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New approaches on the archaic trade in the north-eastern Iberian peninsula : exploitation and circulation of lead and silver				
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Summary

A wide-ranging study based on compositional and isotopic analyses of minerals and manufactured objects from the north-eastern Iberian Peninsula and their respective archaeological and cultural contexts demonstrates significant lead mineral exploitation in the El Priorat area (Tarragona province) linked to Phoenician trade (seventh–sixth centuries BC). This exploitation continued, despite losing intensity, until the Romanization of the territory. Our project also aims to determine the nature and origin of the lead and silver supply in the northern Iberian territory surrounding the Phocaeen enclave of Emporion, especially with regard to the demands of the colonial mint. The behaviour pattern of the circulation of lead, silver and copper in Catalonia in the period studied indicates a plurality of contemporary supply sources, although, at least from the fifth century BC onward, minerals and metals from the south-eastern Iberian Peninsula take on considerable importance.

Introduction

At the end of the 1960s, the possible existence of Phoenician commerce in the north-eastern Iberian Peninsula (Catalonia) was suggested ([Maluquer 1969](#)). Since then, the extent of the evidence supporting the existence of this trade has been such that the phenomenon can today be described as structural. From the end of the eighth century or the beginning of the seventh century BC, the Phoenician colonial economies of the southern Iberian Peninsula extended their trade to the Iberian Levantine coast and the north-east, in a traffic that would have its *floruit* in the second half of the seventh century and the first quarter of the sixth century BC. The Phoenician pattern of commerce took advantage of the already existing regional exchange networks and promoted them. This resulted in a traffic with the local cultures who in return for their goods received mainly food products packed in large containers, as well as other complementary items such as *fibulae*, textiles, ostrich eggs, crockery, etc. Both types of product influenced the local way of life and encouraged economies of prestige goods and the production of surpluses to support this trade. Although we believe, as [Godelier](#) suggests (1974, 138–9), that the changes observed during this period in the cultures affected by this traffic can ultimately be attributed to the local systems' ability to transform, the Phoenician factor was also an external contributory cause of undeniable importance ([Rafel 2006](#)). The distribution of Phoenician trade in Catalonia ([Fig. 1](#)) is centred in three main areas – the lower reaches of the River Ebro, which had the highest density of traffic, the coast of Tarragona and the south of Barcelona, and, finally, the north of Girona, where it is important to mention the presence of Phoenician traders in what would later become the Greek colonial enclave of Emporion ([Aquilué et al. 2008](#)).

Figure 1.

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Main sites in Catalonia where Phoenician items have been documented.

Most researchers who have written in recent years about the indigenous contribution to this commerce have emphasized the trade in minerals and metals and, more specifically, silver. In the case of the Ebro basin, it has been suggested that the main Phoenician interest was in the silver-bearing minerals of El Priorat (Tarragona) ([Genera 1982](#), 215; 1995, 76; [Alaminos *et al.* 1991](#), 280; [Rafel 1993](#), 66; [Aubet 1993](#), 27; [Castro 1994](#), 149–54; [Noguera 1998](#), 27; [Gracia 2008](#), 52–3, among others), and for the L'Empordà (Girona) area ([Fig. 2](#)), attention has been drawn to a possible interest in the exploitation of the mining

resources of the eastern Pyrenees and pre-Pyrenees ([Ruiz de Arbulo 1984](#); [Mar and Ruiz de Arbulo 1993](#), 125–7; [Pons and Pautreau 1994](#); [Santos 2003](#)).

Figure 2.

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Priorat and Empordà, the study areas, with the main sites mentioned: 1. Calvari del Molar; 2. Puig Roig; 3. Serra de l'Espasa; 4. Coll del Moro de Serra d'Almos; 5. Castellet de Banyoles; 6. Coll del Moro de Gandesa; 7. Hospitalet de l'Infant; 8. Empúries-Emporion; 9. Pontós; 10. Ullastret.

The project,¹ the results of which will be described briefly in this article, aimed to verify these proposals as well as study the Protohistoric production and use of silver in the north-eastern Iberian Peninsula and their relationship with the colonial phenomenon; however, the diachronic perspective up until the time of Romanization has also been taken into account. Research is based on the comparison of compositional and lead-isotope analyses carried out on samples from mines and manufactured objects, and on the interpretation of the obtained data within the framework of their respective archaeological contexts as well as the local and regional systems of production and exchange. It is divided into three sub-projects, each starting with a preliminary work plan with common methodologies and general objectives. The results obtained forced a continuous refocusing of the investigation. As a result, a complex panorama of the use and circulation of metal has been revealed, indicating the importance of continuing this area of research for the next few years.²

Some methodological questions

One of the essential aspects of the current research is the characterization of the materials, based on various analytical techniques that have been applied, as appropriate, to the whole or to parts of the different materials ([Rafel, Montero and Castanyer 2008](#)):

- Elemental analysis: this has been applied to objects with a copper, lead and silver base, to slag and various forging and smelting remains, and to minerals. For metals and metallic smelting remains, the energy dispersive X-ray fluorescence technique (EDXRF) was used. For slag and non-metallic metallurgical remains, EDXRF was used for a first identification, followed by microanalysis using a scanning electron microscope with an Energy Dispersive Spectrometer (SEM-EDS). The proportions of metallic fraction present in the minerals were also calculated using EDXRF.
- Lead isotope analysis to determine the origin of the metal ([Table 1](#)): this technique was used on both archaeological mineral samples and geological samples, as well as on metallic objects, slag and smelting remains. The equipment used was a Finnigan Mat 262 thermal ionization mass spectrometer (TIMS) with 8 Faraday collectors and a SEM, belonging to the Geochronology and Isotopic Geochemical Service of the UPV-EHU (University of the Basque Country). Four samples of silver were also analysed by the Geology Institute of Berne University (Switzerland) using an inductively coupled plasma mass spectrometer (ICP-MS multicollector).

Table 1.

