6. Presentation of the site: The Romani Abric

The Abric Romaní site is located in the northwest of the Iberian Peninsula, about 50 km west of Barcelona, in the town of Capellades, at 1º 41' 30" east longitude and 41º 32' north latitude. The town of Capellades is situated at an altitude of 265 m above sea level. The shelter is part of a vertical wall of travertine formation known as Cinglera del Capelló, which rises on the right bank of the Anoia River, a tributary of the Llobregat, reaching an altitude of 60 m in relation to the current river bed (Figure 6. 1).

The Cinglera del Capelló is included in an ecotone where three very different ecosystems converge: the mountain, the valley floor with open spaces and, finally, the river that acts as a link between the two previous ones. This enclave constitutes a strategic point and an ideal place for the establishment of human groups during the Upper Pleistocene, with evidence of their occupation preserved in a large number of cavities, such as: the Abric Agut, Balma de la costa de Can Manel, Balma dels Pinyons (Vaquero et al., in press).

Figure 6. 1. Geographic location of the site and general view of the village of Capellades (Barcelona) and the Abric Romaní. Photos: IPHES.

6.1. Geomorphological context

6.1.1. Structural units

The geomorphological context of the area is conditioned by the confluence of three large different morphostructural units: the Pre-coastal Mountain Range, the Central Catalan Depression (eastern sector of the Ebro Depression) and the Penedés Depression (Muro et al., 1987).

The Anoia River crosses the Catalan Pre-coastal Range taking advantage of a transversal fault, a consequence of the extensional dynamics of the beginning of the Miocene. This fault with a NNW-SSE direction divides the area from a lithological point of view, into two areas (Muro et al., 1987; Mora 1988) (Figure 6. 2):

1) an area located to the East, with Paleozoic materials composed of Silurian slates, which shows overthrust phenomena, in contact with the Eocene of the Ebro Depression.

2) and another in the West, with Triassic materials that form an anticline and are composed of yellowish marls, dolomitic limestones, conglomerates and dark sands. The Triassic materials are found under a unit formed mainly by slates,

which largely determines the hydrographic structure of the area, responsible for the formation of the Quaternary travertines.

The Pre-coastal Range includes the oldest Triassic and Paleozoic materials; these establish contact with the Miocene materials of the Penedés Depression and the Eocene materials of the Ebro Depression. These materials are mainly Silurian slates (Muro et al., 1987).

The Ebro Depression has a triangular shape and is bordered by the Pyrenees, the Iberian Mountains and the Catalánides (Pre-coastal Mountains and Penedés Depression); it is formed by Eocene marls. In the central area, the presence of the Ódena Basin is important, formed by the regressive and erosive action of the Anoia River.

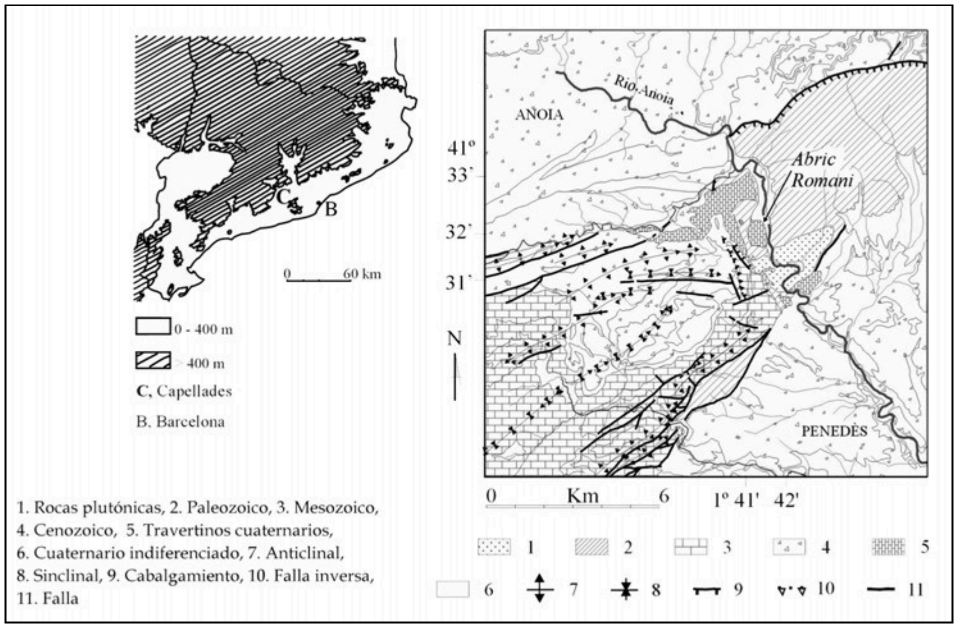

Figure 6. 2. Geological and geomorphological map of the surrounding area of Capellades (taken from Vallverdú 2002).

The Pre-coastal Depression, which includes the Penedés Depression, is the result of the sinking of a large block during the movements following the Alpine orogeny.

The Penedés Depression is filled with Miocene detrital materials and has significant deposits of conglomerates, sandstones and continental silts where it comes into contact with the Pre-coastal Mountain Range, creating a terraced landscape characteristic of differential erosion. The contact is made by means of a fault that takes advantage of a previous compressive accident (Solé Sabarís 1958-1964).

The most important elevations that we can see from the surroundings of Capellades are: to the East, Miramar (598m) and the Sierra de Llabería and to the South, El Monte de Gall in the Sierra de Guixeria.

6.1.2. Quaternary deposits

In the Anoia valley, in the Capellades area, different types of Quaternary deposits are distinguished, whose characteristics and morphology are related to their position and chronology (Muro et al., 1987; Mora 1988):

1) Travertine formations: these are the most important from the point of view of the study of Pleistocene communities. They are located in the Capellades area and in its immediate surroundings. Their origin is due to the contact between Paleozoic materials and the bordering formations, and depending on their origin and type of material, two types are distinguished:

1.1) The first is located in the triangular area formed by the towns of Capellades, La Pobla de Claramunt and La Torre de Claramunt. The altimetric regularity of these formations (between 200 and 300m above sea level) has led to the hypothesis that we are dealing with a travertine of lacustrine origin. Its base is made up of coarse and fine detrital elements (sand and silt), which present an irregular stratification dated by the presence of palaeontological remains in the Villafranquiense.

1.2) The second type is located in the Cinglera del Capelló, it has its origin in the Capellades aquifer springs and comes from the dislocations produced by the last Quaternary movements. Its chronology is later and it has a more spongy appearance. These aquifer springs are responsible for the formation of the hat-shaped cornices that make the “Cinglera” unique.

Travertine is a continental limestone that requires water rich in calcium carbonate (CaCO3) and large accumulations of plant remains for its formation. The appearance of travertine is the result of a chemical process consisting of the loss of CO2 from the water, which results in the supersaturation of CaCO3 and the subsequent precipitation. The Capellades area is characterized by the great speed of its formation, as a consequence of the large amount of calcium carbonate (0.373 grams per liter of water) contained in the water sources in the area. The water is supersaturated with calcite and dolomite, and slightly undersaturated in gypsum (Giralt and Julià 1996), and contains minor amounts of sulfur, nitrogen, chlorine, sodium, potassium, manganese and uranium.

2) Quaternary terraces: they have been located on the terraces of the Anoia River and its tributaries. These formations are made up of a conglomerate in which there are many large rolled elements, which imply a torrential regime. To the north in the Òdena Basin, five levels of terraces have been identified (Gallart 1991 in Vallverdú 2002):

2.1) Upper terrace (T4) at 80 m above the bed of the Anoia. It would correspond to the Capellades travertine, therefore belonging to the Lower Quaternary.

2.2) High terrace (T3) at 55 m above the bed and composed of very cemented lacustrine limestones that form abundant witness hills.

2.3) Middle terrace (T2) at 25 m above the current bed, very extensive and with two sublevels.

2.4) Low terrace (T1) at 8-14 m above the current bed, formed by silt, gravel and sand.

2.5) Lower terrace (T0) at 1-2 m. It is the current flood bed of the Anoia.

3) Quaternary slope: they are made up of conglomerates in which slate pebbles, silts and some quartz pebbles are abundant.

4) Recent alluvial deposits: These appear at the bottom of small ravines, in the form of deposits of Paleozoic or Miocene materials. In the Penedés Depression, this type of deposit has barely rolled pebbles of slate and quartz.

6.2. History of interventions in the Abric Romaní

The history of archaeological interventions in the Abric Romaní dates back to the beginning of the last century, coinciding with the beginnings of prehistoric research in Catalonia. It therefore constitutes a direct testimony of the development of this discipline and of the theoretical and methodological transformations it has undergone throughout the 20th century.

The researchers who have focused their attention on the shelter over these decades have been numerous. These researchers, guided by different perspectives and objectives, They worked on the site using different techniques and working methods. The different actions that took place in the shelter can be summarized in three stages:

6.2.1. First stage: 1909-1930

Amador Romaní i Guerra (1873-1930) has been the most relevant figure in the history of archaeological work in Abric Romaní (Bartrolí et al., 1995). He was an industrialist from Capellades who belonged to a generation of local scholars, a multifaceted character with a basically self-taught education who was interested in sciences such as archaeology, natural history and folklore (Figure 6. 3 and Figure 6. 4).

Aware of his region's past and influenced by the naturalist conception of research, he promoted the first investigations into prehistory in Catalonia. His personal interest in the knowledge of the past and the origin of human beings led him to the discovery of a large number of archaeological sites.

In 1905 he began archaeological exploration in the Cingles del Capelló, discovering prehistoric remains in the Abric Romaní in 1909. That same year, he communicated the importance of his discovery to Nobert Font i Sagué, who, after carrying out some test excavations, managed to get the Institut d'Estudis Catalans to assume the costs of the excavation.

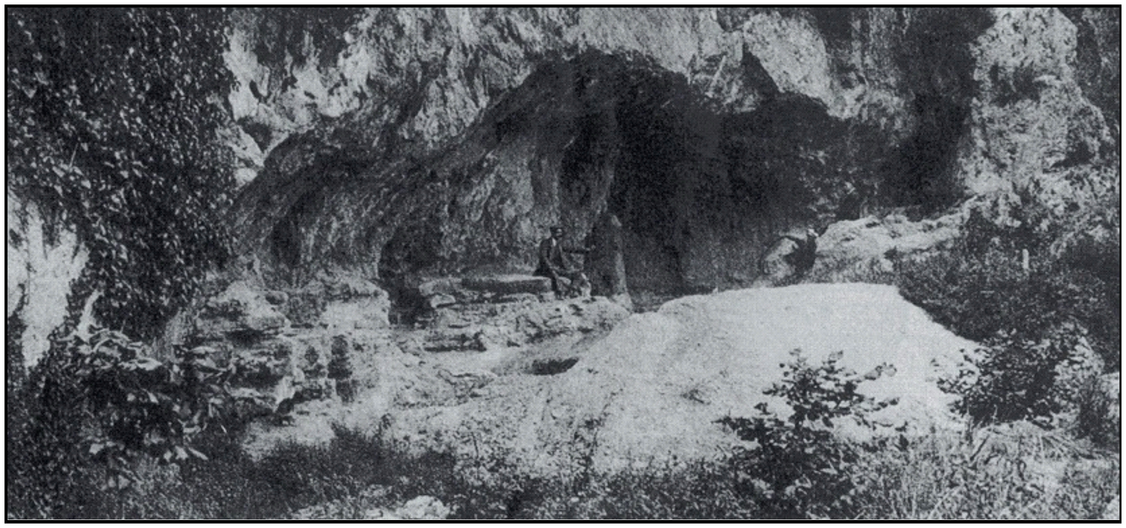

Figure 6. 3. Photograph of the Abric Romaní site during the period of work carried out between 1909-1912 (taken from Bartrolí et al., 1995).

The Institut d'Estudis Catalans (I.C.E.) is an institution founded in 1907 by Enric Prat de la Riba. This centre played an important role in sponsoring and disseminating the first archaeological investigations carried out in the Abric Romaní. The I.C.E. assigned the direction of the works to Font and Sagué, and later, after his sudden death, to Luis Mariano Vidal, a mining geologist who had joined the project before. He finished the excavation in 1911, publishing his first results in the Anuari de l'Institut d'Estudis Catalans (Vidal 1911-1912). Despite the direction of other scientists, Amador Romaní was actually the one in charge of the excavations, reporting punctually on the development of his actions. The systematic excavations continued until 1911, when the I.C.E. stopped sponsoring the works. However, Amador Romaní continued working sporadically until his death in 1930. The development of his interventions has been recorded in his field diary, which he called the Atlas of Prehistory (Bartrolí et al., 1995).

From his documents and notes we know that the work mainly affected the upper levels of stratigraphy. A. Romaní's objectives with his interventions were mainly two:

1) To try to establish the stratigraphic sequence of the shelter. To do this, two boreholes were made: Well I, on the left side of the southern Coveta (known today as Coveta Ripoll or Lobe 3) with a rectangular shape and dimensions of 5x4m, until reaching the wall of the shelter. Well II is located at the eastern end of the shelter, 6 metres in diameter and 4 metres deep. At its base, another circular borehole was made with a diameter of 1.6m and a depth of 8 metres, known as the Romaní Well.

He attempted to reach the substratum of the cave and fully delimit the entire stratigraphic sequence of the shelter, and he developed the first known sequence with the description of 31 layers, 16 of which contain evidence of human and animal occupation (Carbonell 1992).

2) Horizontally delimit the identified layers, excavating practically the entire surface in the upper levels (Set I (level A) and II (level B, C and D)).

The stratigraphic description of A. Romaní, although in its general outline coincides, differs in some aspects from that elaborated in recent years. These differences basically come from the different degree of precision in the description of the stratigraphic units, since Amador Romaní included in homogeneous packages sections of the sequence that are actually formed by several units. However, the work carried out by A.

