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## Cal Sitjo: A new Mesolithic to Neolithic sequence in a chert-rich region (Sant Martí de Tous, NE Iberia)

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### Abstract:

Cal Sitjo is a new archaeological sequence located in a chert-rich region of the NE Iberian Peninsula, in the town of Sant Martí de Tous (Anoia, Barcelona). The area has undergone significant anthropisation and several archaeological sites (*e.g.*, Vilars de Tous), quarries and workshops for the exploitation of chert (*e.g.*, La Guinardera) have been documented, corresponding to different periods. The abundance of chert made this region an almost obligatory passageway for hunter-gatherer communities such as those occupying the nearby cliffs of Cinglera del Capelló (Capellades), located at a direct distance of 15 km, as well as an ideal settlement for later farming communities.

Discovered in 2019, the first excavation campaign was carried out in the fall of 2020. Dates have been obtained from a known sequence of around 8 m, providing a chronological framework that ranges from the Mesolithic to the Middle Neolithic. The preliminary results of this excavation have brought to light lithics, ceramics and charcoals from the Neolithic levels (Levels 3 and 4), and faunal, lithic and charcoal remains from the Mesolithic levels (cleaning section).

Our preliminary results confirm that this sequence is an ideal location for a diachronic study of the evolution from the last hunter-gatherers to the first farmers, from a paleoenvironmental and



technological perspective, as well as in terms of chert management and distribution in a territory with a great abundance of this raw material.

**Keywords:** NE Iberian Peninsula; chert-rich region; Mesolithic; Neolithic; multidisciplinary; Cal Sitjo.

## 1. Introduction

In this paper, we present the preliminary results of the excavation of the Cal Sitjo site (Sant Martí de Tous, Barcelona), a sequence of more than 8 metres with Mesolithic and Neolithic levels located in the Anoia basin (NE Iberian Peninsula). The area is characterised as a region with a great abundance of abiotic resources, mainly chert, which has been widely exploited throughout prehistoric times, from at least the Middle Palaeolithic to the present day (Gómez de Soler *et al.* 2020; Gómez de Soler *et al.* 2021).

The discovery of the Cal Sitjo sequence resulted from a project implemented by the Geoarchaeology Unit of IPHES-CERCA, which aims to document and characterise all chert outcrops and possible associated sites in the region. The first surveying campaigns were executed for the development of a master's and a PhD thesis (2006-2015) (Gómez de Soler 2009; Gómez de Soler 2016: Chapters 7, 8 & 9) and focused on documenting these rock outcrops to the greatest extent possible, as well as on identifying possible quarries and workshops (2018-2019). We subsequently documented and excavated some of these quarries (Gómez de Soler *et al.* 2021), and finally excavated a settlement related to the abundance of chert in the territory (2020- present).

Archaeological research conducted in the region points to an occupational peak in the village of Sant Martí de Tous starting in the Neolithic period. This was evidenced by means of the discovery of a series of settlements, including Vilars de Tous (Cámara 2017; Clop *et al.* 2005), el Trull, Prop de Biosca, and Cal Marquet, among others (Pujol 2016: 18,19 & 25). The high number of occupations in the area continued throughout the Bronze, Iberian and Roman Ages. In this context, the abundance of chert in this territory may have been a key factor in the settlement of the first farming and herding communities.

In the Neolithic literature, the Anoia Basin is considered to be located within the Penedès region (Oms *et al.* 2014; Oms *et al.* 2018), one of the highest concentrations of early Neolithic sites in the Iberian Peninsula (*e.g.*, Cova de la Guineu, Guixeres de Vilobí) (Esteve *et al.* 2012; Oms *et al.* 2014; Riera *et al.* 2007). Many sites have been excavated and studied from the Early and Middle Neolithic (Oms & Martín 2018), but none present such a long sequence with Mesolithic and, so far, Middle Neolithic occupations. The Cal Sitjo site aims to complement our understanding of the Neolithic in this region, and if future results are positive, to fill in the gap in our understanding regarding the transition from the last hunter-gatherers to the first farmers.

We present the preliminary results of two years of excavation in which we will focus on the stratigraphic sequence known to date, the radiometric dating obtained, and the description of the main archaeological levels and their archaeological records, excluding those that are either in a superficial context or do not provide relevant information due to their scarcity of archaeological material (Surface Level and Levels 1 and 2).

## 2. Materials & Methods

### 2.1. Cal Sitjo

Cal Sitjo is located to the southwest of the town of Sant Martí de Tous in the province of Barcelona (NE Iberian Peninsula), with UTM coordinates (ETRS89) 375809X; 4601489Y, and at 456 m.a.s.l. (Figure 1). It is located on the left bank of Tous Stream, a tributary of the Anoia River, which in turn flows into the Llobregat River and drains into the Mediterranean Sea.

Geomorphologically, it is located in the Tertiary aged depression of the Ebro Basin in one of the marginal basins (Anoia Basin) that connects the area inland to the Mediterranean system with its Catalan coastal ranges and the pre-coastal depressions. The sediments that constitute the deposit were formed by Quaternary fluvial deposits, mainly travertines, clays and sands. Currently, a test pit of about 15 m<sup>2</sup> is being excavated on the platform of the slope of the left bank of Tous Stream (Figure 2).

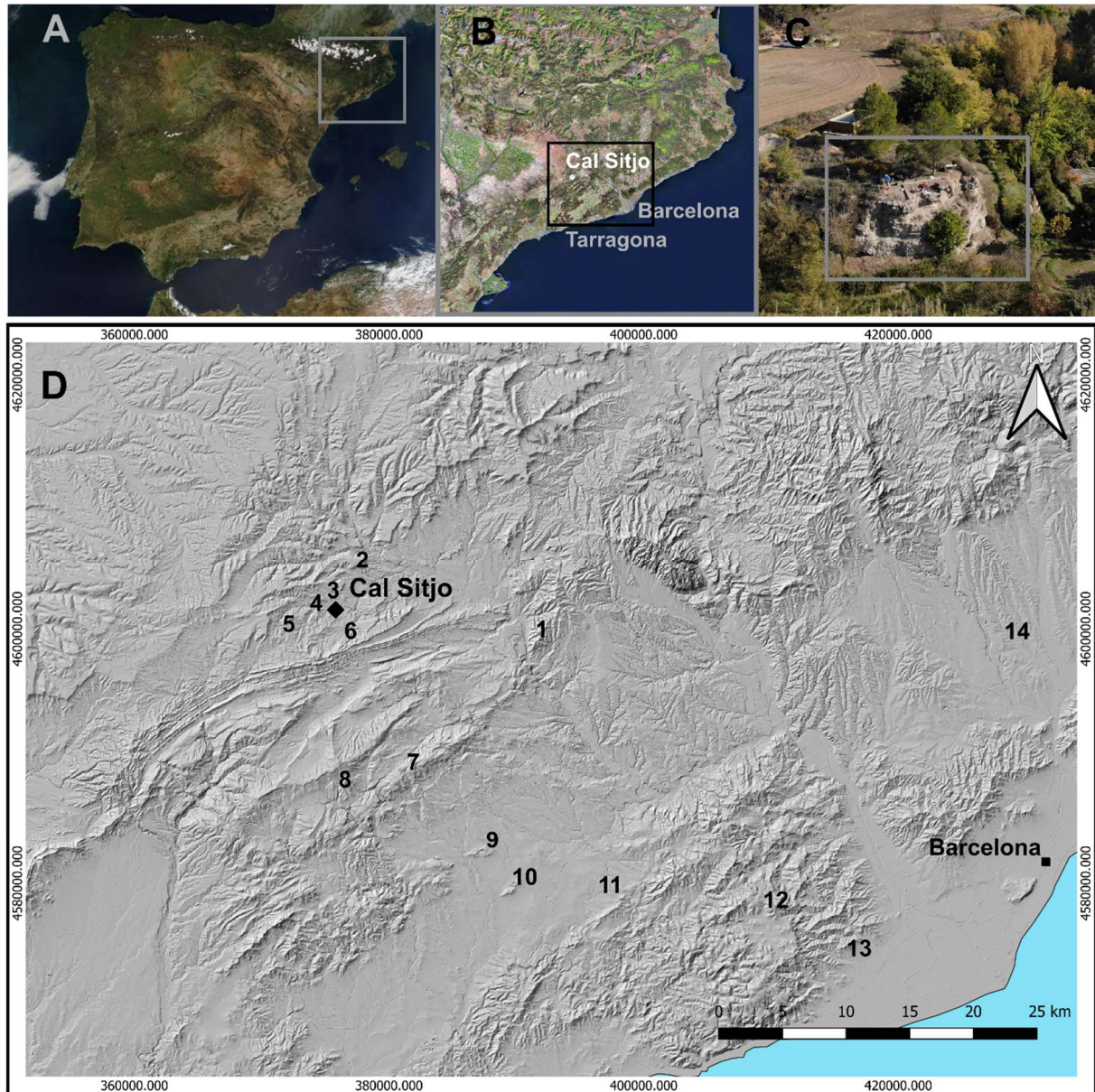


Figure 1. A and B) Location of Cal Sitjo in the Iberian Peninsula and in Catalonia. C) Aerial view of the Cal Sitjo site. D) Cal Sitjo in a DEM map with the aforementioned sites cited along this paper. 1, Cinglera del Capelló cliffs; 2, Prop de Biosca; 3, Vilars de Tous; 4, La Guinardera; 5, Cal Marquet; 6, El Trull; 7, Cova de la Guineu; 8, Font del Molinot; 9, Guixeres de Vilobí; 10, Mas d'en Boixos; 11, La Serreta; 12, Cova de Can Sadurní; 13, Can Tintorer; 14, Can Roqueta. 2

