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**La Turquesa mine and its  
archaeological context.  
Summary and conclusions**

by

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Although the study of ancient mining in the northeast of Iberian Peninsula began a century ago (Serra Vilaró 1915-20, 1920, 1924, 1960-1961), it has not been the subject of specific research projects until recently. The study of prehistoric metallic mineral mining and metallurgy on the Iberian Peninsula has focused on the richest mineralised areas, disregarding others like the present day territory of Catalonia, which although smaller from the volume of resources point of view, are in fact an essential object of study to the research of the social-economic contexts of the prehistoric communities that lived there. Until the year 2000, when our project began, knowledge of mining in the northeast provided a very short perspective. It was limited to the identification of two copper mines, Forat de la Tuta in Solsona –recently questioned and reinterpreted as the grave of a metalworker (Soriano 2011)– and Solana del Bepo in Ulldemolins, and to some stone mining picks located out of context (Rafel *et al.* 2015).

Therefore, not until quite recently have projects been undertaken for the purpose of discovering prehistoric mines in more depth and their characterisation using the methodological and technical apparatus now available. The series of studies carried out this century allow the knowledge of the prehistoric mines in the northeast of the peninsula and more specifically in our area of study, Priorat, to be outlined with more precision. In this region, essentially copper and lead veins were mined. From a diachronic viewpoint, the character and magnitude of the mines of the different mineral ores present some very clear differential aspects. All the copper mines, regardless of the territory and chronology, have a limited scope, suitable mainly for

local consumption and they are predominantly located in the mining basin of Montsant (Alt Priorat). Galena mines, on the other hand, reveal a clear differentiation between periods before and after the 7<sup>th</sup> century B.C. and their epicentre is in the mining area of Molar-Bellmunt-Falset (MBF, Baix Priorat). In addition to its consumption-symbolic use during the Neolithic, galena was used very occasionally during the Late Chalcolithic, of which a single lead object has survived, located in the Coveta de l'Heura in Ulldemolins (Rafel *et al.* 2016). During the first millennium B.C., however, the MBF mining zone emerged as the most important in the northeast with respect to the exploitation of galena and, although its significance is far from comparable to other areas on the Peninsula, such as the southeast and the Linares basin, it is the only one in the northeast capable of providing sufficiently interesting amounts of ore to generate mid- and long-distance exchange (Rafel *et al.* in press a).

The chronology is the central element for placing La Turquesa mine in its archaeological context. The dates established up to now are, in short, the following: on one hand, the material evidence of the lithic mining tools (picks, picks/percussors and percussors) are placed within a prehistoric horizon, and on the other hand, radiometric dates obtained from the sediment that filled the L1 shaft provide a date *ante quem* corresponding to the early Middle Ages. Finally, of note is the consistency of isotopic signature of the mine with archaeological materials that are dated within the Late Chalcolithic and the Early- Middle Bronze Age.

SU	Reference Lab.	RADIOCARBON AGE	MATERIAL	2 $\sigma$ CALIBRATION
27	Beta 434530	1260+30 BP	Polen	669-865 calAD
27	Beta 423141	1110+30 BP	Organic sediment	879-1013 calAD

Figure 50. Graph of the two radiocarbon datings (Shaft L1). Oxcal v. 4.3.2, Bronk Ramsey 2017, r. 5; IntCal 13 atmospheric curve (Reimer *et al.* 2013)

