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Flint sources and petrographical identification in the Late Magdalenian and Epipalaeolithic levels from Parco Cave (Spanish Eastern Pyrenees)

Abstract

The aim of this work is to establish the changes of the raw materials used for the lithic industries in the transition between the Late Pleistocene and Early Holocene in the site of Parco Cave (Spanish Eastern Pyrenees). The differences have been established between level II, ascribed to Late Mediterranean Magdalenian and level Ia2, which include different Epipalaeolithic occupations, both dated in the eleventh and tenth millennia cal B.C.

The comparison between archaeological materials from both levels and different raw material samples documented in the field work, using petrographical analyses, allows us to establish the main outcrop areas of this site, their characteristics, and also the different utilisation of each raw material for each chronological moment.

Keywords: *Petrography, Flint, Upper Palaeolithic, Epipalaeolithic, Prehistory of Catalonia.*

Introduction

The site of Cova del Parco in the Eastern Pre-Pyrenean region of Spain (Alòs de Balaguer, La Noguera, Lleida) stands geographically in the Western Noguera region at 120 m above the level of the river Segre and at 420 m above sea level on the southern versant of Saint Mamet's dome (Fullola & Bergadà 1990; Bergadà 1992).

Geomorphologically this is the area where the river Segre leaves the north-south course determined by the Pyrenean mountain range and takes a drastic turn east-west forming steep gorges and escarpments (Fig. 1).

The site consists of a cave that opens to the west into a rockshelter. The cave gallery is a long floor space of 10.5 x 4.5 m. The rockshelter is rectangular in shape approximately 5.5 m wide.

The cave was discovered in 1974 by Prof. Maluquer de Motes (Maluquer de Motes 1983-84), and since 1987 the work at the site has been undertaken by the Seminari d'Estudis i Recerques Prehistòriques (*Prehistoric studies and research seminar)* under the guidance of Prof. Josep Ma Fullola Pericot, Prehistory professor at the University of Barcelona.

The archaeological stratigraphy is formed by two profiles, both in the cave area, taking into account where the different sedimentary levels and occupational activities are best documented. The cultural sequence of the site began in the middle Magdalenian, GifA 9552: 14300±150 BP (Fullola *et al.* 1996; 1997) and finished in the last dated level in the ancient Neolithic, Gr.N. 20058-Parco-92 (EE1). 1: 6120±90 BP (Petit (ed.) 1996).

Objectives

The object of this paper is to demonstrate the diverse changes having taken place in the raw materials used in the transition between the Late Pleistocene and the Early Holocene.

This study of the lithic materials recovered from both levels of Parco Cave concentrates on the raw materials used, their geographical catchment areas and their petrographic characteristics.

The petrological characterisation of siliceous material was made using a polarisation microscope (Olympus) at 40x, 100x, 200x and 400x magnification (Mangado 1997; 1998 a & b; Mangado *et al*. 1999).