Lead isotope compositions of artefacts studied in the project with probable provenance

Archaeological Site	Item	Sample no.	Chronology	Provenance	Metal	$^{206}\text{Pb}/^{204}\text{Pb}$	$^{207}\text{Pb}/^{204}\text{Pb}$	$^{208}\text{Pb}/^{204}\text{Pb}$	$^{207}\text{Pb}/^{206}\text{Pb}$	$^{208}\text{Pb}/^{206}\text{Pb}$
Castellar de Pontos	Unminted coin	PA11010		SE (Mazarón)	Ag	18.734	15.67	38.96	0.8366	2.0796
Castellar de Pontos	Unminted coin	PA11013		SE (Cartagena)	Ag	18.733	15.71	39.02	0.8384	2.0828
Castellar de Pontos	Unminted coin	PA11011			Ag	18.552	15.64	38.67	0.843	2.0846
Castellar de Pontos	Unminted coin	PA11009			Ag	18.806	15.76	39.29	0.8381	2.089
Castellar de Pontos	Unminted coin	PA11012			Ag	18.857	15.83	39.54	0.8395	2.0965
Castellet de	Ring	5802	III BC	TUSCANY	Ag	18.735	15.7	39.05	0.8378	2.084

Archaeological Site	Item	Sample no.	Chronology	Provenance	Metal	206Pb/204Pb	207Pb/204Pb	208Pb/204Pb	207Pb/206Pb	208Pb/206Pb
Banyoles										
Castellet de Banyoles	Galen a	PA12433	III BC	MOLAR	Pb	18.302	15.67	38.45	0.856	2.101
Castellet de Banyoles	Sheet	PA12268	III BC		Ag	18.67	15.68	38.88	0.8399	2.0824
Castellet de Banyoles	Lead	PA12435	III BC	MOLAR	Pb	18.312	15.67	38.46	0.8556	2.1004
Castellet de Banyoles	Lead	PA12449	III BC	MOLAR	Pb	18.328	15.69	38.55	0.8563	2.1031
Castellet de Banyoles	Vessel	PA12264	III BC		Ag	18.735	15.68	38.89	0.8372	2.0756
Castellet de Banyoles	Vessel	PA12266	III BC	SE (Cartagena)	Ag	18.736	15.73	39.06	0.8395	2.0844
Coll del Moro Gandesa	Pendant	CMG M87	VII-VI BC		Ag	18.68	15.69	38.97	0.8401	2.0862
Coll del Moro Serra d'Almos	Earring	5047	VI BC (second half)	CATALONIA (Falset?)	Ag	18.32	15.65	38.48	0.8542	2.1003
Coll del Moro Serra d'Almos	Ingot	5879	VI BC (second half)		Ag	18.544	15.68	38.77	0.8458	2.0905
El Calvari	Pb Slag	CVM05-177	VII-VI BC	MOLAR	Pb	18.308	15.67	38.46	0.856	2.1010
El Calvari	Pb Slag	UE 149	VII-VI BC	MOLAR	Pb	18.337	15.67	38.48	0.8545	2.0987

Archaeological Site	Item	Sample no.	Chronology	Provenance	Metal	206Pb/204Pb	207Pb/204Pb	208Pb/204Pb	207Pb/206Pb	208Pb/206Pb
El Calvari	Galen a	UE 154	VII-VI BC	MOLAR	Pb	18.31	15.66	38.42	0.8551	2.0985
El Calvari	Galen a	CVM-177-13	VII-VI BC	MOLAR	Pb	18.335	15.7	38.56	0.8561	2.1030
El Calvari	Lead droplet	CVM-170-16	VII-VI BC	MOLAR	Pb	18.321	15.69	38.52	0.8563	2.1025
El Calvari	Lead	CVM-170-17	VII-VI BC	MOLAR	Pb	18.306	15.66	38.45	0.8557	2.100
El Calvari (necropolis)	Needle	PA12793	VIII-VI BC	LINARES	Br	18.247	15.63	38.4	0.8563	2.1041
El Calvari (necropolis)	Arm-ring	PA12792	VIII-VI BC	LINARES	Br	18.273	15.63	38.4	0.8554	2.1016
El Calvari (necropolis)	Chain	PA12794	VIII-VI BC	SE?	Br	18.685	15.67	38.86	0.8387	2.0800
Empúries	Ring	2226 (PA12292)	VI BC	CATALONIA?	Ag	18.348	15.65	38.45	0.8529	2.0958
Empúries	Belt	PA12524			Ag	18.549	15.66	38.74	0.8442	2.0888
Empúries	Disc	N-3-6201	IV-III BC	SE (Cabo de Gata)	Pb	18.787	15.68	38.88	0.8347	2.0695
Empúries	Fractional coin	5130		SE?	Ag	18.763	15.66	38.78	0.8344	2.0668
Empúries	Fractional coin	6181			Ag	18.662	15.65	38.71	0.8384	2.0744

Archaeological Site	Item	Sample no.	Chronology	Provenance	Metal	206Pb/204Pb	207Pb/204Pb	208Pb/204Pb	207Pb/206Pb	208Pb/206Pb
Empúries	Drachma	27794	II BC (early)	SE	Ag	18.705	15.67	38.96	0.8376	2.0827
Empúries	Drachma	5832	II BC (early)	SOUTH FRANCE	Ag	18.495	15.67	38.71	0.8475	2.0930
Empúries	Galen a	PA12373		MOLAR		18.315	15.67	38.47	0.8556	2.0996
Empúries	Galen a	PA12519		MOLAR	Pb	18.303	15.67	38.45	0.8559	2.1005
Empúries	Lead droplet	84-2-66	II-I BC	SOUTH FRANCE	Pb	18.361	15.68	38.56	0.8537	2.1001
Empúries	Sheet	MN5016	IV BC	MOLAR	Pb	18.303	15.66	38.44	0.8557	2.100
Empúries	Sheet	1983-7-717	II-I BC	SE	Pb	18.727	15.69	39.02	0.8376	2.0838
Empúries	Ingot	PA12521		CYPRUS	Cu	18.494	15.57	38.41	0.8417	2.0766
Empúries	Ingot	PA12523		S FRANCE?	Cu+S n+Pb	18.489	15.65	38.63	0.8463	2.0893
Empúries	Ingot	1980-28-163	II-I BC		Pb	18.651	15.68	38.91	0.8406	2.0862
Empúries	Cupel	PA12375		SE	Pb	18.724	15.68	39	0.8374	2.0831
Empúries	Cupel	PA12374		SE?	Pb	18.803	15.78	39.34	0.8391	2.0920
Empúries	Coin	5827	IV BC (second half)		Ag	18.615	15.66	38.76	0.8483	2.082
Empúries	Sheet	2618	IV-III BC	SE	Pb	18.727	15.69	39.01	0.8376	2.0833

