Preistoria Alpina	v. 39 (2003)	pp. 77-90	Museo Tridentino di Scienze Naturali	Trento 2003	ISSN 0393-0157

La Combette (Bonnieux, Vaucluse, France): a Mousterian sequence in the Luberon mountain chain, between the plains of the Durance and Calavon rivers

Pierre-Jean Texier, Jean-Philip Brugal, Emmanuel Desclaux, Cristina Lemorini, José Antonio López Sáez , Isabelle Thery & Lucy Wilson.

ABSTRACT - Integration of data from various fields of investigation shows that the La Combette rock shelter was, at least during the Middle Palaeolithic, situated on the southern margin of a more northerly settlement area. The shelter appears to have been used several times as a refuge by small groups of hunters venturing into the southern reaches of a larger territory, so that they could exploit the resources offered by a mid-altitude mountain environment.

Key words: La Combette, Mousterian sequence, Durance and Calavon rivers.
Parole chiave: La Combette, sequenza Musteriana, Durance e Calavon

Pierre-Jean Texier - CNRS, UMR 6130-CEPAM, 250 rue Albert Einstein, F-05650 Valbonne. E-mail: texier@cepam.cnrs.fr
Jean-Philip Brugal - CNRS, UMR 6636 et GDR 1051-MMSH - BP 647, 5 rue du Château de l'Horloge, F-13094 Aix-en-Provence. E-mail: brugal@mmsh.univ-aix.fr
Emmanuel Desclaux - Laboratoire du Lazaret, 33bis Bd Franck Pilatte, F-06300 Nice.
Cristina Lemorini - Museo delle Origini, Dip. di Scienze Storiche, Archeologiche, Antropologiche dell'Antichità, Univ. "La Sapienza" di Roma, P.le Aldo Moro 5, I-00185 Roma. E-mail: musori@rmcisadu.let.uniromal.it
José Antonio López Sáez - Laboratorio de Arqueobotánica, Departamento de Prehistoria, Instituto de Historia, CSIC, Duque de Medinaceli 6, E-28014 Madrid. E-mail: alopez@ih.csic.es
Isabelle Thery - CNRS, UMR 6130-CEPAM, 250 rue Albert Einstein, F-05650 Valbonne. E-mail: thery@cepam.cnrs.fr
Lucy Wilson - Department of Physical Sciences, University of New Brunswick in Saint John, P.O. Box 5050, CA-Saint John, NB, E2L 4L5. E-mail: lwilson@unbsj.ca

1. INTRODUCTION

Located in the heart of the Luberon mountain chain (1125 m), the site of La Combette (327 m) contains a 7 metre thick stratigraphic sequence, with several layers of extremely well-preserved Mousterian occupations. The shelter is oriented eastward, has a surface area of not more than 50 sq.m., and is located in a narrow valley beside a spring. Multidisciplinary studies have resulted in palaeoenvironmental and palaeoethnologic reconstructions of the use of the site within a well defined territory, achieving a level of resolution which has only rarely been possible in the past.

1.1. *Geologic and geographic outline*

By establishing direct connections between possible areas of raw material supply and the lithic artifacts discovered at the site, an archaeopetrographic study has given us the outline of the territory covered by the Mousterian groups who used the La Combette rock shelter. This territory features great geographical and geologic unity. It is naturally limited westwards

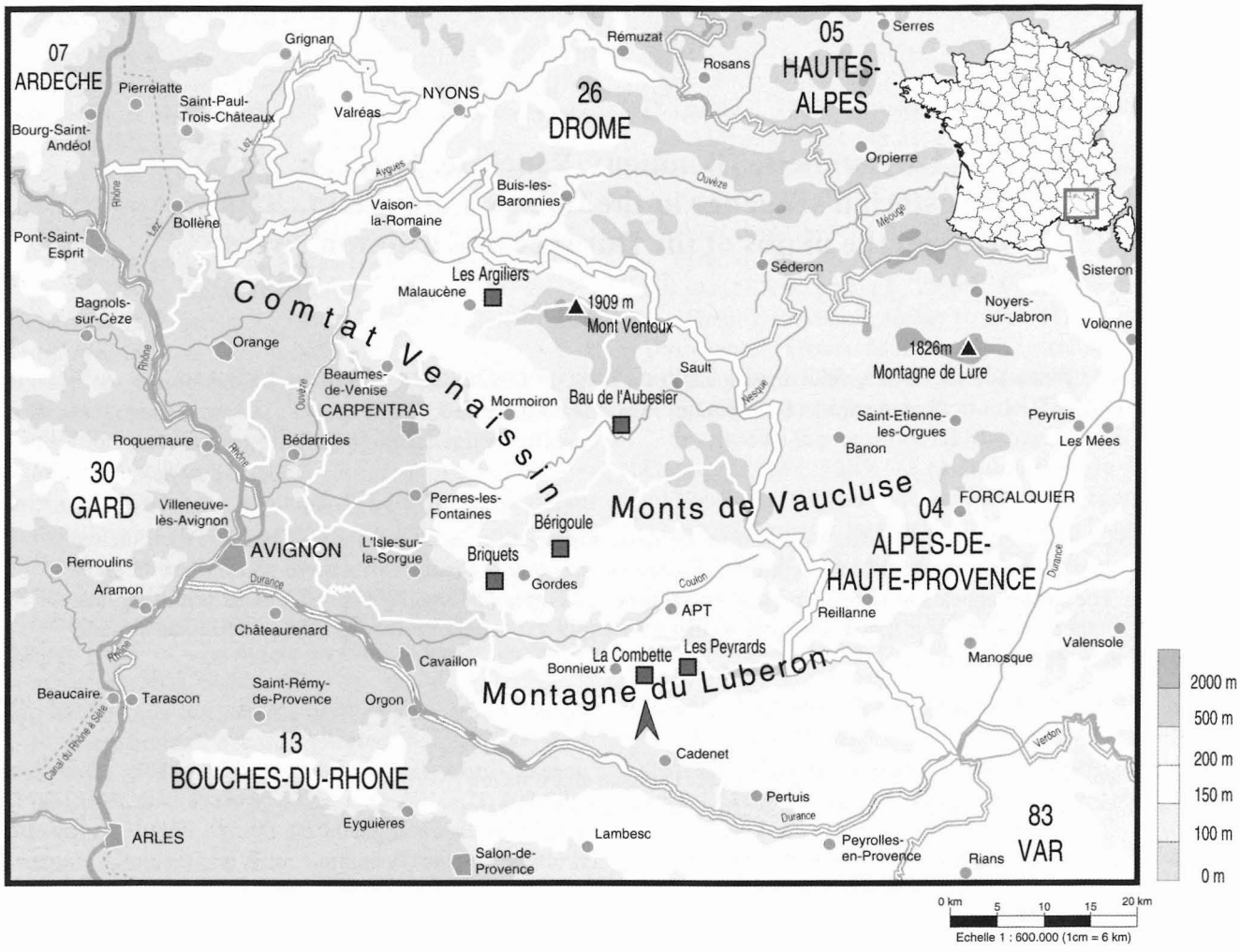


Fig. 1 - Locations of the principal Mousterian stratified sites in the Vaucluse (France).

by the Rhone corridor, southwards and eastwards by the wide valley of the powerful watercourse that the Durance used to be (before human alteration of its flow the Durance's discharge could be up to 3000 m^3/sec), and finally northwards by the southern slopes of Mount Ventoux and the Lure mountain, whose highest points approach 1900 m (Fig.1). After the chasm at Mirabeau, and guided by the mid-Durance fracture zone, the course of the Durance is oriented first of all NNE-SSW, before turning NW-SE at Peyrolles and running for about 50 km along the southern side of the Luberon anticline. It reaches the Rhone south of Avignon, not long after passing through the Orgon Gap, which marks the western end of the Luberon chain.

The landscape of this region is thus one of extreme contrasts. The dry calcareous mountains, of considerable height (Mt. Ventoux - 1909 m, Lure - 1876 m, Luberon - 1125 m), and the karstic remnants, of Barremian-Bedoulian age (the Vaucluse mountains, and the Albion and St. Christol plateaus, extending from 600 to 1200 m), contrast, on the plains leading down to the main rivers, with gentler and more humid slopes, dissected by erosion through the brightly ochre-coloured series of the Albian-Cenomanian.

These three geographic sectors are connected geologically to the sub-alpine area, which consists of calcareous series, including the Urgonian facies limestones which have played a major role in the morphologic, tectonic and hydrologic development of the region (BRGM, 1986, 1998). The most southerly of these, the Cretaceous Luberon chain, marks the boundary between the sub-alpine area and Provence. It is oriented E-W, about 50 km long, ranges from 5 to 10 km in width, and has an average altitude of 800 m.