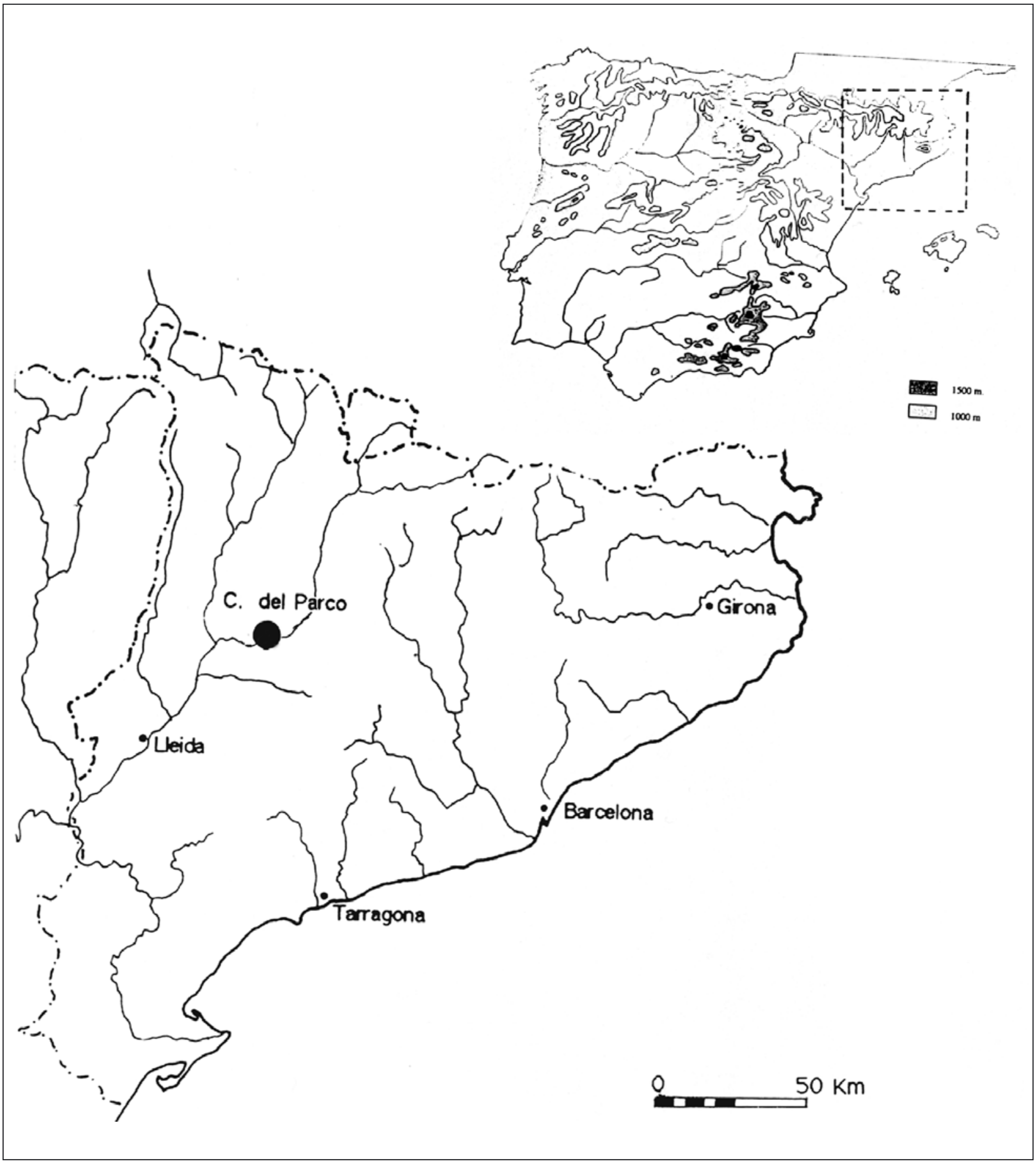


Fig. 1: Situation map.

The cross section data were taken between two levels: Level II attributed to the Late Mediterranean Magdalenian, or Epimagdalenian, and level Ia2 encompassing different Epipalaeolithic occupations, both dated in the eleventh and tenth millennia cal. B.C.

Neither of the two levels are fully excavated, so the conclusions of these analyses could see subtle changes as further excavation of the levels takes place.

Petrographic analysis of the lithic industry at Parco Cave

Non siliceous materials (Fig. 2)

Before centring on the petrographic characterisation of siliceous material it should be noted that with respect to the totality of the recuperated lithic industries we can already observe differences between one level and the other one.