The Romaní collections stand out mainly for their use of a very novel, appropriate and scientific methodology for the period in which they developed their work. The archaeological material recovered during this first phase is basically composed of stone and bone remains, of which only a small collection is preserved in the Museu Molí Paperer de Capellades (Bartrolí et al., 1995) (Figure 6. 5).

Figure 6. 4. Amador Romaní (left) with one of his collaborators during the work carried out at the site between 1909-1930 (taken from Bartrolí et al., 1995).

6.2.2. Second stage: 1956-1963

On the occasion of the celebration of the V International Congress on the Quaternary (INQUA) in 1957, archaeological work was resumed at the Abric Romaní, sponsored by the Archaeological Research Service of the Provincial Council of Barcelona. The direction was in the hands of Dr. Eduard Ripoll i Perelló, with the supervision of Drs. Martín Almagro, Luís Pericot and Alberto del Castillo. This second phase had the collaboration of prestigious French researchers such as Georges Laplace in 1959 (Laplace, 1962) and Henry de Lumley in 1961 (Lumley and Ripoll, 1962).

Archaeological work in this phase is characterized by an almost total absence of information. This is a period in which we have hardly any news about the development of field work. For example, the existence of excavation diaries or the methodology applied is unknown, and there is little knowledge about the excavated sectors, the location of the materials or the creation of inventories. However, the short notes published in different articles and the study of the physical impact on the site have allowed us to understand the objectives pursued at this stage (Vaquero 1997).

The main interest of this stage will be to try to establish the chronological sequence of the site, with the aim of framing it within the temporal sequence established in the area of La Dordogne (France), based on the typological classification of the lithic assemblages. In this sense, the Abric Romaní was associated with a Mousterian of denticulate facies.

The interventions were limited to specific areas of the site, in order to thoroughly verify and study the stratigraphy revealed by Amador Romaní. In general terms, the work in this phase consisted of (Figure 6. 6):

1) The cleaning and excavation of a pit in the central part of the site, between the Testimonies 2 and 3 of Amador Romaní (Well I).

2) The completion of a stratigraphic survey at the western end of the shelter, which describes the stratigraphic sequence corresponding to Set II, and which will be called Well III.

3) Excavation of an "L" shaped trench starting from the southern end of Pit I (squares J-K/49-52 and M-J/52) with a maximum width of 1 metre and a length of 4 metres, turning east at an angle of 90º, where it extended for a further three metres. This trench, which reached the travertine levels below archaeological level I, has been known as the "Ripoll Trench" since its discovery during the clearing work of the 1985 campaign (Figure 6. 6).

Lumley and Ripoll (Lumley and Ripoll 1962) are going to divide the stratigraphy into three sets, granting them a paleoclimatic significance:

1) Basal set: 1.5 m of cryoclastic gravel, attributed to a cold and humid climate (Würm II).

2) Medium set: 4 m of travertine, corresponding to a humid and temperate climate (Würm II-III).

3) Upper set: red silty sands, belonging to a cold climate and dry (Würm III).

Although most of the recovered material was deposited in the Archaeological Museum of Barcelona, its whereabouts are currently completely unknown. After these works, the Abric Romaní was abandoned until 1978, when Dr.

Llongueras will clean the stratigraphic sequence of Well II of the site and extract pollen samples to compare them with the sequence proposed by Ripoll and De Lumley (Deguillaume 1987; Metter 1978).

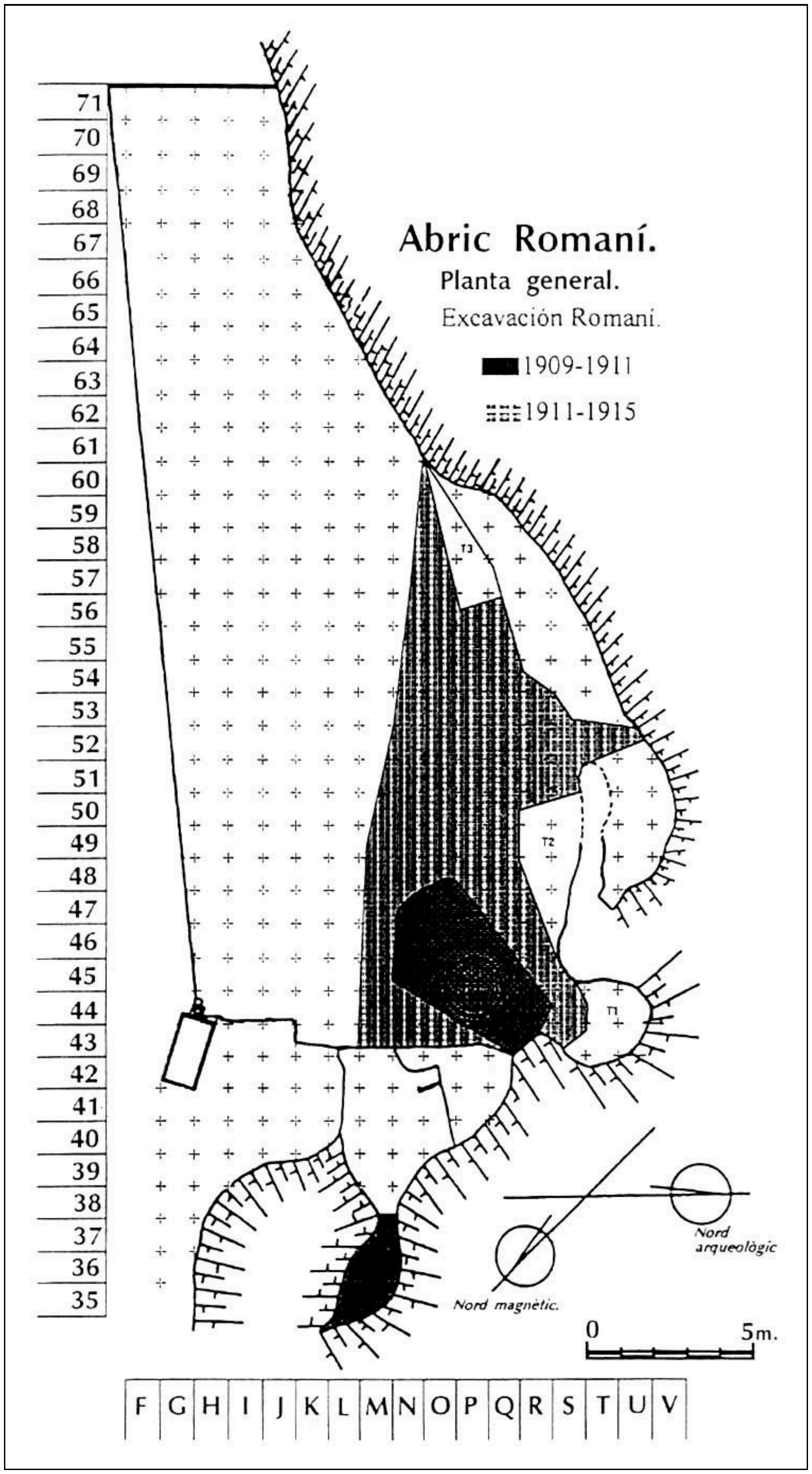

Figure 6. 5. Site plan indicating the area affected by Amador Romaní's work (taken from Vaquero 1997).

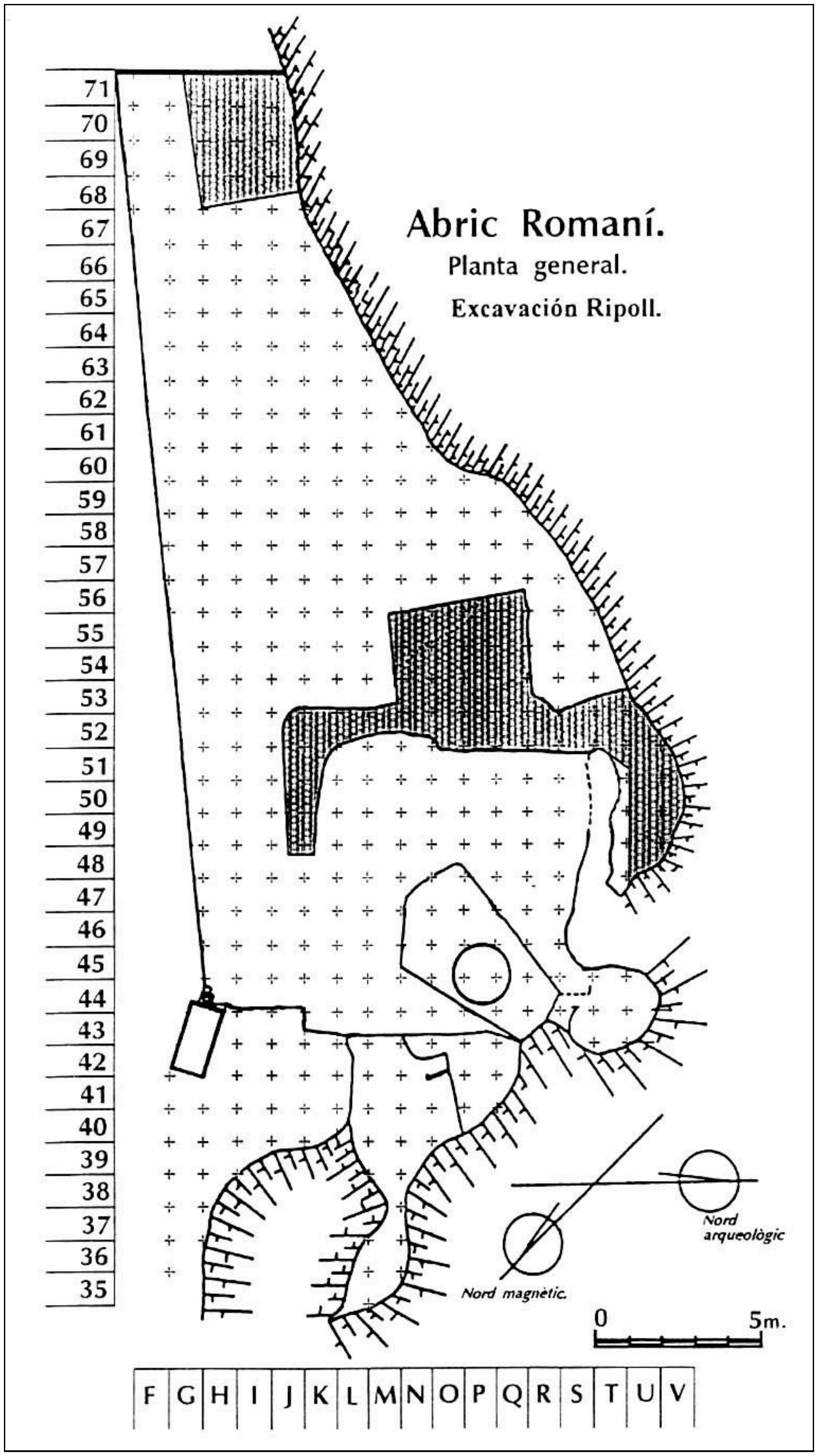

Figure 6. 6. Site plan indicating the work carried out during the second phase of the excavations (taken from Vaquero 1997).

6.2.3. Third stage: from 1983 to the present

The third stage of archaeological work began in 1983 (Carbonell et al., 1994; 1996a). This last phase, which continues to this day, presents two distinct moments:

1) The first (1983-1988) was developed by the Centre de Recerques Paleo-Eco-Socials (C.R.P.E.S) of Girona, under the direction of Eudald Carbonell, Artur Cebrià and Rafael Mora, within the framework of a research project on the Middle and Upper Pleistocene of Catalonia.

The beginning of this phase has been a reflection of the new conception of archaeology; the beginning of a new stage marked by the rejection of previous theoretical currents, and by the assimilation of new theories, which dominated in other countries. The arrival of New Archaeology, implies much more than a simple application of new methods and work techniques. From this moment on, the concept of archaeological culture is conceived as a mechanism for the adaptation of human groups to their natural environment.
The objective of the work will focus on the study of the behavior of human groups and their interrelations with the environment.

Modern archaeological work techniques and methods were introduced during this stage at the Abric Romaní. The new objectives were based on the need to understand the horizontal relationships established between archaeological objects, using Cartesian coordinates, which allow for spatial reading of the record and obtaining a synchronous view of the processes of occupation of space.

The main objective of the interventions will be the extensive excavation of the entire site, with the aim of obtaining a paleo-ethnographic reconstruction of the activities carried out in the shelter. The main work carried out in this phase focuses on the complete cleaning of the surface and the preparation of the shelter for excavation by installing a permanent aerial grid and a cover on the site. Core samples from old excavations are removed, except for the stratigraphic column of squares R54-55, the only core sample that preserves all the sediments of the site and which currently constitutes the reference point for the upper levels of the stratigraphic sequence. The theoretical North is marked on the wall of the shelter and the southern limit of the site is traced.

2) In 1989 the team split up and from that moment on the intervention was taken over by the team from the Prehistory Area of the Rovira i Virgili University (Tarragona), under the direction of Dr. Eudald Carbonell and Artur Cebrià. Currently, under the same direction and line of research, the institutions involved have become the Rovira i Virgili University of Tarragona (URV) and the Institute of Human Paleoecology and Social Evolution (IPHES).

In the same line of research as in the previous phase, the main objective is to offer a vision and interpretation of the archaeological record, from an interdisciplinary perspective (Carbonell 1992) (Figure 6. 7). The most notable works of this third phase are:

1) The Romaní Well is deepened to an approximate height of 4m, without yet reaching the sedimentation base of the shelter.

2) The creation of a dating program through the application of U/Th and C14 (Bischoff et al., 1988; 1994), which allow us to frame the sequence chronologically, and the performance of pollen analysis in the stratigraphic sequence (Burjachs and Julià, 1994; 1996).

3) The study of the geomorphological framework of the area and the analysis of the dynamics sedimentary of the deposit.

4) Extensive excavation of the entire surface of the shelter, reaching 300 m2, and in the 2008 campaign reaching practically the entire area occupied by Neanderthal groups (level P) of the stratigraphic sequence.

