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Biostratigraphic and palaeoenvironmental implications of the Middle Palaeolithic and Chatelperronian occupations of La Tour Fondue site in Chauriat (Puy-de-Dôme, France)

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1 - Introduction

1 La Tour Fondue rock shelter is situated in the Grande Limagne area of the Auvergne, about 15 km from Clermont-Ferrand and next to the village of Chauriat, at an altitude of 465 m (fig. 1). The site is located at the foot of a small limestone massif made of Oligocene sedimentary rocks (dolomitic and silicified limestone) on the Southwest side of the Puy de Pileyre. The discovery of the site was made by Mr Hervouët, owner of the land, who unearthed bones and lithic objects during the construction of his garage in 1988 (fig. 2). He immediately informed the "Direction Régionale des Affaires Culturelles" of his finds. Through the intervention of J.-P. Daugas, then curator at Antiquities Management, several persons were sent to the site. The inventory of the bone pieces, established by J.-L. Guadelli, notably includes two fragments of human crania that we were not able to find again. No inventory of the lithic material was done from this first visit.

2 As Mr Hervouët did not hear any more from the archaeologists, he continued with the work on his property by digging a cellar a few meters away from his garage, on the

West side of the limestone rock face (fig. 3). He took care to collect the archaeological objects he found. Notified by someone he knew, F. Surmely, curator for the "Service Régional d'Archéologie" in the Auvergne, visited the site in 2004 with one of us (J.-F. P.) to examine it and the objects discovered by Mr Hervouët. A quick inspection of the remains showed that the rock shelter was occupied during the Middle Palaeolithic and then during the Chatelperronian and the Upper Palaeolithic.

3 Sheltered prehistoric sites with remains from several human occupations are sufficiently rare in the Puy-de-Dôme region to arouse our interest, even more so if they are likely to bring data on the Palaeolithic settlement of the region. If the Middle Palaeolithic is known at a regional scale through several open air sites, the Chatelperronian is much less familiar, and the Chauriat site appears as the only human occupation from this time period found in the department. The two other known sites in the Auvergne region are situated in the Allier department, one being the eponymous site of Chatelperron and the other the little known site of Theillat. The abundance and the quality of the archaeological and faunal remains discovered at Chauriat strengthen the scientific interest of the site and its research perspectives.

4 As the excavation of the shelter was not possible anymore due to the presence of the garage on the Southern side of the rock face, we concentrated our efforts on the area of the cellar. It was not completed yet, but digging it out 4 square meters to 3 m deep had greatly depleted the fill of the shelter. As an excavation on a large scale was out of question, the operation we carried out consisted of continuing work to the digging done by Mr Hervouët, pushing it back by about 80 cm and in "refreshing" the northern section (fig. 4). We excavated the whole of the deposit by following the orientation of the layers, digging roughly twenty centimetres thick sub-layers at a time. Each object was located in three dimensions and the sediment was water-sieved in order to recover lithic and bone remains as well as the microfauna. Mr Hervouët also kindly allowed us to study the whole of the lithic and bone remains he found while digging his cellar.

5 The main purposes of our intervention were to specify the chronological and stratigraphical position of the human occupations, to characterise them at a cultural level and to establish their chronostratigraphic and palaeoenvironmental framework by using absolute dating as well as the data provided by the study of the macrofauna and the large quantity of micromammals. An in-depth study of the macrofauna bone remains was not possible because of the small-size of the sample and of the excavation context. Only some taphonomic and palethnographic remarks can be made. Our approach for the lithic study was above all qualitative. The material extracted from the excavation of the western section was separated from the one gathered by Mr Hervouët while digging his cellar because of the latter's imprecise stratigraphy. Then, we attempted correlating the unrecorded remains with the ones from the excavation of the section. As no effective refitting was possible, litho-technological criteria seemed to be the most relevant for the study (see below). The elements we could not discriminate were not taken into consideration in the present work.

Figure 1 - Location of Chauriat in the Auvergne region and according to the IGN map 1/25, 000 (Pont-du-Château district).