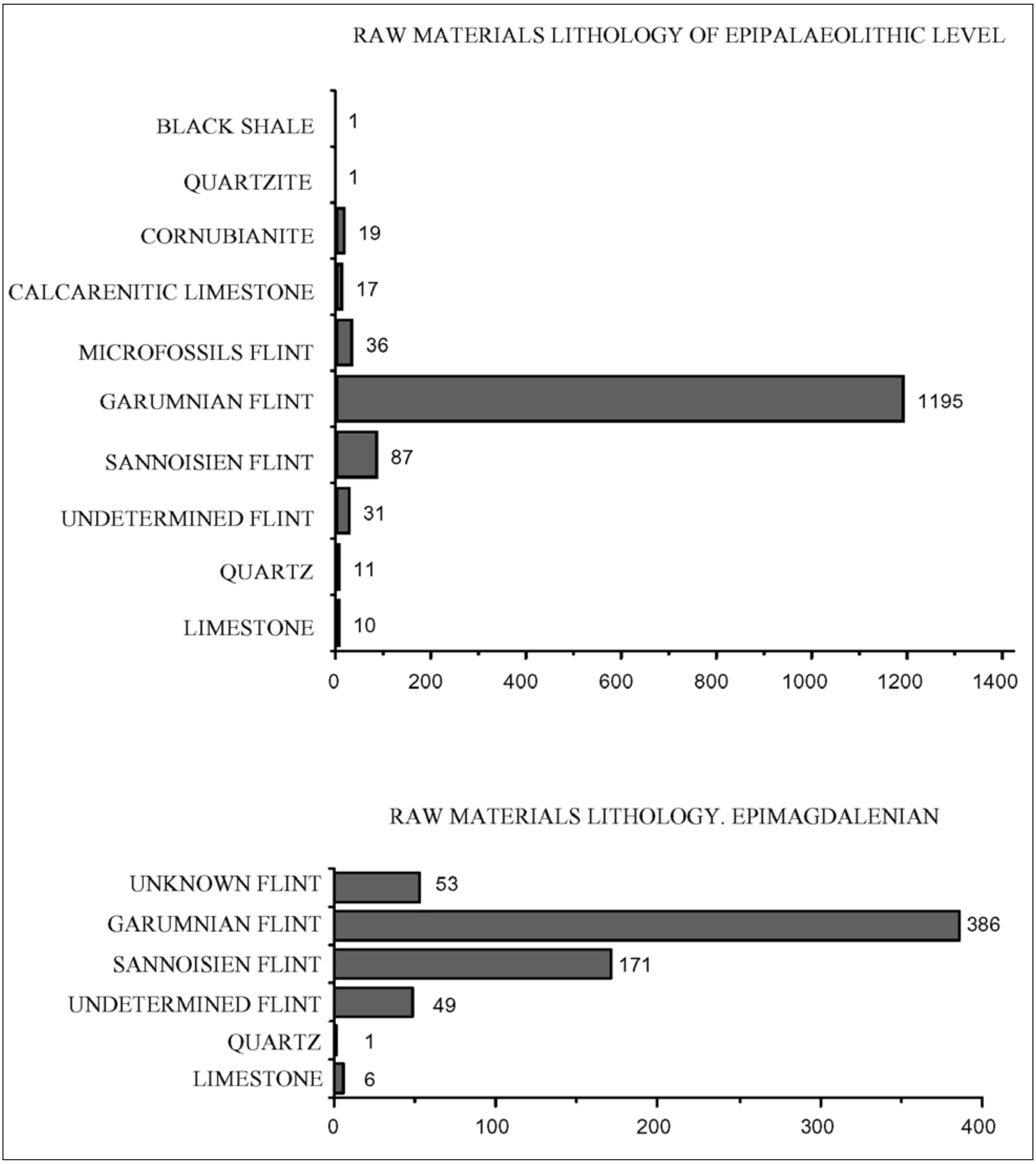


Fig. 2: Raw materials lithology of Epipalaeolithic and Epimagdalenian levels.

The Epimagdalenian level presents a lithic composition formed basically of flint as any broken fragments of other lithologies are very scare. They are reduced to limestone flakes and a fragment of quartz.

In the Epipalaeolithic level flint continues to be the basic lithology of the industry but alongside we can also see the appearance of new flaked materials namely: cornubianite, quartzite, black shale.

Siliceous materials

The main flint types documented from both archaeological levels show completely different origins: Garumnian flint and Sannoisien flint (Fig. 3).

The first step towards establishing the differences between the Epimagdalenian and Epipalaeolithic levels, is the comparison between samples, taken in the fieldwork survey from different raw material outcrops, and samples of archaeological material.

Name	type of outcrop	Lithology	Age	Distance	Type of flint
VSSM	secondary	conglomerates	garumnian	< 100 m	garumnian
FLL	primary	limestones	garumnian	+ 8.1 km	garumniam
CDP	primary	calcarenitic limestones	garumnian	7.7 km	garumnian
BLCFRT	primary	calcarenitic limestones	garumnian	25.4 km	garumnian
CDF	primary	mudstones	sannoisien	> 30 km	sannoisien
CDF	secondary		quaternary?	>30 km	sannoisien

Fig. 3: Flint survey. The main outcrops documented.

Until now flint surveys have allowed the localisation of different outcrops of flint (I.G.M.E 1934; 1956; 1958; 1971; 1980).
1. Secondary position outcrops of Garumnian flint in polygenic Oligocene conglomerates: Southern versant of Saint Mamet (VSSM).
2,3,4. Primary position outcrops in limestones and calcarenitic limestones belonging to lacustrine Garumnian formation: Fontllonga (FLL), Camí de Peralba (CDP), Blancafort (BLCFRT).
5. Primary position outcrops in Sannoisien mudstone in contact with the Stampian limestone in the Ebro Tertiary basin: Castelló de Farfanya (CDF).
6. Secondary position outcrops of Sannoisien flint in ancient quaternary deposits: Castelló de Farfanya (CDF).