The only way through the Luberon, from south to north, is through the gorge of the Aiguebrun stream. This passage was thus, even during the Middle Palaeolithic, an ideal location for ambushing animals, especially those such as horse and deer, which are relatively poorly adapted to steep, rocky, terrain. It was also an excellent location for finding mountain goats in their preferred environment. The La Combette rock shelter is located near this passage.

Several lines of evidence indicate that the latest

Neandertal occupations of the shelter (levels A, B/C, and D), were due to small groups of hunters in search of mountain goats and horses. These hunters were thoroughly aware of the specific features of this mountainous environment, and in particular they knew of its lack of lithic raw materials.

At the base of the sequence (levels E and F/G), the faunal data are comparable, except that in this case, deer are the main species, since the climatic conditions were more favourable for their development (end of isotope stage 4). On the other hand, the sources of raw materials used, the technical traditions, the use of fire, and the organisation of space within the shelter, are very different than in the upper layers.

1.2. *The present climate*

The local climate is as much affected by the corridors of the Rhone and the Durance, as by the high relief bounding the region to the north and south. Consequently, it can show quite dramatic variations. Nowadays the southern side of the Luberon benefits from a mild Mediterranean climate, while the plain of Apt has a humid Mediterranean climate, and the grassy summit of the Grand Luberon shows that it is subject to a colder, mountainous climate. The vegetation of the summit zone is adapted to the rigourous conditions caused by the combined effect of altitude, wind, summer drought and low winter temperatures.

In the valleys and combes, where springs and perennial rivers are rare, the occasional humid areas shelter a specific flora and fauna. The mistral wind comes from the north, starting at the entrance to the Rhone corridor, and is cooled by passing over the heights of Mt. Ventoux and the Albion plateau. It is a very important component of the local climate, since it can blow up to 260 km/h on the summits.

There is a difference in insolation by a factor of 10 between the most sun-exposed side and the shady side of the hills, which results nowadays in a typically Mediterranean vegetation on the southern slope of the Luberon, where green oak and Aleppo pine (Mediterranean stage) can be found. The northern slope is predominantly covered with a deciduous forest system with white oak (hill stage). The long strip of grass near Mourre Nègre (1125 m) represents the mountain stage of the Grand Luberon (Molinier, 1963; Gired, 1978; BRGM, 1986; Guides Gallimard, 1996).

1.3. *Short geological history of the Luberon*

Thick deposits of limestone and marl dating from the Upper Jurassic to the Lower Cretaceous, marked during the Barremian-Bedoulian by an important reef-building episode, form the geologic underpinning of the region.

Tectonic activity was responsible for a major advance of marine waters from the south to the north, around 20 million years ago. During the Upper Miocene, 10 million years ago, the Luberon underwent a process of folding and tilting, and then was thrust southwards. Around 8.5 million years ago, the sea retreated, making way for continental sedimentation. The sediments were rich in quartz grains, gravel and debris of organisms which followed the progression of the sea. They contributed to the formation of the *molasse*, which in particular covers all of the northern side of the anticline in the area of Bonnieux. It is in this molasse layer that the rock shelters of La Combette and of the Baume des Peyrards are found (*de* Lumley, 1969).

It took about three million years at the end of the Miocene for the Luberon to take the shape that we know today. The Aiguebrun, which existed even before the formation of the chain, following a fault, cut its way progressively downward through the anticline as it rose, making a deep canyon.

Around 5.5 million years ago, during the "Messinian Crisis", the level of the Mediterranean was considerably lowered, causing the downcutting of the canyons of both the Rhône and the Durance, and further accentuating the gorge of the Aiguebrun.

The beginning of the Quaternary is marked by the intense erosion and sedimentation which accompanied the advance and retreat of the Alpine glaciers. A whole system of fluvial terraces was created at the same time as a thick layer of colluvium accumulated, smoothing the contours of the steep hillsides (BRGM, 1986, 1998).

During the Palaeolithic, the mountainous ridge of the Luberon, with its average height of 800 m, would have been an important obstacle to travel, were it not for the Aiguebrun, which created a passage by exploiting a weak area and a fault in the centre of the chain. In addition, many other parameters of life are also influenced, directly or indirectly, by the geological context. These include for instance the relief (which affects the thermal gradient and precipitation patterns); the natural communication routes; the erosion of shelters, caves and dolines; the size and quality of the sources of raw material or water ; the nature of the vegetation cover (calciphile or siliciphile); and the animal species that are able to live there.

The geological context thus had important consequences for the Middle Palaeolithic inhabitants of the region. Their presence, on the other hand, had very little impact on the natural environment. They merely used the hunting territories and the rich sources of raw material, leaving behind traces of fire, and the cutting edges of their unnaturally shaped artefacts. These, ac-

companied by the bones of their hunted or scavenged prey, are the discreet but tangible and widespread evidence of their passage.

2. MAJOR PALAEOLITHIC SITES IN THE REGION

The shelter of La Combette was discovered by chance in 1971 by Brochier and Livache (Brochier, 1976) who were looking for deposits contemporary with the final Magdalenian of the cave of La Combette, which had been excavated starting in 1930 by Moirenc and Vayson de Pradenne (Moirenc & Vaison de Pradenne, 1934) and then, much later, by Paccard and Livache (Paccard, 1976). The rock shelter is located several dozen metres from the road bridge over the ravine, and several hundred meters downstream of the cave of La Combette (Brochier, 1976). The shelter is just a few kilometres from the Baume des Peyrards, another famous Mousterian site in the Luberon, which was a major site in the development of the study of prehistory in southern France (de Lumley, 1969; Porraz, 2001).

The La Combette rock shelter had to wait 15 years after its discovery until it became the subject of investigation, first of all by André Tavoso (Tavoso,1986) and later by Pierre-Jean Texier. The excavations have just recently been completed.

At about the same time, in 1987, the Canadian Serge Lebel undertook the first major scientific excavations at the Bau de l'Aubesier, on the territory of the commune of Monieux. With its 14 m of Palaeolithic sediments and its rich archaeological levels, including H-1, which dates back to more than 200000 years, and the even older, lower level J-4, the Bau de l'Aubesier has become a stratigraphic reference for calcareous sites in southern France (Fernandez *et al.*, 1998; Fernandez, 2001; Lebel, 2000; Lebel *et al.*, 2001; Blackwell *et al.*, 2001).

The short, well dated sequence of the open-air site of Bérigoule, investigated between 1988 and 1991, is situated at about the beginning of isotope stage 5. It produced a rich assemblage documenting repeated centripetal Levallois debitage of a local raw material (Brugal *et al.*,1989; Jaubert *et al.*,1991; Texier & Francisco-Ortega, 1995).

The 7 m of deposits which have been excavated in the La Combette rock shelter make this, too, an important reference site. Its importance lies in its particular geologic context, the Burdigalian molasse, in its data concerning Neandertal behaviour, and in the function of the site and its place in a territory that we can determine with unusual precision, based on geography, geomorphology, and geology, as well as on the circulation of silicic raw materials and the function of the tools (Texier *et al.*, 1996, 1998).

The sequences of these three sites, which either have recently been or still are the subject of investigation, cover a large chronological span, from the beginning of isotope stage 7 to the middle of isotope stage 3 (Buisson Catil, ed., 1994).

Being oriented eastward, the La Combette rock shelter is well protected from the cold northern winds. It is located in a narrow valley at the foot of a molasse cliff, near some of the perennial springs that are scattered through the region at the discordant contact between the Oligocene and the Cretaceous.

3. STRATIGRAPHY

The shelter was filled up to its vault at the moment of its discovery, with a stratigraphic sequence more than 7 m thick (Fig. 2) in which five principal Mousterian layers have been detected (Texier *et al.*, 1999).

Deposition occurred in three main stages that may be interpreted as follows (starting at the base):

a) Lower silty series.

- Deposition on the bedrock base of a first sterile sedimentary layer with gravel, flakes and blocks of molasse.
- Deposition of a first silty layer (called the granular lower silty layer) containing the vestiges of one or more Mousterian occupations (level F/G). The geologic study in progress will assess the processes of deposition and the post-depositional evolution of the sediments. Ash and charcoal have given a greyish colour to the sediments, which were originally yellowish but have been strongly affected by human actions.

b) Sedimentary deposits of torrential origin.

- Deposition from the north, in discordance with the erosion of the ravine, of coarse sediments (gravel, blocks and slabs of molasse of variable length, from a few decimetres to a few metres) of torrential origin, forming a fan which spread into the southern part of the shelter.
- Deposition of silty sediments correlated with an important Mousterian occupation (level E). The silt is sometimes full of ashes and remarkably well preserved charcoal. The human influence is clear macroscopically (hearths, numerous charcoal pieces of considerable length in cm, bones and burned flints), microscopically (presence of spores of a fungus that prefers a carbon-rich environment), and even physico-chemically (very high

values of magnetic susceptibility of the sediment: the oxidation due to the fire generated magnetic minerals).