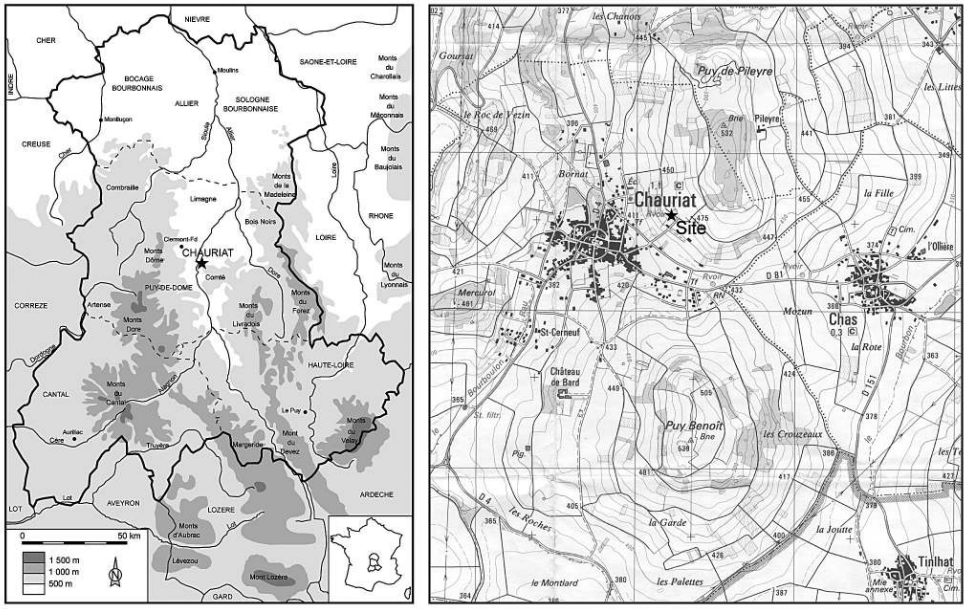


Figure 2 - The shelter and the garage from the South.

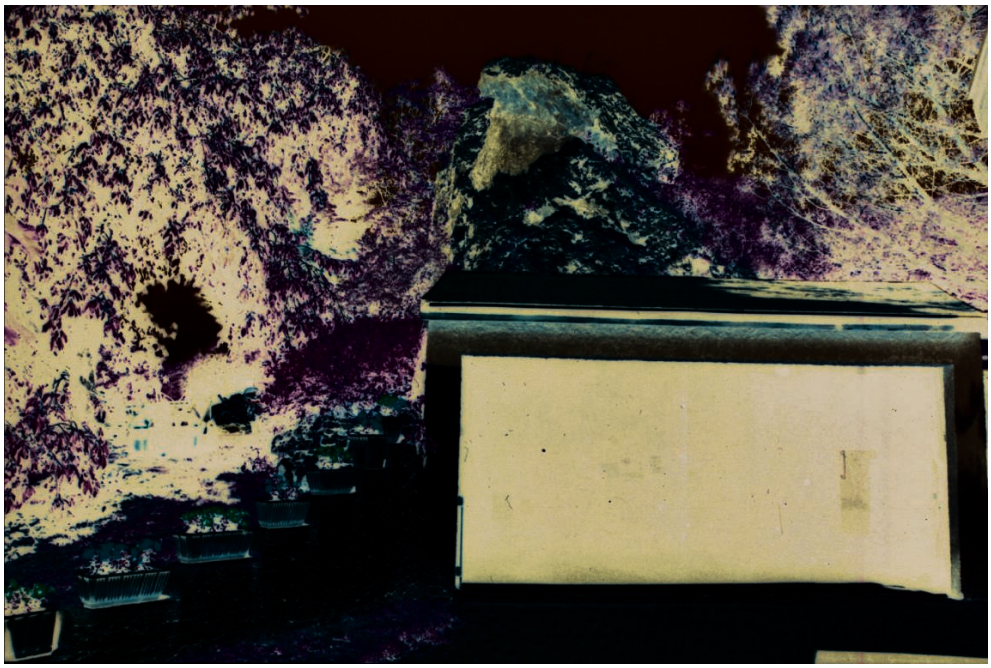


Figure 3 - The excavation area on the location of the future cellar, western side of the shelter.

2 – Stratigraphic framework (Ch.B., J.-F.P.)

