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The mine and the archaeological excavations

by

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The mine

The file in the Geological and Mining Institute of Spain corresponding to La Turquesa mine (also known as Mas de les Moreres mine) lists its main minerals as turquoise and variscite and as accessory minerals chalcopyrite and malachite (BDMIN: Código 0445061). However, as we will see in Chapter 3, we are now in a position to go into much greater detail about the geological structure and mineralogy of the mine. During the geo-mining survey carried out in 2011, to which we referred in the introduction, a stone grooved mining tool was found, indicating prehistoric mining. Likewise, the existence of an opencast mine in a S-N direction with waste heap can be appreciated on its summit. There is also a modern gallery dug at a lower level that, although initially the objective must have been to reach the metal ore veins from an appreciably lower level, work appears to have been halted before the upper workings were reached. As a consequence of the prehistoric mining tool find, an excavation was programmed to attempt to date the mine more accurately and, at the same time, gain more knowledge of the phases and structure of its exploitation.

The archaeological site is located in the municipal area of Cornudella de Montsant (Priorat county, Tarragona province), between the Montsant Mountain massifs, in the west of the municipality, and the Mountains of Prades to the east (Fig. 1). The mine is on a hill 438.6 metres above sea level (coordinates: ETRS89: UTM 31N, 323884.605/4566667.437) on the right bank of the Arbolí Gully –a tributary of the River Siurana– in the so-called Solana del Serrat del Andorrans, to the south-east of the Coll Negre. In fact, Mas de les Moreres, the property that gives the mine one of its names, is part of a small hamlet made up of Mas de Rodés, Mas del Busquets or Mas de Baix and, to the east, Mas de Casacúries or Mas de Dalt. Passing on one side of this village is the old path that once connected Baix Camp and Priorat counties and, in fact, in the 19th century the village was a roadside inn (Amigó and Espasa 1990: 252). The archaeological site is reached via a dirt track that turns off in an easterly direction at Km. 49.1 on the C-242 road from Fraga to Reus. Before reaching Mas de les Moreres you take a turnoff to the left for about 200 metres until you reach the top of the hill where the mining works are documented (Fig. 2). The hill was terraced and reforested with pine trees after the property was purchased by the current owners, some 40 years ago. La Turquesa mine was worked in the contemporary era. It appears that the digging of the gallery mentioned above was interrupted by the appearance of a phosphate ore, that brought the work to a halt (Bareche 1997: 21). At an undetermined time in the contemporary era a relatively large open cast work was dug on the main vein. For safety reasons, this was filled in with rubble by the father of the current owners of the land, Mr and Mrs Busquets, shortly after he purchased the property.

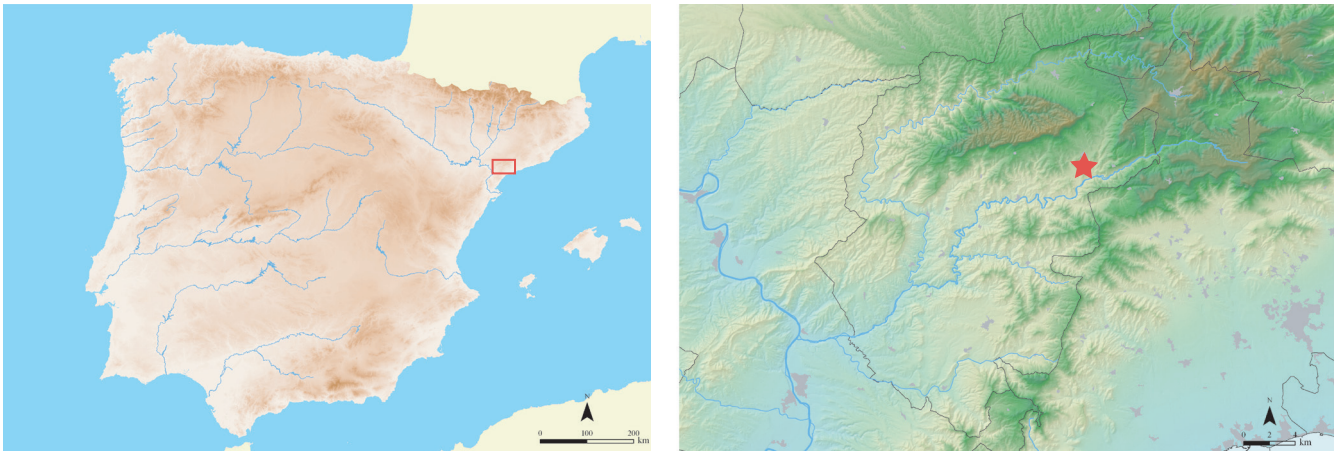


Figure 1. La Turquesa or Mas de les Moreres mine: general situation.

Figure 2. Orthophotomap (Cartographic Institute of Catalonia) on which it is possible to see the elevation on which La Turquesa mine sits; the road that leads to the hamlet formed by Mas de Rodes and Mas de les Moreres; and the old Cornudella to Reus path.

Priorat county is in the Catalan Pre-Coastal Mountain Range and acts as a hinge between the River Ebro, the coastal plains of Tarragona province and the southern edge of the province of Lleida. Narrow and mountainous in its northernmost part and more open and with more modest altitudes in its southern part, it constitutes a natural amphitheatre that opens onto the Ebro. Despite the differences between the mountainous northern part and the southern part with its lower altitudes, in general it is a very rugged terrain with poor soil that presents a considerable challenge to agriculture. From a prehistoric perspective, we can indicate that the most important resources in the county were the abundant veins of

flint and metal ores. The Priorat is divided into three zones: Upper or Northern Priorat made up of the upper valley of the River Montsant and the head of the River Siurana; Historic Priorat that constitutes the Palaeozoic zone and coincides partially with the ancient priory (*priorat* in Catalan) of the Carthusian monastery of Escala Dei; and Lower Priorat, consisting of the flatter lands along the final stretch of the River Siurana and the Marçà Stream basin. The county is drained by two main rivers that rise in the Mountains of Prades: the Siurana and its tributary the Montsant. These two watercourses converge near the municipality of El Lloar and flow into the Ebro in Garcia and constitute a single hydrographic basin. Both rivers give rise to narrow valleys that run from north to south, connecting the county to the major fluvial artery of the Ebro.

In terms of mining and metal ore, of particular note in the Priorat are two basins, the Molar-Bellmunt-Falset Basin (hereinafter MBF) in the Lower Priorat, and the Montsant Basin in the Upper Priorat, the location of the mine we are studying here. The southern part of the Catalan Pre-Coastal Mountains contains numerous mineral veins in its Palaeozoic base. The MBF mining district has copper-bearing resources, although its greatest wealth is in the lead ores that were already known to the settlers in the north-east in the pre-metallurgy phases, when it was used for items of a representational-symbolic type. Several Neolithic archaeological sites in the present-day provinces of Barcelona, Lleida and Tarragona have provided finds of small cubes of galena from the MBF basin. They are still being studied, but are thought to have had an ideological value. During the Late Chalcolithic, the MBF galena was still being mined, although now metallurgically processed and used to make necklace beads (Rafel *et al.* 2016: 117, fig. 19,6). However, it was in the first millennium BC that there was an intensification of galena mining, as has been confirmed by the archaeological and archaeometric studies carried out to date (Rafel *et al*. 2009, Rafel 2012), which have allowed the determination of the specific mines where the mineral was extracted at that time (Fig. 3). In the Montsant Basin, copper mining has been attested to date in the Late Chalcolithic and the Early and Middle Bronze Age (Rafel, Soriano and Delgado-Raack 2017, Rafel *et al.* in press b). Among the mineralisations recorded in this basin (Mata 1990, IGME 1973), the most important formations are veins. Of particular note among them are those of Pb from Cornudella de Montsant and those of Cu (mainly sulphurs) from Cornudella-Alforja. The latter is very extensive and has mines documented in the historical period; it covers the municipalities of Arbolí and Riudecols, as well as those already mentioned of Cornudella and Alforja. It is characterised by mineralisations in veins hosted in the Carboniferous cherts. Here we find the copper mine of Els Crossos to which a prehistoric origin has been attributed (Vilaseca 1973: I, 167), as well as La Turquesa or Mas de les Moreres mine that we are studying here. In the former zone, that of Cornudella de Montsant, brecciated veins also hosted in the carboniferous cherts offer majority minerals such

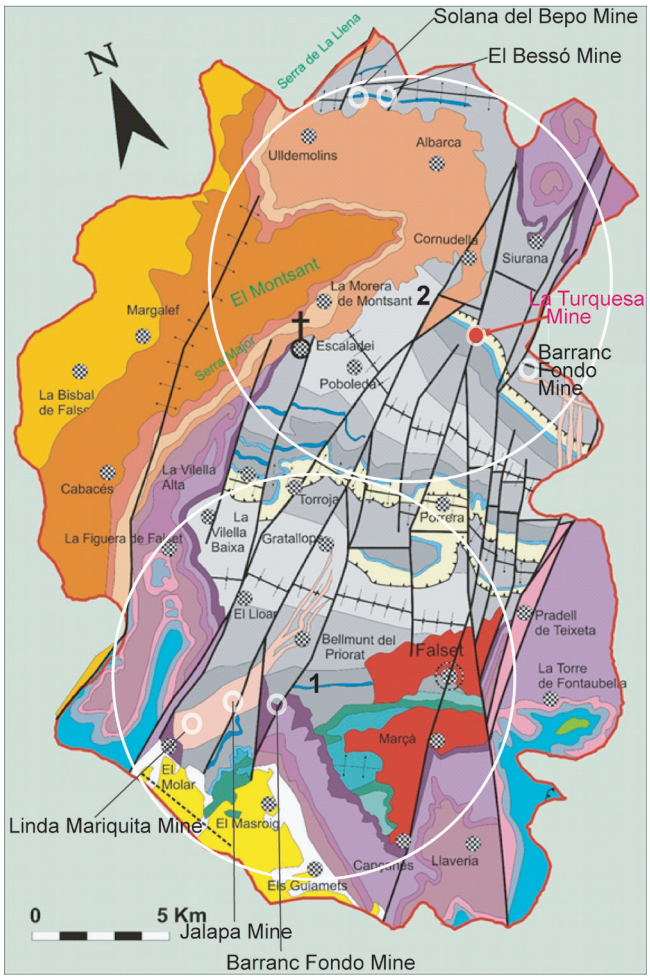


Figure 3. Geological map of Priorat county (based on Melgarejo 1987, see legend in Figure 19) with the situation of La Turquesa mine, the principal mines cited in the text and mining basins MBF (1) and Montsant (2).

as galena, calcite and quartz; in this area we find the Barranc Fondo mine (Pb-Zn), in which copper (Cu-Fe) is also documented. In Ulldemolins and the neighbouring municipality of Vilanova de Prades we document mineralisations of volcanic origin, mainly galena, chalcopyrite and sphalerite, with a minority presence of fahlore, among others; also alteration minerals such as malachite and azurite are documented. In this latter area the prehistoric mine of Solana del Bepo and the El Bessó and Barranc de Sant Joan mines are located (Montero *et al.* 2012a).

