

**Revista**  
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Número extra 2

**A PREHISTORIC COPPER MINE IN  
THE NORTH-EAST OF THE IBERIAN  
PENINSULA: SOLANA DEL BEPO  
(ULLDEMOLINS, TARRAGONA)**

Núria Rafel Fontanals, Ignacio Soriano  
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With the collaboration of  
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**By way of conclusion:  
Solana del Bepo and its context,  
an assessment**

by

**Núria Rafel Fontanals and Ignacio Soriano**



## Introduction

The research undertaken in recent years in the mining basins of the Priorat has provided data about a territory in which advantage was taken throughout prehistory of the abundant mining-metallic resources of the area. At the same time, it has added considerably to our knowledge of the different exploitations and roles they played at each point in history, which, as we will see, were very different in the Chalcolithic and the Bronze Age and the subsequent Early Iron Age. The methodological proposal of our research programme was based on a combination of different focuses that were able to be integrated into a contextual view. Its main bases were surveying, excavation, the review of archaeological finds from earlier excavations or plundering of archaeological sites, and archaeometry.

For the purposes of our project we have grouped the exploitations into two basins: the one we call Montsant, to the north –where the Solana del Bepo mine is located– and that of Molar-Bellmunt-Falset (MBF), to the south (Fig. 56). Our initial research was carried out in the southern part of the county (the MBF basin) and it allowed us to confirm the mining of minerals –mainly galena– at the Linda Mariquita, Jalapa and Barranco Hondo mines in the towns of El Molar and Bellmunt del Priorat (Fig. 8). As far as local copper mining was concerned, up to that time there had only been sparse evidence, basically unprocessed copper mineral found at the 10<sup>th</sup>-9<sup>th</sup>-century archaeological site of Avenc del Primo

(Bellmunt del Priorat; Armada *et al.* 2013). However, recent archaeometric data has revealed Late Chalcolithic copper and lead mining in this basin for the manufacture of two items: the lead necklace bead found at Coveta de l'Heura (Ulldemolins, Priorat) and the probable manufacture of the Palmela point from Tossal de les Benes (Rojals, Conca de Barberà) with copper from the Linda Mariquita mine.

Nevertheless, from the 8<sup>th</sup> century BCE, and above all in the 7<sup>th</sup> and the early 6<sup>th</sup> centuries, the copper used to make the bronze items in use at the time came from the south of Spain, mostly from the Linares mining zone in the province of Jaén and, to a lesser extent, from that of Almería (Montero-Ruiz *et al.* 2012b). To date, no metal object made with local copper has been documented for this period. In parallel to the supply of copper from Linares, at least as early as the 7<sup>th</sup> century BCE, the local populations were focused on obtaining lead ore from galena. This was distributed in the immediate area, although it also had an outlet closely linked initially to the Phoenician commercial networks and later to those of Greece. Thus we find lead from the Priorat in the area of Tartessos and, from the 6<sup>th</sup> century on, in Emporion and its immediate hinterland (Rafel 2012, Murillo-Barroso *et al.* 2016). This demonstrated the incardination of the local populations in the supraregional, long-distance commercial networks. We would like to point out that Linares copper is documented –always within the aforementioned chronological framework and in cultural milieus associated with Phoenician trade– at