- Again from the north and in discordance with the erosion of the ravine, a second deposit of coarse sediments (gravel, blocks and slabs of molasse of variable length, from a few decimetres to a few metres) of torrential origin. The fan is even larger, and preserves the second archaeological layer (E) in the northern half of the shelter; it spreads out and truncates the archaeological layer in the southern part, where the two fans merge.

c) Upper silty series.

There must have been partial or total infilling of the valley of La Combette during this sedimentary cycle. It can be divided into three main episodes (starting at the base):

- Sub-horizontal stream-deposited silts, called "silt with blocks", overlie the irregular upper surface of the fan deposits, and form the base of the silty series. In these sediments we discovered and excavated over an area of about 50 sq.m. what we consider to be a Mousterian living floor, *sensu lato*, (layer D), including several hearths.
- The sequence continues with about 1 m of stratified, sterile silts "exposing a rhythmic sequence of clayey silts, silty sands, sandy silts and silts, in which greenish clay beds get thinner and progressively more widely spaced from the base to the top" (translated from Tavoso, 1986). These sediments were probably deposited in a fairly humid period during which a gently flowing stream seems to have been the primary agent of transport.
- Finely laminated stream-deposited silts giving way progressively to definite loess deposits mark the uppermost 2 m of the La Combette sequence (Brochier *in* Texier, 1999). These sediments contain two archaeological layers (B/C and A), which are disturbed, but whose assemblages are nonetheless plainly comparable to that of layer D.

4. AGE OF DEPOSITS

Based on IRSL and TL measurements, the complete excavated sequence may be situated between 45 and 70000 years ago (Wagner in Texier 1999; Valladas in Texier 1999). A large number of measurements are currently in progress for a series of burned flints selected from the lithic assemblages of levels E and F/G. The analysis of the thickness index of tooth enamel from micromammals of the species *Arvicola* (Desclaux *et al.*, 2000) also suggests a fairly old Upper Pleistocene age (stage 4?).

5. PALAEOENVIRONMENT

Pollen analysis (Fig. 3a) has only been possible for the lower part of the sequence, including the archaeological layers F/G, E and D (López Sáez *et al.*, 1998).

The AP/NAP ratio is always around 60/40. The pollen spectrum of level F/G suggests a fairly wooded environment, dominated by Scotch pine, deciduous oak, and juniper, while grassy areas are represented by the species *Artemisia* and *Chenopodiaceae*. The presence of birch suggests that the climate was relatively cold and humid.

The spectrum of layer E shares the same species as F/G, with the addition of chestnut, hazel, willow and linden, which suggests that the climate was milder. The important human influence on this layer is underscored by the abundance of ascospores of the carbonicolous type *Chætomium* (type 7A), which indicate that the sediments are very rich in charcoal.

Human influence is also indicated by an increase by a factor of 10 (Fig. 2) in the volumetric magnetic susceptibility of the sediment in the archaeological layers (k= 8 at $80x10^{-5}$ SI; analysis by M. Dubar, Cepam).

The appearance of fir, an increasing abundance of *Betula*, goosefoot and *Artemisia*, along with the disappearance of *Castanea* and an abrupt decrease in

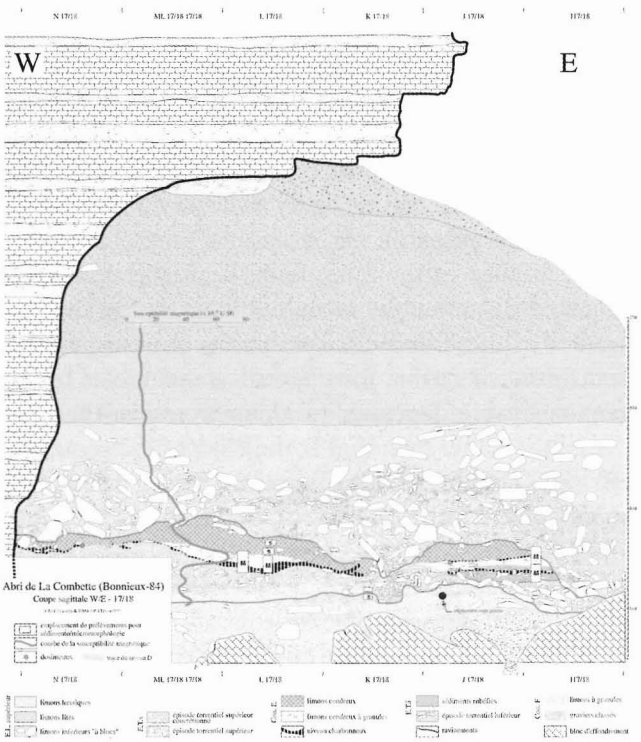


Fig.2 - Sagittal section W-E in the Mousterian deposits of the La Combette rock shelter (Bonnieux, Vaucluse, France).

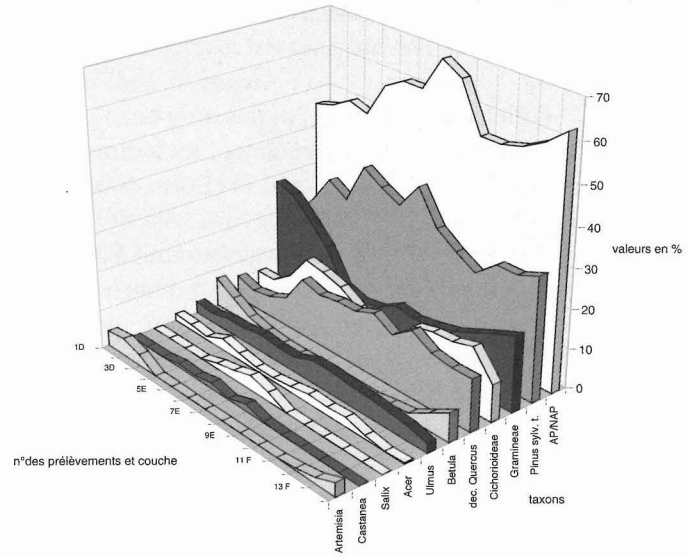


Fig. 3a - Simplified pollen diagram of La Combette. Only a few taxa are shown. The conventional order has been changed for the sake of readability.

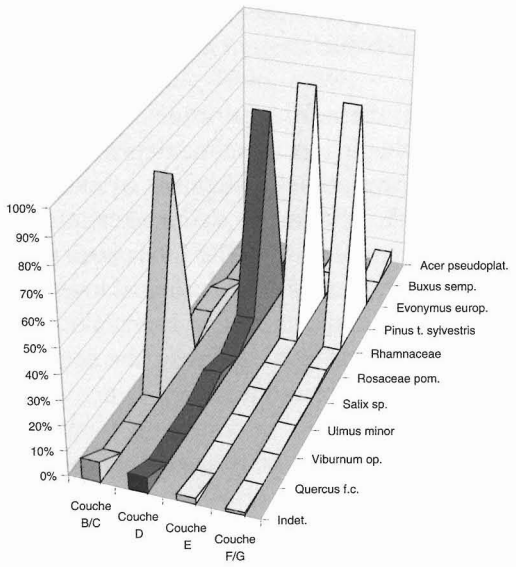


Fig. 3b - Preliminary anthracologic analysis of the archaeological levels of La Combette (levels B/C to F/G).

the abundance of oak (AP/NAP: 45/55) in the pollen spectrum of layer D (at the base of the upper silty series) mark the return of a somewhat colder and more humid climate.

The charcoal is palaeoecologically significant because it results from the burning of fuel collected exclusively as dead wood. The charcoals serves to corroborate the data on the evolution of the vegetation of this landscape, reflecting a deterioration in the climate from the lower levels (F/G, E and D) towards the top of the sequence (B/C). Pine is omnipresent in layers F/G, E and then D, where it begins to decrease slightly, giving way to willow (Fig. 3b). Pine had almost disappeared from the area of the shelter by the time that layer B/C was deposited, while willow had become the dominant taxon (Thery in Texier 1997; Thery & Texier, in press).

Studies of the microfauna and of the malacofauna confirm that the overall climate during the formation of these deposits was colder than at present, and furthermore that the uppermost sediments of the sequence were deposited in an environment that was distinctly colder than that at the base of the sequence (Brugal, Desclaux and Magnin *in* Texier 1999; Desclaux *in* Texier, 2001).