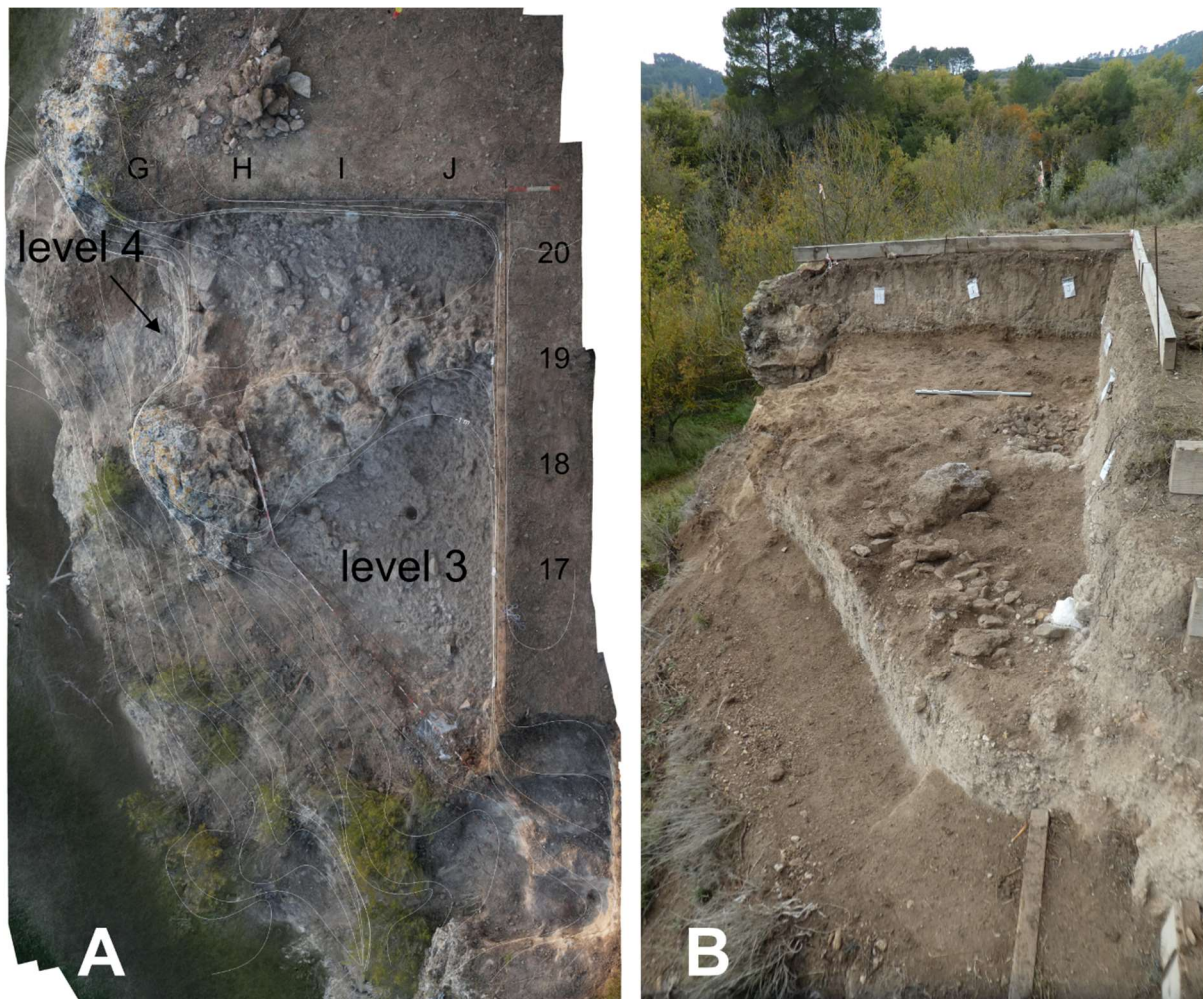


Figure 2. A) Final photogrammetry of the 2020 Cal Sitjo excavation season with elevation contour intervals of 0.20 m. B) Final photograph of the 2021 Cal Sitjo excavation season showing the surface of Level 3.

From a geological point of view, this whole area is located within the Ebro depression, a Tertiary sedimentary basin formed by the infilling of Eocene sediments as a result of the action of erosive processes that dismantled, mainly, the Catalan Pre-Coastal Range. Specifically, the area is located within the Catalan Central Depression, which is formed by a series of Eocene marine sediments at the base and a series of lacustrine sediments from the late Eocene and Oligocene. The town of Sant Martí de Tous is located within one of the marginal basins of this depression: the Òdena Basin. According to Ortí (1990) and Ortí *et al.* (1997) it is precisely such marginal formations that contain abundant quantities of chert. During the Tertiary, this basin suffered from marine transgressions to alluvial and lacustrine systems, which during the Upper Eocene to Upper Oligocene formed alluvial and lacustrine systems of Catalan origin, with evaporitic, carbonate and detrital sedimentation.

## 2.2. Archaeological assemblage

In the two fieldwork campaigns conducted to date (2020-2021), 500 remains have been recovered, including lithics, charcoal, ceramics, and faunal and malacofaunal remains between the Neolithic and Mesolithic levels in a 15 m<sup>2</sup> test pit (Table 1). Along with this material, several structures associated with the Neolithic levels have been documented, mainly post holes and combustion structures.

Table 1. Total assemblage recovered at Cal Sitjo until 2022.

<b>Archaeological assemblage</b>	<b>Number</b>	<b>%</b>
Lithics	278	55.6
Charcoal	167	33.4
Ceramic	36	7.2
Fauna	6	1.2
Malacofauna	13	2.6
<b>Total</b>	<b>500</b>	<b>100</b>

We conducted the lithic analysis using the logical-analytical system (LAS) proposed by Carbonell *et al.* (1983), Carbonell and Mora (1986) & Carbonell *et al.* (1992), with the variants introduced by Vaquero (1997) for the analysis of cores and Laplace's (1972) concepts of typological groups and primary types for retouched artifacts.

The anthracological analysis is based on the study of 167 charcoal fragments. The charcoal fragments were coordinated and recovered manually during fieldwork. They were identified and quantified according to the standard methodology used in anthracological studies (see Chabal *et al.* 1999; Kabukcu & Chabal 2021). The anthracological analysis was performed using both bright- and dark-field reflected light microscopy (Olympus BX41) with magnifications of x50, x100, x200 and x500. Each charcoal fragment was manually split to obtain the three anatomical sections necessary to view the anatomical structure of the wood. The identification was based on anatomical features described in the specialised atlas of European wood anatomy (Schweingruber 1990) and by consulting the reference collection of modern charcoals at the IPHES-CERCA facilities.

For the study of ceramics, considering the degree of fragmentation of the set, we decided to use potsherds as the unit of analysis until a larger ceramic assemblage can be recovered to estimate a minimum number of vessels. The morpho-typological characterisation was based on that set forth in Bernabeu *et al.* (2009), which allowed us to describe the ceramic elements according to their shape, proportions and decorative techniques. A first technological study was conducted focusing on the identification of the surface treatments, firing atmospheres (oxidations and reductions in the sections of the fragments) and maximum wall-thickness (mm). The macroscopic examination of the potsherds has also allowed us to recognise a series of manufacturing traces associated with their forming processes (Cámara 2019). Further studies will allow us to systematise these traces and reconstruct the forming techniques and methods used.

The faunal analysis was conducted using the available modern reference osteological collection, and following the osteological criteria established by Schmid (1972: 70-153), Pales & Lambert (1971: 1-84) and Gilbert (1990: 31-418). The remains were identified anatomically and taxonomically whenever possible. The number of identified specimens (NISP), minimum number of elements (MNE) and minimum number of individuals (MNI) were calculated following Lyman (1994). Bone fragmentation and breakage were analysed in accordance with the methods described by Villa and Mahieu (1991).

### 3. Preliminary Results

Below we present the preliminary results and earliest data from the test pit of the Cal Sitjo site. These data are structured as the first presentation of the last section of the site's stratigraphic sequence, the first geochronological data obtained, as well as the archaeological material recovered in the levels excavated to date (Levels 3, 4, and the cleaning section of the Mesolithic level).

### 3.1. Stratigraphy and geochronology

The stratigraphic sequence of the Cal Sitjo site comprises a deposit over 8 metres thick, only the last 2 m of which are described here. We have adapted synthetic sedimentological columns to the context of the local outcrop of the site to describe the sequence. The stratigraphic column illustrated here is indicated as set A and set B in the survey legend (Figure 3). The strata containing each assemblage are described below.

