. For Alexandropoulos, this shows a causality between the operations of the mints in Carthage and Iberia. The earliest coinage minted by the old Phoenician centres consists in gold and silver coin issues, followed by bronze ones (mostly in Andalusia), but later shifting to silver issues prior to the arrival of the Carthaginian army led by Hamilcar in 237 CE.[29] The old Phoenician colonies of *Sexs* (Almuñécar) and *Abdera* (Adra) also operated their own mints.[30]

The earliest coins minted by Gades were discovered in archaeological remains of commercial and production installations (potteries and salt-fishing). They date to the first third of the 3rd c. BCE and consist in anepigraphic, bronze issues, found in fractions of halves, quarters and eighths. They are thought to correspond to "Punic" metrology,[31] implying a Carthaginian derivation, rather than an IA I Phoenician origin. A three-tier system was observed based on a 8-9 g standard and its half at 4.5 g (coins with a diameter of 10-11 mm, 12-13 mm and 14-18 mm), which shows a metrological relationship with the bronze coins of Carthage and Punic north Africa according to Alexandropoulos.[32] The 8-9 g. standard unit, followed by the 10-11 g. standard persists down to the Roman Republic period in Gades.[33] The old Phoenician colonies of *Malaca*, *Sexs* (Almuñécar) and

[27] PAZ GARCÍA-BELLIDO 2000, 129.
[28] CAMPO 2011.
[29] ALEXANDROPOULOS 2007, 52-53.
[30] CHAVES TRISTÁN 2000.
[31] CHAVES TRISTÁN 2000, 117-118.
[32] ALEXANDROPOULOS 2007, 53.
[33] CHAVES TRISTÁN 2000, 119.

Abdera (Adra) operated their own mints.[34]

The coinage issued by the earliest Phoenician/Punic mints of Iberia, has a mean weight around 4.8-4.9 g that associates it with the standard of the 'Sicilian-Punic' Carthaginian mints, but also with those of *Emporion*.[35] One suggestion is that this so-called Iberian standard is a "compromise standard" that offered interconvertibility between the Phocaean Greek standard of 3.75 g and the Phoenician *light* shekel of 7.2 g, comprising the weight of approximately 5/4 of the former and 2/3 of the latter.[36] A different explanation assumed that the 4.7-4.8 g weight does not reflect an entire unit, but half of a Phoenician shekel of 9.5 g.[37]

THE METROLOGY OF PRE-ROMAN, ATLANTIC BALANCE WEIGHTS AND COINAGE

FBA – IA I contexts

A group of 26 small bronze objects from settlement sites in Beira, south of the Douro river, were published by Vilaça, the excavator of two FBA settlement sites (12th -9th c. BCE): Moreirinha (Idanha-a-Nova) and Monte do Trigo (Idanha-a-Nova, Castelo Branco).[38] The excavator astutely identified them as balance weights, considering them local products that reflected eastern Mediterranean/Near Eastern metrological systems. The conclusion of the comparative study was that these objects were balance weights utilising the metrical unit of 9.3-9.4 g, interpreted as the Syrian shekel used in the eastern Mediterranean prior to 1200 BCE, thus allegedly denoting contacts with that Portuguese region between 12th/11th c. and the 10th -9th c. BCE.[39] This study of morphology and metrology by Vilaça presented the information from these two excavated sites in connection with balance weights from other hilltop settlements in the regions fed by the Tagus, Mondego and Aveiro rivers and their tributaries in Beira, Alentejo and Estremadura (Portugal) and Extremadura (Spain). [40]

These objects, made of copper alloys, are of varying dimensions and forms, often perforated (Table 1). Vilaça determined their typological types on the basis of form: fusiform, discoidal, spherical, octahedron-shaped, or bi-frustoconical, (in the form of a cone frustum joined at its base by an identical frustum).[41] The latter is typical of the region and not met in the Mediterranean. Central perforations were present in some of the discoidal or flatter balance weights.

The metrologies, typologies, contexts and attached dates (where available) of the FBA weights studied here are presented in Tables 1, 2 and 3. The balance weights from Beira (Table 1) come from inland sites between the Douro the Tagus: Canedotes (Vila Nova de Paina); Senhora da Guia de Baioes (S. Pedro do Sul); Santa Luzia; Moreirinha (Idanha-a-Nova); Monte do Trigo (Idanha-a-Nova, Castelo Branco). Those from Estremadura (Table 2) come from sites around the Tagus estuary: Abrigo Grade das Bocas (Rio Maior), Castro da Ota (Alenquer), Penha Verde (Sintra) and Castro de Pragança (Cadaval). Datasets from inland Alentejo and Algarve come from the sites Baleizão (Beja) and Castro dos Ratinhos (Moura) (Table 3). The seven balance weights from Baleizão were found in a ceramic container with hoarded jewellery, an ingot and 10 rings of metal, a total of 31 objects.[42]

Vilaça discussed as relevant balance weights from two additional settlement sites located in Extremadura. Cabezo de Araya (Arroyo de la Luz, Cáceres) yielded three balance weights of a local typology, weighing 3 g, 1.8 g, and 1 g.[43] The site of Los Concejiles (Lobón, Badajoz) yielded two local balance weights of 19.01 g and 14.18 g, the former interpreted as a double shekel of the 9.4-9.5 g unit, the latter as a 2/3 fraction of it. A third balance weight from the same site was of a clear Near Eastern typology, parallelepipedic, and weighed 6.37 g.

Vilaça (2011, 159) interprets these balance weights as fractions and multiples of a 9.3-9.4 weight unit, explaining it as a derivation of the Late Bronze Age (henceforth: LBA) of Ugarit (Syria), which she assumes to have been ca. 9.3-9.4 g. The author's conclusions are that western Iberians adopted the Ugaritic weight unit of 9.4 g from Syria, equivalent to the Egyptian standard *qdt*, by the end of the 2nd millennium BCE.[44] In Vilaça's view, an adoption in the late 2nd millennium BCE by western Iberians is supported by the fact that the standards that followed 1200 BCE was the Hittite shekel of 11.75 g and the Phoenician shekel of the 7.9 g, which would exclude that the adoption of the 9.4 g standard occurred during the 1st millennium BCE. The postulation of 2nd millennium BCE contacts with this region that could have influenced the commercial metrological systems is not new.[45]. A more recent suggestion maintained that the underlying metrology pertains to the Egyptian *qdt*[46].

As will be shown below, the insistence on an LBA eastern Mediterranean derivation of these locally produced balance weights of Atlantic sites is based on the misunderstanding of the multiplicity of metrological systems in use in Phoenicia during the 1st millennium BCE.

The metrology of balance weights at IA I Orientalising settlements in the Tagus and Sado estuaries

IA I balance weights of Phoenician typologies, are known from the settlements of Alcácer do Sal, on the Sado estuary, and Almaraz on the Tagus estuary. Both sites have yielded Orientalising material culture, architecture and religious customs and are interpreted as indigenous settlements with a Phoenician presence or influence.

Almaraz

Quinta do Almaraz (Fig. 2) is located on the south shore of the Tagus estuary, in Cacilhas (Almada), opposite Lisbon. The site itself has been partially excavated, located on a rocky spur that raises abruptly from the river bank.

[34] CHAVES TRISTÁN 2000.
[35] CALLEGARIN AND PAZ GARCÍA-BELLIDO 2000, 9.
[36] ALEXANDROPOULOS 2007, 53.
[37] CALLEGARIN AND PAZ GARCÍA-BELLIDO 2000, 9.
[38] VILAÇA 2011.
[39] VILAÇA 2011.
[40] Here the evidence for pre-colonial metrological systems excludes sites with clear Phoenician connections, so as to avoid later intrusions.
[41] VILAÇA 2011.
[42] VILAÇA 2011, 154.
[43] VILAÇA 2011, 144-145.
[44] VILAÇA (2011, 159)
[45] *E.g.* RUIZ-GÁLVEZ PRIEGO 2008.
[46] RUIZ-GÁLVEZ 2014, 174-175.