Archaeological Site	Item	Sample no.	Chronology	Provenance	Metal	206Pb/204Pb	207Pb/204Pb	208Pb/204Pb	207Pb/206Pb	208Pb/206Pb
Puig Castellet	Pendant	PA12270			Ag	18.593	15.67	38.81	0.8427	2.0874
Sant Jaume	Droplet	SJ-1022-C1		SE (Cartagena)	Pb	18.697	15.7	38.98	0.8392	2.0851
Sant Jaume	Droplet	SJ-1006-278	VII-VI BC		Pb	18.7	15.68	38.9	0.8384	2.0805
Sant Jaume	Crampon	SJ-1004-705	VII-VI BC		Pb	18.679	15.68	38.93	0.8396	2.084
Sant Jaume	Sheet	SJ-1022-209	VII-VI BC		Pb	18.688	15.69	38.95	0.8395	2.084
Ullastret-Serra de Daró	Arm-ring	3586	V-III BC		Ag	18.713	15.67	38.84	0.8373	0.2075
Ullastret	Drachma Rhodé	4237	III BC		Ag	18.68	15.68	38.84	0.8392	2.0794
Ullastret	Galená	PA12407		GIRONA	Pb	18.535	15.69	38.87	0.8465	2.0973

The area of el Priorat (Tarragona) and its surroundings

The Bronze Age settlements from before the ninth/eighth century BC are located in the northern, more mountainous part of this county (Fig. 3). Evidence of malachite and azurite exploitation has been documented at the Solana del Bepo and Coveta de l'Heura sites, where mining tools, smelting waste and a smelting crucible were found. At the Arbolfí sites, a miner's pick and a copper ingot also bear witness to mining and metallurgical activity.³ Taken as a whole, these enclaves can be placed in the Early Bronze Age and the Vilaseca I period (Fig. 3 and Table 2). The most recent site in this area is the necropolis of Les Obagues (Ulldemolins), the later phases of which have been dated to the eighth century BC (Vilaseca II).

Figure 3.

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Priorat County and its related environment, with the main mining areas and principal sites corresponding to the Bronze Age and the First Iron Age.

Table 2.

Correlation between phases of Vilaseca and Almagro Gorbea and its absolute chronology

Vilaseca 1963	Almagro Gorbea 1977	
I	I	1100–1000 BC
	II	1000–900 BC
II	III	900–800 BC
III	IV	800–700 BC
	V	700–600 BC
IV	VI	600–500 BC

From the second half of the ninth century cal BC or the eighth century BC, the northern mountainous zone became depopulated and the southern part of the county was colonized. The burial sites of Tosseta (Guiaments) and El Calvari (El Molar) ([Vilaseca 1943; 1956](#)) (Vilaseca III) are also from this period ([Fig. 3](#)). The initial phases of the latter can be dated to the ninth century cal BC ([Rafel and Armada 2008](#)), and constitute evidence of a settlement that was presumably exploiting the mineral resources of the area, whose closest seams (Linda Mariquita: copper, galena) are less than a kilometre away from the hill of El Calvari. These already sedentary communities lived in settlements composed of huts made of perishable materials until the second half of the eighth century or the first half of the seventh century BC, when they began to build in stone.

The First Iron Age shows a panorama of settlement that reflects a society territorially structured around two main settlements, Calvari del Molar ([Armada et al. 2005; Rafel and Armada 2005; Gener et al. 2007; Rafel, Montero and Castanyer 2008](#)) and Puig Roig ([Genera 1993; 1995](#)), and two dependent settlements, El Turó de la Cova del Camat and El Turó de l'Avenc del Primo ([Fig. 4](#)). During the second half of the seventh century and the first half of the sixth century BC, this settlement structure controlled the mining basin of the lower reaches of the River Siurana, characterized by the presence of various minerals of copper, silver and, especially, lead (galena with a low silver content), and became a distribution centre for the lead mineral. The First Iron Age occupation brings evidence of the exploitation of the mineral resources of the Molar-Bellmunt zone, and their use in the extraction of metal from them. In Puig Roig, and particularly in El Calvari, the horizons of the second half of the seventh century and the beginning of the sixth century BC show a significant presence of Phoenician amphora material that, together with the rest of the data, suggests close links between the local mineral exploitation structure and the Phoenician traders.

Figure 4.

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Priorat settlement structure, with two main settlements, Calvari and Puig Roig, and two dependent settlements. Intervisibility and seams where prehistoric workings have been documented.

The evidence of mineral exploitation and metallurgy from recent excavations in the neighbouring settlement of El Calvari del Molar ([Armada *et al.* 2005](#)) can now be added to the data we already have regarding the settlement of El Puig Roig, which provides incontrovertible evidence of lead-working ([Genera 1995](#), 69–76, figs. 89, 90, 91). Appreciable amounts of lead slag have been documented in several of the rooms excavated in this settlement, as well as drops of metallic lead, an untreated block of galena in the floor level of one of the rooms, another smaller piece of galena, a saddle quern used to grind the mineral, on which lead and silver have also been detected, a rectangular tuyère of a typology unique in the north-eastern Iberian Peninsula but which appears frequently in the south and always in association with Phoenician colonial contexts or in indigenous sites with close links to them, and an orientalizing bronze arrowhead from the so-called ‘arrowheads with harpoon’ group ([Ferrer's \(1996\)](#) form 5, type 51), presumably a local imitation ([Armada *et al.* 2005](#); [Renzi 2007](#)).

In addition, the lead isotope analyses have allowed us to characterize the spectrum of the mining zone of Molar-Bellmunt-Falset with precision and to confirm that the galena fragments, lead slag and molten lead droplets from the settlement of El Calvari (six items in total) coincide with the isotopic field of the mining zone ([Fig. 7](#)), specifically with two seams located in the areas known by the names of the modern mining concessions, Linda Mariquita, Jalapa and Barranco Hondo ([Fig. 4](#)). However, the analysis of the three pieces of bronze from the burial site indicates the use of foreign metal, specifically from the area of Linares (Jaén) and the south-eastern Iberian Peninsula ([Rafel, Montero and Castanyer 2008](#)).

Figure 7.