2.1 - Description of the sections

6 The drawing shows the western section after the excavation. The northern section was only cleaned. From bottom to top five levels were recognised (fig. 5 and 6):

- **Layer 5** : piling up of limestone blocks, light brown to light grey interstitial sediment, silty-clayey, loose (percolation and gradual filling-up of the interstices). Middle Palaeolithic.
- **Layer 4** : light brown to grey sediment, sandy-silty, with limestone blocks in sub horizontal position, decimetric to centimetric in size with a lot of microfauna. Middle Palaeolithic. This layer only appears partially in the eastern part of the western section. However, it is found at the back of the section, at the level of layer 3b where we were able to excavate it. It is less sandy and less rich in microfauna because we are probably on the edges of the sedimentary group containing the microfauna.
- **Layer 3c** : brown-grey to whitish-when-dry sediment, silty with some gravels and some angular limestone blocks, in sub horizontal to oblique position and decimetric to centimetric in size. Pulverulent structure (ashy when dry). Middle Palaeolithic.
- **Layer 3b** : light brown to light grey sediment, clayey-silty to silty-clayey, containing limestone blocks in varied position (sub horizontal or oblique blocks, two blocks on their edges), decimetric to centimetric in size, with some microfauna. In a plan view, layer 3b appears as a circular depression with slanting walls that eat into layer 4 which makes it invisible on the drawing of the northern section. The layers certainly suffered from post-depositional disturbances in this area (rotation, creep?). Middle Palaeolithic.
- **Layer 3a** : light brown to light grey sediment, clayey-silty to silty-clayey with a lot of gravel and sand, includes limestone blocks mostly in sub horizontal to oblique position, decimetric to centimetric in size. Middle Palaeolithic topped by Chatelperronian.
- **Layer 2 :** dark brown to grey sediment, clayey-silty to silty-clayey, that includes nodules and small angular limestone blocks, centimetric in size, and some rare decimetric blocks.

Organic matter packed level. Layer 2 corresponds to the basis of the calcimagnesic soil accumulated over the limestone scree. Chatelperronian topped by an unspecified Upper Palaeolithic.

- **Layer 1 :** present-day soil, dark brown to dark grey, clayey-silty and calcareous, that contains centimetric and decimetric limestone blocks in heterogeneous position coming mostly from a backfill.

Figure 4 - Location of the excavation.

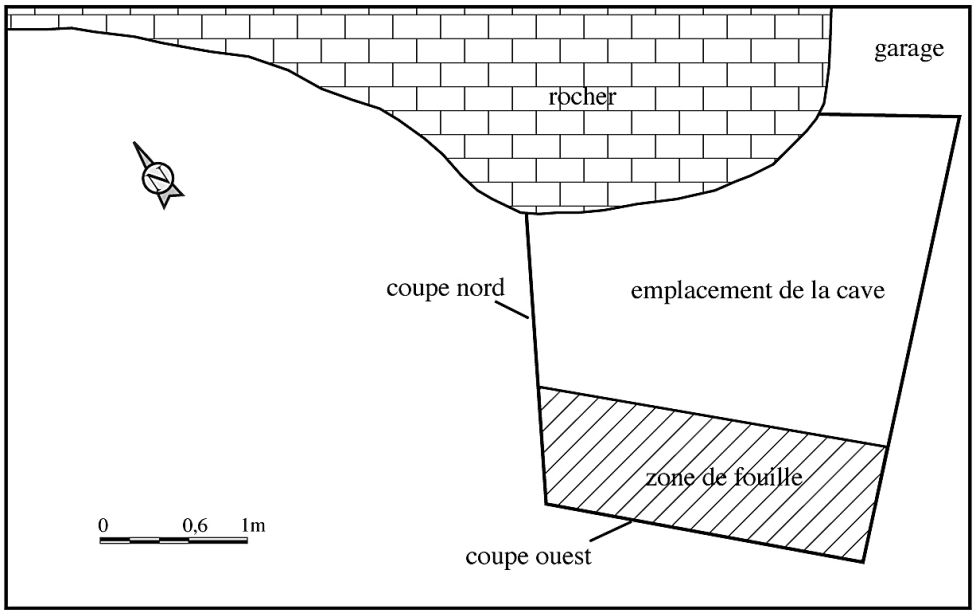
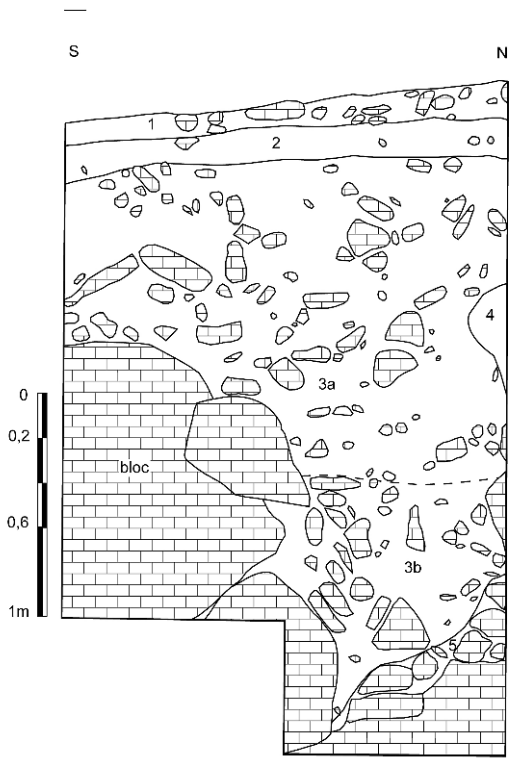