On the inland side where approach by land was feasible, the settlement was delimited by a defensive wall and ditch.[47] Almaraz was occupied continuously since the Neolithic period,[48] but during the early 1st millennium BCE, the settlement obtained fortifications. During this period, rectilinear architecture and Phoenician and Orientalising types of pottery are attested. Within a 1 km radius, six other sites have been identified, of which at least all but one date with certainty to the 1st millennium BCE.[49] Radiocarbon dates obtained from Almaraz place the beginnings of the Orientliaing period to the 9th c. BCE,[50] but have been contested on the grounds of the samples used.[51]

Pottery was typical of Orientalising or Phoenician settlements, with over a million Phoenician Red Slip ware fragments, as well as the local Grey Ware pottery and the pithoi that are Iberian adaptations of the Bichrome Style of the Near East/Cyprus. The earliest safely dated imports in Almaraz are two amphorae of the type 10.1.1.1 of the Ramón Torres typology of western Phoenician-Punic amphorae,[52] and 26 specimens of the 10.1.2.1 type, the latter dated to 650-575 BC by Olaio.[53] Type 10.1.2.1 represents a common transport container produced in Phoenician colonies and indigenous settlements in Andalusia. In well-dated strata from Carthage, type 10.1.2.1 is dated between the late 8th c. BC and the first quarter of the 7th c. BC.[54] A new typology for transport containers produced in the Tagus region has developed a new system of classification for locally-produced types, several of which are attested at Quinta do Almaraz, showing a local production of Phoenician amphorae that branched off from the series 10 of Ramón Torres' typology.[55] This shows an intensification of contacts and exchanges with the Phoenician colonies in Andalousia and not merely some imports and occasional influences in the material record. Availability of gold from the Tagus banks may have played a role in this. At any rate, smelting of ores is documented at the site, as shown by the chemical analysis of two slugged crucible fragments suggesting that they were used for silver,[56] likely imported.[57]

The balance weights found at the site comprise a small group of two cubic weights of different sizes and two local types, one of which consists in a perforated flat disc and the other in a fusiform balance weight, also perforated (Fig. 3).[58] The two cubic ones, probably made of a lead alloy, weigh 2.63 g (1.5 cm side length) and 6.38 g (1.75 cm side length).[59] The latter thus approaches the weight of the parallelepipedic specimen from Los Concejiles, discussed above. The cubic ones from Almaraz are engraved with presumably figures of animals, too difficult to identify further.[60]

[47] BARROS/CARDOSO/SABROSA 1993, 148-181.
[48] LUIS BARROS, *pers. com.*, July 2018.
[49] OLAIO 2018, 125-128.
[50] BARROS/MONGE SOARES 2004.
[51] PAPPA 2012, 23-24.
[52] RAMÓN TORRES 1995.
[53] OLAIO 2018, 144.
[54] PAPPA 2013, 170-183.
[55] OLAIO 2018.
[56] ARAÚJO *et alii* 2004.
[57] QUINTA DO ALMARAZ – BARROS, *pers. com.*, July 2018.
[58] QUINTA DO ALMARAZ – BARROS, *pers. com.*, July 2018.
[59] VILAÇA 2011, 147.
[60] QUINTA DO ALMARAZ – BARROS, *pers. com.*, July 2018.

The cubic form mostly parallels weights published as 'Aramaic', dating to the Kingdom of Hama (800-700 BCE), as well as Phoenician ones.[61] While engravings of animal motifs are not common in the Syro-Palestine region, the balance weights themselves were often zoomorphic, representing lions, deer, turtles etc.[62]

Alcácer do Sal

The settlement at Alcácer do Sal (Setúbal), inland from the Sado estuary was occupied continuously since at least the Neolithic period (Fig. 4). The indigenous toponym of Alcácer do Sal, Roman *Salacia*, ended in *–ipo*, vocalised as *–vipon* or *–uipon*, but the first signs on coin legends are not agreed upon (*-a* or *ma*, or *e-*, or *be-*); the toponym lay in the semantic field of 'salt', given the continuity from *Salacia* to present-day *Alcácer do Sal*.[63] Salt production was an important economic activity from at least the 6th c. BCE in coastal Iberia[64] and its continuity through the late antiquity to the medieval and modern period may explain the perseverance of a salt-related name for the town.[65]

Unfortunately, publications on the excavations have remained patchy over decades. The medieval castle where the Orientalising and later habitation levels have been excavated is situated on a hillock overlooking the river Sado. The IA levels are found interspersed among later ruins, rendering chronological attribution difficult. The earliest rectilinear architecture has the hallmarks of Phoenician domestic structures in Iberia. The necropolis, 1 km to the west, attests to a variety of burial customs (e.g. different types of cremation), and burial goods that included Phoenician and Orientalising objects (e.g. pottery, scarabs).[66]

Balance weight from the site correspond to the Orientalising period, and may date even to the 5th c. BCE. Two such objects were found at the site of the medieval castle. One came from Sector L, was cubic and weighed 9 g, the other came from sector I, was parallelepipedic and weighed 29.5 g.[67] Three additional cubic balance weights, inscribed with graffiti (published as "undecipherable") have been briefly reported, along with other finds that purportedly belong to the plates of balance scales. These were found south of the castle (in Rua dos Ratos), close to the river "by the perimeter of the fortification wall". They weighed 12.6 g, 21.3 g. and 15 g.[68] It is unclear whether this is meant to refer to Orientalizing or medieval fortifications. The material of which they were made was not specified; presumably it was a copper alloy.

The fragments of the balance scales from the site correspond to a known eastern type. The earliest representation of the balance scales with two plates belong to the 5th Dynasty of Egypt. In Mesopotamia, the Near East and Cyprus, this balance scale is documented archaeologically in the 2nd and 1st millennium BCE. Finds of such scales in tombs in Hama (1200-720 BCE) give a *terminus ante quem* of 720

[61] ELAYI/ELAYI 1997, PL. IV-VI.
[62] ELAYI/ELAYI 1997.
[63] CORREIA 2004, 271.
[64] *E.g.* SÁEZ ROMERO 2014.
[65] PAPPA 2017, 298-299.
[66] See PAPPA (2013, 2013-214) for a list of finds and bibliography on excavations from the settlement site and the necropolis.
[67] VILAÇA 2011, 147.
[68] ARRUDA 2014, 526.

BCE, while in Megiddo they have been found in contexts dated to 1700-1050 BCE.[69]

The metrology of pre-Roman numismatic series

An extensive study on the coinage of Alcácer do Sal has been conducted by Correia, who described and classified the coinage that emerged in the 3rd c. BCE.[70] According to Correia, the pre-Roman coinage of Alcácer do Sal can be subdivided according to different chronological phases:

1. coinage without names of city magistrates, bearing legends in the indigenous script and language.
2. coinage with names of magistrates, with legends in the Latin alphabet.
3. coinage with the Latin legend of *Imp[eratoria] Sal[acia]*, without names of magistrates.