The archaeological excavations

Three excavation campaigns were undertaken in 2012, 2013 and 2015. During the first campaign (2012), five sondage trenches were opened by hand with the aim of obtaining a general view and preliminary definition of the different appreciable parts of the mining complex, in other words in (Figs. 4 and 5):

— the visible upper part of the work situated on the vein that can be appreciated on the surface on the top of the hill (Square 1, 2.60 x 4.80 m)
— on the waste heap (Square 4, 2 x 4 m. and Square 3, 3 x 1 m)
— on a lower terrace where remains of the mine workings can no longer be appreciated, but where

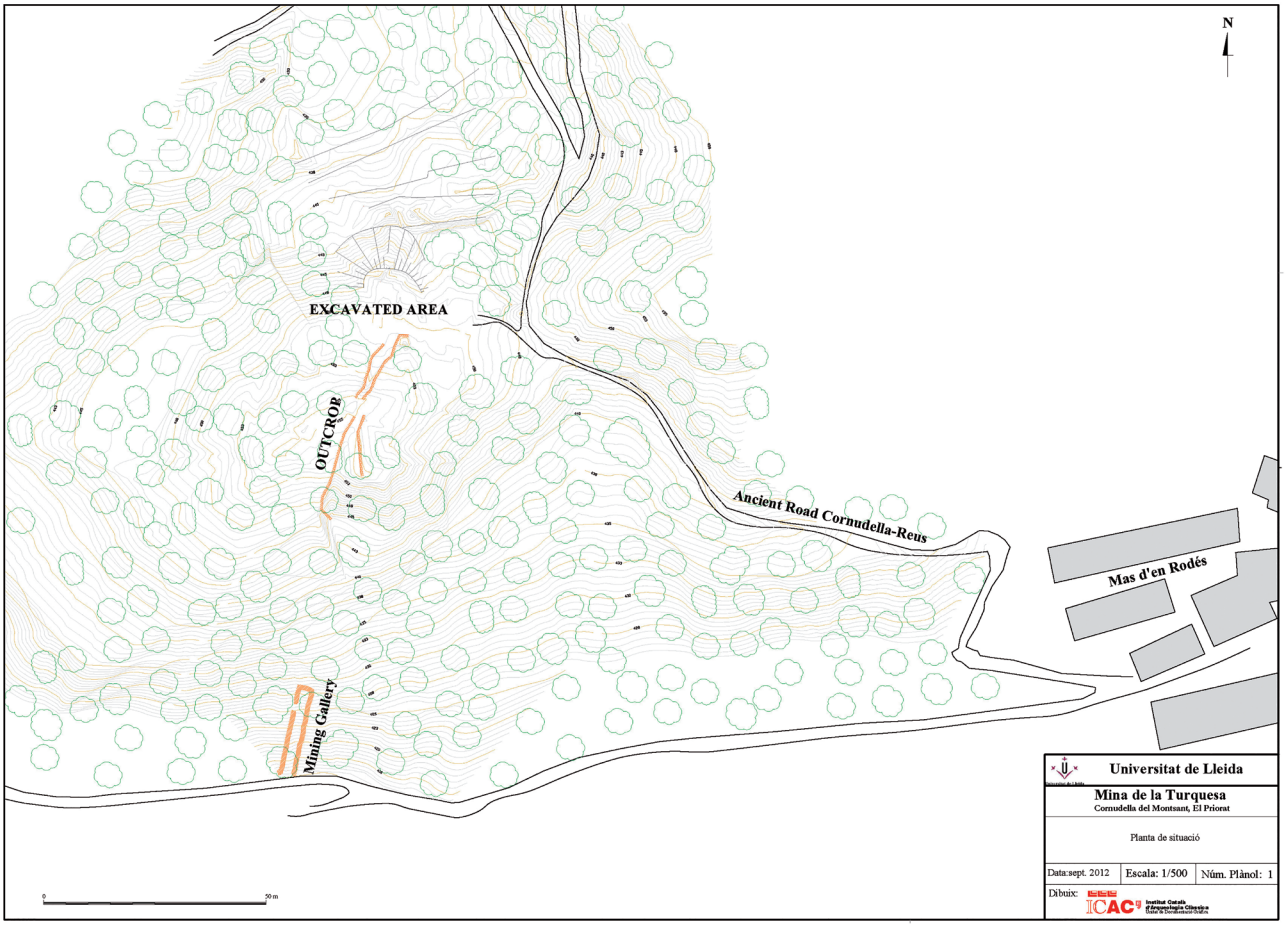


Figure 4. Location plan of the area surveyed in the first excavation campaign.

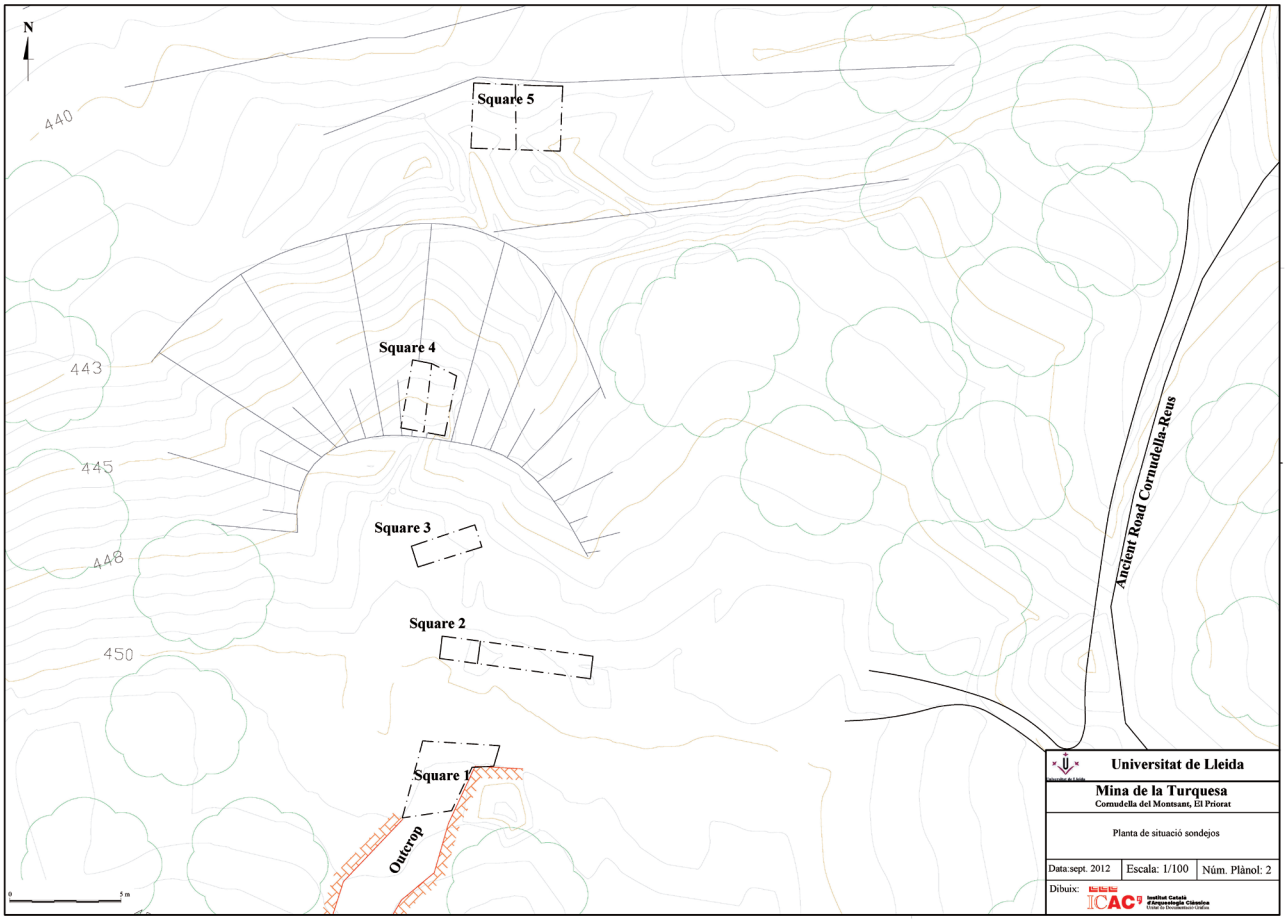


Figure 5. Squares opened in the course of the first excavation campaign.

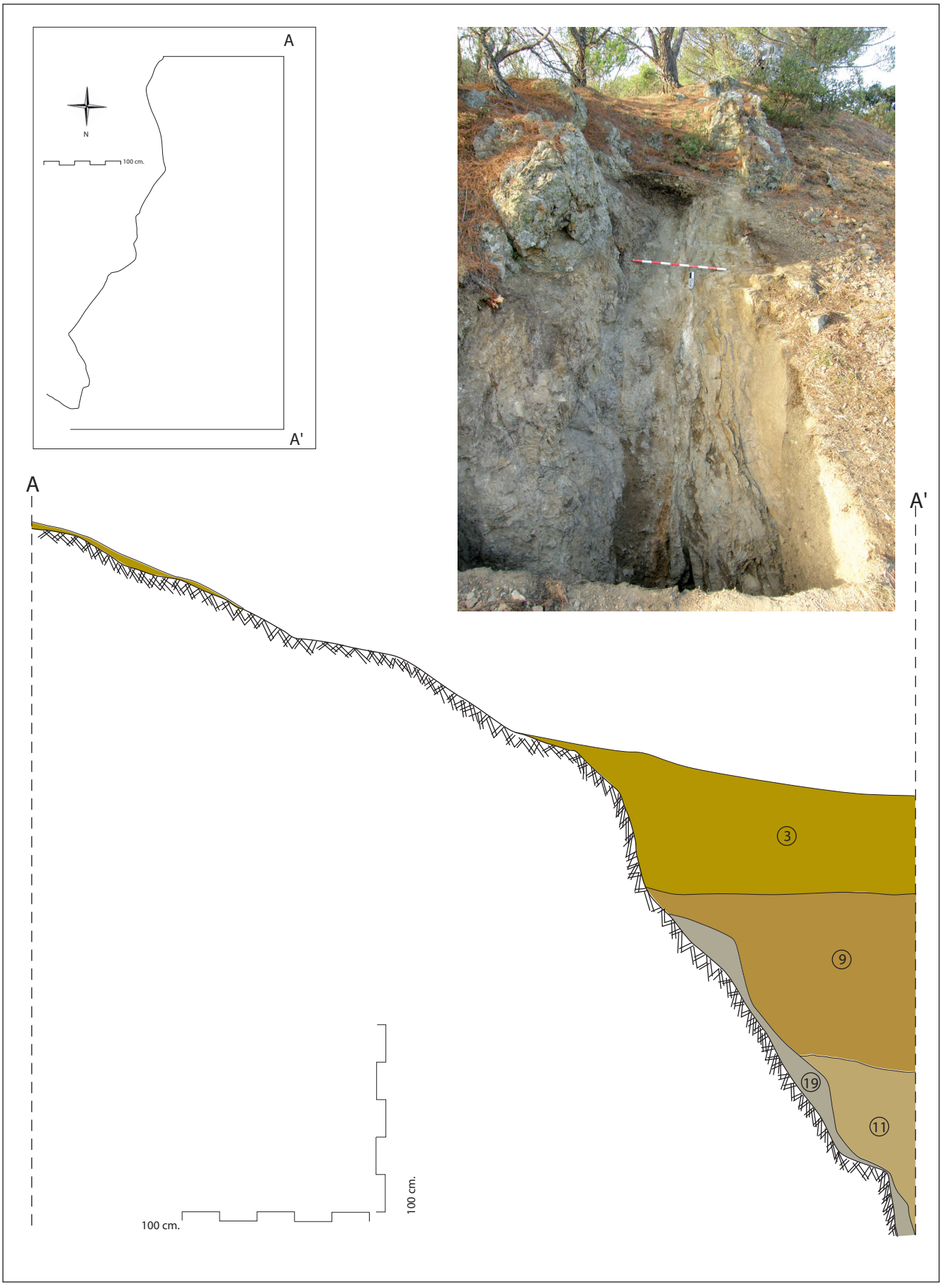


Figure 6. Square 1. Ground plan, overview and western longitudinal section.

the prehistoric mining tool was found during the preliminary surveying (Square 5, 4 x 3 m)
— another sondage in the area that seemed to be also filled with rubble some forty years ago (Square 2, 5 x 1 m)

As we will see, a large part of the cuts presented mixed fill levels of modern or contemporary materials. Despite this, they provided a considerable number of prehistoric stone mining tools.

The vein and its workings fall in a pronounced slope (*c*. 45°, and in some places, vertically), a fact that led to the abandonment of Square 1 at a relative depth of 2.80 m. The strata excavated in it show the presence of two modern fill levels, one of which (U.E. 3) covered the whole surface of the sondage, while the second (U.E.9) only occupied the northern part. Below them, at the northern end (U.E. 11), a level with little homogeneity consisting of sands, large cherty blocks and very consistent clay nodules that appear to be the result of the decomposition of the base rock itself was documented. Immediately to the south of the sharp drop of the workings on the vein was another level (U.E. 12) consisting of large blocks of rock that would have come from the collapse of the rock wall on the western side of the workings and was now lying on the base rock. Finally, in the far northwest of the square, a small level (U.E. 19) was found; very homogeneous, it was made up of very fine-grained cherty fragments that covered the rock and was the result of its disintegration (Fig. 6).