Petrographic characteristics of Garumnian flint

Siliceous components

These are mainly samples of microquartz mosaic fabric (10 to 50 µm) which only on two occasions tend towards criptoquartz mosaic fabric and only occasionally blocky mosaic fabric of cementing quartz as cavity-filling.

Varieties of fibrous textures of quartz appear in three different situations: Samples of only length fast chalcedony (MALP 312, 363, 393, 524) and samples of only length slow chalcedonic aggregates and spherulites (MALP 139, VSSM 5), due to evaporite replacement (Fig. 4). The coexistence of both types of chalcedony, of not very frequent occurrence, has been observed (VSSM 14, 11, 9 & MALP 402) (Bustillo 1980).

Non siliceous components

The presence of iron oxides (hematites) has been observed under different morphologies:

- hematite plaques, evident both in isolated and aggregated morphologies (MALP 524).
- laminated hematites, seen as fibrous under polarisation microscope which could be formed by the presence of evaporitic minerals (Fig. 5) (MGLP VSSM 5).
- ferruginous cement.

The calcium carbonate of these samples is mainly previous to silicification process as demonstrated by numerous contacts of concave/convex types observed (VSSM 10, 5) and by the morphology of carbonate crystals highly disfigured by silica (MALP 312).

One of the most important elements that have been seen are pseudomorphs of microlenticular gypsum crystals giving clear evidence of evaporitic formation ambience (Fig. 6).

Fig. 4: Garumnian flint. Length slow chalcedony.

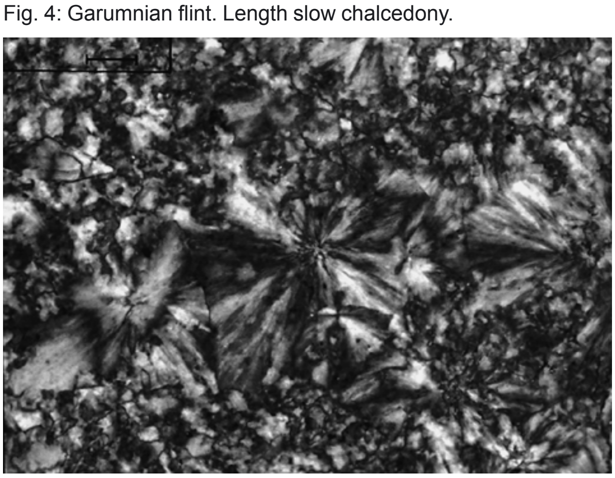
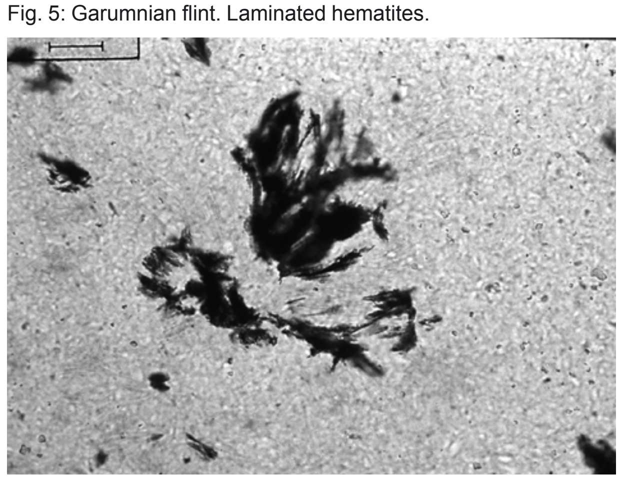


Fig. 5: Garumnian flint. Laminated hematites.



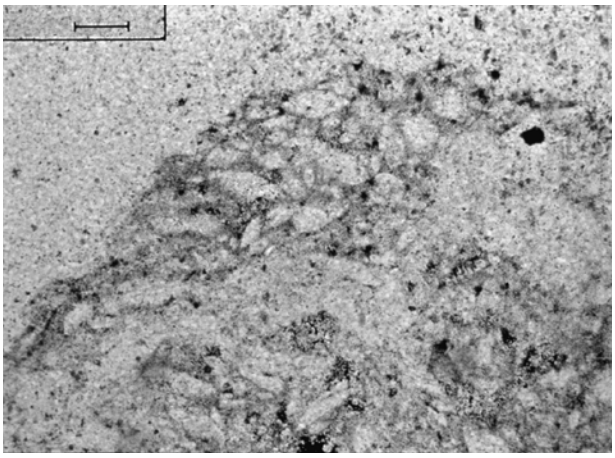


Fig. 6: Garumnian flint. Pseudomorphs of microlenticular gypsum.

