
Virtual trip to the Abric Romaní site and its lithic procurement areas

Bruno Gómez de Soler^{1,2}, María Soto^{3,4}, Miguel Soares-Remiseiro^{1,2},
M. Gema Chacón^{1,2,5}

1. Institut Català de Paleoecologia Humana i Evolució Social (IPHES-CERCA). Zona Educacional 4, Campus Sescelades URV (Edifici W3), 43007 Tarragona, Spain. Email: Gómez de Soler: bgomez@iphes.cat; Soares-Remiseiro: masoares@iphes.cat; Chacón: gchacon@iphes.cat
2. Universitat Rovira i Virgili (URV), Departament d'Història i Història de l'Art. Avinguda de Catalunya 35, 43002 Tarragona, Spain.
3. Madrid Institute for Advanced Study (MIAS). Casa Velázquez. Ciudad Universitaria C/de Paul Guinard, 3 28040, Madrid, Spain - Universidad Autónoma de Madrid. C/ Einstein 13 Pabellón C 1ª Planta, 28049, Madrid, Spain. Email: marial.soto@uam.es
4. Universidad Autónoma de Madrid. Departamento de Prehistoria y Arqueología. Facultad de Filosofía y Letras. Ciudad Universitaria de Cantoblanco, 28049, Madrid, Spain.
5. UMR7194 - HNHP (CNRS - MNHN -UPVD - Sorbonne Universités). Palais de Chaillot. Musée de l'Homme, 17 Place du Trocadéro, 75016 Paris, France.

Abstract:

This paper introduces the virtual field trip organised on the occasion of the 13th International Symposium on Knappable Materials in Tarragona from 4th to 6th October 2021, showing the Abric Romaní site (Northeastern Iberian Peninsula) and the chert procurement areas located within a 30 km radius.

The Abric Romaní section consists of a general presentation of the Middle Palaeolithic site, including a brief description of its 50 m stratigraphic sequence, where more than 20 archaeological levels have been identified dating from 110 to 39 ka BP, and some of the main traits of the archaeological assemblages have been recovered. This was followed by an introduction of the siliceous outcrops of the Panadella cherts approximately 24 km from the Abric Romaní; the Sant Martí de Tous chert outcrops 16 km away and the Valldeperes and Ca l'Alemany chert outcrops at distances of 24 and 25 km, respectively. In all cases, the geological formations, as well as the main chert macroscopic and microscopic characteristics, are described.

This paper yields the most relevant aspects of a field trip that had to be recorded due to the COVID-19 pandemic, but which brought us back together and facilitated the presentation of the main source areas frequented by the Neanderthal groups of this referential site.

Keywords: lithic raw materials; chert; Middle Palaeolithic; Abric Romaní; Sant Genís formation; Montmaneu formation; Valldeperes formation; Bosc d'en Borràs formation



1. Introduction

During the 13th International Symposium on Knappable Materials (ISKM) held virtually at Tarragona in October 2021, a virtual field trip was organised. It consisted of the recording of the original field trip, which would never have been done if not for the Covid-19 pandemic, which promoted the first entirely virtual ISKM ([link](#)).

This field trip involved a visit to the Middle Palaeolithic site of Abric Romaní and the new sequence of the Abric de la Consagració, both in the Cinglera del Capelló cliff (Capellades, Barcelona), as well as some locations that acted as procurement sources for the Neanderthals occupying the central areas of the Catalanian region.

The Abric Romaní site represents one of the most important Middle Palaeolithic archaeological sequences, becoming a referential site for its fossil record, structures (*e.g.* combustion structures), spatial distribution and temporal and stratigraphic high resolution. The new Abric de la Consagració excavations started in 2019, confirming an enormous archaeological potential; however, due to the limited information available, we decided not to include it in this presentation.

Regarding the locations presented in the field trip video ([link](#)), the symposium participants had the opportunity to virtually visit: (1) the siliceous outcrops of the Panadella chert (Montmaneu formation), located in the towns of Montmaneu and Veciana (Barcelona); (2) the Sant Martí de Tous outcrops in the homonym municipality and; (3) the chert workshop of La Guinardera and a recently discovered Mesolithic - Neolithic sequence, Cal Sitjo, both in the town of Sant Martí de Tous (Barcelona). These locations are evidence of an intense and diachronic occupation of the area due to the chert abundance and availability for procurement and have already been discussed in this and previous volumes (Gómez de Soler *et al.* 2021; Gómez de Soler *et al.* 2023a).

With the idea of presenting the main chert outcrops frequented by the Neanderthals of Abric Romaní, we introduce the different chert types according to their importance in the archaeological assemblages, including the Valldeperes and Ca l'Alemanys cherts as exploited raw materials of the Abric Romaní sequence.

2. The Abric Romaní archaeological site

The Abric Romaní site is located in the town of Capellades (Barcelona, Spain) (Figure 1). It is a large rock shelter situated on the travertine cliff, known as Cinglera del Capelló (Vallverdú *et al.* 2014; Vaquero *et al.* 2013).

It was discovered in 1909 and first excavated by Amador Romaní at the beginning of the 20th century (Vidal, 1913: 272). The ongoing project began in 1983 and is currently under the direction of the Institut Català de Paleoecologia Humana i Evolució Social (IPHES-CERCA). The research interest is based on the systematic recovery and spatial documentation of all structures and archaeological materials obtained from a large-surface excavation (200–300 m²) focused on H to R (currently under excavation) archaeological levels.

The stratigraphic sequence comprises 50 m of well-stratified travertine sediments dated by U-Series and 14C between 40 and 110 ka years, which contains more than 20 archaeological layers (Bischoff *et al.* 1988; 1994; Sharp *et al.* 2016; Vallverdú *et al.* 2014; Vaquero *et al.* 2013). All archaeological horizons are associated with the Middle Palaeolithic, except for the uppermost level A, which is attributed to the Early Upper Palaeolithic.

The palaeoecological record from Abric Romaní indicates a mosaic landscape, with different vegetal communities, including forests, riparian forests, prairies and steppe environments (Burjachs *et al.* 2012). Climate variations include alternating wet and dry phases along the sequence with colder conditions than today (Vaquero *et al.* 2013).

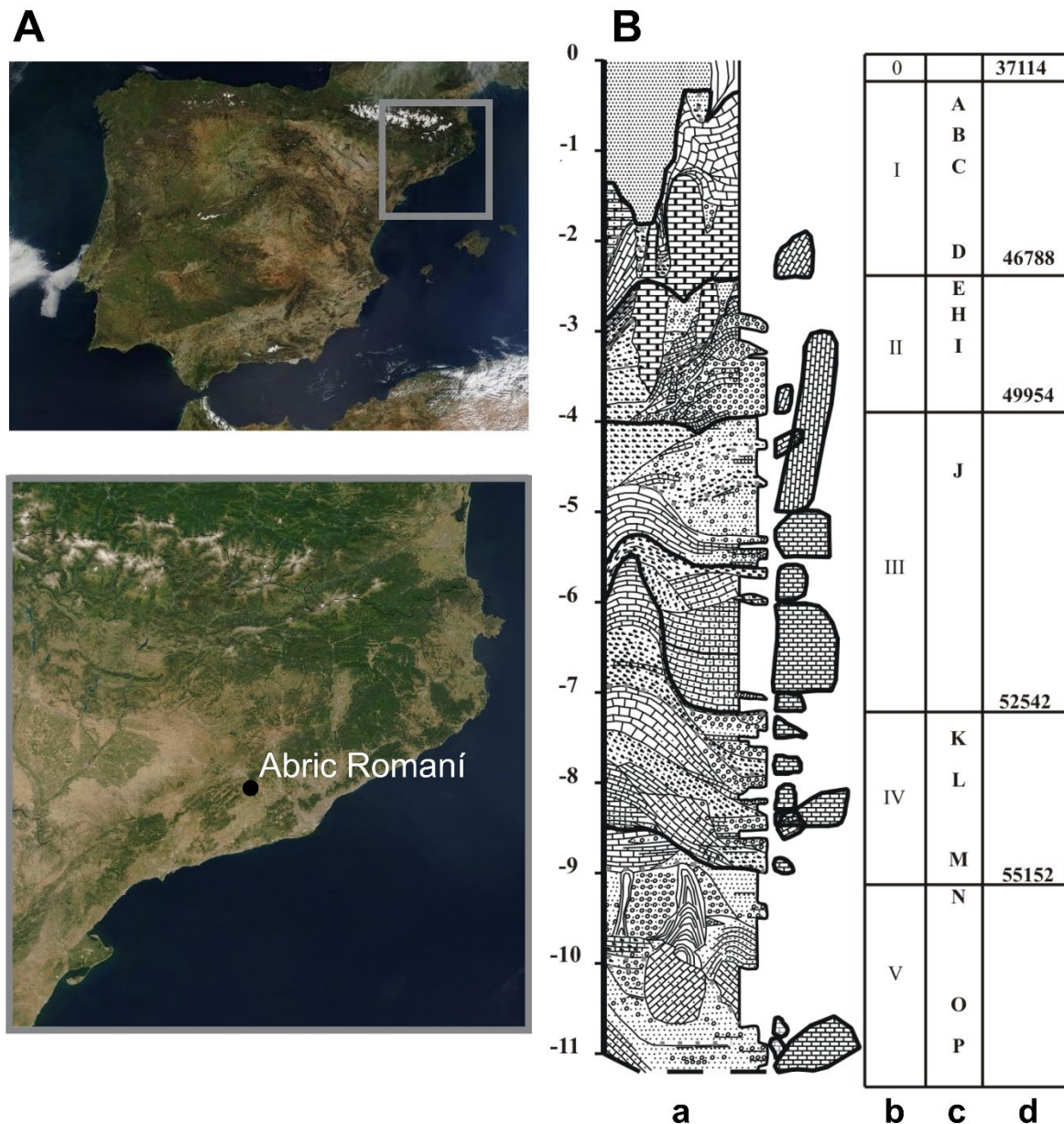


Figure 1. A) Location map of Abric Romaní. B) Stratigraphy and dates of the archaeological levels excavated up to level P: a. lithostratigraphy, B) sequence number, C. archaeological levels, D. ka years dates (modified from Gómez de Soler *et al.* 2020b: 5).