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Lead isotope ratios of archaeological items and Molar/Bellmunt ores.

Both the historical data from the mines⁴ and the analysis of the galena from the area indicate a low silver content (less than 400 ppm, too low to obtain silver in antiquity, [Tylecote 1987](#)) which, together with the slag from El Calvari, suggests that the galena was mainly used for extracting lead. Lead became a strategic resource during this period, as it was essential for the extraction of silver from the argentiferous raw materials (jarosite and coppers) which were deficient in this element, as could have been the case with some of the mineralizations of the south-western Peninsula ([Hunt 2003](#)). The trade in galena and lead subproducts, such as litharge, becomes well documented in this period, two remarkable cases being the Mazarrón (Murcia) shipwreck ([González Gallero et al. 2001–2002](#)) and the Phoenician site of La Fonteta in Guardamar del Segura (Alicante) ([Renzi et al. 2009](#)).

Thus, the picture of metal and mineral circulation that emerges is characterized by its complexity, pending further study of the distribution channels. Nevertheless, we would like to emphasize a fact that mirrors the background of the vase-related material from the First Iron Age settlements of southern Catalonia: a very high proportion of the Phoenician amphora material found in the Ebro Valley settlements comes from workshops we have so far been unable to identify precisely, but which were probably located in the area between the south-eastern Iberian Peninsula and the present-day provinces of Málaga and Granada. However, this type of amphora material has not been documented at all on the island of Ibiza, the area to which researchers traditionally attribute the monopoly of the distribution of Phoenician products in the north-east. Although the isotopic data from the island are still relatively sparse, this fact, together with the circumstance that to date there has been no galena from El Priorat or from the Linares area documented on Ibiza, suggests that the paradigm of Ibiza's monopoly in Phoenician trade with Catalonia ([Ramon 1994–1996](#)) should be revised. In any case, during the First Iron Age the circulation of the mineral from El Priorat is clearly linked to Phoenician trade, a role that, from the fifth and fourth centuries on, appears to be totally or partially assumed by the Greeks from Emporion. For the time being, however, we are unable to determine with any clarity the chronology and socio-political conditions surrounding this change, although it can perhaps be linked to the hypothetical port landing stage at Hospitalet de l'Infant (Tarragona) ([Dupré 2006](#)).

El Calvari del Molar may have played a predominant role in these circuits. The distinctive room complexes, their size, the favourable location on the River Ebro, and the mineral outcrops in the area, all point in this direction. [Castro \(1994, 107–25, 154–5\)](#) proposed the emergence of two social sectors with positions of privilege that would be reflected, in one case, in the direct investment of work in the construction of the tombs, and in the other, in the possession of sufficient surpluses to allow the use of metal in them. This situation would indicate a social differentiation that, as [Ruiz Zapatero](#) has pointed out (2004, 320), might be related to different degrees of access to the metallic products and even to the ownership of these graves by traders and metalworkers, as suggested by [Pons \(2003, 122\)](#). What we can say, albeit cautiously, as the research is still in progress, is that the settlement appears to reflect this situation: its relatively large size compared with the norm for the period and the area, an urban structure that is very different from the expected pattern, and the existence of an unusually large building with a tripartite ground plan and a floor decorated with reliefs, appear to point in this direction.

The local settlement network that controlled the mineral from El Priorat in the First Iron Age went into crisis, along with Phoenician trade itself, during the sixth century BC, immediately prior to the emergence of what is known as the Early Iberian Period (550

BC). This is indicated by the abandonment of El Calvari and El Puig Roig, the latter apparently following its destruction and burning.

We have little data on the population, and consequently on how metal was obtained and circulated during the Early Iberian Period. From this time we have some silver items from Coll del Moro in Serra d'Almos (a small ingot and a silver earring) and Coll del Moro in Gandesa (a small silver thread pendant). These finds are insufficient to propose a continuity of the mineral exploitation of El Priorat during the sixth century BC, although one of the finds (the earring) appears to coincide with the isotopic signature of El Priorat.

During the Classical Iberian Period, between the fifth and third centuries BC, there is evidence of a settlement system on the lower reaches of the Ebro, with a predominance of small fortified settlements, some of which were already occupied during the sixth century BC, as suggested by fragmentary data ([Asensio et al. 2001](#); [Belarte and Noguera 2002](#); [Noguera 2002](#); [Diloli and Bea 2005](#)). The population of El Baix Priorat is documented during these centuries, but appears to be of little significance. In this setting, the presence of a large urban settlement stands out, El Castellet de Banyoles in Tivissa, which would perform the role of capital for this area during the third century BC and perhaps in the fourth. The importance of El Castellet de Banyoles is demonstrated not only by its considerable size, the density of its buildings and the complexity of its architecture, but also by some exceptional finds made there. These include the famous silver pateras, vessels and silver jewellery found during the first half of the twentieth century, which are of particular interest to our subject ([Bosch Gimpera 1913–14](#); [Serra Ràfols 1941](#); [Villaronga 1982](#); [Vilaseca et al. 1949](#); [Asensio et al. 2002](#)).

Far more lead and silver items have been recovered from this site than is normal for northern Iberian settlements ([Fig. 5](#)). Of particular interest is the large number of coins, the study of which has led to the theory of a mint at the site itself ([Tarradell-Font 2003–2004](#)), although this hypothesis has yet to be verified. A concentration of molten lead found next to the remains of a kiln in one of the rooms in the northern part of the town suggests some metallurgical activity related to obtaining silver ([Asensio et al. 2005](#)). However, no waste from this kind of activity was found in the room, or instruments, or anything else that could be related to this type of metalworking. Neither is there any evidence to be found of silver extraction from the mineral. It is possible that the lead remains found in the room may have been everyday objects that melted in the fire which brought an end to the occupation of the site around 200 BC. One possibility is that it may have been an artisan's workshop where, among other things, lead objects were produced by casting. The finds in the same part of the settlement, not only of finished lead items, but also of cut ingot sheets, strips and droplets, are evidence for the manufacture of lead objects at this site ([Fig. 6](#)).

Metal	Fragments	% Fragments	MNI	%MNI
Iron	83	19,22	24	24
Bronze	44	10,18	18	18
Silver	1	0,23	1	1
Gold	2	0,46	2	2
Lead	302	69,9	55	55

Figure 5.