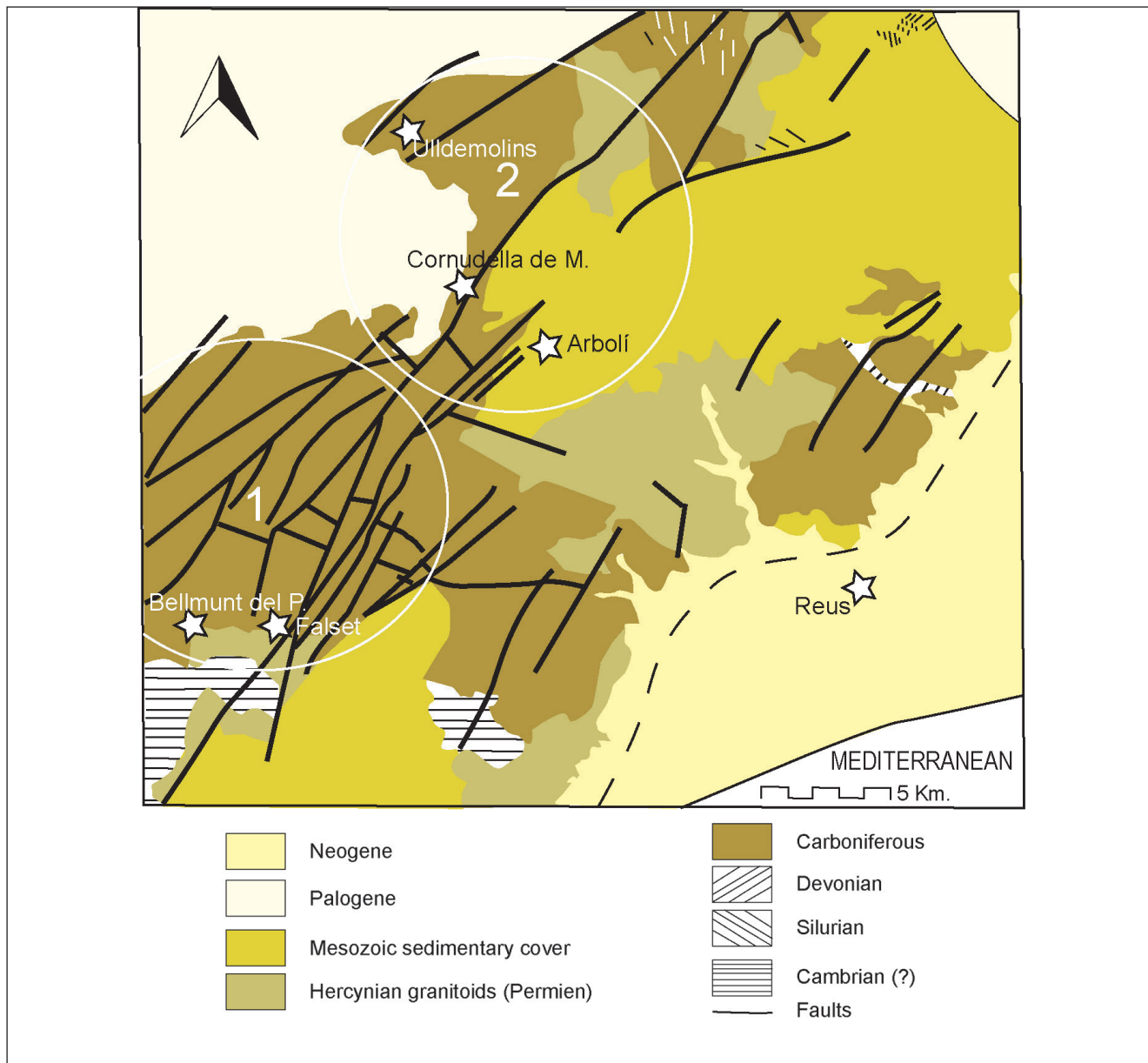


Figure 56. Geological map of the Priorat showing the Montsant and Molar-Bellmunt-Falset (MBF) mining basins. Base: Alfonso *et al* 2002, Fig. 1.

other places in north-eastern Spain (Montero-Ruiz *et al.* 2012b), further evidence, in this respect, of supraregional trade with a significant reach.

The subsequent expansion of our research to include the northern basin, that of the Montsant, shed light on a completely different panorama. The mines documented to date were exclusively exploited for copper; they were already operating in the Late Chalcolithic and continued into the Bronze Age. From the point of view of the role of mining and metallurgy in the local societies everything appears to indicate that in this area and at this time it was limited to their own use and a local and perhaps regional distribution, within the framework of cooperative networks (Primas 2012).

However, there are still many aspects that need to be studied in greater depth. One of the main challenges at present is the chronology. Also in this

respect, the northern zone of the county presents a very different set of problems to that of the south. Various factors add to the difficulty of accurately dating the exploitations. On the one hand, the majority of the known archaeological sites in this northern area of the county were studied decades ago; they suffer from a lack of reliable stratigraphies and, of course, absolute datings. The only exception is Coveta de l'Heura, where we recently dated funerary remains. The ancient mines are also generally much deteriorated due to historical working, a fact that hampers their study and has so far prevented the location of prehistoric levels *in situ*, although as can be seen from the Solana del Bepo mine and the new La Turquesa or Mas de les Moreres mine, recently discovered and excavated by our team (Soriano *et al.* in press), abundant prehistoric mining tools are to be found in modern levels. In part, archaeometry has come



to make up for these deficiencies, as the systematic programme of compositional and lead isotope analyses on ore samples and archaeological finds has allowed the exploitation of the mines to be confirmed. It has also allowed us to profile some chronologies based on the typological dating of the objects analysed and, in some cases, their archaeological contexts.

## The mining implements from Solana del Bepo and their chronology

Despite its significant presence in the archaeological bibliography, we know little about the Solana del Bepo mine and all that we do know, as already mentioned, is the fruit of Vilaseca's surface survey of the archaeological site. Fortunately, since that author's investigations so many years ago, the site has not undergone any notable changes, with the remains of the supposed spoil bank (Fig. 3) still visible and some fragments of macrolithic artefacts waiting to be picked up. In reality, now, as in Vilaseca's time, the importance of Solana del Bepo lies, at least for the time being, in its considerable assemblage of artefacts. We also wish to point out that the fact that we were able to collect stone implements from the surface means that we cannot guarantee that Vilaseca's collection was not, in addition to being superficial in the literal sense of the word, also selective. We hope that the fieldwork which will start soon within the framework of our project allows us clear some of the unknowns about Solana del Bepo.

As we have already seen, the stone mining implements found –mainly picks– were made from local rock (especially rocks affected by contact metamorphism and granitic rocks) that were easily obtained in the immediate surroundings. They are noteworthy for their high degree of modification, both in terms of the preparation of their passive faces and active fronts and the fact that a very high percentage of them have relatively complex hafting devices, among which are those that have the diverse types of T-shaped handles. The high degree to which the mining picks found had been worked is not limited to the hafting devices, but also, and above all, to the transformation of the natural material itself by knapping, pecking and polishing to obtain the pointed morphology with a triangular tendency. In fact, the Solana del Bepo macrolithic assemblage has no clear parallels in the known panorama of European prehistoric mining, as, although handles similar to those from our archaeological site have been documented, we know of no examples in which they are combined with such elaborate working.

Their dating, therefore, is not easy, given the lack of stratigraphic context and the fact that, unfortunately, both on the Iberian Peninsula and in Europe as a whole, it is a type of find that has not received the attention it merits. There are very few examples of this type of implement with good datings, as the contexts in which they are found often suffer from similar problems to those of our site. Therefore, there is a general tendency to apply technological-evolutionary criteria, assuming that the more elaborately a piece is worked, the later it should be dated (Blázquez,

Domergue and Sillières 2002: 79). For the Iberian Peninsula, the best work carried out in this respect is without doubt that of M. Hunt Ortiz (2003); however, the finds on which his typology is based are mainly from contexts that are undated or of doubtful dating. As a consequence, although in the face of the general lack of data it is not advisable to disregard this type of technological-evolutionary criteria, no one can deny that their confirmation is a challenge that future research into prehistoric mining in Spain will have to face up to. At any rate, if we trust these criteria, we should consider the lithic artefacts from Solana del Bepo as technologically advanced within the framework of what is known with respect to prehistoric mining tools.