The lithic tools recovered and studied show the coexistence of unmodified picks, together with others that were more complexly and highly modified, the latter similar to those documented at the neighbouring Solana del Bepo mine (Ulldemolins), where radiometric dating places them during the Middle Bronze Age (Rafel *et al.* in press b). The macrolithic assemblage could be interpreted as the result of two different sub-assemblages, one older and more rudimentary from a crafted point of view and another more modern one with a more complex elaboration, or resulting from two different contemporary traditions, as seems to occur in other European prehistoric mines. As already mentioned, the oldest fill level in the L1 mining shaft allowed two samples to be dated (Fig. 50), of pollen and sediment, respectively. The calibration to two-sigma of the first, gives a margin between 669 and 865 cal AD and for the second, of between 879 and 1013 cal AD. Therefore, a date *ante quem* for the L1 mine ranges between the 7<sup>th</sup> and 10<sup>th</sup> centuries AD. With regard to the isotopic consistency between the mine and the metal-ore materials documented around it, of significance is an arsenical copper awl from the Coveta de l'Heura in Ulldemolins, whose analytical characterisation indicates that it is consistent with the ore from La Turquesa mine (Montero 2017). Awls, manufactured from copper and bronze, are common in the north-east of the Peninsula and cover a chronology from the Chalcolithic to the Early and Middle Bronze Age, although some types exist from the Late Bronze Age (Soriano 2013: 121-127). In this study, and despite the difficulties of interpreting the stratigraphy of the site (Rafel *et al.* 2016), a chronology from the Late Chalcolithic is suggested, based on the analysis of the assemblage of archaeological materials recovered. A reduction vessel from Balma del Duc (Montblanc) in the neighbouring district of Conca de Barberà is also consistent with the isotopic field of La Turquesa mine. More questionable is the possible relation with this mine of another reduction vessel, in this case from the Cova del Buldó (La Bartra, Conca de Barberà) and of a copper arrowhead found out of context in Marçà (Priorat) (Montero 2017). Reduction vessels were used on the Iberian Peninsula during the Chalcolithic as well as in the Early and Middle Bronze Age. During the Late Bronze Age, furnace technology began to replace them, although in some areas on the Peninsula their use continued up to contexts of Iron Age II (Rovira 2004). However, in the case of the three vessels mentioned, from Coveta de l'Heura, Balma del Duc and Cova del Buldó, one fact to consider is that none of these sites have materials that can be dated from the Late Bronze Age. Therefore, they can be attributed to a timeframe between the Late Chalcolithic and the Middle Bronze Age (Rafel, Soriano 2017b: 86).

Chronologically speaking, it can therefore be established that La Turquesa mine was exploited in prehistoric times, with all likelihood during a period between the Late Chalcolithic and the end of the Middle Bronze Age. The main elements that support this statement lie in the assemblage of lithic mining artefacts recovered and in the isotopic consistencies of the mine with metallurgical objects with this chronology. Another matter is establishing the chronology of the opening of mining works, shafts, named as L1, L2 and L3. In the case of L1, a fact in favour of the prehistoric chronology is that the excavation of the walls was carried out using stone tools, without any evidence of the use of metal-tools intervention, considering it a mining work that may have a pre-Roman chronology. With regard to shafts L2 and L3, in all probability the first one mined with the help of the fire-setting method, for the time being their chronology cannot be established.

There are countless examples of European prehistoric mines that reveal the wide diversity of the types of exploitation and techniques used. These vary from horizontal and almost superficial works following the vein of ore, to their combination with –or solely– vertical pits and shafts, to underground exploitations of enormous dimensions with horizontal galleries and ventilation systems. In addition, this diversity does not reveal a chronological scale from lesser to greater complexity, rather it responds to the diverse variables of a geological, technological and social type. It is therefore complicated, for want of saying impossible, to establish the chronology of the workings at La Turquesa mine focusing solely on this, works tipology, variable. A similar situation arises with the fire-setting method, which is documented from prehistory to the Mediaeval era at some metal mines.

A slightly different case is that of stone mining tools. As recently expounded (Rafel, Soriano 2017b) picks with a greater modification (T shafts), such as those found at neighbouring Solana del Bepo mine, do not appear in Europe in contexts prior to the Bronze Age. In contrast, those less modified (transversal groove, slight lateral recesses) or with no modifications at all, are documented throughout prehistory in very diverse geographic and geological areas. Furthermore, in some mines with different chronologies and spaces, both stone tools with and without modifications coexist. These data, although not particularly conclusive, do place La Turquesa mine in the same dynamics as other European prehistoric mines, where different exploitation phases have been documented and for which the chronological identification is a complex and thankless task. Hopefully, the thermoluminescence dating, under way, of the documented shafts will help to date with more precision the mining activities.