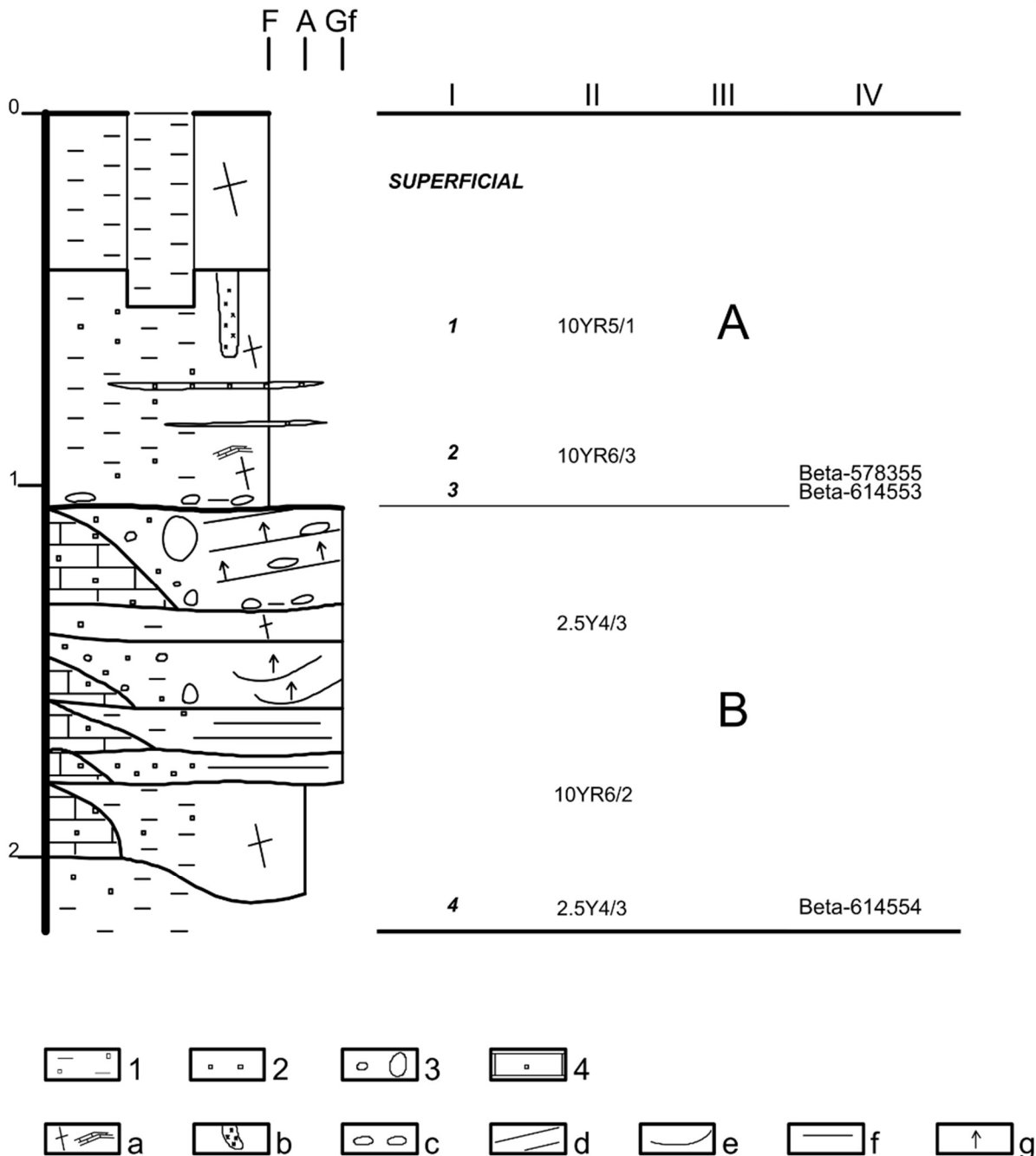


Figure 3. Stratigraphic sequence of the first two metres of the Cal Sitjo pit.

Lithology: 1, muds and sandy muds; 2, sands; 3, fine gravels to coarse gravels. 4, sands with calcareous cement (travertines).

Structures: a, massive and carbonate films (pseudomycelids); b, root passages; c, coarse gravel pavements; d, planar cross-stratification; e, furrow cross-stratification; f, horizontal stratification; g, normal gradation.

Vertical profile: F, muds; A, sands; Gf, fine gravels.

Comments: I, archaeological levels; II, Munsell colours; III, sets of strata; IV, radiocarbon dates.

Set A is formed by 2 strata of decametric thickness of grey and pale brown sandy muds and silts. The upper stratum contains the superficial archaeological level. The lower stratum contains archaeological Levels 2 and 3. The brown sandy muds are massive and contain a horizon enriched in pellicular carbonates. In the central part of the stratum, lenticular sandy strata can be observed stratified with the massive muds. At the base of the succession there is a pavement of blocks buried by massive muds that rest on the sands and gravels of the roof of set B.

Set A is related to a flooding episode of Tous Stream. The stratification of the lenticular strata of sands with muds is characteristic of breakage at the margins of watercourses and the formation of lobes in the floodplain. The paving of the base of the stratum together with the horizontalization with carbonate enrichment points to a phase of landscape stability linked to archaeological Levels 2 and 3. The stratigraphic position of these archaeological levels is related to the beginning of the formation of the floodplain during which the archaeological surfaces-levels were buried.

Set B is formed by at least 5 centimetric and decametric strata and its base is unknown. It contains archaeological Level 4, only observable by means of scattered remains in the available outcrop and those documented for verification purposes in a 1-m<sup>2</sup> test pit.

The strata of set B are formed by terrigenous lithologies of sands and fine gravels olive-brown in colour containing medium and coarse gravels in the centile (out of size). The terrigenous strata are stratified with calcareous cemented phytoclastic sands (travertines) in dome-shaped layers. The structure of the terrigenous strata is massive, horizontal, cross-flat and cross-furrowed. There is normal gradation in the cross stratification.

Set B is related to a lateral change from terrigenous to travertine sediments that can be considered characteristic of watercourses with chemical and clastic sedimentation. The currents described left sedimentary structures, especially those with normal gradation, that point to the scarce development of high regime stratification. The exception is in the planar cross stratification, which points to the sedimentation of ephemeral-episodic watercourses characteristic of streams and rivers with marked seasonality. The rich travertine bars with phytoclasts are related to the formation of cross bars and particle clusters (pavements) that are formed during the sedimentation of large catastrophic high regime and antidune events, or low hydraulic regime events.

Four radiocarbon dates have been obtained (Table 2). From bottom to top, the Mesolithic level, 6 m deeper than the known sequence, was dated at 9326-9134 cal BP (Beta-546393), and the other three radiocarbon dates correspond to the known and partially excavated sequence (see Figure 3). The earliest dates were obtained from Level 4 with a chronology of 4071-3971 cal BCE (Beta-614554) followed by two dates for level 3 in different stratigraphic positions: 3879-3801 cal BCE (Beta-614553) for the lower part and 3816-3706 cal BCE (Beta-578355) for the top of the level. While we anticipate descending further down into the test pit and locating new archaeological levels, these dates show great overall coherence, and raise the possibility of a continuous settlement throughout the sequence.

Table 2. Radiocarbon dates obtained for the site of Cal Sitjo. Calibrated data with BetaCal4.20. HPD method: IntCal20, Northern Hemisphere (Reimer *et al.* 2020).

Level	Sample	Reference	Date BP	Date Cal BP	Date Cal BCE
Level 3	<i>Acer</i> sp.	Beta-578355	5010 ± 30	5765 - 5655	3816 - 3706
Level 3	<i>Quercus</i> sp. deciduous	Beta-614553	5120 ± 30	5828 - 5750	3879 - 3801
Level 4	<i>Quercus</i> sp. deciduous	Beta-614554	5240 ± 30	6020 - 5920	4071 - 3971
Mesolithic	Maloideae	Beta-546393	8270 ± 30	9326 - 9134	7377 - 7185

### 3.2. Level 3

An area of about 15 m<sup>2</sup> (see Figure 2) is currently being excavated in Level 3. To date, the level has yielded 414 archaeological remains, including lithics, ceramics, charcoal, fauna and malacofauna (Table 3). In addition, several different structures have been documented in the level (from S1 to S5), which we will briefly describe below (Figure 4).

Table 3. Material recovered in level 3.

Materials	Number	%
Lithics	211	51.0
Ceramic	30	7.2
Charcoal	160	38.6
Fauna	1	0.2
Malacofauna	12	3.0
<b>Total</b>	<b>414</b>	<b>100%</b>

Structure 1 (S1) is a combustion structure delimited by rocks formed by carbonaceous sediment that fills a cobblestone consisting mainly of pebbles and angular blocks of sandstone, conglomerates and burnt tuff. The slabs of pebbles and angular blocks on a flat surface allow it to be described as a flat combustion structure on slabs (Perlès 1977). Structure 2 (S2) is a semi-circular structure delimited by stones located just below S1. Structure 3 (S3) is another combustion structure formed by blocks and burnt gravel nailed together at the roof, some of which appear to have collapsed in the centre of the structure. At the base, a pavement of burnt blocks is present. Show a prominent concave cutout with a small triangular tip (Figure 4C). This small triangle has been described in typologies of combustion structures under the name of bucket hearths with a tail (Perlès 1977). Structure 4 (S4) is a semi-circular combustion structure with no delimiting stones and with a base of pebbles. It can be described as a combustion structure in a cube with a tail and a slab bottom. The cube has the particularity that there are two large tuff blocks, in a part of its perimeter (Figure 4B), characteristic of slabs combustion structures with a protective wall (Perlès 1977). Structure 5 (S5) corresponds to a negative structure.