6. THE SILICIOUS RAW MATERIALS

Extensive research carried out in the Vaucluse and in neighbouring departments (particularly the Alpes-de-Haute Provence) regarding the raw materials available in the environment of the Bau de l'Aubesier and La Combette (Wilson, 1996; Texier *et al.*, 1998; Wilson *in* Texier, 1999; Texier *et al.*, in press) indicates that the potential sources are (presently) and were (during the upper Pleistocene) abundant and diverse.

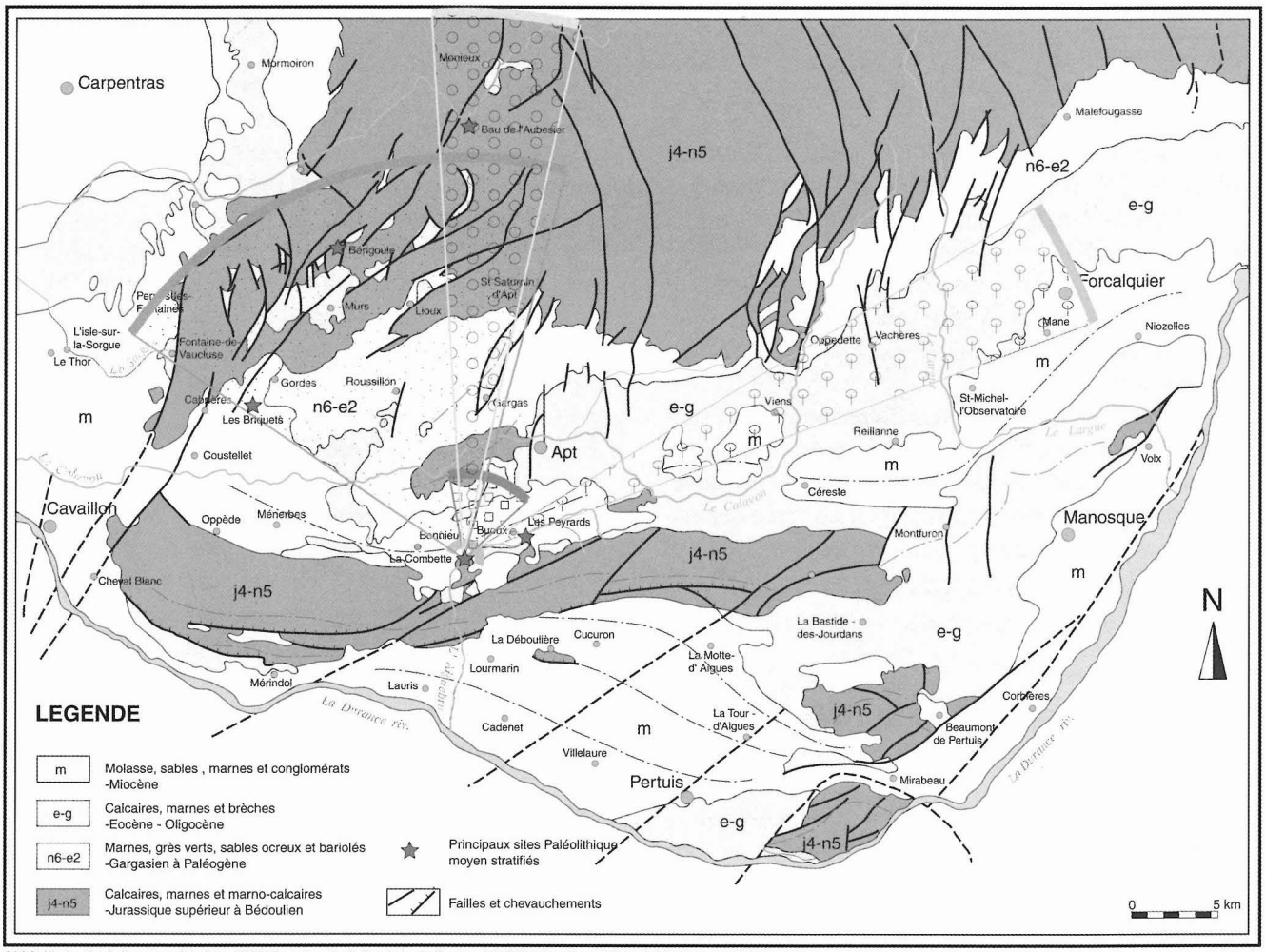
A recent study of raw material sources used during the Mesolithic (Guilbert, 2000) has significantly enriched the data available, extending it over a larger geographic area.

The potential sources can be classified in four main groups: flint in primary position of Cretaceous, Eocene or Oligocene age; and flint in secondary positions, in accumulations resulting from the weathering and/or erosion and transportation of older rocks, such as conglomerates or fluvial terraces. These can date to the Cretaceous, Oligocene or even the Quaternary (Fig. 4).

In the still preliminary research on the various archaeological assemblages from La Combette (Texier *et al.*, in press), we have been able to classify more

	Local	Tertiary	Cretaceous	Patinated
A	16,4%	27,1%	38,2%	18,4%
B/C	10,7%	39,2%	40,0%	10,1%
D	6,3%	54,9%	32,7%	6,0%
E	11,8%	46,9%	28,1%	13,2%
F/G	12,0%	43,0%	31,7%	13,4%
TOTAL Col.	**11,7%**	**44,0%**	**31,5%**	**12,9%**

Tab. 1 - % values and main geologic origins of identified material in the different archaeological layers of La Combette.



DAO P-J Texier, d'après les cartes géologiques BRGM Carpentras, Sault, Forcalquier, Reillanne au 1:50 000 et Parc Naturel Régional du Luberon au 1:100 000

Fig. 4 - Principal areas of supply of siliceous materials used by the Mousterian groups that frequented la Combette rock shelter (Bonnieux, Vaucluse, France).

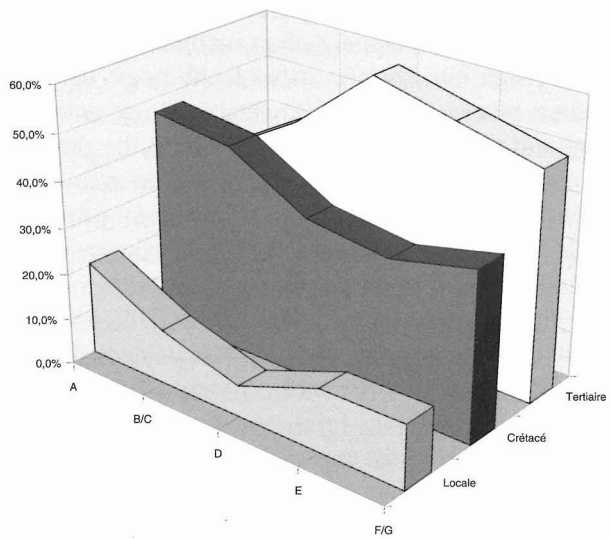


Fig. 5 - Layer D shows the most significant variability in raw material supply: anticipation of certain activities and the needs associated with them resulted in the importation of large quantities of Tertiary (54.0%) and Cretaceous (32.4%) flints, with concomitantly less use of local materials (6.7%), which are of poor quality.

than 5000 pieces so far, and identify more than sixty petrographic types.

For between 6% (D) and 18% (A) of the pieces, depending on the layer, we have no indication of their geologic origin, because of the alteration (patination) of their surfaces.

The figures below are rough, inasmuch as they do not take into consideration all of the activities that could have occurred at the rock shelter that may have caused the over- or sub-representation of any source or area of supply (Tab. 1, Fig. 5).

The use of Tertiary flint (Eocene and Oligocene from the basin of Apt and from small basins within the Vaucluse mountains) is never below 33%, calculated excluding the patinated pieces. However, the Tertiary flints are the most likely to vary in their percentage of use, from 33% in layer A to 58% or more in layer D, a difference of around 25%.

Use of Urgonian flint from the north and northeast of the department seems to have been more stable, the percentage varying from 32 to 46% between layers, a difference of 14%.

Local sources within the Luberon (such as a conglomerate of pebbles with a greenish cortex, which marks the base of the Miocene in contact with the Urgonian limestone) represent on average about 13% of the material; layer D is an exception to the rule, with under 7%, which is 13.4% less than in layer A.

A more in-depth analysis shows that even within the geologic subdivisions described above, the precise sources used might have varied through time. Some of the types were present in all levels, although in different proportions, while others were totally absent from some layers.

The accessibility of the different sources of supply must have varied through time, both during and since the Middle Palaeolithic, depending on the development and evolution of the periglacial scree deposits which accumulated in parallel with the infilling of the numerous caves in the region.