[Open in figure viewer](#)

Totals of metallic objects recovered from 1998 to 2006 in El Castellet de Banyoles, with the exception of the coins. Quantities are indicated both in number of fragments and Minimum Number of Individuals.

Figure 6.

[Open in figure viewer](#)

Sample of lead objects from the recent excavations in El Castellet de Banyoles, showing the important typological diversity.

The lead isotope analyses of items from El Castellet de Banyoles (Tivissa) suggest that the lead objects analysed (a cut plaque and a fragment of molten lead) came from El Baix Priorat. Two fragments of galena and a lead sheet originating from the El Molar mineralizations have also been found in Empúries, in fifth–third century BC levels ([Fig. 7](#)). The characteristics of El Castellet de Banyoles suggest that it could have controlled the exploitation and/or distribution of lead from this mining area, at a time when there does not appear to have been any major population centre in El Priorat.

As far as the silver objects are concerned, the samples analysed (a ring and three container fragments) do not indicate an isotopic relationship with the mineralizations of El Molar and the El Priorat areas. One of the pieces (the ring) may have been made of silver from Tuscany ([Fig. 8](#)); the rest are probably from the south-eastern Iberian Peninsula. The available evidence clearly shows differentiated patterns of origin for the different metals – the lead was local and the silver imported. These data appear to reinforce the theory that silver was not a significant part of the mineral exploitation activity in El Priorat.

Figure 8.

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Lead isotope ratios of archaeological items and Mazarrón, Cartagena and Toscano ores.

During the second and first centuries BC, significant changes, of which we yet know little, take place in the Lower Ebro area. Their most visible indication is the abandonment, around 200 BC, of El Castellet de Banyoles. Some smaller settlements continued to be occupied during the second and first centuries BC, although few sites from this period have been excavated so far. In general terms, very little lead is found, with the exception of two sites, Sant Miquel de Vinebre and, particularly, Serra de l'Espasa, which might by then have been controlling the exploitation of the metal, although this is a point which still needs analytical confirmation. However, the quantity and typological diversity of the lead objects documented at Serra de l'Espasa are comparable only to those found in El Castellet de Banyoles in the earlier period, which suggests that the former took over the role of controlling and distributing the area's mining products.

Empúries and the indigenous hinterland (Girona)

The second area of study for our project focused on the far north-east of the Iberian Peninsula, with the aim of defining the role of the Greek colonial enclave of Emporion in the ancient silver and lead trading circuits, as well as its impact on the Iberian communities in its immediate geographical surroundings. Most of the material studied is from the period between the arrival of the Phocaeans in the sixth century BC and the first Roman presence (end of the third–beginning of the second century BC). However, when evaluating the possibility that this area's metalliferous resources were exploited during this period, we cannot ignore the context of the prior trading relations that already existed during the First Iron Age and at the time of the first colonial contacts.

From the Late Bronze Age, at the beginning of the first millennium BC, the territory of the present-day counties of L'Empordà was an area open to cultural and economic contacts on a relatively wide regional scale, which reached as far as the neighbouring zones across the Pyrenees ([Pons 1984](#)). In this context of exchanges, the supply of metal, either as manufactured objects, as raw material to be worked, or as scrap to be reused, was an essential factor. Recent finds, such as the hoard of bronze tools from Sant Martí d'Empúries ([Santos 2007](#)), confirm the active role played by the settlements located on the coast and advantageously placed in relation to the communication routes to the interior.

During the final stages of the Late Bronze Age, and especially at the beginning of the Iron Age, this activity increased at the same time as new iron materials were added to the bronze ones already in circulation ([Pons 1984; 2006; Rovira i Hortalà 2007](#)). All this contributes to the definition of some particularly dynamic areas in this context of trading relationships and circulation of resources, which served as a stimulus for the transformation processes that the native populations underwent. This is true in the case of the area located around the old mouths of the Rivers Ter and Fluvià, in the far south of the Gulf of Roses, an advantageous position in respect to the maritime routes. As early as the second half of the seventh century BC these factors enabled this area to be involved in the trading activities organized by distant Mediterranean colonial enclaves. In this respect, the excavations carried out in the indigenous settlement of Sant Martí d'Empúries and more recently in the necropolis of Vilanera ([Aquilué 1999](#), 103–215; [Santos 2003](#); [Agustíet al. 2004](#); [Aquiluéet al. 2008](#)) have significantly increased the repertoire of pottery and other exotic items that presumably reached the far north-eastern Iberian Peninsula via the Phoenician commercial routes ([Arteaga et al. 1986](#); [Aubert 1993](#); [Ramon 1994–96](#)).

One of the factors that may have attracted the Phoenician traders to this area is the possibility of gaining access, via the indigenous exchange networks, to the local metalliferous resources, which included several areas rich in galena ore ([Ruiz de Arbulo 1984](#); [Mar and Ruiz de Arbulo 1993](#), 25–127; [Mata 1990](#)). These were possibly already being mined during this period, although this is still a hypothesis needing confirmation. However, indirect evidence may lie in the presence of imported goods as well as handmade pottery inspired by the Phoenician vase forms, found in the First Iron Age necropolis of Agullana ([Palol 1958](#), 153, Tomb 184; [Graells 2004](#), 64–5; [Toledo and Palol 2006](#), 166) and Anglès ([Pons and Pautreau 1994](#)). Significantly, both burial sites are located in areas with mineralizations that include seams of silver-bearing galena, to the north of the L'Empordà plain and especially around the middle reaches of the River Ter.

With the beginning of the sixth century BC, the panorama of Mediterranean contacts in the north-east diversified as the activities of the Greek traders increased along the coastline of the Gulf of Lyon from the Phocaeen colony of Massalia. Coinciding with the decline of Phoenician trade along the Mediterranean coast of the Iberian Peninsula from 575/550 BC onwards ([Asensio and Sanmartí 2005](#), 95–6; [Vives-Ferrándiz 2006](#), 157), the situation finally crystallizes in the creation of a permanent *emporion* in this area. Excavations carried out at Sant Martí d'Empúries have contributed important information regarding the first Phocaeen settlement on this coastal promontory, the Palaia Polis mentioned by Strabo ([Aquilué 1999](#), 217–330; [Aquiluéet al. 2000](#)). In the second half of the sixth century BC, the limitations of the original settlement led to the development of a new urban sector located to the south of the port inlet, known today as the Neapolis. Conceived originally for the consolidation of the economic links with the local indigenous population, this Phocaeen enclave became over time a key hub in the deployment of maritime trade routes, directed mainly at the most active Iberian areas in the Levantine and south-eastern coasts of the Peninsula ([Fig. 10](#)).