During Phase 1, the coinage was inscribed using a variant of the South-West script that had emerged upon contacts with the Phoenician colonists in the 8th c. BCE.[71] The longevity of the script is attested, *inter alia*, by a graffito found in a votive deposit at Vila de Garvão, with a *terminus ante quem* of ca. 150 BCE, 75 km from Alcácer do Sal, assigned either to the South-West script or to a local variant (Meridional). Correia considers that the difficulty in attributing the coinage legends to a specific variant (South-West or Meridional) reflects the intentional choice to simplify coin legeds so that they would be legible across Iberia regardless of the script variant used in each locality.[72]

The coinage of Phase 1 pertains to the period prior to any Roman involvement (Table 5). The iconography of the coinage of this phase (Table 6) crystallises the complete repertory of motifs found in the rest of phases too, albeit then characterized by syncretism: Melqart/Herakles and Baal/Jupiter, as well as dolphins, tuna and wheat.[73] The crescent that appears as the first symbol in the legend is used as an astral symbol and it is not a palaeographic sign.[74] The image of dolphins is a common motif in pre-Roman Iberia. For example, the pre-Latin legend coinage of Tamusia (Villasviejas del Tamuda, Extremadura) depicts on the obverse a male head with two dolphins, while the reverse features mounted warriors with spears.[75]

According to Correia's chronological reconstruction and interpretation, Phase 1 corresponds to the period when Alcácer do Sal came under the Gaditanian-Carthaginian hegemony during the events of the Second Punic war. Hasdrubal's Carthaginian armies were stationed in the Tagus and in Algarve, necessitating the issuing of coinage by the town to cover military needs.[76]

During Phase 2 (Table 7, Table 8) of Correia's reconstruction, the Latin alphabet is adopted, albeit most of the names of the magistrates mentioned on the obverse are not Roman and refer to the indigenous system of governance, prior to the integration of the region into the Roman administrative system.[77] According to this author, the *aedil* of the coin legends refers to a local magistrate, not the Roman office of that name. The letter *S* indicates half a unit (*SEMIS*). In coins of Group 2 of this phase, a reference to *Filius* may indicate that the succession of local magistrates followed hereditary lines, although the appearance of a Roman name (*TLV*) suggests that power at this time power was co-shared with the Romans. Phase 2 dates to after the end of the Lusitanian war in 139 BCE, as the adoption of the Latin alphabet suggests that the local magistrates were effectively appointed by the Romans, but predates the annexation of the region into the Roman administrative system.[78] Phase 3 (Table 7) is dated to the period of Roman annexation beginning in 45/44 BCE, when Alcácer do Sal became the seat of a *conventus,* in the role of a *caput conventi/portus* according to Correia.[79]

Correia estimated the average standard weight of Phase 1, made up of three coin series spanning 80 years, to 10.1 g, that of Phase 2, made up of six coin series spanning 95 years, to 13.03 g and of Phase 3, made up of three coin series spanning 12 years, to 12 g.[80] Thus, in Phase 1 (Table 5) the weight of 10.1 g was the average unit, based on the suggested divisions of 3 series of coins and their sub-divisions.

An alternative reconstruction that I suggest is that Correia's Unit 2 (9.2 g) corresponds to a shekel of 9-9.3 g, Correia's Unit 3 (9.9 g.) represents a shekel of ca. 10 g., and that the remainder of Phase 1 coins are fractions and multiples thereof. Thus, in my reconstruction, Correia's Division 1.1. (6.6. g) represents a 2/3 fraction of his Unit 3 (9.9. g), that is 2/3 fraction of a 10 g. shekel. Correia's Division 2.1 (4.9 g) represents a 1/2 fraction of his Unit 3 (9.9 g.), that is half a shekel of 10 g., while Unit 1 (15 g.) represents the cumulative weight of a ca. 9 g shekel and 2/3 of it. Balance weights reflecting the cumulations of different standard units (e.g. a whole unit and a fraction) are known in Phoenicia.[81] Such a model of two shekel units (9.3/9.3 g and ca. 10 g.) being used concurrently corresponds to the metrological system that seems to underly the town's Iron Age balance weights, with a 9 g. balance weight and another potentially corresponding to a double shekel based on a 10 g unit (see Table 4).

DISCUSSION

Several threads have arisen in the discussion of pre-Roman Atlantic metrological system of Iberia. They concern the putative metrological system of FBA balance weights, the relationship of the latter's metrology with the IA I Phoenician balance weights found in the region, as well the origins of the metrological system of pre-Roman coinage from the region.

The discussion, including any possible correlation between the metrological system of balance weights and coinage does not imply that the use of weighed metal for payments led to the development of coinage. Rather, it suggests that only once the minting of coinage came into

[69] ELAYI /ELAYI 1997, 218-220.
[70] CORREIA 2004.
[71] CORREIA 2004, 269.
[72] CORREIA 2004, 268.
[73] CORREIA 2004, 268.
[74] CORREIA 2004, 268.
[75] CORREIA 2004, 277-278, table 6.
[76] CORREIA'S 2004, 274-275.
[77] CORREIA'S 2004, 270-271.
[78] CORREIA 2004, 270-271.
[79] CORREIA 2004, 273-276.
[80] CORREIA 2004, 276.
[81] ELAYI /ELAYI 1997.

vogue in Atlantic Iberia, the metrological system on which it was dependent reflected earlier monetary practices current in the region.

The issue on the monetary or not nature of the scrap metal pieces, ingots and jewellery retrieved from hoards in the Near East remains open. Such hoards dated from the Middle Bronze Age (henceforth: MBA). In discussing the evidence for hoards from different locations in the Transjordan and the Levant dating from the MBA IIA to the Early IA IIA, Eshel *et alii.* discounted the possibility that hoarded fragments of silver and other metals led to the use of coinage.[82] Their study discounted too the results of metal provenance by earlier isotopic studies on methodological grounds. In the same study, Eshel *et alii.* suggested that bundles of metal pieces, wrapped up in cloth with seals affixed, did not correspond to specific metrological systems; rather, incisions on metal bars were interpreted as quality control checks of the silver, and not a method of portioning the ingots, ready to be cut in pieces of a standard weight for future payments, especially since several of these hoards were stored under house floors which does not suggest daily usage. The smaller fragments would have been used to balance the scales not individually. The study concluded that the bundled and hoarded metal pieces do not correspond to established weights of metal and therefore cannot have led to the development of coinage.

That the use of silver by weight for payment did not lead to the development of coinage in the Levant is correct. Metal pieces wrapped up in bundles, however, may have been received as payment in transactions, and stored for safety below floors. After all, a location under the floor speaks of storing wealth. The total weights of each bundle of metal pieces need not correspond to any particular metrological unit weight. This does not preclude that they constituted individual payments for property or other goods sold, with the guarantee of authority on the seal attesting to the particulars of a specific transaction. Stored under a house floor, any bundle with silver pieces may have been the payment for some item sold previously, not a ready-made quantity corresponding to a metrological unit for use in the future. Be that as it may, there is no reason to suggest that payment in precious metal by weight led to the use of coinage, which was invented in Lydia. Payment by silver, however, was long used in Mesopotamia and the Syro-Palestinian coast according to established metrological systems. It is conceivable that once Phoenician coinage was adopted through foreign influences, the metrological system that underlay the earlier monetary practices may have continued to be used.

However, in the 3rd c. BCE, when the local Atlantic polities first mint coinage in order to cover expediently the military needs of the Punic Wars, they do so having in mind the Greek, and by then, Carthaginian too, monetary practice of coinage-based transactions. The metrological system these Atlantic polities used for the coinage that they minted may have been inherited from the earliest Phoenician commercial contact that brought Phoenician shekel units for local transactions. The alternative suggestion is that the 3rd c. BCE coinage was a direct adoption of Carthaginian coinage weights. This is the most common theory, but one that per force ignored the recent evidence for the early 1st millennium BCE metrological systems in use in the region. Effectively, the questions here relate to the possibility of a Syrian, Phoenician or other Near Eastern metrological system underlying Atlantic FBA balance weights, the establishment of the metrology of balance weights in Phoenician/Orientalising settlents of the IA I on the Atlantic façade, and finally, the identification of the metrologcal system underlying the earliest minted coinage in an indigenous but Orientalizing town of the same region.

1. The question of Near Eastern metrological systems underlying the indigenous Atlantic FBA balance weights

Despite the documented early dating of the indigenous weights studied by Vilaça (2011) on the basis of site-based or specific context-based radocarbon dating, their function as weights given the variety of forms and contexts must remain unconfirmed. Apart from the Monte do Trigo specimens, all other radiocarbon dates permit a 9th c. BCE date, at their lower end, which would place them in the context of Phoenician colonisation. The several examples stated do not easily fall into a single metrological system and cannot be ascribed to a Syrian or Ugaritic shekel for this reason. In the LBA eastern Mediterranean, the shekel 'of Khatti' (11.75 g.) and the shekel 'of Ugarit' (9.4 g.) were often used. The FBA balance weights of Iberia cannot unequivocally be attributed to a single Hittite or Syrian/Ugaritic metrology, althougth this cannot be excluded.