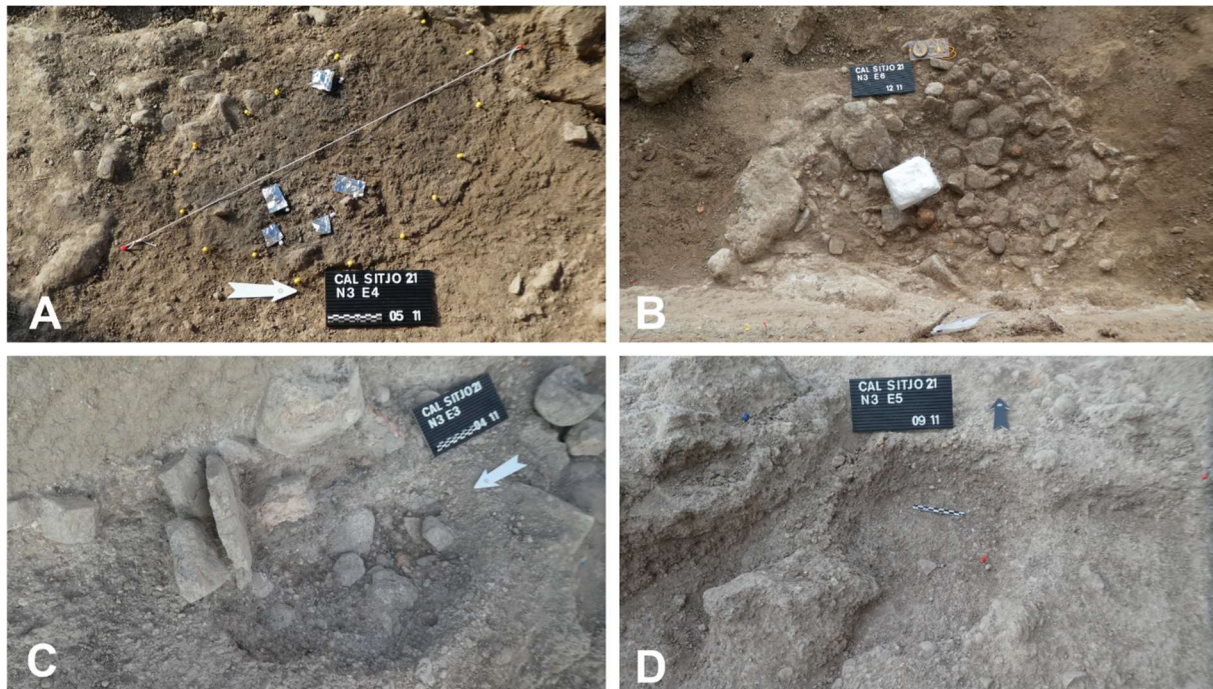


Figure 4. Some examples of the structures documented in Level 3 of Cal Sitjo. A and B) Initial and final photos of combustion structure S4. C) Combustion structure S3. D) Negative structure S5.

Below we present most abundant materials (lithics, ceramics and charcoal) documented in this level. The dominant raw material used in the lithic industry is chert, which accounts for over 95% of the remains, as would be expected in an area with such an abundance of this raw material. The most common products are flakes, followed by flake fragments and fragments. Less common remains include cores and retouched tools (equally represented), followed by unworked nodules and blocks (Table 4). Some of the unworked nodules were recovered without any traces, others with percussion stigmas and others with fractures. Generally, these are related to structural elements (*e.g.*, stones delimiting hearths) or hammers. The most common cores are laminar and bifacial centripetal, and the exploitation phase is between initial and full, with no depleted products. Flakes, except for a few, do not display laminar knapping. Tools are dominated by marginal retouch, highlighting two side scrapers in chert, a fractured polished axe made of hornfels and a possible polisher made from sandstone (Figure 5).

Table 4. List of raw materials by structural categories.

Raw material	Blocks	Unworked Nodules	Cores	Flakes	Flake Fragments	Tools	Fragments
Chert		4	10	80	57	9	42
Limestone		2					1
Sandstone		2				1	
Hornfels						1	
Other rocks		2					
<b>Total</b>		10	10	80	57	11	43

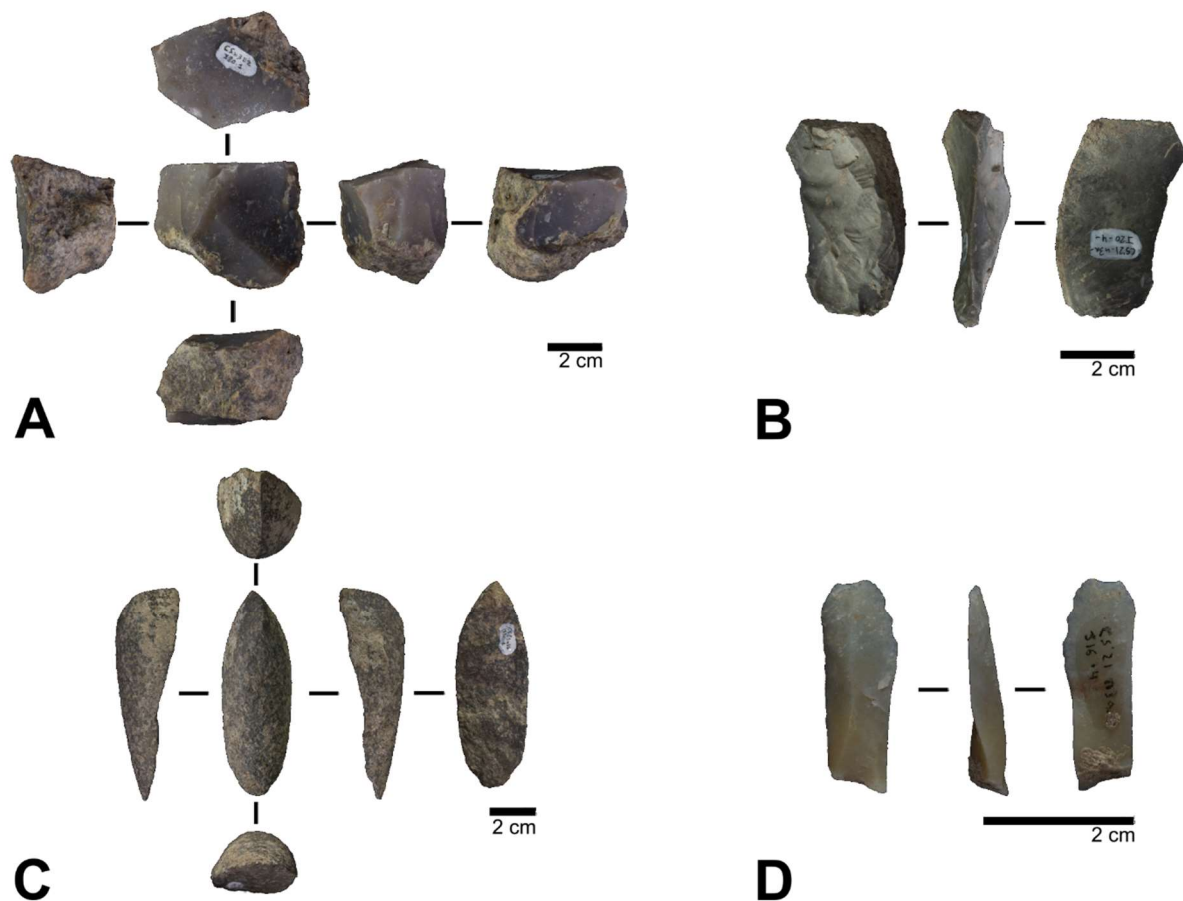


Figure 5. Lithic industry from Level 3. A) Core of laminar feature with centripetal unipolar extractions in chert. B and D)) Blades in chert. C) Fractured polished axe in hornfels. Photos M.D. Guillén (IPHES-CERCA).

The ceramic remains that preserve significant parts of the vessels (rims, secondary elements and partially preserved profiles) provide preliminary morpho-typological data to characterise the ceramic assemblage. In accordance with the classification established by Bernabeu *et al.* 2009, we documented rims with a rounded lip (L1, n=1) or rounded with internal (L4.3, n=1) or external (L5.2, n=2) thickening (Figure 6A). Only one vessel preserves a large part of its profile, which corresponds to an open bowl (Group G1.I) with hemispherical walls and rounded lip (Figure 6B). The wall-thickness measurements for all the potsherds recovered show the prevalence of thin walls, from 3.5 to 6.5 mm (41.67%, n=10) and from 6.6 to 9.5 mm (41.67%, n=10), followed by a lower number of potsherds with thick walls, from 9.6 to 12.5 mm (12.5%, n=3) and from 12.6 to 15.5 mm (4.16%, n=1). These wall-thickness variations may be representative of the manufacture of different ceramic products with variations in their volumes. The internal and external surfaces are generally smoothed (n=13), including here one rim which its external surface was possibly brushed (Figure 6A, CS'21-C1-3a-J16). Polishing treatments of both surfaces (n=1), or of the external (n=2) or internal (n=3) surface, are recognised in some potsherds with polishing features, such as satin bands caused by the friction of a tool. The cross-sections reveal the predominance of reducing firing atmospheres (complete blackening or brownish colouration of the section) (n=17) and, in some cases, reduction processes with reoxidation of the internal (n=2) or external (n=2) surfaces resulting in the reoxidation of almost  $\frac{1}{4}$  of their sections.