The results of the excavation of Square 2 allowed us to asses that the sediment in this area corresponded to the rubble used to fill a large mine open work located there, whose east limit was defined. It was, therefore, left to be excavated by mechanical means in subsequent excavation campaigns.

Square 3 was opened on a flat platform situated on the waste heap. It provided several fill levels, some of which corresponded to small contemporary rubble dumps made from the western side of the cut. A small quadrangular-shaped cutting (U.E. 17) that cut through the basal substratum could correspond to an anthropic lowering for ore extraction. It was filled by sediment made up of yellowish sand and abundant stones and rock, some of which contained copper minerals (U.E. 14). In this stratum we found some microfauna bone fragments impregnated with copper that were radiocarbon dated. Although of a very limited contextual reliability, a sample was dated (Beta 338534) and gave a conventional dating of 850±30 BP that corresponds to a calibrated dating at 1σ of 1163-1120 cal AD (100%) and at 2 σ of 1152-1260 cal AD [94.9%][1]. The date could indicate that the area was worked in the Middle Ages, although given the stratigraphic context and the absence of archaeological finds or other elements that would confirm it, we cannot rule out that we are looking at a mere frequentation of the site without archaeological or anthropic implications.

Square 4, opened on the strongly-sloping surface of the waste heap situated to the north of the vein, contained a sediment made up of different dump levels of diverse granulometries, although all fine and uniform, indicating mechanical crushing and considered evidence of contemporary industrial activity. The composition of the levels in the sondage, as well as their modernity, has resulted in a waste heap sediment that is still not very consolidated. This meant that we were unable to reach the base levels in this cut, due to the considerable danger of collapse of the walls of the square (Fig. 7).

Square 5, which was opened at the northern end of the surveyed area, where the aforementioned first stone mining tool was found in the initial surface survey, did not provide any archaeological remains. At a shallow depth the geological substratum was reached: a crust of yellowish and reddish marls resulting from the alteration of the basal rock.

In view of the results of the first campaign, during the second (2013), mechanical means were used to remove the deep levels of contemporary fill and, first of all, to delimit and reveal the modern mine work, pointing out more at an open pit than a thench or shaft work, that was partially documented in the previous campaign, as well as to evaluate its stratigraphic depth (Fig. 8). The excavation of the work, which was completed in the following campaign, provided abundant samples of copper ore, as well as prehistoric stone tools, but all in contemporary fill levels.

Mechanical means were also used during the third (2015) and final archaeological campaign at the mine, this time on a smaller scale to be able to work inside the mine open cast. Initially there were two objectives: to eliminate the still-existing profiles and fully delimit it and to attempt to locate intact strata belonging to previous, even prehistoric, mining works in its interior by removing the contemporary fill strata. The manual excavation of the south-western profile of the resulting irregular cut led to the documentation of a small, preindustrial vertical mining shaft (L1) that was partially cut by the digging of the contemporary mine open cast and two other smaller workings (L2 and L3). The latter were also segmented and only preserve two circular cavities (Figs. 9, 10, 11 and 12). The shaft (L1) is located in the upper part of the mineralization, immediately to the west of the main vein, probably to exploit a lateral mineral concentration. It is wholly preserved only at the basal level (1.20 x 0.80 m.) and presents a section with a slightly bi-conical tendency with a large opening at the top. The total depth is 4.73 m. (Fig. 13). On each of the three preserved walls there is a recess or crevice cut into the rock. The recesses are opposite each other and are interpreted as hand and footholds for accessing the shaft. The western wall has a larger recess at a distance of barely 0.30 m from the bottom that could have been used as a shelf. The excavation by hand of the interior of L1 allowed us to document two levels. The most recent (U.E. 22) occupied the whole of the upper part of the shaft to the point where it was fully preserved and was a constituent part of the fill levels of the contemporary mine shaft that embedded L1 (Figs. 14 and 15). At the bottom, in contrast, the protection of the perimeter of intact rock allowed the conservation

1. Calib Rev. 7.1, calibration curve used IntCal13 (Reimer *et al*. 2013).

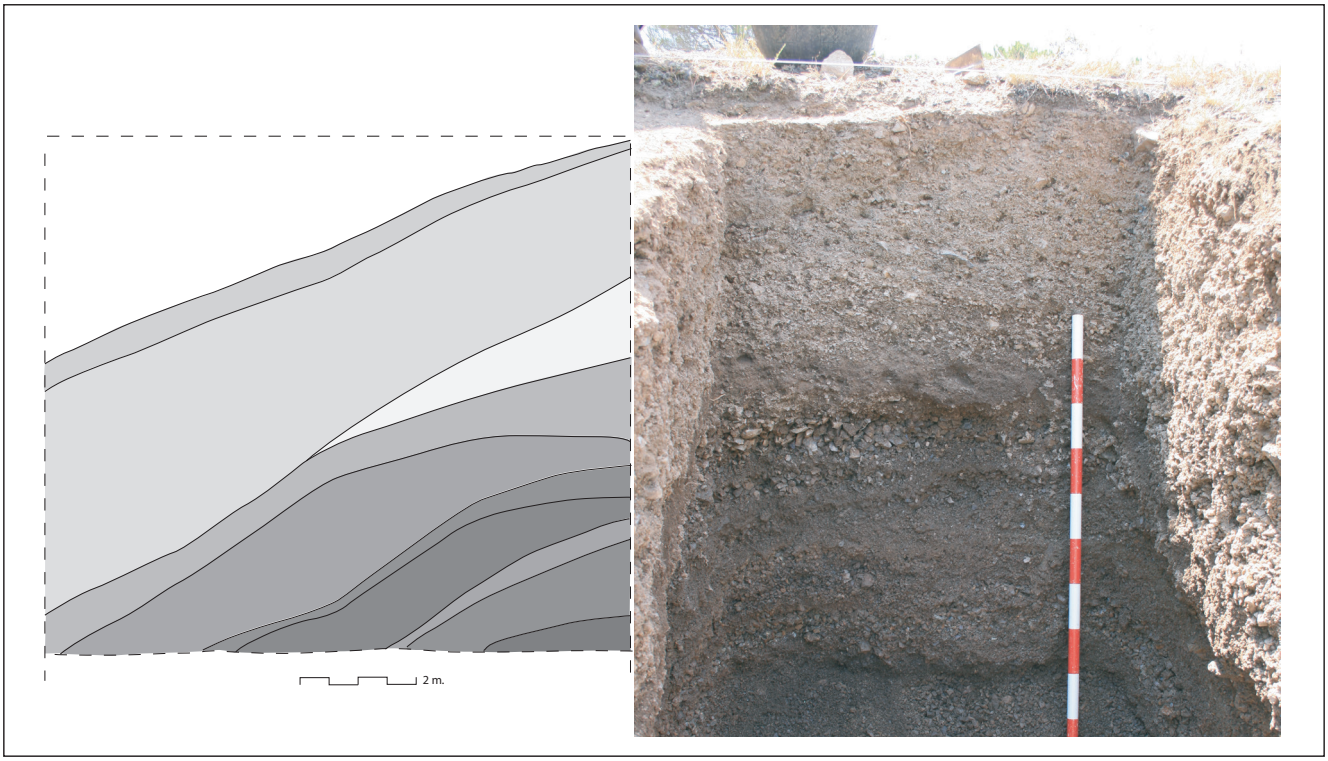


Figure 7. Square 4. Western (left) and northern (right) sections.

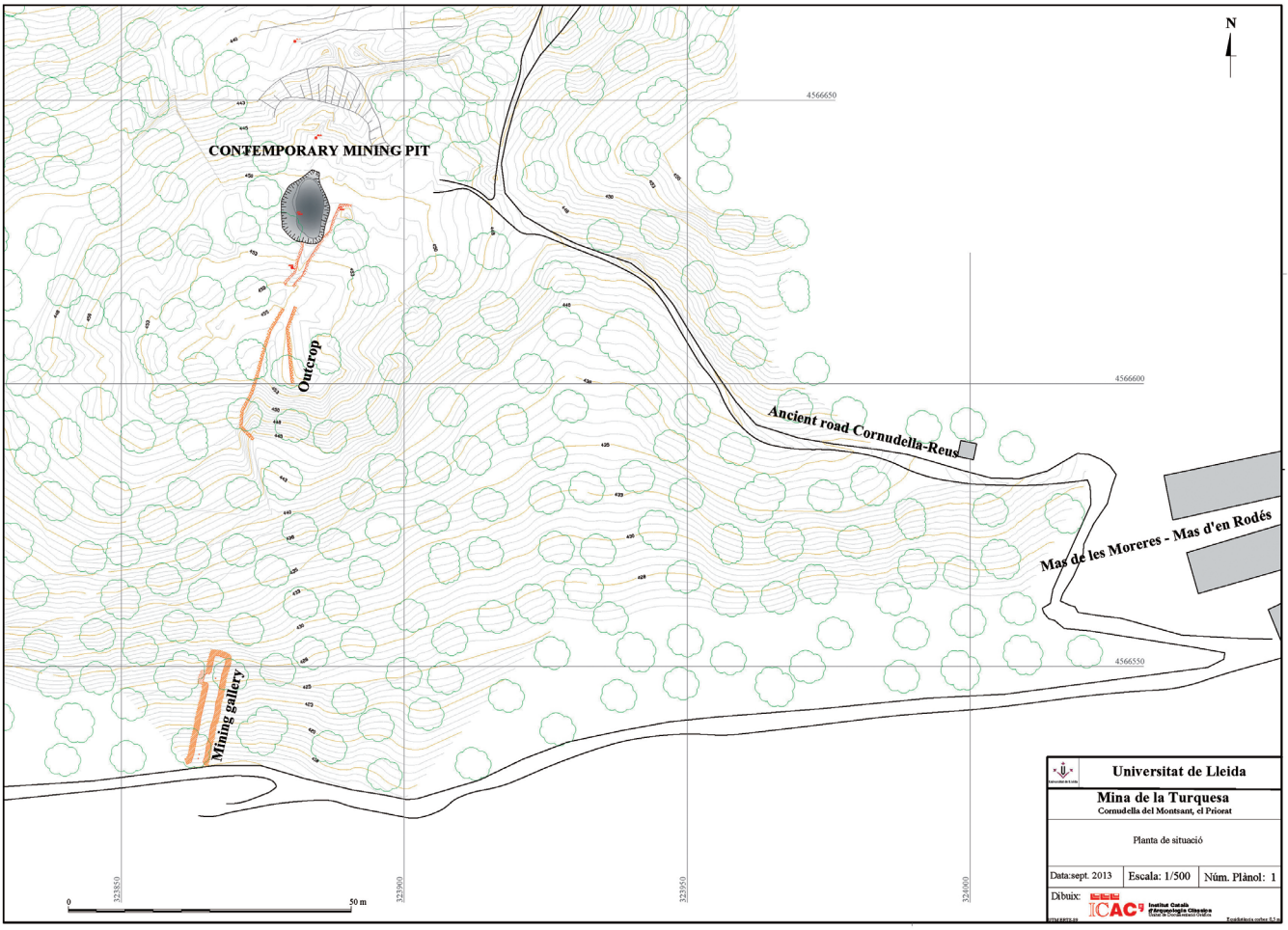


Figure 8. 2013 campaign. Location plan showing the contemporary mine shaft.