Relevant to the discussion are the perforated balance weights discovered in Lefkandi. The Warrior-Trader tomb (tomb 79) at the Toumba cemetery of Lefkandi (possibly ancient *Eretria*), dated to the 9th c. BCE, yielded 16 hematite balance weights, which are thought to correspond to the Babylonian shekel of 8.3 g, the Syro-Egyptian qedet of 9.4 g and the Palestinian unit of 10.5 g, as well as a supposed Karkemish shekel of 7.6-7.8 according to a perfunctory study by Kroll.[83] Those weights published as "sphendonoid" and "rounded-end sphendonoids" by Kroll derived from a 8.3 shekel and a 9.4 shekel.[84] Their typological forms and perforations recall Vilaça's fusiform Atlantic FBA types discussed above.[85] The sphendonoids (based on a 8.4 g. and on a 9.4 g. shekel) were common ca. 1200 BCE in the eastern Mediterranean but in Cyprus they survive in Palaipaphos-Skales, where they are found in Early Cypro-Geometric tombs.[86] At any rate, such units would have been used for payment in silver or other noble metals in Euboea at the time, during interregional exchanges. The hoarded scrap of metals known as the so-called treasure of Eretria, dated to the 8th c. BCE, found in a domestic context, attests to payments in metal by weight.[87] Could then Cyprus be considered an intermediary in these interregional contacts between eastern and western Mediterranean at the turn of the 2nd millennium BCE that explains the presence of the balance weights found in Beira?

It is worth considering the island as a possible

[82] ESHEL *et alii* 2018.

[83] KROLL 2008, 41-42, fig. 1, 1-7.

[84] KROLL 2008, table 1.

[85] VILAÇA 2011.

[86] KROLL 2008, 42.

[87] LE RIDER/VERDAN 2002.

intermediary, not least because of its Phoenician connections since the 2nd millennium BCE. Three Cypriot wares found either at Paterna de la Rivera, 25 km north of Cádiz or at Paterna (Barbate, Vejer), in the palaeo-estuary of the Barbate river, have been dated to the Cypro-Geometric II period. They include a Plain White Ware II amphora, a Bichrome II trefoil oinochoe and a White Painted Ware II pyxis.[88] Plain White ware was produced exclusively in Enkomi, in the Mesaoria plain, in north-eastern Cyprus, as a geochemical analysis of fabrics on representative samples from the island and Palestine has shown.[89] Enkomi was one of the main LBA Cypriot states on the island. While a lot of the excavations of the French Mission remain unpublished, what limited published information comes from the region suggests that Enkomi did not experience an abandonment during the 13th-12th c. BCE crisis, but only a disruption: some of its dependent mining centres (e.g. at Mathiatis, Kotchiati, Lythrodontas, Analiontas and Shia) were abandoned but others continued to be in use, e.g. the Late Cypriot ore-processing centre at Athienou-Bamboulari tis Koukouninas, which only fell out of use during the Late Cypriot IIIA, ca. 1200-1100 BCE.[90] Other Cypriot settlements continued to thrive, such as Palaipaphos that acquired two new ore-processing, satellite hilltop centres (Pyla and Maa) that processed the mineral from the Troulli Mountains. There, balance weights of Syro-Egyptian and other metrologies were discovered.[91]

Connections with Cyprus could explain why the earliest Orientalising pottery in Iberia, the so-called Tartessian, constitutes simple forms and decorations of the Bichrome Ware: jugs, small globular amphorae, pithoi and the occasional hand-made krater decorated in alternating red bands and black lines. In particular, the production of trefoil-mouthed jugs decorated in parallels black lines and red bands continued almost unaltered through the Turdetanian period (5th-4th c. BCE) to the Roman conquest, repeating *ad nauseum* the same decorative style of centuries earlier. For example, pottery styles in Carmona maintained the same, 7th c. BCE decoration throughout the 4th and 3rd centuries BCE, derived directly from the eastern Mediterranean Bichrome Ware. In Cyprus, Bichrome ware quickly led to briskly decorated figurative pottery, with the linear ornament in secondary position, and plastic elements (e.g. bovine heads) on the point where the handle is attached to the body already in the early Archaic period. The plainer, linear form of Bichrome decoration continued to be produced for centuries, as seen in jugs of the Cypro-Archaic period, and thus cannot be used for a precise dating of the Orientalising ware of Iberia.[92] In the case of Iberia, however, the linear motif of black lines and red bands, was never enriched with any figurative ornamentation or plastic decoration, but remained repetitive, the only innovation being that this decoration was applied to large storage jars too, which makes it difficult to date with precision.

But was the Cypriot Bichrome ware the prototype for this Iberian ware or the Phoenician Bichrome ware? After all Phoenician Bichrome ware is found in Tyre, and in Period 3 of Tyre Al-Bass,[93] it decorates trefoil jugs that are the earliest identifiable Phoenician pottery found in the colonies of Spain. Gilboa and Goren conducted a study of fabric provenance of Phoenician Bichrome ware of the Iron Age Ia - Iron Age IIa (corresponding to LC IIIB – Cypro-Geometric III) on samples from Cyprus, conventionally dated to the late 12th - mid-9th c. BCE.[94] Their study demonstrated two-way similarities in the production of Phoenician and Cypriot Bichrome ware, especially as regards the globular jug. The pottery was produced in the Sidon-Tyre area, but also at Dor on the Carmel coast, Megiddo (western Jezreel valley) and at the inland site of Dan (Hulah basin). The similarities in production methods were explained as the result of close interconnections, in manufacture technology and style, between the Levant and Cyprus, which evolved in contact with one another.[95] This two-way process clearly applies to the production environments of other pottery types. The Black-on-Red ware, for example, appears in the Levant in the 10th c. BCE and in Cyprus in the following century. A chemical analysis of fabrics showed that the Black-on-Red was manufactured only in Cyprus.[96] Schreiber argued on the basis of stylistic analysis that similar ceramic traditions that predate this ware existed in the Levant, but that the specific Black-on-Red known from Cyprus is different typologically and thus a Cypriot creation that began in the Cypro-Geometric III (850- 700 BCE).[97] Would it not have been a Cypriot production then instigated by, or in conjunction, with perhaps an earlier Levantine one?

The close connections in pottery styles must derive from large-scale traffic between these two regions, certainly not dedicated exclusively to ceramic containers. The copper production of Cyprus may have been one main export, which does not cease after 1200 BCE. Recently, the long-postulated identification of biblical Tarshish with Tartessos was persuasively demonstrated, on the basis of historical and crucially, linguistic and epigraphic grounds.[98] This identification was bolstered by a 9th c. BCE pottery fragment from Israel, inscribed in an early Hebrew script with a reference to "silver of Tarshish" (interpreted as documenting the collection of funds for the Temple in Jerusalem), in conjunction with silver from a 11th c. BCE context at Tel Dor, which was isotopically traced to the Rio Tinto mines of Huelva (Spain).[99] Given the more recent methodological problems of isotopic studies from material in this region described recently,[100] perhaps it is worth revisiting the issue of this suggested provenance.

The evidence above makes Vilaça's postulation of an eastern Mediterranean derivation of metrological system conceivable, but without supporting a ca. 1200 BCE date.[101]

88 FERRER ALBELDA 2017, 64-65, fig. 13.
89 TSCHEGG/NTAFLOS/HEIN 2009.
90 GEORGIOU 2011, 113-115.
91 GEORGIOU 2011, 117-123.
92 Example of Bichrome V dated to the Cypro-Archaic period, ca. 600-475 BCE, British Museum; Museum number 1978,0719.6. http://www.britishmuseum.org/research/collection_online/collection_object_details.aspx?objectId=415956&partId=1&searchText=Bichrome++II&page=1
93 NÚÑEZ 2014.
94 GILBOA/GOREN 2015.
95 GILBOA/GOREN 2015, 80-90.
96 BRODIE/STEEL 1996.
97 SCHREIBER 2003.
98 CELESTINO PÉREZ /LÓPEZ RUIZ 2016, 113-114.
99 CELESTINO PÉREZ /LÓPEZ RUIZ 2016, 113-114.
100 ESHEL *et alii* 2018.
101 VILAÇA 2011.