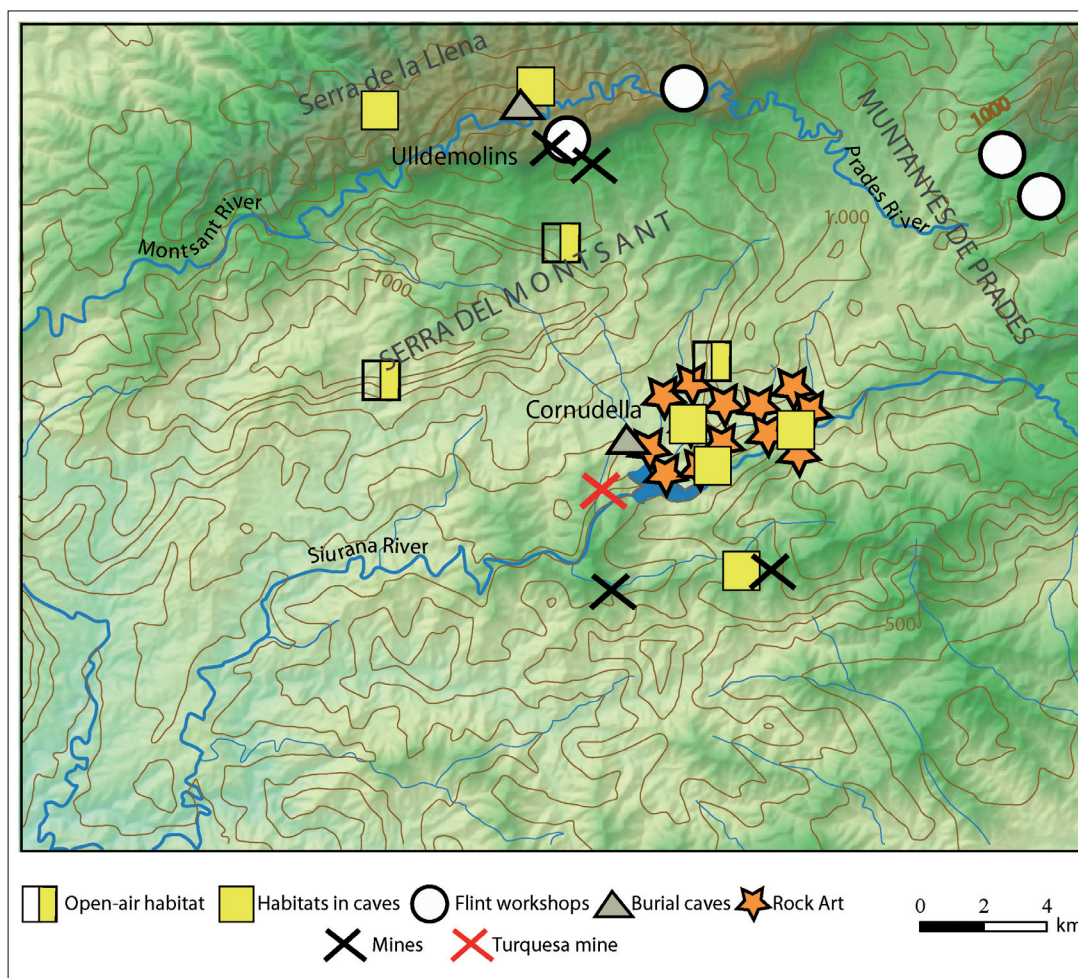


Figure 51. Neolithic, Chalcolithic and the Early- and Middle-Bronze Age archaeological sites in the vicinity of La Turquesa mine.