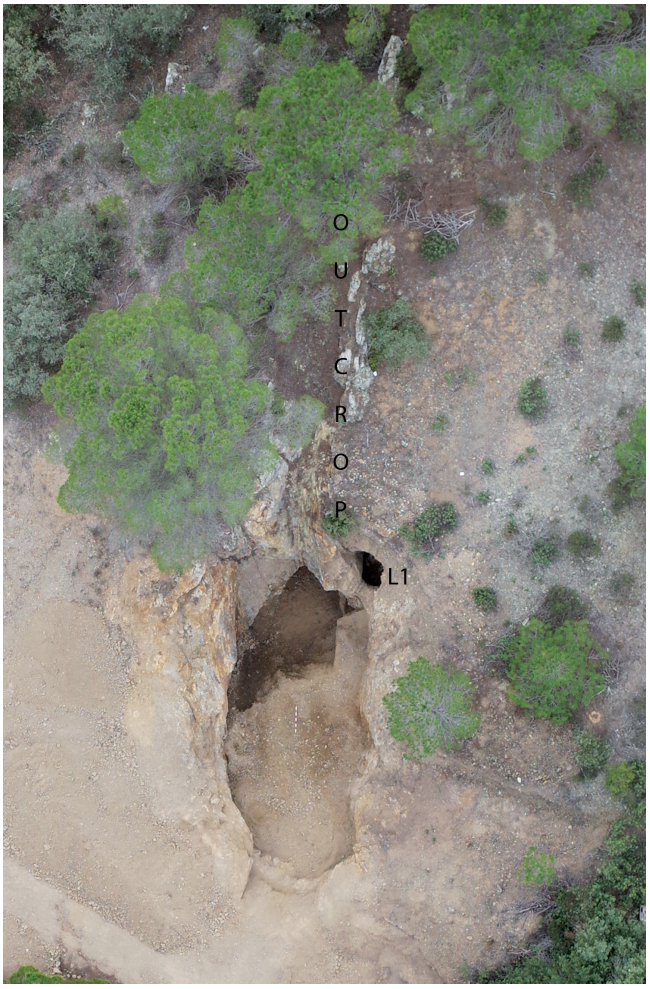


Figure 9. Aerial view of the excavation (2015) showing the main vein, the contemporary mine shaft and the preindustrial shaft L1.

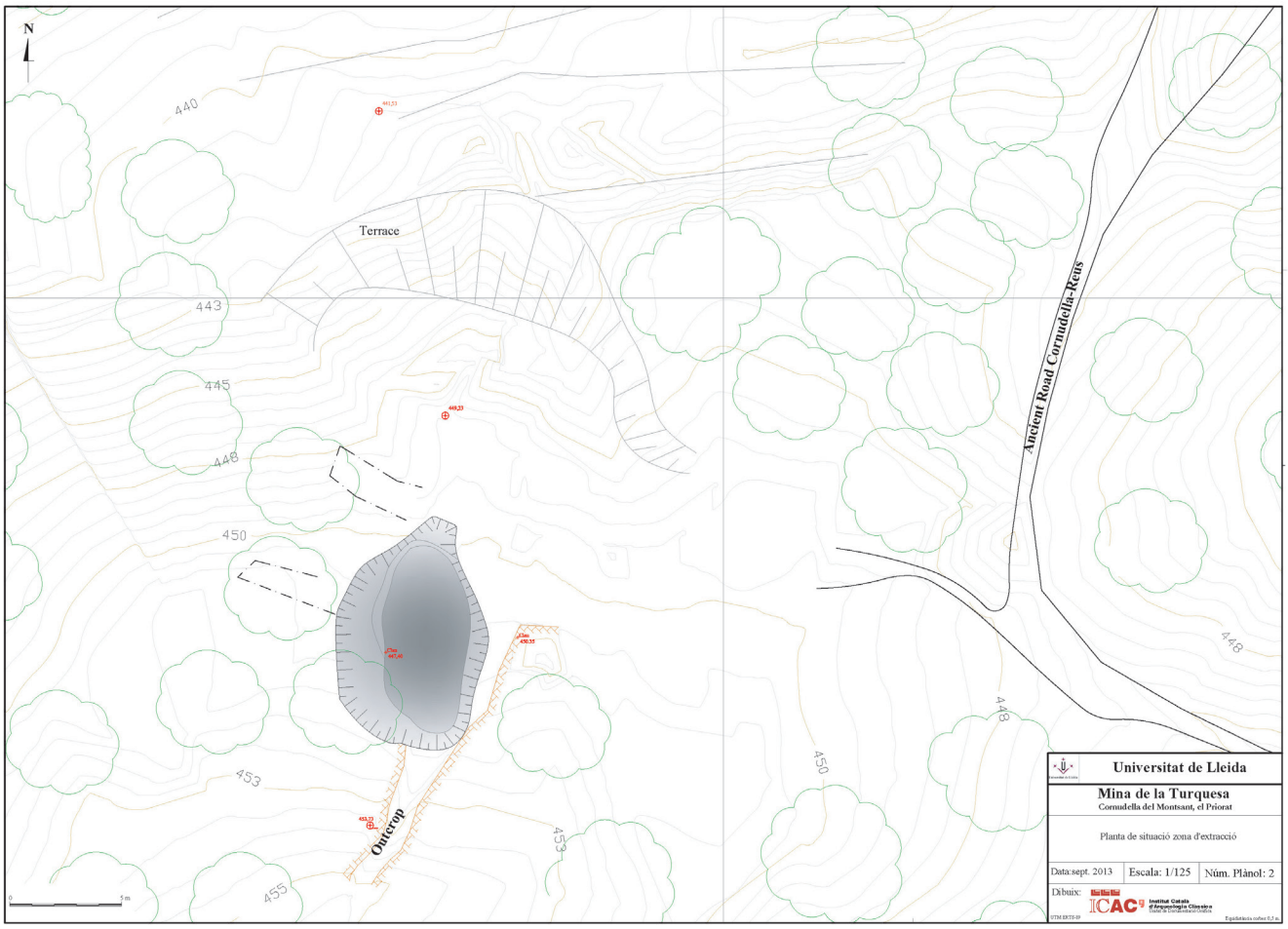
Figure 10. Aerial view of the excavation (2015).

of a prior level (U.E. 27), from which two samples were radiocarbon dated: one of pollen and the other of sediment. The first (Beta 434530) gave a conventional dating of 1260+30 BP (689-751 cal AD [85%] at 1σ and 669-778 cal AD [89.7%] at 2σ), and the second (Beta 423141), of 1110+30 BP (895-928 cal BC [48.6%] and 940-976 cal BC [51.3%] calibrated at 1 σ and 879-1013 cal BC [100%] at 2σ)[2]. U.E. 27 contained mineral remains (which were also documented at different points on the walls in the whole of Shaft L1), microcarbons and many small stones, with the occasional larger block and a fragment of a stone mining tool. In summary, with respect to the absolute chronology of Working L1, it provided an *ante quem* date in the Early Mediaeval period.

In the area closest to the southern wall of the shaft, where the main vein is located, we documented evidence of another two small shafts (L2 and L3) on a lower level and separated from each other by less than half a metre. They present an identical rounded, alveolar-type morphology with surfaces that can be clearly distinguished from the angular walls resulting from the modern mining and the exfoliation of the rock. The paucity of preserved remains prevents us from determining their original morphology with any certainty, although they could be the remains of fire-setting evidence (Figs. 16 and 17) (see Chapter 4). Based on their location and taking into account the configuration of L1, these two workings can be interpreted in two different ways. They either originate from a single vertical shaft that presented two small horizontal workings at the base, or they are the result of two independent shafts very close to each other.

In parallel we continued to excavate the main contemporary open cast work with mechanical means to a relative depth of *c.* 6 m, at which point we had to stop due to a lack of sufficient means to continue the excavation with machinery. This contemporary mining work has an irregular ellipsoidal morphology (*c.* 13 x 9 m) and its walls have a vertical tendency. The north wall presented a semi-circular, stepped recess some 3 metres long that could be related to the shaft access system. The southern wall shows the continuation of the vein (Fig. 9) to the south, and probably also to the north, under the modern waist heap.

2. Calib Rev. 7.1, calibration curve used IntCal13 (Reimer *et al*. 2013).



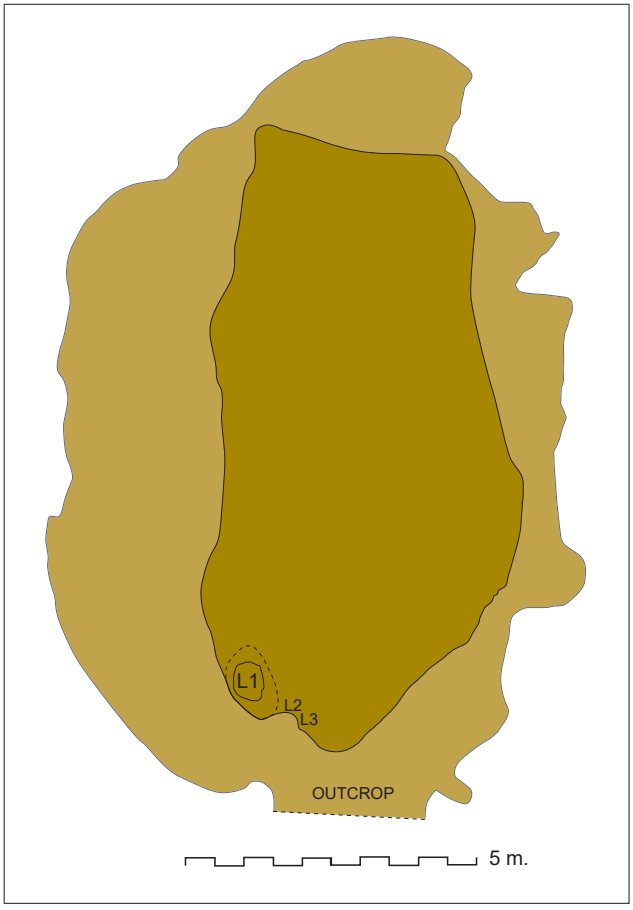


Figure 11. 2015 campaign. Location and plan of the contemporary mine shaft. In the plan the location of the mine workings L1, L2 and L3 can be seen.

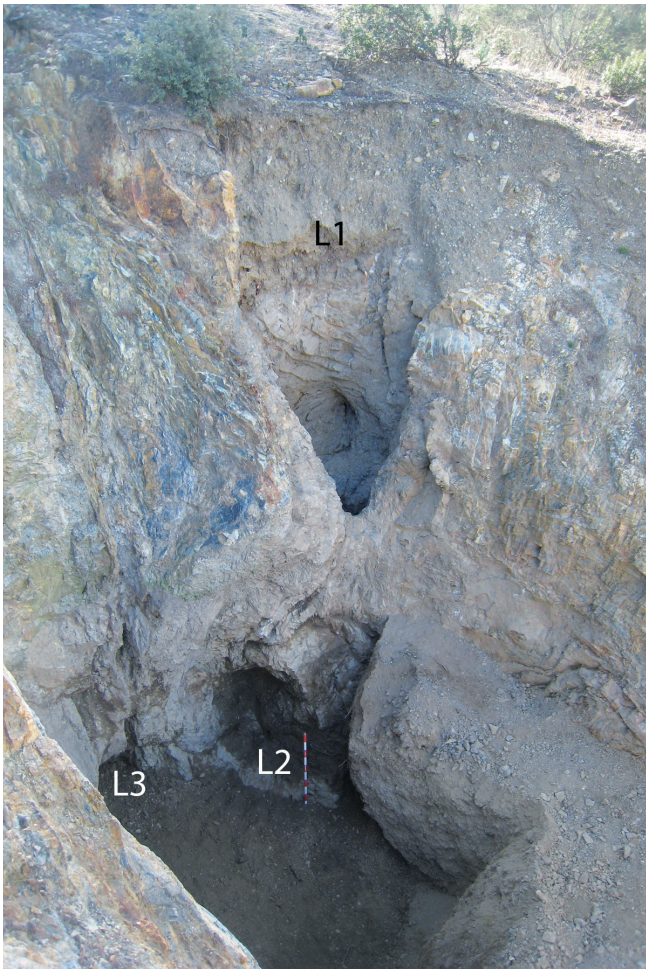


Figure 12. Workings L1, L2 and L3.