On the contrary, the supposed disappearance of the 9.4 g standard in the eastern Mediterranean after 1200 BCE, on which Vilaça's theory pivots, is not supported by the archaeological evidence for balance weights in the Near East. In parallel, some of the high chronologies from FBA contexts, used to date the locally produced balance weights, may be the result of dating methods that do not allow for such high precision.

2. The metrological systems of FBA and IA II balance weights: exploring the possibilities

Contemporary data on the exact weight of balance weights are affected by ancient attempts at falsification for cheating on the scales, metal corrosion, and museum conservation practices that ignore the underlying metrological system of balance weights.[102] These parameters obstruct further the identification of metrological systems using weights that relied on ancient balance scales that could not achieve high precision.[103]

In the neo-Assyrian empire two metrological systems were used concurrently: a heavy one ('mina of the King'), and a light one ('mina of the land'), which was half the weight of the former. Each metrological system was established on a 3-tier unit scale: talent, mina and shekel, linked on a sexagesimal system (1 talent = 60 minas, 1 mina = 60 shekels). The approximate weight of an Assyrian shekel was 0.0085 kg = 8.5 g in the light metrological system, and 0.017 kg = 17 g in the heavy one. These weights referred to silver and could easily be converted to a weight in bronze following a standard ratio.[104] This sort of tripartite system is reflected in the metrologies of the Levant too.

Several metrological systems are documented in the Syro-Palestinian region and Israel during the 1st millennium BCE. Based on the main study of Elayi and Elayi on the metrological systems of Phoenician balance weights from the Levant,[105] it is postulated that balance weights could comprise not only units, fractions or multiples, but also the cumulated weight of units/fractions corresponding to different metrological systems, e.g. a Syrian balance weight of incorporating a shekel of 13.5 g and 7.6 g.[106]

The Iron Age metrology of balance weights classified as Aramaic, that is Syrian ones, of various forms (pyramidal, troncoconical, parallelepipedic, cubic, zoomorphic), document shekels of different units: 9.4 g.; 8.33 g.; 8.5-9.5 g.[107] Balance weights inscribed with references to the 'Kingdom of Hama' or attributed to that kingdom (ca. 800-700 BCE) correspond to the following weights: 12.65 g; 13.5 g; 26.6 g; 7.602 and 7.6. In addition, the Aramaic graffito "shekel of Qarqar" on a balance weight of 9.46 identifies it as a regional unit. Other balance weights in use in Syria and inscribed are represented by a weight of 11.25 (fraction or multiple). As mentioned above, one spherical weight documents through its Aramaic inscription that its weight corresponds to the cumulative weight of a 13.5 g standard and a 7.6 g standard.[108]

Balance weights from Israel during this period, by contrast, have a different metrology: the 'shekel of the King' is represented by a specimen of 11.33 g, while smaller ones are documented too: the *pym* of 7.8 g, the *bqc* of 5.9 g and the *grh* of 0.5 g. The commercial shekel, on the other hand, had a value of 9.76 g, with the intention of approximating the Egyptian quedet of 9-10 g.[109]

Regarding Phoenician balance weights, different metrological systems have been identified on the basis of their respective weights and inscriptions. On a sample of 298 inscribed weights dated to ca. 8th-4th c. BCE, Elayi and Elayi [110] documented different weight series: a Sidonian shekel of 11.26-12.74 g., three Tyrians shekels of 8.5 g, 9.5 g, and 10. 5 g, and the 11.52 g shekel of Arwad. [111] These different series of metrological systems present internal variation on the basis of their weights within ranges, but also inscriptions. For example, cubic weights in bronze inscribed with the letter *Š* range in weight from 9.34 g to 10.44 g.[112] These are based on estimations of variable data, not always representative equally for each group. For the pre-Hellenistic period, the data collected by Elayi and Elayi can be summarized as follows:[113]

- 2.25 g., fraction, inscribed with the letter *P*.
- 8.02-8.42 g (95%) or 7.93-8.51 (99.97%), bronze parallelepipedic or pyramidal, inscribed with the letter *H*
- 10.24 g, 10.33 g, 43.75 g etc: pyramidal weights, in bronze, anepigraphic
- ca. 8.87 g, pyramidal weights in lead.
- 9.19-9.65 g., cubic/parallelepipedic, in lead, inscribed with motif
- 9.13-10.65, triangular, in lead, inscribed with the letter *Š*
- 9.97-10.81 g, cubic, in lead, inscribed with the letter *Š*
- ca. 11 g (inscribed with the letter *Š*, fractions recorded in this category: 3.13 g.; 11.7; 11 g; 15g.; 21 g)
- 10.46 g, with a possible range of 10.23-10.69 g, bronze parallelepipedic, cubic or pyramidal
- 10.52 g (derived from a bronze turtle of 2.63 g with the inscription '1/4 of shekel')
- 9.81 -10.97 g, inscribed with the letter *Š* plus a number (5, 12, 22, 24).
- 11.20 g, cubic, in bronze inscribed with *aleph*)
- 11.26-12.74 g., 'shekel of Sidon' (e.g. bronze turtle of 11.70 g inscribed with the phrase 'shekel of Sidon' and a bronze bovine head of 6.15 g, inscribed with 'half shekel of Sidon')
- 12.50 g, derived from bronze turtle of 2.499 g. inscribed with "1/5"

Firstly, the above documents that the 9.4 g unit was very much in use in Syro-Palestine in the period that corresponds to the production of FBA weights in the Atlantic, need not suggest 1200-1000 BCE contacts. Secondly, the preponderance of a multiplicity of contemporary metrological systems used in the 1st millennium BCE Syro-Palestine regions makes the identification of the one(s) in

[102] ELAYI /ELAYI 1997.
[103] VILAÇA 2011.
[104] FALES 1996.
[105] ELAYI/ELAYI 1997, 31
[106] ELAYI/ELAYI 1997, 31.
[107] ELAYI/ELAYI 1997, 19-41.
[108] ELAYI/ELAYI 1997, 19-41. Tentatively, Aramaic balance weights include a 11.25 g. crouched lion and another of 7.25 g. interpreted however as neo-Assyrian by FALES (1996).
[109] ELAYI/ELAYI 1997.
[110] ELAYI/ELAYI 1997, 296-329.
[111] ELAYI/ELAYI 1997, 319.
[112] ELAYI/ELAYI 1997, 317-319.
[113] ELAYI/ELAYI 1997, 296-329.

use in Portugal a matter of examining different possibilities. The weight of 3.13 g, corresponding to half of the larger balance weight from Almaraz, is known from Phoenicia, and belongs to the category of Phoenician weights inscribed with the letter *Š*.[114] Alternatively, it could be a ½ fraction of the 'Kingdom of Hama' shekel. The smaller one from Almaraz, with a weight of 2.63 g., finds a parallel in the Phoenician bronze turtle bearing the inscription of ¼ of shekel, pointing to a 10.52 g unit.[115] The 21.3 g weight from Alcácer do Sal could correspond to a double shekel of a 9.5 g.,[116] while the 25 g balance weight from the same site could be a double shekel of a 12.5-12.6 g standard. Thus, parallels with the 8th c. BCE Aramaean Kingdom of Hama are conceivable, chronologically and in terms of metrology, as well as with Phoenicia.