Petrographic characteristics of Sannoisien flint

Siliceous components

The main textures are microquartz/cryptoquartz mosaic fabric. It is almost impossible to distinguish them with a polarisation microscope.
The macroquartz is limited to isometric mosaic fabrics formed by second generation of internal porous cementation of skeletal elements which only preserve micritic cement (MALP 199).
With reference to fibrous quartz only length-fast chalcedony has been documented.

Non siliceous components

These correspond to micritic size calcium carbonate skeletal elements with varying degrees of conservation.
On the one hand there are documented elements totally silicified. The silicification process showing stages of evolution. The first generation of fibrous quartz forming a rim type mosaic, and the second generation is macroquartz blocky mosaic. On the other hand, remains of carbonated skeletons in a prime state of preservation have been documented and allow their identification. They are *charophyta algae* belonging to fresh water sources (Fig. 7).

Another element common to these materials are terrigenous particles. These are minuscule rounded quartz grains covering all the sample. Their appearance shows that they were incorporated in the sedimentation basin and they do not form part of the diagenetic silicification process.

Garumnian and Sannoisien flint are found in both archaeological levels. However, it is in the Epipalaeolithic level where exploitation of new varieties of siliceous materials were documented for the first time. The origins of these are still unknown.

These are specifically flint with microfossils (foraminifera and bryozoa), which are still being determined. However a maritime origin can be seen which makes a new geological fieldwork survey of marine limestone necessary.

Petrographic characteristics of new types of flint documented in the Epipalaeolithic levels

The first group of siliceous materials identified as new in respect to previous materials have been called flint with fossils which in some cases have been observed with the aid of binocular.

At the moment it is not possible to ascribe this type of silicification to any geological stage. They can only be related to silicified marine limestone given the presence of microfossils in the texture (remains of foraminifera, briozoa, and echinoderm) associated with dolomite crystals and possibly detritical quartz (Fig. 8).

Fig. 7: Sannoisien flint. *Charophyte algae*.

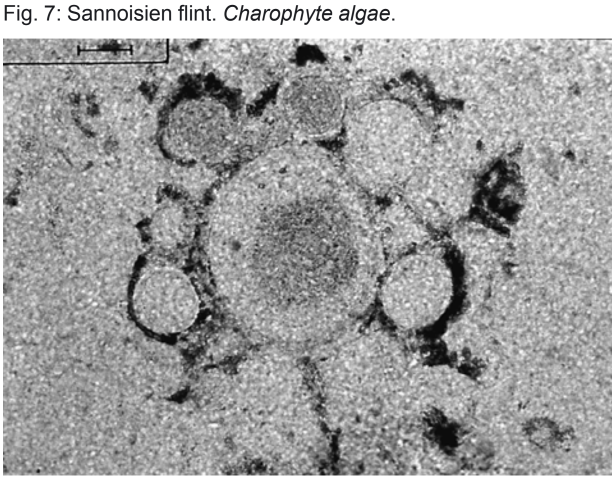
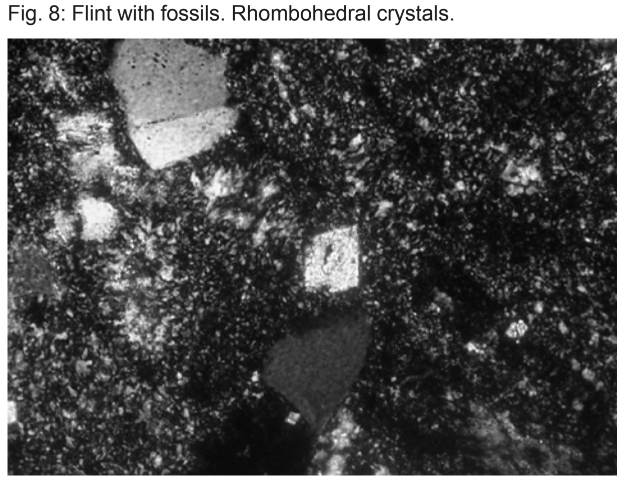


Fig. 8: Flint with fossils. Rhombohedral crystals.