Figure 10.

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General view of Emporion, with the urban sector of the Neapolis and, to the left, the village of Sant Martí d'Empúries, built over the remains of the first Phocaean settlement (the Palaia Polis) (MAC-Empúries photograph).

One of the reasons for the need of a regular supply of metal, specifically silver, was the mint located in Empúries, from where the earliest issues minted on the Iberian Peninsula originated and which, between the fifth century and the first half of the second century BC, produced only silver coins. Thanks to the large number of published studies – [Campo 1987; 1997; 2002; Ripollés 1989; Villaronga 1997; 2000; 2002; 2003](#) (with bibliographical references) – we have good knowledge of the evolution of this mint, which coincides with that of Rhode during the third century BC ([Villaronga 2000; Campo 2006](#)), the diffusion of its issues and the role played by these colonial enclaves in the transmission of the knowledge and use of coinage to the Iberian societies ([Campo 2002; 2004; Ripollés 2004](#)). Thus, the most important body of evidence relevant to our study is that comprising the silver coins issued by the Emporion mint.

As for the rest of the metallic objects, either brought by traders or locally made, the majority are made of bronze and iron, although there is a significant group of pieces made with noble metals, as well as lead objects. Those made of silver are mainly elements of jewellery and personal accessories, of which many were found in funerary contexts. The other items are chance finds or insufficiently documented discoveries, with stratigraphically well contextualized items rarely being found. The inventory of lead items includes utilitarian objects such as weights and other articles related to fishing, as well as more significant pieces such as the lead sheets with Greek and Iberian inscriptions.

We also have archaeological data and material evidence that are irrefutable proof of metalworking in the Neapolis. The remains recovered in the excavations carried out here since 1908 have allowed the documentation of metallurgical activities related primarily to bronze and iron-working. Nonetheless, lead-working activity is also confirmed by the finds of galena, cupel remains ([Fig. 11](#)), fragments of sheets, lead droplets and other smelting

remains, which have been included in the analytical study carried out within the framework of our project.

Figure 11.

[Open in figure viewer](#)

Fragments of cupels found during the excavations at the Neapolis of Emporion (MAC-Empúries photograph).

However, the best known metalworking facility in Emporion, with the remains of several furnaces, a well and various channels, is located outside the urban area, beyond the southern section of the wall that protected the town from the middle of the second century BC. Although the period of activity of this suburban workshop is outside the chronological limits of our study, we decided it would be of interest to include some samples taken from materials found in this sector, including slag remains, lead sheets and smelting residues.

The data from Emporion have been complemented by other materials documented in the most immediate indigenous area, particularly from the important Iberian settlements of Ullastret and Mas Castellar de Pontós ([Fig. 2](#)).

The large *oppidum* of El Puig de Sant Andreu (Ullastret) performed the role of capital of the Indigeta area ([Martin 2000; 2005](#)). Together with the neighbouring site of Illa d'en Reixac ([Martin et al. 1999](#)), this Iberian centre has its origins in the First Iron Age settlements. Already fortified by the second half of the sixth century BC, El Puig de Sant Andreu reached its height, in terms of size and urban development as well as the consolidation of its territorial control, between the fourth century BC and the beginning of the second century BC, when it was abandoned as a consequence of the arrival of the Romans. The necropolis of Serra de Daró may have been the burial site related to these nuclei between the fifth century and the middle of the third century BC ([Martin and Genís 1993](#)).

The Mas Castellar de Pontós site covers some 5 ha, split between the areas known as Camp de Dalt (Upper Field) and Camp de Baix (Lower Field). Its initial occupation, during the

First Iron Age, was followed by a short-lived fortified settlement (fifth–fourth centuries BC). Later on, this was replaced by a rural community, with an urban layout of Hellenistic influence (fourth–second centuries BC) (Pons 2002). Some 2000 silos have also been found spread out among both fields, suggesting that the successive settlements specialized in the production and trade of cereals, in close relationship with Emporion. A determining factor in this was its strategic position in the far north-western corner of the L'Empordà plain, at some distance from the marshland areas and only 17 km from the coast.

Most of the precious metal found at these two sites is also related to coinage. It is mainly fractional currency, silver drachmas and their divisors, minted in Emporion. To these we can add some unminted, coin-shaped pieces (Fig. 12) and a few sparse ornamental objects, either made of or partially decorated with silver (bracelets, *fibulae*, belt buckles) (Fig. 13). Several of the samples that have been analysed in the project come from these pieces, together with others taken from lead objects, as well as a galena nodule found at Ullastret.

Figure 12.

[Open in figure viewer](#)

Coin-shaped pieces of silver from the Iberian site of Mas Castellar de Pontós (MAC-Girona photograph).

Figure 13.

[Open in figure viewer](#)

Fragment of a silver bracelet from the Iberian necropolis of Serra de Daró (MAC-Ullastret photograph).

Finally, in this study we have also included an unusual silver pendant found at the fortified Iberian enclosure of Puig Castellet (Lloret de Mar), occupied for a short period between 275 and 225 BC ([Pons *et al.* 1989](#)).

Another of the objectives of the project was to obtain lead isotope analytical data, in order to characterize the local areas of galena mineralizations. This is aimed at determining possible coincidences with the analysed objects that would confirm the exploitation of regional metalliferous resources in the pre-Roman period. The mineral samples came from two of the main filonian mineralization areas in this north-eastern zone – the middle Ter Valley (the mines of Osor and Sant Julià de Llor) and the eastern part of the Les Gavarres massif (the mines of Mont-ras and Palamós). The silver content of the galena samples that have been analysed is, however, low (less than 300 ppm).