There is another interesting question, although outside the prehistoric field, as to whether the La Turquesa mine was worked in the Late Antiquity and during Islamic period. It is highly likely that it was, although no material evidence has been found that confirms this, beyond the dating of pollen and organic sediment from the first fill level of mining work L1. Dates do indicate the time the shaft was filled but it cannot be ruled out that it remained open and abandoned, perhaps without being filled or only partially, since prehistory. Either way, future excavations at the mine must consider this aspect. Al-Andalus mining was significant on the Iberian Peninsula and, specifically, during the 11<sup>th</sup> and 12<sup>th</sup> centuries A.D., perhaps even before, the Islamic people mined galena (*alcohol*) from the MBF Priorat basin, which was known for its quality and was exported to the East (Vallvé 1980 and 1996), hence the quote by 11<sup>th</sup>-century geographer Al-Bakri (Bramon 2000: 87, f53). Although often at some mines there is no lack of technological anachronisms, it is our belief that the mining work L1 was not opened by the Islamic people, who were knowledgeable about the mining technology of the era (Vallvé 1996) and, naturally, had metal tools *ad hoc*.

So, what data is available for the Late Chalcolithic-Middle Bronze Age in the Alt Priorat region, where the mine under study, La Turquesa, is located? Unfortunately, apart from our data, no recent research

projects have been carried out in the area. As a result, the field work carried out at sites with this chronology is scarce and therefore lacks a more up-to-date methodology (Rafel, Soriano 2017a). Nonetheless, there are many sites from these periods in the Alt Priorat, which are concentrated around the town of Cornudella de Montsant, where La Turquesa mine is. This evidence has already been published (Rafel, Soriano 2017a) and therefore is only briefly discussed here. Despite the fact, for reasons previously outlined, that there is a little-studied evidence base, it is sufficient to substantiate the existence of settlers in the area around La Turquesa mine, and therefore opens the possibility of attributing the exploitation of the mine to them (Fig. 51).

The Priorat district has, with 30 sites, the greatest number of caves with prehistoric cave art in the whole of the northeast. Almost half of these can be found in the municipality of Cornudella de Montsant (Viñas *et al.* 2006 and 2007, Viñas 2011, Viñas and Sarrià 2009-2010). The oldest date back to the Epipalaeolithic, although most are dated between the Neolithic and the Bronze Age. Priorat, and particularly its northern part, has important chert formations, which during prehistory supplied not only the district but also the neighbouring regions (Marín 2017). Eight sites known as “flint workshops” have been documented in Alt Priorat (Vilaseca 1936 and 1953, *Inventari*), none of which have been excavated. Surface findings have



provided abundant examples of flint tools, which place its continual use between the Neolithic and the Early and Middle Bronze Ages, with the exception of Pedrenyeres (Ulldemolins) and Camp de les Carboneres (Cornudella de Montsant), which apparently began to be used in the Epipalaeolithic.

The funerary records for the area include natural caves used for collective burials. In Ulldemolins there is a splendid assemblage at Coveta de l'Heura (Rafel *et al.* 2016), a dolmenic-type cave. The site is of particular interest as it has various phases of occupation, with very different uses. Initially the cave was used as a workshop for manufacturing foliaceous flint blades and also as a dwelling. However, by the middle of the 3<sup>rd</sup> millennium cal BC (Late Chalcolithic) a new phase began and the cave was modified and used as a collective burial site. Ore fragments and smelting drops provide evidence of the site having also been used as a metal workshop. However, it has not been determined whether this use corresponds to the Chalcolithic period or if it occurred during the Early to Middle Bronze Age. Notably, three radiometric datings have been carried out on human bone. Two correspond to the early mediaeval period (8<sup>th</sup> to 9<sup>th</sup> centuries cal AD) and the third to the middle of the 3<sup>rd</sup> millennium (2618 to 2491 cal BC) (Rafel *et al.* 2016). This latter dating is coherent with the fact that most of the significant batch of materials recovered from the site is typologically consistent with a Late Chalcolithic date. The first two datings notably reveal that although the ossuary of the cave had a prehistoric phase, it also had a burial phase during the Al-Andalus period. Very little data is available regarding the other funerary cave in the area, that of Carboneres (Cornudella de Montsant). A child's corpse was recovered from it, together with a few grave goods (Vilaseca 1956), but they only allow a date to be established of between the Neolithic and the Chalcolithic.