5) The interpretation of the record will be carried out from two different points of view: 1) Synchronous reconstruction of each of the levels of the site, to make possible the paleoethnographic reconstruction of the activities carried out in each of them; 2) and the diachronic reconstruction of the Abric Romaní, to frame it within the cultural evolution of the hunter-gatherer groups of the Upper Pleistocene (Vaquero 1997; 1999b).

From this stage onwards and in parallel with the archaeological work, an important task of publishing scientific works has been carried out (doctoral theses, dissertations, research papers, articles, monographs and workshops).

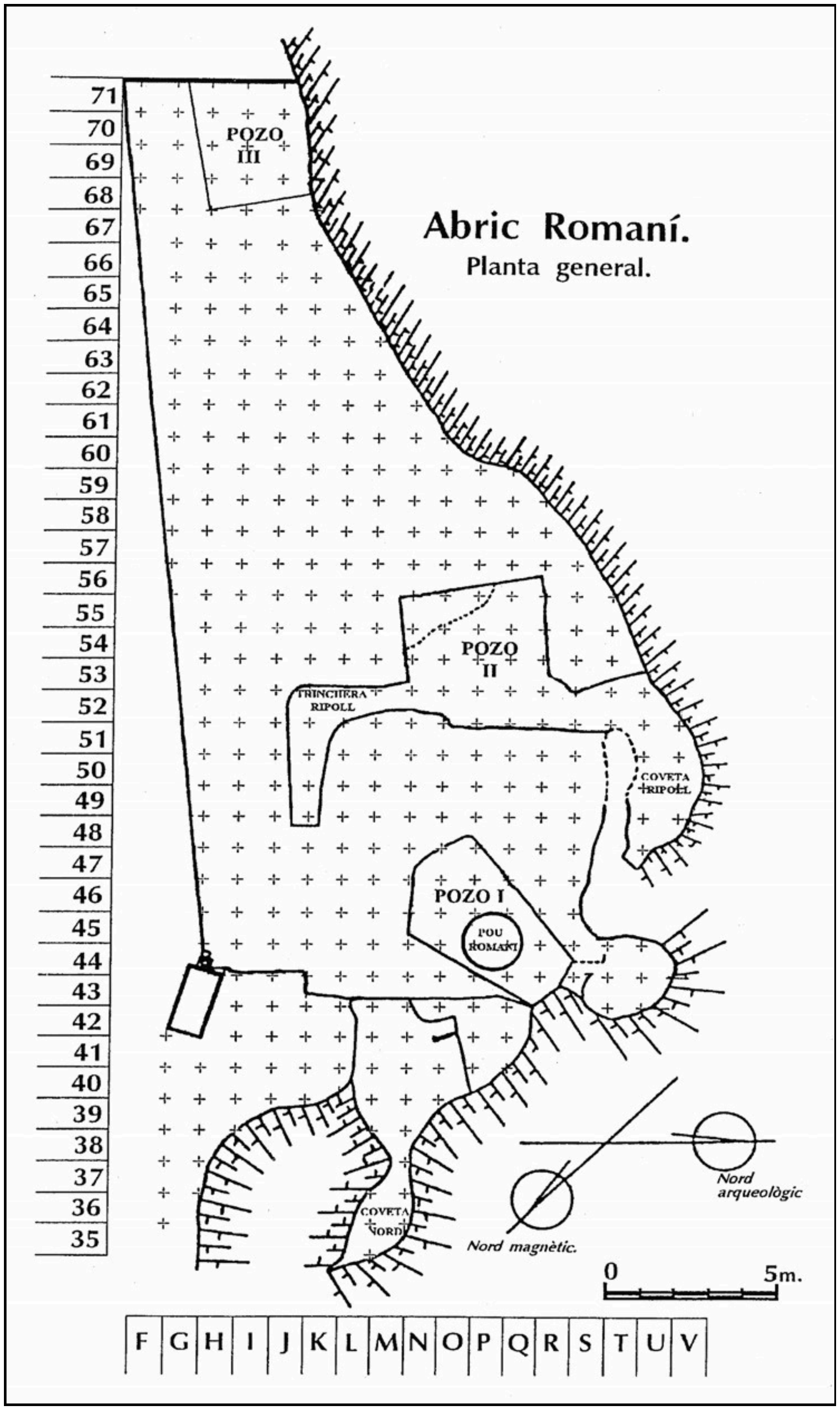

Figure 6. 7. Site plan indicating the location of the main interventions that were documented when work was restarted in 1983 (taken from Vaquero 1997).

6.3. Stratigraphic context

6.3.1. Stratigraphic sequence and sedimentary dynamics

The known stratigraphic sequence, almost 20 m thick, documents a total of 27 archaeological levels named in alphabetical order, all of them belonging to the Middle Paleolithic, except for level A, which corresponds to the Upper Paleolithic (Carbonell et al., 1994). Level P is currently being excavated (Figure 6. 9).

The stratigraphy is mainly formed by the succession of travertine platforms.

These platforms are the result of the water sources existing in the surroundings of the site. The platforms model the microrelief of the shelter, determining to a large extent the occupation strategies, in terms of the spatial organization of the activities.

Although the basic structural element that forms the stratigraphic sequence of the Abric Romaní are the formations produced by calcium carbonate, there is also a dynamic that alternates diagenetic factors with allochthonous and autochthonous fillings. This will determine that the sequence is very homogeneous and is characterized by the alternation of the same type of units, with few moments in which this dynamic is broken.

This break basically translates into important phenomena of lateral variation and discontinuity, and in the formation of microspaces with a differential sedimentary behaviour, such as the Coveta Nord (Metric alveolus 2 or Lobe 2) and the Coveta Ripoll (Metric alveolus 3 or Lobe 3) (Vaquero 1992a; Vaquero et al., 1997;
Vallverdú 2002; Vallverdú et al., 2005b) (Figure 6. 8).

The sedimentary environment of the Abric Romaní is characterized by the succession of various sedimentary environments, which is the specific response of said environment to the succession of certain neotectonic or climatic events, and to the changes that mark the paleoenvironmental dynamics on a regional scale. Each of these environments results in the formation of different sedimentary facies. Five have been distinguished:

1) Platform Series: This is the main environment for most of the shelter sequence.

It occurs at times when water supplies are abundant, which leads to the formation of travertine platforms, where human occupation will take place. They usually generate flat or domic (convex) morphologies. These environments are usually interpreted as periods with no occupation; it would be an unfavorable environment for the habitat, since water circulates without channelling through the shelter. Different facies have been identified, characterised by specific types of travertine, whose morphology informs us of the type of vegetation on which the calcium carbonate was fixed (Carbonell et al., 1994; Giralt and Julià 1996):

a) Tubular travertine facies, formed by plant stems. They are located towards the interior of the shelter, and are related to low-energy water systems.

b) Filiform travertine facies, composed of mosses. They are located near the ledge line, and their formation is due to high-energy water systems.

c) Leaf travertine facies, from different plant species.

2) Palustrine series: defined by the presence or absence of water at different times inside the shelter. It is determined by the existence of individual units of paleorelief on the travertine platforms, such as gours (small accumulations of water measuring decimetres and closed by limestone concretion) and paleochannels (fossil alluvial channels, which mark the areas with the greatest water energy, generally outside the cornice or between the gours). The latter are characterised by accumulating detrital deposits and channelling water when its circulation decreases.

In this series there is a greater diversity of facies, which are arranged within the tours, following a decreasing grain stratification:

a) Oncolite facies: they are formed in times of greater water intensity and are usually found at the base.

b) Carbonate sand facies: they are deposited at times when the water intensity is lower.

c) Silt facies: fill the cavity when water circulation is almost non-existent, causing total clogging of the gour.

d) Formation of tubular, filiform, leaf-shaped travertines, etc., on the margins of the gours which will give rise to the platforms.

3) Fall series: characterized by the presence of two facies:

a) Platelet facies: formed by small decimetric and centimetric flakings with polygonal and angular shapes. They are located flat with respect to the surface, although sometimes they may appear overlapped due to high-energy water currents. They originate from the fragmentation of the walls and the roof, as a consequence of cold climatic conditions.

b) Block facies: identified by the existence of angular blocks with measurements from decimetric to metric, which do not have a regular arrangement. They correspond to climatic conditions very similar to those of the platelet facies, but their origin may be due to the force of gravity or seismic phenomena that cause a partial collapse of the cornice. They appear punctually in the stratigraphic sequence and usually coincide with archaeological units of great anthropic activity, such as levels E and J.

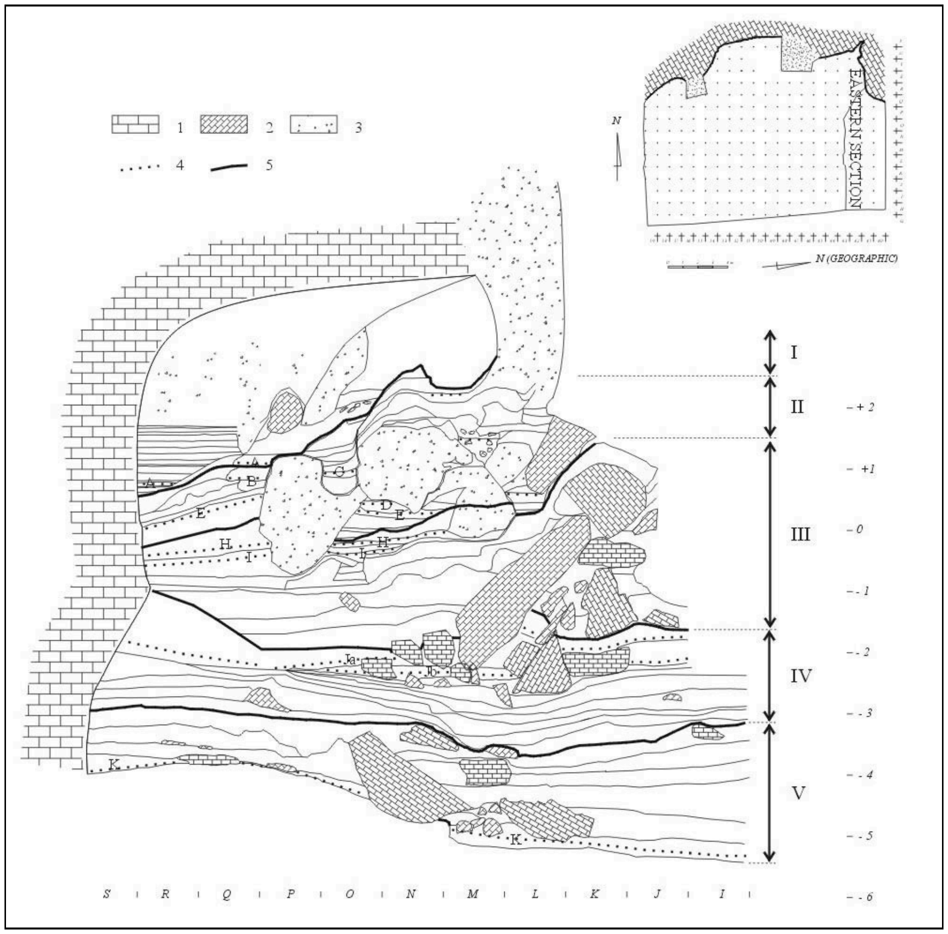

Figure 6. 8. Stratigraphy of the Coveta Nord Sector (SCN) (Vallverdú 2002; Vallverdú et al., 2005b). Legend: 1. Cinglera del Capelló, wall of the Abric Romaní; 2. Fallen blocks of the cornice; 3. Stalagmites and stalactites; 4. Archaeological levels; 5. Large discontinuities.

4) Terrigenous series: it is formed by facies of red sands and silts, which determine the formation of edaphic soils and are usually the result of arid climatic conditions. It only appears at two points in the lithostratigraphic sequence. On the one hand, in level E, formed by fine sands and red silts, whose origin will surely be edaphic and which coincides in its formation with a block fall facies. On the other hand,

It coincides with the level of silting up of the shelter and may be of wind origin (Bischoff et al., 1988a).