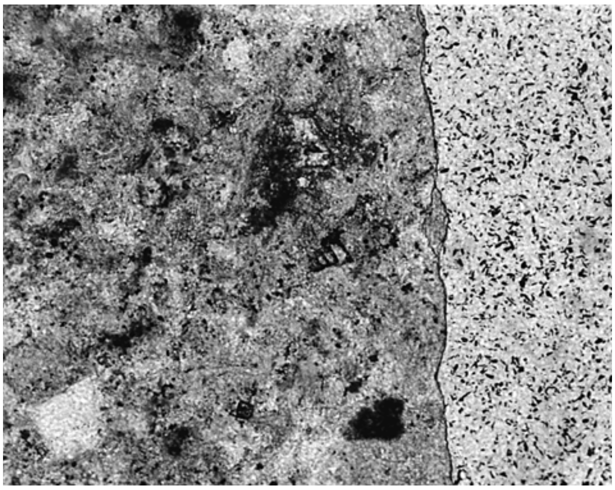


Fig. 9: Flint with fossils. Skeletal elements.

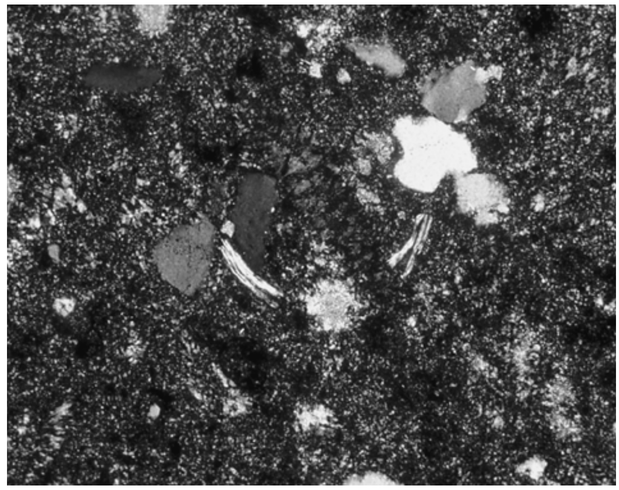


Fig. 10: Calcarenitic limestone. Muscovite.

Siliceous components

The main texture is of microquartz/cryptoquartz mosaic fabric almost impossible to distinguish with a polarisation microscope.
The presence of blocky anedric megaquartz is merely evidential.

With respect to fibrous quartz (±5%) only the presence of length-fast chalcedony has been documented both as a range of fibres and small spheres (50-100 µm).

Non siliceous components

These are mainly formed of calcium carbonate previous to silicification with diverse morphologies:

- rhombohedral crystals of calcite/dolomite (25-50 µm), their state of preservation varying between fully identificated and others highly altered as shown contacts of concave/convex types.
- micritic mud is the most important carbonate texture documented as micritic cement of silicified bioclastic skeletons.
- skeletal elements (microfossils) (Fig. 9).

Associated with non siliceous components the presence of terrigeneous particles is also documented, they are rounded detritic quartz grains (70-170 µm). They are randomly distributed over all the sample area. Both analysed samples show the presence of microcrystaline iron oxides, probably hematites.

The second raw material documented as new in the Epipalaeolithic level is a kind of calcarenitic limestone.

Siliceous components

These compose 80% of the sample. Evidence of blocky isometric megaquartz with undulate extinction crystals was found.

The main siliceous texture is cryptoquartz mosaic (75%) while fibrous quartz length-fast type appears sporadically as rim type cement in the pore filling of shells of considerably altered bioclastic elements.

Non siliceous components

These are abundant (20%) and form the main definition of this material microscopically. They are terrigenous/detritical particles such as hornblende and especially muscovite which is relatively important (Fig. 10).
The calcium carbonate previous to silicification is basically represented by micrite (10%), however dolomite rhombohedral crystals (2%) and bioclast remains are observed (10%).

Finally the presence of rounded detritic quartz grains distributed all over the sample and iron oxides (hematites) showing isolated and aggregated cryptocrystaline grains, which give the samples a red colouring has been documented.

At the moment the geological knowledge of the area does not allow to identify the exact point of the outcrop.

Petrographical analysis conclusion

This consists of four types of clearly different materials.

1. On the one hand there are a large number of remains that clearly show evidence of evaporitic formation ambience (pseudomorphs of lenticular gypsum, length slow chalcedony, laminated hematites). These materials belonging to Garumnian lacustrine formation can be found in the same Oligocene conglomerate where the cave opens, and form the main type of lithic remains on the Epimagdalenian level as well as Epipalaeolithic levels.