The closest dwelling places to the mine are the cave sites of Porta-Lloret, Balma de Siurana I and Balma de Siurana II, in Cornudella de Montsant; the cave assemblage of Cingle Blanc in Arbolí; and the previously-mentioned phase of Coveta de l'Heura and Balma del Barranc de la Pastera, both in Ulldemolins. Pedrera del Catero and Mare de Déu del Montsant in Cornudella de Montsant, and Sant Blai and Partida de la Planeta in Morera de Montsant are all open-air dwelling places that have been discovered through superficial explorations, so these are the most difficult to interpret because the limited information available. With regard to the caves, the findings in Porta Lloret are of note, including materials that indicate a continuous occupation from the Late Chalcolithic with Bell Beaker materials, until the Late Bronze Age (Vilaseca 1957-58, Maya and Petit 1986: 61-62). The materials recovered out of context from the important cave assemblage of Cingle Blanc in Arbolí cover a period from the Early Chalcolithic to Iron Age I. However, quantitatively and qualitatively, most of the materials correspond with the Late Chalcolithic to the Early and Middle Bronze Ages (Vilaseca 1934, 1935, 1941, 1963, 1973: 205-211, 232-236 and 245, fig. 141-148, Plates 93 to 113, 119 and 135). Most are from dwelling contexts, although there is no shortage of funerary evidence. The other dwelling caves that have been referred to

are from between the Neolithic and the Bronze Age, without the possibility of being more precise.

For now, in the Alt Priorat, no mines have been clearly documented that are attributable to the Late Bronze Age and Iron Age I, a period that, on an archaeological level, considerably lacks data. The only archaeological site that can be mentioned is the cremation necropolis of Obagues in Ulldemolins and some residual materials from the Cingle Blanc caves in Arbolí (Vilaseca 1947, Rafel, Balaguer and Salazar 2015).

Although our research interest has focussed on prehistoric metallic ore exploitation, a mention must be made of the data obtained regarding the early mediaeval occupation of the area, which during the Al-Andalus period was organised from the *Hisn* (fortification) of Šabrāna or Šibrāna (present day Siurana). Tentatively, construction of the *hisn* can be placed during the 9<sup>th</sup> century, and was for the purpose of controlling, with the support of a network of defence establishments around it, the extensive territory under its command (Menchón 2006). Very little data is available regarding the Al-Andalus district of Siurana: there are a number of cemeteries with a few tombs (Menchón 2012) and indirect data is provided in town charters awarded during the second half of the 12<sup>th</sup> century, after the feudal conquest (1153-1154). They reflect, indirectly, the organisation and anthropisation of the rural territory. Settlements were in the form of small agricultural and livestock groupings, *almúnyas* (farms) and farmsteads, spread around the region (Bolós *et al.* 2016: 60-61). There are also data that indicate the mining of galena (Rafel, Armada 2010: 256) and, perhaps, silver in Baix Priorat (Bolós *et al.* 2016: 59), as well as other additional resources, such as honey. Evidence obtained regarding the burial sites at Coveta de l'Heura in Ulldemolins reflect the existence of cave burial sites that can be dated to the Islamic period, thus contributing new elements to funerary archaeology for the period, up to now based exclusively on a superficial knowledge of the constructed tombs (Menchón 2012). Furthermore, the pollen data from the fill in mining work L1, indicate that in the timeframe between the 7<sup>th</sup> and 10<sup>th</sup> centuries AD, the landscape was characterised by a significant deforestation and human intervention, with the presence of grain cultivation close to the mine, data in line with information gathered from the previously-mentioned 12<sup>th</sup>-century town charters.

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