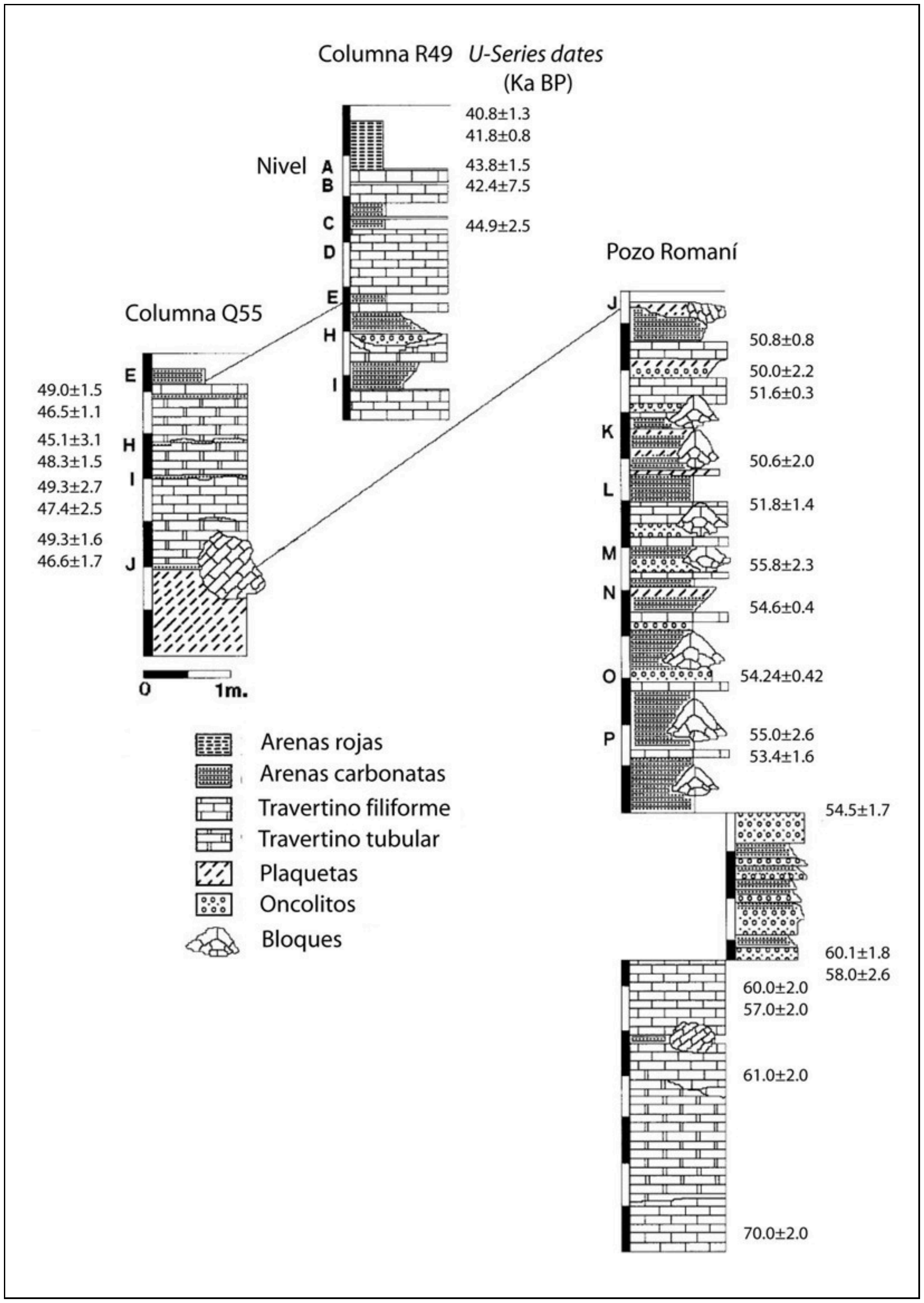

Figure 6. 9. Stratigraphic succession and dating of the Abric Romaní (modified from Giralt and Julià 1996; Bischoff et al., 1988; 1994; Vaquero et al., in press).

5. Anthropic series: found throughout the entire sequence. It is not considered an isolated formation phenomenon in itself, but associated with the rest of the sedimentary environments. They tend to have little power and are located between platforms when there is little or no water activity, except during times of block falls and terrigenous formation, which is when they acquire greater power.

6.3.2. Dating methods and chronology

The stratigraphic sequence of the Abric Romaní currently has two series of dates obtained from two different methods: 1) the U/Th method, which places the shelter between ca. 40 and 70 Ka, with a constant sedimentation of 1 m every 1760 yrs (Bischoff et al., 1988; 1994). The Abric Romaní is an ideal place for the application of this method due to the high uranium content of the waters and the high efficiency in the fixation of uranium, as a consequence of the high organic content of the sediment (Carbonell 1992).

2) The second series of C14 dates obtained from coal samples, using accelerator mass spectrometry (AMS), corresponds only to the upper part of the sequence, providing dates of 35.40±0.81 Ka for level A, and 47.10±2.10 Ka for level J (Bischoff et al., 1994; Carbonell et al., 1994).

Archaeological location	*USGS Laboratory No.*	*depth 30*	*Uppm*	*230Th/ 232Th*	*U/Th date ka*
Above level A	*87-88*	-10	*0.98*	26	*40.8±1.3a*
Above level A	87-36f	-20	1.24	7	39.4±1.5
Above level A	87-35f	-30	1.3	11	42.9±1.6
Above level A	87-44	-50	0.76	8.5	39.1±1.5
Above level A	90-AR4	-70	-	-	41.8±0.8a
Below level A	90-AR3	-60	-	-	42.7±1.3a
Below level A	87-37f	-110	1.99	25	43.8±1.5
Below level B	87-52	-120	0.73	9	43.4±1.5
Below level B	87-32f	-120	0.88	21	48.1±3
Below level B	87-107	-100	0.60	19	43.1±1.5
Below level B	86-33f	-100	0.71	24	44.0±1.3
Below level C	86-35f	-150	0.65	35	42.4±7.5
Below level C	87-41f	-150	0.69	52	44.2±1.5
Above level Eb	87-133	-180	0.33	>1,000	44.6±1.5
Above level Eb	87-126	-200	1.01	11	44.9±2.5
Above level Hb	03-64	-200	1.0	18	38.1±0.9
Above level Hb	02-18	-290	0.88	53	36.4±1.4
	02-22	-290	0.74	15	49.0±1.5
	03-65		0.58	16	46.5±1.1

Table 6. 1. . U/Th dating of travertine samples from the Abric Romaní. (a) Mean of different datings. (b) unpublished datings (Vaquero et al., in press).

The joint application of the two dating methods has given very similar results, both showing a high internal correlation and coherence. However, the dates obtained by C14 tend to be more recent than those of uranium. Differences of 5.6±1.5 Ka are observed in the upper part of the sequence, while at other levels

In archaeological records such as H, I and J these differences are not appreciated (Carbonell 1992). In recent years, new datings have been carried out and the results obtained have been compiled in a recent publication (Vaquero et al., in press) (Table 6. 1, Table 6. 2, Table 6. 3 and Figure 6. 10).

Archaeological location	*Laboratory No. USGS*	*depth -340*	*Uppm*	*230Th/ 232Th*	*U/Th dates ka*
Above level I	*87-55*	-340	*0.75*	20	*45.1±3.1*
Above level Ib Below level I Below level I Below level I Below level I Below level I Below level I Below level I Below level I Below level I Above level J Above level J Above level Jb Below level J Below level J Above level Kb Above level Kb Above level L Above level L Above level L Above level Lb Above level Mb Above level Mb Above level N Above level N Above level Nb Above level Ob Above level Pb Romani well ... Romanib	02-21	-360	0.86	26	48.3±1.5
	87-54	-360	0.92	70	45.3±1.5
	87-129	-360	0.79	105	47.7±1.6
	87-66	-360	-	-	48.6±2.3
	87-64	-360	-	-	46.9±2.6
	87-56	-380	-	-	46.3±2.4
	87-60	-370	-	-	49.2±3.3
	87-123	-380	0.96	86	48.0±1.6
	87-59	-390	-	-	47.4±2.5
	87-57	-480	-	-	49.3±2.7
	87-61	-490	0.55	>1,000	49.3±1.6
	87-58	-500	-	-	49.2±2.9
	02-19	-520	0.80	34	46.6±1.7
	87-3	-520	1.82	>1,000 >1,000 13 >1,000 >1,000 >1,000 >1,000 146 79	50.0±1.6
	87-16	-600	1.80		50.8±0.8
	02-24	-600	0.45		50.0±2.2
	07-19	-650	0.68		51.6±0.3
	86-58f	-650	2.00		52.0±1.26
	87-10f	-650	1.84	164	53.0±0.8
	87-128	-685	1.00	27.5	51.9±1.6
	87-4f	-700	0.65	27	52.2±1.6
	02-20	-800	0.77	50	50.6±2.0
	02-23	-800	0.98	330	51.8±1.4
	03-67	-820	0.64	140	61.7±2.2
	87-17f	-820	1.34	13	54.9±1.7
	87-5f	-850	1.22	30	54.1±1.6
	02-17	-950	0.82	29.5	55.8±2.3
	07-9	-980	0.71	26	54.6±0.4
	07-10	-1010	0.76	32	54.24±0.42
	86-65f	-1010	1.56	40	55.0±2.6
	87-131	-1155	0.80	29	53.4±1.6
	87-129	-1155	0.92	27.5	54.5±1.7
	87-11f	-1155	1.46	23	55.5±1.7
	86-57f	-1180	1.60	43	60.6±1.7
	86-51f	-1180	1.93	14	57.2±0.8
	87-12f	-1180	1.79	15	59.6±1.7
	87-130	-1240	0.97	16	59.0±1.7
	86-67f	-1240	1.73	8	63.2±0.9
	87-132	-1240	0.91	20	59.0±1.7
	86-63f	-1240	1.75	121	60.1±1.8
	87-62	-1240	0.93	18	58.0±2.6
	87-63	-1425	0.89		59.6±2.6
	93-12	-1480	0.85		60.0±2.0
	93-13	-1580	0.65		57.0±2.0
	93-14	-1640	1.10		61.0±2.0
	93-15		0.98		70.0±2.0

Table 6. 2. U/Th dating of travertine samples from the Abric Romaní. (b) unpublished dating (taken from Vaquero et al., in press).

Level	Lab. Ref.	Radiocarbon date	ca BP 43610	Material
A A	AA-7395	37290 ± 990	-41250	Carbon
A A	AA-8037A	35400 ± 810	42690 -38810	Carbon
A B	AA-8037B	37900 ± 1000	44180 -41500	Carbon
B D	NZA-1817	28440 ± 650	35330 -31010	Carbon
E H	NZA-1818	23160 ± 490	29030 -26870	Carbon
H J	NZA-2312	43500 ± 1200	49630 -44150	Carbon
	AA-7396	29230 ± 530	35760 -32680	Carbon
	NZA-2313	40680 ± 940	46000 -42720	Carbon
	NZA-2314	43200 ± 1100	49190 -44070	Carbon
	NZA-2315	44500 ± 1200	50570 -44770	Carbon
	NZA-3138	44140 ± 5930	59120 -37840	Carbon
	NZA-2316	47100 ± 2100	55910 -45350	Carbon
				Carbon

Table 6. 3. C14 (AMS) dating of Abric Romaní on charcoal (extracted from Vaquero et al., in press).

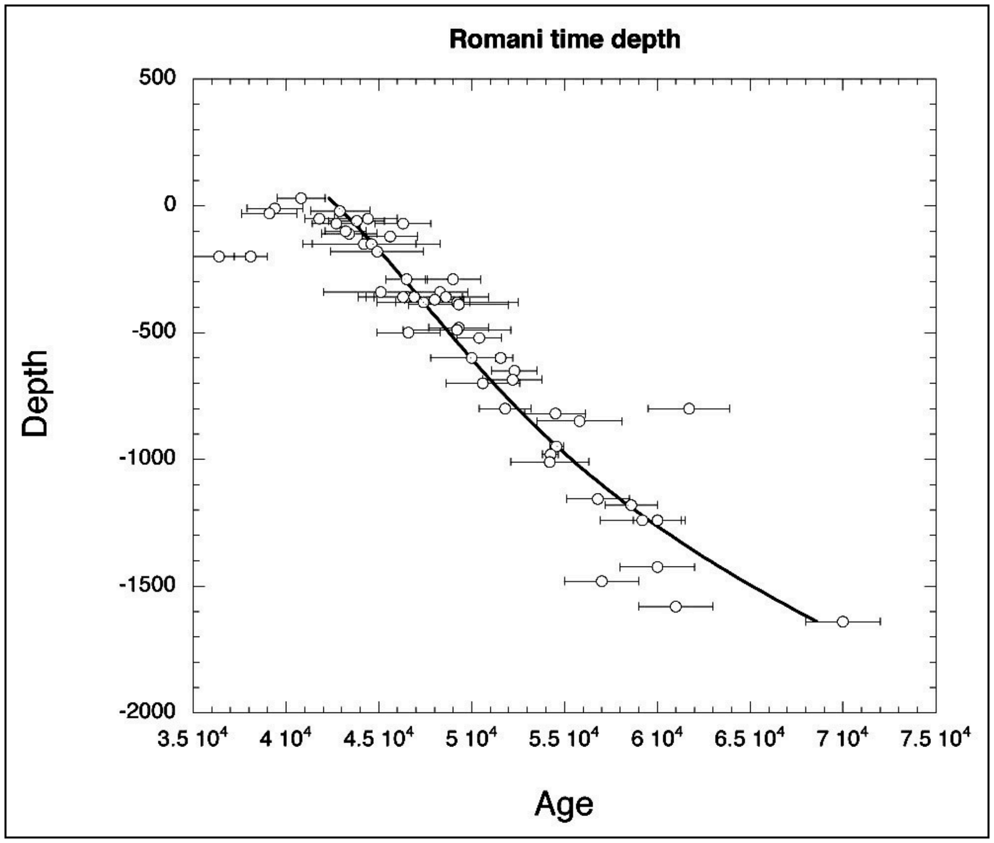

Figure 6. 10. C14 (AMS) dating of the Abric Romaní on charcoal (extracted from Vaquero et al., in press).

6.4. Paleoenvironmental reconstruction

The first works carried out on paleoenvironmental reconstruction in the Abric Romaní have been based mainly on palynological and anthracological analyses (Metter 1978; Deguillame 1987; Allué et al., 1998; Burjchas and Julià 1994; 1996; Allué 2002a; 2002b).

The first pollen study was carried out by Metter (1978) and Deguillame (1987). These analyses only cover the sequence that extends from the roof to level I. The results of the analyses carried out by Metter confirm the constant existence of a tree cover, with pine (approximately 50%) being the most represented species. Deciduous trees are present in a small percentage, due to the presence of mixed oak forests, where Quercus t. pendunculata and Ulmus dominate. The presence of typically Mediterranean tree species is also notable, and as for herbaceous plants, grasses dominate.

The study carried out by Deguillaume begins at the point where Metter ended (the upper part of Set III (levels E, H and I) and Set II (B, C and D)). He distinguishes five pollen sets, coinciding with the previous one in the predominance of pine and grasses. These two authors affirm that the variations in the dryness/humidity ratio were the fundamental factor in the changes experienced by the plant associations, recorded in the pollen sequence of the Abric Romaní.

Later, (Burjachs and Julià 1994; 1996) carried out new pollen studies covering the entire stratigraphic sequence, which allowed them to establish a precise relationship between the paleoclimatic events and the different occupational moments. These authors have established a succession of five pollen zones, based on the main plant taxa observed (Figure 6. 11):

Zone 1 (ca 65.5-70.2 Ka BP, MIS 4) corresponds to the lower part of the stratigraphic sequence, and shows two temperate climatic phases, with a predominance of thermophilous taxa such as the evergreen Quercus type or the Olea-*Phillyrea. Among them there is a cooling period marked by the expansion of* Poaceae.