A review of the panorama on a European level reveals, as a first general consideration, that the mining implements have similarities that do not always appear to bear any clear relation to their chronology, geographical location or even to what was being mined. Moreover, tools with hafting devices are often found in the same context as those without. Despite the already mentioned lack of clear parallels for the Solana del Bepo assemblage, it is possible to point out certain aspects of interest related to the hafting devices. In the European framework, the tools most commonly linked to some type of mining have a transversal groove for their haft, this being a type of device documented throughout prehistory (Gale 1995, Pascale 2003). There are many illustrative examples at European archaeological sites from the 6<sup>th</sup> millennium on, including the La Defensola chert mines in Italy (Galiberti *et al.* 1997: 217) and the copper mines of Rudna Glava and Prljuša-Mali Šturak in Serbia (Jovanovic and Ottaway 1976: 108, Bogosavljević 1990, Borčić 2009, Antonović and Vukadinović 2012). These tools continue to be found in Chalcolithic and Bronze Age copper mines, such as Monte Loreto in Italy (Maggi and Pearce 2005: 69), El Áramo and El Milagro in Asturias, Northern Spain (Blas Cortina and Suárez Fernández 2010), and Chinflón in southern Spain (Hunt Ortiz 2003: 282, Linares Castela and García Sanjuán 2010, ). Other mining tools documented in European contexts are characterised by not having any modification whatsoever or for having only slight lateral grooves. These are also documented in chronologically widely diverse contexts ranging from the variscite mines of Can Tintorer (Gavà, Spain, late 5<sup>th</sup> and the whole of the 4<sup>th</sup> millennium cal BCE; Villalba and Edo 1991) to the copper mines of the 3<sup>rd</sup> and 2<sup>nd</sup> millennium documented in Spain, France and Great Britain (Timberlake 2003, Carozza *et al.* 2010, Barge and Talon 2012, Hunt Ortiz *et al.* 2013, Timberlake and Craddock 2013, Delgado-Raack *et al.* 2014.). Finally, we should also mention the chronological and spatial coexistence of tools with and without grooves at a large number of mines of different chronologies (4<sup>th</sup> – 2<sup>nd</sup> millennium cal BCE). This is the case of the Ross Island copper mines in Ireland (O'Brien 2004, 2011, Timberlake and Craddock 2013: 39), Cabrières-Péret in Hérault (Bouquet *et al.* 2006, France, Ambert *et al.* 2009) and Mitterberg in Salzburg (Austria, Barge *et al.* 1998, Gale 1991). The T-shaped hafts found at Solana del Bepo do not appear in contexts prior to

the Bronze Age. We know of some examples on the Iberian Peninsula, although they unfortunately lack any context that would allow them to be placed chronologically: an example located in the foundations of the chapel of Aixovall (Sant Julià de Lòria, Andorra; Martzluff and Mas 1989-1990), another from the La Preciosa Mine (Peñaflor, Seville; Hunt Ortiz 2003: 67) and three examples of uncertain origin, although they are apparently from the north of Asturias and one was possibly found in an Iron Age hillfort, a fact that cannot definitely be corroborated (Álvarez and Pajares 2011). In the rest of Europe, we only know of this type of haft at Alderley Edge (Cheshire, Great Britain, *c.* 1750 BCE), a mine worked during the Early-Middle Bronze Age, as well as in the Roman and historical periods (Timberlake and Prag 2005, Timberlake and Craddock 2013). However, the radiocarbon datings of the Bronze Age mine workings do not present comparable associations with implements with this type of haft and, on the other hand, they are less worked than those from Solana del Bepo.

In our case, in addition to the assemblage of mining implements, we have another piece of information: the possible link between the ore from Solana and the three-rivet dagger from Cova de la Font Major at L'Espluga de Francolí, which would place us in the Early Bronze Age. In summary, the elements available for the dating of the mine are sparse and weak. Therefore, it will be necessary in the future to expand our research –both in the field and in the laboratory– to resolve or at least make progress in this aspect. One of the actions planned for the near future as part of our research project is precisely to embark on an excavation campaign at the archaeological site with the aim of characterising the spoil bank, definitively locating the vein –currently only a hypothesis– and, as far as possible, gathering contextual information that will allow us to advance in the chronological aspect.

## The archaeometric perspective

The diverse archaeological mining sites in the Montsant Basin have been characterised compositionally and isotopically, although it will be necessary in the future to expand and study this characterisation in greater depth and, above all, to extend it to neighbouring areas. However, the archaeometric knowledge we have of these sites to date is enough to allow us to compare them with the analytical data from the archaeological finds. As a result, we can state that mining of metallic ores in the Montsant Basin began without doubt in the Late Chalcolithic and continued during the Early and Middle Bronze Ages. There can be little doubt that it is to this period that we can date various items that indicate the exploitation of local ores. The first of these is the lead necklace bead from Coveta de l'Heura, the only one of its kind documented on the Iberian Peninsula and an object with clear parallels in the south of France in a chronological horizon between Ferrières and the end of the Middle Bronze Age. We should remember that we have a radiocarbon date from the middle of the 3<sup>rd</sup> millennium cal BCE from one of the individuals

