Trade between Minturnae and *Hispania* in the Late Republic

by

CLIVE STANNARD,
ALEJANDRO G. SINNER
&
MARCO FERRANTE
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A comparative isotopic analysis of the Minturnaean lead issues and the Spanish *plomos monetiformes* of the Italo-Baetican series, and numismatic and epigraphic evidence of the trade

CLIVE STANNARD, ALEJANDRO G. SINNER & MARCO FERRANTE

[PLATES 21-28]

**INTRODUCTION**

Two large complexes of struck lead pieces,\(^1\) from the Roman colony of Minturnae and from Baetica (southern Spain) in the late Republic, have been documented in recent years. There are close and unique iconographic parallels between them. We accordingly undertook an analysis of the isotopic signatures of the leads used in the two areas, to see if this aids in understanding their relationship. At the same time, we investigated the presence of tin in the alloys of both complexes, and its implications. We then expanded to a consideration of the evidence of the presence in Carthago Nova of Italian *gentes* known from the area of Minturnae in the second and first centuries, and their role in the production of, and trade in, Spanish lead. This allowed us to identify a die-linked series among the lead pieces from Minturnae, signed by members of some of the most prominent *gentes* at Carthago Nova, which we suggest is evidence of a company trading between the two ports. We also investigated possible contacts with Minturnae of the *gentes* signing the Baetican complex.

**THE PORT OF MINTURNAE, THE LIRI DATABASE, AND SPANISH COINS FROM MINTURNAE**

Minturnae was a Roman *colonia maritima*, founded in 296/295. It was in a strategic position, where the *via Appia* crossed from Latium to Campania, and a port on the navigable River Garigliano or Liri (the ancient *Liris*), two km from the coast. Rome’s armies and other travellers regularly transited Minturnae, on the main route to southern Italy and Greece. At the same time, it was a major port serving southern Latium and northern Campania. Many Italians migrated from here to Spain, and there is strong evidence of contacts with Carthago Nova, approximately eleven sailing days

\(^1\) All dates are BC, unless otherwise mentioned; BC and AD may however occasionally be used, in order to avoid confusion. We thank François de Callataý (École pratique des hautes études), Borja Díaz (Universidad de Zaragoza), Robert Knapp (University of California, Berkeley), Ignacio Montero (Consejo Superior de Investigaciones Científicas), Javier Velaza (University of Barcelona) and Paolo Visonà (University of Kentucky) for reading and advising us on drafts of this article. They are innocent of our errors. In this paper, we use the term ‘pieces’ for these lead issues, rather than ‘tesserae’ or the like, in order to avoid having to enter into a discussion of their nature and function.
away. Minturnae played an important role in the importation and redistribution of goods from the Iberian Peninsula. Families from Cales and Teanum in its hinterland were also prominent in the lead trade from Cartago Nova. During the second half of the second century into the first century, Minturnae exported large volumes of its local wine, and wines from the *ager Caecubus* and *ager Falernus*—accompanied by Calenan black gloss wares as a secondary cargo—to Languedoc and to Spain.

For many years, Stannard has been assembling a data-base of non-Roman coins—almost all pre-Imperial and bronze—as well as lead pieces that have come from the river and been dispersed in commerce. Most are from the area under the bridge, and it is probable that they were tossed in by travellers. The number of coins involved is estimated at some hundreds of thousands, of which over 2,000 non-Roman have been recorded in the Liri data-base. This large sample, from all areas of the Graeco-Roman world, has been the basis for a number of studies of contacts between Minturnae as well as west-central Italy generally and other places, in the second and first centuries, including Massalia, Ebusus, Ionia and in particular Kos, Cyrenaica, and Hispania.

![Spanish mints in the Liri data-base](image)

**Fig. 1.** Spanish mints in the Liri data-base

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2 Data from the ORBIS/Stanford model.
4 Principal and Ribera i Lacomba, 2013; Madrid i Fernández and Sinner, 2019.
5 For the circumstances of these finds: Stannard and Ranucci, 2016, pp. 158–161.
10 Stannard and Ranucci, 2016.
11 Based on Stannard and Sinner, 2014, pp. 168–172, with figs. 9 for the data and 10 for the map.
Spanish coins make up 4.5% of the database—69 bronze coins and the two Italo-Baetican lead pieces (B12 and B17 listed and described below)—if Ebusus (60 coins) is not included. Stannard has argued that a large block of Ebusan coin was brought to Pompeii about 150, and put into circulation there. This was followed by the imitative issues of the Pompeian pseudo-mint, using types of Ebusus, Massalia, Carthage and Rome. Stannard has argued that a large block of Ebusan coin was brought to Pompeii about 150, and put into circulation there. This was followed by the imitative issues of the Pompeian pseudo-mint, using types of Ebusus, Massalia, Carthage and Rome. It is impossible to estimate that part of the finds that may have come directly from Ebusus. The abundance of Ebusan coins at Minturnae is therefore not a reliable index of direct contact with the island, but is a result of these unusual circumstances.

Coins of Hispania Citerior and Ulterior have been found in the Liri in about equal numbers. In Citerior, the ports of Kese / Tarraco (18.6%) and Undikesken / Emporion (14.3%) are especially prominent, Carthago Nova (1.4%) less so. Coins of the Laietani (Laišken, Ilduro, Lauro, Baitolo) are relatively common (7.2%), which appears significant, because these circulated locally, unlike the coins of Kese / Tarraco, which are found throughout Catalonia. In Ulterior, the main ports represented are Malaka (10%), then Gadir (4.3%) and Carteia (2.9%). The interior mints account for 28.8%, and the most prominent are Kastilo / Castulo and Corduba (4.3% each). The limited size of the sample means that the percentages for the different mints can only be illustrative, particularly as the production volumes of the various mints and their dates of activity vary greatly, but it is clear that Minturnae was in contact with all Spain, in particular the coastal North-East and the interior cities of Baetica.

THE ITALO-BAETICAN SERIES, IN ITALY AND IN SPAIN

The sheer number of coins in the Liri database made possible the identification of two large, previously unknown groups, among the more normal mints of the late Hellenistic world: an extensive complex of non-state bronze coins, some of which are local issues of Minturnae, and others that were probably made in Rome; as well as a large complex of lead issues. These together account for over 1400 specimens, in addition to the non-Roman coins. Once these were recognised, other issues and many further specimens of the bronze complex were identified in museums’ uncertain trays, but no specimens of the lead complex are known from anywhere but Minturnae, except from the Isla Pedrosa shipwreck, which we discuss below.

There is as yet no final catalogue of either of these complexes, but Stannard published a Provisional catalogue of the local coinages in the late Roman Republic in 2007 (cited in this paper as LOC + series number), which includes both. The two complexes are characterised by the use—though not exclusive—of a small number of types that are extremely rare or unknown elsewhere, except for a

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12 The Carthaginian imitations have not yet been published.
14 Sinner 2013.
15 A number of these are described and illustrated in Stannard, 2018, pp. 151–152.
16 Lead was used for a number of formal and informal coinages, as well as for a variety of para-monetary objects, in late Hellenistic times, particularly in the western Mediterranean. For an overview, de Callatajá, 2010.
group of issues from Baetica (southern Spain), almost all lead. Stannard first drew attention to this shared iconography in 1995, and coined the term ‘Italo-Baetican’ to describe it. In 2007, Stannard, Sinner, Moncunill Martí and Ferrer i Jane provided a catalogue of the Baetican complex (cited as PLO + catalogue number).

Three shared diagnostic types define the Italo-Baetican issues, examples of which are described in this paper and illustrated on the plates, numbered M for Minturnae, B for Baetica, and IP for pieces from the Isla Pedrosa wreck. These are: a pair of strigils and aryballos hanging from a carrying ring, either alone (pl. 21, M7, M10; pl. 22, B3; pl. 27, B13; pl. 28, B17), as a secondary type (pl. 21, IP1, and pl. 22, B1, B4), or carried by an athlete or dog (pl. 21, M6); an often ithyphallic furnacator with a shovel on his shoulder (pl. 21, M4; pl. 22, B4, B5; and as a secondary type, pl. 27, B14); and Vulcan (pl. 21, IP1). The shared iconography apart, the two complexes appear to be distinct productions, which, as finds show, were made separately in Baetica and at Minturnae. They share no issuers’ names, and the technical details of production—sizes and weights, etc.—are different. In both areas, a number of the issues carry uncial values, which suggests that they had a monetary function in the economic units in which they were issued.

An understanding of what the relationship between the issues in Italy and the issues in Spain may be could help elucidate trade contacts across the western Mediterranean. Were the issuers in the two places working together, and if so, who were they?

![Fig. 2. Use of Italo-Baetican types in different linguistic areas in the second and first centuries.](http://hesperia.ucm.es/img/Mapas_Cronologicos_Inscripciones_3.jpg)
In Spain, the Italo-Baetican issues are particularly interesting because, as fig. 2 shows, the use of the diagnostic types is very widespread, and involves a number of language groups and cultures.\textsuperscript{22} It extends from the city of Salacia in Portugal in the West, which uses the \textit{furnacator} type with an unclassified Southern non-Iberian script on a bronze coin (\textit{PLO} p. 75, fig. 17, 1),\textsuperscript{23} to the city of Albatha, with Vulcan and a Neo-Punic script on a bronze coin (\textit{PLO} p. 75, fig. 15, 6), and, in lead, somewhere between Carthago Nova and Saitabi (modern Xàtiva), in the east, where the only issue with a North-Eastern Iberian script (\textit{PLO} 22, p. 86, 22) was most probably struck. The largest group of these issues are the Latin-language \textit{grandes plomos monetiformes} from the lower Guadalquivir Valley, south of Córdoba.\textsuperscript{24}

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{image}
\caption{A \textit{furnacator} from the Praedia of Iulia Felix, Pompeii (II 4, 6–7) Naples, National Archaeological Museum, room 132\textsuperscript{25}}
\end{figure}

In the Spanish context, the misreading of the \textit{furnacator} type as a miner, because of the shovel he carries on his shoulder, and because the pieces are struck in lead—a by-product of the silver mines that were a source of great wealth to Roman colonists—have often led to these issues being considered ‘\textit{plomos de las minas}’\textsuperscript{26}. If this were true, the \textit{plomos} would be at least a witness to, and probably a tool in, Roman colonists’ exploitation of the Spanish silver/lead mines, and—if the Italian and Spanish Italo-Baetican series were in fact linked—one would expect this to

\textsuperscript{22}For the languages and epigraphies of pre-Roman Spain, see Sinner and Velaza, 2018, and especially 2019 with bibliography.
\textsuperscript{23}On coin evidence for Palaeohispanic languages, and Salacia, see Ripollès Alegre and Sinner, 2019, p. 395.
\textsuperscript{24}Stannard, Sinner, Moncunill Martí and Ferrer i Jané, 2017.
\textsuperscript{25}Photo © Michael Larvey.
\textsuperscript{26}Cf. Casariego, Cores, and Pliego, 1987.
condition our understanding of the reason behind the central Italian series as well, and of the nature of a relationship between the two groups of issuers.

The *furnacator* however, stokes hypocausts in public baths, and has nothing to do with mining. Fig. 3 shows a *furnacator* in a baths mosaic from Pompeii. There is in reality no significant evidence that the *grandes plomos*, and the Baetican assemblage in general, relate to mining. The association of the man with the shovel with the strigils, which can have nothing to do with mining—pl. 22, B4 for example—is an argument against it.

A further peculiarity of the Spanish issues that could have implications for the nature and role of the Italo-Baetican issues is that a number of the *grandes plomos* from the Latin-language area prominently carry the legend, Γ·S. Pl. 22, B5, is an example. Fig. 4 shows how widespread the finds of pieces with this legend are. García-Bellido suggested expanding Γ·S to *Publica Societas*, and that the *grandes plomos* were a ‘company coinage’, issued by a corporate body exploiting the Spanish mines and oil-production. However, this is unlikely. As we have seen, the iconography of the *grandes plomos* is not related to mining, which is the context in which *societates* are documented. Nor is it now believed that Roman *publicani*, as such, owned mining companies. The *grandes plomos*, not datable beyond the first century BC at the latest, predate the massive exportation of olive oil to Rome that began under Augustus, when the Guadalquivir valley became the major supplier of oil to the metropolis, with the discarded amphorae in which it was transported forming the bulk of the artificial hill of Monte Testaccio. However, if Γ·S in fact denotes some type of corporate body with an economic function, then agriculture is its most likely interest. The legend is not present in Italy.

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27 ‘Je n’ai, pour ma part, jamais remarqué la moindre relation entre de tels types de plombs monétiformes et les mines. Il faudrait être assuré que ce genre d’objets proviennent d’établissements miniers ou qu’il peut être mis épigraphiquement en relation avec les mines ou les compagnies minières de façon indiscutable. Ce n’est, me semble-t-il, pas le cas.’ (Claude Domergue, personal communication, 1 October 2006).


29 García-Bellido, 1986, pp. 29–30: ‘Una posible interpretación sin base suficiente para ser defendida, sería la lectura de *P(ublica) S(ocietas)*, o *S(ocietas) P(ublica)* como aparece en el precinto, y se trataría por su nombre de una única sociedad pública frente a otras muchas privadas, lo cual parece bien atestiguado para España a partir de Síla, fechas en que probablemente las antiguas explotaciones arrendadas por los equites se venden a particulares. Es comprensible que el estado, o el municipio más cercano, se hubiese reservado la explotación de alguna mina o tierra de labranza, y se permitiese marcar, por su excepcionalidad, sus monedas, téseras y precintos como pertenecientes a la *res publica*. Pues bien, si estuviésemos en lo cierto al interpretar así las siglas, tendríamos que pensar entonces en fechas post-silanas preimperiales.’