The excavation of such a large area, combined with the high temporal resolution of the archaeological units, has provided a detailed picture of the spatial organisation strategies of the Middle Palaeolithic human groups (Figure 2). The occupations are mainly focused around on well-preserved hearths that form a clustered distribution on most archaeological levels (Vaquero & Pastó 2001). These are the result of an unknown number of long term occupation events or short occupation or non-residential ones (Vallverdú *et al.* 2005; 2010; Vaquero *et al.* 2012).

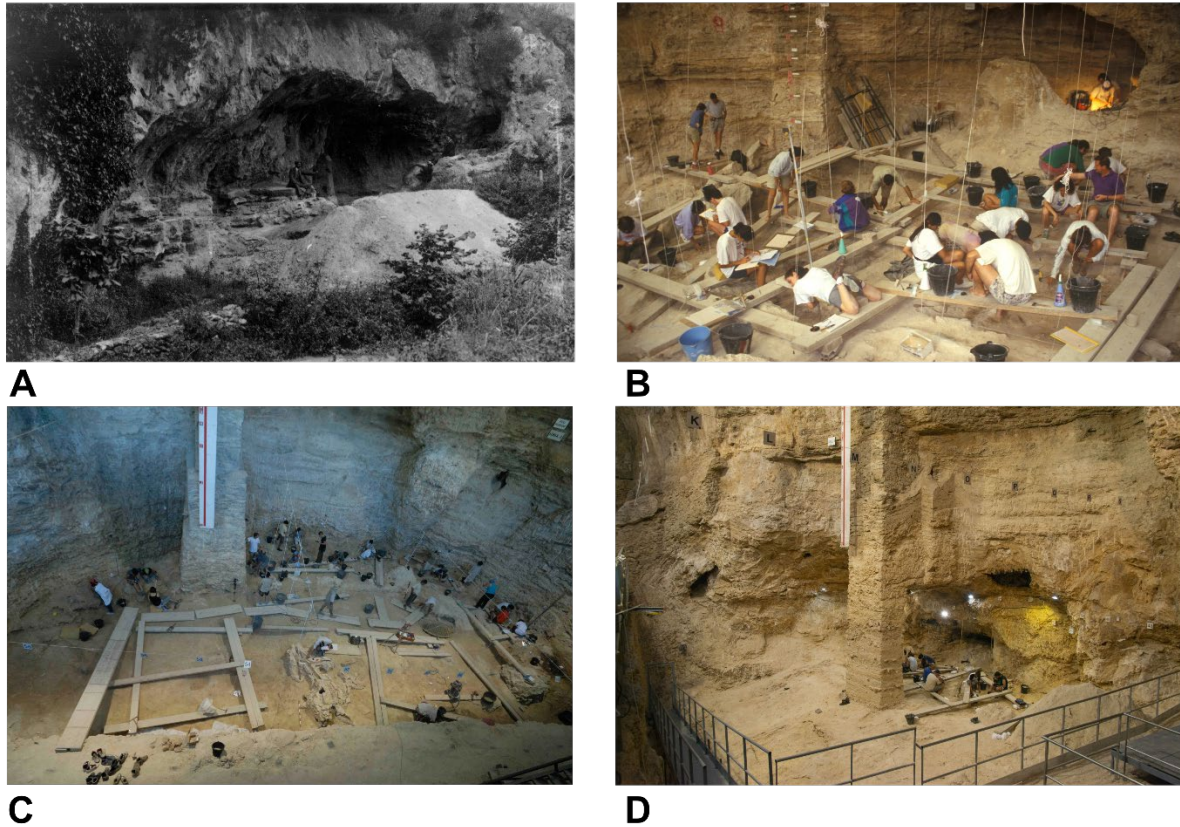


Figure 2. A) Amador Romaní in the site in 1924. B) Excavation of level J in 1994. C) Excavation of level O in 2015. D) Excavation on level R in 2022.

A general characteristic of the archaeological levels of Abric Romaní is the fragmentation of the lithic reduction sequences, although refitting studies have shown that some of them were carried out on the spot in well-defined knapping areas (Vaquero *et al.* 2007; 2012). The main objective of the lithic sequences was to obtain as many knapping products as possible, and these form the predominant category on all archaeological levels. Cores and retouched objects are scarce (Figure 3). Chert was the main exploited raw material, usually representing at least 80% of the whole lithic assemblage, followed by limestone and quartz (Gómez de Soler *et al.* 2020b). Chert was mainly collected in primary or sub-primary position in a regional range (between 15 and 20 km from the site), with fluctuations in the percentage of chert procured in outcrops approximately 30 km west (W) - north-west (NW) from the site (Gómez de Soler *et al.* 2020a; Soto *et al.* 2014).

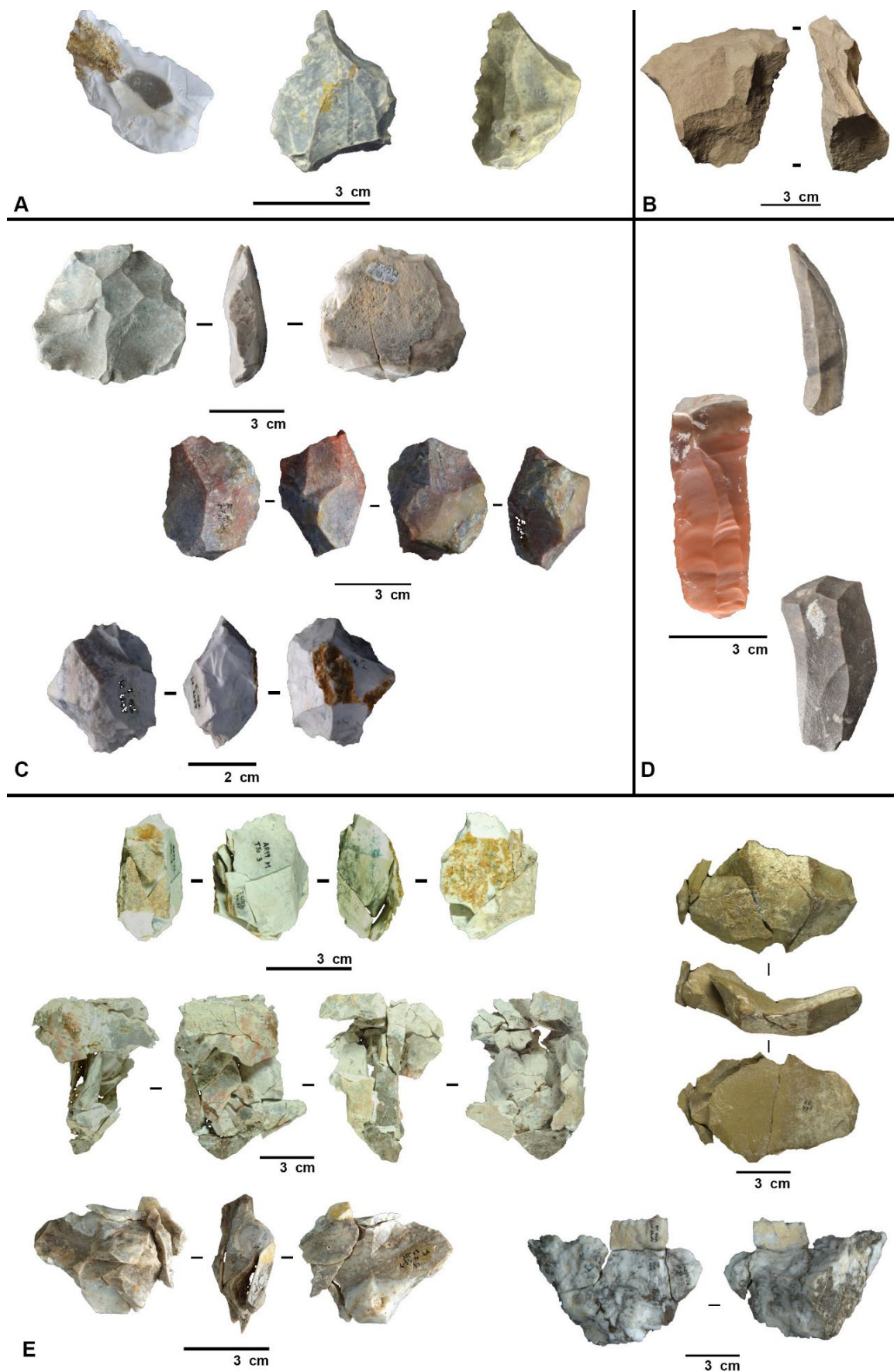


Figure 3. Lithic industry at Abric Romaní. A) Chert denticulate tools. B) Pseudo-Levallois lithic flake in limestone. C) Chert bifacial centripetal cores (discoïd and Levallois). D) Chert flake and laminar flake. E) Refits on chert, quartz and limestone (modified from Vallverdú *et al.* 2014: 228).