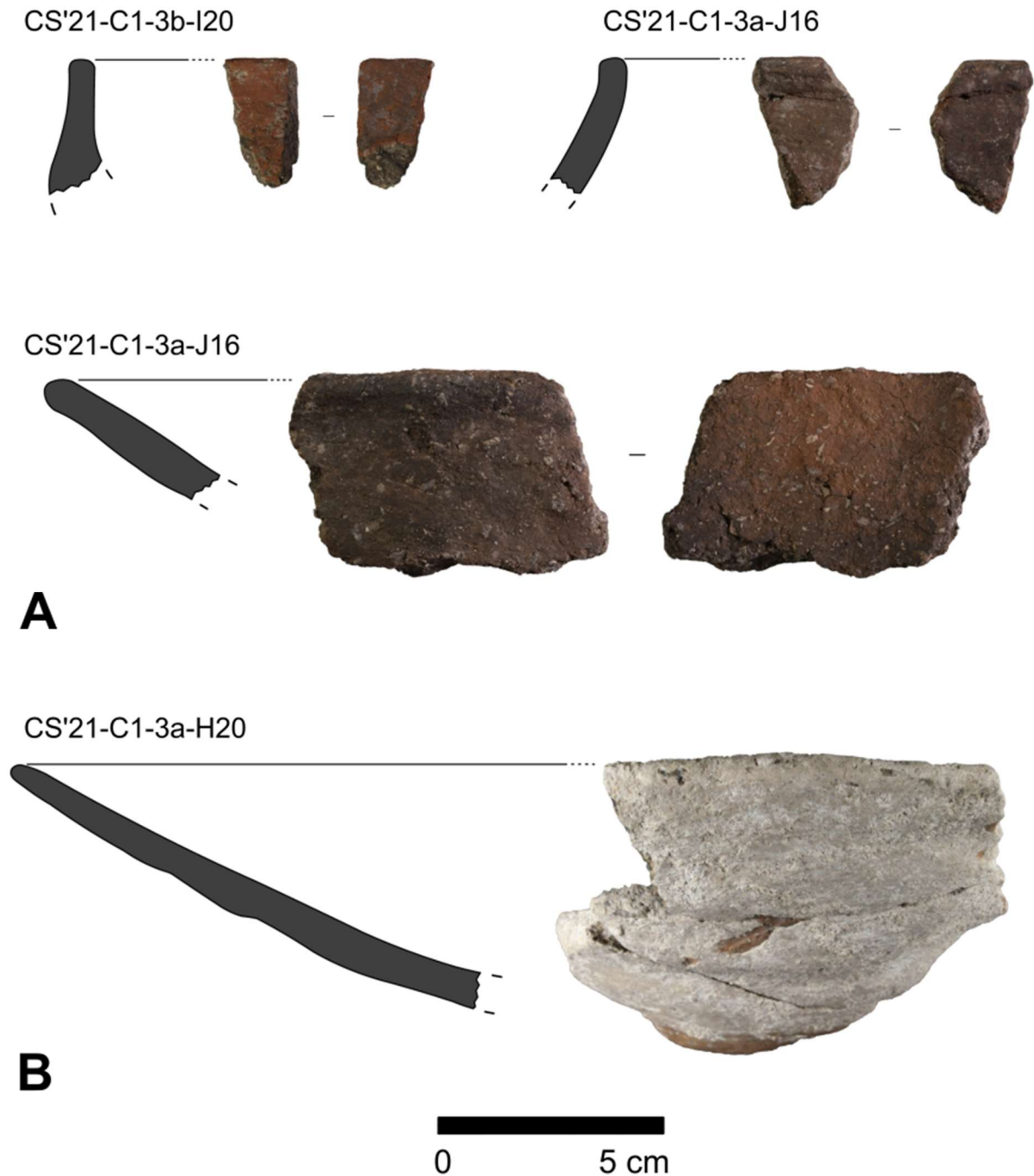


Figure 6. Ceramic fragments. A) Fragments of rims. B) Dish. Photo M.D. Guillén (IPHES-CERCA).

Archaeological Level 3 has yielded 160 charcoal fragments, of which 49 have been identified taxonomically, corresponding to a total of nine taxa: *Acer* sp., *Quercus* sp., *Quercus* sp. deciduous, *Quercus* sp. evergreen (holm oak), cf. *Quercus*, cf. Fabaceae, Maloideae, *Salvia rosmarinus* (rosemary), and indeterminate angiosperms (Table 5).

Table 5. Results of the anthracological analysis of Cal Sitjo for Level 3 and structures separately.

	<b>Level 3</b>	<b>S1</b>	<b>S2</b>	<b>S3</b>	<b>S4</b>
<b>Taxon</b>	<b>Total</b>	<b>Total</b>	<b>Total</b>	<b>Total</b>	<b>Total</b>
<i>Acer</i> sp.	1				
<i>Quercus</i> sp.	5			1	4
<i>Quercus</i> sp. deciduous	7		1		2
<i>Quercus</i> sp. evergreen	5				1
Maloideae				1	1
<i>Salvia rosmarinus</i>					1
cf. Fabaceae	1				
cf. <i>Quercus</i>	2	1			10
Indeterminate angiosperm 1	1				
Indeterminate angiosperm 2					1
Indeterminate angiosperm 3					2
<b>Total determined</b>	<b>22</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>22</b>
<b>Taxa identified</b>	<b>6</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>7</b>
Undetermined angiosperm	36			3	31
Undetermined	20	1		2	19
<b>Total</b>	<b>78</b>	<b>2</b>	<b>1</b>	<b>7</b>	<b>72</b>

As described above, several structures have been documented in Level 3, most of them related to combustion. Because the presence of charcoal is linked to these structures, we will present the anthracological results by structure. S1 yielded one charcoal fragment corresponding to *Quercus* sp. S2 also yielded one charcoal fragment, corresponding to *Quercus* sp. deciduous. This is not unusual considering that these first two structures seem to have undergone heavy weathering, so no carbonaceous or rubefacted material has been recovered. Seven charcoal fragments were found in S3, two of which were identified taxonomically, corresponding to two indeterminate angiosperm and Rosaceae or Maloideae. S4 yielded a total of 72 charcoal fragments, 22 of which could be taxonomically identified, corresponding to eight taxa: *Quercus* sp., *Quercus* sp. evergreen, *Quercus* sp. deciduous, Rosaceae or Maloideae and *Salvia rosmarinus* (rosemary) and indeterminate angiosperm.

Most of the structures (and Level 3 in general) have yielded a reduced number of remains, between one and 78 charcoal fragments. This scarce sample is common in open-air sites, often affected by post-depositional processes. Also, the abundant effects of combustion processes, such as the vitrification and presence of cracks, are especially related to the documented structures (S3 and S4). Biological processes, especially insect attacks, knots and cell collapse are documented throughout the level, but especially in structures S3 and S4.

### 3.3. Level 4

Level 4 has been excavated only in a 1-m<sup>2</sup> test pit in the NW sector of the Cal Sitjo pit (see Figure 2), so very few materials have been recovered. However, this material has proved highly diagnostic and has provided interesting information. The material recovered consists of 25 archaeological remains corresponding to lithics, charcoals, ceramics and malacofauna (Table 6).

Table 6. Material recovered in Level 4.

Materials	Number	%
Lithics	15	62.5
Ceramic	2	8.3
Charcoal	7	25
Malacofauna	1	4.2
Total	25	100%

With the exception of one sandstone implement, the lithic assemblage is entirely made up of chert artefacts (93.3%). Flake fragments (n=6) are the most common category, followed by fragments (n=5) and cores and blades with the same number (n=2). One of the cores is highly diagnostic and features clear laminar production. The other is in an initial phase and presents a multi-facial and multipolar structure. Flake fragments tend to be fractured laminar products (Figure 7).