30 The mines were probably declared *ager publicus*, and exploited under a regime of *occupatio* (Rico, 2010, pp. 407–409; Díaz Arínó and Antolinos Marín, 2013, pp. 551–553).

31 The open letter-form, Γ, used on the *plomos* is replaced by the closed form, P, in the last decades of the first century.

32 Blázquez Martínez, Remesal Rodríguez, and Rodríguez Almeida, 1994; Blázquez Martínez and Remesal Rodríguez (eds), 2014.

33 But see the discussion of pl. 21, M11, below.
Finds of the Spanish *plomos* in Italy, and of Minturnai lead pieces in Spain, are direct evidence of contacts between the two areas. In Spain itself, only one *grandes plomo* is known from outside the South, which travelled north to Citerior along the *via Heraclea*, while two are known from the River Liri at Minturnae, the only specimens found outside Spain (pl. 28, B17, Liri 23.048, like *PLO* 16; and pl. 25, B12, Liri 24.058 = *PLO* 75). There is also a purse from the *Isla Pedrosa* shipwreck off Estarit in Catalonia, of about 150/130, which contains five Minturnae lead pieces, the only examples known from anywhere else (four are illustrated on pl. 21, IP1–IP4, the fifth being from the same dies as IP1), as well as Neapolitan coins.

The pattern of trade at this time was one of long-distance shipping between major entrepôts, and local redistributive networks: the purse probably belonged to a passenger from Minturnae who had taken ship on a south-bound coaster from the major entrepôt of Emporion, which was selling Campanian A black gloss wares and local millstones down the Catalan coast. The shipwreck provides the only sure TPQ for any of the lead issues from Minturnae.

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34 Villaronga, 1993 = *PLO* 60.
35 *Obv.* Foot wearing sandal or boot right.
*Rev.* Strigils and aryballos facing; star to left; wheel to right. B17 22mm 10.35g.
38 Árévalo and Delgado, 2016.
Fig. 5. Places mentioned, mining areas in Spain, trade routes, and the Isla Pedrosa shipwreck\textsuperscript{39}

\textit{Obv.} Head of Vulcan right, wearing pileus.

\textit{Rev.} Boy kneeling left, tying the sandal of a stooping man, facing right; \(\ddagger\) to right; ring, from which are suspended two strigils and an aryballos, in field above value-mark; \(\ldots\)VR (?) behind.

\textbf{IP1} 16mm \(\nabla\) 3.56g MAC-CASC inv. 18031

\textit{Obv.} Bearded long-haired male theatre mask right; linear border.

\textit{Rev.} Oil-lamp, nozzle right; a mouse to right, standing up, left, with its fore-paws on the lamp; all on exergual line.

\textbf{IP2} 16mm \(\nabla\) 2.59g MAC-CASC inv. 18040

\textit{Obv.} Helmeted head of Minerva right.

\textit{Rev.} Victory standing right; SAN behind.

\textbf{IP3} 18mm \(\nabla\) 2.90g MAC-CASC inv. 18035

\textit{Obv.} Unclear.

\textit{Rev.} Clasped hands

\textbf{IP4} 18mm 4.21g MAC-CASC inv. 1142

\*  \*  \*

This brief rehearsal of the evidence leaves us in somewhat of a quandary in understanding the relationship between the central Italian and the Baetican issues. We have the evidence for trade between the two areas of the shared use of the diagnostic Italo-Baetican types, as well as the finds. The use of lead to strike these pieces in the two areas points to an important context: the massive production of lead in south-eastern Spain, as a by-product of silver mining.\textsuperscript{40} In the Republican period,

\textsuperscript{39} We thank Suzanne Frey-Kupper for allowing us to use this map. © Source Nasa/BlueMarble; Grafische Gestaltung, artmax GmbH, Schweiz.

\textsuperscript{40} Sustained high levels of lead pollution in Greenland ice from the fourth the mid-fourth to second centuries correspond to intensive mining in Carthaginian and Roman Republican Spain (McConnell \textit{et al}., 2018. See also de Callataj, 2005.) The intensity of production is shown by lead concentrations and stable isotopes in sediment cores from lagoon areas in France and Spain (Elbaz-Poulritch \textit{et al}., 2011). Litharge from earlier silver production may also have been reworked to recover the lead (Diaz Ariño and Antolinos Marin, 2013, p. 538).
the galena ores of the Cartagena/Mazarrón area in south-east Spain were intensively exploited, and lead was exported in ingots to Italy and elsewhere through the port of Carthago Nova, with a peak between about 150 and 50. Ingots of Cartagenan lead are common in shipwrecks throughout the western Mediterranean.

According to Strabo (3.2.10), in the mid-second century, 40,000 men were regularly engaged in the mines of Carthago Nova, which extended over 400 stadia, and generated a profit of 25,000 drachmas per day for the Roman people. The Cartagena-Mazarrón area remained the main source of lead until the end of the Republic, after which the mines of the Sierra Morena in Baetica replaced it as the main source of lead for the Empire.

Mining and trade drew Italians to Spain, to exploit its economic potential, as documented by comparative studies of inscriptions in Italy and in Spain. These have identified a number of Italian gentes involved in this trade, particularly from Campania and Minturnae and its hinterland. Many of these signed the Cartagenan ingots. We will review the relevant evidence later.

**LEAD ISOTOPE AND TIN-CONTENT ANALYSES**

We have therefore undertaken a comparative study of the isotopic signatures of the lead used in the Baetican and in the central Italian complexes, with the objective of seeing whether it is possible to identify the probable origins of the metal, in the hope that this might elucidate the relationship between the two.

We also investigated the presence of tin in these alloys, because Arévalo and Delgado, in commenting on the Minturnaean lead pieces in the Isla Pedrosa purse, undertook an XRF analysis of their alloy, which showed surprisingly high percentages of tin, which must have been added, as no ores contain such amounts (tab. 1). This is a factor that had not earlier been documented, and we wished to know if the Baetican alloys also contained high levels of tin, and to understand the implications.

<table>
<thead>
<tr>
<th>Pl. 1, no.</th>
<th>% CuO</th>
<th>% As$_2$O$_3$</th>
<th>% SnO$_2$</th>
<th>% PbO</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP1</td>
<td>-</td>
<td>-</td>
<td>17.42</td>
<td>62.35</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(8.08)</td>
<td>(8.71)</td>
</tr>
<tr>
<td>IP2</td>
<td>8.89</td>
<td>-</td>
<td>32.25</td>
<td>21.70</td>
</tr>
<tr>
<td></td>
<td>(0.89)</td>
<td></td>
<td>(17.98)</td>
<td>(2.57)</td>
</tr>
<tr>
<td>IP3</td>
<td>-</td>
<td>-</td>
<td>25.82</td>
<td>59.53</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(10.91)</td>
<td>(9.28)</td>
</tr>
<tr>
<td>IP4</td>
<td>2.49</td>
<td>0.40</td>
<td>2.21</td>
<td>81.72</td>
</tr>
<tr>
<td></td>
<td>(0.66)</td>
<td>(0.26)</td>
<td>(1.35)</td>
<td>(7.21)</td>
</tr>
</tbody>
</table>

*Tab. 1. XRF analysis of the lead pieces from the Isla Pedrosa wreck, held in the Museu d’Arqueologia de Catalunya-Girona, Centre d’Arqueologia Subaquàtica de Catalunya, Girona. (Percentage by weight and coefficient of variation)*

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41 Domergue, 1990, pp. 179–222. The only group of Cartagenan ingots later than the first century AC is from the Baie de l’Amitié wreck, dated to AD 50; Trincherini *et al.*, 2009, p. 16; ‘Here we simply indicate [this] problem, to be treated elsewhere’.

42 Sousa Gomes *et al.*, 2017, p. 149.


44 Arévalo and Delgado, 2016, p. 219, fig. 19.
The samples

A total of 14 Minturnaean pieces (Pl. 21, M1–M14) and 12 Baetican pieces (Pl. 22–5, B1–B12) were analysed.\textsuperscript{45}

The selection criteria for central Italy were to:

a. Reflect the variety of the issues.
b. Include specimens of issues related to the pieces from the Isla Pedrosa shipwreck: M9 shares its obverse and reverse dies with IP2, though the reverse die has been modified, and M1 shares its reverse type (a boy tying or untying a man’s sandals) with IP1.
c. Include pieces with the Italo-Baetican diagnostic types, and other shared types: the furnacator on M4, M5 and M6; and the strigils and aryballos on M6, M7 and M10. A fly type is used both in Italy (M13) and in Baetica, alone or as a secondary type (here B2).
d. Include pieces with value-marks: M1 (+), M4 (l), M6 (–) and M11 (––).
e. Reflect trade: M11 appears to be an issue of a wine- or oil-trader.

The selection criteria for Baetica were to:

a. Reflect the variety of the issues.
b. Include pieces with the Italo-Baetican diagnostic types, and other shared types: the furnacator on B4 and B5, and the strigils and aryballos on B1, B3 and B4; B2 carries a fly symbol.
c. Include the piece from the Liri, B12.
d. Include pieces with value-marks: although B1 itself does not carry a value-mark, it carries the same types and is of the same size as PLO 10, which does (––).
e. Reflect trade: P·S, which could refer to a Publica Societas, is used on B5 and B6.

The Minturnaean sample

\begin{itemize}
\item \textbf{Obv.} Head of Apollo right; • behind.
\item \textbf{Rev.} Boy facing left, tying the shoe, or washing the foot, of a stooping man, facing right; the man’s left knee is lifted, and his left hand is on the boy’s head; • to right.
\item \textbf{M1} 14mm \( \downarrow \) 5.30g Liri 18.070
\end{itemize}

\textit{LOC} series 163a

\begin{itemize}
\item \textbf{Obv.} Head of Mercury right, wearing petasus; linear border.
\item \textbf{Rev.} Bearded long-haired male theatre mask right; linear border.
\item \textbf{M2} 14mm \( \sim \) 4.85g Liri 18.055
\end{itemize}

\textit{LOC} series 38

\begin{itemize}
\item \textbf{Obv.} Bearded head of Janus; border of dots.
\item \textbf{Rev.} Centaur galloping right, holding a club over his head; K·Æ before; border of dots; large pellet to right.
\item \textbf{M3} 20mm \( \downarrow \) 3.53g Liri 26.005
\end{itemize}

\textsuperscript{45} We thank Pere Pau Ripollès for his help in assembling the Baetican sample.
LOC series 51b, as

*Obv.*  Head of Janus; I above; N to left; border of dots.

*Rev.*  *Furnacator* in a short tunic, with a large, flaccid phallus, advancing right, carrying something in his left hand at waist height, a shovel on his shoulder; border of dots.

**M4**  21mm  \  14.13g  Liri 45.549

LOC series 51c

*Obv.*  Beardless male head right.

*Rev.*  Man walking right, on an exergual line, carrying an askos; C·AVE up behind; border of dots.

**M5**  14mm  ↓  3.33g  Liri 29.107

LOC series 63a, quadrans

*Obv.*  *Furnacator* in a short tunic, with a large, flaccid phallus, advancing right, holding a shovel out before him; Γ·CA Γ to right; TI to left, border of dots.

*Rev.*  Dog, wearing a collar, advancing right, carrying a ring with two strigils and an arylballos suspended from it in its jaws; **·** above.

**M6**  14mm  \  2.96g  Liri 36.002

LOC series 66

*Obv.*  Hercules standing right, a club in his right hand, placing something on an altar to right; garbled legend between.

*Rev.*  Ring, from which are suspended two strigils and an arylballos; garbled legend around.

**M7**  17mm  ↓  5.45g  Liri 34.046

LOC series 87b

*Obv.*  Panther standing right, looking back, a thyrsus over its shoulder.

*Rev.*  Uncertain object.

**M8**  11mm  \  2.13g  Liri 34.054

LOC series 89a

*Obv.*  Bearded long-haired male theatre mask right; linear border.

*Rev.*  Oil-lamp, nozzle right; a mouse to right, standing up, left, with its fore-paws on the lamp; all on exergual line.

**M9**  15mm  →  2.80g  Liri 29.019

These are the same dies as pl. 21, **IP2**, from the *Isla Pedrosa* wreck, but following deterioration of the reverse die, a handle has been cut through the oil-lamp, to make it into an axe.

LOC series 65a

*Obv.*  Ring, from which are suspended two strigils and an arylballos.

*Rev.*  Purse; ...ΟΗΓΟ?

**M10**  14mm  ↑  1.67g  Liri 25.009

LOC series 161a, quadrans

*Obv.*  Amphora, with a rope (?) draped over the top; CN·CORNIILI·Γ·S around; border of dots.

*Rev.*  Oil-lamp right; **·** above; CN·CORNIILI·Γ·S below.

**M11**  13mm  ↑  2.71g  Liri 24.018
LOC series 160

Obv. Helmeted head of Minerva, right; border of dots.
Rev. Well-head (?); border of dots.

M12 26mm \ 18.05g Liri 27.007

LOC series 91a

Obv. Fly, seen from above.
Rev. Blank.

M13 15mm ← 2.70g Liri 24.026

LOC series 169

Obv. Victory crowning trophy right; RF to right.
Rev. Two goats on their hind legs, facing each other; C·VERG around.

M14 11mm → 1.85g Liri 29.013

The Baetican sample

PLO 9

Obv. Mule head right; star before; L·HER below; border of dots.
Rev. Foot wearing sandal or boot right; carrying ring with two strigils right; dot between; ΠC AN M·C; border of dots.

B1 22mm ← 9.38g eBay Spain, 23 February 2018, no. 172666234926

PLO 13

Obv. Mule head right.
Rev. Figure seated right on a three-legged stool; fly to right.