Technological analysis has also allowed us to describe different reduction sequences performed at the site (Bargalló 2014: Chapters 5, 6 & 8; Chacón, 2009; Chapters 8, 10 & 11; Chacón *et al.* 2013; Romagnoli *et al.* 2018; Vaquero, 1997: Chapters 5, 6 & 7; Vaquero *et al.* 2012, among others): tested cores without later transformation, hierarchical centripetal cores, Levallois method (essentially recurrent centripetal), discoid methods, polyhedral morphologies and core on flakes with some removals without any predetermined organisation. The distribution of the different strategies is not homogeneous on all levels. At the upper levels (level E), there is a tendency for hierarchical strategies. However, in the intermediary levels (levels I, J, K, L, M and N), there is a preference for non-hierarchical and expedient strategies. In lower levels O and P, the existence of hierarchical strategies is identified again, with a high number of cores and knapped products showing the use of the Levallois method (level O) and laminar production (level P). Levels Q and R are currently under study. The main retouched artifacts on all levels are denticulates and notches (up to 90%), but scrapers are also present (Figure 3).

The faunal assemblage presents 13 different taxa, although deer (*Cervus elaphus*) and horses (*Equus ferus*) are the most common species at all archaeological levels. Aurochs (*Bos primigenius*) and chamois (*Rupicapra pyrenaica*) are also present (Marín *et al.* 2017a; 2017b). The presence of rhinoceros (*Stephanorhinus hemitoechus*) has also been documented at various levels, although the remains are very scarce. Despite the high predominance of herbivores, some carnivore remains have also been recovered. These are more abundant in the upper part of the sequence (up to level E), where a cave environment allows the presence of these animals along with occasional dens. Apart from the natural intrusion of carnivores on levels B and O, the remains of *Lynx sp.* and *Felis silvestris* with cut marks have been documented as the result of their processing and consumption (Gabucio *et al.* 2014; 2017).

The skeletal profiles show a high presence of survival items: craniums, jaws and diaphysis fragments of long leg bones (Figure 4). This representation is attributed to the development of various transport strategies for medium-sized and large animals. The postcranial axial skeleton was transported only in a few events, and once at the site, it was highly sensitive to destruction due to taphonomic processes. However, the decision to transport or discard at the kill or butchering site was not made according to the size - weight difference (Marín *et al.* 2017a; 2017b).

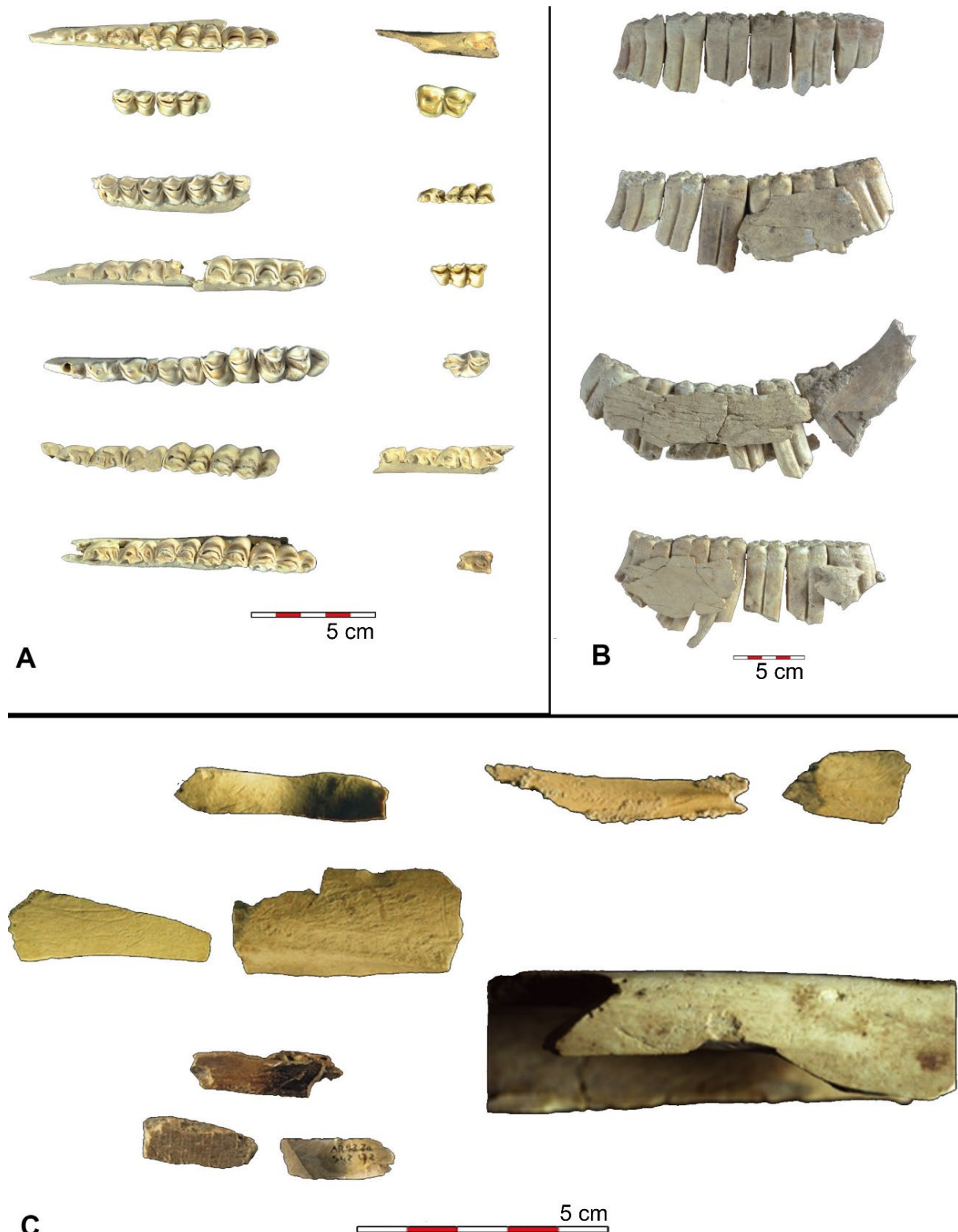


Figure 4. Examples of faunal remains from different levels of the Abric Romaní site: A) Mandibular specimens of *Cervus elaphus*. B). Mandibular specimens of *Equus ferus*. C) Specimens with anthropogenic and carnivore modifications (Photos P. Saladié & J. Marín IPHES-CERCA)

The sedimentary context of Abric Romaní is characterised by the dominance of travertine formation dynamics, which provide tufa deposits covering most of the archaeological levels and allowing an excellent preservation of the remains, especially wood imprints and hearths. Wood remains have been identified on all levels excavated on the large surface (from H to R)

(Figure 5). Their use for various activities has been documented: (1) as fuel, the wood imprints are documented as charred firewood on the combustion structures or as accumulated reserves; (2) as structural elements, to organise the occupied surface and; (3) as wooden objects and for tools, making it possible to document the use of wood by Neanderthals (Allué *et al.* 2017; Carbonell & Castro-Curel 1992; Castro-Curel & Carbonell 1995; Solé *et al.* 2013).



Figure 5. A) Wood imprint from level N (Photo IPHES-CERCA - Vallverdú *et al.* 2014: 230). B) Carbonised wood from level P; C–D) Examples of combustion structures from levels M (left) and P (right) (Photos IPHES-CERCA).

The preservation of numerous hearths has also been used as a proxy for recognising the activity areas, along with the spatial distribution of the lithic artifacts and faunal remains. Hearths played a central role in spatial organisation, as most activities were carried out around them. This gave rise to a spatial pattern characterised by well-defined hearth-related accumulations (Gabucio *et al.* 2017; Vallverdú *et al.* 2005; 2010; 2012; 2014; Vaquero & Pastó 2001; Vaquero *et al.* 2004; 2007; 2012).

The spatial documentation of the combustion structures of Abric Romaní supports the argument that the Neanderthals used fire for different purposes. The number of hearths comprises about 300 and shows different construction techniques. The most common combustion structures (>80%) are flat and without stones. There are also flat combustion structures with stones, within concavities with carved tails, in small pits with burned stones and sediments and in re-excavated holes (Carbonell *et al.* 2007; Vallverdú *et al.* 2012).

3. Chert outcrops

As previously mentioned, chert was the most exploited raw material by the Neanderthals that occupied the Abric Romani, representing over 80% of most of the archaeological levels (Gómez de Soler *et al.* 2020b). Systematic surveys performed in recent years have determined that the potential procurement areas are within a radius of 30 km from the site, where up to 32 chert outcrops have been located. The calculation of the chert abundance ratio (Soto *et al.* 2018), a quantitative approach to measure the raw material availability in specific areas, together with macroscopic and petrographic analyses, confirm the under-exploitation of the local raw materials (<10 km), attributing most of the procurement strategies to a regional framework (15-25 km) (Gómez de Soler *et al.* 2020a).

The main procurement areas are located between a 16 km (Sant Martí de Tous chert) and 24 km (Panadella chert) radius, indicating different procurement strategies and mobility patterns (Figure 6). For example, stone tool assemblages from levels M and Oa fall within a foraging radius, whereas level P, in part, suggests a logistical radius, suggesting a complex scenario of extensive knowledge and intensive exploitation of the landscape among Neanderthals.