buried at this site, although, owing to the conditions of the excavation carried out there by Vilaseca, we are unable to definitely link that date with certain finds. The analytical characterisation of the aforementioned bead reveals it came from the Baix Priorat mining basin (MBF, probably the Linda Mariquita mine). The analytical characterisation of another piece from the same archaeological site –an awl made of arsenical copper– indicates that the mineral came from the La Turquesa or Mas de les Moreres mine (Montsant Basin). Copper and bronze awls are common in the north-east of the Iberian Peninsula and have a chronology ranging from the Chalcolithic to the Early-Middle Bronze Age, although some types continue until the Late Bronze Age (Soriano 2013: 121-127). In this case, and despite the difficulties in interpreting the stratigraphy of the archaeological site, we lean towards proposing a Late Chalcolithic chronology. A small group of metallurgic remains also indicates an origin in the Montsant Basin. On the one hand, the smelting vessel, a fragment of mineral, and metallurgy remains from Coveta de l'Heura fit, both compositionally and isotopically, into the field of the Barranc Fondo mine in Cornudella de Montsant; and on the other, a smelting vessel from Balma del Duc in Conca de Barberà county fits into the field of the La Turquesa or Mas de les Moreres mine, the same as the arsenical copper awl. Less certain is the possible attribution to this mine of a smelting vessel from Cova del Buldó (La Bartra, Conca de Barberà) and a copper arrowhead without context from Marçà (Priorat). Smelting vessels were in use on the Iberian Peninsula in both the Chalcolithic and the Early-Middle Bronze Age. During the Late Bronze Age, kiln technology began to replace them, although in some parts of the Peninsula they continued in use in Second Iron Age contexts (Rovira 2004). However, in the case of the three vessels we are looking at, from Coveta de l'Heura, Balma del Duc and Cova del Buldó, a fact to take into account is that at none of these archaeological sites have finds datable to the Late Bronze Age been made, meaning that they could possibly be attributed to a lapse between the Late Chalcolithic and the Middle Bronze Age. As we have already pointed out, we have also been able to assign an origin to the three-riveted bronze dagger found in Cova de la Font Major (L'Espluga de Francolí), also in the neighbouring county of Conca de Barberà. Although in this case the piece also suffers from a lack of stratigraphic information, it is of a type that, both on the Iberian Peninsula and in other European contexts, has a Bronze Age chronology. This dating had been corroborated by the metallurgic mould from Camp Cinzano (Vilafranca del Penedès, Barcelona), which has a casting matrix for riveted daggers and a radiocarbon date of *c.* 1850 cal BCE (Soriano and Amorós 2014). Its analytical characterisation allows us to suggest a link to the Solana del Bepo mine, although, as previously mentioned, a more in-depth isotopic characterisation of this mine needs to be carried out in the future (Fig. 57). The isotopic characterisation of two flat copper axes from Cova M at Cingle Blanc (Arbolí), dated respectively to the Early and Late Chalcolithic (Soriano 2013: 93-95),