The results obtained in this first phase of the project have allowed us to reach some provisional conclusions and interpretative hypotheses. In the earliest period, corresponding to the First Iron Age, it can be stated that silver is absent from the area's settlements and necropolises, despite the fact that, at least from the second half of the seventh century BC, there is evidence of contacts with Mediterranean colonial agents. The Phoenician materials found in the area around Empúries illustrate this and confirm the existence of an active indigenous port enclave in a favourable strategic position in relation to the regional trade networks and the navigation routes. However, apart from a small amount of material of Phoenician origin or influence documented in the indigenous burial sites located around the areas near galena mineralizations, to date we have no additional data to show its possible exploitation during this period. The possibility of obtaining silver from this area cannot be ruled out completely. It would, however, have been much more

scarce and difficult to exploit than other local products, which we are forced to consider would have been more attractive for this reason.

For the subsequent historical period, coinciding with the consolidation of the Phocaean *emporion* and the development of the Iberian population centres in the surrounding area, the data we have on supply and trade routes for silver and lead are still somewhat inexplicit, although we do have some indications. As far as the Greek colonial enclave is concerned, the silver pieces of jewellery and personal accessories may have been brought as manufactured items by traders. The data obtained from the oldest piece analysed, the ring found in one of the indigenous cremation tombs at the necropolis on the north-eastern wall (sixth century BC) ([Almagro 1955](#), 377–8), appear to place it within the isotopic fields corresponding to the El Priorat mineralizations ([Fig. 7](#)). In the case of the sample from a diadem or silver belt from Empúries, the data tell us little, although it does not appear to be linked to the south-east. Of particular interest, on the other hand, is the fact that the two analysed samples of lead mineral found in the Neapolis at Empúries confirm that galena from El Priorat was brought to this area and used in the metallurgical workshops of the Greek colony. The same origin may be attributed to a fragment of lead sheet found in a stratigraphic context of the Neapolis dating to before the second quarter of the fourth century BC.

Another essential question is that of the supply of silver to the Empúries mint. So far, we have only been able to analyse a sample attributable to one of the issues of fractional currency from Emporion prior to the drachmas, possibly from the second half of the fourth century BC, although, for the time being, the isotopic data are insufficient to determine the possible origin of the metal. Neither is there conclusive information for the small units of coinage minted during the subsequent period of activity of the Emporion mint, during the third century BC, at the same time as the drachmas were being issued. The possibility that the metal was being reused, together with the probable supply of raw materials from various locations, does definitely limit the chances of tracing their origin through archaeometric analysis. However, the isotopic data from the two drachmas analysed, both attributable to a more recent phase of silver coinage issued in Emporion (after the Second Punic War), appear to feature this diversification in the supply of the raw metal, particularly during the periods of greatest activity of the mint. Thus, whereas the isotopic data for one of the drachmas ([Fig. 14](#)) coincide with those for the mines of southern France at Mont Lozère (Cevennes, France) – the best correlation being with the minerals from the sector of Les Boudons –, the second drachma matches the data from the south-east of the Iberian Peninsula, probably the Cartagena area.

Figure 14.

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One of the silver drachmas minted at Emporion that has been analysed (MAC-Empúries, no. 5832), with isotopic data that seem to coincide with those of mines located in the south of France (Mont Lozère) (MAC-Empúries photograph).

The mining areas in the south-eastern Iberian Peninsula also appear to be the most likely origin for the coin-shaped silver pieces found at Pontós ([Campo 2004](#)) ([Figs. 9 and 12](#)). Moreover, the coincidence with the isotopic field of the south-eastern zone is also evident in the case of other samples corresponding to lead objects from Empúries, among them a curse tablet with a Greek inscription and an undetermined piece found in an excavation in the southern sector of the Neapolis. Significantly, the origin of the two fragments of cupel studied also appears to be related to the isotopic fields of the south-east ([Fig. 11](#)). All this evidence proves that the supply of metal mined in that area by the Emporitans goes back at least to the fourth century BC and probably to an even earlier period, coinciding with the intensification of Greek trade with the Iberian peoples of the Mediterranean façade of the Peninsula and the contacts with the southern and Ebusitan Punic world.

Figure 9.
[Open in figure viewer](#)

Lead isotope ratios of archaeological items and ores from Girona province and the south of France.

On the other hand, the analyses of lead materials found in the suburban metallurgical factory ([Sanmartí-Gregó *et al.* 1983-84](#)) have provided complementary information regarding a later period in the evolution of the archaeological site (end of the second century/first half of the first century BC). They belong to a very different set of historical

circumstances, trading relationships and economic realities, coinciding in time with the founding of the new Roman city on the upper part of the Empúries hill. It is worth pointing out that the isotopic results also show that the lead used came from diverse sources. Whereas the origin of one of the many lead plaques found in this sector may have been the south-eastern Peninsula, the analyses carried out on other smelting remains indicate the possibility of the contemporary arrival of metal from mines in the south of France.

The analysis of the silver-bearing objects found in the indigenous sites of the area appears to rule out their being manufactured from local raw materials. The use of silver at Ullastret, mainly in a funerary context ([Fig. 13](#)), indicates a clearly restricted circulation of these items among the northern Iberian elite classes, both in their ritual aspect and as elements of social distinction. At the same time, the adoption of silver coinage minted in Emporion and Rhode is evidence of the close economic relationships between these Phocaean enclaves and the indigenous society, who would switch from performing metal transactions by weight to adopting the colonial metrological system, although both methods coexisted at least until the fourth century BC, as is shown by the Pont de Molins hoard ([Campo 1987; 2004; Ripollés 2004](#)). Eventually, the use of minted coinage completely takes over, so the concealed hoards or treasures of the *oppidum* of Ullastret are good examples of the stockpiling of wealth that takes place at a chronologically advanced stage, immediately prior to the Second Punic War.

Finally, it is important to emphasize that to date none of the analysed samples from Emporion have allowed us to verify the possible exploitation of metalliferous resources from its own geographical surroundings. The only coincidence detected so far is the galena nodule found at Ullastret.

Final considerations

The evidence we have gathered so far clearly indicates that galena from El Molar and Bellmunt (El Priorat, Tarragona) was mined throughout the entire period covered by this study (seventh–first centuries BC). Lead mineral from El Priorat, which is very pure and therefore of little use for extracting silver, is documented locally either in its mineral or metallic state, as well as in El Castellet de Banyoles in Tivissa (late fourth century BC to c.200 BC) and in Empúries (galena possibly from the fifth century BC or earlier, galena at the latest prior to the late third century BC, lead from before the second quarter of the fourth century BC). Empúries, however, appears also to receive lead from elsewhere, specifically from the south-eastern Peninsula and the south of France.