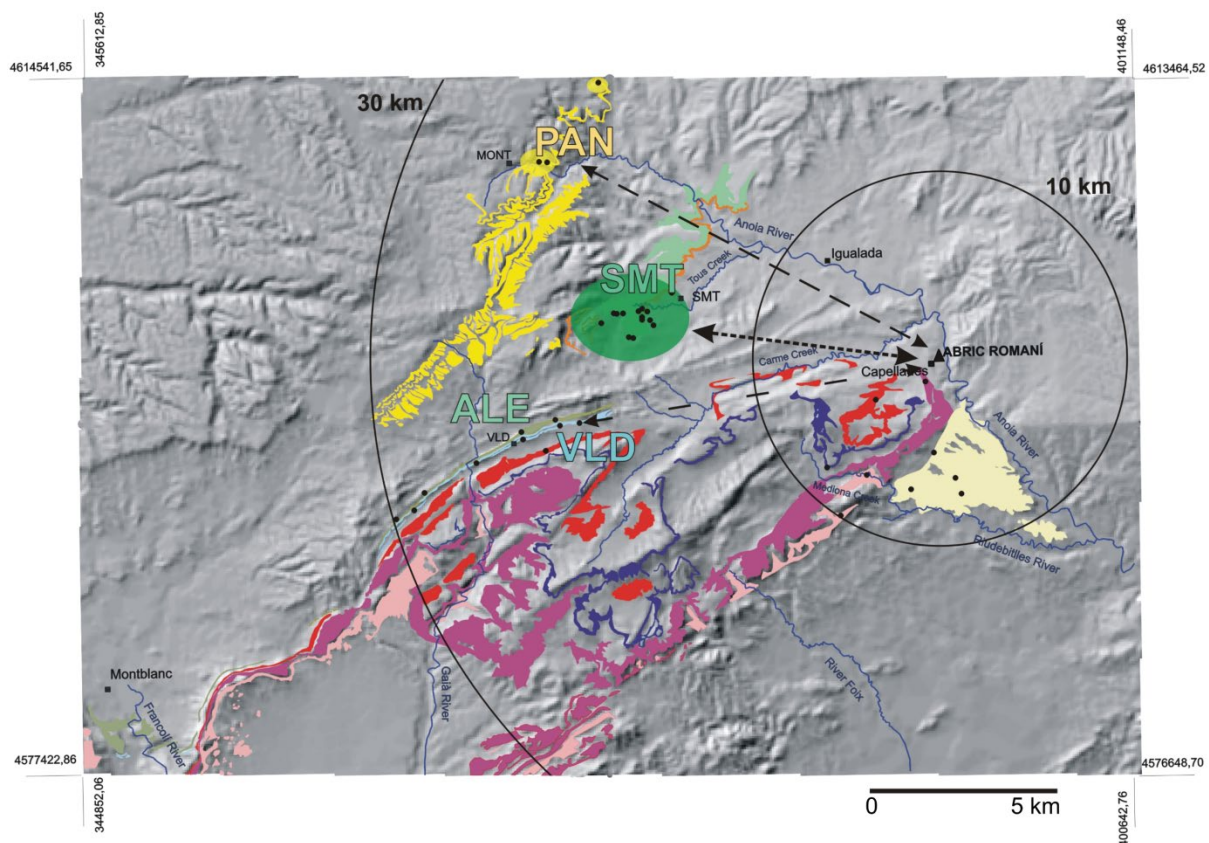


Figure 6. Location of the Sant Genís formation with its chert outcrops (green, SMT), the Montmaneu formation with the three described chert outcrops (yellow, PAN) and the Valldeperes (VLD) and Ca l'Alemany (ALE) cherts (light green and light blue, respectively). The black triangle on the right represents the Abric Romani site, and the black dots indicate the localised chert outcrops. Towns: MONT, Montmaneu; SMT, Sant Martí de Tous; VLD, Valldeperes (modified from Gómez de Soler *et al.* 2020a: 10).

3.1. The Sant Martí de Tous chert

The Sant Martí de Tous chert is included within the Sant Genís formation (Colldefons *et al.* 1994a), a Cenozoic lithostratigraphic unit which is part of the sedimentary filling of the Ebro Basin, an extensive triangular unit bordered by the Pyrenees and the Basque-Cantabrian

Ranges to the north, by the Iberian Ranges to the south and by the Catalan Coastal Ranges to the east. This depression is mainly drained by the Ebro River and corresponds to a tertiary sedimentary basin with Paleogene deposits formed by erosive processes affecting the bordering ranges.

The Sant Genís formation has a Priabonian age (Upper Eocene) and is part of the La Noguera Lacustrine system (Anadón *et al.* 1989), under the denomination of Upper Gray Lutites (Sáez 1987: 60). Currently, it has a maximum extent of 1.5 km width and 12 km length, with a NE-SW orientation, located between Sant Genís (Jorba) and Fillol (Sant Martí de Tous), with a surface area of approximately 5.6 km². It is formed by a succession of 400 m of sandy lutites of red colour, with horizontal lamination and ripples, inserted by occasional limestone layers with charophytes and gastropods (Colldefons *et al.* 1994a). In the cartographic maps, two formations divide it: one formed by red sandstones and marls, and the other by grey sandstones and marls, with local stratified gypsum (Peón & Alonso 1975).

In the locality of Sant Martí de Tous, where silicifications appear in red sandy lutites interlayered with red tabular limestones, they are associated with lacustrine shallow conditions or sabkha environment type. At the base of the formation, alternant layers of bedded nodular and laminated gypsums are present. Through the SW of the locality, these gypsum layers become massive gypsums with nodular chert (Ortí *et al.* 2007). These outcrops are located approximately 16 km from Abric Romaní.

Due to its great variability, it can be defined as heterogeneous chert. Macroscopically, it is characterised by fine-to-medium textures, with blue, grey and brown translucent colours with evaporite relicts. Microscopically, it is formed by microcrypto quartz (50 - 60%), with secondary gypsum (15 - 25%), disseminated, sparry calcite (5 - 10%) and dissolution and nodulisation structures. This heterogeneous character, represented in different shapes, sizes, colours and textures, also confers a highly variable aptitude for knapping, depending on the chosen block.

Applying the chert abundance ratio method (Soto *et al.* 2018) to the Sant Genís formation, we estimated a chert volume of .0052 km³ in an outcrop volume of .0207 km³, which means a density of .25 km³.

Two main sectors have been defined with high chert abundance: the Guinardera sector and the Fillol sector (Figure 7). In the Guinardera sector, we define two sections: Guinardera and Cal Perdut. The Guinardera section, with a 40 m sequence, contains three chert outcrops in the primary position (from bottom to top: Guinardera -01, -02 and -03). Between the chert outcrops of Guinardera-02 and Guinardera-03, we localised and excavated two chert workshops: the Guinardera workshop (from different chronologies) and the Guinardera Nord workshop (for the configuration of gunflints). The two workshops are located on two different slopes on a small hill, named 'Serral dels Concos', 300 m apart from each other (Gómez de Soler *et al.* 2021).

The Cal Perdut section presents five chert outcrops in the primary position in an 80 m sequence (from bottom to top: Cal Perdut -01, -02, -03, -04 -PER- and in the same layer as Cal Perdut -04, Mas de Tous, the toponym that gives it its name).

At the Fillol sector (Ortí *et al.* 2007), we define two sections: Cal Tomàs and Fillol. The Cal Tomàs section contains three chert outcrops in a 40 m sequence, formed of 20 m white marls with chert nodules at the base (Cal Tomàs -01 -CT-01-); 10 m of red lutites with chert (Cal Tomàs -02 -CT-02-), corresponding to the base of the Fillol section and 10 m of grey lutites with chert nodules at top (Cal Tomàs -03 -CT-03-).

The Fillol section is formed of 20 m of alternant red massive lutites with secondary gypsum in its basal part, red lutites and cherts (Cal Calaf -CAL- 01 and -02) with banded stratifications and nodular and meganodular structures.