3. The metrology of the pre-Roman coinage of Alcácer do Sal

The Carthaginian inroads in 4th-3rd c. BCE Iberia complicate significantly the identification of potentially underlying Phoenician metrological systems in the earliest coinage issued by Iberian towns, since Carthaginian intermediaries may be postulated instead of Phoenician ones. Both metrology and iconography should be taken into account. The *prima facie* exclusion of a IA I Phoenician derivation of metrological systems is not justified, despite the current practice so far to explore only Carthaginian comparanda.

Iconography specific to the Phoenician-Punic milieu persists in Iberian coinage through the Roman Republic period, influencing the coinage minted in regions outside the Phoenician cultural *milieu* of Iberia. For example, Republican-period lead seals produced in Baetica (Andalousia), in association with honey production, were in the form of coin, were inscribed with the word *Celte,* and depicted on one side, a male figure carrying a handled ingot object, and on the other, a handled ingot.[117] Handled ingots are not known in Iberia. However, a handled balance weight is known from Phoenicia, in the form of an inversed frustum of a cone, topped by a large looped handle, weighing ca. 42.60 g and inscribed with the graffito "*Š* 5".[118] It seems likely that imagery connected to commercial transactions and currency in Phoenician and Punic contexts persisted until the earliest centuries of the Roman Republic in Iberia and that some of this imagery points to actual objects used in the context of transactions.

The iconographical choices of the pre-Roman coinage issued by Alcácer do Sal expresses clear connections with the eastern Mediterranean. If the iconology of the coinage during this phase refers to the broader Phoenician milieu of the region, then there is an increased possibility that the metrological system probably refers to the one used previously during the IA I. The earliest coins depict a male head with lionskin and a club, a clear reference to the syncretized model of Melqart/Herakles, and on the other side tuna fish. Tuna was a main product of the Atlantic façade of Iberia, which explains the motif. The motif of Herakles' head on coins is common in the Phoenician and later Punic realm and may speak volumes about the self-identification of its inhabitants.

Herakles was syncretized with the Tyrian hero-god Melqart in the eastern Mediterranean already in the Archaic period. The earliest extant coin issued by the Phoenician colony of Kition (Cyprus) was minted ca. 525-480 BCE. It was made of silver and weighed 0.96 g, interpreted as the denomination of a Greek *obol*. The obverse depicts the head of Herakles, youthful, beardless, and clad with lionskin. The reverse depicts a lion devouring a stag.[119] Herakles continues to feature on later coin issues by Kition, but the imagery becomes broader. The hero is depicted advancing with bow and club in the nude for example, covered only by a lionskin, as on a silver *siglos* of 0.79 g. (475-450 BCE) minted in the reign of King Baalmilk I.[120] In the earliest coinage minted by Gadir in the 4th c. BCE (unclear if in full independence or under Carthaginian influence), the earliest coinage depicts Herakles' head, with club and lionskin. Two other early Phoenician colonies in Andalousia, *Malaca* and *Sexs* (Almuñécar), issued their earliest coinage at the end of the 3rd c. BCE, with depictions of Herakles' head, followed suit by another old Phoenician colony in the region, *Abdera* (Adra).[121] There is however stylistic differences as to the depiction of Herakles-Melqart. In the Gaditanian realm, the god-hero is presented beardless with a club. Coin types issued by Sexs reflect both this imagery type (Herakles's head as a beardless youth with club and lionskin). Another was introduced under Barcid influence, and featured Herakles as a 'brute' (full-bodied in the nude, with club and lionskin)[122]. Abdera minted coinage that ichnographically drew on both traditions.[123]

The Alcácer do Sal coinage shows an iconographic resemblance not to the Carthaginian type, but to those associated with the Phoenician realm of Gades, and by homology (?) to Kition. Can the syncretized Herakles/Melqart motif aid as to the origin of the imagery? The Kition coins show that this process of iconographic (perhaps also 'theological') syncretism was already completed by 575-474 BCE. Cyprus, in fact, may be the place where we should be tracing such syncretism, as the island had been a hotbed of Phoenician-Greek cultural interactions for centuries. Sicily would be another option, especially given the literary references to the West, but archaeologically Cyprus takes chronological precedence. Thus, iconographically, the type resembles more 6th c. BCE Phoenician prototypes from Cyprus, than contemporary Carthaginian iconography.

Regarding the putative Carthaginian derivation of the metrology of the Alcácer do Sal coinage, the evidence needs to be examined carefully. Carthage began minting coinage in the late 5th c. BCE (410-390 BCE) so as to cover military

114 ELAYI/ELAYI 1997.
115 ELAYI/ELAYI, 307.
116 ELAYI/ELAYI, 31.
117 CHIC 1997, 154.
118 ELAYI/ELAYI 1997, n. 124, fig. 3, plate VI.
119 Cyprus, Kition, Uncertain king of Kition, Acc. No *SilcoinCy* (A1053), in *Kyprios Character* kyprioscharacter.eie.gr/en/cyprus-coins/details/A1053 (last update 10/23/2018); Copenhagen, Royal Collection of the National Museum of Denmark, RP 919.2
120 Cyprus, Kition, Baalmilk I, Acc. No *SilcoinCy* (A1044), in *Kyprios Character* kyprioscharacter.eie.gr/en/cyprus-coins/details/A1044 (last update 10/23/2018).
121 MORA SERRANO 2000, 164-165.
122 MORA SERRANO 2000, 164-165
123 MORA SERRANO 2000, 164-165.

expenditures.[124] Mints under the Carthaginian control operated in northern Africa (e.g. Kerkouane, Sabratha, Heraclea Minoa) and Sicily (Monte Iato, Monte Adranone, Morgantina, Segesta, Selinus, Solus). They issued coinage in gold, electrum, silver, billon (alloy of copper-silver, mostly) and bronze.[125] The earliest Carthaginian coinage corresponded to the Attic tetradrachm. Visoná argued that the coins were intended to cover "large payments" in Sicily.[126] Yet, the choice of the Attic tetradrachm as a standard is not exceptional. Not only was Carthage exposed to the coinage of the Greek colonies of Tripolitania (Libya) to its east and Sicily to its north, but the sheer concept of coinage as currency must have arrived from the Greek world. Additionally, the adoption of the Attic tetradrachm *per se* is not remarkable. It was a common, international currency, produced in abundant quantities for export in Athens from the 5th c. BCE.[127] Extensively used in the Near East and Egypt, it was circulating far east into central Asia in the 4th and 3rd centuries BCE, and was locally copied in Egypt.[128]

Carthage introduced a gold shekel in use in the first half of the 4th c. BCE. The earlier of these types depict a horse on one side, and a palm tree iconography on the other, or a hose and a female head respectively. Later types offer a variant to the palm tree/female head in the form of a male head adorned with a corn era.[129] In the second half of this century, the production of gold shekels increased substantially. The coin depicted a horse and a female head, like the earlier types. The metrology was based on a 9.4 standard with a 5-denomination system. By the end of the century, a heavier weight coin was issued, in bronze, presumably to account for the shift in the metal, depicting a horse head and a palm tree, but later being overstruck, probably in connection with military needs in Sicily.[130] During 300-290 BCE, electrum replaced gold as the coin metal.[131] Around this decade, two Carthaginian mints operated in Sicily by mercenary groups, the "People of the army" and the "Financial controllers", choosing the tetradrachm as a standard.[132] By the late 4th c. BCE, bronze coinage connected to Carthage and its centres circulated in the central Mediterranean, with gold and electrum coins found in huge quantities in tombs in north Africa, but also in hoards, such as the Mqabba hoard in Malta that contained bronze issues too, in small fractions down to 1 g.[133] Sardinia had its own, short-lived mint issuing five groups of bronze coins, located in Sulcis, or somewhere else in the south-west of the island, operating until 238 BCE.[134]

Similarities between Carthaginian coinage and that struck by Alcácer do Sal are not evident in iconography, coin size or metrological system, with few potential exceptions. For example, a coin of 7.6 g. (320-310 BCE) issued by a mint in Carthage was meant to correspond to 1/5 of a Greek stater. It depicted Tanit's head and on the reverse a horse head. Another Carthaginian coin of 6.6 g. had a diameter of 22 mm.[135] A 6.7 g. shekel in silver, at 20-22 mm in diameter (ca 300 BCE) was issued by a Carthaginian mint in Sicily, and probably corresponds to a ½ shekel.[136] A 7.5 g shekel issued in Sardinia, of a smaller size (21-23 mm), was minted ca. 264-241 BCE.[137]