7. THE MAIN ARCHAEOLOGICAL LEVELS: D, E AND F/G

The sequence of La Combette can be broadly divided into two main units, with the summit of the second torrential episode marking the boundary between the lower unit (layers F/G and E) and the upper unit (layers D, B/C and A).

In order to understand how sediments have been deposited, it is sedimentological practice to describe a stratigraphy from the base to the top, thus respecting the chronological order of the deposits. This is what we have done, so far. However, when we come to the archaeological material, it becomes impossible to continue to respect this rule, since the oldest layers, being the most recently uncovered, are less well studied. Thus, at La Combette, one of the most recent Mousterian levels, D, which is a reference layer for the site, has to be compared with the older levels E and F/G, whose study has only just begun.

7.1. *The use of fire in the main archaeological levels*

Although fire is present all through the sequence, there are major differences from one unit to another. In the upper unit, fire was well circumscribed and has only slightly affected the archaeological remains. The hearths, which are small and clearly marked by changes in the colour of the sediments, seem to have been intentionally placed along the line marking the extent of the rock shelter's overhanging roof (Texier *et al.*, in press).

Charcoal and wood ash are so abundant in the archaeological layers of the lower unit (E and F/G) that they have changed the colour of the sediment. The bones and the lithic remains have also been greatly affected by the action of this element (from 35 to 55% of the bones, and from 52 to 60% of the lithics), so much so that we suspect that the bones may have been used as an additional fuel for the fire.

The discovery of polygenic hearths, including one built against the wall of the shelter using a block which fell from the roof, and on top of what seems to be a stone pavement, suggests that the duration of occupation of this layer was somewhat longer than we infer for the levels of the upper unit.

Anthracologic analysis of the firewood used during the different Mousterian occupations shows that it was dead wood, greatly affected by micro-organisms. It would have been easy to ignite, but it must have burned out very quickly. The fact that this is the only combustible that has been found shows that its users preferred to use the fire to transfer heat through conduction (indirect cooking or thermal transfer to another material), rather than using it as a source of light, or of radiant or convection heat (producing a flaming fire requires very dry firewood, rich in inflammable materials and therefore not weathered) (Texier *et al.*, in press; Thery & Texier, in press).

7.2. *The upper unit*

7.2.1. *Layer D*

The results obtained for this layer (so far only partially published) show that it is in many respects very close to the image of an actual living floor. This interpretation is possible because of the integration of data resulting from analyses in many different fields of investigation, such as lithic technology, use-wear studies, petroarchaeology, archaeozoology, anthracology, and the spatial organisation within the shelter.

The 50 sq.m of preserved surface area in this layer (Fig. 6) is just about the largest surface area that could be used at La Combette. Furthermore, it is so well preserved that it has allowed us attempt a kind of high-definition archaeology (Gowlett, 1997) which is rarely even conceivable for a Middle Palaeolithic site.

Thus we have been able to conclude that the length of occupation was brief, and we have determined the specific activities that took place there, in a short seasonal context. The occupation surface actually protected by the shelter is relatively small (around 30 sq.m), and is delimited by the hearths. The distribution of the remains shows that the activities were synchronic and took place during a single period of occupation. The remains are in a primary context, as the depositional processes were favourable to the preservation of the structures.

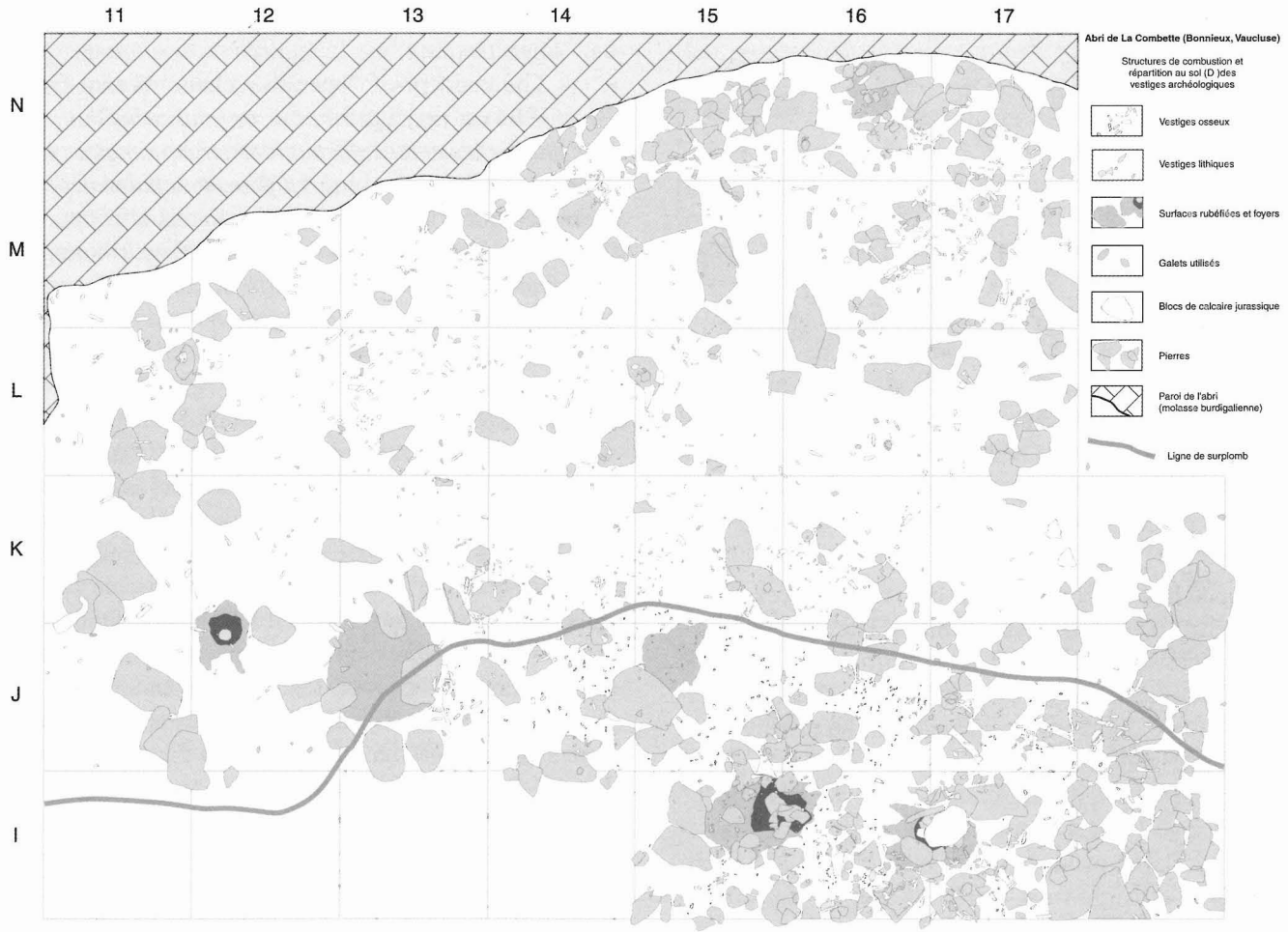


Fig. 6 - Distribution of archaeological material, hearts and large stones (Layer D).

The information that has come to us, through a limited taphonomic filter, gives us the image of a temporary camp on the southern edge of a territory. The small group of Neandertals who stayed briefly in the shelter at that particular time engaged in sometimes complex activities like the tanning of hides (Texier et al. 1996, Lemorini 2002). These activities were strictly related to the result of their hunting expeditions. The fact that these activities were part of a well organised system of exploitation of the territory, and that the Neandertals were fully aware of the distribution of food and mineral resources within that territory, is clearly shown by the fact that some of their actions show anticipation of the constraints imposed by the environment.

It is clear that the people of La Combette already knew of the existence of this shelter near a spring, and knew that the surrounding area was favourable for hunting, but poor in lithic resources. The techno-functional study of the lithic assemblage shows that most of the pieces were already knapped, often retouched, and designed for very specific functions, and that they had been transported over distances ranging from 5 to 40 km to their place of use. Only 6,7% of the lithic remains, mainly rough knapping products, are of local origin.

The numerous reduction sequences identified, based usually on only a small number of natural or

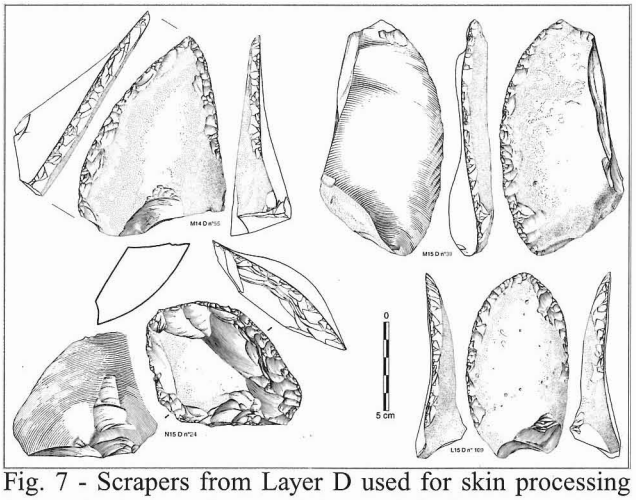


Fig. 7 - Scrapers from Layer D used for skin processing (traceological analyses: C. Lemorini, dreawings: J.-G. Marcillaud). Note the considerable sizes of these pieces, and the regularity of the retouch.