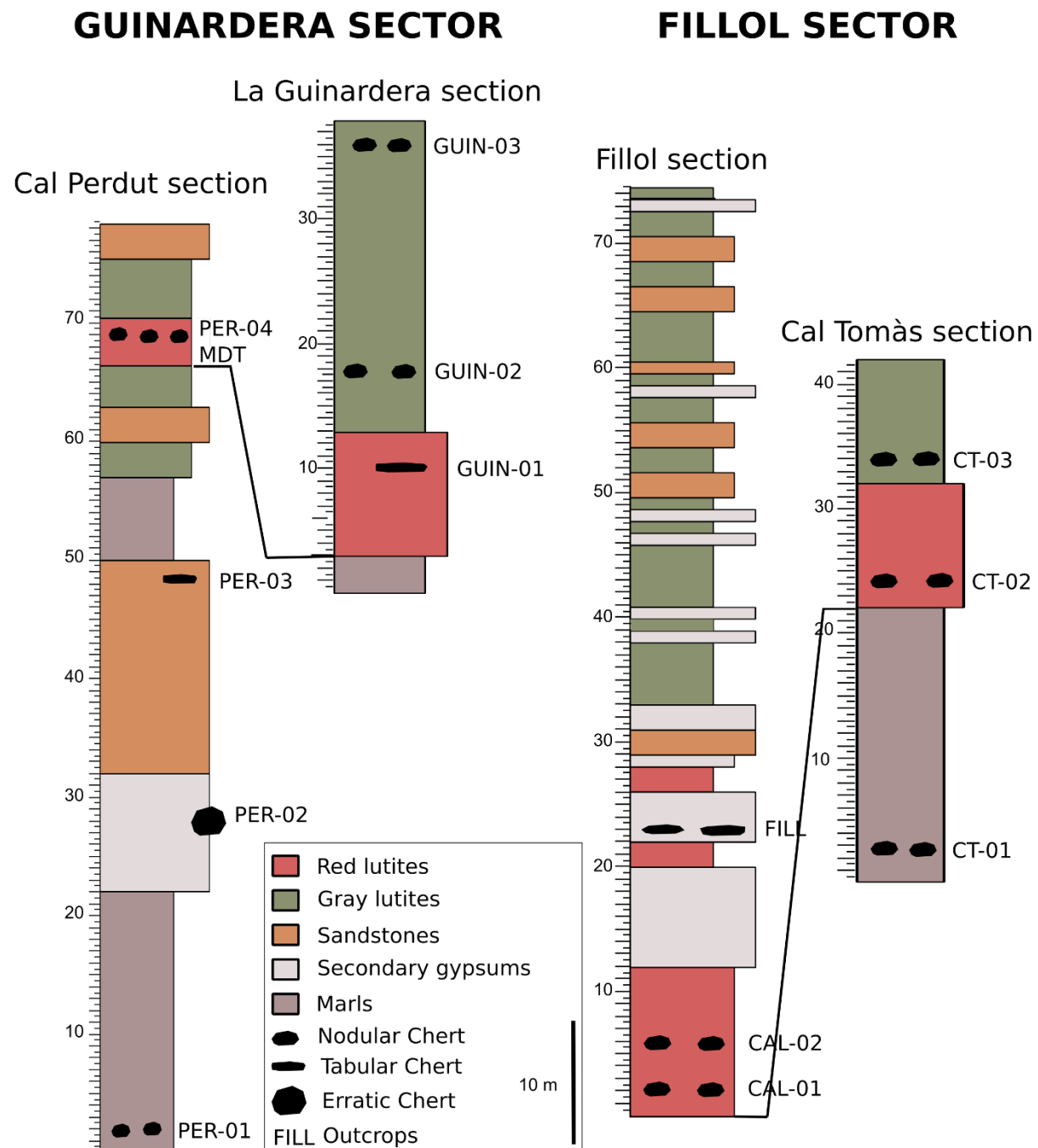


Figure 7. Synthetic stratigraphic sequence of the Sant Genís formation at the two main sectors containing chert outcrops, and its stratigraphic position (Gómez de Soler *et al.* 2023b: 8).

3.2. The Panadella chert

The Panadella chert is located in the Montmaneu formation at the NE margin of the Ebro Basin (Catalonia, Spain) and dates back to the Rupelian (Lower Oligocene). It is formed of 120 m of light grey stratified limestones with bedded-nodular chert, associated with the La Segarra lacustrine system (Figure 8). This chert is macroscopically characterised by its homogeneity, with opaque greenish black colours, very fine texture and bioclasts that generate mudstone-wackestone textures. Thin sections show a micro-cryptocrystalline quartz matrix with micritic calcite, abundant charophytes and scattered detrital quartz. These features confer excellent qualities for knapping (Gómez de Soler *et al.* 2020b).

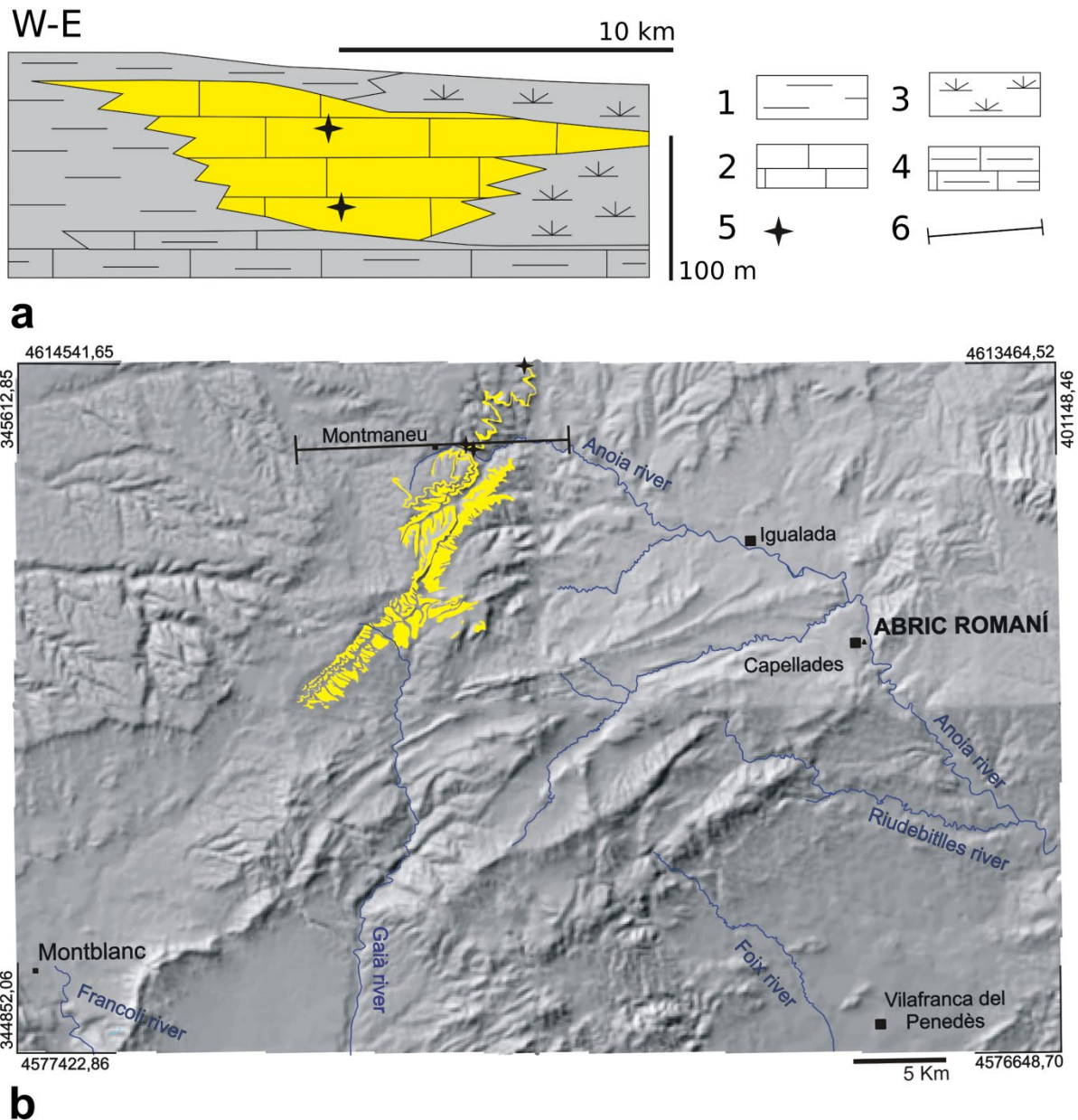


Figure 8. a) Synthetic stratigraphic section of the Montmaneu Formation in the Panadella area, based on Colldefons *et al.* (1994a). Legend: 1, Civit Mb. from the Montmaneu Fm. Laminated marls and limestone-marls; 2, Montmaneu Fm. Stratified micritic limestones with ostracodes and charophytes; 3, Calaf Fm. Limestones, marls and ignites; 4, Sta. Coloma Fm. Limestones and marls with micritic-biomicritic limestones; 5, Chert locations; 6, Synthetic stratigraphic section. b) Map of the Montmaneu formation with chert outcrops and the location of Abric Romaní and main fluvial courses, as well as the location of the synthetic stratigraphic section (modified from Gómez de Soler *et al.* 2020b: 3).

Only three outcrops of the Panadella chert (PAN) have been located, considering the Montmaneu Formation, a non-continuous chert formation. Raw material sources are circumscribed to the northern part of this formation. The first two outcrops are close to each other. They are grouped together and named Panadella, the toponym that gives name to the type of chert, and are situated at the entrance of Montmaneu town (Anoia, Barcelona). The third one is situated in an old quarry at Veciana (Anoia, Barcelona); this outcrop is known as Pla de la Casilla, defined by Ortega *et al.* 2016 (Figure 9). The average distance of the three outcrops from Abric Romaní is 24 km.



Figure 9. a) PAN outcrop and detail of one of the layers with chert. b) PC outcrop and detail of one of the layers yielding chert (from Gómez de Soler *et al.* 2020b: 8).

3.3. The Valdeperes chert

The Valdeperes chert is formed in the homonymous formation. Initially, the Valdeperes formation was assigned a Lutetian age (Benzaquen *et al.* 1972; Anadón 1978;). Later, Anadón and Marzo (1986) attributed it a possible Bartonian age, which was ratified by Ortí *et al.* (2007) definitively attributing this age to this formation (Middle Eocene). It extends from the town of Vilaverd, in the province of Tarragona, and runs parallel to the Pre-littoral Mountain Range until past Valdeperes (Pontils) in the province of Barcelona, extending along 55 km. It is made up of two stretches of white chalky dolomites with chert and limestone, which intersperse the levels of calcareous and dolomitic marls. It has a width of approximately 120 m. In large areas, it is characterised by nodular gypsum with chert, developed within dolomitic sections, reaching, in some cases, the predominant lithofacies (*e.g.*, in the location of Valdeperes) (Anadón & Marzo 1986). The study of gypsum levels shows that these evaporites have a hydration origin of diagenetic primary nodular anhydrites (Anadón 1978).