B2 22mm ↓ 6.67g Todocolleción Spain, 23 February 2018, no. 216700294

PLO 21

Obv. Askos right; border of dots.
Rev. Strigils and aryballos facing; border of dots.

B3 23mm ← 8.63g Aureo Auction, 15 Dec. 1994, lot 2309

PLO 34

Obv. Naked furnacator walking right on exergual line, a shovel on his shoulder; strigils and aryballos facing before.
Rev. CELTE; plough inverted (?) above; uncertain object below.

B4 23mm ↓ 11.06g eBay Spain, 23 February 2018, no. 253429510118

PLO 25

Obv. Naked man walking left, a shovel marked FRVM on his shoulder, holding out a bell; P·S to either side; wreath border.
Rev. Naked man standing right pouring water from an askos onto a beribboned phallus; broom below on exergual line; Q·CO ILLI.Q around, and LVSO in a tablet in exergue; wreath border.

B5 49mm ← 174.06g eBay Spain, 23 February 2018, no. 253429510118

PLO 46

Obv. Bull or cow’s head facing, wreath tied above.
Rev. Boar right, palm behind; M·LE before; P·S above.

B6 46mm ↗ 52.96g Todocolleción Spain, 24 February 2018, no. 2167011068
**PLO 48**

*Obv.*  Bull or cow’s head facing, in wreath tied above.

*Rev.*  Boar right, some object above and Α above that; in wreath tied below.

B 7 47mm  52.86g  Milancios Spain, 7 March 2018, no. 224654236

**PLO 52**

*Obv.*  Bull or cow’s head facing.

*Rev.*  Boar right, Α above.

B 8 49mm  73.47g  Milanuncios Spain, 17 April 2018, no. 265568841

**PLO 53**

*Obv.*  Bull or cow’s head facing, adorned for sacrifice.

*Rev.*  Boar right.

B 9 49mm  174.38g  eBay Spain, 23 February 2018, no. 192204611103

B 10 50mm  120.65g  eBay Spain, 17 April 2018, no. 192204611442

These pieces share both dies.

**PLO 74**

*Obv.*  Wreathed head of Apollo right.

*Rev.*  Owl on amphora; Ń downwards on square tablet left and VOS upwards to right (V and S on tablets); all in wreath tying below.

B 11  c. 54mm  19.32g  eBay Spain, 22 February 2018, no. 232672015648

This piece has been quartered.

**PLO 75**

*Obv.*  Mercury seated on altar (?) left, his right hand extended; MERCVR… before.

*Rev.*  Toad seen from above; L-LVCIL-F above.

B 12 49mm  136.56g  Liri 24.056

**Analytical methodology**

The isotopic analyses were undertaken by Marco Ferrante of Trace Research Centre in Italy. The instrument used for the analysis was a Finnigan 262 (Thermo Finnigan, Bremen, D), equipped with variable manifolds, and therefore with extended geometry.

The preliminary chemical treatment of samples is of considerable importance, in order to guard against possible contamination that could alter the true value of the isotopic ratios. Lead is widespread in the environment, even in the air, though less so nowadays than in the recent past. In principle, if the sample is composed of lead only, or is large enough, the problem of contamination is marginal, but if the sample is very small, or at trace level, even the smallest contaminating interference must be avoided.

This operation was performed in a Class 100 Clean room, where ultra-cleaned FEP (Fluoro-ethylene Propylene) was used for all containment materials during chemical treatment. In order to optimise the measurement of isotopic ratios, it is advisable with this method to extract a quantity of lead of between 100 and 500 μg from the sample, and possibly separate it from other elements present, through a passage on microcolumns containing a Pb-specific resin (TrisKem, Bruz, F). The subsequent deposition of a microquantity of the eluate on the filament, and the ionization procedure inside the source, are described in detail in Trincherini and Facchetti.
(1983). The use of a Thermal Ionization Mass Spectrometer (TIMS) generally gives very precise results. In these analyses, the internal precision (2σ) of the isotopic ratios $^{206}\text{Pb}/^{207}\text{Pb}$ and $^{208}\text{Pb}/^{206}\text{Pb}$, calculated on the average of 60 values acquired for the same measure, was on average $\leq$ 40 ppm.

**Strengths and limits of lead isotope analysis for the identification of metal origins**

Each chemical element has a specific number of protons in the nucleus of its atoms, equal to the number of its electrons. The number of neutrons may vary, and the sum of protons and neutrons in an atom is its atomic mass. Isotopes are atoms of a single chemical element with different atomic masses. For most chemical elements, the ratio of isotopes in the earth’s crust is constant. Lead is a striking exception. The ratios of its four stable isotopes—$^{204}\text{Pb}$, $^{206}\text{Pb}$, $^{207}\text{Pb}$, $^{208}\text{Pb}$—vary according to where it is mined. This is because the radioactive isotopes of uranium ($^{235}\text{U}$ and $^{238}\text{U}$), and thorium ($^{232}\text{Th}$), present in ores in different percentages, decay spontaneously to produce $^{206}\text{Pb}$, $^{207}\text{Pb}$ and $^{208}\text{Pb}$, to add to the primordial $^{204}\text{Pb}$. Lead with different ratios of the isotopes can therefore be compared to known ores from known mines, with the aim of identifying its origins. However, while it is theoretically possible for each ore deposit to have a unique isotopic composition, the differences may, in reality, be so small as to demand the utmost analytical precision and accuracy to tell them apart.\(^{46}\) The interpretation of lead isotope data, in order to identify probable origins of the metal in the objects tested—assuming that lead of different origins has not been mixed—by comparison against a database of known ores, is therefore not automatic, but requires the consideration of historical and archaeological data, to weigh the possibilities that the lead isotope analysis establishes.\(^{47}\)

**Results**

<table>
<thead>
<tr>
<th>Sample</th>
<th>$^{206}\text{Pb}/^{207}\text{Pb}$</th>
<th>$^{208}\text{Pb}/^{206}\text{Pb}$</th>
<th>$^{206}\text{Pb}/^{204}\text{Pb}$</th>
<th>$^{207}\text{Pb}/^{204}\text{Pb}$</th>
<th>$^{208}\text{Pb}/^{204}\text{Pb}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>1.195038</td>
<td>2.079076</td>
<td>18.669897</td>
<td>15.622358</td>
<td>38.814682</td>
</tr>
<tr>
<td>B2</td>
<td>1.1952</td>
<td>2.077779</td>
<td>18.69012</td>
<td>15.637703</td>
<td>38.834694</td>
</tr>
<tr>
<td>B3</td>
<td>1.176636</td>
<td>2.092419</td>
<td>18.325137</td>
<td>15.574247</td>
<td>38.343619</td>
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<tr>
<td>B4</td>
<td>1.183067</td>
<td>2.087898</td>
<td>18.470149</td>
<td>15.612207</td>
<td>38.56299</td>
</tr>
<tr>
<td>B5</td>
<td>1.173441</td>
<td>2.096021</td>
<td>18.303602</td>
<td>15.598207</td>
<td>38.365747</td>
</tr>
<tr>
<td>B6</td>
<td>1.18917</td>
<td>2.082411</td>
<td>18.566917</td>
<td>15.613082</td>
<td>38.662548</td>
</tr>
<tr>
<td>B7</td>
<td>1.194597</td>
<td>2.081137</td>
<td>18.6514</td>
<td>15.612913</td>
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<tr>
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<tr>
<td>B10</td>
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<tr>
<td>B11</td>
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<td>18.23029</td>
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<td>B12</td>
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<td>15.651508</td>
<td>38.904455</td>
</tr>
<tr>
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<td>1.194932</td>
<td>2.065228</td>
<td>18.679697</td>
<td>15.632933</td>
<td>38.573761</td>
</tr>
<tr>
<td>M2</td>
<td>1.193985</td>
<td>2.07637</td>
<td>18.667209</td>
<td>15.634777</td>
<td>38.759468</td>
</tr>
</tbody>
</table>

\(^{47}\) Domergue et al., 2011.
which means that they are more subject to error—as analysis: firstly because of the lesser precision with which they can be measured—specific mining area.

Mazarrón, and perhaps the artagena-

c de órdoba

artesian plane, against a background with the isotopic data on the main ore lead in the 26 samples analysed (both Minturnae and

antiquity, in order to assess the probable origin of the metal from which the piece was made.

Fig. 6a is an isotopic map that projects the \( \text{Pb}^{206}/\text{Pb}^{207} \) and \( \text{Pb}^{208}/\text{Pb}^{206} \) ratios of the lead in the 26 samples analysed (both Minturnae and Baetica) onto the x- and y-axes of a Cartesian plane, against a background with the isotopic data on the main ore bodies in Spain from which lead was extracted in Antiquity, which were: the Sierra de Cartagena (Cartagena/Mazarrón); the Sierra Morena near Seville and Córdoba in central Baetica; the Sierra de Almagrera (Almería), which here includes Cabo de Gata; and the south-west pyritic belt (Huelva and Cádiz). As can be seen, a number of the samples are comparable to isotopic ratios of ores from the Cartagena-Mazarrón, and perhaps the Almeria, regions, while others are not easily fitable to a specific mining area.

The \( \text{Pb}^{206}/\text{Pb}^{204} \), \( \text{Pb}^{207}/\text{Pb}^{204} \) and \( \text{Pb}^{208}/\text{Pb}^{204} \) ratios are less relevant for cluster analysis: firstly because of the lesser precision with which they can be measured— which means that they are more subject to error—as \( \text{Pb}^{204} \) is present at \(<1.5\% \) only; and secondly because \( \text{Pb}^{206} \), \( \text{Pb}^{207} \) and \( \text{Pb}^{208} \) are radiogenic decay products of uranium and thorium, whose current percentages depend on the original and differing original amounts of these elements in the ore-body, while primordial \( \text{Pb}^{206} \) is stable and invariable. The three radiogenic isotopes contain all the information needed for analysis: \( \text{Pb}^{206} \) is usually invoked only to investigate uncertain \( \text{Pb}^{208}/\text{Pb}^{206} \) : \( \text{Pb}^{206}/\text{Pb}^{207} \) results.

Tab. 2. Isotopic ratios of the pieces analysed

Tab. 2 provides the values of the lead isotope ratios measured in samples taken from the 26 pieces. The \( \text{Pb}^{206}/\text{Pb}^{207} \) and \( \text{Pb}^{208}/\text{Pb}^{206} \) ratios are used to characterise a piece, for comparison against a database of isotope ratios of lead ores of sure provenance from specific ore bodies in mining areas in the Mediterranean active in Antiquity, in order to assess the probable origin of the metal from which the piece was made.

The \( \text{Pb}^{206}/\text{Pb}^{204} \), \( \text{Pb}^{207}/\text{Pb}^{204} \) and \( \text{Pb}^{208}/\text{Pb}^{204} \) ratios are less relevant for cluster analysis: firstly because of the lesser precision with which they can be measured—which means that they are more subject to error—as \( \text{Pb}^{204} \) is present at \(<1.5\% \) only; and secondly because \( \text{Pb}^{206} \), \( \text{Pb}^{207} \) and \( \text{Pb}^{208} \) are radiogenic decay products of uranium and thorium, whose current percentages depend on the original and differing original amounts of these elements in the ore-body, while primordial \( \text{Pb}^{206} \) is stable and invariable. The three radiogenic isotopes contain all the information needed for analysis: \( \text{Pb}^{206} \) is usually invoked only to investigate uncertain \( \text{Pb}^{208}/\text{Pb}^{206} \) : \( \text{Pb}^{206}/\text{Pb}^{207} \) results.

49 Using the ARCHAEO_TRACE database, with the isotopic data on 3,500 mineral samples. This results on the Oxford Archaeological Lead Isotope Database from the Isotrace Laboratory (Oxalid) database, with additional data from the literature.

49 Cabo de Gata is part of the Almeria Region. In this analysis, we sometimes split it out from the remainder of the Almeria region. When we use ‘Almeria’ without further specification, Cabo de Gata is included.

<table>
<thead>
<tr>
<th>Sample</th>
<th>( \text{Pb}^{206}/\text{Pb}^{207} )</th>
<th>( \text{Pb}^{208}/\text{Pb}^{206} )</th>
<th>( \text{Pb}^{206}/\text{Pb}^{204} )</th>
<th>( \text{Pb}^{207}/\text{Pb}^{204} )</th>
<th>( \text{Pb}^{208}/\text{Pb}^{204} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>M3</td>
<td>1.191927</td>
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<td>2.078318</td>
<td>18.677442</td>
<td>15.628149</td>
<td>38.818199</td>
</tr>
<tr>
<td>M5</td>
<td>1.194122</td>
<td>2.08421</td>
<td>18.704537</td>
<td>15.664068</td>
<td>38.98725</td>
</tr>
<tr>
<td>M6</td>
<td>1.196072</td>
<td>2.074785</td>
<td>18.67383</td>
<td>15.612293</td>
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</tr>
<tr>
<td>M7</td>
<td>1.198854</td>
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<td>38.727664</td>
</tr>
<tr>
<td>M8</td>
<td>1.193327</td>
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<td>18.637812</td>
<td>15.617799</td>
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<td>M9</td>
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<td>38.732031</td>
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<td>2.078936</td>
<td>18.658014</td>
<td>15.619204</td>
<td>38.788959</td>
</tr>
</tbody>
</table>
Fig. 6a. Isotopic map of the 14 Minturnaean samples and the 12 Baetican samples, compared to ores from known mines in Spain ($^{208}\text{Pb}/^{206}\text{Pb} : ^{207}\text{Pb}/^{204}\text{Pb}$)

We nonetheless provide, in figs. 6a and 6b, isotopic maps using $^{204}\text{Pb}$. Like fig. 6a, fig. 6b shows a number of the samples comparable to ores from Cartagena-Mazarrón and Almería. Fig. 6c is less informative, as there is overlap with almost all ore-bodies.