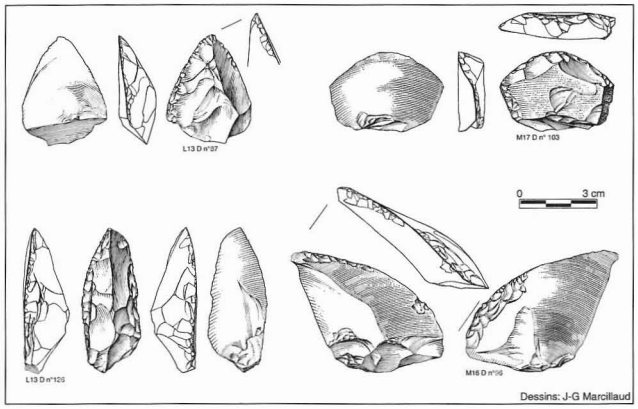


Fig. 8 - Small retouched tools used for wood-working, from Layers B/C and D of La Combette rock shelter (traceological analyses: C.Lemorini, drawings: J.-G. Marcillaud). Note the great range of forms and types.

knapped retouched supports, seem to have been aimed at maximizing size and usefulness. The knapped supports were selected from both the initial stages and the more advanced stages of reduction, unlike the situation that we observed for instance at the nearby lithic knapping workshop and habitation site of Bérigoule. Long, very curved, sidescraper edges were produced on large, very flat flint nodules, on large cortical flakes, on large flakes produced with hard (stone) hammers, and even on large frost-cracked flakes. These constitute the basis of a highly specialised tool kit designed for preparing hides, which gives a very unusual character to the lithic assemblages of the upper levels of La Combette (Fig. 7). More diverse tools, of a more normal size, were used for wood working (Fig. 8), while quarters of meat were cut up with the help of rough cutting edges. This very specific organisation and use of materials is well documented, and allows us to deduce that there was also forethought with respect to the acquisition of particular animal products and by-products, whether for food (horse and mountain goat) or for functional reasons.

A main camp (near the sources of raw materials), and some temporary camps (sometimes far from the main one), near which animals were killed and various activities depending on the result of the hunt were carried out, thus made up the basic socio-economic organisation of the Mousterians at La Combette.

The characteristics of the lithic and bone assemblages of the two more recent archaeological layers (B/C and A) suggest that the La Combette rock shelter was used as a temporary camp at least three times during the climatic period corresponding to the deposition of the silts and loess of the upper unit. As such it was an important part of the logistical organisation that groups of hunter-gatherers had developed in order to exploit a territory that they knew extremely well, in terms of both its potential and of the distribution of its resources.

7.2.2. *A grid for reading the archaeological data of layer D*

The concept of "operative chain" (Leroi-Gourhan, 1964) is very useful *pour organiser les données archéologiques et les informations manquantes en tant qu'éléments et/ou phases des différentes chaînes opératoires* (Pelegrin *et al.*, 1988). Using this concept, the structures of the lithic and bone assemblages were placed in parallel in order to construct a grid (Brugal, 1995). The usefulness of this grid was tested with the archaeological data from the layer that seemed best suited to it (Texier *et al.*, 1998). This grid allows us to propose a synthetic representation of the function of the site at a particular moment in its use (layer D). Such an interpretation of the role of the site is aided in particular by the excellent state of preservation of the remains, and their spatial integrity, which comes to us through a reduced taphonomic filter. Another major role in this analysis is played by experimentation and functional analysis, which allow us to determine the nature and sometimes even the processes used to transform the organic materials which have not been preserved.

The proposed model (Fig. 9) is divided into two distinct zones. The upper part refers to what the available information can tell us about the behaviour of a given prehistoric group at the level of their territory. The lower part refers to what we know about activities carried out in the shelter. A combination of horizontal reading and vertical reading allows us to compare the faunal and lithic data, while passing from a study of the nature of the different occupations to a study of all of the activities that could have been carried out within a specific area of exploitation (Brugal, 1995).

This change in scale is only possible when the transportation of resources, both lithic and biotic, is taken into consideration. The parallel development of the lithic and animal operative chains provides a schematic representation of the adaptative relationships between the environment (physical and bioclimatic) and the human groups who created the sites, whose function was for the greatest part determined by the ecosystem.

By shedding some light on the principal causal relationships linking the fauna and the tools, this approach provides stronger arguments in support of our hypotheses about the function of the site at a particular moment in time. It also allows us to extrapolate these ideas, with all necessary prudence, to other occupation layers presenting a similar structure, even though these are not as well preserved (Texier *et al.*, 1998).

7.3. *The lower unit*

The oldest layers amongst those preserved in the shelter (E and F/G) were affected by two periods

of deposition of sediments of torrential origin. They have many sedimentological and archaeological features in common:

The sediments are strongly influenced by human action and in particular by the action of fire, which has left traces such as reddened sediments, ashes mixed with the silt, burned stones and charcoal. Many remains of multiphase hearths have been detected, both in layer F/G and in layer E. One of these, in layer E, was positioned up against a block of breccia, and seems to have been built on a bed of stones piled against the wall of the shelter. A great deal of bone and lithic material in different stages of incineration was found in this structure. The sediment is composed of powdery black or grey ashes, very rich in organic material, but with no phytolites present now (if there ever were any). There are no pieces of charcoal at the centre of the structure, but they are particularly abundant and well preserved on its fringes (one 50 mm long piece was collected from this layer).

56% of the flints and 35% of the bones recovered in layer E are burned, if not partly destroyed by the action of fire, while the respective figures for layer F/G are 67% and 52% (Texier *et al.*, in press). The traces of fire are not restricted to the area of combustion, but rather show that fire intensely affected the entire excavated surface.

The faunal assemblages differ from those of the upper levels: horse (46% of the identifiable remains in E vs. 10% in F) and mountain goat dominate alternately in E and F/G, while deer, which is scarce in layer D, is much more common in the lowermost level.

The remains of a large bovine, probably of the genus *Bos*, have also been found in these two layers. Based on the faunal associations (macro- and microvertebrates), the malacology and the palaeobotany, the oldest deposits at La Combette are evidence of a fairly temperate climate and a forested environment, which evolved towards more severe conditions and a more open landscape as we approach the top of the sequence.

There are many clear signs of human actions on the faunal material: removal of muscular mass (striae of flesh removal), fractures (spiral fractures, percussion marks, splinters), and combustion (bones may have been used accidentally or intentionally to feed the fires).