The depositional environment corresponds to very shallow lakes of the beach sabkha-type lake, characterised by the deposition of carbonate muds and marls exposed to emersions in large areas, with the development of diagenetic evaporites, as well as dolomitisation of the initial calcareous muds.

Different chert outcrops have been defined, highlighting those of Vallespinosa, Valdeperes and Cal Salvat (Figure 10). The average distance of the three outcrops from Abric Romaní is 24 km.

The Valdeperes formation chert exhibits varying colours of bluish, greyish and brownish. Light colours have opaque transparency, while dark colours have translucent transparency. Both have different aspects. Its texture ranges from fine to medium grains. In many cases, evaporitic relicts are lenticular gypsum crystals or gypsum crystal pseudomorphs. From a microscopic viewpoint, it is formed of a microquartz with secondary gypsum.



c Figure 10. Some outcrops of the Valdeperes chert. a) Left, general view of the Vallespinosa outcrop (MONT); right, detail of the silicifications. b) Left, general view of the Valdeperes siliceous outcrop (VLD); right, detail of the silicifications. c) Left, general view of the Cal Salvat outcrop (SAL); right, detail of silicifications

3.4. The Ca l'Alemany chert

The Ca l'Alemany chert is located in the Bosc d'en Borràs formation, Bartonian age dated (Middle Eocene). Its chert outcrops extend between the towns of Vallespinosa and Valdeperes and lie on the Valdeperes formation. Towards the NE, it passes to the La Portella formation. and, in part, to the Fontanelles formation. To the SW of Pontils, it loses development, partially becoming a formation made up of lutites, red sandstones and gypsum.

It has a sequence of 95 m and is characterised by two carbonate units separated by an intermediate unit of lutites and red marls with thin limestone levels. The carbonate tranches are made up of grey and brown micritic and biomicritic limestones with chert that intersperses the levels of marls and lignites (Anadón 1978; Colldefons *et al.* 1994b; Ortí *et al.* 2007). It is associated with marshy depositional environments with abundant emersions and traces of soil formation in the primitive carbonates deposited.

Different chert outcrops have been defined, highlighting those of Els Solans and Ca l'Alemany (Figure 11). The average distance of the three outcrops from Abric Romaní is 25 km.

The Bosc d'en Borrás formation cherts have brownish and bluish greyish colours, with dark tones for the brownish and light tones for the greyish. It presents matt aspect and translucent tones with a fine texture and evaporitic relicts. Microscopically, it is formed mainly by microquartz, followed by cryptoquartz and length-fast chalcedony. As non-siliceous components, secondary gypsum and sparitic carbonates are described.



a



b



Figure 11. Some outcrops of the Ca l'Alemany chert. a) Left, general view of the Els Solans outcrop (SOL); right, detail of the silicifications. b) Left, general view of the Ca l'Alemany siliceous outcrop (ALE); right, detail of the silicifications.

4. Conclusions

The Abric Romaní site offers an amazing Middle Palaeolithic sequence, allowing us to analyse in detail several aspects of Neanderthal lifeways. The chert sources of the region show a rich territory where lithic raw materials were exploited since at least the Middle Palaeolithic up to historical times.

For Abric Romaní, the main procurement areas were the Sant Martí de Tous chert, approximately 16 km in straight line distance from Abric Romaní, followed by the Panadella chert, approximately 24 km, and the Valdeperes chert and Ca l'Alemany chert, with distances of 24 and 25 km, respectively.

Regarding the chert outcrops presented, Sant Martí de Tous chert is characterised by its great heterogeneity and concentration in a delimited area, which played a key role as a source, supply route and distribution of raw material throughout prehistoric times. In contrast, the Panadella chert is characterised by its great homogeneity and quality knapping but with a scarce presence in the territory, which causes a lower procurement and exploitation of this chert variety.

Finally, the cherts from Valdeperes and Ca l'Alemany, both quite heterogeneous, with a variability in knapping aptitudes are present in the territory in a similar manner. The Valdeperes and Ca l'Alemany cherts are somewhat continuous over an extension of approximately 55 km long between the provinces of Tarragona and Barcelona.

The 13th ISKM virtual trip presented here offered the symposium participants the possibility to know, first hand, a complex territory with abundant and varying lithic resources exploited from the Middle Palaeolithic up to now, becoming a key area for human occupations.

Acknowledgements

Funding for this research was provided by the Catalan Government research group nos. 2017 SGR 859 and 2017 SGR 836 and by the Spanish Government projects PID2019-103987GB-C31 and PID2019-103987GB-C33. The research of B.G.S. and M.G.CH. was funded by the CERCA Programme/Generalitat de Catalunya. M.S. research was funded by the UAM- 2019 Tomás y Valiente Program. M.S.R was funded by a PTA contract (PTA2018-016561-I). The Institut Català de Paleoecologia Humana i Evolució Social (IPHES-CERCA) received financial support from the Spanish Ministry of Science and Innovation through the 'María de Maeztu' program for Units of Excellence (CEX2019-000945-M).

Finally, we would like to thank the anonymous reviewers for their comments and suggestions that have improved the manuscript, as well as the members of the editorial team of the JLS Dr. Anne Ford, Dr. Otis Crandell and Dr. Alejandro Prieto.

Data accessibility statement

All data generated or analysed during this study are included in this published article.

References

- Allué, E., Solé, A. & Burguet-Coca, A. 2017, Fuel exploitation among Neanderthals based on the anthracological record from Abric Romaní (Capellades, NE Spain). *Quaternary International*, 431: 6-15. DOI: <https://doi.org/10.1016/j.quaint.2015.12.046>
- Anadón, P. 1978, El Paleógeno inferior anterior a la trasgresión "biarritziense" (Eoceno medio) entre los ríos Gaià y Ripoll (Provincias de Tarragona y Barcelona). *Estudios Geológicos*, 34: 431-440. (in Spanish) ("Lower Paleogene before the "Biarritzian" transgression (middle Eocene) between the Gaià and Ripoll rivers (Tarragona and Barcelona Provinces)

- Anadón, P. & Marzo, M. 1986, Sistemas deposicionales eocenos del margen oriental de la Cuenca del Ebro: Sector Igualada-Montserrat. In: *XI Congreso Español de Sedimentología* (Anadón, P. & Cabrera, L., Eds.), Universidad de Barcelona, Barcelona: 59 p. (in Spanish) (“Eocene depositional systems of the eastern margin of the Ebro Basin: Igualada-Montserrat sector.”). URL: <http://hdl.handle.net/10261/147291>
- Anadón, P., Cabrera, L., Colldefons, B. & Sáez, A. 1989, Los sistemas lacustres del Eoceno superior y Oligoceno del sector oriental de la Cuenca del Ebro. *Acta Geológica Hispánica*, 24: 205-230. (in Spanish) (“The Upper Eocene and Oligocene lacustrine systems of the eastern Ebro Basin”). URL: <https://digital.csic.es/handle/10261/6830>
- Bargalló, A. 2014. *Anàlisi tecnològica del assentament neandertals del nivell O de l'Abric Romaní (Barcelona, Espanya)*. PhD at the Història i Història de l' Art Department, Universitat Rovira i Virgili, Tarragona, 308 p. (in Catalan) (“Technological analysis of the Neanderthal settlement of Abric Romaní level O (Barcelona, Spain)”).
- Benzaquen, M., Nuñez Galiano, A. & Martínez del Olmo, W. 1972, Mapa Geológico de España. Escala 1:50.000. Hoja nº418 (Montblanch). Serie Magna. IGME. Madrid. (in Spanish) (“Geological Map of Spain. Scale 1:50.000. Sheet nº418 (Montblanch)”) Bischoff, J.L., Julia, R. & Mora, R. 1988, Uranium-series dating of the Mousterian occupation at Abric Romani, Spain. *Nature*, 332(6159): 68-70. DOI: <https://doi.org/10.1038/332068a0>
- Burjachs, F., López-García, J.M., Allué, E., Blain, H.-A., Rivals, F., Bennisar, M. & Expósito, I. 2012, Palaeoecology of Neanderthals during Dansgaard-Oeschger cycles in northeastern Iberia (Abric Romaní): from regional to global scale. *Quaternary International*, 247: 26-37. DOI: <https://doi.org/10.1016/j.quaint.2011.01.035>
- Carbonell, F. & Castro-Curel, Z. 1992, Palaeolithic wooden artefacts from the Abric Romaní (Capellades, Barcelona, Spain). *Journal of Archaeological Science*, 19: 707-719. DOI: [https://doi.org/10.1016/0305-4403\(92\)90040-A](https://doi.org/10.1016/0305-4403(92)90040-A)
- Carbonell, E., Lorenzo, C. & Vallverdú, J. 2007, Centralidad espacial y operativa de los neanderthales. Análisis espacial diacrónico de las actividades de combustión en el Abric Romaní (Anoia, Capellades, Barcelona). In: *El Universo Neanderthal I* (Baquedano, E., Ed.), Arquex & Ibersaf Editores, Madrid: p. 197-219. (in Spanish) (“Spatial and operational centrality of Neanderthals. Diachronic spatial analysis of combustion activities in Abric Romaní (Anoia, Capellades, Barcelona)”)
- Castro-Curel, Z. & Carbonell, E. 1995, Wood pseudomorphs from level I at Abric Romaní, Barcelona, Spain. *Journal of Field Archaeology*, 22: 376-384. DOI: <https://doi.org/10.1179/009346995791974206>
- Colldefons, B., Anadón, P. & Cabrera, L. 1994a, Litoestratigrafía del Eoceno superior-Oligoceno inferior de la zona oriental de la Cuenca del Ebro. Sector Igualada-Santa Coloma de Queralt. *Geogaceta*, 15: 55-58. (in Spanish) (“Upper Eocene-Lower Oligocene lithostratigraphy of the eastern Ebro Basin. Igualada-Santa Coloma de Queralt sector”). URL: <http://hdl.handle.net/10261/144462>
- Colldefons, B., Anadón, P. & Cabrera, L. 1994b, Nuevos datos sobre la litoestratigrafía del Eoceno-Oligoceno inferior de la zona suroriental de la Cuenca del Ebro (Sector de Pontils-Montblanc, provincias de Tarragona y Barcelona). *Geogaceta*, 16: 98-101. (in Spanish) (“New data on the Eocene-Lower Oligocene lithostratigraphy of the southeastern part of the Ebro Basin (Pontils-Montblanc sector, Tarragona and Barcelona provinces)”).