Fig. 6b. Isotopic map of the 14 Minturnaean samples and the 12 Baetican samples, compared to ores from known mines in Spain ($^{206}\text{Pb}/^{204}\text{Pb} : ^{207}\text{Pb}/^{204}\text{Pb}$)
Fig. 6c. Isotopic map of the 14 Minturnaean samples and the 12 Baetican samples, compared to ores from known mines in Spain (\(^{206}\text{Pb}/^{204}\text{Pb} : ^{208}\text{Pb}/^{204}\text{Pb}\))

Fig. 7 compares the isotopic maps of the Minturnaean and the Baetican samples. This shows that, although the samples are distinct, there is considerable overlap.

The Minturnaean samples

Fig. 8 analyses the 14 Minturnaean pieces against the most similar ores from Spain: Cartagena-Mazarrón, Cabo de Gata, and Almería. There are two clusters.

Cluster 1 comprises seven pieces (\(\text{M2, M3, M4, M5, M7, M11, M14}\)). The ores with the closest compatibility are from the Cartagena-Mazarrón mining area of southeast Spain. Domergue has shown that ingots of this lead are signed by members of families mining and trading lead in Carthago Nova.\(^{50}\) The fit is good, and there is no reason to doubt this attribution.

\(^{50}\)Domergue \textit{et al.}, 2011.
Cluster 2 comprises seven pieces (M1, M6, M8, M9, M10, M12, M13). The ores with the closest compatibility appear on first analysis to be from the Cabo de Gata mining area of south-east Spain, near Almeria. Domergue et al. obtained similar readings for some lead ingots from the Comacchio (Ferrara) wreck, but, after an extensive review, rejected the attribution, as incompatible with the historical and archaeological evidence. Cabo de Gata lead does not seem to have been exploited in the Republican period: in his survey of mining in the Province of Almeria, Arboledas does not mention Cabo de Gata, and his map shows no lead mining in the area. Stos-Gale and Gale report an archaeometallurgical survey that found no ‘ancient’ slagheaps in the area, and that many of the small galleries on the Gata peninsula were relatively modern, perhaps exploratory. As Trincherini et al. have shown, the isotopic ratios of lead from Cartagena-Mazarrón shade into the isotopic ratios of lead from the Almería mines. Minturnae cluster 2 overlaps with both these ranges, and we provisionally conclude that the origin of the lead involved is likely to be Almería (perhaps from the Sierra Almagrera), and will describe it as such in this paper. Further research may clarify the matter.

![Isotopic map of the 14 Minturnaean samples](image)

**Fig. 8.** Isotopic map of the 14 Minturnaean samples, compared to ores from Cartagena-Mazarrón, Cabo de Gata and the Almeria region, and to some ingots from the Comacchio (Ferrara) wreck

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51 *L’analyse de ceux de Comacchio constitue en effet un excellent exemple de ce genre d’études. Comme on le sait, les mesures isotopiques du plomb et l’utilisation d’une banque de données correspondantes permettent avant tout, lorsqu’on s’intéresse à l’origine d’un produit, d’écarter un certain nombre d’hypothèses, parce que les signatures isotopiques s’y opposent, pour ne laisser ouvertes que quelques possibilités. Ici, finalement, il n’en est resté que deux, l’une et l’autre dans le sud-est de l’Espagne : la Sierra Almagrera et le district de Cartagena-Mazarrón. Mais, pour en arriver à ce résultat, les disciplines historico-archéologiques avaient dû intervenir pour écartier, elles aussi, des districts miniers dont la signature isotopique était compatible avec celle des lingots, mais qui n’avaient pas été exploités à l’époque considérée : c’est le cas de la Toscane, et surtout du Cabo de Gata (ibid.: 18).

52 Arboledas Martínez, 2010, p. 89.

53 Stos-Gale and Gale, 2009, p. 207.

54 Trincherini et al., 2009, p. 13, graph 5.
The Baetican sample

As fig. 9 shows, there are two clusters.

Cluster 1 comprises five samples (B1, B2, B7, B8, B12). The ores with the closest compatibility are from the Cartagena-Mazarrón mining area of south-east Spain, more probably from Mazarrón than from Cartagena. There is no reason to doubt this attribution.

Cluster 2 comprises 7 pieces (B3, B4, B5, B6, B9, B10, B11). The cluster is clearly distinct from cluster 1. These samples do not appear to be very compatible with any of the Spanish ore-bodies, although there is some overlap with ores from the Huelva region in the south-west.

We therefore widened the search to the western Mediterranean generally, and it might appear as if Cluster 2 were compatible with Sardinian ores (fig. 10). However, there is no historical or archeological evidence that the mines of Iglesiente (south-western Sardinia) were active during this period, although there is evidence of lead mining at an earlier stage—for example, lead used to mend clay pots at the Nuragic site of Santa Barbara, Bauladu, whose isotopic signature matches that of Sardinian Cambrian ores—and it is unlikely that it had totally stopped. Neither Strabo nor Pliny mention Sardinian mines, and the first definite proof of mining in Sardinia (stamped ingots) only appears in the second century AD, although Sardinian lead seems to reach the market first in the time of Augustus. All the lead in Republican wrecks off Sardinia is from Cartagena, but for one case where the producer-stamps are uncertain. Lead from the Sierra Morena replaces it in wrecks of early Imperial times.

Fig. 9. Isotopic map comparing the 12 Baetican samples with ores from Cartagena and Mazarrón

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56 Lo Schiavo et al., 2005, pp 164–166.
57 Mederer and Chelle-Michou, 2011, p. 25.
58 Domergue and Rico, 2018, pp. 197 and 203.
59 Bagagli, 2002, pp. 156–157, describes the routes ships going to and coming from Cartagena took around Sardinia, and the ports used.
We must therefore also consider the possibility that the lead in cluster 2 is not from a single source, but from mixed origins melted together. Fig. 11 compares the Baetican samples to both the Sardinian and the main Spanish ores. In preparing this graph, we have purged the database of records that are potentially misleading: from the Sardinian sample, we have removed all records derived from lead in copper ores, and the mines of Cala and Sultana, which are also copper ores, from the Huelva sample. Though Huelva falls away as a comparator, Sardinia could remain. However, cluster 2 is strung out along an axis that runs from ores from the Sierra Morena (in particular, those of Linares, Ossa Morena and the Alcudia Valley) to ores from Cartagena-Mazarrón. Such a distribution would be compatible with mixtures with varying percentages of the lead from these two areas.

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60 The region of Huelva (ancient Onoba) was not a major lead producer: ‘la frecuente aparición de monedas de cecas de otros lugares pone de manifiesto los intensos contactos comerciales que se producían, fundamentalmente con las zonas mineras en donde se han localizado cecas procedentes del valle del Ebro y de Córduba (Córdoba) con quienes se produciría el abastecimiento de cereales, así como las cecas de Cástulo (Linares), desde donde se importaría el plomo necesario para la metalurgia de la plata (escaso en esta zona), junto con el que se compraría procedente de las minas de Cartagena, algunos de cuyos lingotes se han encontrado en Riotinto’ (Linares Toro, 2007, p. 31). Two ingots from the ancient mines of Rio Tinto (Huelva), stamped CARTHAGO NOVA, now lost, may show that the city was directly exploiting one or more mines, if they date to the early Empire (Orejas and Rico, 2015, p. 527).
Fig. 11. Isotopic map comparing the 12 Baetican samples with ores from Sardinia, the Sierra Morena, Huelva and Cartagena-Mazarrón

Although the production of Sierra Morena lead only overtakes Cartagena-Mazarrón lead in the early Empire, these mines were producing earlier: at La Loba mine (Fuentebobujuna, in the Province of Córdoba), large quantities of Dressel 1 amphorae of the late second and early first centuries have been found in miners’ dwellings, and middle Calenan black gloss wares (c.130/120–90/80), exported through Minturnae, are also very common there.

There are interesting parallels in recent lead isotopic analyses of 36 Ebusan bronze coins. The authors report that Cartagenan lead was already being used there in the pre-Roman period and continued in use into the late first century, though not exclusively:

<table>
<thead>
<tr>
<th>Campo group</th>
<th>Date</th>
<th>Coins</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>VII</td>
<td>c.300–225</td>
<td>6/6</td>
<td>100%</td>
</tr>
<tr>
<td>XII</td>
<td>c.225–218</td>
<td>8/9</td>
<td>89%</td>
</tr>
<tr>
<td>XVIII</td>
<td>c.218–c.150</td>
<td>17/22</td>
<td>77%</td>
</tr>
<tr>
<td>XIX</td>
<td>After c.80</td>
<td>5/8</td>
<td>62%</td>
</tr>
</tbody>
</table>

*Tab. 3. Cartagenan lead in Ebusan bronze coinage*

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63 The end date proposed is based on the fact that all the symbols of Campo Group XVIII were present by the time the block of these pieces reached Pompeii. Frey-Kupper and Stannard, 2018, pp. 299–309, and Stannard, 2018, pp. 106 and 110–111.
64 The date is that proposed by Costa Ribas, 2007, p. 98.
Coins of the Pompeian pseudo-mint with Ebusan types were also analyzed, and 22/30 (= 73%) of these used Cartagenan lead. The authors also report a number of outliers that do not have the Cartagenan lead signature. In fig. 12, we compare the data from these analyses with the 12 Baetican samples, ores from Mazarrón and Cartagena, and Linares, Ossa Morena and the Alcudia Valley. Much of the lead in the Ebusan coins analysed appears to follow the same distribution as Baetica cluster 2, and is likely to also be mixed leads of similar origin.

![Graph showing lead analysis results](image)

**Fig. 12.** Lead from bronze coins of Ebusus compared to the 12 Baetican samples (clusters 1 and 2 circled), ores from Mazarrón and Cartagena, Linares, Ossa Morena and the Alcudia Valley

On balance, we feel that Baetica cluster 2 is most likely to be of varying mixtures of lead from Cartagena-Mazarrón and the Sierra Morena, but the possibility that the lead is from Sardinia cannot be theoretically excluded, though on the basis of current evidence, this seems most unlikely. We will describe it as mixed in this paper.

66 These are TC-28 of Stannard’s catalogue of the pseudo-mint issues. For the separate but similar phenomenon of the imitation of Ebusan types in *Hispania Ulterior*: Martínez Chico, 2018.


68 The idea that Sardinian lead was being imported into the Guadalquivir valley during the period may seem counterintuitive, but it could reflect a shipping route from central Italy, past Sardinia, to the mouth of the River Baetis and inland. Sea-born traffic was heavy enough for Quintus Servilius Caepio, consul in 140–139, to build a lighthouse on an island in the mouth of the river (*Turris caepionis*, modern Chipiona) (Strabo 3.1.9; Keay, 1988, p. 34). However, the attribution to Sardinia of lead used in the large area of Baetica from which the *grandes plumos* come (fig. 4), as well as in Ebusus, from c. 300–225 (the earliest Ebusan coins) to the first century, would imply important and regular Republican mining activity in the island, and that Sardinia was competing with Carthago Nova in supplying the same users. We know no historical or archaeological evidence to support such suppositions.
Tin content analysis

The tin contents of all 26 samples was also measured, by inductively coupled plasma mass spectrometry (ICP-MS). The data for tin are important for understanding the nature of these issues, as well as for consideration of the origins of the lead in which the tin is found, in which context we discuss them below. The results of the tin analysis are included in tab. 4.

Interpretation

Our analyses have identified three possible sources of lead. Of these, the best understood is the Cartagena-Mazarrón area, and such lead is present both at Minturnae (cluster 1), and in the plomos of Baetica (cluster 1).

There are, however, two other distinct isotopic signatures: Almería at Minturnae (cluster 2) and mixed lead (cluster 2) in Baetica.

Tab. 4 resumes both the probable origins of the leads used in each of the Minturnaean and Baetican pieces, on the basis of isotopic analysis, and the part of tin in their alloys, as well as the information on the Italo-Baetican types, value-marks and possible trade references. The pieces from the Isla Pedrosa wreck—all almost certainly from Minturnae—are also listed. Although a different analytical methodology was used to measure their tin content, the comparability of the data is adequate for our purposes.

Tin was rare at this period, and from other areas than silver and lead: Cornwall, Armorica, Galicia, the north of Portugal and Extremadura. Cornwall was the main supplier, perhaps by sea to Spain, more probably by land through Gaul, either down the Rhône or through Narbo Martius. A number of western Mediterranean wrecks carry tin ingots. The 26 ingots in the Port-Vendres II wreck of Claudian date, south of Perpignan—the cargo of which was probably assembled in Narbo Martius—are in a variety of odd ‘handbag’ shapes. They weigh between 3.12 and 9.7 kg, and so were easily carried. Other ‘hand-bag’ ingots are known from the Capo Bellavista or Arbatax wreck off the western coast of Sardinia and the Plage de Losari wreck off Corsica, as well as from Ischia. Domergue thought that this might reflect small-scale native production in north-west Spain. Similar ingots have been reported from

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70 Mairecolas and Pailler, 2010, p. 160. However, for a discussion of the usually underestimated tin deposits of north-western Iberia: Comendador Rey et al., 2007.
71 Domergue and Rico, 2018, p. 207 and map on p. 245.
72 Illustrated in Colls et al., 1975, pp. 85–92, and in Domergue and Rico, 2018, p. 250, fig. 14 and 15.
73 ‘J’ai toujours été frappé par le caractère fruste et le manque d’homogénéité de tous ces lingots d’étain, en face de la régularité et de la standardisation des lingots de plomb et même des lingots de cuivre. Je me demande si, vu le caractère des régions qui, en Espagne, produisaient de l’étain—la Galice, le pays des Artabres, la Lusitanie : régions reculées, situées à l’extrême du monde, peu romainisées, où la production de l’étain a pu rester longtemps entre les mains des indigènes, dans les conditions d’exploitation et de troc que décrit Strabon, en particulier à propos des étranges îles Cassitérides—ces lingots ne sont pas des produits indigènes que des marchands romains auraient achetés à des producteurs plus ou moins romanisés’ (Domergue, 1994, p. 83).
St. Austell Moor in Cornwall.74 We cannot hazard where the tin in Minturnaean and Baetican lead came from, nor is it germane to our discussion, except that Chic García has drawn attention to the similarity of the ‘hand-bag’ ingots to the object at the bottom of the reverse of pl. 22, B4.75 That this could be an ingot was first suggested by García-Bellido, who when she wrote knew no such object from Spain.76 The suggestion is intriguing, but would need solider proof. If this were a tin ingot, it would be extremely enlightening for our understanding of the Italo-Baetican issues.