Zone 2 (ca 57-65.5 Ka BP, MIS3) predominance of the Poaceae family, and the Artemisia and Pinus genera. This phase is interpreted as cold and humid.

Zone 3 (ca. 50-57 Ka BP, MIS 3) is characterised by the predominance of Artemisia, Poaceae and Pinus. This is a cold phase interspersed with warm and more humid episodes with the development of mesothermophilous taxa (Quercus, Olea-Phillyrea, Fabaceae, Rhamnus and Scrophulariaceae) and thermophilous taxa (Pistacia, Cistus, Juglans, Syringa, Erica, Coriaria and Hedera). Most of the archaeological levels of the site are included within this pollen zone.

Zone 4 (ca. 50-46 Ka BP, MIS 3) is characterized by a low percentage of tree pollen and the presence of regional steppe vegetation with a predominance of Asteraceae, Poaceae and Artemisia. This phase is the coldest of the entire stratigraphic sequence of the shelter and corresponds to levels H and I of Set III.

Zone 5 (ca 46-41 Ka BP, MIS 3) This zone is characterized by a warm period with an increase in colonizing trees. At this time, an expansion of colonizing trees (Juniperus and Pinus spp.) begins, followed by an increase in Quercus spp. and

Olea-Phillyrea. This area has been correlated with the Hengelo interstadial (Burjachs and

Julià 1996) and corresponds to levels B, C and D, as well as to the levels of Complex II (levels B, C and D).

Anthracological analyses (Allué 1994; 2002a; 2002b; Allué et al., 1998) carried out on part of the stratigraphic sequence up to level M show a practically exclusive predominance of a single species corresponding to Pinus type sylvestris/nigra. Other identified taxa show the presence of Gymnosperms, which would indicate more temperate and humid environments (Table 6. 4).

	DCN	D	A	H	Y	Y	Jb
Pinus sylvestris/nigra	34	134	254	141	275	630	217
Pinus sylvestris/uncinata type	-	-	1	2	-	21	11
Pinus sp.	13	20	28	7	33	61	29
Rhamnus cathartica/saxatilis	-	-	1	-	- -	-	-
Quercus sp. deciduous Olea	-	1	-	-	- -	-	-
europaea Cf. Hippophae	-	1	-	-	- -	-	-
rhamnoides Cf.Ulmaceae Cf.	-	1	-	-	- -	-	-
Prunus Acer sp. Hedera sp.	-	1	-	-	- -	-	-
Vitis sp. Salix sp.	-	1	-	-	- 1	-	-
Angiosperm indet.	-	4	-	-		-	-
Indeterminable conifer	-	1	-	-		-	-
Indeterminate Indeterminable	1	7	-	-		-	-
	-	-	-	-		1	-
	-	2	-	-		-	-
	5	14	38	51	130	112	47
	-	2	-	-	-	-	1
	-	1	6	36	13	55	20

Table 6. 4. Anthracological results (NR) of the Abric Romaní levels (DCN: in front of Coveta Nord-2, probably corresponding to level B or C (Allué 2002a).

All the remains correspond to combustion residues, as a consequence of the use of wood as fuel, whose exploitation depends on the strategies of the Neanderthal groups that inhabited the shelter. Therefore, the presence or absence of taxa is related to the strategies of anthropic management and manipulation. Human groups seem to use pine preferably as fuel, probably due to the greater availability of this species in the immediate surroundings of the site. In the vicinity of the shelter, there was a plant formation of mountain pines that would have been maintained during the time period covered by the stratigraphic sequence. These pines grow under the xeric and cold conditions characteristic of this period. It is probable that it was not the only species in this formation, since fragments of Juniperus, Rhamnus or Salix sp. are documented in some levels. (Allué 1994; 2002a; 2002b; Burjachs and Julià 1994; 1996; Burjachs and Allué 2003) (Table 6. 4 and Figure 6. 19).

Riparian vegetation is documented by some remains of Salix and fragments of Vitis, although the pollen diagram shows a greater diversity of these species. It is possible that riparian formation did not exist as such, and that these taxa are related to the vegetation that grows near the water courses or in the upwelling located in the upper part of the Cinglera, and that is occasionally used as fuel (Allué 1994; 2002a; 2002b).

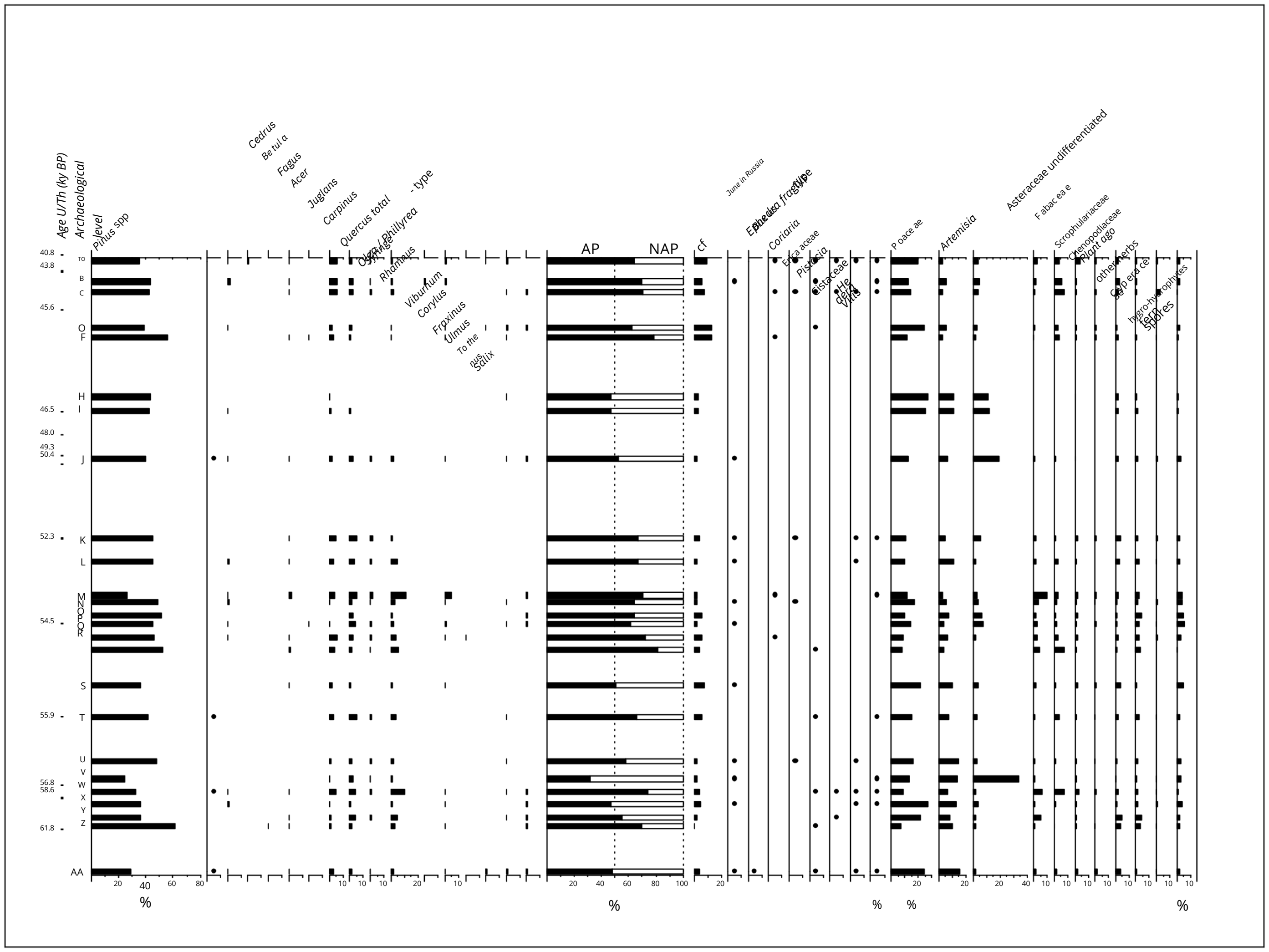

Figure 6. 11. Pollen diagram of the archaeological levels of the Abric Romaní (Burjachs and Julià, 1994).

6.5. Archaeological record

6.5.1. Homes

The presence of hearths has been documented in all archaeological levels of the Abric Romaní. The properties of travertine and the rapid sedimentation processes favour the preservation and recording of hearths or combustion structures, whose impacts are perfectly recorded on the travertine surfaces, even though post-depositional processes have substantially altered the archaeological accumulations associated with the hearth.

The excellent preservation of the homes, together with the exceptional synchronic and diachronic record, gives us a very significant and exceptional sample for carrying out a systematic study of them; and for understanding numerous aspects of the behaviour of the Neanderthals (Pastó et al., 2000; Vaquero and Pastó 2001). In fact, they were described ethnoarchaeologically by Binford (1983; 1996), and archaeologically with those documented by Meignen et al., (2001) and Henry (1998; 2003).

their characteristics functional show clear analogies with the

Figure 6. 12. General view of the Abric Romaní during the excavation of Level M, where the location and arrangement of the combustion structures can be seen. (Photo: G.Campeny/IPHES).

The hearths, in general, appear well defined on the travertine substrate in more or less circular or oval areas. They are characterized by chromatic change, stratification of rubefactated facies and carbonaceous facies, and by the compaction of the sediment. These appear associated with combustion residues (ashes and coals) and other types of records, such as bone and lithic remains, which due to the high temperatures to which they are subjected show changes in color and fractures (Carbonell et al., 1996b). The excavation and analysis of the structures of the activities carried out try to determine the origin of the fires.

the spatial extent of combustion processes and their natural and/or anthropogenic dispersion (Carbonell et al., 2007) (Figure 6. 12).

The excavation methodology and field documentation consist of collecting as much data as possible in the most appropriate way. The first step is the delimitation and drawing of the plan of the carbonaceous and rubefacted layer. Subsequently, a section is drawn and samples are collected from each layer, and half of the combustion structure is excavated. After drawing and photographing the section, the excavation of the other half of the hearth is completed (Vallverdú pers. comm.). In recent years, measurements of the magnetic susceptibility of the rubefacted layer have been taken.

Depending on the characteristics of homes, different types have been differentiated (Table 6.5):

1) Flat or simple: they are identified directly on the substrate without an apparent prior preparation. These are the most documented type at all archaeological levels.
2) Concave: they are documented in natural basins (taking advantage of the gours) or excavated.
3) Complexes: they are identified delimited around them by blocks and/or platelets.

Homes	Flat					Concave				Flat		Concave		
										Bl.	Pl.	Bl. and/or Pl.		
Diameter(cm)	D	A	H	I	J	E	H	Y	J	J	J	D	A	J
10-40 40-100 >100	1 - -	N D	- 4 -	- 5 7	7 32 1	- 3 -	2 4 -	o 1 9	- 2 -	3 8 -	1 6 -	- - 1	N D - 2	- 2 -
Prof. (cm)	-	1	2	6	8	1	1	4	-	3	-	-	-	-
Low 1-2 Medium 4-6 Strong 7-10 Very strong >10	1 - -	3 2 - 6	1 - 1	6 - -	17 10 5	1 1 -	3 3 2	4 7 1 -	1 - -	7 1 -	5 2 -	- - 2	- 2 -	- - 2

Table 6. 5. Classification of the hearths based on their diameter (in cm), their depth in the substrate (in cm) and type, where flat, concave and with blocks (bl.) and/or platelets (Pl.) identified in the archaeological levels D-J are specified (extracted from Arteaga et al., 2001).

These types of homes based on spatial analysis, spatial identification of operational chains, and sedimentological and micromorphological analyses carried out have been grouped into (Vaquero and Pastó 2001; Vallverdú 2002; 2009) (Figure 6. 15, Figure 6. 13 and Figure 6. 14):

1) Small-sized hearths in empty areas: they are interpreted as hearths in resting areas, located in the wall of the shelter. They have a diameter of less than 50 cm and the section presents lenses of rubefaction less than 20 cm in radius. The thickness of the carbonaceous stratum is ≤1 cm and that of rubefaction ≤7 cm. The remains resulting from the

anthropogenic activities within or near them are scarce or practically non-existent.

2) Large-sized homes with accumulations of small and large artifacts: they have a diameter greater than 50cm, and the section shows reddening lenses greater than 20cm radius. The thickness of the carbonaceous stratum may be ≥10cm and the rubefaction ≤5cm. Accumulations of remains resulting from anthropic actions are usually abundant.

Figure 6. 13. Households identified at level L (Photo: G.Campeny/IPHES).

Figure 6. 14. Households identified at level K (Photo: G.Campeny/IPHES).