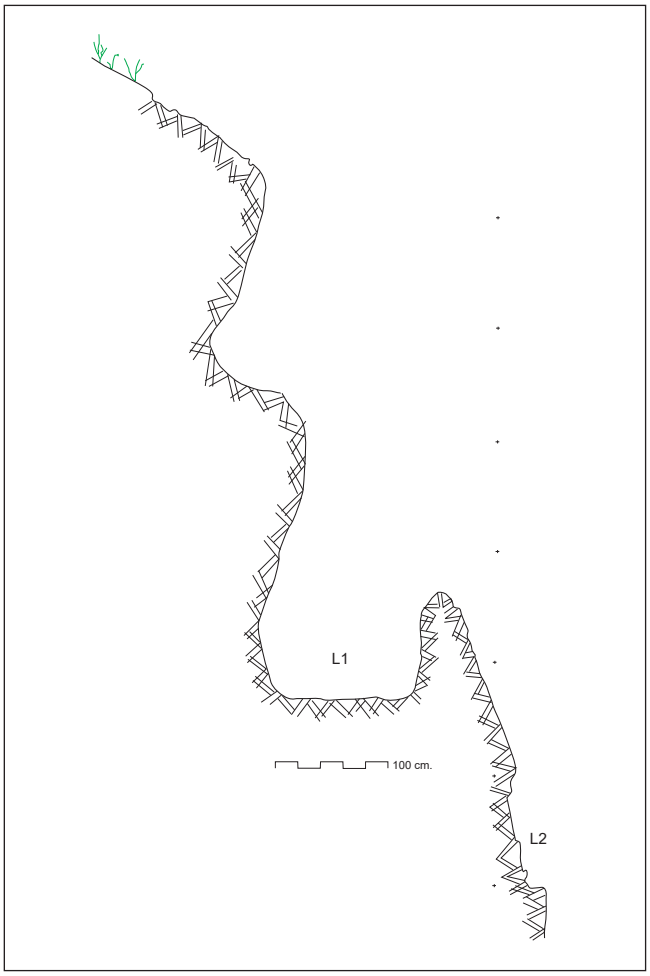


Figure 13. South-north section of Workings L1 and, at the foot, L2.

The only archaeological finds documented during the excavation campaigns carried out in the mine are the 117 stone mining tools attributable to that period, although excavated in disturbed, post-prehistoric levels, as well as a few pottery sherds with no defined typology, of a post-prehistoric chronology. This is not uncommon, as it is quite frequent, intensively in contemporary times, to cover old mine workings using the waste from earlier activities (Timberlake 2003, Hunt Ortiz 2005, Bouquet *et al.* 2006, Ambert *et al*. 2009). It is also usual, as in Turquesa mine, that historical-period works have a major impact on the prehistoric exploitations, in such a way that the direct documentation of the oldest working is sometimes difficult.

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Figure 14. Mine shaft L1.

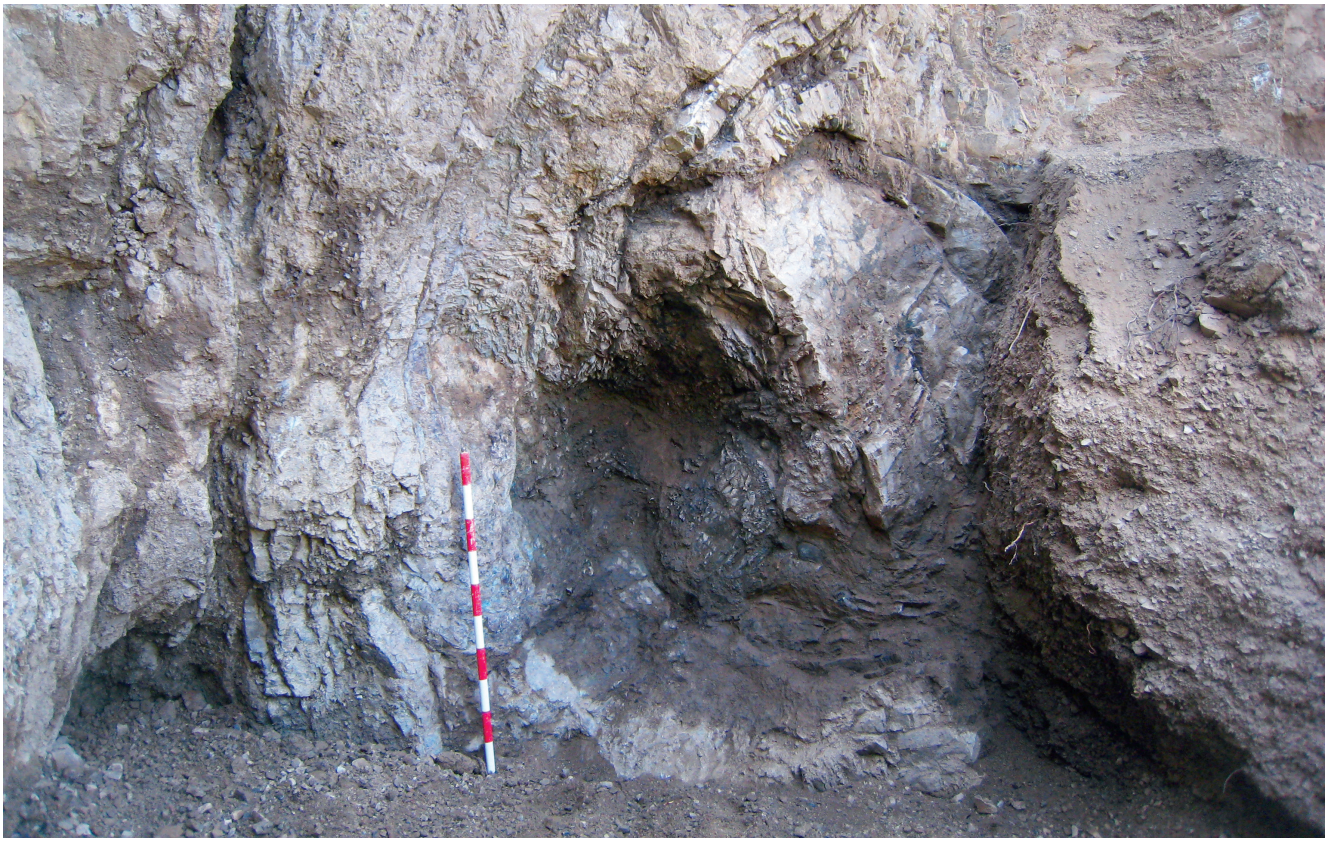

Figure 16. Workings L2 (right) and L3 (left).

Figure 15. Bottom of mine shaft L1 indicating of the lateral recesses.

Figure 17. Working L2.

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References

Adams, J., Delgado-Raack, S., De Breuil, L., Hamon, C., Plisson, H., Risch, R. (2009). Functional analysis of macro-lithic artefacts: a focus on working surfaces. In F. Sternke, L. Eigeland, L., L. J. Costa (eds.). *L'utilisation préhistorique de matières premières lithiques alternatives,* British Arcaheological Reports International Series 1939, Archaeopress, Oxford: 43-66.

Aitken, M. J. (1999). Archaeological dating using physical phenomena. *Rep. Prog. Phys.* 62: 1333-1376.

Ambert, P. (2002). Utilisation préhistorique de la technique minière d'abattage au feu dans le district cuprifère de Cabrières (Hérault). *C. R. Palevol* 1: 711-716.

Ambert, P., Figueroa-Larre, V., Guendon, J-L., Klemm, V., Laroche, M., Rovira, S., Strahm, Ch. (2009). The Copper Mines of Cabrières (Hérault) in Southern France and the Chalcolithic Metallurgy. In T. L. Kielin and B. W. Roberts (eds.), *Metals and Societies. Studies in honour of Barbara S. Ottaway*, Universitatsforschungen zur Prähistorischen Archäologie, Band 169, Bonn: 285-295.

Amigó, R., Espasa, J.B. (1990). *Noms actuals i pretèrits del terme municipal de Cornudella de Montsant*, Associació d'Estudis Reusencs, Reus.

Anadón, P., Colombo, F., Esteban, M., Marzo, M., Robles, M.S., Santanach, P., Solé Sugrañes, Ll. (1979). Evolución tectonoestratigráfica de los Catalánides. *Acta Geol. Hisp.* 14: 242-270.

Anadón, P., Julivert, M., Sáez, A. (1983). El Carbonífero del las Cadenas Costero Catalanas. In *Carbonífero y Pérmico de España. X Cong. Int. Estr. i Geol. del Carbonífero*. I.G.M.E: 332-336.

Anadón, P., Julivert, M., Sáez, A. (1985a). Aportación al Carbonífero del las Cadenas Costero Catalanas. *X Cong. Int. Estr. y Geol. del Carbonífero*. Madrid 1983. I.G.M.E. 1: 99-106.

Anadón, P., Cabrera, Ll. Guimerà, J., Santanach, P. (1985b). Paleogene strike-slip deformation and sedimentation along the Southeastern margin of the Ebro basin. In K.T. Biddle, N. Christie-Blick. (eds.), *Spec. Publ. 37 on strike-slip deformation, basin formation and sedimentation:* 303-318.

Ancel, B. and Py, V. (2008). L'abattage par le feu: une technique minière ancestrale. *Archéopage*s, 22: 34-41.

Bareche, E. (1997). Mines de Catalunya. Cornudella del Montsant (Priorat). *Mineralogistes de Catalunya: Revista de Mineralogia i Paleontologia* VII(1): 16-21.

Barnolas, A., López, F., Anadón, P., Ardévol, L., Cabra, P., Cabrera, L., Calvet, F., Enrique, P., Fernández, P., Giner, J., Guimerá, J., González, J., Julivert, J., Marzo, M., Orti, F., Salas, R. (1987). *Mapa geológico de España 1:200.000, hoja Tarragona*. *IGME*, Madrid.

BDMIN. *Base de datos de recursos minerales*. Instituto Geológico y Minero de España. <http://doc.igme.es/bdmin/VerIndicio_IGME.aspx>

Breglia, F., Caricola, I., Larocca, F. (2016). Macrolithic tools for mining and primary processing of metal ores from the site of Grotta della Monaca (Calabria, Italy). *Journal of Lithic Studies* 3, 3: 57-76.

Beug, H. J. (2004). *Leitfaden der Pollenbestimmung für Mitteleuropa und angrenzende Gebiete*. Stuttgart, Fisher.

Blas Cortina, M. Á. de (2007-2008). Minería prehistórica del cobre en el reborde septentrional de los Picos de Europa: las olvidadas labores de "El Milagro" (Onís, Asturias). *Veleia. Revista de Prehistoria, Historia Antigua, Arqueología y Filología Clásicas* 24-25, Homenaje al Profesor Ignacio Barandiaran Maeztu: 723-753.

Blas Cortina, M. A. de, Rodríguez del Cueto, F. (2015). La cuestión campaniforme en el Cantábrico Central y las minas de cobre prehistóricas de la sierra del Aramo. *Cuadernos de Prehistoria y Arqueología de la Universidad Autónoma de Madrid*, 41: 165-179.

Bolos, J., Bonales, J., Flórez, M., Martínez Elcacho, A. (2016). *Caracterització històrica del paisatge del Priorat-Montsant-Siurana*. Observatori del Paisatge de Catalunya. Generalitat de Catalunya and Diputació de Tarragona <http://www.catpaisatge.net/pahiscat/docs/CHPC_PRIORAT-MONTSANT-SIURANA.pdf>

Bottema, S. (1975). The interpretation of pollen spectra from prehistoric settlements (with special attention to liguliflorae). *Palaeohistoria* 17: 17-35.

Bouquet, L., Figueroa-Larre, V., Laroche, M., Guendon, J-L., Ambert, P. (2006). Les Neuf-Bouches (district minier Cabrières-Péret), la plus ancienne exploitation minière de cuivre de France: travaux récents, conséquences. *Bulletin de la Société Préhistoriques Française* 10,1: 143-159.

Bramon, D. (2000). *De quan érem musulmans. Textos del 713 al 1010*. Institut Universitari d'Història Jaume Vicens Vives, Eumo Editorial, Institut d'Estudis Catalans, Barcelona.