<table>
<thead>
<tr>
<th>Sample</th>
<th>IB types</th>
<th>Value-marks</th>
<th>Trade?</th>
<th>Sn/Pb, % by weight</th>
<th>Likely origin of Pb</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP1</td>
<td>Bath type shared with M1; strigils</td>
<td>†</td>
<td></td>
<td>17.34 / 63.35</td>
<td>n/a</td>
</tr>
<tr>
<td>IP2</td>
<td></td>
<td></td>
<td></td>
<td>32.35 / 21.70</td>
<td>n/a</td>
</tr>
<tr>
<td>IP3</td>
<td></td>
<td></td>
<td></td>
<td>25.82 / 59.53</td>
<td>n/a</td>
</tr>
<tr>
<td>IP4</td>
<td></td>
<td></td>
<td></td>
<td>2.21 / 81.72</td>
<td>n/a</td>
</tr>
<tr>
<td>M1</td>
<td>Bath type shared with IP1</td>
<td>•</td>
<td></td>
<td>0.00 / 65.71</td>
<td>Almería</td>
</tr>
<tr>
<td>M2</td>
<td></td>
<td></td>
<td></td>
<td>0.02 / 76.67</td>
<td>Cartagena-Mazarrón</td>
</tr>
<tr>
<td>M3</td>
<td></td>
<td></td>
<td></td>
<td>0.10 / 80.00</td>
<td>Cartagena-Mazarrón</td>
</tr>
<tr>
<td>M4</td>
<td>Furnacator</td>
<td>I</td>
<td></td>
<td>0.07 / 77.78</td>
<td>Cartagena-Mazarrón</td>
</tr>
<tr>
<td>M5</td>
<td>Furnacator with askos</td>
<td></td>
<td></td>
<td>33.85 / 20.</td>
<td>Cartagena-Mazarrón</td>
</tr>
<tr>
<td>M6</td>
<td>Furnacator; Dog with strigils</td>
<td>...</td>
<td></td>
<td>0.10 / 80.00</td>
<td>Almería</td>
</tr>
<tr>
<td>M7</td>
<td>Strigils</td>
<td></td>
<td></td>
<td>0.01 / 75.83</td>
<td>Cartagena-Mazarrón</td>
</tr>
<tr>
<td>M8</td>
<td></td>
<td></td>
<td></td>
<td>0.08 / 78.46</td>
<td>Almería</td>
</tr>
<tr>
<td>M9</td>
<td></td>
<td></td>
<td></td>
<td>16.13 / 54.84</td>
<td>Almería</td>
</tr>
<tr>
<td>M10</td>
<td>Strigils</td>
<td></td>
<td></td>
<td>8.72 / 35.47</td>
<td>Almería</td>
</tr>
<tr>
<td>M11</td>
<td>... Wine/oil types</td>
<td></td>
<td></td>
<td>8.72 / 61.54</td>
<td>Cartagena-Mazarrón</td>
</tr>
<tr>
<td>M12</td>
<td></td>
<td></td>
<td></td>
<td>0.00 / 48.33</td>
<td>Almería</td>
</tr>
<tr>
<td>M13</td>
<td>Fly</td>
<td></td>
<td></td>
<td>0.04 / 67.86</td>
<td>Almería</td>
</tr>
<tr>
<td>M14</td>
<td></td>
<td></td>
<td></td>
<td>0.01 / 50.29</td>
<td>Cartagena-Mazarrón</td>
</tr>
</tbody>
</table>

75 Chic García, p. 81.
76 García-Bellido, 1986, p. 15: ‘Se la interpretación como lingote es acertada nos mostraría un objeto del que no han quedado testimonios reales en Hispania.’
Was the lead remelted, and, if so, what are the implications? The effects on its isotopic character of remelting lead have been well studied, and it has been shown that this does not in itself significantly alter the original isotope ratio. Remelting with lead from different sources makes geographical attribution hazardous and sometimes impossible.

The data on tin content provides important clues. The percentage of tin in the 26 pieces analysed ranges widely, in an irregular distribution. For the purpose of our discussion, we use the following terms: ‘minimal-tin’ = ≤0.01%; ‘low-tin’ = >0.01 and ≤0.10%, with an outlier at 0.42%; and ‘high-tin’ = 7.14%–33.85% in our analyses, as well as 2.21%–35.35% in the case of the four pieces from the Isla Pedrosa wreck.

Tin occurs as a trace element in Spanish galena ores—including from the Cartagena-Mazarrón and the Sierra Morea regions—at a level of less than 0.01%, with the exception of ores from the Catalan coastal region, where a mean value of 0.0% has been obtained, but our analysis does not suggest that any of the pieces are made with Catalan lead. A cut-off point of >0.01 is therefore assumed to characterise leads that cannot be shown to contain added tin.

Tab. 4. Probable origin of lead, tin content, and types and values

<table>
<thead>
<tr>
<th>Sample</th>
<th>IB types</th>
<th>Value-marks</th>
<th>Trade?</th>
<th>Sn/Pb, % by weight</th>
<th>Likely origin of Pb</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>Strigils</td>
<td>Linked to (****)</td>
<td></td>
<td>0.42 / 74.42</td>
<td>Cartagena-Mazarrón</td>
</tr>
<tr>
<td>B2</td>
<td>Fly symbol</td>
<td></td>
<td></td>
<td>7.86 / 35.71</td>
<td>Cartagena-Mazarrón</td>
</tr>
<tr>
<td>B3</td>
<td>Strigils</td>
<td></td>
<td></td>
<td>7.14 / 80.95</td>
<td>Mixed</td>
</tr>
<tr>
<td>B4</td>
<td>Furnacator; strigils</td>
<td></td>
<td></td>
<td>0.05 / 74.60</td>
<td>Mixed</td>
</tr>
<tr>
<td>B5</td>
<td>Furnacator</td>
<td>Γ·S</td>
<td></td>
<td>0.06 / 75.61</td>
<td>Mixed</td>
</tr>
<tr>
<td>B6</td>
<td></td>
<td>Γ·S</td>
<td></td>
<td>0.02 / 68.00</td>
<td>Mixed</td>
</tr>
<tr>
<td>B7</td>
<td></td>
<td></td>
<td></td>
<td>0.00 / 70.59</td>
<td>Cartagena-Mazarrón</td>
</tr>
<tr>
<td>B8</td>
<td></td>
<td></td>
<td></td>
<td>0.00 / 71.05</td>
<td>Cartagena-Mazarrón</td>
</tr>
<tr>
<td>B9</td>
<td></td>
<td></td>
<td></td>
<td>0.07 / 69.70</td>
<td>Mixed</td>
</tr>
<tr>
<td>B10</td>
<td></td>
<td></td>
<td></td>
<td>0.06 / 80.00</td>
<td>Mixed</td>
</tr>
<tr>
<td>B11</td>
<td></td>
<td></td>
<td></td>
<td>0.03 / 60.78</td>
<td>Mixed</td>
</tr>
<tr>
<td>B12</td>
<td></td>
<td></td>
<td></td>
<td>0.05 / 54.35</td>
<td>Cartagena-Mazarrón</td>
</tr>
</tbody>
</table>

Sn/Pb, % by weight

- ≤0.01%
- 0.01≤0.10%
- 0.42%
- 7.14%–33.85%

77 Cincotti et al., 2001.
79 Sardinian ores also appear to have a low tin content: of 20 prehistoric lead pottery-repair clamps found at the Nuragic site of Santa Barbara, Bauladu, whose lead isotopic data matches the signature of Sardinian Cambrian ores, only three contain more than 0.01%, and 17 average 0.0013% (Lo Schiavo et al., 2005, pp. 164–166).
Higher tin levels derive from the remelting of lead objects—most frequently water pipes—that had been manufactured with tin-lead solders. At Pompeii, the lead content in water-pipe solders is variable, and can reach 84%, but much lower levels of tin have also been reported for Roman solders used in manufacturing water pipes elsewhere. Roman lead pipe was manufactured by bending lead sheet around a wooden bar, replacing this with sand or clay, and early research reported both welding the seam with ordinary lead, or joining with solders usually containing 5% to 25% tin. However, weld materials of 0.6% tin were also reported from Portugal, and of ≤0.3% or lower from Switzerland. A recent study of piping from Imperial Conimbriga shows that pipes could be either welded with lead alone, or joined with solders containing about two-thirds tin, but only two of 16 pipes tested used a tin solder, undoubtedly because lead was much cheaper than tin, and because welding with lead was capable of providing a good quality seal, able to contain high water pressures. Remelting mixes the lead body with the solder, which it dilutes. At Conimbriga, 64% of pipes tested contained between 0.1% and 0.9% tin, probably reflecting a build-up over time. 

Our six minimal-tin pieces (M1, M7, M12, M14, B7, B8) use Cartagena-Mazarrón lead at both Minturnae and Baetica, as well as Almería lead at Minturnae (M1). In these cases, fresh lead was probably used. There is no minimal-tin lead in the Baetican lead of mixed origin. There are 14 low-tin pieces (M2, M3, M4, M6, M8, M13, B1, B4, B5, B6, B9, B10, B11, B12), with lead from both Cartagena-Mazarrón and Almería at Minturnae, and both lead from Cartagena-Mazarrón and mixed lead in Baetica.

The use of lead from the massively productive Cartagena-Mazarrón area in both places is not surprising. It also seems possible that the societates distributing this lead (exploitation of the mines and distribution of the product could be separate activities) had a monopoly in the supply of raw metals to some of the mints of northeast Spain and therefore to their cities, in the late second and first centuries.

The use of Cartagena-Mazarrón and Almería leads at Minturnae, with no sign of mixture between them (though it must be noted that their isotopic signatures are similar), or any sign of mixing with Sierra Morena lead, may reflect sequential production of the different issues, or perhaps two different groups of issuers, with different contacts in Spain, but we cannot be more specific.

In Baetica, the large, coherent, and presumably contemporary, group of grandes plomos with bull’s head / running boar types uses both Cartagenan (B7, B8) and mixed (B9, B10) lead. That unmixed lead from the nearby Sierra Morena is not present is significant, and bears on the question of dating. It may also suggest that the lead in question was already mixed when received. The precise origin of the Sierra Morena lead in the mixture is not recoverable, but, on the basis of the isotope map in fig. 12, an attribution to Ossa Morena and the Alcudia Valley seems likely.
The high-tin pieces (M5, M9, M10, M11, B2, B3, as well as the Isla Pedrosa wreck pieces, IP1, IP2, IP3, IP4), are of another nature, and raise a wholly different set of questions. This level of tin content cannot be explained by the remelting of soldered objects, and must be deliberate, unless we assume that high-tin solder or pewter was at hand, and simply pressed into use. (As we have seen, some solders were very high-tin, and Roman pewter was often about 80% tin.) But this would fly in the face of economic considerations, as tin was expensive, and it is unlikely that such a casual approach would be found in two separate places. We do not know tin prices in late Republican times, but Diocletian’s Price Edict of AD 301 values tin at 11½ times lead and 3½ times copper. The fact that tin is only used in small proportions in Iberian bronze coinage of the second and first centuries may be a sign of its high contemporary value.

The addition of tin to the lead cannot have been intended to raise the metal, and so exchange, value of these pieces, at least some of which had monetary functions at Minturnae and in Baetica, as the value-marks show. The visual aspects of tin and pewter are so similar that users could hardly have told them apart. There is no known case of pewter coinages at this time, and while two pieces with a value-mark are high-tin (IP1, M11), the others (M1, M4, M6, B1) are minimal-tin or low-tin. Tin levels also vary widely.

The high-tin pieces, in addition to having been made in the separate complexes—at Minturnae and in Baetica—involves all sources of lead: Cartagena-Mazarrón at Minturnae (M5, M11) and in Baetica (B2); Almeria at Minturnae (M9, M10); and the mixed lead (B3) in Baetica.

Is it possible that this use of tin is a sign of real contacts between the two areas, or is it a result of similar technologies, in ways we cannot understand? We have no easy answer to this conundrum. One thing, however, does stand out: the four Isla Pedrosa pieces and M9 are datable to c.150/130, and other of the Minturnae high-tin pieces (M1, M5) seem stylistically similar (high relief, smooth classical style). It is therefore possible that the high-tin phenomenon is characteristic of an early period in the production of these lead complexes.

The Italo-Baetican bronze issues that accompany the lead issues in Italy can be arranged around the largest bronze issue, LOC series 15, with Dionysos / panther types, which can be securely dated by overstrikes on Republican coins to the late 90s/80s. Overstrikes identify a number of series that precede this issue, though it is not certain by how long. There are few historical pointers in the Baetican complex.