- Chacón, M.G. 2009. *El Paleolítico medio en el suroeste europeo: Abric Romaní (Capellades, Barcelona, España), Payre (Rompón, Ardèche, Francia) y Tournal (Bize, Aude, Francia). Análisis comparativo de los conjuntos líticos y los comportamientos humanos*. PhD at the Història i Història de l'Art Department, Universitat Rovira i Virgili, Tarragona, 607 p. (in Spanish) (“The Middle Paleolithic in southwestern Europe: Abric Romaní (Capellades, Barcelona, Spain), Payre (Rompón, Ardèche, France) and Tournal (Bize, Aude, France). Comparative analysis of lithic assemblages and human behaviors”).
- Chacón, M.G., Bargalló, A., Gómez de Soler, B., Picin, A., Vaquero, M. & Carbonell, E. 2013. Continuity Or Discontinuity of Neanderthal technological Behaviours During MIS 3: Level M And Level O of The Abric Romaní Site (Capellades, Spain). In: Pleistocene foragers on the Iberian Peninsula: their cultures and environment. Festschrift in honour of Gerd-Christian Wenger for his sixtieth birthday (Pastoors, A. & Auffermann B., Eds.), Wissenschaftliche Schriften des Neanderthal Museums Vol. 7., Neanderthal Museum, Mettmann: pp. 55-84.
- Gabucio, M.J., Cáceres, I., Rodríguez-Hidalgo, A., Rosell, J. & Saladié, P. 2014, A wildcat (*Felis silvestris*) butchered by Neanderthals in the level O of the Abric Romaní site (Capellades, Barcelona, Spain). *Quaternary International*, 326-327: 307-318. DOI: <https://doi.org/10.1016/j.quaint.2013.10.051>
- Gabucio, M.J., Fernández-Laso, M.C. & Rosell, J. 2017, Turning a rock shelter into a home. Neanderthal use of space in Abric Romaní levels M and O. *Historical Biology*, 30: 743-766. DOI: <https://doi.org/10.1080/08912963.2017.1340470>
- Gómez de Soler, B., Soto, M., Vallverdú, J., Vaquero, M., Bargalló, A., Chacón, M.G., Romagnoli, F. & Carbonell, E. 2020a, Neanderthal lithic procurement and mobility patterns through a multi-level study in the Abric Romaní site (Capellades, Spain). *Quaternary Science Reviews*, 237: 106315. DOI: <https://doi.org/10.1016/j.quascirev.2020.106315>
- Gómez de Soler, B., Soto, M., Vallverdú, J., Bargalló, A., Chacón, M.G., Romagnoli, F. & Vaquero, M. 2020b, The Panadella chert (Montmaneu Formation): a high-quality raw material in the Abric Romaní sequence (NE Iberian Peninsula). *Archaeological and Anthropological Sciences*, 12: 252. DOI: <https://doi.org/10.1007/s12520-020-01198-9>
- Gómez de Soler, B., Soares-Remiseiro, M., Arteaga-Briebe, A., Borràs, G., Cámara, J., Campeny, G., Chacón, M.G., Fernández-Marchena, J. L., Guinart, V., López, G., Mas, B., Soto, M., Suesta, A., Shkarinska K., Ramírez-Pedraza, I., Val-Peón, C. & Vallverdú, J. 2021, The Guinardera Quarry (Sant Martí de Tous, Barcelona). A new chert exploitation location during historical times. *Journal of Lithic Studies*, 8(2): 24. DOI: <https://doi.org/10.2218/jls.6546>
- Gómez de Soler, B., Allué, E., Cámara, J., Campeny, G., Chacón, M.G., Díez-Canseco, C., Guinart, V., Mas, B., Soares-Remiseiro, M., Soto, M., Suesta, A. & Vallverdú, J. 2023a. Cal Sitjo: a new Mesolithic to Neolithic sequence in a chert-rich region (Sant Martí de Tous, NE Iberia). *Journal of Lithic Studies*, 10(2): 25. DOI: <https://doi.org/10.2218/jls.7487>

- Gómez de Soler, B., Soto, M., Carrancho, Á., Gispert-Guirado, F., Mommsen, H., Morales J. I., Muñoz del Pozo, A., Roldám, C., Eixea, A., Chacón, M.G., Soares-Remiseiro, M. & Vallverdú, J. 2023b. A multi-technique approach to characterization: the Sant Martí de Tous chert as a prehistoric resource for the NE of the Iberian Peninsula. *Archaeological and Anthropological Sciences*, 15: 85. DOI: <https://doi.org/10.1007/s12520-023-01780-x>
- Marín, J., Saladié, P., Rodríguez-Hidalgo, A., Carbonell, E. 2017a, Ungulate carcass transport strategies at the Middle Palaeolithic site of Abric Romaní (Capellades, Spain). *Comptes rendus Palevol*, 16: 103-121. DOI: <https://doi.org/10.1016/j.crpv.2015.11.006>
- Marín, J., Saladié, P., Rodríguez-Hidalgo, A., Carbonell, E. 2017b, Neanderthal hunting strategies inferred from mortality profiles within the Abric Romaní sequence. *PloS one*, 12: e0186970. DOI: <https://doi.org/10.1371/journal.pone.0186970>
- Ortega, D., Terradas, X., Roqué, C., Ibáñez, J., Beamud, E. & Larrasoana, J. C. 2016, Caracterización Petrológica Del Sílex de La Formación Calizas de Montmaneu (Sector Oriental de La Cuenca Del Ebro). *Geogaceta*, 60: 95–98. (in Spanish) (“Petrological Characterization of the Montmaneu Limestones Formation (Eastern Sector of the Ebro Basin).
- Ortí, F., Rosell, L., Inglès, M. & Playà, E. 2007, Depositional models of lacustrine evaporites in the SE margin of the Ebro Basin (Paleogene, NE Spain). *Geologica Acta*, 5(1): 19-34.
- Peón A. & Alonso, F. 1975, *Mapa Geológico de España. Escala 1:50.000. Hoja nº391 (Igualdada)*. Serie Magna. IGME. Madrid. (in Spanish) (“Geological Map of Spain. Scale 1:50.000. Sheet nº391 (Igualdada)”)
- Romagnoli, F., Gómez de Soler, B., Bargalló, A., Chacón, M.G. & Vaquero, M. 2018. Here and now or a previously planned strategy? Rethinking the concept of ramification for micro-production in expedient contexts: implications for Neanderthal socio-economic behavior. *Quaternary International*, 474: 168-181. DOI: <https://doi.org/10.1016/j.quaint.2017.12.036>
- Sáez, A. 1987, *Estratigrafía y sedimentología de las formaciones lacustres del tránsito Eoceno-Oligoceno del NE de la Cuenca del Ebro*. PhD at the Geología Dinámica Department, Universitat de Barcelona, Barcelona, 359 p. (in Spanish) (“Stratigraphy and sedimentology of the lacustrine formations of the Eocene-Oligocene transit of the NE Ebro Basin).
- Sharp, W.D., Mertz-Kraus, R., Vallverdú, J., Vaquero, M., Burjachs, F., Carbonell, E. & Bischoff, J.L. 2016, Archeological deposits at Abric Romaní extend to 110 ka: U-series dating of a newly cored, 30 meter-thick section. *Journal of Archaeological Science: Reports*, 5: 400-406. DOI: <https://doi.org/10.1016/j.jasrep.2015.12.015>
- Solé, A., Allué, E. & Carbonell, E. 2013, Hearth-related wood remains from Abric Romaní layer M (Capellades, Spain). *Journal of Anthropological Archaeology*, 69: 535-559. URL: <http://www.jstor.org/stable/24393938>
- Soto, M., Gómez de Soler, B., Vallverdú, J. & Vaquero, M. 2014, Potential siliceous sources during Prehistory: Results of prospecting in the East margin of the Ebro Basin (NE Iberian Peninsula). *Journal of Lithic Studies*, 1(1): 293-318. DOI: <https://doi.org/10.2218/jls.v1i1.772>