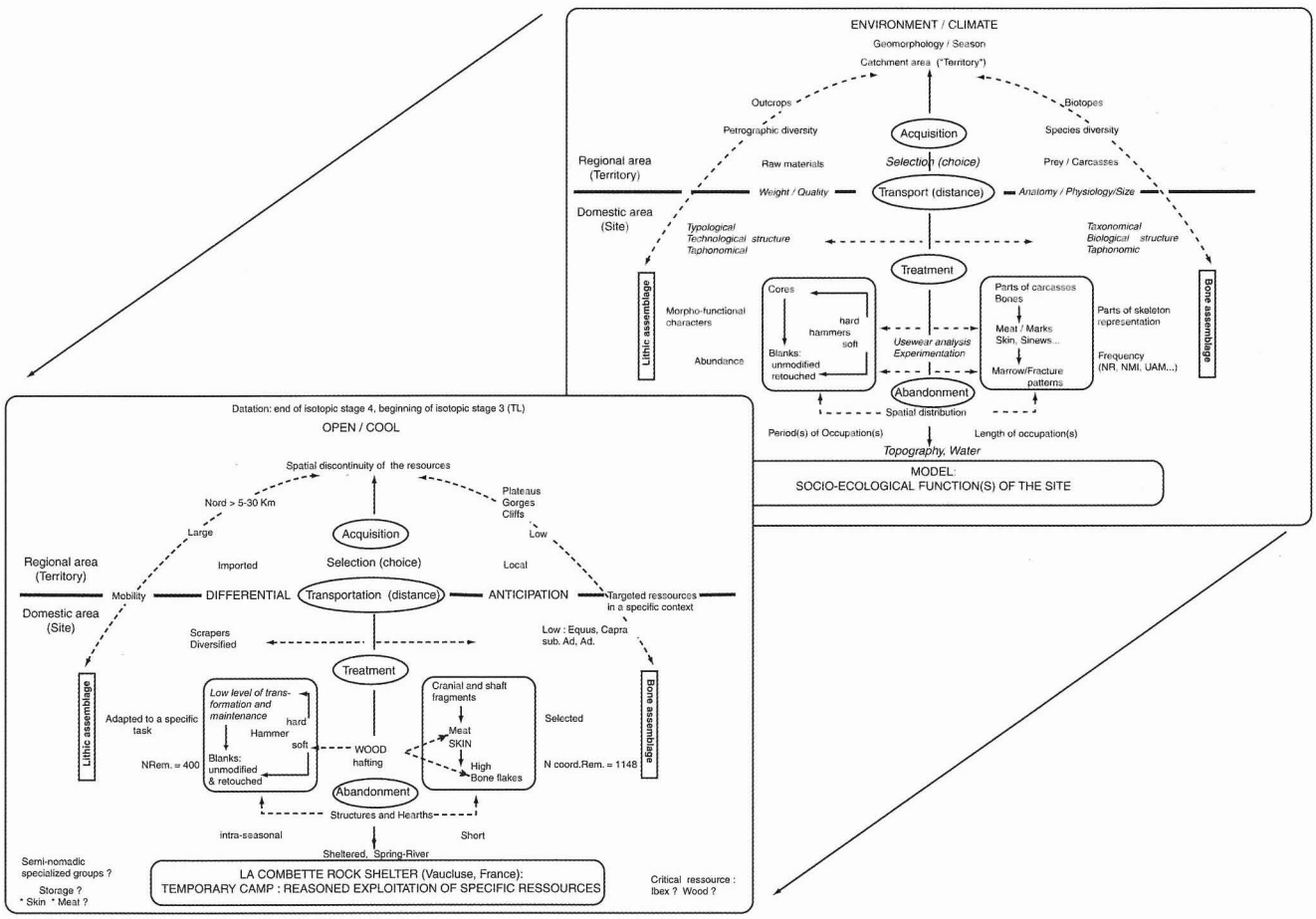


Fig.9 - Model of the operative chain applied to faunal and lithic data for a functional interpretation of La Combette Layer D (Brugal 1995; Texier *et al.* 1998)

The lithic structures of the lower unit (F/G and E) are highly comparable to each other in terms of technology, but differ distinctly from those of the silty layers of the upper unit (D, B/C and A). Broadly speaking, as we have seen, the main areas of supply remained the same all through the sequence, providing siliceous raw materials in equivalent proportions. However, a more detailed analysis suggests that the precise sources of supply might have varied. The lithic assemblages of the lower unit are greatly affected by fire. However, we can see that they consist primarily of discoid and centripetal recurrent Levallois reduction sequences on blocks of more modest size which were in at least some cases exploited on site. Cores and knapping debris are considerably more abundant than in the archaeological layers of the upper unit.

On the other hand, retouched tools, mainly simple or double sidescrapers which are small in size and low in resharpening potential, make up a much smaller proportion of the assemblages here than in the upper unit, and are often accompanied by knapped flakes (Fig. 10).

This equipment was either imported already worked or produced on site. It consistently shows that these people had a good knowledge of the mineral resources in the local, neighbouring, and even distant environment (as much as 40 km from the site). Just as in the upper unit, the Mousterians of the lower unit anticipated the local lack of siliceous raw materials south of the valley of the Cavalon. Thus the study of the archaeological layers has shown that the sources of raw materials and their transport distances are very similar in the two sedimentary units.

Despite some encouraging preliminary results in the use-wear analysis, it has not so far been possible to establish any evidence of anticipation with respect to specific domestic activities, such as was shown for instance for layer D (Texier *et al.*, 1996).

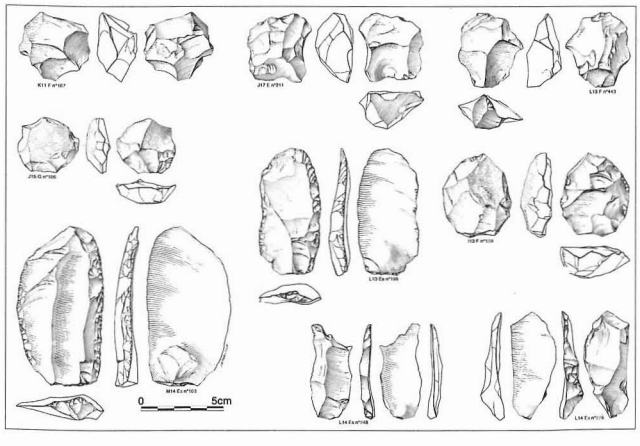


Fig.10 – Examples (discoid block, Levallois flakes and sidescrapers) of the Mousterian lithic sequence from the lower layers (E and F/G) in the La Combette rock shelter.

The preliminary techno-functional analysis of the lithic production sequences, and the study of the traces left by intensive use of fire, provide evidence of very different technical and domestic behaviours. It still remains to be shown whether this variability is due simply to a difference in cultural tradition, or if it is due for instance to a different, and perhaps less clearly defined, use of the shelter, which may have been used for a longer period at a different time of year.

Finally, the use-wear analysis demonstrated that some of the tools were used for carving deer antler, before we had found any remains of deer. This result was then confirmed in the most striking way by the discovery of a fragment of deer antler bearing deep, semicircular incisions which had reached the inner spongiosa layer, thus preparing the piece to be broken by bending. Although this is a manifest case of work on a deer antler by Neandertals, any similar discoveries, particularly from this chrono-cultural period, are still very rare.

CONCLUSION

The role we believe this site to have played, all through the Mousterian sequence of La Combette, reflects the perennial nature of the territory used during the Middle Palaeolithic: a territory whose limits were clearly defined by obvious geographic features. During the entire sequence, the shelter was in a marginal position in the territory, serving as a southern camp site for hunting expeditions of limited size and duration.

The anticipation of the objectives of these expeditions is more variable through time. The consistently high proportion of allochthonous raw materials in the lithic units is evidence of an outstanding knowledge of the territory, of its mineral resources, and of their locations.

The variability in the technological behaviours, clearly detectable from one unit to the next, is due as much to the weight of tradition and technology as to the anticipation of needs related to very specific activities such as tanning hides (layer D).

In one case (the lower unit, layers E and F/G), Levallois and discoid cores, partially worked on site, were used to provide small blanks to be retouched into a small number of sidescrapers without any particularly marked characteristics. This interpretation is corroborated by the use-wear analysis.

In the other case (upper unit, layers A, B/C, and D), the great majority of the tools were imported already worked and retouched into sidescrapers. The tools represent around 30% of the potential or modified

supports. The low technological, but very marked petrographic and especially functional specificity of the largest of these, clearly documented by the functional analysis, is a clear indicator of anticipation of particular, targeted, activities linked to the results of hunting expeditions.

The La Combette rock shelter is a very special case among Middle Palaeolithic sites. Multidisciplinary studies have been of great benefit in increasing our understanding of the domestic and technological behaviours of these groups of hunter-gatherers. The results give us a glimpse of the logistical organisation of their socio-economic system. This approach also gives us an impression of Neandertal society which looks more modern, and which was very near the transition to the Upper Palaeolithic.

ACKNOWLEDGEMENTS

This work stems from research developed within a program of investigation and excavation headed by P.J. Texier, financially and logistically supported by the Ministry of Culture and Communications (France), the General Council of the Vaucluse, and the municipality of Bonnieux.

RESUME - L'intégration des données actuellement disponibles dans de multiples domaines d'investigation, permet d'ores et déjà de disposer de nombreux arguments pour démontrer que l'abri de La Combette fut, un temps tout au moins durant le Paléolithique moyen, un élément marginal d'un dispositif logistique situé plus au nord. Il apparaît que l'abri a servi à plusieurs reprises de refuge à de petits groupes de chasseurs s'aventurant aux confins méridionaux d'un vaste territoire pour y exploiter les ressources cynégétiques d'un environnement de moyenne montagne.

RIASSUNTO - L'integrazione dei dati attualmente disponibili nei vari settori d'indagine, permette di disporre di numerose argomentazioni per dimostrare che il riparo di La Combette fu, almeno durante il paleolitico medio, un punto marginale di un dispositivo logistico situato più a Nord. Sembra infatti che il riparo abbia svolto in più occasioni il ruolo di rifugio per i piccoli gruppi di cacciatori che si spingevano verso i confini meridionali di un vasto territorio per sfruttare le risorse cinegetiche di un ambiente di media montagna.