86. Alloys of tin and lead are known as pewter, the hardest variety of which contains 80 per cent of tin and 20 per cent of lead. Roman pewter contains about 80 per cent of tin, but the proportions of tin and lead in pewter have been found to vary considerably throughout the centuries, owing to scrap metal having been so often melted down and refashioned. (Plenderleith and Werner, 1956, p. 266). In addition to hardening the alloy, lead stabilises tin, and prevents tin pest, which decomposes the metal into powder. For a wreck with a large cargo of pewter table vessels, c.150, see the relitto del Pozzano a Baratti, off Piombino (Romualdi and Firmati, 1998).
87. Morrisson, 1993, p. 82, tab. 2.
89. Stannard, 2007, series 15; Stannard and Sinner, 2014; Stannard and Sinner, 2016; Stannard, 2018, pp. 120–129.
The reverse of **B11** uses the type of the Athenian New Style tetradrachm; these date widely to between 164 and 42. The *plomo* found at Cerro Lucena, above Xàtiva—the only known piece with a North-Eastern Iberian legend—uses a Roman prow like that on bronzes of 115–90.\(^9\) While it is possible that the Minturnaean complex may predate the Baetican, a wide date for both, from c.150 to the mid-first century, seems inevitable, in our current state of knowledge.

Tab. 4 shows that there is no correlation between the different sources of lead and the use of Italo-Baetican types, value-marks, or the possible indexes of trade that we had identified.

**THE MINTURNÆAN LEAD ISSUES AND EPIGRAPHIC EVIDENCE FOR CONTACTS WITH SPAIN**

We did not become aware of Michele Stefanile’s recent epigraphic study of emigration from central Campania to *Hispania* until after having completed our analyses. We subsequently compared the names known from the Minturnaean lead complex (from Stannard’s 2007 *Provisional Catalogue*, pp. ix–xviii, tab. 2) with the epigraphic evidence Stefanile marshals of Italian gentes in south-eastern Spain. One name-match stands out: **M8** belongs to a copious series of die-linked issues struck by a group of five persons, who sign **FVRI, C·BAIBI, L·NVM, C·NVM, and C·SAM / IR.** *Stefanile documents the presence of three of these gentes* in south-eastern Spain (tab. 5). The towns he considered in his review of inscriptions, where relevant inscriptions are found, cover much of coastal south-eastern Spain, north of Carthago Nova.

<table>
<thead>
<tr>
<th>Minturnae</th>
<th>Gentes</th>
<th>Place documented</th>
<th>Date</th>
<th>Stefanile</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVRI</td>
<td>Furii</td>
<td>Iltici</td>
<td>1(^{st}) c. BC and 1(^{st}) c. AD</td>
<td>Fig. 28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lucentum</td>
<td>1(^{st}) c. BC and 1(^{st}) c. AD</td>
<td>Fig. 33</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Saetabis</td>
<td>All dates</td>
<td>Fig. 44</td>
</tr>
<tr>
<td>C·BAIBI</td>
<td>Baebii</td>
<td>Dianium, La Safor, Saetabis,</td>
<td>Until the mid-1(^{st}) c. AD</td>
<td>Fig. 38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Edeta</td>
<td>All dates</td>
<td>Fig. 49</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Valentia</td>
<td>2(^{nd}) c. BC and 1(^{st}) c. AD</td>
<td>Fig. 53</td>
</tr>
<tr>
<td>L·NVM C·NVM</td>
<td>Numisii</td>
<td>Dianium, La Safor</td>
<td>Until the mid-1(^{st}) c. AD</td>
<td>Fig. 38</td>
</tr>
</tbody>
</table>

*Tab. 5. FVRI, C·BAIBI, L·NVM, C·NVM and presence of these gentes in the towns considered by Stefanile*

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Pl. 26 illustrates the issues in this tightly die-linked series, which combine a set of dies in variety of pairings (pl. 26). Some dies are used more than once:

Die 1  Head of Mercury right, wearing a petasus, caduceus on shoulder; FVRI before.
Die 2  C·BAIBI around a barley-corn.
Die 3  Panther right, looking back, a thyrsus over its shoulder.
Die 4  Knife right; C·SAM / IR around.
Die 5  Bundle of cloth? If this identification is correct, the cloth has been drawn up around a string that provides two loops at the top, by which it can be hung.
The neck below this is bound round and tied with a ribbon.

<table>
<thead>
<tr>
<th>LOC Series 87h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Obv.</strong> Die 1.</td>
</tr>
<tr>
<td><strong>Rev.</strong>  Dolphin right.</td>
</tr>
<tr>
<td><strong>M15</strong> 29mm ✓ 34.36g Liri 23.053</td>
</tr>
</tbody>
</table>

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Obv.</strong>  Die 1.</td>
</tr>
<tr>
<td><strong>Rev.</strong>  Blank.</td>
</tr>
<tr>
<td><strong>M16</strong> 13mm 1.26g Liri 23.049</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LOC Series -</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Obv.</strong>  Die 1.</td>
</tr>
<tr>
<td><strong>Rev.</strong>  Askos right.</td>
</tr>
<tr>
<td><strong>M17</strong> 11mm ✓ 1.38g Liri 45.553</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LOC Series 87f</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Obv.</strong>  Die 3.</td>
</tr>
<tr>
<td><strong>Rev.</strong>  Die 4.</td>
</tr>
<tr>
<td><strong>M18</strong> 11mm ← 2.35g Liri 23.043</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>LOC Series 87b</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Obv.</strong>  Die 3.</td>
</tr>
<tr>
<td><strong>Rev.</strong>  Die 5.</td>
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<tr>
<td><strong>M20</strong> 10mm ← 1.06g Liri 100.198</td>
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<th>LOC Series 87c</th>
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<tr>
<td><strong>Rev.</strong>  Die 2.</td>
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<tr>
<td><strong>M21</strong> 14mm ↑ 2.95g Liri 23.040</td>
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<tr>
<td><strong>Obv.</strong>  Die 5.</td>
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<tr>
<td><strong>Rev.</strong>  Die 4.</td>
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<tr>
<td><strong>M22</strong> 11mm ✓ 1.38g Liri 45.559</td>
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LOC Series 87a

*Obv.*  Head of Vulcan, wearing pileus, right; tongs on shoulder; C[-N?]VM below.

*Rev.*  Die 5.

**M23**  10mm  1.01  Liri 23.050

LOC Series 86

*Obv.*  Head of Vulcan, wearing pileus, right; L·NVM around.

*Rev.*  Cupid seated right.

**M24**  14mm  2.17g  Liri 29.014

LOC Series 87d

*Obv.*  Uncertain object.

*Rev.*  Die 2.

**M25**  15mm  1.81g  Liri 6.009

LOC Series 87e

*Obv.*  Balance?

*Rev.*  Die 2.

**M26**  9mm  0.72g  Liri 34.076

*Fig. 13.* Epigraphic representation of the most important families of the city of Carthago Nova

Almudena Orejas lists the *Furii*, the *Baebii*, and the *Numisii* amongst the 16 most important families of the city of Carthago Nova itself, on the basis of inscriptions (fig. 13).

Orejas and Sánchez-Palencia, 2002: 548, fig. 543.
The lead pieces from Minturnae show that members of these gentes collaborated in Italy, and indeed were close enough to create a single die-linked lead issue associating their names. This suggests that they were members of a single entity—probably a societas—involved in the lead trade with Carthago Nova. We do not wish to speculate as to the function of these small pieces, which seem unlikely to have had a monetary role, but they were struck in large numbers: the Liri database currently counts 73 pieces, 17.4% of the lead pieces of all issues.

The lists of magistrates of colleges honouring various gods at Minturnae are a valuable resource documenting gentes in the city. There are twenty-nine such lists, which can be dated by mention of Roman consuls and duoviri of Minturnae to between 90 and 50.92 Many of the magistrates are servile, which provides the names of their domini. Servile magistrates are known in Republican times from very few places, and outside Italy, only from Carthago Nova.93 At Minturnae, the Furii are attested six times as domini of magistrates.94 A vinarius, Cn. Furius A.f., is also known from an amphora lid from the Forum of the Italians in Delos. The praenominae present in his inscription (Gnaeus and Aulus), used by two of these domini, suggest that he may have belonged to the Minturnaean branch of the gens,95 which was widespread throughout the Mediterranean in Imperial times, with a particular presence around Norma in Latium, in the hinterland of Minturnae.96

The Furii exploited silver/lead mines at Carthago Nova during the Republic, and produced ingots, such as the one signed by A· and P· Furii, freedman of C·, L· and P· Furii, which was found in the Gulf of Fos sur Mer, near Marseille.97 There is another ingot from the sea at Pointe de Bonnieu (Martigues), with a stamp interpreted as A(ulus et) P(ublius) Furieis C(ai et) P(ubli et) L(ucii) l(iberti), and Furieis is an early nominative plural form of Furius.98 The inscription also lacks a cognomen, a naming convention widely adopted by the late Republic.99 Domergue dates an ingot of the Roscii gens with the same grammatical form—M·P· ROSCIEIS M·F MAIC—to the

93 Per l’età repubblicana magistri di condizione servile (da soli o insieme a liberti) sono finora attestati in area laziale e campana, oltre che a Minturnae, solo a Praeneste, Cora e Pompei e, nelle province occidentali, a Carthago Nova’ (Gregori and Nonnis, 2014: 96).
95 Ibid., p. 94.
96 Orejas and Beltrán, 2010, p. 401.
97 Liou, 1992. Cerezo Andreo, p. 2002, fig 12, dates these ingots of the Furii to c.50–10, on the basis of the wrecks in which they appear.
98 ‘Conocemos los epitafios de dos Furii cartageneros de finales de la república y comienzos de época de Augusto, aunque los praenomina que utilizan son Gnaeus y Marcus, por lo que no puede asegurarse su relación con los mencionados en el lingote. Este nomem se documenta en cuatro ocasiones en Delos y cuenta con varios ejemplos de interés en el Lacio y Campania. En Tusculum se descubrió a mediados del siglo XVIII el sepulcro familiar de unos Fourii del siglo III a.c.; también están atestiguados Furii en las inscripciones de los magistri de Minturnae y entre los magistrados de Lanuvium y Pompeya. La forma Furieis debe considerarse como un nominativo plural arcaico de origen dialectal, que se atestigua en otras inscripciones republicanas hispanas. La presencia de la forma arcaica Furieis permite otorgar a este sello una cronología temprana, tal vez de finales del II a.e. o comienzos de la siguiente centuria.’ (Díaz Ariño, 2008, p. 281, SP12).
end of the second century. These are some of the earliest ingots, and could support an early role for the company in the lead trade. The Minturnaean lead issues are not much help for dating: although M8 is low-tin, this does not necessarily mean it is late.

Impressed stamps on the side of Cartagenan lead ingots of Augustan times—which record sequential sales of the ingots—from the wreck at Comacchio (Ferrara) show that the gens was still involved in the lead trade at that time, but as a dealer, rather than a primary producer.

No ingots of the Numisii are known, despite their being one of the leading families of Carthago Nova over a long period of time, attested by inscriptions between the end of the Republican era and the second century AD. They were connected with the mines, with a Sextus Numisius appearing as a donor of an altar to the Lares in an inscription found in the vicinity of the San Rámón mine in the Boltada ravine (Portmán). This is probably because companies specialized, some in mining and some in metalworking, the Numisii among the latter. A similar inscription from Puteoli suggests a date around 100. The Numisii are also known from Córdoba, in early Imperial times.

In Italy, Numisii stamp locally produced amphora in Mutina in the first centuries BC and AD. There is also evidence of the importation to Mutina, at this period, of fish sauces in amphorae from Baetica, probably by river through Comacchio, where the wreck with the ingots was found. The Numisii are attested three times at Minturnae, as domini of magistrates.

The Baebii are attested at Minturnae by the domina of a magistrate. The Baebii are also documented in Imperial times, as an important gens in the mining area of Turobriga and Arucci in Sierra Morena. Members of the gens are attested as magistrates of the city during the first century.

The legend C·SAM / IR or IR / C·SAM is not easily resolved. The two parts of the legend are separate. At Minturnae, two members of the Samiarii are documented as domini of magistrates, so the fourth member of the group is probably a Samiarius. The origin of the gens is Palestrina. It had wide commercial interests, with members reported from Delos, Miletos, Iasos and Aquileia in the first century, as well as from Signia, Tarentum, Cumae and Rome. It does not appear to be known from Spain. Samii are known from Tarraco in imperial times.