Brown, T.A., Nelson, D.E., Mathewes, R.W., Vogel, J.S., Southon, J.R. (1989). Radiocarbon dating of pollen by Acelerator Mass Spectrometry. *Quaternary Research* 32: 205-212.

Brindley, Brindley, G.W., Brown, G. (1980). *Crystal Structures of Clay Minerals and their X-ray Identification*. Monograph 5, Mineralogical Society, London.

Bronk Ramsey, C. (2017). Methods for Summarizing Radiocarbon Datasets. *Radiocarbon 59* (2): 1809-1833.

Burjachs, F. (2000). Les dades palinológiques. In A. Bosch, J. Chinchilla, J. Tarrús (eds.), *El poblat lacustre neolític de La Draga. Excavacions de 1990 a 1998*. Monografies del CASC 2, Museu d'Arqueologia de Catalunya, Centre d'Arqueologia Subaquàtica de Catalunya, Girona: 46-50.

Burjachs, F., López Sáez, J.A., Iriarte, M.J. (2003). Metodología Arqueopalinológica. In R. Buxó, and R. Piqué (eds.), *La recogida de muestras en Arqueobotánica: objetivos y propuestas metodológicas*. Museu d'Arqueologia de Catalunya, Barcelona: 11-18.

Cailleaux, A. (1951). Morphoskopische Analyse der Geschiebe und Sandkörner und ihre Bedeutung für die Paläoklimatologie. *Geologische Rundschau*, 40: 5-13.

Calvet, F. (1986). El cicle Triàsic al marge oriental d'Iberia. In *Història Natural dels Països Catalans*. Vol. 1. (Geologia-I). Fundació Enciclopèdia Catalana: 253-280.

Camprubí, A., Costa, F., Melgarejo, J.C. (1994). Mineralizaciones de fosfatos férrico-alumínicos de Gavà (Catalunya): tipología. *Boletín Geológico y Minero*: 105-5: 444-453.

Camprubí, A., Melgarejo, J.C., Proenza, J.A., Costa, F., Bosch, J., Estrada, A., Borrell, F., Yushkin, N.P., Andreichev, V.L. (2003). Mining and geological knowledge during the Neolithic: a geological study on the variscite mines at Gavà, Catalonia. *Episodes* 26 (4): 295-301.

Castaing, J., Mille, B., Zink, A., Bourgarit, D., Ambert, P. (2005). L'abattage préhistorique au feu dans le district minier de Cabrieres (Hérault): évidences par thermoluminescence (TL). In *La premiere métallurgie en France et dans les pays limitrophes*. Mémoire XXXVII de la Société Préhistorique Française: 53-62.

Cert, C. (2005). Les outils de métallurgiste du site du Néolithique Final de La Capitelle du Broum (Péret, Hérault). In P. Ambert, J. Vaquer (dirs.). La première métallurgie en France et dans les pays limitrophes: 109-118. Carcassone, 28-30 sept 2002. Actes du colloque international, Société Préhistorique Française mémoire XXXVII : 109-115.

Colombo, F., Barbé, D., Escarré, V. (1995). Controles alocíclicos en el relleno sedimentario de una cuenca paleógena: arquitectura deposicional del Grupo Cornudella, Cuenca del Ebro (Tarragona). *Geogaceta* 17: 27-30.

Colombo, F., Vergés, J. (1992). Geometría del margen SE de la Cuenca del Ebro: discordancias progresivas en el Grupo Scala Dei, Serra de la Llena (Tarragona). *Acta Geologica Hispanica* 27: 33-54.

Costa, F., Camprubí, A., Melgarejo, J.C. (1994). Aproximación geológica a las minas neolíticas de fosfatos férrico-alumínicos de Gavà (Catalunya). *Boletín Geológico y Minero* 105-5: 436-443.

Craddock, P. T. (1992). A short history of firesetting. *Endeavour* 16 (3): 145-150.

Delgado-Raack, S. (2008). *Prácticas económicas y gestión social de recursos (macro)líticos en la prehistoria reciente (III - I milenios ac) del mediterráneo occidental*. PhD Dissertation, Universitat Autònoma de Barcelona, Bellaterra. <http://hdl.handle.net/10803/5528>

Delgado-Raack, S., Escanilla, N., Risch, R., (2014). Mazas ocultas. Rastros de minería prehistórica en el Cerro Minado de Huércal-Overa (Almería). *Cuadernos de Prehistoria de la Universidad de Granada*, 24: 13-44.

Delgado-Raack, S., Gómez-Gras, D. (2017). Technological-functional study of the macrolithic artefacts from Solana del Bepo. In N. Rafel, I. Soriano, S. Delgado-Raack (eds.). *A prehistoric copper mine in the north-east of the Iberian Peninsula: Solana del Bepo (Ulldemolins, Tarragona)*. Revista d'Arqueologia de Ponent, nr. Extra 2: 45-63.

Ejarque, A., Juliá, R., Reed, J. M. Mesquita, F., Marco Barba, J., Riera, S. (2016). Coastal evolution in a Mediterranean microtidal zone: mid to late Holocene natural dynamics and human management of the Castelló Lagoon, NE Spain. *PLoS One* 11, <https://doi.org/10.1371/journal.pone.0155446>.

Enrique, P. (1990). The Hercynian intrusive rocks of the Catalonian Coastal Ranges (NE Spain). *Acta Geologica Hispanica* 25 (1-2): 39-64.

Eriksson, J.A., Possnert, G., Aldahan, A.A., Lindstrom, H., Ockilng, G. (1996). An improved method for preparing a pollen concentrate suitable for 14C-dating. *Grana* 35: 47-50.

Escanilla, N. (2016). Recursos minerales de cobre y su explotación prehistórica en el sudeste peninsular. El valle del Guadalentín (Murcia). PhD Dissertation, Universitat Autònoma de Barcelona, Bellaterra. < http://hdl.handle.net/10803/399293>

Escanilla, N., Delgado-Raack, S. (2015). Minería prehistórica del cobre (3100-1550 cal ANE) en el Levante murciano. *Phicaria. III Encuentros Internacionales del Mediterráneo. Minería y metalurgia en el Mediterráneo y su periferia oceánica*, Universidad Popular de Mazarrón: 78-99.

Escusa, A., Melgarejo, J.C. (1998). Mineralogy of the El Molar metamorphized deposit of Mn, Catalonia. *Abstracts 17th IMA International Meeting, Toronto*: A-124.

Faegri, K., Iversen, J. (1989). *Text-book of pollen analysis*. 4th. edn., John Wiley & Sons, Chichester.

Gale, D. (1990). Prehistoric stone mining tools from Alderley Adege. In P. Crew, S. Crew (eds.). *Early mining in the British Isles*. *Proceedings of the Workshop Early Mining en Plas Tan y Bwlch (17-19 noviembre 1989)*, Snowdonia National Park Study Centre, Plas Tan y Bwlch, London, nal Park Study Centre, Plas Tan y Bwlch, London: 47-48.

González, F., Moreno, C., Melgarejo, J.C., Sáez, R. (2015). Palynological age constraint of Les Vilelles unit, Catalan Coastal Chain, Spain. *Geologica Acta*: 345-361.

González Sampériz, P., Valero Garces, B.L, Moreno A., Jalut, G., Garcia Ruiz, J.M., Marti Bono, C., Delgado Huertas, A., Navas, A., Otto, T, Dedoubat J.J. (2006). Climate variability in the Spanish Pyrenees during the last 30,000 yr revealed by the El Portalet sequence. *Quaternary Research* 66: 38-52.

Grimm, E. C. (1992). *Tilia, version 2, Springfield*. IL 62703. USA. Illinois State Museum. Research and Collection Center.

Grimm, E.C. (2004). *TGView*. Illinois State Museum, Springfield.

Guimerà, J. (1988). *Estudi estructural de l'enllaç entre la Serralada Ibèrica i la Serralada Costanera Catalana*. Tesi doctoral. Universitat de Barcelona. 600 p. <http://hdl.handle.net/10803/1936>.

Hamon, C. (2016). Salt mining tools and techniques from Duzdağı (Nakhchivan, Azerbaijan) in the 5th to 3rd millennium B.C. *Journal of Field Archaeology* 41, 4: 510-528.

Hunt Ortiz, M. A. (2003). *Prehistoric Mining and Metallurgy in South West Iberian Peninsula*, British Archaeological Reports International Series 1188, Archaeopress, Oxford.

Hunt Ortiz, M.A. (2005). La explotación de recursos minerales en Europa y la Península Ibérica durante la Prehistoria. *Bocamina. Patrimonio Minero de la Región de Murcia*: 3-18.

Hunt Ortiz, M. A., Lull Estrellas, B., Perelló Mateo, L., Perelló I Fiol, D., Salvà Simonet, B. (2013). Sa Mitjalluna: minería prehistórica de cobre en Illa d'en Colom (Mahón, Menorca). *De Re Metallica*, 21: 45-57.

Huelga-Suarez, G., Moldovan, M., Suárez Fernández, M., De Blas Cortina, M. Á., García Alonso, J.I. (2014a). Defining the Lead Isotopic Fingerprint of Copper Ores from North-West Spain: The El Milagro Mine (Asturias). *Archaeometry* 56 (1): 88-101.

Huelga-Suarez, G., Moldovan, M., Suárez Fernández, M., De Blas Cortina, M. Á., García Alonso, J.I. (2014b). Isotopic Composition of Lead in Copper Ores and a Copper artefact from the La Profunda Mine (León, Spain). *Archaeometry*, 56 (4): 651–664.

Huelga-Suarez, G., Moldovan, M., Suárez Fernández, M., De Blas Cortina, M. Á., Vanhaecke, F., García Alonso, J.I. (2012). Lead isotopic analysis of copper ores from the Sierra El Aramo (Asturias, Spain). *Archaeometry* 54 (4): 685–697.

IGME (1973). *Mapa metalogenético de España. E. 1:200.000*. Hojas *Tortosa* y *Tarragona*, primera edición, Instituto Geológico y Minero de España, Madrid.

Inventari del Patrimoni Cultural Immoble de Catalunya: Arqueològic: Priorat. Barcelona: Generalitat de Catalunya. Departament de Cultura. <https://extranet.cultura.gencat.cat/EGIPCI/login.aspx>.

López Sáez, J.A., van Geel, B., Farbos-Texier, S., Diot, M.F. (1998). Remarques paléoécologiques à propos de

quelques palynomorphes non-polliniques provenant de sédiments quaternaires en France. *Revue de Paléobiologie* 17 (2): 445-459.

López Sáez, J.A., van Geel, B., Martín Sánchez, M. (2000). Aplicación de los microfósiles no polínicos en Palinología Arqueológica. In V. Oliveira Jorge (coord.), *Contributos das Ciências e das Technologias para a Arqueologia da Península Ibérica*. Actas 3º Congresso de Arqueologia Peninsular, vol. IX, Vila-Real, Portugal, setembro de 1999, ADECAP, Porto: 11-20.

López Sáez, J.A., López García, P., Burjachs, F. (2003). Arqueopalinología: Síntesis crítica. *Polen* 12: 5-35.

López Sáez, J.A., López Merino, L. (2005). Precisiones metodológicas acerca de los indicios paleopalinológicos de agricultura en la Prehistoria de la Península Ibérica. *Portugalia* 26: 53-64.

López Sáez, J.A., Burjachs, F., López García, P., López Merino, L. (2006). Algunas precisiones sobre el muestreo e interpretación de los datos en Arqueopalinología. *Polen* 15: 17-29.

López Sáez, J.A., López Merino, L., Mateo, M.Á., Serrano, Ó., Pérez Díaz, S., Serrano, L. (2009). Palaeoecological potencial of the marine organic deposits of Posidonia oceanica: a case study in the NE Iberian Peninsula. Palaeogeography, Palaeoclimatology, *Palaeoecology* 271: 215-224.