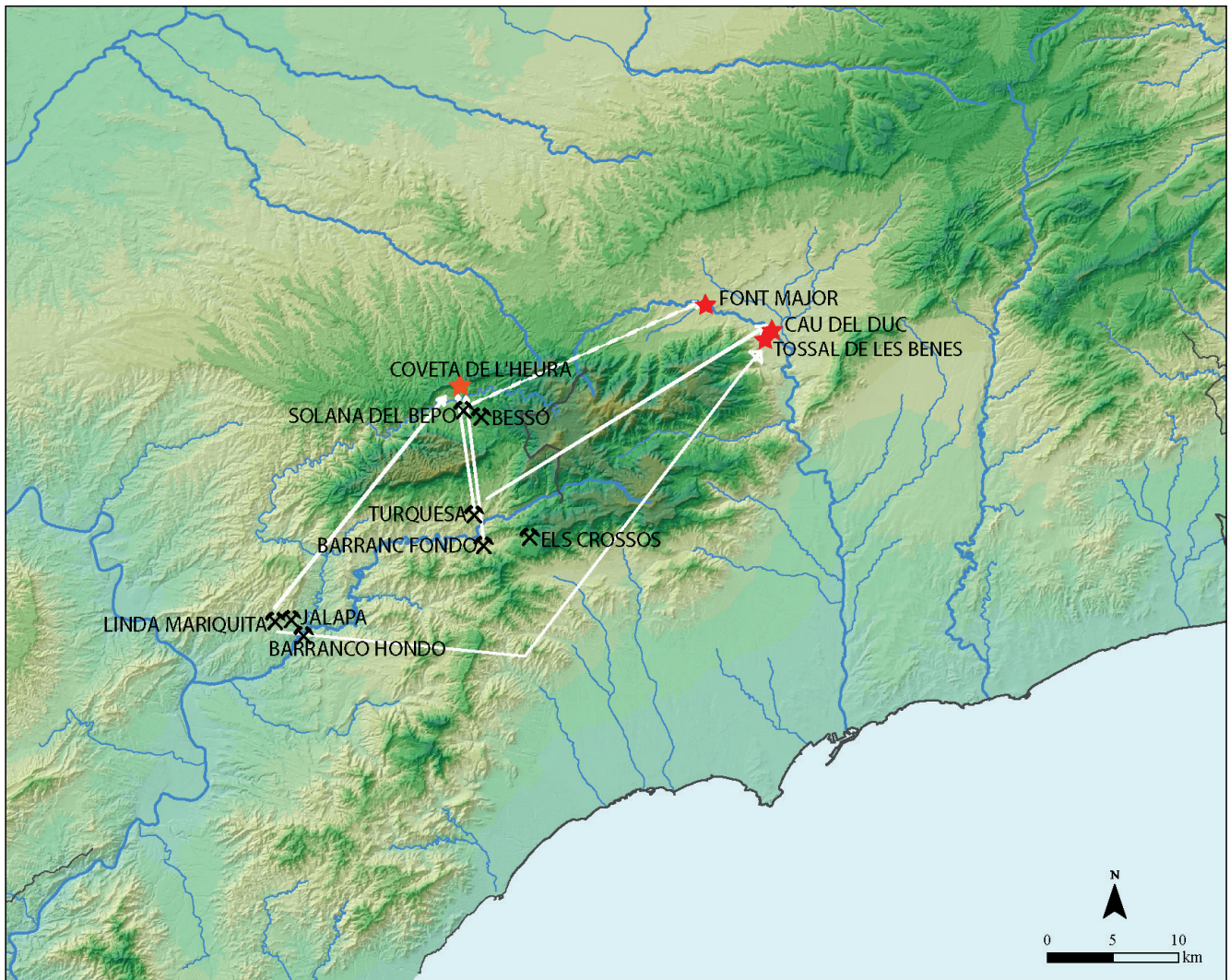


Figure 57. Mines with exploitation data and finds with assignment of origin.

could also be linked to Solana del Beпо or Barranc Fondo, although that association cannot, for the time being, be considered conclusive. The Middle Bronze Age arrowhead from Cova C-H of Cingle Blanc may be related to Barranc Fondo, although, as in the previous case, this is an attribution that needs to be confirmed. Finally, there is a series of pieces that may have been manufactured with copper ore from Linda Mariquita in the MBF basin, although once again this provenance cannot be confirmed. They consist of a flat axe from Cova Josefina (Riudecanyes, Baix Camp; Serra Vilaró 1925), a copper casting drop from the Early-Middle Bronze Age archaeological site of Minferri (Juneda, Les Garrigues; Rovira Hortalà 1998), a bead datable to the Early Chalcolithic from Cau d'en Serra (Picamoixons, Alt Camp) and an arrowhead datable to the Early-Middle Bronze Age (Soriano 2013: 116) from the Milmanda necropolis (Vimbodí i Poblet, Conca de Barberà; Graells 2008).

### The contextual perspective

The evidence of mining and metallurgy in the Montsant Basin must be considered together with a

collection of data linked to prehistoric metallurgic production in wider area, that of the Prades Mountains (the present-day counties of Alt Camp, Baix Camp, Conca de Barberà and Garrigues, as well as the Priorat). In the context of the north-eastern Iberian Peninsula, where such evidence is not exactly abundant, the information we have to date reveals a significant concentration of items related to metallurgic and metal object production (Fig. 58), which makes this area one of the most important in terms of mining and metallurgy.

During the Chalcolithic (c. 3400-2300 cal BCE) we can establish two clearly differentiated groups of find contexts. The first corresponds to funerary archaeological sites of the multiple collective type, in which there does not appear to have been a particular interest in separating the metal grave goods and their owner from the rest of the persons buried there. This type of tomb follows the habitual rules of Chalcolithic funerary practices in the north-east throughout the entire period (Early and Late Chalcolithic): the original individual burial space of the deceased is given up when new bodies are buried. The oldest remains