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100 Domergue, 1990, p. 268, fn. 235; Díaz Arioño, 2008, p. 288 SP34.
101 Domergue et al., 2011, pp. 90–91 and 99–100.
102 Díaz Arioño and Antolinos Marin, 2013, pp. 541–543.
103 Orejas and Ramallo, 2004, p. 89.
104 Ventura Villanueva, 1999, p. 72.
108 Orejas and Ramallo, 2004, p. 111, fig. 112.
111 Epigraphik-Datenbank Clausl / Slaby, 18 February 2019.
Yet another probable testimony to trade between Minturnae and Spain is M11, which, because it is high-tin, may date from the third quarter of the second century. It is particularly interesting, because, in addition to the name CN·CORNILLI·P·S, it carries quadrantal value-marks, and so reflects some entity—territorial or social, probably commercial—in which it had currency. Like the FVRI, C·BAIBI, L·NVM, C·NVM, C·SAM / IR series, this piece was struck in considerable numbers: 50 pieces, or 11.9% of the lead pieces in the Liri database.112 Its types—an amphora and a mouse stealing oil from an oil-lamp—suggest a commercial entity that dealt in wine and oil. At that date, not only wine, but oil as well was exported from Italy.113 During the second century, at least 18 villas producing wine were established near Minturnae, within easy reach of the via Appia or the river, and two kiln sites producing Dressel 1 and Dressel 2-4 amphorae have been identified. Horace thought the wine mediocre,114 but Minturnaean exporters also dealt in the famous wines of the ager Caecubus, around Fundi to the north, and the ager Falernus, to the south.115

Much of Minturnae’s commercial shipping went north, to Massalia and Emporion. The Isla Pedrosa wreck is a sign of Minturnaean trade on the Catalan coast, as are the large numbers of coins in the Liri database from Undikesken / Emporion and Kese / Tarraco (fig. 1).116 The relatively large numbers of Massaliot taureau passant coins in the river Liri117—which circulated in Languedoc in the second quarter of the first century—are a sign of Minturnae’s wine exports to that region.118 By the second quarter of the first century, Minturnaean trade seems to have gone directly to Spain, without going through the Phocaea cities of southern Gaul, with Calenian black gloss wares outnumbering Campanian A from the Vesuvian area, which had until then been dominant on the Catalan coast.119 (In Cabrera de Mar, the ancient settlement of Ilduro, abandoned in 90/80, Pompeian amphorae dominate.120) From about the middle of the second century, Calenian black gloss wares appear at Carthago Nova, an entrepôt for the reception and redistribution of Italian products.121

112 Stannard has documented the paucity of small change in west-central Italy, from about 150, which could be a contributing reason for such an informal money.
113 The Monte Testaccio spoil heap of oil-amphoras shows that massive imports to Rome probably began in early Imperial times, with the greatest volume being between the reigns of Augustus and Aurelian (Blázquez Martínez, Remesal Rodríguez, and Rodriguez Almeida, 1994, p. 12). Italian oil from Brindisi was imported into Citerior and Ulterior between about 150 and 50, probably for the use of Roman civilian and military elites (Carreras Monfort et al., 2016).
114 Horace, Epist. 1.5.5.
119 ‘Ya es bien sabido el escaso papel que en Hispania juega la Campaniense A tardía [90/80–40/20], totalmente superada por sus homólogas calenas, al contrario de lo que parece suceder en el Midi francés, alrededor de Marsella, donde las ultimas cerámicas napolitanas de barniz negro mantiene unas proporciones bastante superiores’ (Principal and Ribera i Lacomba, 2013, p. 104).
Wine from the Vesuvian area continued to flow mainly towards Massalia, as evidenced by coins of the Pompeian pseudo-mint from southern France.²¹²

Producers and shippers of Pompeii and Minturnae collaborated. Towards the end of the first century, Minturnae developed and appears, from what we currently know, to have been the only user of ships constructed to carry bulk wine in dolia rather than amphorae. The Grand Ribaud D wreck off Hyères, from the last decade of the century, carried two tonnes of wine almost certainly shipped at Pompeii, along with some Pompeian and Adriatic amphorae. Shipping of a perishable, liquid bulk commodity can only have been possible with a solid commercial infrastructure, including stockage in the receiving ports: horrea vinaria are known from Ostia and Massalia, Salona in Dalmatia, and perhaps Histria in Pontos.²¹³

The legend, CN-CORNIIII-I·S,²¹⁴ is difficult to resolve. The letter written ‘II’ is a variant of E, often used at this period. If this is a company money, as the quadrantal value-mark suggests, S might stand for servus, or company slave. One would not, however, expect S to follow a tria nomina, which would indicate a freedman, if P is a cognomen. Perhaps S could be resolved as an adoptive cognomen. Another reading of S might be socius. The company of pitch collectors working the local forests, with a ready market for the impermeabilization of amphorae, dolia, and ships, was, with the salt company, one of two societates owning slaves at Minturnae.²¹⁵ A number of slaves of the company are attested with the formula PIC(AR) SOC S: PHILEMO PIC(ariorum) SOC(iorum) S(ervus), ANTIOCHUS PICAR(iorum) [soc(iorum) S(ervus)] and STEP(h)ANUS PICAR(iorum) SOC(iorum) S(ervus).²¹⁶ With the much smaller space available on the die of these pieces, the simpler I·S could have been used, perhaps for Picariorum Socius.²¹⁷ We have no evidence that a similar expansion would also apply to I·S on the grandes plomos.

Another large-scale shipper of wine, in Dressel 1B amphorae stamped L(uci)·LENTV(li)·P(ublii)·F(ili), from kilns near Minturnae—a member of the Cornelii—was not of servile status, which was unusual for persons stamping amphorae. It has therefore been suggested that he was the consul of 49, Lucius Cornelius Lentulus Crus, dominus of slaves listed among the magistrates of Minturnae, who owned property in Minturnae and elsewhere in Campania. His amphorae have been found at

²¹⁴ We thank Regula Frei-Stolba and Bernhard Woytek for having discussed this legend with us.
²¹⁶ IED 11.7, pp. 609, record 762; 703, record 891; and 719, record 907.
²¹⁷ The nature of such societates needs consideration. ‘In the Roman law of societas, partnerships never achieved a juristic personality that allowed them to function as a legal entity distinct from the individuals comprising the partnership. Indeed, in Roman law, a partnership would generally dissolve at the death or withdrawal of one of the partners’ (Kehoe, 2011, p. 146). Moreover, ‘It is most remarkable that all sources, despite the diversity of the businesses conducted, have one thing in common: No societas seems to have consisted of more than a few partners, and most sources provide evidence of only two partners’ (Fleckner, 2011). However, the generality of the name, Picariorum Societas, with the genitive plural, may suggest an entity with a number of members and continuity, like a corpora or collegia.
Santa Severa to the north of Rome, the port of Narbonne, Vieille Toulouse, Minorca, and in large numbers in Athens.\textsuperscript{128} If \textbf{M11} and \textit{Cnaeus Cornelius} date to the mid-second century, then this later evidence would testify to the long-term trading activities of this \textit{gens}.

Stefanile documents \textit{Cornelii} from Dianium and La Safor in the first centuries BC and AD, Edeta between the second century BC and the first century AD, and Saguntum in the first centuries BC and AD.\textsuperscript{129} Orejas lists Cornelia as one of the 16 most epigraphically attested \textit{gentes} at Carthago Nova (fig. 13), and \textit{P. Cornelius Pollio}, of the tribe of \textit{Aimilia}, signed ingots as P-CORNEL L-F POLLION FORMIAN GAL, specifying his origin as the town of Formia, immediately north of Minturnae.\textsuperscript{130}

\section*{The Baetican Lead Issues and Epigraphic Evidence for Contacts with Minturnae}

Gian Luca Gregori and David Nonnis provide a listing of names present at Minturnae, focusing on stamps on tableware, amphorae, \textit{dolia}, lids, and on lists of magistrates,\textsuperscript{131} against which we have compared the names known from the Italo-Baetican \textit{plomos} of the Latin-language area (figs. 1 and 3), as listed in Stannard \textit{et al.} 2017 (\textit{PLO}), pp. 84–101.

There is one \textit{plomo} from the Latin-language area with the legend Q·PACCI, which carries the Italo-Baetican strigils and aryballos type and a quadrantal value-mark (pl. 27, \textbf{B13}). It was recorded in trade in Seville. We know of two other specimens of this issue, one from the same auction as \textbf{B13}. It is therefore possible that the two pieces in the auction have the same provenance, and as \textbf{B13} is high-tin, they may both be early, perhaps of the second half of the second century. The third specimen was also recorded in Seville.

Like \textbf{M11}, the quadrantal value-mark implies some entity—probably commercial—in which it had currency, and the amphora shows that the commodity traded was possibly wine or oil. The image is of course schematic, but the amphora depicted is most likely a Dressel 2-4 (from c. 70 on).\textsuperscript{132} If this identification is correct, it would instead be consistent with a date towards the mid-first century.

\textit{PLO} 21
\begin{itemize}
  \item \textit{Obv.} Amphora; Q·PACCI up to left; unidentifiable object to right; border of dots.
  \item \textit{Rev.} Strigils and aryballos facing; border of dots.
  \item \textbf{B13} 27mm \hfill 19.03g \hfill Pliego stock 1994, Seville
\end{itemize}

\textsuperscript{128} Gianfrotta, 1982, pp. 73–77; Gregori and Nonnis, 2014, pp. 90 and 104.
\textsuperscript{129} Figs. 390, 49, 53 and 57.
\textsuperscript{130} Domergue, 1990, p. 254, tab. 4, no. 1013. \textit{Aimilia} was the tribe of Formia from 118 (ibid., p. 322, fn. 11).
\textsuperscript{131} Gregori and Nonnis, 2014.
\textsuperscript{132} The criteria for the amphora identification are its long neck and toe, and especially the fact that the handles form a 90º angle. These characteristics could also fit amphorae from the Koan and Pseudo-Koan family, from which Dressel 2-4 derive. However, the historical context of \textbf{M3} makes it more likely that the image on the piece is a Dressel 2-4, which were largely produced in Italy.
Four men and a woman of the *Paccii* are known as *domini* of magistrates at Minturnae, and the *gens* is widely attested at a number of places in Campania and Samnium, including thrice in Pompeii. The *gens* is not very common in *Hispania*. In *Baetica*, there is one inscription from Astigi, and a number from *Citerior*, mostly of Imperial times. There is one stamp that reads Q·PACCI on an amphora sherd from Emporion.

In Spain, with the variant orthography *Paquisti*, *Paquius L. l. Silvanus*, of the early first century, and a *Paquius N. l. Diphillus* of the early Principate, are known from Carthago Nova. *Paquii* are also attested on a mid-second century helmet from the Valladolid area, *N(umerius) Paquiu(s)*, and as a freedman magistrate at Cabo de Palos near Cartagena in the mid-first century, *L(ucius) Paquiu(s) Noni l(ibertus) Sil(o)*.

There are two inscriptions from Córduba, one probably sepulchral of *[Vib?]ius Pa[c]ciaecus*, and a funerary inscription of a young slave of the *Paciaecae gens*, *Cléobis*. The *Paciaecae* are otherwise only known from Plutarch, who discusses the fortunes of *Vibius Pacciaecus* and *L. Viblius Pacciaecus*, perhaps father and son, and substantial landowners in southern Spain. The former linked himself to *Publius Licinius Crassus* (Cos. 97) when he was praetor in *Ulterior*, and protected his son, *Marcus Licinius Crassus*, when he fled to *Ulterior* in 87, as Marius and Cinna seized Rome. A *C. Pacciaecus*—perhaps his son—was with Crassus during his disastrous Parthian campaign, and *L. Pacciaecus*, perhaps another son, was a Spanish supporter of Caesar in 46 and 45.

The *Vibii* are probably of Oscean origin. They are widely attested from Capua, Campania and Samnium, and a *Vibia was domina of a magistra* at Minturnae. In *Baetica*, the *Vibii* are epigraphically represented—along with other *gentes* enriched by mining, like the *Numisiti* and the *Furii*—in the Augustan theatre at Córdoba, in the area from which many of the *grandes plomos* come. The cognomen *Paciaeaeus* is of especial interest, because, like the cognomen *Paccius / Paquius*, it derives from the Oscean praenomen *Pakkuis*, and was combined with a Celtic suffix, -aeo, that probably denotes the owner of a property. Juan Sebastián Hernández has argued that *Vibius Pacciaecus* was an *eques* who took up farming in Carteia, a Latin colony founded in 171, and that the *Vibii* and the *Paccii* are amongst the earliest settlers in *Citerior*. 

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135 Epigraphik-Datenbank Clauss / Slaby, 18 February 2019.
136 Díaz Ariño, 2008, pp. 187-188 (C114) for the helmet, and pp. 137–138 (C50) for the magistrate.
138 Plu. Cras. 4.2.
140 Gregori and Nonnis, 2014.
141 Ventura Villanueva, 1999, p. 72.
On pl. 27, M27 and M28, we also illustrate an issue from Minturnae, with variant outlays of two names, M·PACON and BENN. We know three pieces. The probable root of Paconia is the same Oscan praenomen, also reflecting Campanian immigration to Spain. The gens is attested from Latium and Campania, including once from Mondragone/Sinuessa. In Spain, it is attested once at Jerez de la Frontera.

Bennia is a relatively rare name in Spain, where L. Bennius signs coins at Carthago Nova of 10/20 AD (RPC 1, 162–164) and was praefectus Imperatoris Caesaris quinquennalis. The name is otherwise attested in Spain only from Tarraco in Imperial times. It is widespread in Campania, most commonly in the Bay of Naples.

The citing of two different gentes on the same piece raises the possibility that they were associated, perhaps as members of a single societas.

LOC Series 203

Obv. M·PA CON in two lines.
Rev. BENN.
M27 13mm  2.12g Liri 18.057
Rev. ... PA CON in one line.
M28 12mm  1.26g Liri 25.013
Reverse double-struck.

Three further gentes that are recorded at Minturnae also appear on the Baetican plomos: the Herennii, Marcii and Fundanii.

The Herennii were a very widespread gens of the late Republic, with many branches. There is a single mention of a freedwoman, Herennia, acting as a magistrate, at Minturnae. The gens is, however, widespread in Latium and Campania in the hinterland of Minturnae, and in Pompeii and Puteoli. Herennii are attested at Lucentum, in Valentia—where they are one of three civilian gentes dating from the first two centuries of the city—and from Saguntum, where most gentes arrived by movement within Spain in the first century. Unlike the Herennii, the enormous gens of the Marcii is well represented at Minturnae. The Herennii

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144 Epigraphik-Datenbank Clauss / Slaby, 18 February 2019.
146 Deniaux, 1979, p. 650: ‘La prosopographie des Herennii à l’époque républicaine et augustéenne découvre une si large extension géographique qu’il est impossible de rattacher tous à une seule grande famille’.
147 Gregori and Nonnis, 2014, p. 106.
148 Epigraphik-Datenbank Clauss / Slaby, 18 February 2019, 163 records.
149 Stefanile, 2017: Lucentum, fig. 34; Valentina, fig. 53; and Saguntum, fig. 57. At Valentina, the Herennii and the Marcii and both among the best attested gentes. Stefanile (p. 111) comments ‘con l’eccezione degli Herennii, che forse possono essere messi in qualche relazione con l’area campana, tutti i gentilici più frequenti a Valentina sono nomina estremamente comuni e connessi probabilmente con le clientele di militari coinvolti in operazioni sul panorama iberico ... nei primi due secoli di vita della città, solo Herennii, Caesii e Rubrii sembrano poter essere collegati al fenomeno dell’emigrazione civile dall’area campana’.
150 Epigraphik-Datenbank Clauss / Slaby, 18 February 2019; 46 of 2532 records from Latium and Campania.
and the *Marcii* are amongst the commonest *gentes* in Valentia.\(^{151}\) It seems probable that pl. 27, B14 and B1, reflect links to Minturnae.