2. On the other hand there is a relatively large group of Sannoisien flint. The outcrop area of this material is situ-

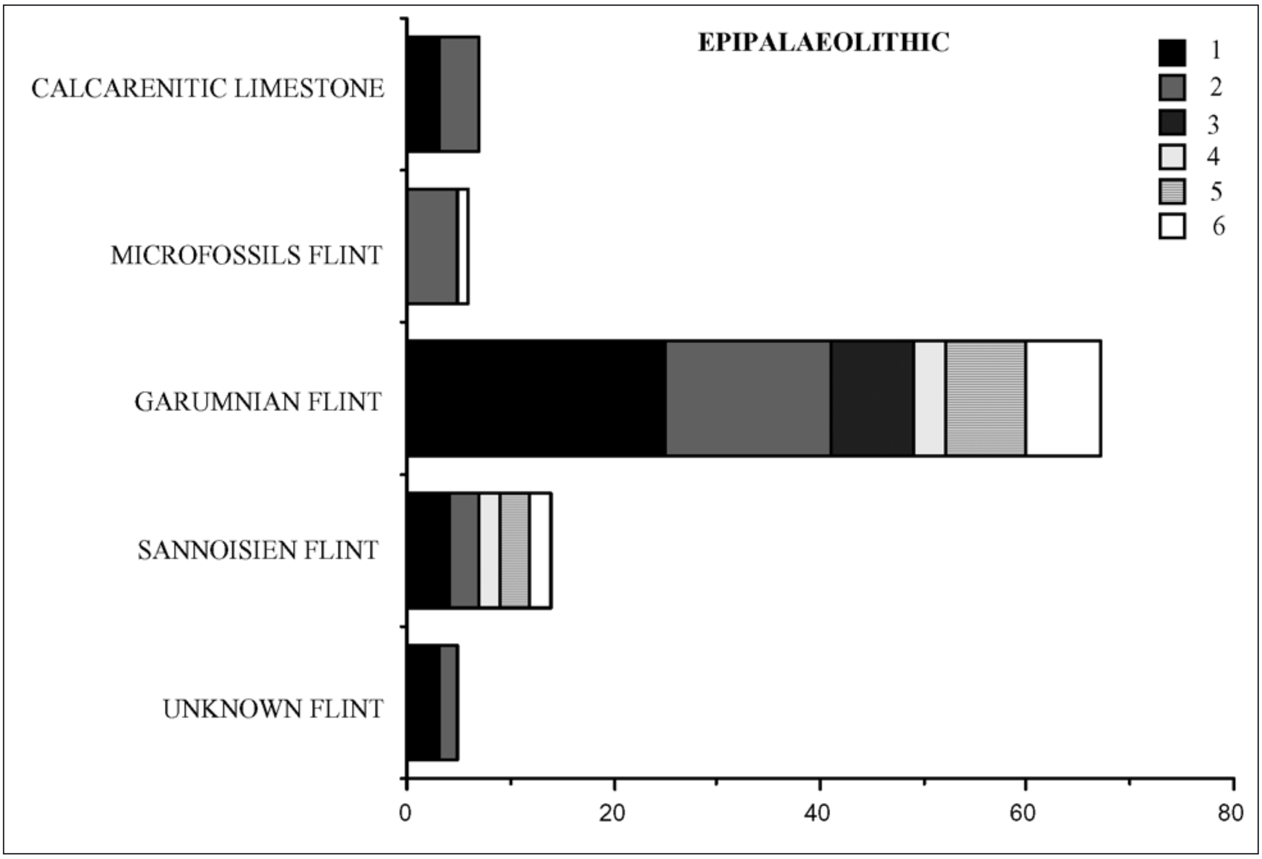


Fig. 11: Tool types according to flint types. 1 pointed and retouched bladelets; 2 microliths; 3 burins; 4 end-scrapers; 5 side-scrapers; 6 truncatures.