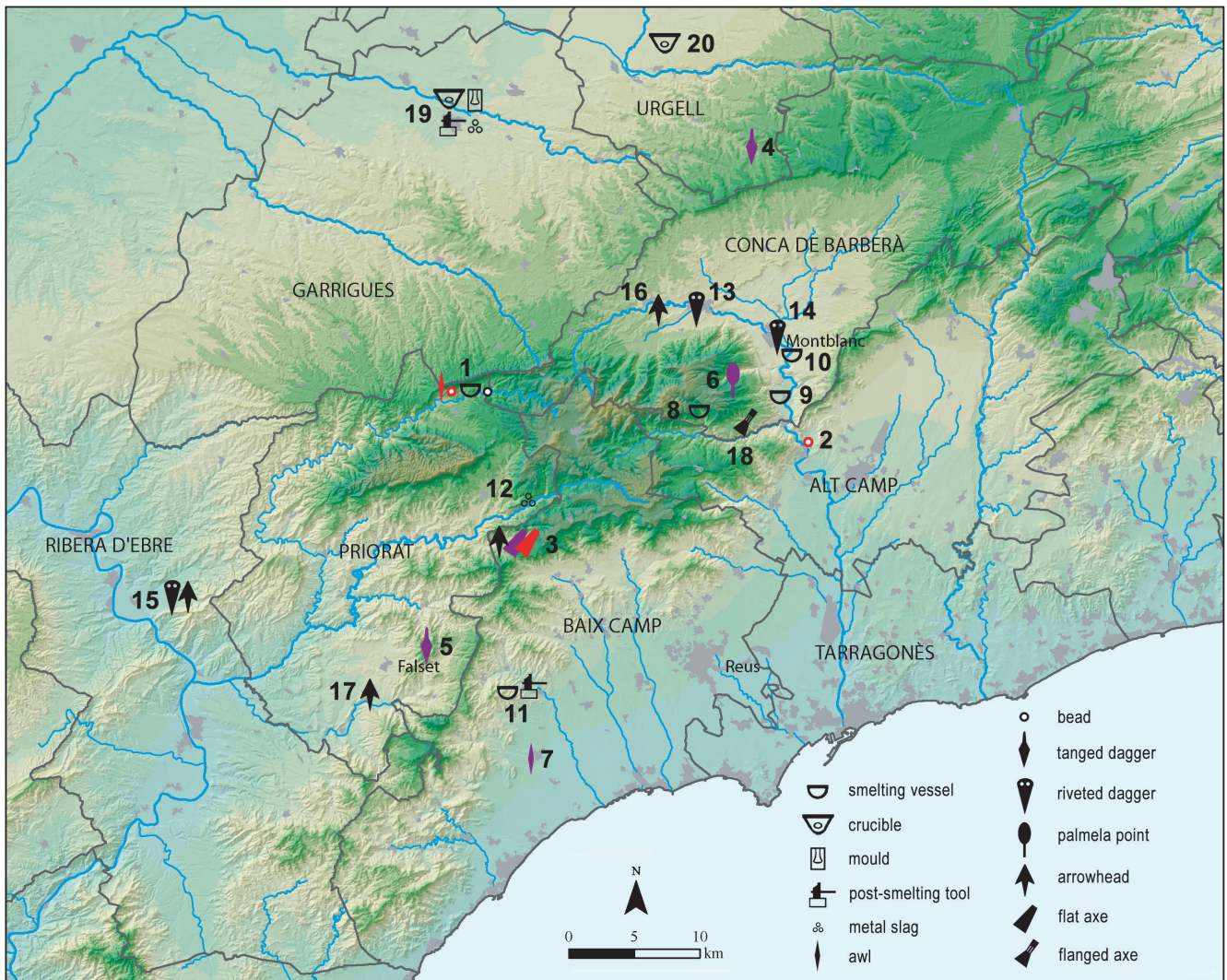


Figure 58. Items related to metallurgical production and metal objects in the study area and its adjacent territories, according to type and chronology. Red = Chalcolithic; Purple = Bell Beaker; Black = Early-Mid Bronze Age: 1. Coveta de l'Heura, 2. Cau d'en Serra, 3. Cingles d'Arbolí, 4. Rocallaura, 5. Cova de l'Arbonès, 6. Tossal de les Benes, 7. Barranc d'en Rifà, 8. Cova del Buldó, 9. Cova del Cartanyà, 10. Balma del Duc, 11. Cova Josefina, 12. Cova de Porta-Lloret, 13. Cova de la Font Major, 14. Cova dels Assedegats or dels Xaragalls, 15. Roca de la Bruixeta or del Cap Pla, 16. Milmanda, 17. Marçà, 18. Mas de la Torra, 19. Minferri, 20. Cantorella.

are moved out of the way, placed in a corner or arranged neatly inside the same sepulchre used by the whole community. The second, a type of individual or individualised multiple grave, corresponds to an incipient process of individualisation that coincides chronologically with the Bell Beaker phenomenon in the Late Chalcolithic, although it is not always associated with that type of decorated pottery. Making this distinction is not always a simple matter, given the possibility that certain contexts of the second group were not correctly identified, especially those from early excavations. This means that during the Late Chalcolithic two opposing funerary traditions coexisted (Soriano, 2016).

In the first group, apart from the aforementioned lead bead from Coveta de l'Heura, we can refer to the three copper cask beads found at Cau d'en Serra (Picamoixons, Alt Camp). While the former are from the Late Chalcolithic, the two datings recently carried out on human remains from the latter archaeological

site date them to the Early Chalcolithic. The two flat copper axes referred to above that come from Cova M at Cingle Blanc in Arbolí; one of them (number 5008) can be considered one of the first metal axes from the north-east and are even perhaps linked to the Early Chalcolithic (Soriano 2013: 93-95). The copper awl from Coveta de l'Heura may correspond to a period within the Chalcolithic, as we indicated previously in relation to the results of its compositional analysis. The find of square-section copper awls in multiple collective funerary contexts of this chronology is clearly attested in the rest of Catalonia (Soriano 2013: 126).

The second group comes from contexts in which the grave goods are clearly individualised within the tomb or there is evidence that points towards this intention. In all of them elements belonging to the Bell Beaker group were found, although no decorated pottery. To date we have no explanation for this, given that archaeological sites with Bell

Beaker pottery are well documented in the territory (Harrison 1977). Firstly, we can cite the flat copper axes (Number 5009) from Cova M at Cingle Blanc in Arbolí that could have come from an infant burial in a pit grave, although the data referring to the find are not conclusive. In Rocallaura (Vallbona de les Monges, Urgell) a tomb was found dug into a sedimentary bank; its floor had been paved with flat slabs and it contained two individuals, one with a copper tanged dagger and another with thirteen pyramidal buttons with V-shaped perforations placed in a decrescent fashion on the legs (Vilaseca 1953). Between them there was a plain troncoconical vessel with raised foot and digitations on the edge classified as an item of Bell Beaker common ware. Another tanged dagger was found in the already mentioned Cova de l'Arbonés (Pradell, Priorat) that quite possibly formed part of individualised grave goods as in the previous case. The tomb of Tossal de les Benes (Rojals, Conca de Barberà) was dug into the subsoil and had a stone slab structure or lining. This archaeological site, unpublished and about which we have very little information, contained the remains of one or more individuals accompanied by a Palmela point, a plain hemispherical bowl, nine pyramidal shell buttons with V-shaped perforations, three bone awls with epiphysis, a foliated flint arrowhead and a basalt axe (J. Massó, pers. comm.). The last item corresponds to Barranc d'en Rifà (Mont-roig del Camp, Baix Camp), an indeterminate excavated sepulchre –possibly a hypogeum – in which nearly 30 individuals were interred. The grave goods consisted of various bone ornaments, among them eleven pyramidal buttons with V-shaped perforations, two plain hemispherical bowls and a copper awl (Vilaseca 1973: 190-193). This archaeological site, which is currently being studied, has two C14 datings that place it in the first third of the 3<sup>rd</sup> millennium cal BCE (K. Alt & Ch. Roth pers. com.).