B14 is particularly interesting, as it provides two probably contemporary portraits, which are once more signs of a well-structured entity, in which this piece was struck.

B1, which we analysed, is struck on Cartagena-Mazarrón lead, and contains 0.42% of tin, which must result from remelting with solder.

**PLO 42**

*Obv.* Male head right; *[M]ARCI·…* behind.

*Rev.* Male head right; *furnacator* walking right behind, a shovel on his shoulder; L·HERENI·C before; border of dots.

**B14**

45mm  
140.10g  
Cores collection, Madrid

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At Minturnae, *C. Fundanius* and *Trupho Fund(ani)* appear as *domini* of magistrates. The *gens* is attested most at *Fundi* and at *Ostia*, in small numbers.\(^{152}\) In Baetica, we have not been able to document the *Fundanii*, other than on pl. 28, B15 and B16, and in one Christian funerary inscription from *Hispalis*.\(^{153}\) The rarity of other attestations in Baetica may in itself be an indication that the *Fundanii* of Baetica, who signed these *plomos*, were linked to Minturnae. These pieces too, carry quadrantal value-marks.

**PLO 76**

*Obv.* Dog running left; M·FVND / NI above and below; border of dots.

*Rev.* Eagle right, snake rearing before; *v* to right; border of dots.

**B15**

37mm  
50.92g  
Cores collection, Madrid

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Another *gens* present in both southern Spain and Minturnae is the *Lucillii*, a member of which signed the Latin language-area *grande plomo* B12, which was found in the Liri at Minturnae. Another specimen was found in 1879 in a tomb near ancient Saitabi.\(^{154}\) The *Lucillii* are known from Saguntum and Saitabi in the second to first century.\(^{155}\) They are attested in the early third century in an inscription from the

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\(^{151}\) Stefanile, 2017, pp. 111-112.

\(^{152}\) Epigraphik-Datenbank Claus / Slaby, 18 February 2019; 16 records: three from *Fundi*, four from *Ostia*.

\(^{153}\) CIL 2 5393.

\(^{154}\) Caballero Infante, 1880, p. 10 & fig. 2; *PLO*, p. 79. Stannard recorded a third specimen in trade in Seville.

Roman colony of Sinuessa that neighbours Minturnae, and throughout Italy, with the earliest and largest number of inscriptions coming from Latium and Campania. Slaves of the family are known in the lists of magistrates from Minturnae, at the end of the second, or beginning of the first, century.

**Conclusions**

We have documented and considered a wide range of evidence for trade between Minturnae and south-eastern Spain in the second and first centuries, starting from the two large complexes of lead issues—most with Italo-Baetican types—from Minturnae and from the lower valley of the River Guadalquivir, the ancient _Baetis_. The data from the lead isotope analyses we carried out shows that the two complexes both largely used lead from the massively productive Cartagena-Marrazón area, but that each also had another separate supply, which we hope to investigate further at another time. Isotopic data must, as we have done, always be interpreted in a wider archaeological and historical framework.

Tin has been so far only rarely and peripherally been invoked in the study of the Republican lead trade, and we believe that it should now be moved centre-stage.

Our documentation of tin in the lead in both complexes is a type of evidence that can help elucidate whether metal came straight from a mine, or from remelted lead objects that had been joined with a tin-lead solder. Judging whether or not the presence of tin means that different sources of metal are involved, or remelting within metal from a single source, also requires placing the phenomenon in the larger historical context.

In addition to this, we have documented the strange, and we believe separate, phenomenon of the addition of large quantities of expensive tin to some of the lead issues in both complexes. We can suggest no reasonable motive, as this seems to be alien to economic logic. We suggest, however, that it may largely be a practice of the mid-second century, but this too requires further research, to which we hope to return.

The individual lead issues are difficult to date, but the presence of Minturnaean lead pieces in the _Isla Pedrosa_ wreck (all high-tin issues), of 150/130, shows that Minturnae was an early participant in the exploitation of _Hispania_, and that, at that stage, its trade probably reached north by the same route that was taking wine to Languedoc, and south by a direct route through the strait of Bonefaccio to Carthago Nova, and perhaps on to and up the _Baetis_ river. (At 10%, the coins of Malaka, a lead exporting port well south of Carthago, are the third most common Spanish coin in the Liri.)

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158 Stannard and Sinner, 2016, p. 168.
The production of these issues probably continued well into the first century. The portraits on B14, for example, are close in style to Roman denarii of the 50s, most obviously RRC 437/1 and 2, CALDV S III V I R, of 51, and RRC 439/1–4, MARCELLINUS, of 50.

The Minturnaean and Baetican complexes must be seen against the general background of the immigration of Italians to Hispania after the Second Punic War. Rome needed to maintain a permanent military presence, and it has been argued that many soldiers settled after service.159 However, archaeological evidence and the ancient sources do not always seem to support this.

Many of the gentes present in Hispania before the civil wars were noble families, whose members played an important role in the development and government of the province, as praetors and consuls. This is not necessarily the case of the gentes from Minturnae that we have identified, through our focus on the lead issues at Minturnae and in Baetica, as active in the lead trade and attendant commerce. There has been some uncertainty as to the number and date of settlement of civilians, who came largely from south Latium, Samnium and Campania, and were attracted to the area in order to take advantage of its natural resources, in particular its minerals, but many of the gentes involved in mining and the metal trade can be traced back to the second century.160

The lead issues therefore take us to both the silver-producing, galena-ore regions stretching from the Sierra de Cartagena behind Carthago Nova down to the Sierra Almagrera around Almeria, and to the Sierra Morena. There is some uncertainty as to when the massive exploitation of the lead around Carthago Nova began.161 With an initial concentration on silver won from galena by cupellation, the resulting litharge (lead monoxide) may not have initially been refined to lead metal, but will later have made possible large-scale lead-production, through the reprocessing of this by-product, perhaps by the 120s. If this presumption is correct, the high period of lead production fell between c.120 and 30. Basing himself on Alonso Campoy, Cerezo Andreo remarks that it is strange that none of the signed ingots found in wrecks can be dated much before the 90s. Certain of these ingots specify the signatories’ tribes, into which they would have been enrolled after the Social War, with the granting of citizenship to the Italians.162

Whatever the chronology of the massive lead production, we know that lead from Cartagena-Marrazón was being used in the Ebusan mint in the third century (tab. 3) and in the coins and lead piping of Ilduro between 150-100,163 while our isotopic analysis of a piece of a Minturnaean lead issue present in the Isla Pedrosa wreck (M9) shows that lead from south-eastern Spain was used at Minturnae by about 140 at the latest.164

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160 This paragraph draws on Marín Díaz, 1986.
161 Alonso Campoy, 2008, p. 18, raises the possibility that Romans closed the silver mines until 167 as Livy (45.18.3–5) says they did with the Macedonian mines.
162 Cerezo Andreo, 2016, p. 183.
163 Sinner et al., forthcoming.
164 M9, which shares a die with IP 2, uses Almeria lead, as does IP1, which has the same unique bath type as does M1.
Stefanile’s study suggests that many of the *gentes* named in the Minturnaean lead issues settled in cities from Carthago Nova along the *Via Heraclea* north to Valentia, where metal may not have been their primary occupation, but metal from south-east Spain was the focus of production down to the end of the Republic, when metal from the Sierra Morena largely replaced it. There is however evidence that La Loba in the Sierra Morena, for example, was already producing in the mid-second century, and our isotopic data for the Baetican complex suggests that such lead was being mixed with Cartagenan lead, and used to make some of the *grandes plomos*.

The Italo-Baetican types shared between the Minturnaean and Baetican complexes—which although obvious and unique, are still difficult to explain—show that Minturnae and the Italian settlers in Baetica continued within a shared Italic culture. The identification of a probable *societas* trading out of Minturnae to Carthago Nova, through the FVRI, C·BAIBI, L·NVM, C·NVM, and C·SAM / IR lead series from Minturnae, shows an organised trade network. The extensive Minturnaean lead issue signed CN·CORNII1·I·S was probably produced by another *societas*, and the later amphorae attributed to *Lucius Cornelius Lentulus Crus* may show the longevity of the trading activities of this *gens*, from the mid-second to at least the late first century. The value-marks on a number of the issues in both complexes show them to have probably been company moneys of some sort, and the high degree of organisation must have been involved: only some organised and authoritative entity could have given them fiduciary value and the power to circulate. Although the evidence of the Minturnaean *dolia* bulk wine carriers is of early imperial times, such a large-scale trade in unpacked perishables cannot have been possible without shared market knowledge and company agents at the two ends of the trade, contractual agreements prior to shipment, and collecting, storing, processing and marketing infrastructures. The pattern seems to have been primary trade with entrepôts such as Ostia, Massalia, Emporion and Carthago Nova, feeding secondary redistribution networks, by sea and by land. The picture, then, of Italic commerce in the last two centuries BC is of a long-distance trade in—amongst other things—metal, slaves and agricultural commodities, which under the Empire develops further in the Baetican oil-trade that fed the amphora spoil-heap of Monte Testaccio, though other parts of the economy may have regressed to intra-regional trade.

Minturnae’s commerce was not limited to metals, or trade with the metal-rich south-east. It was the port for the export of its own wine, as well as wine from the *ager Caecubus* and the *ager Falernus* in its hinterland, accompanied as secondary cargoes by Calenan black gloss tablewares, found in large quantities from Languedoc to southern Spain, where Calenan wares dominate from the beginning of the first century. The *Isla Pedrosa* wreck, with Minturnaean lead pieces in the purse of

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165 Alonso Campoy, 2009, p. 49, notes that many of the *gentes*—including the *Furii*—who signed lead ingots are present at Delos, were probably active in the slave trade. This was the period when slave-based production in Italy made possible the massive exportation of agricultural product—above all wine—to colonial Spain (ibid, p. 11).

166 Woolf, 1993.

someone on a coaster out of Emporion, is a sign of this wider trade network, as are the important number of coins of Undikesken / Emporion and Kese / Tarraco, the two main harbours in north-east Spain in the second century, in the River Liri.

In this study, we have focused on lead, and must stress that lead issues are not a self-standing phenomenon, but are part of a much wider congeries of non-state coinages in central Italy from the mid-second to the late first century, most of which are bronze, use Italo-Baetican types, and involve gentes who did not sign lead issues, in particular, the Annii. A few but not all of the bronze issues, we know, were struck in Minturnae, and although the Annii are by far the commonest signatories of the central Italian bronze issues, they sign none of the certain Minturnaean issues. Stefaniile mentions no Annii in Spain or central Italy, and a single Annia only is known from Minturnae. A wider and still obscure history than that displayed on the Minturnaean lead lies behind the central Italian bronze complex.

In Baetica, the Italo-Baetican diagnostic types spread across the south of Spain and Portugal, beyond the Latin-language area, to peoples of different cultures, using different languages. We will return to the wider discussion of these issues on another occasion.

We have concluded that the central role of Minturnae as a Republican port trading with Spain has been under-estimated, on the assumption that this trade went first and foremost to Puteoli. For example, Minturnae is not even mentioned in Domergue and Rico’s extensive surveys of the Roman metals trade, where the major commercial hubs are listed as Narbo Martius, Arelate, Massalia, Puteoli, Portus and Aquileia. This may be because no actual Hispano-Roman lead ingots have been found at Minturnae and in its vicinity (but then, nor have any been found at Puteoli), because of the obvious importance of Puteoli in early Imperial times—witnessed by the rich finds of actual and well-preserved commercial documents—and because Minturnae was a river port, rather than a seaport. Moreover, Puteoli was founded in 193, a century after Minturnae, which could therefore have established trade links to Spain before Puteoli.

The metal analyses that we have undertaken, the numismatic evidence of finds of Spanish coin, and above all of Baetican plomos, at Minturnae, as well as the epigraphic parallels between the issuers of lead series at Minturnae and the gentes attested at Carthago Nova and in Baetica, are primary evidence for the key role of Minturnae in the early colonisation and exploitation of Hispania.

168 For these issues, most recently, Stannard, 2018; also, Stannard, 2007.
171 Camodeca, 1999; Jones 2006.
172 However, for the importance of river ports in Antiquity: Arnaud, 2016.
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RPC 1 = Burnett, A., Amandry, Michel, and Ripollès, P. (1992), Roman Provincial Coinage (1. From the Death of Caesar to the Death of Vitellius (44 B.C.–A.D. 69)).


STANNARD, SINNER & FERRANTE, TRADE BETWEEN MINTURNAE AND HISPANIA (1)
STANNARD, SINNERT & FERRANTE, TRADE BETWEEN MINTURNAE AND HISPANIA (3)
PLATE 24

STANNARD, SINNER & FERRANTE, TRADE BETWEEN MINTURNAE AND HISPANIA (4)
PLATE 26
(All 1.5x)

STANNARD, SINNER & FERRANTE, TRADE BETWEEN MINTURNAE AND HISPANIA (6)
STANNARD, SINNER & FERRANTE, TRADE BETWEEN MINTURNAE AND HISPANIA (7)