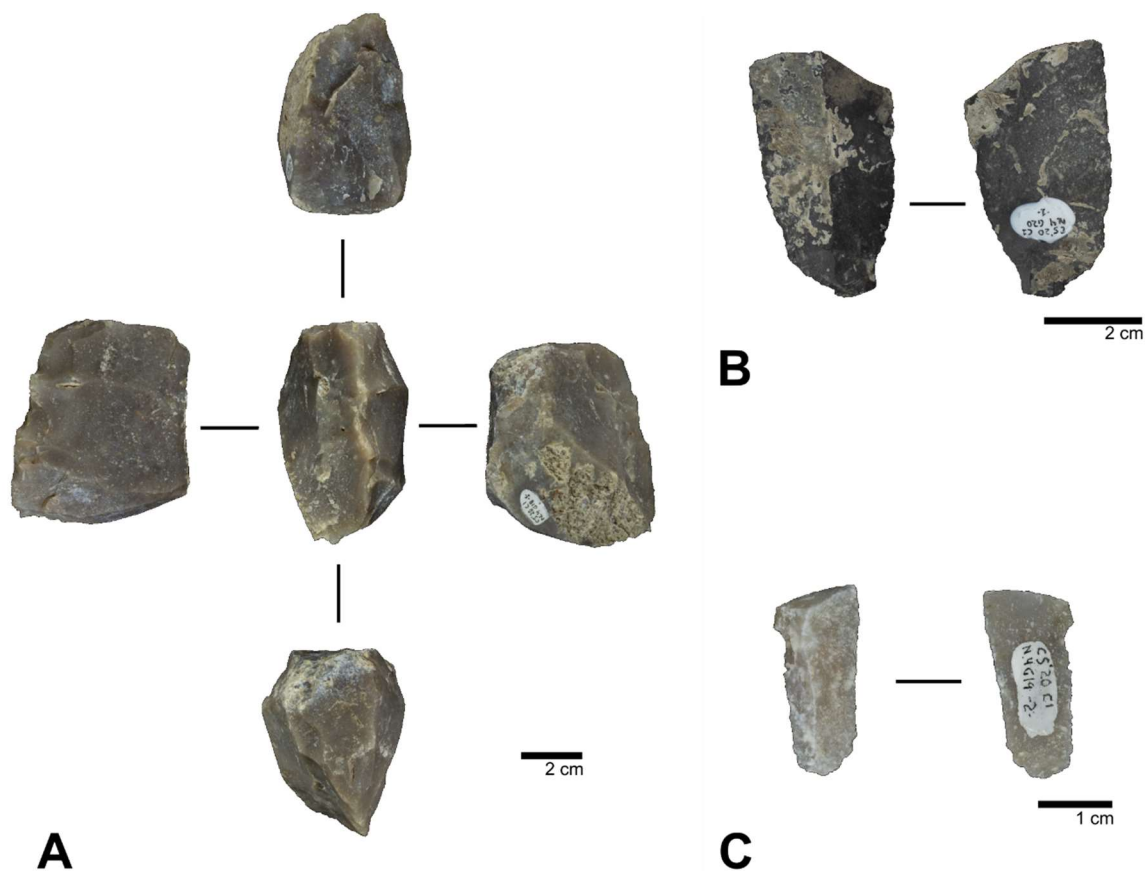


Figure 7. Lithic industry from Level 4. A) Laminar core in chert. B) Blade in chert with a transversal-distal fracture. C) Blade in chert. Photo M.D. Guillén (IPHES-CERCA).

The two only ceramic potsherds recovered to date from Level 4 correspond to secondary and grip elements. The first is a triangular cross-section cordon (plastic application of cordon type) from the belly of a vessel, possibly of a large proportion due to the significant thickness of the wall (Figure 8A). The second presents a slight convexity on the external surface that may correspond to the beginning of a handle, although due to its fragmentation and lack of integrity this cannot be completely confirmed (Figure 8B).

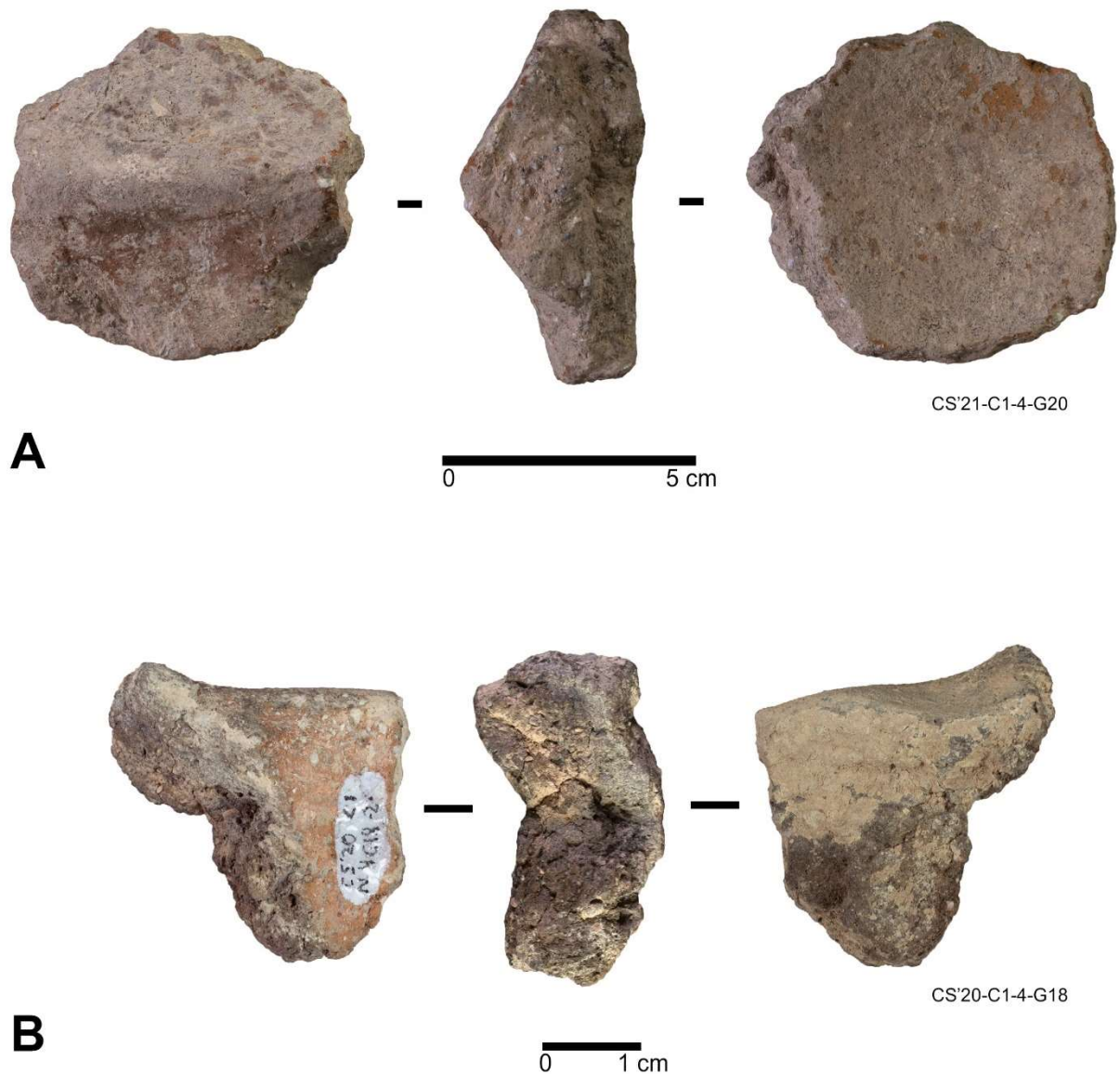


Figure 8. Ceramic fragments from Level 4. A) Smooth cord of triangular section. B) Possible handle. Photo M.D. Guillén (IPHES-CERCA).

Six charcoal fragments were recovered from the pit, and two taxa were identified related to two fragments, one of *Quercus* sp. deciduous and the other one of cf. *Quercus*. Despite the small sample, one of the charcoal fragments has allowed us to date the archaeological level as presented above.

### 3.4. Mesolithic level

The excavation of the Mesolithic level has consisted only of clearing the profile 4 m below the first Neolithic excavated levels. In fact, it was after the discovery of these remains in 2019 when the systematic excavation of the site from a drilling pit was considered. For these reasons, the material presented below is very scarce and fragmentary. From this clearing, the recovered material consists of 20 objects (Table 7).

All of the lithics are made of chert and the assemblage consists of three cores, one on flake; three flakes; two flake fragments; one fragment; and two tools - one denticulate and one side-scraper (Figure 9).

Table 7. Material recovered in the Mesolithic level.

Material	Number	%
Lithics	12	60
Fauna	5	25
Charcoal	3	15
<b>Total</b>	<b>20</b>	<b>100</b>