Thus, for this chronological period, the find contexts are exclusively funerary, although traceological analysis has confirmed that the objects had previously been used for their original purposes (Soriano 2013) and had not therefore been produced exclusively for ideological-symbolic purposes.

During the Early-Middle Bronze Age (c. 2300- 1300 cal BCE) we document various smelting vessels in the area, in addition to the one already mentioned from Coveta de l'Heura. They were found in another four nearby archaeological sites, all caves and rock shelters and all lacking precise archaeological contexts. They are Cova del Buldó (Rojals, Conca de Barberà) and Cova del Cartanyà (Vilaverd, Conca de Barberà) with one example from each; Balma del Duc (Montblanc, Conca de Barberà) with two examples; and Cova Josefina (Riudecanyes, Baix Camp) with three examples (Serra Vilaró 1925, Vilaseca 1926, Vilaseca and Iglésies 1929, Solé 1982). They all present a hemispheric morphology and a flat bottom. The first three archaeological sites are very close to each other; Balma del Duc is the only one in which the finds were made in stratigraphy, although unfortunately only a short preliminary note has been published on this site (Solé 1982). As we have already indicated,

the lead isotope analysis links one of the vessels to Balma del Duc and another found at Cova del Buldó possibly to La Turquesa mine. The last cave, Cova Josefina (Riudecanyes, Baix Camp) is farther away, to the south of the others. The finds made at that archaeological site also included four stone hammers/anvils and a grinding stone or polisher related to the finishing and maintenance of metal tools, as well as two flat metal axes whose origin in the cave is not, however, certain (Soriano 2013: 63, 77). In relation to the axes, we lack specific data about one of them (the whereabouts of which is currently unknown), while for the others it has not been possible to establish a relative chronology based on their morphology (Soriano 2013: 96). The last archaeological site with data linked to metallurgic production is Cova de Porta Lloret (Siurana, Priorat). Found in this cavity, also without any context, was a bronze casting drop, the only evidence of casting we have in the area (Vilaseca 1957-1958). The sporadic presence at this archaeological site of finds from the Iron Age prevents us from affirming categorically that it belongs to the Bronze Age.

We see, therefore, that unlike the preceding period, the majority of the metal objects from the Early-Middle Bronze Age do not come from funerary contexts. They are generally chance finds or finds without stratigraphic context from habitation sites - caves, rock shelters or open-air settlements.

A tubular bead made of rolled bronze sheet was documented at Coveta de l'Heura; it could fit chronologically into this period, although we cannot completely rule out that it is later. Likewise, the region has given us three riveted daggers, all of which have recently been reviewed and classified according to their morphology (Soriano 2013: 105-110). We have already mentioned the first of them, the bronze dagger from Cova de la Font Major (L'Esplugu del Francolí, Conca de Barberà), the only one with three rivets in the whole of Catalonia (Vilaseca 1959). The two remaining daggers are from Cova dels Assedegats or dels Xaragalls (Montblanc, Conca de Barberà) and Roca de la Bruixeta or del Cap Pla (Torre de l'Espanyol, Ribera d'Ebre) and have been classified as part of Groups 1A and 2 respectively (Abad and Alonso 1972, Genera *et al.* 1985: 52). In chronological terms, the first of these can be dated to the Early-Middle Bronze Age while the second, with a trapezoidal section and a prominent central rib, corresponds to a later phase in the period, perhaps the Middle Bronze Age.

To this list we can add four arrowheads, one each from Roca de la Bruixeta or del Cap Pla, the necropolis of Milmanda (Vimbodí, Conca de Barberà), Marçà (Priorat) and Cova C-H at Cingle Blanc in Arbolí (Vilaseca 1941: 591, 1973: 173, Genera *et al.* 1985: 52, Graells 2008: 106, Soriano 2013: 113-118). The second of these archaeological sites is an Early Iron Age cremation necropolis in which the arrowhead was found reused as grave goods. The first two cases show a rhomboidal body and an extremely long sharpened stem, which suggests their use as javelin or assegai tips rather than arrowheads (Group 2A). The two remaining pieces present prominent shoulders, a triangular body and a stem (group

3B). The example from Marçà is made of copper. The one from Cingle Blanc was discovered lodged in a human skull, having penetrated the maxillary sinus, which would have killed its victim (Campillo 1977: 290-295, Etxeberria and Vegas 1992: 130). This example, without known parallels and which could constitute a typological group of its own, had been situated in the 3<sup>rd</sup> millennium cal BCE (Soriano 2013: 151). However, its recent compositional analysis revealed that it is made of bronze and not copper, as had been thought, and the radiocarbon dating of the skull in which it was lodged gave a date between the end of the Middle and Late Bronze Ages. Finally, we have knowledge of two axes whose whereabouts are currently unknown. The first is a flat axe linked to the Camp de Tarragona area, but bought from an antique dealer, which is why we do not know its exact origin (Bosch Gimpera 1915-1920), although typologically it can be placed in this period (Group 3B). The second is a fragment of an edged axe with medial constriction from Mas de la Torra (Pinatell de Rojals, Conca de Barberà) (Vilaseca 1973: 171). It has been classified as part of Group 2A, possibly from the end of the Early Bronze Age or even later (Soriano 2013: 98-100).