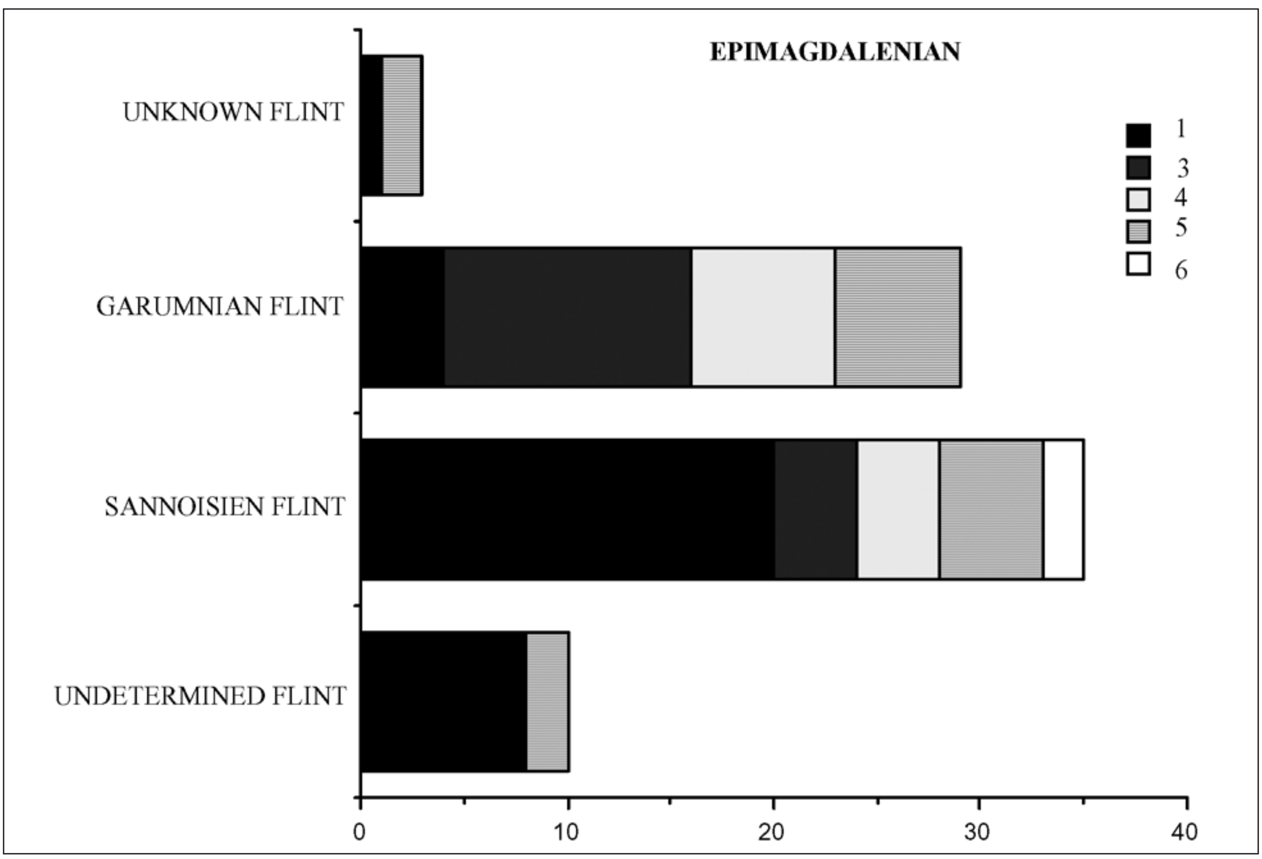


Fig. 12: Tool types according to flint types. 1 pointed and retouched bladelets; 3 burins; 4 end-scrapers; 5 side-scrapers; 6 truncatures.

ated at some distance about 40 km as the crow flies from the site.

Even if these materials do not form the main part of lithic remains they play a different role between the Epimagdalenian and Epipalaeolithic levels.

3. A new group of materials appears in the Epipalaeolithic level. They are microfossil flint types and calcarenitic limestone. The amount of non-siliceous components in both types of materials is important. This could have repercussions in the homogeneity of the material and its capacity to obtain a standardised laminar flaking.

In Fig. 11 and 12 it can be seen that Sannoisien flint was relatively important in the elaboration of tool types in the Epimagdalenian level showing a clear tendency towards laminar type supports (pointed and retouched bladelets). The relation between Sannoisien flint and bladelet supports is lost in the Epipalaeolithic level.

In the Epipalaeolithic level the retouched types were made basically of a local variety of Garumnian flint without any tendency to tool making with specific materials. In the same way new siliceous varieties are used to obtain geometrical elements.

The use of these materials was partly possible by the introduction of the microburin technique which does not need standardised blades to obtain projectile elements, however the presence of a standardised stock of geometrical arrowheads in calcarenitic limestone is important.

Because of the changes in the appearance an exploitation of different raw material types and the distances necessary to obtain them it is believed that there was a certain reduction on the catchment area of some siliceous materials especially Sannoisien flint of Serra Llarga.

This process was probably accompanied by new mobility routes that would explain the presence of these new siliceous materials not previously documented (microfossils flint and calcarenitic limestone).

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