BIBLIOGRAPHY

Blackwell B., Skinner A.R., Blickstein J.I.B., Lebel S. & Leung H.Y.M., 2001- ESR Isochron dating analyses at Bau de l'Aubesier, Provence, France: clues to U uptake in fossil teeth. *Geoarchaeology: An International Journal*, vol.16,7: 719-761.

BRGM, 1986 - Atlas des ressources du sous-sol et des eaux souterraines du département de Vaucluse, *BRGM*, Marseille: 40.

BRGM,1998 - Découverte géologique du Luberon, guide et carte géologique au 1/100.000.

Brochier J.E., 1976 - Abri de la Combette (Bonnieux, Vaucluse). *IX^e Congrès UISPP, Nice 13-18 septembre 1976*, Livret-Guide de l'excursion C2:113.

Brugal J.-P., 1995 - Archéologie et Zoologie pour un nouveau concept, la paléoéthologie humaine, *Préhistoire Anthropologie Méditerranéennes*, 4:17-26.

Brugal J.-P., Jaubert J. & Texier P.-J., 1989 - *Découverte d'un site moustérien de plein-air en Vaucluse (Bérigoule, Murs), Bulletin de la Société Préhistorique Française*, 86,3: 69-71.

Buisson-Catil J . (ed.), 1994 - Le Paléolithique moyen en Vaucluse. A la rencontre des chasseurs néandertaliens en Provence nord-occidentale, *Notices d'Archéologie Vauclusienne*, 3, Avignon.

Desclaux E., Abassi M., Marquet J-C., Chaline J.& Van Kolfshoten T., 2000 - Distribution and evolution of Arvicola Lacépède, 1799 (Mammalia, Rodentia). In: France and Liguria (Italy) during the Middle and Upper Pleistocene., *Act zool. crcov.*, 43, 1-2: 107-125.

Fernandez P., Faure M., Guérin M.& Lebel S., 1998 - Stratégie de chasse des néandertaliens du Bau de l'Aubesier ; choix et opportunisme. In : Économie préhistorique : les comportements de subsistance au Paléolithique. *Actes des XVIIIe Rencontres Internationales d'Archéologie et d'Histoire d'Antibes-Juan-Les-Pins*, octobre 1997. Sophia Antipolis, APDCA : 309-323.

Fernandez P., 2001 - Etude paléontologique et archéozoologique des niveaux d'occupations moustériens au Bau de l'Aubesier (Monieux, Vaucluse): implications biochronologiques et palethnologiques. Thèse, Univ. Claude Bernard, Lyon I.

Gired B., 1978 - Inventaire écologique et biostratigraphique de la flore du département de Vaucluse, *Bulletin de la Société d'Etude des Sciences Naturelles de Vaucluse*, 47-48ème année.

Gowlett J.A.J., 1997 - High definition archaeology: ideas and evaluation, *World Archaeology*, 29,2:152-171.

Guides Gallimard, 1996 - *Parc Naturel Régional : Luberon*, Eds. Nouveaux Loisirs.

Guilbert R., 2000 - Gestion des industries lithiques mésolithiques du sud-est de la France. Thèse de l'Université de Paris I Panthéon-Sorbonne: 369.

JAUBERT J., TEXIER P.-J & BRUGAL J.-P., 1991 - Bérigoule (Murs, Vaucluse). Rapport de fouille programmée pluriannuelle 1989-1991: 76.

LEBEL S., 2000 - Monieux, Bau de l'Aubesier. In: Bilan Scientifique 1999, *DRAC PACA*, Service Régional de l'Archéologie: 179-180.

LEBEL S., TRINKAUS E., FAURE M., FERNANDEZ P., GUERIN C., RICHTER D., MERCIER N., VALLADAS H. & WAGNER G. A., 2001 - Comparative morphology and palaeobiology of Middle Pleistocene human remains from the Bau de l'Aubesier, Vaucluse-France, *PNAS*, vol. 98, n 20: 11097-11102.

LEMORINI C., 2000 - Reconnaître des tactiques d'exploitation du milieu au Paléolithique moyen. La contribution de l'analyse fonctionnelle, *BAR Int. Series* 858: 142.

LEROI-GOURHAN A., 1964 - *Le geste et la parole,* t.1, Technique et language, Paris.

LÓPEZ SÁEZ J.A., TEXIER P.-J.& BUI-THI-MAI M., 1998 - Paléoenvironnement durant le Pléistocene supérieur en Vaucluse: analyse palynologique des couches inférieures de l'abri de La Combette (Bonnieux, Vaucluse, France), *Trabajos de Prehistoria*, 552: 151-162.

LUMLEY H. DE, 1969 - La Baume des Peyrards. In: Le Paléolithique inférieur et moyen du midi méditérranéen dans son cadre géologique, tome I, Ligurie-Provence, *CNRS V^e supplément à Gallia Préhistoire*: 419-461.

MOIRENC A. & VAISON DE PRADENNES A., 1934 - La grotte de La Combette à Bonnieux. *Congrès Préhistorique de France*, compte rendu de la 10^e session: 427-434.

MOLINIER R., 1963 - Vue d'ensemble sur la végétation du Grand et du Petit Luberon (Vaucluse), *Bulletin du Museum d'Histoire Naturelle de Marseille*, t. XXIII: 5-28.

PACCARD M., 1976 - Grotte de la Combette (Bonnieux, Vaucluse). *IX^e Congrès UISPP, Nice 13-18 septembre 1976*, Livret-Guide de l'excursion C2: 113.

PELEGRIN J., KARLIN C.& BODU P., 1988 – "Chaînes opératoires": un outil pour le préhistorien, *Technologie Préhistorique*, Ed. du CNRS, notes et monographies techniques n°25: 55-62.

PORRAZ G., 2001 - Etude techno-morphologique des pièces amincies des couches 9 à 5 de la Baume des Peyrards (Vaucluse). Mémoire de DEA, Université de Provence, Centre d'Aix, UFR Civilisations et humanités: 157.

TAVOSO A., 1986 - Bonnieux-La Combette (Vaucluse). Rapport sur les fouilles effectuées du 1er au 24 Juin 1986: 8.

TEXIER P.-J., 1997 - Abri du pont de La Combette, site paléolithique moyen à Bonnieux (Vaucluse). Opération programmée pluriannuelle (1997-1999). Rapport intermédiaire 1997: 21.

TEXIER P.-J., BRUGAL J.-P., LEMORINI C.& WILSON L., 1998 - Fonction d'un site du paléolithique moyen en marge d'un territoire: l'abri de La Combette (Bonnieux, Vaucluse), In: Economie préhistorique: les comportements de subsistance au paléolithique, *XVIII^e Rencontres Internationales d'Archéologie et d'Histoire d'Antibes*, Editions APDCA, Juan-les-Pins: 325-348.

TEXIER P.-J.& FRANCISCO-ORTEGA I., 1995 - Main technological and typological characteristics of the lithic assemblage from level I at Bérigoule (Murs-Vaucluse, France), *The Definition and Interpretation of Levallois Technology*, Monographs in World Archaeology, 23, Prehistory Press: 213-248.

TEXIER P.-J., LEMORINI C., BRUGAL J.-P.& WILSON L., 1996 - Une activité de proto-tannage des peaux dans l'habitat moustérien de La Combette (Bonnieux, Vaucluse, France). *Quaternaria Nova, actes de la Table Ronde Reduction processes* ("Chaînes opératoires") *for the European Mousterian*, Rome 25-28 May 1995: 189-211.

TEXIER P-J, 2001 - L'abri de La Combette, site paléolithique moyen à Bonnieux (Vaucluse), Rapport intermédiaire: 25.

TEXIER P-J *et alii,* 1999 - L'abri de La Combette, site paléolithique moyen à Bonnieux (Vaucluse), Rapport de synthèse (1997-1999): 84.

TEXIER P-J, BRUGAL J-P, LEMORINI C., THERY I.& WILSON L. (in press) - Abri du pont de La Combette (Bonnieux, Vaucluse): variabilité intrasite des comportements néandertaliens. *Actes du 126èmes congrès du CTHS, Colloque Pré et Protohistoire: territoires, déplacements, mobilité, échanges Toulouse avril 2001*, CTHS, Barbaza & Jaubert ed.: 16.

THERY I.& TEXIER P.-J. (in press.) - L'utilisation du bois mort dans le site moustérien de La Combette (Vaucluse) : apport d'une approche morphométrique des charbons de bois, *Bulletin de la Société Préhistorique Française*.

WILSON L., 1996 - Mousterian raw material strategies in a regional context in Southern France. *Actes du XIIIème Congrès UISPP,* Forli, vol.6, t. II: 783-791.