Recapitulating this information, throughout the Early-Middle Bronze Age we attest the smelting of copper ore in five different caves (three of them grouped to the east of the Prades Mountains) and possible smelting in another cave, in addition to the finishing and maintenance of metallic objects at one of the archaeological sites with smelting vessels. To this we have to add the use and subsequent deposition/abandonment of an ornament and eleven diverse metal implements: beads, riveted daggers, arrowheads and axes (flat and flanged). These numbers, although not excessively high, are considerable in relation to the total assemblage documented in Catalonia. There can, therefore, be no doubt that the mining-metallurgic area of the Prades Mountains played a significant role in the metal production of that period. However, in the list of finds there is a notable absence of items linked to casting: crucibles, moulds, slag, metallurgic pits, tuyères, etc. This absence is difficult to explain when in the same region we document finished metal objects that, in some cases, have been made with metal from local mines. The nearest archaeological sites with this type of casting evidence are Minferri (Juneda, Garrigues) and Cantorella (Maldà, Urgell) (Equip Minferri 1997, Rovira Hortalà 1998, Escala *et al.* 2014, Soriano and Escanilla 2016). As we have already stated, only the first of these has lead isotope data that, for the present, are not conclusive with respect to their link to the Baix Priorat mining basin (MBF), making that question another of the challenges awaiting future research.

## Coda

The research carried out to date allows us to place the prehistoric mining and metalworking in the Montsant Basin as a whole between the Late Chalcolithic and the Middle Bronze Age. There can be no doubt that La Turquesa mine began to be

worked in the Late Chalcolithic. This is clearly documented in the archaeometric data on the copper mining at Barranc Fondo in the lapse between the Late Chalcolithic and the Middle Bronze Age and, finally, the three-riveted dagger from Cova de la Font Major suggests that the Solana del Bepo mine was active during the Early-Middle Bronze Age. In the neighbouring Molar-Bellmunt-Falset basin the local copper and lead was beginning to be mined in the Late Chalcolithic.

We currently have no data for the continuity of the mining during most of the Late Bronze Age (c. 1300-1000 cal BCE), a period in which the north of the Priorat appears to have suffered a severe population recession. However, we cannot rule out that this is due to insufficiencies in the archaeological record or our current knowledge. On the other hand, the clearly evident fact that from the 10<sup>th</sup> century BCE on there was a displacement of the population from the north of the county to the areas located more to the south does not mean that the mines in the Montsant Basin did not continue to be worked. In fact, during the Chalcolithic and the Early-Middle Bronze Age the reverse phenomenon occurred: in the southern part of the county (MBF basin) barely any population is documented and, in contrast, the archaeometric data confirm the mining of lead (the necklace bead from Coveta de l'Heura) and copper (the Palmela point from Tossal de les Benes) in this basin. However, in addition to the question of the population, another fact points towards a possible interruption of copper mining in the Montsant region, at least from the 8<sup>th</sup> century BCE: we must not forget that from this date all the analyses made of pieces of copper alloys indicate that the ore came from outside the area, from the Linares Basin in Andalusia and, to a lesser extent, from mines in Almería. As far as the origin of the copper is concerned, our current knowledge points to a vacuum between the end of the Middle Bronze Age (c. 1300 cal BCE) and the 8<sup>th</sup> century BCE, although this can plausibly be linked to the lack of a sufficiently in-depth study of this period. In this temporal lapse we know only of the possible mining of copper ore in the southern Priorat basin (MBF) in the 10<sup>th</sup>-9<sup>th</sup> centuries BCE; however, we have no other data that would support, not even hypothetically, the existence of copper exploitation in the Priorat. We must keep this fact in mind, because it may affect the dating of the mine we are studying here, Solana del Bepo, which could fill this time lapse. However, to date there is no archaeological evidence of this, except perhaps the typologically evolved nature of the mining implements found in it.

In the north of the Priorat, the social and cultural context in which these activities took place reveals a panorama of communities settled in the territory, but with a certain mobility within it. They were organised in small groups living in caves, rock shelters and open-air habitats; they buried their dead collectively in natural cavities or para-dolmens and they had a farming-based economy. These communities also exploited a series of raw materials: local copper-bearing resources (the Montsant and MBF Basins), the area's rich veins of chert, one of largest

of their type in the Ebro Depression, and, possibly at certain points in time, the lead resources of the MBF mining basin. The presence of chert from here in the neighbouring territories, as is the case of the Minferri and Pla del Tabac I archaeological sites (Palomo *et al.* 2013, Esteve *et al.* 2015), indicates the existence of trade networks. On the other hand, the information we currently have on Montsant Basin copper suggests it was distributed within a radius of 50 km. Not wishing to magnify the repercussions of mining and metalworking in the prehistoric social contexts, we interpret the exploitations in the basin as a maximisation of the territory's resources and their distribution in the Priorat and adjacent counties. We see this as symptomatic of a cooperative action and a complementary distribution of resources between neighbouring territories, rather than the result of a specialised activity. None of the data in the archaeological record suggest a social structure that was hierarchically organised around these activities. In fact, the opposite appears to be the case: they were small-scale communities, collectively self-organised into networks and without formal powers that regulated them. However, this does not exclude the existence

of temporary authorities that formed an intrinsic part of the network itself.

As we have already indicated, the major increase in size in terms of the social context of metal exploitation did not take place until much later, in the Early Iron Age. This would come about in a context in which the development of the local communities, the tradition of trading in networks and, especially, the irruption of the Phoenician commercial structure resulted in the development of supraregional trade networks that transported products over long distances, including copper from the Linares mining basin to Catalonia and lead from the Baix Priorat basin to Tartessos.

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