In general, the spatial distribution of homes presents a similar situation at the different levels analyzed. This is related to the type of occupation carried out and to the cultural decisions of the group. Homes are the central element of domestic areas, where human groups develop all their subsistence and daily activities. In addition, homes constitute from an archaeological point of view the basic structural element, the elementary spatial unit that organizes and articulates the occupation patterns in the different occupation events developed. Fire is the element that acts as a localizing center of social relations, increases the communication and interaction of the group, and contributes to its cognitive complexity and transformation in group relations (Carbonell and Rosell 2000-2001; Vaquero and Pastó 2001; Carbonell et al., *2007).*

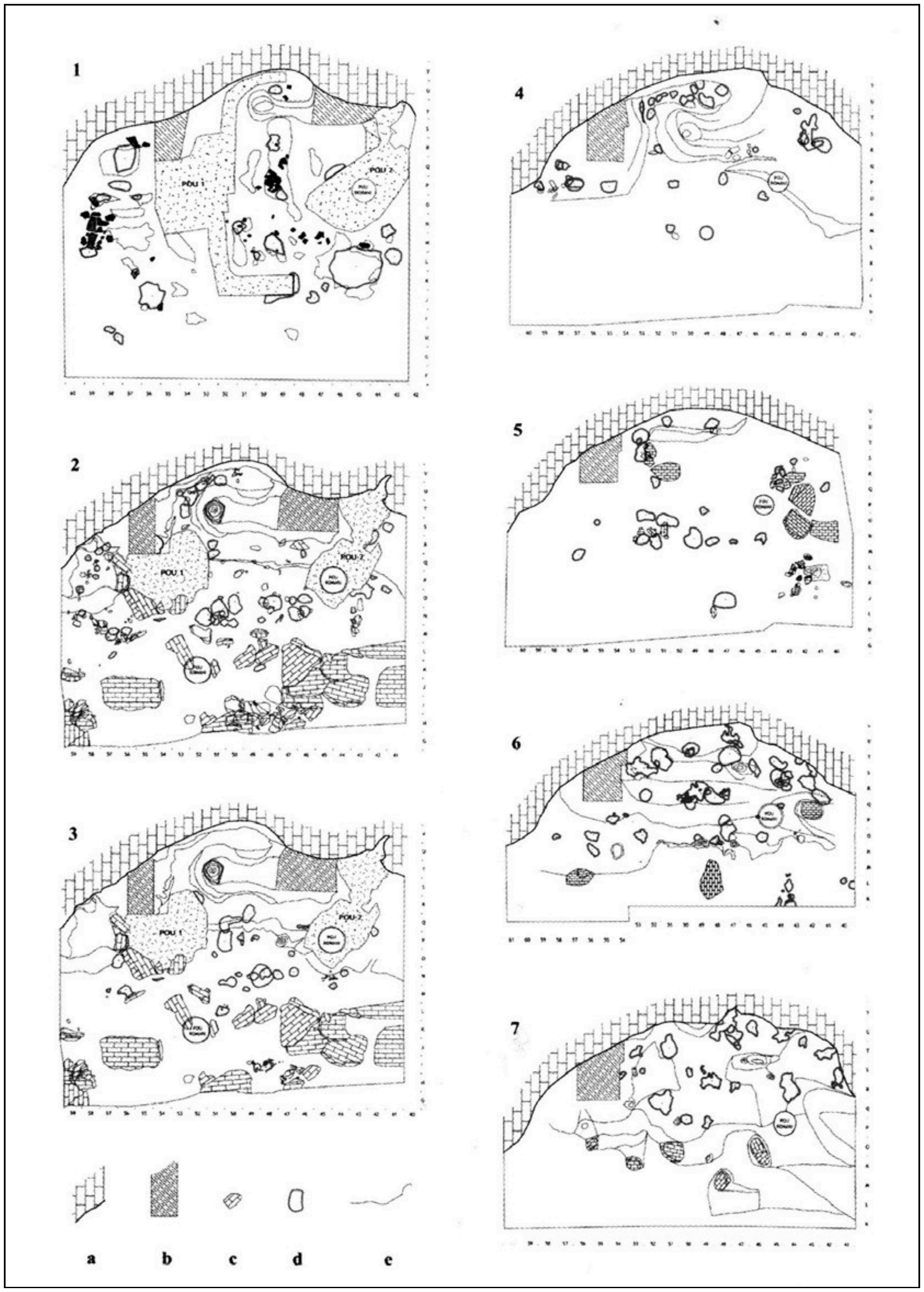

Figure 6. 15. Location and extension of the homes by archaeological levels (1: level I, 2: level Ja, 3: level Jb, 4: level K, 5: level L, 6: level M, 7: level N), where the following are specified: a) shelter wall; b) stratigraphic cores; c) blocks; d) home; e) topographic lines based on slope changes (taken from Carbonell et al., 2007).

Broadly speaking, at the different levels it can be observed that the number, shape and position of the homes varies depending on the intensity of each occupation. At levels H and I the homes appear isolated, while at the rest of the excavated levels they are separated by a large number of units.

(H-O) appear occupying the central part of the shelter, in small groups and inside the shelter, very close to the wall. In some cases, the superimposition or overlapping of the hearths does not allow the number of hearths to be recognized. Level Ja is the one that documents the greatest number of combustion structures (n=61), constituting in some areas authentic combustion areas, characterized by the juxtaposition of hearths, and N is the one that presents the lowest number (n=19). The horizontal spatial study has allowed us to see that the hearths are distributed by drawing two lines or rows more or less parallel to each other (Carbonell et al., 2007) (Figure 6. 15, Table 6. 6):

1) a first line of hearths, which are located more or less parallel to the shelter wall and at a certain distance, and which depending on the level can vary considerably (between 1 and 5m).
2) a second line of homes located in the central part of the shelter.

Finally, it is worth highlighting the analysis of phytoliths carried out at level J, assisted by IR-FT (FTIR: Prospect IR Midac software GRAM5-386TM) and mass calculations. This, together with other studies carried out during sample processing, has enabled a link to be created between disciplines more closely linked to botany (palynology or anthracology) and geological disciplines (micromorphology), providing highly significant results on the functioning of hearths (Cabanes et al., 2007). The type of phytoliths identified indicate the existence of wood, bark and, probably, pine cones from Pinus type sylvestris, the main fuel at all archaeological levels. This seems to be occasionally combined with the use of grasses.

Levels I	Household	Average distance
J K L	No. 22 61	5.85 4.67 2.48
M N	25 23 37 19	4.67 3.16 1.96

Table 6. 6. Number of households identified in levels I-N, and average distance between them and the shelter wall (taken from Carbonell et al., 2007).

6.5.2. The lithic remains

The general characteristic in all archaeological levels is the fragmentation of the operational sequence, although in some, complete or almost complete carving sequences have been reconstructed through reassembly (Vaquero 1997; 2005; 2008; Martínez and Rando 2001; Vaquero et al., 2004; Chacón and Fernández-Laso 2005a; Martínez et al., 2005) (Figure 6. 16).

All levels (B-O) of the Abric Romaní are included within the technical systems of the Middle Paleolithic, except for level A, which is attributable to the technical systems of the Upper Paleolithic. These levels (B-O) present a series of common characteristics derived from a set of fundamental technical criteria.

Age Geological Formation	Description of the Geological Formations	Main outcrop (*)	Raw material
Paleozoic (Ordovician)	Massive slates with intrusion of quartz and porphyry dikes. Dismantled fragments are recovered from Quaternary terraces and colluvium.	Capellades Strait (PZC)	Slate, quartz, porphyry and quartzite in primary position
Triassic (Lower Muschelkalk)	Dolomitic limestone formation containing flint lenses. Mediona Formation.	St. Quíntí de Mediona (MED)	Chert in primary position
Paleocene (Tanetian)	Red clays with limestone levels of caliche, chert and conglomerates. Orpí Formation.	St. Joan de Mediona (SJM)	Chert in primary position
Eocene (Ilerdian)	Marine limestones containing fossils (Nummulites perforatis) and microfossils (various types of alveolines). St. Càndida Formation.	Orpí	Limestone in primary position
Eocene (♦) (Ilerdian-Cuisian)	Alternation of marls, clays and carbonate levels (predominance of limestone, sporadically dolomitic limestone with cherts). Valldeperes Formation.	*Not found St. Magí (SMG)*	chert in primary position
Eocene (Bartonian)	Paleogene evaporite formation with white dolomitic chalk containing limestone, gypsum and cherts. Pobla de Claramunt Formation.	Vallespinosa (VLD)	chert in primary position
Eocene (Lutetian-Bartonian)	Fluvial deposits formed by levels of clays, sandstones and conglomerates. The latter contains flint boulders. St. Martí de Tous Formation.	Carme (CME)	chert in secondary position
Eocene (Priabonian)	Grey sandy clays with ripple lamination containing cross-stratified cherts and sandstones and levels of lenticular conglomerates. Montmaneu Formation.	St. Martin of All (SMT)	chert in primary position
Oligocene (Stampian)	Carbonate levels of lacustrine origin formed by limestone strata with nodular cherts. Guixera Series.	Panadella (PAN)	chert in primary position
Pliocene	Formation of stratified conglomerates containing limestone and siliceous pebbles from the Catalan coastal mountain range and the marine Paleogene of the Ebro Basin.	St. Quinti of Mediona (SQM)	chert in secondary position
Quaternary	Fluvial terrace deposit with a sandy matrix and heterometric pebbles.	Anoia River	Limestone, chert and quartz in secondary position

(*) Place of collection of the analyzed samples. (♣) Under study. LFC= Length-Fast Chalcedony. (♦) data Anadón, 1978.

Table 6. 7. Location and description of the raw material formations of the Abric Romaní. Modified from Fernández-Laso et al., in press a, new data extracted from Gómez, 2007 (extracted from Chacón 2009).

In general terms, a preferential selection of flint over other materials, such as limestone or quartz, is documented. Quartzite, sandstone, slate and porphyry are also present, although quantitatively to a lesser extent. The presence of these materials does not depend on a selection in relation to the proximity of the catchment areas, but on the factors imposed by the technical systems themselves. That is to say, flint

It is selected because it is the most suitable raw material for carving, due to its mechanical fracturing conditions.

Age Geological Formation	Microscopic Texture	DRX	Size	Fitness for Size	Distance
Paleozoic (Ordovician) *Triassic (Lower*	- Cryptoquartz	- quartz,	5-40 cm	Various carving aptitude Difficult	Opposite the deposit ≥ 300
Muschelkalk) Paleocene	Quartz mosaic and Calcite (♣) biomicrite	calcite and dolomite	≤10 cm	carving (due to internal	m ≥ 8-10 km
(Thanetian) Eocene *(Ilerdian) Eocene (♦)*	-	(♣) calcite -	5-20 cm	fractures) Difficult carving (due to internal	≥ 7-9 km ≥
	crypto to microquartz		≤ 50 cm	fractures) Good for	4-10 km
(Ilerdian-Cuisian) Eocene	and fibrous LFC	Quartz and moganite	-	carving -	≥20-25 km
(Bartonian) Eocene	Cryptoquartz Quartz	quartz,	≤ 1 m	Good for carving	≥20-30 km
(Lutetian-Bartonian) *Eocene (Priabonian)*	mosaic and sparitic calcite (♣) (♣) crypto	calcite and moganite	≤ 5 cm	Good for carving	≥ 3 km
Oligocene (Stampian)	to microquartz and	(♣) (♣)	≤ 1 m	Various carving aptitude Good for	≥ 12-15 km
	fibrous LFC Quartz		10-30cm	carving	≥25-28 km
Pliocene	mosaic and euhedral quartz -	quartz	6-18 cm	Various size suitability Various size	≥ 7-10 km
Quaternary		-	≤ 6 cm- ≥ 25 cm	suitability	≥ 150 m

(*) Place of collection of the analyzed samples. (♣) Under study. LFC= Length-Fast Chalcedony. (♦) data Anadón, 1978.

Table 6. 8. Location and description of the raw material formations of the Abric Romaní. Modified from Fernández-Laso et al., in press a, new data extracted from Gómez, 2007 (extracted from Chacón 2009).

Most of the raw materials are located in an environment close to the deposit, since the terraces of the Anoia River and the Paleozoic formations of the Capellades Strait contain limestone, sandstone, quartzite, slate and quartz. Flint, on the other hand, is found in several formations within a maximum radius of 28 km (Morant 1998, Morant and García-Antón 2000; Gómez 2007) (Table 6. 7, Table 6. 8 and Figure 6. 19).

However, significant differences can be observed throughout the stratigraphic sequence in the strategies for the collection of raw materials. For example, in the case of flint, we find a percentage of 50% of the total in level I, while in level F or G, this value reaches 90% of the total; and in level H, flint comes to monopolize all the carved objects (Vaquero 1992; 1997; Carbonell et al., 1996a). This fact may be a reflection of the capacity of Neanderthal groups to select the most appropriate strategy for the collection of raw materials, depending on each moment of occupation, and the needs imposed by the technical systems.

The predominant structural category is Positive Bases (BP=flakes) which, although identified in all formats, are the most abundant ones of medium and small size. Cores (BNP) and retouched objects (BNC) are scarce at all levels. The morphotechnical analysis of the BNP (Negative Production Bases or cores) and the BP (Positive Bases=flakes) has allowed the reconstruction of the production and exploitation sequences, and to distinguish three different models:

1) The first model defines an exploitation organised from the horizontal plane of the object, which draws a bifacial structure with two secant surfaces of opposite convexities, which shows a certain degree of hierarchisation of one of its surfaces. These are hierarchical centripetal cores (Vaquero and Carbonell 2003). On the other hand, in the lower levels of the shelter such as level O, Levallois-type strategies are identified (Boëda 1993).

2) The second model shares with the previous one a clear volumetric conception, based on the existence of two opposite convex surfaces, separated by an intersection plane in line with the horizontal plane of the object, although in this case both faces are exploited equally and not in a hierarchical manner. Consequently, both surfaces during the carving sequence act as a percussion platform and as an exploitation surface, which is called the discoid method (Boëda 1993).

3) The third model involves a tendency towards the creation of various non-hierarchical exploitation plans. Different plans are used, generally previous extractions, giving rise to polyhedral morphologies.

The distribution of these models is not homogeneous at the different levels of the shelter. Thus, at levels E and O there is a predominance of model 1, while at the intermediate levels (J-M) there is a preference for models without hierarchy (models 2 and 3), although in certain cases model 1 is also documented. This trend may possibly be related to the change in the strategy for capturing raw materials.

Regarding the configuration sequences, significant differences are observed, since a practically exclusive operational standard is observed, that is, in all levels there is a predominance of denticulate morphologies, especially in the lower levels (with 90% of the total). This fact led Lumley and Ripoll (1962) to classify the Abric Romaní sequence, according to traditional typology, as a "Mousterian of denticulates" (Lumley and Ripoll 1962).

On the other hand, the functional analysis of the deformations caused by the use of lithic instruments, using an electron microscope, has allowed us to identify their use in the processing of animal biomass and, occasionally, in technical activities related to the transformation of wood (Martínez 1999; 2002; 2005).