- Soto, M., Gómez de Soler, B. & Vallverdú, J. 2018, The chert abundance ratio (CAR): a new parameter for interpreting Palaeolithic raw material procurement. *Archaeological and Anthropological Sciences*, 10(8): 2027-2046. DOI: <https://doi.org/10.1007/s12520-017-0516-3>
- Vallverdú, J., Allué, E., Bischoff, J.L., Cáceres, I., Carbonell, E., Cebrià, A., García-Antón, D., Huget, R., Ibañez, N., Martínez, K., Pastó, I., Rosell, J., Saladié, P. & Vaquero, M. 2005, Short human occupations in the Middle Palaeolithic level i of the Abric Romaní rock-shelter (Capellades, Barcelona, Spain). *Journal of Human Evolution*, 48(2): 157-174. DOI: <https://doi.org/10.1016/j.jhevol.2004.10.004>
- Vallverdú, J., Vaquero, M., Cáceres, I., Allué, E., Rosell, J., Saladié, P., Chacón, G., Ollé, A., Canals, A. & Sala, R. 2010, Sleeping activity area within the site structure of archaic human groups. *Current Anthropology*, 51: 137-145. DOI: <https://doi.org/10.1086/649499>
- Vallverdú, J., Gómez de Soler, B., Vaquero, M. & Bischoff, J.L. 2012, The Abric Romaní Site and the Capellades Region. In: High Resolution Archaeology and Neanderthal Behavior: Time and Space in Level J of Abric Romaní (Capellades, Spain) (Carbonell, E., Ed.). Vertebrate Paleobiology and Paleoanthropology Book Series. Springer, Dordrecht: p. 19-46.
- Vallverdú, J., Allué, E., Bargalló, A., Cáceres, I., Campeny, G., Chacón, M.G., Gabucio, M.J., Gómez de Soler, B., López-García, J.M., Fernández-García, M., Marín, J., Romagnoli, F., Saladié, P., Solé, A., Vaquero, M. & Carbonell, E. 2014, Abric Romaní (Capellades, Anoia). In: Pleistocene and Holocene hunter-gatherers in Iberia and the Gibraltar Strait: the current archaeological record (Sala Ramos, R., Ed.), Universidad de Burgos & Fundación Atapuerca, Burgos: p. 221-231.
- Vaquero, M. 1997. *Tecnología lítica y comportamiento humano: organización de las actividades técnicas y cambio diacrónico en el Paleolítico Medio del Abric Romaní (Capellades, Barcelona)*. PhD at the Història i Història de l'Art Department, Universitat Rovira i Virgili, Tarragona, 872 p. (in Spanish) (“Lithic technology and human behavior: organization of technical activities and diachronic change in the Middle Paleolithic of Abric Romaní (Capellades, Barcelona)”).
- Vaquero, M., Rando, J. M. & Chacón, M.G. 2004, Neanderthal Spatial Behavior and Social Structure: Hearth-related Assemblages from the Abric Romaní Middle Palaeolithic Site. In: Settlement dynamics of the Middle Paleolithic and Middle Stone Age II (N.J. Conard, Ed.), Tübingen: Kerns Verlag: p. 367-392.
- Vaquero, M., Allué, E., Bischoff, J.L., Burjachs, F. & Vallverdú, J. 2013, Environmental, depositional, and cultural changes in the Upper Pleistocene and Early Holocene: the Cinglera del Capelló sequence (Capellades, Spain). *Quaternaire*, 24: 49-64. DOI: <https://doi.org/10.4000/quaternaire.6481>
- Vaquero, M., Chacón, M.G., García-Antón, M.D., Gómez de Soler, B., Martínez, K. & Cuartero, F. 2012, Time and space in the formation of lithic assemblages: the example of Abric Romaní Level J. *Quaternary International*, 247: 162-181. DOI: <https://doi.org/10.1016/j.quaint.2010.12.015>
- Vaquero, M., Chacón, M.G. & Rando, J.M. 2007, The interpretative Potential of Lithic refits in a Middle Paleolithic Site: the Abric Romaní (capellades, Spain). In: Fitting rocks. Lithic refitting Examined (A. Schurmans and M. de Bie, Eds.). Oxford: Archaeopress. BAR International Series S1596: p. 75-89.

Vaquero, M. & Pastó, I. 2001, The definition of spatial units in Middle Palaeolithic sites: the hearth-related assemblages. *Journal of Archaeological Science*, 28(11): 1209-1220. DOI: <https://doi.org/10.1006/jasc.2001.0656>

Vidal, L.M. 1913, Abrich Romaní, Estació Agut, Cova del Or, o dels Encantats. Estacions prehistòriques de les èpoques musteriana, magdaleniana y neolítica a Capellades y Santa Creu d'Olorde (provincia de Barcelona). *Anuari de l'Institut d'Estudis Catalans*, MCMXI-XII: 267-302. (in Catalán) (“Abrich Romaní, Estació Agut, Cova del Or, or Encantats. Prehistoric stations from the Mousterian, Magdalenian and Neolithic periods in Capellades and Santa Creu d'Olorde (Barcelona province)”).

Viaje virtual al yacimiento del Abric Romaní y sus zonas de aprovisionamiento lítico

Bruno Gómez de Soler^{1,2}, María Soto^{3,4}, Miguel Soares-Remiseiro^{1,2},
M. Gema Chacón^{1,2,5}

1. Institut Català de Paleoecologia Humana i Evolució Social (IPHES-CERCA). Zona Educacional 4, Campus Sescelades URV (Edifici W3), 43007 Tarragona, España. Email: Gómez de Soler: bgomez@iphes.cat; Soares-Remiseiro: masoares@iphes.cat; Chacón: gchacon@iphes.cat
 2. Universitat Rovira i Virgili (URV), Departament d'Història i Història de l'Art. Avinguda de Catalunya 35, 43002 Tarragona, España.
 3. Madrid Institute for Advanced Study (MIAS). Casa Velázquez. Ciudad Universitaria C/de Paul Guinard, 3 28040, Madrid, Spain - Universidad Autónoma de Madrid. C/ Einstein 13 Pabellón C 1ª Planta, 28049, Madrid, España. Email: marial.soto@uam.es
 4. Universidad Autónoma de Madrid. Departamento de Prehistoria y Arqueología. Facultad de Filosofía y Letras. Ciudad Universitaria de Cantoblanco, 28049, Madrid, España.
 5. UMR7194 - HNHP (CNRS - MNHN -UPVD - Sorbonne Universités). Palais de Chaillot. Musée de l'Homme, 17 Place du Trocadéro, 75016 París, Francia.
-

Resumen:

En este trabajo se presenta la salida de campo virtual organizada con motivo del 13th International Symposium on Knappable Materials organizado en Tarragona del 4 al 6 de octubre de 2021, en el que se muestra el yacimiento de Abric Romaní (NE de la Península Ibérica) y las zonas de captación de sílex situadas en un radio de 30 km, la cual tuvo que ser grabada por la situación de pandemia causada por la COVID-19.

La sección del Abric Romaní consiste en una presentación general del yacimiento del Paleolítico Medio, incluyendo una breve descripción de su secuencia estratigráfica de 50 m, donde se han identificado más de 20 niveles arqueológicos datados entre 110 y 39 ka BP, y se presentan de manera general los principales rasgos de los conjuntos arqueológicos. A continuación, se han introducido los afloramientos silíceos de los sílex de la Panadella a unos 24 km del Abric Romaní; los afloramientos de sílex de Sant Martí de Tous a 16 km y los afloramientos de sílex de Valldeperes y Ca l'Alemanya a distancias de 24 y 25 km, respectivamente. En todos los casos se describen las formaciones geológicas, así como las principales características macroscópicas y microscópicas del sílex.

Entrando un poco en detalle, el yacimiento de Abric Romaní ofrece una asombrosa secuencia del Paleolítico Medio, que nos permite analizar en detalle varios aspectos de los modos de vida de los neandertales. Las áreas fuente de captación de sílex de la región muestran un rico territorio donde se explotaron materias primas líticas desde al menos el Paleolítico Medio hasta épocas históricas.

Para el Abric Romaní, las principales zonas de captación de sílex fueron las de Sant Martí de Tous, a unos 16 km en línea recta de Abric Romaní, seguido del sílex de Panadella, a unos 24 km, y el sílex de Valldeperes y el sílex de Ca l'Alemanya, con distancias de 24 y 25 km, respectivamente.

En cuanto a los afloramientos de sílex presentados, el sílex de Sant Martí de Tous se caracteriza por su gran heterogeneidad y concentración en un área delimitada, que jugó un papel clave como área fuente, vía de abastecimiento y distribución de materia prima a lo largo de la prehistoria. Por el contrario, el sílex de la Panadella se caracteriza por su gran homogeneidad y calidad de talla pero con una escasa presencia en el territorio, lo que provoca una menor obtención y explotación de esta variedad de sílex.

Por último, los sílex de Valldeperes y de Ca l'Alemany, ambos bastante heterogéneos, con una variabilidad en las aptitudes de talla, están presentes en el territorio de forma similar. Los sílex de Valldeperes y Ca l'Alemany tienen cierta continuidad en una extensión aproximada de 55 km entre las provincias de Tarragona y Barcelona.

El viaje virtual del 13º ISKM ofreció a los participantes del simposio la posibilidad de conocer de primera mano un territorio complejo con abundantes y variados recursos líticos explotados desde el Paleolítico Medio hasta la actualidad, convirtiéndose en un área clave para las ocupaciones humanas.

Keywords: materias primas líticas; sílex; Paleolítico Medio; Abric Romaní; Formación Sant Genís; Formación Montmaneu; Formación Valldeperes; Formación Bosc d'en Borràs