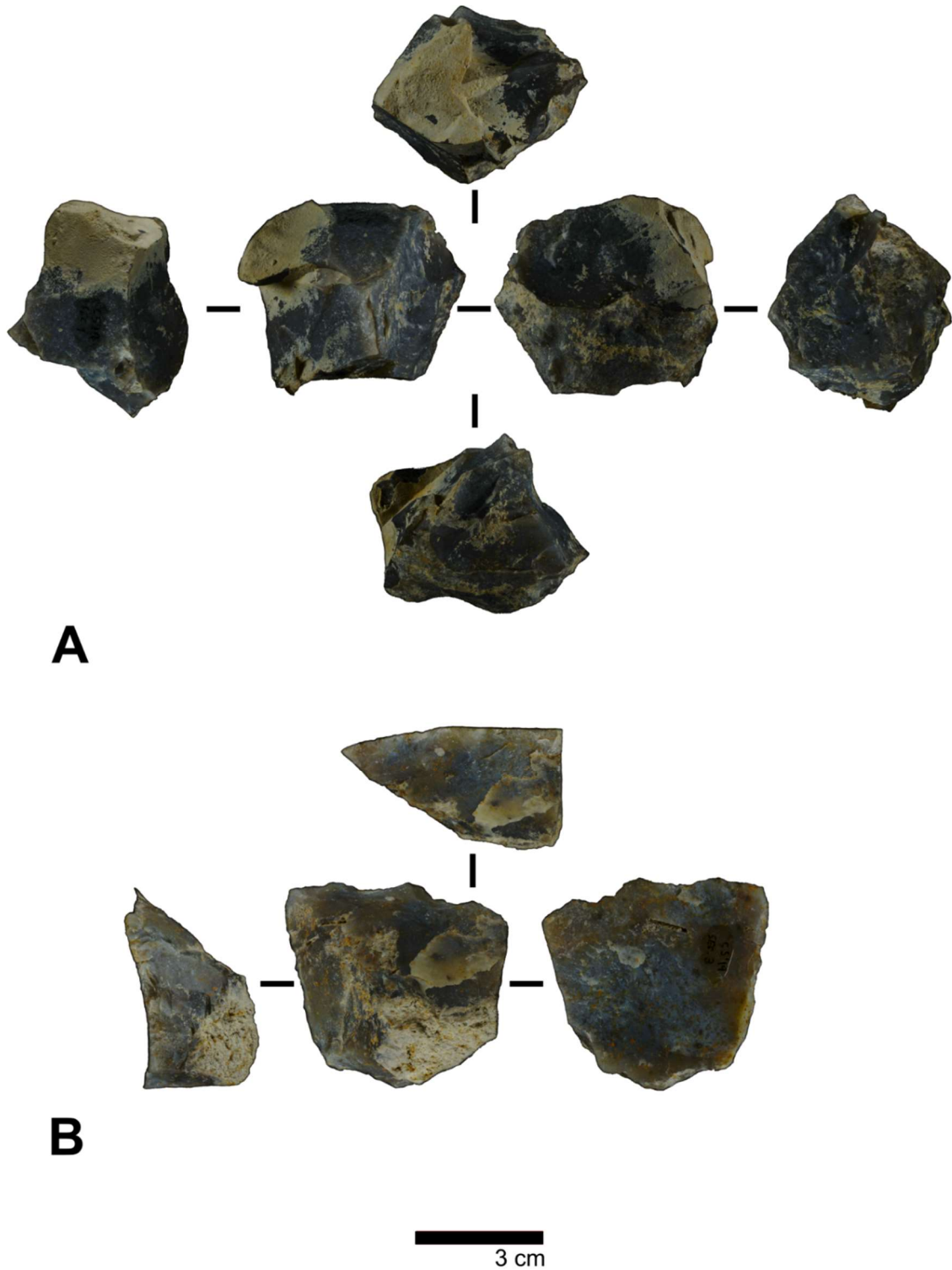


Figure 9. Lithic industry from the Mesolithic level. A) Centripetal core in chert. B) Denticulate in chert. Photo M.D. Guillén/IPHES-CERCA.

Overall, the bone assemblage is well preserved, although the bone remains are highly fragmented and the surfaces are often altered by natural taphonomic processes like chemical corrosion and root etching. One mandibular fragment and several appendicular bones have been identified anatomically (MNE=3), all of them from medium-sized mammals (NISP=1, NMI=1). One metacarpus fragment has been identified as *Cervus elaphus*. Although anthropic marks are not clearly documented in the faunal assemblage, some bone fragments show green fracture morphologies (*i.e.*, curved fractures, oblique angles and smooth surfaces of fracture planes) (Villa & Mahieu, 1991) (Figure 10).

The charcoal representation consists of two *Salix* sp. fragments and one Maloideae fragment.

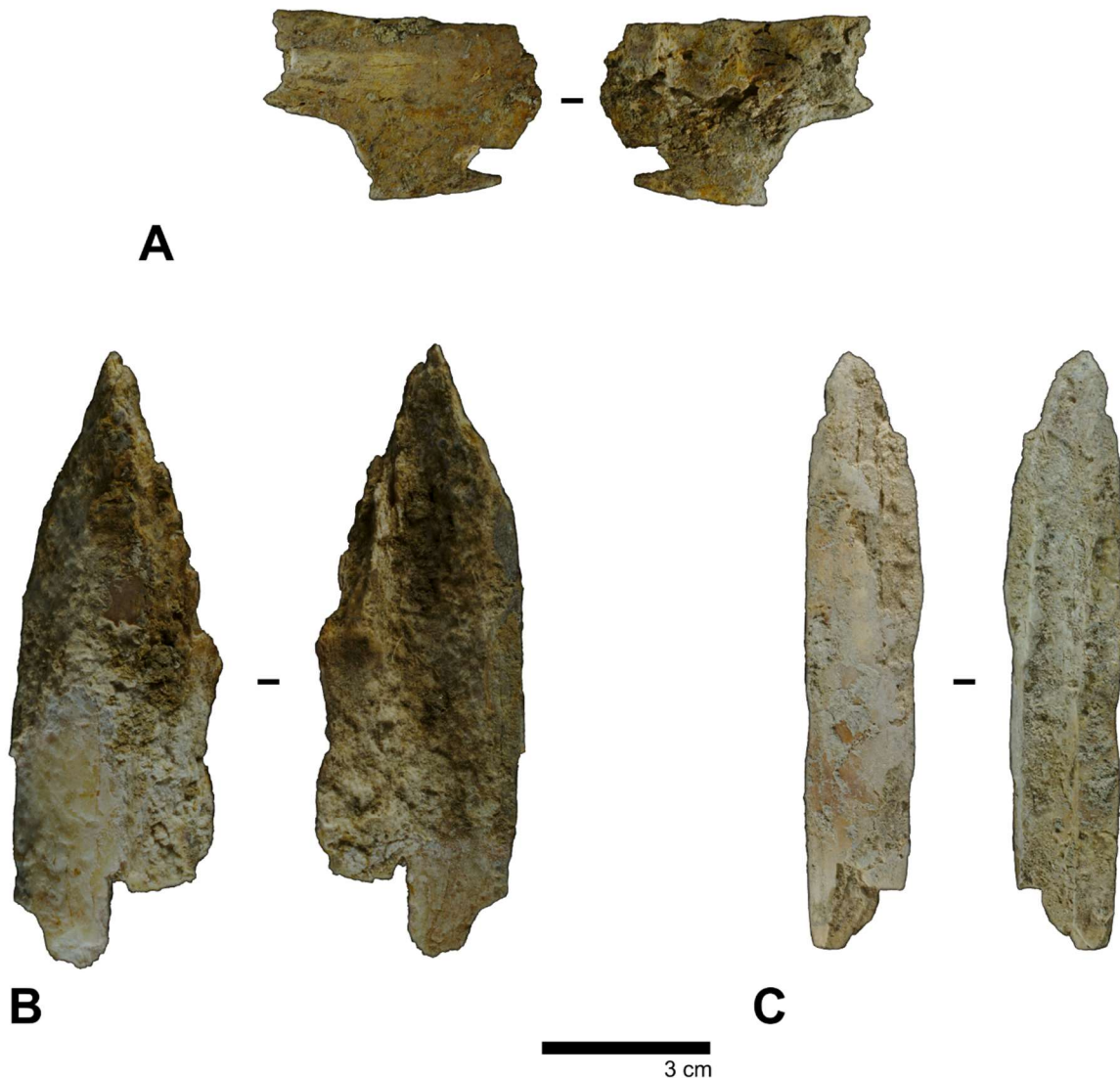


Figure 10. Some bone remains recovered from the Mesolithic level. A) Mandibular fragment. B) Tibia diaphysis fragment. C) Metacarpus diaphysis fragment identified as a red deer. Photo M.D. Guillén/IPHES-CERCA.

#### 4. Interpretations of the data

Based on the surveys carried out and previous research in the area (Clop *et al.* 2005; Pujol 2016: 1-50), the Cal Sitjo site, at least in its Neolithic levels, could occupy an area of at least 50,000 m<sup>2</sup> extended along both banks of Tous Stream. The presence of the Vilars de Tous site 250 m to the north with at least one synchronic occupation (4325-3980 cal BCE according to



Clop *et al.* 2005) and with some hut-bottom structures suggests that it would be the same settlement, at least for the Postcardial Neolithic. The El Trull site (Pujol 2016: 18), which is located on the other bank of Tous Stream about 100 m to the SW, the material recovered on the surface, and the black stains that appear in the cultivated fields suggest that it may be related to the occupation of Cal Sitjo. If these hypotheses are confirmed, the site of Cal Sitjo may have covered a large expanse of land during the Postcardial and Middle Neolithic.

This notion is strengthened by the appearance of so many structures in such a small area. The existences of villages with numerous negative structures can be paralleled to more or less nearby settlements such as Les Guixeres de Vilobí (Oms *et al.* 2021). Our excavation suggests an area related to a hut structure within a larger settlement. The water course and the great abundance of chert would make this location an ideal place to establish a settlement. This vision of the chert-rich region is also evidenced by the type of lithic industry found: no finished products or cores.

The scarce faunal remains are concentrated in the Mesolithic level, except for one bone remain in Level 3 (Middle Neolithic). This paucity of faunal specimens provides limited information, and we have only been able to identify one taxon and several anatomical parts. However, it has become clear that the type of settlement (open air) and the conditions of the sediment do not seem to be the most suitable for high degrees of bone preservation.

The anthracological assemblage is dominated by angiosperms, and no conifers have been documented to date. Taphonomic alterations have greatly contributed to the recovery of a high number of angiosperms and indeterminable fragments. However, deciduous and evergreen oaks are the most representative taxa. The arboreal communities in the area may have consisted of mixed oak forests living under more or less humid conditions. The presence of *Acer* sp. and Maloideae may indicate the presence of relatively humid forest, while the presence of *Salvia rosmarinus* indicates open spaces. All in all, the nearby landscape would be a mosaic of forested areas dominated by mixed forests and open areas allowing the development of shrubby vegetation. However, the anthracological record does not provide any insight into the diachronic evolution of the vegetation landscape. From a broader regional perspective, the evidence shows that deciduous oak forests were dominant in this area during the early Neolithic due, in some part, to high rainfall rates (Allué *et al.* 2009; 2017; Riera *et al.* 2007). These forests were probably managed and exploited for different purposes, including the acquisition of firewood, building and manufacturing raw materials and food (forage and wild plants). Over the course of the Neolithic, the increase in human settlements resulted in human pressure (agriculture and herding practices) in some areas that, together with an increase of aridity from 4500 years BP, caused transformations that shaped the landscape (Allué *et al.* 2009; Mas *et al.* 2022; Revelles 2017; Riera *et al.* 2007). Despite the limited results obtained up to now from Cal Sitjo, we can suggest that this area was part of this mosaic landscape affected by human communities.