Although mineral exploitation in El Priorat goes back to the Late Bronze Age and is clearly of indigenous origin, the increased trade with the Phoenician world encouraged a more intensive mining of lead, probably for use as an element in the cupellation process. In the seventh–sixth centuries BC, a native population structured around various sites located very close to the seams exerts control over the mineral and its trade with the Phoenicians. This structure enters into crisis in the mid-sixth century BC, as does Phoenician trade with the north-east of the Iberian Peninsula. From that time, mining begins to lose importance and control of this resource seems to shift to places some distance away from the mining area, in El Castellet de Banyoles (fourth–third centuries BC) and Serra de l'Espasa (second–first centuries BC).

Data from the rest of the Peninsula currently under study appear to indicate that the lead from El Priorat was distributed outside the geographical area of Catalonia, apparently to other territories in the southern Iberian Peninsula connected to the Phoenician sphere;

nevertheless, these data, which were unsuspected when we began this project, are difficult to interpret and require further study.

As for the exploitation of the silver resources of the north-eastern Iberian Peninsula, the evidence we have to date is still somewhat imprecise; however, there is a clear supply of silver from the south-east of the Peninsula (Murcia and Almería provinces) spanning at least the fifth to the first centuries BC. In addition, but involving much smaller amounts and materials of a more recent date (end of the third–first centuries BC), there is evidence of manufactured metal from Tuscany (El Castellet de Banyoles) and possibly from the south of France (Empúries). There is some data for the sixth century BC, which have to be verified, that point to possible silver mining in El Priorat (the ring from the necropolis on the north-eastern wall of Empúries and the earring from Coll del Moro in Serra d'Almós). The data we have at present indicate that the position of silver in Mas Castellar de Pontós and El Puig de Sant Andreu in Ullastret was similar to that of Empúries, although we have yet to ascertain a clear pattern for the supply of lead.

For copper we know, as is documented at El Calvari del Molar, that apart from a preference for the local mineral, bronze ornamental items datable to the seventh–sixth centuries BC and made with metal from the south-east of the Peninsula and the area of Linares (Jaén) were present. In Empúries, a fragment of copper ingot, unfortunately without exact provenance and date, appears to be of Cypriot origin.

In summary, the picture we have at present for the circulation of metal in the north-eastern Iberian Peninsula features a degree of complexity unsuspected when this project began, except perhaps in the case of Empúries where a diverse flow would be expected, given its status as an important trading port.

Thus, the results of the project have redirected the investigation and revealed a complex scenario regarding the use and circulation of metal that makes the continuation of this work worthwhile. The starting hypothesis rests with the significance of the exploitation of the mineral resources from the mines at El Molar-Bellmunt (El Priorat) in relation to Phoenician trade. This activity gradually decreased in importance up until the end of the period, when faced with competition from minerals and/or metals from elsewhere, mainly the south-eastern Iberian Peninsula, as well as a decrease in the use of local resources and the exploitation of other mining areas still to be determined, but probably in an intermediate location between the area of Catalonia and the south-east or from inland.

The results of this three-year project, 'Pre-Roman Silver in Catalonia', outline a picture that is without doubt an improvement on the complete lack of data with which we began, although at the same time it distances itself in some respects from our starting hypothesis and opens up new perspectives for study. It is necessary to obtain isotopic data from other areas with as yet uncharacterized lead and silver resources, and to improve our archaeological knowledge of the area around the El Molar mines and, particularly, of the El Calvari site, which appears to have played a determining role in the production and distribution of the mineral-metal up to the sixth century BC, as well as to learn more about its immediate surroundings in the Iberian period, as the evidence analysed to date appears to indicate that the distribution centre or centres at that time were outside what can strictly be considered the mining area. Likewise, in order to give a historical interpretation of the general time-scale in which these exchanges took place, we need to widen our study to other areas of the western Mediterranean involved in silver and lead production in the first millennium BC. These include Ibiza – of which it is strategically important for the project to have a sound knowledge, given its role in the distribution of Phoenician products in the north-east – and the Phoenician and Iberian settlements. This will make it

possible to explain the likely presence there of galena from the Catalan area and, on the other hand, the arrival of metal in Catalonia from other areas.

Footnotes

- ¹ The coordinated project 'Plata Prerromana en Cataluña' (Pre-Roman Silver in Catalonia) (HUM2004-04861-C03-00), financed by the Ministry of Education and Science, is made up of three sub-projects: 1. *El área minero-metalúrgica Molar-Bellmunt-Falset en la protohistoria* (The Molar-Bellmunt-Falset mining area in Protohistory). University of Lleida. Team members: N. Rafel, X.-L. Armada, C. Belarte, P. Gasull, R. Graells, M.A. Hunt, A. Pérez and P. Villalba; 2. *Emporion y el comercio y explotación de la plata en el NE peninsular en época prerromana* (Emporion and the trade and exploitation of silver in the north-eastern Iberian Peninsula during the pre-Roman period). Archaeological Museum of Catalonia-Empúries. Team members: P. Castanyer, M. Santos, J.M. Mata, E. Pons and M.C. Rovira; and 3. *Caracterización de la producción metalúrgica protohistórica de plata en Cataluña* (Characterization of the Protohistoric metallurgical production of silver in Catalonia). Consejo Superior de Investigaciones Científicas. Team members: I. Montero, S. Rovira, M. Gener and M. Renzi.
- ² To this second phase of the project (2007–10) the Ministry of Education and Science has approved the coordinated project '*Aprovechamiento de recursos de plomo y plata en el primer milenio aC: interacción comercial y cultural en el Mediterráneo Occidental*' (Use of the lead and silver resources in the first millennium BC: commercial and cultural interaction in the western Mediterranean) (HUM2007-62725-C03-00).
- ³ All compiled in [Rafel, Abella and Martínez Elcacho 2003](#), with references.
- ⁴ The historical references to mining in this area date back to the eleventh–twelfth century writings of the Andalusian geographer, Al-Bakri. He does not refer to silver mining, only to that of galena ([Bramon 2000](#), 87, f 53). By the fourteenth century there is a wealth of written information showing the rise in silver mining ([Martínez Elcacho 2004](#)) that, nevertheless, is obtained mainly from silver minerals and native silver, and only in a small part from galena.

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