The realization of the lithic reassemblies has allowed to reconstruct the spatial organization of the technical activities and the transport of materials inside the shelter (Figure 6. 16). The spatial location of the operational sequences shows a differentiation of space in different areas of activity, especially in the levels with greater anthropic impact such as Ja, where areas are identified that function as points of convergence of different operational processes (Carbonell et al., 1996a, Vaquero et al., 2001a; 2004; Chacón and Fernández-Laso 2005a; Vaquero 2005; 2008).

The morphotechnical analysis of the lithic objects and the reconstruction of the carving sequences, through reassembly, have allowed us to distinguish different models of introduction of the lithic material (mobility matrices): first, the introduction of BN (Natural Bases) of limestone, sandstone or porphyry, used without prior modifications as percussion instruments in domestic tasks.

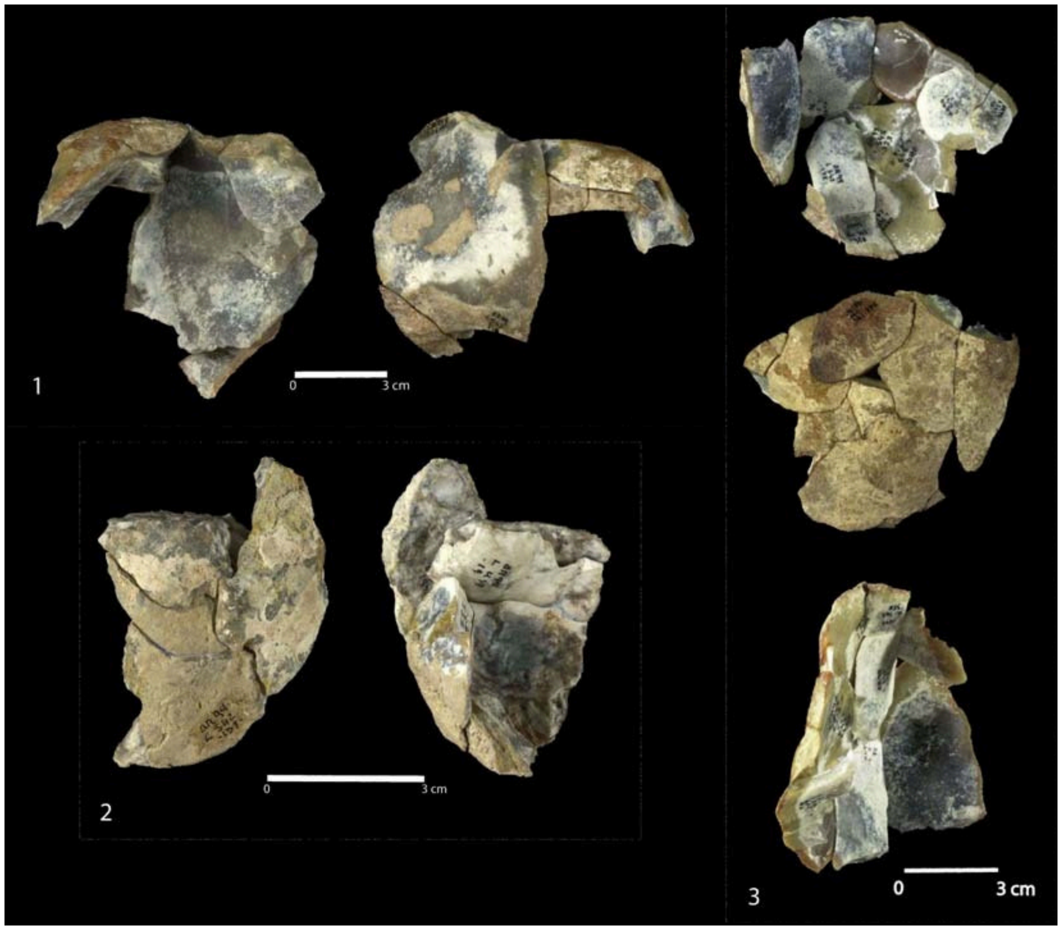

Figure 6. 16. Flint reassemblies of debarking phases identified at level L. Photo: A.Ollé/IPHES.

The second is the introduction of BN from flint, limestone or quartz to obtain BP (Positive Bases). This process is generally carried out within the shelter. Most of the BP obtained during this process is abandoned within the deposit, although some

Larger ones are usually transported to other locations. This pattern has also been recognized for NCBs (Negative Configuration Bases).

The third with the introduction of BNP (cores) at different stages of the operational sequence,

within the framework of strategies characterized by spatial discontinuities.
temporal in the carving sequences.

And finally, a fourth model of introduction of large BP or BN2G of materials from catchment areas far from the deposit.

These mobility patterns show differences at a diachronic level, although in general terms the same technical trend is observed at the different levels studied.

6.5.3. Wood remains

The sedimentary dynamics of the site favour the preservation of perishable elements such as plant macroremains (imprints or negatives). The formation of the so-called wood pseudomorphs occurs from the deposition of calcium carbonate on living vegetation (algae, moss, plant branches, leaves, pine cones, tree trunks), or on disarticulated and dry woody materials. The organic matter undergoes a process of decomposition until it disappears, leaving only its imprint.

Woody tissues degrade, disappear and the bark is preserved, consolidated by the action of biogeochemical agents. The identified plant macroremains correspond to Junipuerus sp. and Pinus sp., these species being predominant in all archaeological levels (Allué 2002a; Solé 2007).

The plant macroremains have been classified mainly into two categories (Figure 6. 17 and Figure 6. 18):

1) the positives of carbonized wood: remains of woody matter subjected to processes carbonization by the direct or indirect action of fire.

2) Wood negatives: imprints formed in travertine, in which the wood disappears but the volume and texture are preserved in the form of a negative. When the texture has carbon within the imprint, they are called carbonized wood negatives.

The archaeological levels that have best preserved this type of evidence are H, I, K, M and O. At these levels, a rapid rate of sedimentation occurs due to low-energy water inputs. The remains are located directly on the hearths, which is interpreted as remains of unconsumed fuel. In other cases, the morphology of the remains and their spatial location have allowed us to infer, as in level H, the use of wood for the manufacture of utensils (Carbonell and Castro-Curel, 1992; Castro-Curel and Carbonell 1995; Allué 2002a; Solé 2007).

Figure 6. 17. Non-carbonized wood negatives from level M (Photos: IPHES and G.Campeny/IPHES).

Figure 6. 18. Positive of carbonized wood identified in level M (IPHES Photo).

At level I, a significant number of carbonized and non-carbonized wood imprints have been found, which are distributed throughout the occupied surface. Based on their spatial location, they have been grouped into different groups and related to wood work and unused fuel (Allué 2002a). At level M, a very high number of positive and negative wood imprints (n=114) have also been identified, which, as at level I, due to their spatial arrangement have been grouped and interpreted as tools or artifacts related to hunting or gathering, and to the use of domestic artifacts (Solé 2007). Finally, large modified wooden pseudomorphs have been documented in level N, which have been interpreted as elements of room construction (Carbonell et al., 2007).

6.5.4. Bone remains

Since the beginning of the 20th century, paleontological work has been carried out in the Abric Romaní. Unfortunately, some taxa identified in the upper levels are only known from their reference in some works (Vidal, 1911-12; Villalta, 1964; Estévez, 1979; Sánchez, 1989; Mora, 1988). Subsequently, from 1983 or the third stage of interventions, the shelter has been the subject of various zooarchaeological and taphonomic works on the bone remains recovered at different levels (Cáceres 1995; 2002; Aïmene et al., 1996; Aïmene, 1997; Saladié, 1998; Cáceres et al., 1998; Bravo 2001; Rosell 2001; Fernández-Laso 2001; Gabucio 2007) (Table 6. 9, Table 6. 10 and Figure 6. 19).

These works have detected throughout the entire stratigraphic sequence: a dominance of herbivores over carnivores. The constant and systematic presence of the deer (Cervus elaphus) and the horse (Equus ferus) at all levels. These taxa are combined with both open spaces (Bos primigenius) and mountain animals (Rupicapra rupicapra). *The predominant age in all taxa is adult.*

	A	B	C	D	E	F	G	H	I	J	K	L	M	O
Equus ferus	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Cervus elaphus	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Rupicapra rupicapra	●	●	-	●	●	●	●	●	-	●	●	-	-	-
Bos primigenius	●	-	-	-	●	-	●	-	-	●	-	●	●	●
Stephanorhinus hemitoechus	-	-	-	-	-	-	-	●	-	●	-	-	-	●
Proboscidea indeterminate	-	-	-	-	●	-	-	-	-	-		-	-	-

Table 6. 9. List of herbivore species identified in levels A-O of the Abric Romaní.

In relation to the skeletal parts of the different taxa, it can be observed that the postcranial skeleton is quantitatively more numerous than the cranial skeleton. Depending on the weight of the animals, a differential anatomical representation is observed. Large animals (>300 kg) are represented by elements of the cranial and proximal appendicular skeleton, with axial and distal appendicular elements being practically non-existent.

Animals of medium size (between 150 and 300 kg) and small size (<150 kg) tend to have more complete skeletons, although axial elements and distal limbs are usually absent. Zygopodia and stylopodia and, to a lesser extent, cranial elements are usually absent.

They are generally the most abundant elements in the shelter. On the other hand, there is an absence of epiphyses and articular bones, which is related to anthropic activity: the intense fracturing of the long bones with the separation of the epiphyses from the diaphyses, and the introduction of the epiphyses into the homes, either as fuel or as a space-cleaning action.

The age of the prey and the presence of the skeletal parts richest in nutrients indicate an intense primary and immediate anthropic activity on the animals. The biased skeletal representation is a consequence of the differential transport that is carried out based on the weight of the animal, the distance to the shelter, the number of participants, etc. That is to say, if possible, they transport the entire animal, otherwise they select the parts richest in nutrients and leave the rest at the place of extraction. This pattern is documented in large-sized animals and, occasionally, in medium-sized ones.

Neanderthal groups are therefore the agents responsible for the bone accumulations at the different levels studied. In all of them, anthropic activities (cut marks, fracturing and cremation of bones) are identified, which normally take place around homes.

Carnivores are present in the shelter in a very marginal way and competition between them has not been identified at any level. No systematic exploitation by Neanderthal groups has been detected, except for a lynx radius from the upper part of the sequence. This element shows marks of skinning, demonstrating a punctual exploitation of this animal (Saladié and Aïmene 2000).

	A	B	C	D	E	F	G	H	I	J	K	L	M O
Ursus sp. Canis	-	●	-	-	-	-	-	-	-	-	-	-	● -
lupus Panthera	-	●	-	-	●	-	-	-	-	-	-	-	- -
leo spelaea	-	-	-	-	-	-	-	-	PI	-	-	-	- -
Panthera pardus	-	-	-	PI	-	-	-	-	-	-	-	-	- -
Lynx sp. Felis	●	●	-	-	●	-	-	-	-	-	-	-	- -
silvestris Crocuta	●	-	-	●	-	-	-	-	-	-	-	-	● ●
crocuta	CI	●	-	-	●	-	-	-	-	-	-	-	- -

Table 6. 10. List of carnivore species identified in levels A-M and O of the Abric Romaní, (PI: lower platform; CI: Set I.

These animals use the shelter by making natural or occasional intrusions in order to take advantage of the remains left behind by the paleo-settlers. In other cases, they use it when the conditions are more cavernous and suitable as a habitat for these animals, as occurs in the upper levels, where this species is most abundant (Saladié).

1998). It has also been documented in travertine platforms, such as the travertine platform below level B and the upper one at level E and J (Cáceres et al., 1993). Zooarchaeological and taphonomic studies indicate that its activity at different levels is very low (Aïmene 1998; Cáceres 1998; Saladié, 1998).

Regarding micromammals, different species have been identified throughout the sequence. The levels with the highest presence are O, N and E. The best represented species are Arvicola sapidus, Apodemos sylvaticus and Iberomys cabrerae (López García 2007, 2008; Lopez-Garcia and Morales 2007; Lopez-Garcia et al., 2009) (Table 6. 11).

The association of micromammals present in the shelter shows a type of semi-open environment, together with relatively humid environments. The predominance at all levels of Apodemus sylvaticus (wood mouse), as well as the occasional appearance of Eliomys quercinus (black-faced dormouse) and Nyctalus lasiopterus indicate a forest environment context.

In addition to these taxa, Terricola duodecimcostatus (common vole) in most of the sequence and, to a lesser extent, Terricola pyrenaicus (Pyrenean vole) and Crocidura russula – suaveolens (common shrew - garden shrew), show an open environment. In addition, the identification at all levels of Iberomys cabrerae, Arvicola sapidus (water vole) and, occasionally, of Microtus agrestis (common vole), Terricola pyrenaicus, Sorex coronatus (tricoloured shrew), Talpa cf. europaea (European mole) and Rana sp., indicates humid conditions (López-García 2007; 2008; López-García et al., 2009) (Table 6. 11).

	D	E	I	J	K	L	M	N	O	Total
Crocidura russula	-	-	-	-	-	-	-	3	7	10
S.gr.coronatus-	-	-	-	-	-	-	-	-	1	1
araneus Talpa	-	-	-	-	-	-	7	-	4	11
europaea Talpa sp.	-	-	-	2	-	-	-	-	-	2
Miniopterus	-	-	-	-	-	-	2	-	-	2
shreibersi	-	-	-	-	-	-	2	-	-	2
Pipistrellus	-	-	-	-	-	-	-	-	1	1
pipistrellus Nyctalus	-	1	-	-	-	-	-	-	-	1
lasiopterus	1	1	-	2	-	-	-	-	16	20
Rhinolophus sp	-	2	-	-	-	-	-	-	7	9
Microtus arvalus	1	5	-	-	-	-	-	13	39	56
Microtus agrestis	3		-	-	-	2	-	1	18	29
Iberomys cabrerae	-	1	-	-	-	-	-	-	-	1
T.duodecimcostatus	9	4	1	12	1	6	-	4	52	89
Terricola pyrenaicus	10	16	-	2	-	-	-	8	39	75
Arvicola sapidus	5	1	-	-	-	-	-	-	4	10
Apodemus	29	31	1	21	1	8	7	33	188	319
sylvaticus Eliomys										
quercinus										
Total										

Table 6. 11. Number of remains of micromammal species by D-O levels identified in the Abric Romaní (López-García 2007; 2008; López García et al., 2009).