The only diagnostic element that allows us to draw a preliminary contextualisation of the ceramic assemblage within the framework of the Neolithic ceramic productions of the NE Iberian Peninsula corresponds to a triangular cross-section cordon recovered in Level 4. According to the radiocarbon dating of this level (4071-3971 cal BCE), this potsherd would have come from the occupation of the site during the last century of the 5th millennium cal BCE and the beginning of the 4th millennium cal BCE. In this area and timeframe, Neolithic ceramics present diagnostic elements of the Molinot regional group framed within the Postcardial Neolithic (ca. 4500-4000 BCE). This artefact presents clear parallels with the ceramic elements of the Molinot group, characterised by the presence of one or several smooth cordons (arciform or horizontal, with a triangular section), but also by the brushing treatment of the surfaces: parallel striations left on the outer surface of the vessels and made with a toothed tool.

In the NE Iberian Peninsula, the ceramic elements of the Molinot group stand out in the central coastal and pre-coastal areas, such as the open-air sites of La Serreta, Les Guixeres de Vilobí and Mas d'en Boixos (Penedès area) and in caves such as La Guineu, Font del Molinot (Penedès)(Mestres 1981; Oms *et al.* 2014) and Can Sadurní (Begues, Baix Llobregat) (Edo *et al.* 2011: 58-75). On the western plains, these elements have also been identified in open-air sites such as l'Espina C (Tàrraga, Urgell)(Piera 2016). Currently available radiocarbon dating allows us to temporally place these elements of the Molinot group in the NE Iberian Peninsula between ca. 4500 and 3800 cal BCE (Oms *et al.* 2019).

On a local scale, the presence of ceramic diagnostic elements belonging to the Postcardial Neolithic is identified in the ceramic productions of the Vilars de Tous hut bottom, where a relatively high number of ceramics with brushed surfaces and triangular cross-section cordons were identified (Clop *et al.* 2005). Moreover, with the revision of the archaeological inventory of Sant Martí de Tous it was possible to recognise some ceramic elements possibly attributable to the Postcardial Neolithic in El Trull site (smooth cordons with a triangular section)(Pujol 2016: 18), although this must be confirmed through systematic excavation and radiocarbon dating.

In short, the radiocarbon dating obtained for Level 4 and the characteristics of these ceramics place the occupation of this level in the horizon of the Postcardial Neolithic (Mestres 1981), or the Early Middle Neolithic (Edo *et al.* 2011: 58-75). The progress of the excavations of Levels 3 and 4 will allow us to obtain an extensive archaeological record (ceramics, lithics, fauna, *etc.*) and deepen our understanding of the morphological and technological traits of Neolithic ceramic and lithic production, as well as consumption patterns and biotic resource management at Cal Sitjo.

The large number of archaeological sites documented in this area (Llobregat basin) from the Early Neolithic onwards (*e.g.*, Can Tintoré, Cova de Can Sadurní, Can Roqueta), especially in the Penedès area (*e.g.*, Cova de la Guineu, Les Guixeres de Vilobí, La Serreta), points to how the landscape must have played an important role in the occupation of the territory during the Holocene. An abundance of water, forest, fertile soils for agriculture and nearby mountains where forests can be exploited for hunting, wild plants and wood (Allué *et al.* 2009; Esteve 2006), together with abundant outcrops of high-quality lithic raw materials (chert) in the basins (Gómez de Soler *et al.* 2020; 2021) make this area of passage (plain) an ideal place to settle. As a future note, we will see if the next excavations that we will carry out in the Cal Sitjo site will allow us to obtain a continuous sequence of human occupation and to elucidate the question of the hiatus of 500 years of archaeological evidence in the NE of the Iberian Peninsula, coinciding with the well-known climatic cold episode of 8200 cal. BP (Morales & Oms 2012; Morales *et al.* 2012; Oms *et al.* 2014; 2018; Vaquero & García-Argüelles 2009; among others).

## 5. Conclusions

Cal Sitjo is a new archaeological sequence located in the NE Iberian Peninsula in the town of Sant Martí de Tous (Anoia, Barcelona) in a chert-rich region with an archaeological sequence of at least 8 m and, at least, Neolithic and Mesolithic occupations. This sequence will allow us to characterise the last hunter-gatherers as well as the first farmers and herders of the region. In addition, the lithology of the sequence (travertines, clays and sands) will allow us to extract very valuable paleoecological information in order to reconstruct the landscape and infer the differential management of the territory by these communities.

The radiocarbon dating and the ceramic fragments recovered give great coherence to the occupation of the Neolithic levels in the Postcardial horizon. Likewise, the dating of the Mesolithic level, at a depth of 6 m, mark an interesting sequence of occupation and open the

door to the possibility of finding those transitional levels so poorly understood in western Europe.

We hope in the coming years to recover more material that can be used to diachronically characterise the use of technology in these communities as well as their hunting, butchering and pastoralism patterns, and the environment in which they lived.

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### Data Accessibility Statement

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

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## Cal Sitjo: una nueva secuencia del Mesolítico al Neolítico en una región rica en sílex (Sant Martí de Tous, NE Iberia)

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### Resumen:

Cal Sitjo es una nueva secuencia arqueológica situada en el en el municipio de Sant Martí de Tous (Anoia, Barcelona) al NE de la Península Ibérica en una región rica en sílex. La zona ha sufrido una importante antropización y se han documentado diversos yacimientos (p. ej., Vilars de Tous) y canteras y talleres de explotación de sílex (p. ej., La Guinardera), correspondientes a diferentes épocas. La abundancia de sílex hizo de esta región un lugar de paso casi obligado para comunidades cazadoras-recolectoras como las que ocupaban los cercanos acantilados de la Cinglera del Capelló (Capellades), situados a una distancia en línea recta de 15 km, así como un asentamiento ideal para comunidades agrícolas posteriores.

Las investigaciones arqueológicas realizadas en la comarca apuntan a un apogeo ocupacional en el municipio de Sant Martí de Tous a partir del Neolítico. Esto se evidenció mediante el descubrimiento de una serie de asentamientos, como los Vilars de Tous (Cámara 2017; Clop et al. 2005), el Trull, Prop de Biosca y Cal Marquet, entre otros (Pujol 2016: 18,19 y 25). El elevado número de ocupaciones en la zona continuó a lo largo de la Edad del Bronce, el período Ibérico y Romano. En este contexto, la abundancia de sílex en este territorio pudo ser un factor clave para el asentamiento de las primeras comunidades agrícolas y ganaderas. Descubierta en 2019, la primera campaña de excavación en Cal Sitjo se realizó en otoño de 2020. Se han obtenido dataciones por radiocarbono a partir de una secuencia conocida de unos 8 m, proporcionando un marco cronológico que va desde el Mesolítico hasta el Neolítico Medio. Los resultados preliminares de esta excavación han sacado a la luz restos de industria



lítica, cerámica y carbones de los niveles neolíticos (niveles 3 y 4), y restos faunísticos, líticos y de carbones de los niveles mesolíticos (extraídos de la limpieza de la sección).

En la literatura neolítica, la cuenca del Anoia se considera dentro de la región del Penedès (Oms et al. 2014; Oms et al. 2018), una de las mayores concentraciones de yacimientos del Neolítico temprano en la Península Ibérica (por ejemplo, Cova de la Guineu, Guixeres de Vilobí) (Esteve et al. 2012; Oms et al. 2014; Riera et al. 2007; Esteve et al. 2012; Oms et al. 2014). Son muchos los yacimientos excavados y estudiados del Neolítico Inicial y Medio (Oms & Martín 2018), pero ninguno presenta una secuencia tan larga con ocupaciones mesolíticas y, hasta ahora, del Neolítico Medio. El yacimiento de Cal Sitjo pretende complementar nuestra comprensión del Neolítico en esta región y, si los resultados futuros son positivos, llenar el vacío en nuestra comprensión respecto a la transición de los últimos cazadores-recolectores a los primeros agricultores.

Las dataciones radiocarbónicas y los fragmentos cerámicos recuperados dan una gran coherencia a la ocupación de los niveles neolíticos en el horizonte Postcardial. Asimismo, la datación del nivel Mesolítico, a 6 m de profundidad, marca una interesante secuencia de ocupación y abre la puerta a la posibilidad de encontrar niveles transicionales a inicios del Holoceno tan poco conocidos en Europa occidental.

Nuestros resultados preliminares confirman que esta secuencia es un lugar idóneo para el estudio diacrónico de la evolución de los últimos cazadores-recolectores hasta los primeros agricultores, tanto desde el punto de vista paleoambiental y tecnológico, como desde el punto de vista de la gestión y distribución del sílex en un territorio con gran abundancia de esta materia prima.

**Keywords:** NE de la Península Ibérica; región rica en sílex; Mesolítico; Neolítico; multidisciplinar; Cal Sitjo