Coins of the Unit 1 from Alcácer do Sal had a diameter of 26 mm and a weight of 15 g. (Table 7). To this coin size and weight corresponds only a Sardinian coin of 14.5 g., and a diameter of 26-30 mm. Supposing a metrological correspondence of the Alcácer do Sal Unit 1 with 4th c. Carthaginian coins of 7.6 g, as multiples of 2 (=15.2 g ≈15. g), we may argue tentatively for a Carthaginian connection. The underlying unit of 7.6 g. is ultimately however a derivation from an IA I shekel of 7.6 g from the Syro-Phoenician homeland, as attested in balance weights issued by the Kingdom of Hama in Syria (8th-7th c. BCE). The 7.6 g. weight is interpreted as a whole shekel, separate to the standard of 9.3-9.4 g. Correia's Unit 2 at 9.2 g finds parallels in coins minted in Punic Sardinia at 9.2 g. But for all these correlations with Carthaginian weights, there are the earlier Phoenician homologues that are reflected in the IA I balance weights from Alcácer do Sal. One of the five IA I balance weights known from the town, for example, weighed 9 g, and the others can be considered multiples or fractions of two different standards, a 9.2-9.4 g and a 9.9-10 g. standard.

Ultimately a derivation of the Alcácer do Sal coinage series from Carthaginian prototypes cannot be established. The iconographical parallels are not Carthaginian, and the metrological systems underlying them have parallels in the IA I balance weights found in Alcácer do Sal in 7th and 6th-5th c. BCE contexts. Thus, the derivation of the underlying metrological system of the coinage issued by the independent town of Alcácer do Sal from a metrological system already in use for centuries there should remain a possibility open to discussion, supported by the choice of the indigenous script for the coin legends. This does not suggest a Carthaginian overlordship or control over the mint.

CONCLUSIONS

The aim of the study departs from recent suggestions that the purported eastern Mediterranean metrologies used in balance weights of Atlantic Iberian sites suggest that a 2nd millennium BCE Near Eastern standard of 9.4 g was in use in settlements of central Portugal dating to ca. 1200-1000 BCE. This study demonstrates that a postulation of early dates is not a necessity, given that the standard was in ample use in 1st millennium Syro-Palestinian region. Secondly, the present study brought together for the first time all the evidence for pre-Roman metrological systems in use in the same Atlantic region of Iberia. Thirdly, this diachronic approach supports the model of a derivation of pre-Roman coinage weights from the Phoenician balance weight metrologies in use in the region during the Orientalising and post-Orientalising periods (7th-5th c. BCE). Basically, it explores the relationship between the metrological systems underlying Phoenician balance weights from Alcácer do Sal and the neighbouring

124 VISONÀ 1998, 4-5.
125 ALEXANDROPOULOS 2007; VISONÁ 1998, 2.
126 VISONÁ 1998, 3.
127 KROLL 2011.
128 KROLL 2011.
129 VISONÀ 1992, 5.
130 VISONÀ 1992, 8.
131 VISONÀ 1998, 7.
132 VISONÀ 1998, 8.
133 VISONÁ 1998, 5-6.
134 JENKINS 1992.
135 ALEXANDROPOULOS 2007, 380.
136 ALEXANDROPOULOS 2007, 368.
137 ALEXANDROPOULOS 2007, 377.

settlement of Almaraz, and pre-Roman coinage issued by Alcácer do Sal. The study choice was based on the availability of data, taking into account all published balance weights. On the basis of comparisons of coin types, sizes, iconography and metrology, a direct Carthaginian derivation for the pre-Roman coinage of this Atlantic town is brought here into question. A homologous derivation of Carthaginian and Alcácer do Sal coins from older Syro-Palestinian metrological systems is postulated to explain the tenuous similarities in standards used in these mints. The rest of evidence (iconography, script of coin legends) is not conclusive, but it does suggest, pending further evidence, that Alcácer do Sal was not copying Carthaginian prototypes, but was employing a metrological system in use in the town already from the Orientalizing period onwards.

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FIGURES

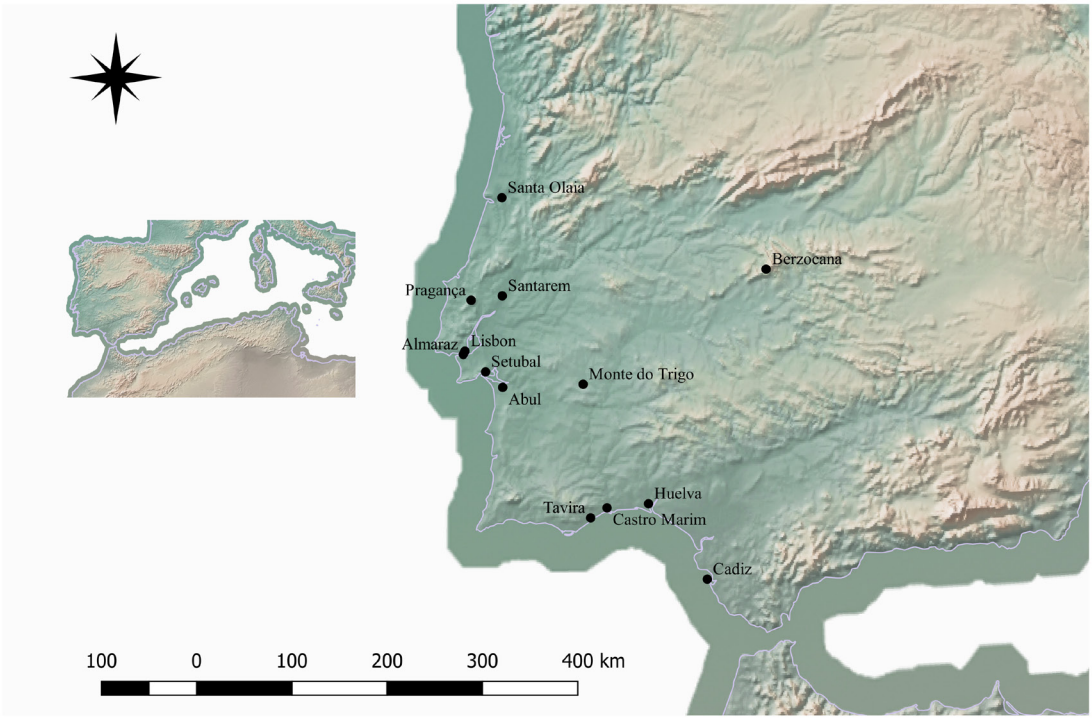

Fig1. Map of Iberia showing sites mentioned in text (author)

Fig2. Photo of the precipice upon which Quinta do Almaraz is taken from the bank of the Tagus river (author)

Fig3. Balance weights from Quinta do Almaraz (courtesy of Luís Barros; Divisão de Museus da C. M. Almada).