López Sáez, J. A., Sánchez Mata, D., Alba Sánchez, F., Abel Schaad, D., Gavilán, R. G., Pérez Díaz, S. (2013). Discrimination of Scots pine forests in the Iberian Central System (*Pinus sylvestris* var. iberica) by means of pollen analysis. Phytosociologial considerations. *Lazaroa* 34: 191-208.

Maestro-Maideu, E., Estrada, R.M., Remacha, E. (1998). La Sección del Carbonífero en el Priorat central (prov. de Tarragona). *Geogaceta* 23: 91-94.

Marín, D. (2017). Origen, tecnología y funcionalidad del utillaje lítico tallado durante la Edad del Bronce en el Nordeste de la Península Ibérica (2000-1300 cal ANE). Tesis Doctoral, Universitat de Lleida <http://hdl.handle.net/10803/462138>.

Mata Perelló, J.M. (1990). *Els minerals de Catalunya*, Institut d'Estudis Catalans, Barcelona.

Maya, J. L., Petit, M. A. (1986). El Grupo del Nordeste. Un nuevo conjunto de cerámicas con boquique en la Península Ibérica. *Anales de Prehistoria y Arqueología*, 2 : 49-71.

Melgarejo, J.C. (1987). *Estudi geològic i metal·logenètic del Paleozoic del Sud de les Serralades Costaneres Catalanes*. Tesi doctoral inèdita. Departament de Cristal·lografia, Mineralogia i Dipòsits Minerals. Universitat de Barcelona. 615 p.

Melgarejo, J.C. (1992): *Estudio geológico y metalogenético del Paleozoico del sur de las Cordilleras Costeras Catalanas*. Memorias del Instituto Tecnológico y Geo-Minero de España 103, 605 p. Madrid.

Melgarejo, J.C., Ayora, C. (1994). Mineralizaciones sedimentario-exhalativas del Carbonífero del SW de las Cordilleras Costeras Catalanas. *Boletín de la Sociedad Española de Mineralogía* 17: 170-171.

Menchón, J. (2006). Necrópolis y "Husun": dos aspectos de la arqueologia de Tarragona anterior a la conquista feudal. *Sautuola* 12: 331-348.

Menchón, J. (2012). Necròpolis de l'antiguitat tardana i alta edat mitjana a les comarques del Camp de Tarragona, Conca de Barberà i Priorat. In N. Molist and G. Ripoll (eds.). *Arqueologia funerària al nord-est peninsular (segles VI-XII)*. Monografies d'Olèrdola 3.1: 125-154.

Mensing, S.A., Southon, J.R. (1999). A simple method to separate pollen for AMS radiocarbon dating and its application to lacustrine marine sediments. *Radiocarbon* 41 (1): 1-8.

Mirás, Y., Ejarque, A., Riera, S., Palet, J.M., Euba, I. (2007). Dynamique holocène de la végétation et occupation des Pyrénées andorranes depuis le Néolithique ancien, d´après l´analyse pollinique de la tourbière de Bosc dels Estanyons (2180 m, Vall del Madriu, Andorre). *Comptes Rendus Paleobol* 6: 291-300.

Montero-Ruiz, I. (2017). La Solana del Bepo from an archaeometallurgical perspective. In N. Rafel, I. Soriano and S. Delgado-Raack, (eds.): *A prehistoric copper mine in the Noth-East of the Iberian Peninsula: Solana del Bepo (Uldemolins, Tarragona)*. Revista d'Arqueologia de Ponent, número extra 2: 65-79.

Montero Ruiz, I. (2018). Minería y circulación del cobre en la Prehistoria Reciente de la península Ibérica. *Actas del IX Simposio Internacional sobre Minería y Metalurgia históricas en el SW europeo: Nuestras raíces mineras* (Madrid, 23-26 de junio de 2016). SEDPGYM (Sociedad Española para la Defensa del Patrimonio Geológico y Minero), Madrid.

Montero Ruiz, I. Benítez de Lugo Enrich, L., Álvarez García, H.J. , Gutiérrez-Neira, P.C., Murillo-Barroso, M., Palomares Zumajo, N., Menchén Herreros, G., Moraleda Sierra, J., Salazar-García, D.C. (2014). Cobre para los muertos. Estudio arqueométrico del material metálico procedente del monumento Megalítico prehistórico de Castillejo del Bonete (Terrinches, Ciudad Real). *Zephyrus* LXXIII (1): 109-132.

Montero-Ruiz, I., Gener, M., Renzi, M., Hunt, M., Rovira, S. a, Santos-Zalduegui, J.F. (2009). Provenance of lead in First Iron Age sites in Southern Catalonia (Spain). In J.F. Moreau, R Auger, J. Chabot and A. Herzog (eds.), *Proceedings ISA 2006. 36th International Symposium on Archaeometry (2-6 may, 2006, Quebec, Canada)*: 391-398. Quebec. Cahiers d'archéologie du CELAT, 25. Série archéométrie, 7.

Montero, I., Rafel, N., Hunt, M.A., Mata, J.M. , Odriozola, C.P., Soriano, I., Murillo-Barroso, M. (2012a).

Minería prehistórica en el Priorato: Caracterización arqueométrica de minas de Cornudella y Ulldemolins. In J.M. Mata-Perelló (ed.). *El patrimonio minero y metalúrgico a lo largo de la Historia*. Libro de actas del VII Congreso Internacional sobre Minería y Metalurgia Históricas en el Suroeste Europeo (Utrillas, 2012). Teruel: SEDPGYM: 131-140.

Montero-Ruiz, I., Rafel, N.,Rovira,, M.C., Armada, X.-L., Graells, R., Hunt, M., Murillo-Barroso, M., Renzi, M., Santos, M. (2012b). El cobre de Linares (Jaén) como elemento vinculado al comercio fenicio en El Calvari de El Molar (Tarragona). *Menga* 3: 167-186.

Moore, P.D., Webb, J.A., Collinson, M.E. (1991). *Pollen Analysis*. Blackwell Scientific Publications, London.

Moreno, C., González, F., Sáez, R., Melgarejo, J.C., Suárez-Ruiz, I. (2018). The Upper Devonian Kellwasser Event recorded in a regressive sequence from inner shelf to lagoonal pond, Catalan Coastal Ranges, Spain. *Sedimentology*, 65: doi: 10.1111/sed.12457

Odriozola, C. P., García, R. V. Burbidge, C. I., Boaventura, R., Sousa, A. C., Rodríguez-Ariza, O., Parrilla-Giraldez, R., Prudêncio, M. I., Dias, M. I. (2016). Distribution and chronological framework for Iberian variscite mining and consumption at Pico Centeno, Encinasola, Spain. *Quaternary Research* 85: 159–176.

Parra, I., van Campo, E., Otto, T. (2005). Análisis palinológico y radiométrico del sondeo Sobrestany. Nueve milenios de historia natural e impactos humanos sobre la vegetación del Alt Empordà. *Empúries* 54: 33-44.

Pascale, A. de (2003). Hammerstones from early copper mines: sintesi dei ritrovamenti nell'Europa en el Mediterrraneo orientale e prime considerazioni sui mazzuoli di Monte Loreto (IV millennio BC-Liguria). *Rivista di Studi Liguri* LXIX: 5-42.

Pascual, R. (2007). *Flora de la Serra de Montsant*. Dalmau, R. (ed.). Barcelona.

Pérez Díaz, S., López Sáez, J. A. (2015). Evidence of agriculture and livestock. The palynological record from the Middle Ebro Valley (Iberian Peninsula) during the 3rd and 2nd Millennia cal BC. In M.P. Prieto, M.P., L. Salanova (eds.), *The Bell Beaker Transition in Europe. Mobility and local evolution during the 3rd. Millennium BC,* Oxbow Books, Oxford: 159-168.

Pérez Díaz, S., López Sáez, J.A., Nuñez de la Fuente, S., Ruiz Alonso, M. (2018). Early farmers, megalithic builders and the shaping of cultural landscapes during the Holocene in Northern Iberian mountains. A palaeoenvironmental perspective. *Journal of Archaeological Science, Reports* 18: 463-474.

Pérez Lacunza, E., Colombo, F. (2001). Variaciones del estilo deposicional en el Grupo aluvial Scala Dei, Cuenca del Ebro (Provincias de Tarragona y Lleida): Características y significado sedimentológico. *Geogaceta* 30: 211-214.

Pickin, J. (1990). Stone tools and early metal mining in England and Wales. P. Crew, S. Crew (eds.). *Early mining in the British Isles. Proceedings of the Workshop Early Mining, Plas Tan y Bwlch, 17-19 November 1989,* Snowdonia National Park Study Centre, Plas Tan y Bwlch, London: 39-42.

Poggiali, F., Buonicontri, M.P., D'Auria, A., Volante, N., Di Pasquale, G. (2017). Wood selection for firesetting: First data from the Neolithic cinnabar mine of Spacasso (South Tuscany, Italy). *Quaternary International* 458: 134-140. doi.org/10.1016/j.quaint.2017.06.028.

Py, V., Ancel, B. (2006). Archaeological experiments in fire-setting: protocol, fuel and anthracological approach. *Charcoal analysis: new analytical tools and methods for archaeology. Papers from the table-ronde held in Basel, 14-15 October 2004*, BAR International Series S 1483.

Rafel, N. (2012). La cuenca minera del Baix Priorat (Tarragona): Explotación y distribución en época colonial. Recursos locales *versus* recursos alóctonos. *Interacción social y comercio en la antesala del colonialismo. Actas del Seminario Internacional celebrado en la Universidad Pompeu Fabra el 28 y 29 de marzo de 2012. Cuadernos de Arqueología Mediterránea, 21*. Ed. Bellaterra, Barcelona: 71-85.

Rafel, N., Armada, X.-L. (2010). L'explotació minera al Baix Priorat (Tarragona) en època romana: notes a propòsit del *plumbum nigrum oleastrense. Quaderns de Prehistòria i Arqueologia de Castelló* 28: 247-261.

Rafel, N., Balaguer, P., Salazar, N. (2015). La necrópolis de les Obagues reconsiderada. A propòsit d'una intervenció de salvament. *Revista d'Arqueologia de Ponent* 15: 169-179.

Rafel, N., Montero-Ruiz, I., Castanyer, P., Aquilué, X., Armada, X.-L., Belarte, MC., Fairén, S., Gasull, P., Gener, M., Graells, R., Hunt, M., Martin, A., Mata, JM., Morell, N., Pérez, A., Pons, E., Renzi, M., Rovira, MC., Rovira, S., Santos, M., Tremoleda, J., Villalba, P. (2009); New approaches on the archaic trade in the North-Eastern Iberian peninsula: exploitation and circulation of lead and silver. *Oxford Journal of Archaeology* 29, 2: 175-202.

Rafel N., Montero I., Soriano, I., Hunt M.A., Armada X.L. (2015). Nuevos datos sobre la minería pre y protohistórica en Cataluña. *Cuadernos de Prehistoria y Arqueología de la Universidad de Granada* 24: 147-166.

Rafel N., Montero I., Soriano, I., Delgado-Raack, S. (2016). L'activité minière préhistorique dans le Nord-Est de la péninsule Ibérique. Étude sur la Coveta de l'Heura et l'exploitation du cuivre à la Solana del Bepo (Tarragone, Espagne). *Bulletin de la Société Préhistorique Française* 113, 1: 95-129.

Rafel, N., Soriano, I., Delgado-Raack, S., eds. (2017). *A prehistoric copper mine in the Noth-East of the Iberian Peninsula: Solana del Bepo (Uldemolins, Tarragona)*. Revista d'Arqueologia de Ponent, número extra 2

Rafel, N., Soriano, I. (2017a). The archaeological site of Solana del Bepo and the archaeology of the Priorat between the Late Chalcolithic and the First Iron Age. In N. Rafel, I. Soriano and S. Delgado-Raack, (eds.): *A prehistoric copper mine in the Noth-East of the Iberian Peninsula: Solana del Bepo (Uldemolins, Tarragona)*. Revista d'Arqueologia de Ponent, número extra 2: 14-16.