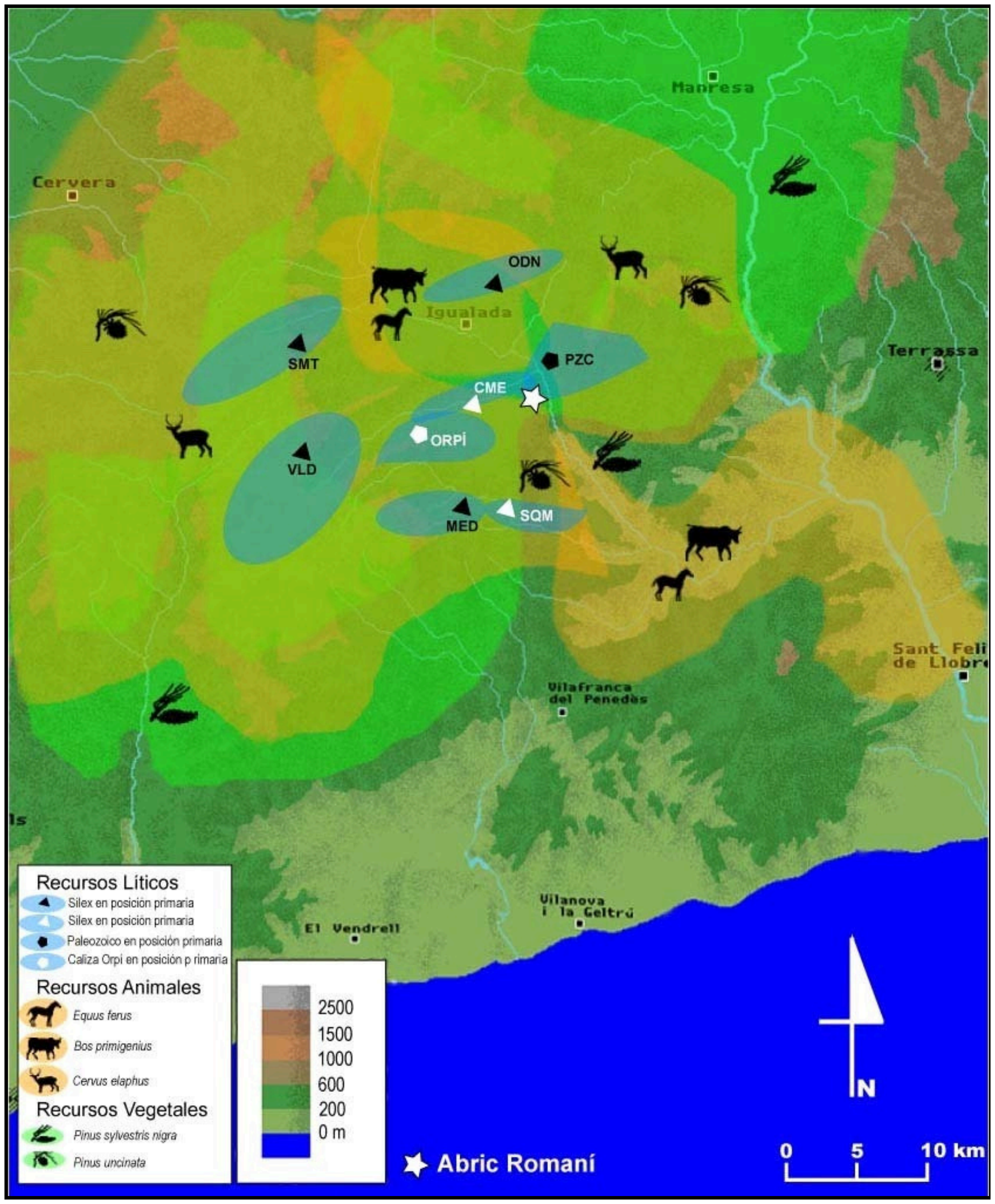

Figure 6. 19. Map of the potential biotic and abiotic resources for exploitation by the Neanderthal groups of the Abric Romaní (extracted from Fernández-Laso et al., in press a).

7. Data Presentation

This chapter analyses and presents all the data obtained from the study of the three archaeological levels selected from Abric Romaní for the preparation of this doctoral thesis. The presentation of data is divided into three large blocks: each of these blocks corresponds to one of the three archaeological levels: K, L and M. In turn, each of these is divided into three units. In these units, firstly, a general analysis of the archaeological level is presented, with all the information and data from its excavation and analysis of the archaeological record (geoarchaeological data, lithic remains, archaeobotanical data, etc.); and with all the data obtained from the zooarchaeological, taphonomic and spatial study according to the methodology and techniques previously described.

In the second unit, the bone record is presented and addressed from a spatial analysis perspective, with projections at both horizontal and vertical levels. The different spatial units identified are thus presented. The third and final unit of each block describes and analyses the bone assemblies identified. However, to make the spatial analysis more understandable, these have been grouped by their spatial location in the shelter; that is, they are described taking into account the different bone accumulations identified.

Likewise, the description of the reassemblies is classified according to the anatomical part to which they belong: firstly, the reassemblies of the cranial skeleton are described, subsequently, those of the postcranial skeleton and, finally, those included in the categories of long, flat and indeterminate bones. Within this classification, priority has been given to those that show anthropic modifications (cut marks, fractures and/or cremation).

Data Presentation 1st block: K

1st unit of analysis: Zooarchaeological and taphonomic analysis
2nd unit: Spatial analysis
3rd Unit: Remounts

2nd Block: L

1st unit of analysis: Zooarchaeological and taphonomic analysis
2nd unit: Spatial analysis
3rd Unit: Remounts

3rd block: M

1st unit of analysis: Zooarchaeological and taphonomic analysis
2nd unit: Spatial analysis
3rd Unit: Remounts

7.1. Materials

The faunal remains from archaeological levels K, L and M of the Abric Romaní site were excavated between the 1996 and 2004 campaigns by the Research Team of the Catalan Institute of Human Paleoecology and Social Evolution (IPHES) and the Rovira i Virgili University (URV) of Tarragona.

Levels K, L and M are the first in the Abric Romaní stratigraphic sequence to be excavated in extension without being affected by the interventions of previous stages (see chapter 6.2). This allowed the Research Team, among others, to systematically excavate in extension the entire surface of the shelter, reaching 279 m2 and the complete recovery of all the materials for their subsequent spatial study.

The archaeological levels are dated by U/Th 50.0 ± 2.2 and 51.6 ± 0.3 ka for level K, level L between 53.0 ±0.8 and 50.6 ± 2.0 ka and level M at 51.8 ± 1.4 ka (Vaquero et al., in press).

Figure 7.1. 1. General view of the Abric Romaní during the 1998 campaign, and the excavation of level L. Photo: IPHES.

Figure 7.1. 2. View of the theoretical northern sector of the Abric Romaní, where the combustion structures identified in level M can be seen. Photo: G.Campeny/IPHES.

Figure 7.1. 3. Detail of a home with associated structures identified at level M.

Photo: G.Campeny/IPHES.

Figure 7.1. 4. Recovery of a deer jaw during the excavation of level L. Photo: G.Campeny/IPHES.

Paleoenvironmental conditions frame the archaeological levels within zone 3 of the pollen diagram, which corresponds to a cold phase interspersed with warm and more humid episodes at intervals of ca. 10 ka. Within OIS 3, this period is characterized by the development of open-space taxa, such as Poaceae, Artemisa and Pinus. It is a cold phase interspersed with warm and more humid episodes with the development of mesothermophilous taxa (Quercus, Olea-Phillyrea, Fabaceae, Rhamnus and Scrophulariaceae) and thermophilous taxa (Pistacia, Cistus, Juglans, Syringa, Erica, Coriaria and Hedera) (Burjachs and Julià 1994; 1996).

The bone record analysed at the different archaeological levels amounts to a total of 11,180 remains. These are temporarily stored in the laboratory of the Prehistory Area (URV)-IPHES in Tarragona. This laboratory was used for both their study and for the completion of this Doctoral Thesis.

The bone coordinate record (x, y, z) has been analysed, and the data from the level bags and the screening of the material has been rejected after its visualisation and study. These materials do not have a spatial location and, therefore, cannot be projected. One of the objectives of this work focuses precisely on those materials that can be contextualised, horizontally and vertically, and analysed spatially.

It should be noted that some of the fossils presented in this paper have been previously studied, as is the case of Level K, presented in a Research Paper (Fernández-Laso 2001; 2002). However, for the present work the remains have been reviewed applying the same methodological criteria for all levels. Likewise, during the study of the levels, various publications have been made with preliminary results (Vaquero et al., 2001a; Fernández-Laso 2004; Chacón and Fernández- Laso 2005a; 2005b; 2007; Chacón et al., 2005; 2007; Martínez et al., 2005; Fernández-Laso et al. in press a; in press b).

The bone record of levels A-Ja and O of the Abric Romaní stratigraphic sequence has been studied in doctoral theses (Rosell, 2001; Cáceres, 2002), bachelor's and master's theses (Cáceres, 1995; Aïmene, 1996; Saladié, 1997; Bravo, 2001; Gabucio, 2007) and has been widely published (among others, Carbonell, 1992; 2002; Carbonell et al., 1996a; Vaquero et al., 2001b; Vallverdú et al., 2004; 2005a; 2005b). In this doctoral thesis we have attempted to continue with the same methodological criteria as those applied in previous works, providing and adding data that allow us to improve the interpretation of the record, while allowing us to carry out an exhaustive diachronic study of the different archaeological levels of the Abric Romaní site.

7.2. Level K

Level K was excavated during the excavation campaigns carried out between 1996 and 1999, and was the first level of the stratigraphic sequence that was not affected by excavations from previous stages (section 6.2). This made it possible to excavate the entire surface (279 m2) in depth. Level K is located below a large block package that separates it from the upper level (Jb), as a result of the massive collapse of the shelter's cornice. The fall of the travertine cornice reduces the vertical protection of the shelter's surface, forming an irregular positive relief by stacking large blocks. This gives rise to an irregular occupation surface, to which human groups adapt perfectly.

The excavation of the level presented various stratigraphic problems. The existence of three archaeological sub-levels was observed, which were called Ksup, K and Kinf, separated by thin travertine platforms, which in certain sectors of the shelter lost thickness and prevented their stratigraphic identification. These travertine platforms were well developed in those areas of the shelter that, because they are more stable areas, accumulate low-energy water and are especially protected from subsequent erosion. These are the cases of lobe 3 (Coveta Ripoll) and lobe 2 (Coveta Romaní).

However, during the excavation of the external areas of the shelter it was observed that the central sector and the outer line presented a greater dispersion of archaeological material, and that the travertine platforms lost thickness, sometimes disappearing. This fact obviously made it difficult, and even impossible on many occasions, to distinguish the three archaeological sub-levels in situ.

During the excavation it was observed that level K is part of a stratigraphic package with three sub-levels. Sub-level K is the only one that is continuous throughout the archaeological level, while Ksup and Kinf are only identified in some areas of the shelter and clearly delimited in the theoretical northeast. Kinf has been identified on the southern line of the site with a steep slope, and separated from level L by a sterile travertine platform. The spatial and archaeostratigraphic analysis of the bone record has allowed us, as we will see later, to distinguish these sub-levels.

Archaeological location	USGS Lab No.	Prof.	Uppm	230Th/ 232Th	U/Th date, ka
Above level	02-24	-600	0.45	13	50.0±2.2
Kb Above level Kb	07-19	-600	0.68	>1,000	51.6±0.3

Table 7.2. 1. Level K datings, (b) unpublished datings (extracted from Vaquero et al., in press).

The results of the anthracological analysis (Table 7.2. 2) from the charcoal fragments of the hearths show that there is a predominance of Pinus sylvestris/nigra type, followed by a few remains of Pinus sylvestris/uncinata type. These species are mountain pines that grow from 500m to 2000m. It is probable that the identification of Pinus sp., conifers and undeterminable ones are Pinus of the same type, which due to the size and conservation of the samples have not been able to be determined (Allué, 2002a).

Taxon	Number of fragments	%t
Pinus type sylvestris/nigra	132	54.10
Pinus type sylvestris/uncinata	1	0.41
Pinus sp.	23	9.43
Indeterminable Conifer	49	20.08
Indeterminable	39	15.98
TOTAL	244	100

Table 7.2. 2. Results of anthracological analyses at level K (Allué 2002a).

1796 lithic remains have been recovered (Figure 7.2. 1). A significant lithological diversity has been identified, among which flint (47.9%) stands out for its abundance, and to a lesser extent, quartz (28%) and limestone (19.2%). Other documented materials, although very scarce, have been quartzite (0.4%), schist (2.6%), agate (0.1%), granite (0.3%) and slate (1.6%). These raw materials are located within a radius of approximately 15-25 km from the shelter. These distances determine the ways in which the different raw materials are introduced into the shelter; thus, quartz and limestone, available in the most immediate areas, are introduced in the form of rough blocks or initial stages of exploitation. However, flint, located in the most remote areas, comes in the form of flakes or cores in advanced stages of exploitation (Chacón 2000; Chacón and Fernández-Laso 2005a; 2007; Chacón et al., 2001; 2007).

A single discoid cutting method is observed, which is applied to all materials. The flexibility of this method allows it to be transformed throughout the exploitation process depending on the objectives and aptitudes of the material.

Most of the record is made up of remains derived from the carving sequences. The operational chains are basically focused on the systematic obtaining of flakes, where small and medium-sized ones (40 mm in length) stand out. The cores and retouched objects are scarce. Most of the latter are already configured from the