Fig4. Photo of the river in Alcácer do Sal, taken by the medieval castle where the settlement was identified (author)

Table 1. Metrology and contexts of balance weights from sites in Beira (based on data after Vilaça 2011, 140-143)

Site	Shape and Form	Dimensions (cm)	Weight (g)	Context	Chronology – C14, cal BCE
Canedotes	Sub-circular; elliptic section	1 (diam.)	3.8	Stone structure, Sector II, level 2	Site sector, at 2s: 996-812
Senhora da Guia de Baiões	Bi-frustoconical; hexagonal section	1.4 x 1.1	9.1	Unknown	Site, at 2 s: 993-979 cal 906-796 895-789 895-806
Senhora da Guia de Baiões	Spherical	1.2 (diam)	6.2	Unknown	As above
Santa Luzia	Spherical	Unknown		Unknown	Site, at 2s: 1370-1019 1606-769 1260-802
Moreirinha	Flattened bi-frustoconical; hexagonal section	1.3 x 0.4	3.98	Southern part of upper platform Layer 2	Context, at 2 s: 1262-949 1117-808
Monte do Trigo	Bi-frustoconical; hexagonal section	1.5 x 0.9	9.54	Sector B8, 02 Level - ritual deposit (?)	Level 2, at 2s: 1419-1057 1387-1056 1368-1022 1262-997 1211-925 1193-937
Monte do Trigo	Bi-frustoconical; hexagonal section	1.6 x 1.1	17.16	B8 Sector Level 02 – ritual deposit (?)	As above
Monte do Trigo	Discoidal; sub-rectangular section	06. x 0.3	2.32	B8 Sector Level 02 – ritual deposit (?)	As above
Monte do Trigo	Octahedron; longitudinal lozenge	2.8 x 2.6	37	B 8 Sector Level 02 – Ritual deposit (?)	As above

Table 2. Metrology and contexts of balance weights from sites in Estremadura (based on data after Vilaça 2011, 145-149)

Site	Shape and Form	Dimensions (cm)	Weight (g)
Abrigo Grande das Bocas	Discoidal	1.3 x 0.5	4.929
Castro da Ota	Bi-frustoconical; hexagonal section	1.6 x 0.7	8.9
Penha Verde	Bi-frustoconical; hexagonal section	1.2 x 0.6	4.54
Penha Verde	Bi-frustoconical; hexagonal section	1.6 x 1.5 x 0.7	8.5
Penha Verde	Bi-frustoconical; hexagonal section	0.9 x 1 x 0.6	2.2
Penha Verde	Discoidal; sub-rectangular section	0.9 x 1 x 0.5	2.2
Castro de Pragança	Bi-frustoconical, slightly oblong; hexagonal section	0.8 x 0.6	1.82
Castro de Pragança	Bi-frustoconical; hexagonal section	0.9 x 0.5	2.86
Castro de Pragança	Irregular, plano-convex; plano-convex section	1.1 x 0.7	4.10
Castro de Pragança	Bi-frustoconical, angular; hexagonal section	1.1 x 0.8	4.79
Castro de Pragança	Irregular, frustoconical; hexagonal section	1.1 x 0.6	4.21
Castro de Pragança	Bi-frustoconical; hexagonal section	1.2 x 0.6	4.08
Castro de Pragança	Bi-frustoconical; hexagonal section	1.5 x 0.8	8.7
Castro de Pragança	Bi-frustoconical; hexagonal section	1.6. x 0.7	9.32
Castro de Pragança	Bi-frustoconical; hexagonal section	1.9 x 1.1	18.72

Site	Shape and Form	Dimensions (cm)	Weight (g)
Castro de Pragança	Bi-frustoconical; hexagonal section	1 x 0.7	3.87
Castro de Pragança	Sub-spherical; sub-spherical section	1.1 (diam.)	4.65
Castro de Pragança	Sub-spherical; sub-circular section	1 (diam.)	3.29
Castro de Pragança	Sub-spherical; circular section	1 (diam.)	3.2
Castro de Pragança	Sub-ovoid; sub-circular section	1.1 x 1.1	6.28
Castro de Pragança	Frustoconical; spherical section	1.5 x 0.5	4.34

Table 3. Metrology of balance weights from sites in inland Alentejo and Algarve (based on data after Vilaça 2011, 152-154)

Site	Shape and Form	Dimensions (cm)	Weight (g)
Baleizão	Sub-circular, discoidal.	1.2 x 0.3	2.32
Baleizão	Octahedron	1.4 x 1.4	4.56
Baleizão	Bi-frustoconical; perforated	1.2 x 0.8	6.37
Baleizão	Bi-frustoconical; perforated	1.6 x 0.9	9.67
Baleizão	Bi-frustoconical	1.6 x 0.9	9.75
Baleizão	Bi-frustoconical; perforated	1.7 x 1.6	12.78
Baleizão	Bi-frustoconical	1.9 x 0.1	18.64
Castro de Ratinhos	Bi-frustoconical		7

Table 4. Cubic balance weights from Quinta do Almaraz (data after Vilaça 2011, 147) and Alcácer do Sal (data after Arruda 2014, 526)

Site	Balance weight - form	Weight (g)
Almaraz	cubic	2.63
Almaraz	cubic	6.38
Alcácer do Sal	cubic	9
Alcácer do Sal	cubic	12.6
Alcácer do Sal	cubic	21.3
Alcácer do Sal	cubic	25
Alcácer do Sal	parallelepipedic	29.5

Table 5. Coinage of Alcácer do Sal during Phase 1: metrology (adapted from Correia 2004, Table 4).

Coinage Phase	Coinage Group	Numismatics	Metrology mm	Metrology g
Phase 1, 218-139 BCE		Unit 1	26	15
		Division 1.1	21	6.6
		Unit 2	25.5	9.2
		Division 2.1	13	4.9
		Unit 3	22	9.9

Table 6. Coinage of Alcácer do Sal during Phase 1: iconography (adapted from Correia 2004, Table 1).

Coinage Group	Coin	Reverse	Obverse
Phase 1	Unit 1	Two tuna fishes and legend with crescent	Head with lionskin and club
Phase 1	Division 1.1.	Tuna fish and legend with crescent	Head with lionskin and club
Phase 1	Unit 2	Two dolphins and legend with crescent	Wreathed head
Phase 1	Division 2.1	Dolphin and legend without a sign	Wheat
Phase 1	Division 2.1	Hippocampus and legend without a sign. “Contramarca“ S.	Two wheat spikes and crescent

Table 7. Coinage of Alcácer do Sal during Phases 1-3 (adapted from Correia 2004, Table 4).

Coinage Phase	Coinage Group	Numismatics	Metrology mm	Metrology g
Phase 1, 218-139 BCE		Unit 1	26	15
		Division 1.1	21	6.6
		Unit 2	25.5	9.2
		Division 2.1	13	4.9
		Division 2.2	22	9.9
Phase 2, 139-44 BCE	Group 1	Unit 1	24.5	12.5
		Division 1.1	18	6.7
		Unit 2	26	10.3
	Group 2	Unit 3	27	15.2
		Unit 4	25	12
		Division 4.1	20	6.5
		Unit 5	26	13.3
	Group 3	Unit 6	27	14.9
		Division 6.1	20	15.1
Phase 3, 44-31 BCE		Unit 1	26	12
		Division 1	22	8.7

Table 8. Coinage of Alcácer do Sal during Phase 2: iconography (adapted from Correia 2004, Table 4

Coinage Group	Coin	Obverse	Reverse
Group 1	Unit 1	Head with lionskin and club	Two tuna fish with crescent, initial ODACIS.A(edilis)
Group 1	Division 1.1	Head with lionskin and club	Tuna and legend ODA(CIS).A(edilis).S(emis)
Group 1	Unit 2	Head with lionskin and club SISVCRHIL	Two tuna fish and legend with initial crescent
Group 2	Unit 3	Wreathed head CANDNIL SIS(v)C(v)R(hil). F(ilius)	Two dolphins and legend and crescent
Group 2	Unit 4	Wreathed head SISBE. SIS(v)C(v)R(hil).F(ilius)	Two tuna fish and legend with initial crescent
Group 2	Division 4.1	Head with lionskin and club CANDNIL. SIS(v)C(v)R(hil).F(ilius)	Tuna fish and legend SISBE.A(edilis).S(emis)
Group 2	Unit 5	Head with lionskin and club ANDVGEP.SISVC(vrhi).F(ilius).TVL(?)	Two dolphins and legend with crescent
Group 3	Unit 6	Head with lionskin and club CANTNIP.[EDNI?].AE(dilis).F(ilius)	Two dolphins and legend with crescent
Group 3	Division 6.1	Head with lionskin and club CORAN	Dolphin and legend