Rafel, N., Soriano, I. (2017b). By way of conclusion: Solana del Bepo and its context, an assessment. In N. Rafel, I. Soriano and S. Delgado-Raack, (eds.): *A prehistoric copper mine in the Noth-East of the Iberian Peninsula: Solana del Bepo (Uldemolins, Tarragona)*. Revista d'Arqueologia de Ponent, número extra 2: 83-91.

Rafel, N., Soriano, I., Armada, X.-L., Hunt, M.A., Montero, I. (in press a). Lead and copper mining in Priorat county (Tarragona, Spain): from cooperative exchange networks to colonial trade (2600-500 BC). In Armada, X.L., Murillo-Barroso, M., Charlton, M., eds.; *Metals, minds and mobility: Integrating scientific data with archaeological theory.* Oxbow Books.

Rafel, N., Hunt Ortiz, M.A., Montero, I., Soriano, I., Delgado-Raack, S., Marín, D. (in press b). New absolute datings for a prehistoric copper mine: Solana del Bepo (Ulldemolins, Tarragona province, Spain). *Mediterranean Archaeology and Archaeometry* (status: revision).

Raymond, D., Caridroit, M. (1993). Le Dévonien-Carbonifère inférieur du Priorat (Catalogne, Espagne) nouvelles données micropaléontologiques et interprétation paléogéographique. *Acta Geologica Hispanica* 28: 27-31.

Reille, M. 1999. *Pollen et spores d´Europe et d´Afrique du Nord*. Laboratoire de Botanique Historique et Palynologie, Marseille.

Reimer, P.J., Bard, E., Bayliss, A., Beck, J.W., Blackwell, P.G., Bronk Ramsey, C., Buck, C.E., Cheng, H., Edwards, R.L., Friedrich, M., Grootes, P.M.: Guilderson, T.P., Haflidason, H., Hajdas, I., Hatté, C., Heaton, T.J., Hogg, A.G., Hughen, K.A., Kaiser, K.F., Kromer, B., Manning, S.W., Niu, M., Reimer, R.W., Richards, D.A., Scott, E.M., Southon, J.R., Turney, C.S. M., Van Der Plicht, J. (2013). IntCal13 and MARINE13 radiocarbon age calibration curves 0-50000 years cal BP. *Radiocarbon*, 55(4): 1869-1887.

Rieser, B. Y Schrattenthaler, S. (2004). Prähistorischer Kupferbergbau im Raum Schwaz/ Brixlegg (Nordtirol) – Geländebefunde und experimentelle Untersuchungen zur Schlägelschäftung. In G. Weisgerber, G. Goldenberg (eds.). *Alpenkupfer – Rame delle Alpi, Seminario Urgeschichtliche Kupfergewinnung im Alpenraum, Universität Innsbruck, 4-8 October 1995*, Deutsches Bergbaumuseum, Bochum: 75-94.

Risch, R. (1995). *Recursos naturales y sistemas de producción en el Sudeste de la Península Ibérica entre 3000 y 1000 ANE*, PhD Dissertation, Universitat Autònoma de Barcelona, Bellaterra. <http://hdl.handle.net/10803/5524>.

Risch, R., Martínez, F. (2008). Dimensiones naturales y sociales de la producción de hachas de piedra en el noreste de la Península Ibérica. *Trabajos de Prehistoria* 65, 1: 47-71.

Rodrigues dos Santos, A. L. (2015). Geoquímica, mineralogia e luminescência de um Mundo Pré-histórico em Negativo. PhD thesis, <http://ria.ua.pt/handle/10773/14828>.

Rovira, S. (2004). Tecnología metalúrgica y cambio cultural en la prehistoria de la Península Ibérica. *Norba. Revista de Historia*, 17: 9-40.

Sáez, A., Anadón, P. (1989). El Complejo Turbidítico del Carbonífero del Priorato (Tarragona). *Acta Geologica Hispanica* 24: 33-47.

Scherer, N. (1969). Faltung von Lyditen am Beispiel des Unterkarbons in Südostkalonien (Spanien). *Geologie* 18: 1190-1198.

Schneider, J. (2002). Milling tool design, stone textures and function. In R. Treuil, H. Procopiou (eds.). *Mouldre et broyer*, CNRS, Paris: 31-53.

Serra Vilaró, J. (1915-1920). Mina i fundació d'aram del primer període de l'edat del bronze de Riner. *Anuari de l'institut d'Estudis Catalans* 6: 535-538.

Serra Vilaró, J. (1920). Mina i fundició d'aram del primer període de l'edat del bronze. *Butlletí del Centre Excursionista de Catalunya* 301: 33-39.

Serra Vilaró, J. (1924). *De metal·lúrgia prehistòrica a Catalunya*, Musaeum Archaeologicum Diocesanum, Solsona.

Serra Vilaró, J. (1960-1961). Castell de Riner. Senyoriu dels repobladors de l'Espluga de Francolí. *Boletín Arqueológico* 4, 69-76:65-88.

Soriano, I. (2011). De tumbas de metalúrgico en el Nordeste peninsular. El Forat de la Tuta (Riner, Solsonès, Lleida). *Revista d'Arqueologia de Ponent* 21: 37-56.

Soriano, I. (2013). *Metalurgia y Sociedad en el Nordeste de la Península Ibérica (finales del IV-II milenio cal ANE)*. British Archaeological Reports, International Series 2502, Archeopress, London.

Soriano, I., Rafel, N., Hunt Ortiz, M. A., Montero, I., Delgado-Raack, S. (2017). Una nueva explotación minera prehistórica en el noreste: la mina de la Turquesa o del Mas de les Moreres en Tarragona. In L. J. García-Pulido, L. Arboledas Martínez, E. Alarcón García and F. Contreras Cortés (eds). *Presente y futuro de los paisajes mineros del pasado. Estudios sobre minería, metalurgia y poblamiento*. Granada, Universidad de Granada and SEDPGYM: 52-59.

Stöllner, T., Eibner, C., Cierny, J. (2004). Prähistorischer Kupferbergbau Arthurstollen –Ein neues Projekt im Südrevier des Mitterberg-Gebietes (Salzburg). In G. Weisgerber, G. Goldenberg (eds.). *Alpenkupfer –Rame delle Alpi, Seminario Urgeschichtliche Kupfergewinnung*

im Alpenraum, Universität Innsbruck, 4-8 October 1995, Deutsches Bergbaumuseum, Bochum: 95-106.

Teixell, A. (1986). *Estudi geològic de les Serres de Pàndols, de Cavalls i del Montsant i de les seves relacions amb les depressions de l'Ebre i de Móra (Tarrago*na). Tesi de Llicenciatura inèdita, Univ. de Barcelona, 149 p.

Teixell, A. (1988). Desarrollo de un anticlinorio por transpresión, aislando una cuenca sedimentaria marginal (borde oriental de la cuenca del Ebro, Tarragona). *Rev. Soc. Geol. España* 1: 229-238.

Timberlake, S. (1990). Excavations and fieldwork on Copa Hill, Cwmystwyth, 1989. In P. Crew, S. Crew (eds.). *Early mining in the British Isles*. *Proceedings of the Workshop Early Mining en Plas Tan y Bwlch, 17-19 November 1989,* Snowdonia National Park Study Centre, Plas Tan y Bwlch, London: 22-29.

Timberlake, S. (2003). *Excavations on Copa Hill, Cwmystwyth (1986-1999). An Early Bronze Age copper mine within the uplands of Central Wales*. British Archaeological Reports British Series 348, Archaeopress, Oxford.

Valenzuela, S. (2005). *Cristalinidad de la illita y de la clorita: aplicación en la caracterización del metamorfismo de grado muy bajo, límite diagénesis-metamorfismo, del Priorat (Tarragona)*. Tesi de màster inèdita. Dept. Petrologia, Geoquímica i Prospecció Geològica, Universitat de Barcelona. 248 p.

Valenzuela, S. (2016). *El metamorfismo hercínico de grado muy bajo del Priorat Central*. Tesi doctoral inèdita. Dept. Petrologia, Geoquímica i Prospecció Geològica, Universitat de Barcelona. 392 p.

Vallvé, J. (1980). La industria en Al-Andalus. *Al-Qantara* I: 209-241.

Vallvé, J. (1996). La minería en Al-Andalus. *Actas de las I Jornadas sobre minería y tecnología en la Edad Media Peninsular*, León: 56-64.

Van Geel, B. (2001). Non-pollen palynomorphs. In J.P. Smol, H.J.B. Birks, W.M. Last (eds.): *Tracking environmental change using lake sediments, volume 3: Terrestrial, algal and silicaceous indicators*. Kluwer Academic Publishers, Dordrecht: 99-119.

Vasil`chuk, A.C., Kim, J.C., Vasil`chuk, Y.K. (2004). The AMS dating of pollen from syngenetic ice-wedge ice. In M. Breese, L.E. Rehn, C. Trautmann, I. C. Vickridge. *Nuclear Instruments and Methods in Physics Research B* 223: 645-649.

Vilaseca, S. (1934). Les coves d'Arbolí (Camp de Tarragona). *Butlletí Arqueològic* 47, 48 and 49, 3ª época, enero-setiembre: 317-328, 341-356 and 373-388.

Vilaseca, S. (1935). Noves troballes prehistòriques a Arbolí. *Butlletí Arqueològic*, vol. 5(3), 3ª época: 77-86.

Vilaseca, S. (1936). *La indústria del sílex a Catalunya. Les estacions tallers del Priorat i extensions*. Reus, Llibreria Nacional i Estrangera.

Vilaseca, S. (1941). Más hallazgos prehistóricos en Arbolí (provincia de Tarragona), *Ampurias* III: 45-62.

Vilaseca, S. (1947). El campo de urnes de les Obagues del Montsant (y la evolución de los Campos de Urnas del sur de Cataluña). *Archivo Español de Arqueología* XX: 28-45.

Vilaseca, S. (1952). La coveta de l'Heura, de Ulldemolins (provincia de Tarragona). *Ampurias* XIV: 121-135.

Vilaseca, S. (1953). *Las industrias del sílex tarraconenses*. CSIC, Instituto de Arqueología y Prehistoria "Rodrigo Caro"-CSIC, Madrid.

Vilaseca, S. (1956). Cuevas sepulcrales de Ciurana, en la Sierra de Prades. *Libro Homenaje al Conde de la Vega del Sella*, Diputación Provincial de Asturias, Oviedo: 199-205.

Vilaseca, S. (1957-1958). La cueva de Porta-LLoret en el antiguo término de Siurana. Montes de Prades. *Ampurias* 19-20: 103-121.

Vilaseca, S. (1963). Dos nuevas cuevas del bronce medio y final del macizo de Prades. *Ampurias* 25: 105-136.

Vilaseca, S. (1973). *Reus y su entorno en la prehistoria*. 2 vols., Asociación de Estudios Reusenses, Reus.

Viñas, R. (2011). Les manifestacions rupestres de Catalunya: un patrimoni per conèixer i gaudir. Notes sobre historiografia, conservació i divulgació. *Podall*, 1: 14-50

Viñas, R., Rubio, A., Martínez, L., Serrano, J.A. (2006). Descobriments de pintures rupestres a les Muntanyes de Prades (Cornudella de Montsant, Tarragona). *Actes de les Segones Jornades sobre el Bosc de Poblet i les Muntanyes de Prades*, Poblet: 485-489.

Viñas, R., Rubio, A., Martínez, L., Serrano, J.A. (2007). Nous conjunts de pintures rupestres a les Muntanyes de Prades i el Montsant. Abrics del Grau dels Masets III i Escala Dei (Cornudella i la Morera de Montsant, Tarragona). *Aplec de Treballs*, 25, Centre d'estudis de la Conca de Barberà: 23-30.

Viñas, R., Sarrià, E. (2009-2010). Documentació dels nous conjunt d'art rupestre del Priorat (Tarragona). *Tribuna d'Arqueologia 2009-2010*, Departament de Cultura. Generalitat de Catalunya, Barcelona: 53-84.

Weisgerber, G., Willies, L. (2000). The use of fire in prehistoric and ancient mining-firesetting in *La pyrotechnologie à ses débuts. Evolution des premières industries faisant usage du feu*. Paléorient 26 (2): 131-149.