Figure 5 - West side stratigraphy.



2.2 - Stratigraphic position of the archaeological remains

7 An overall inclination of the layers from North to South appears in the filling at the level of the western section (fig. 5). This inclination is very clear at the level of layers 3a and 3b, but less marked at the top of the sequence (layer 1 and 2 and top of layer 3a). As for the northern section, layers 5, 4, 3a and 3c show a strong inclination from West to East toward the inside of the shelter (fig. 6). The progressive filling of the shelter results from inputs from the cliff side for the silty-clayey part as well as from the shelter itself for the limestone blocks (gelifraction). On the other hand, layers 1 and 2 slope toward outside of the shelter, following the present-day slope of the hill side. One of the aims of the project was to locate in stratigraphy the two main phases of occupation identified from the archaeological material gathered by Mr Hervouët while digging his cellar. Projecting the whole of the recorded objects clearly shows their stratigraphic position in the two main archaeological groups separated by a near-sterile level between 100 cm and 140 cm deep (sub-layers 3 and 4 of layer 3) (fig. 7). The collapse of the southern section during the excavation, which took away the thin layer of sediment covering the large limestone bloc visible on the left of the western section, is the reason for the lack of pieces on the left side of the stratigraphy.

8 Middle Palaeolithic remains were found in the lower part of the sequence. The material was spread for a total thickness of 1.80 m from the base of the sequence, without apparent ordering. The upper limit of the level is located at the depth of -140 cm (which is the top of sub-layer 5 in layer 3). Remains are found in layers 5 (sub-layer 13), 4, 3b (sub-layers 8 to 12) and 3a (sub-layers 5 to 7), in an homogeneous manner. The technical characteristics of the material do not show specific differences over the whole of the sequence (see below). The upper levels are spread for about 80 vertical cm from the top of the filling. Remains are found in layers 1, 2 and at the top of layer 3a. The lower limit of the level is quite neat (the base of sub-layer 2 of layer 3 at a depth of -100 cm). However, some pieces were found by sieving between the two levels and there were some rare Upper Palaeolithic lithic objects in the underlying level, up to a depth of -230 cm at the most. These elements comprise some small flakes made of tertiary flint used in the upper group that, in our opinion, migrated between the limestone blocks. The two main groups are well differentiated from a stratigraphic but also a lithological and technotypological point of view. On the other hand, the homogeneity of the upper levels is only apparent. Indeed the lithic studies allowed distinguishing between two phases of occupation within them. The older is attributed to the Chatelperronian and seems mainly located at the top of layer 3 (sub-layer 1 and 2) and at the base of layer 2. The most recent belongs to an unspecified Upper Palaeolithic whose most characteristic elements were found on top of all in layer 2. However, it is more than likely that layers 2 and 3 are mixed to a certain point. The lithic industry from the upper levels was submitted for confirmation to J. Pelegrin; we wish to thank him here.

Figure 6 - North side stratigraphy.

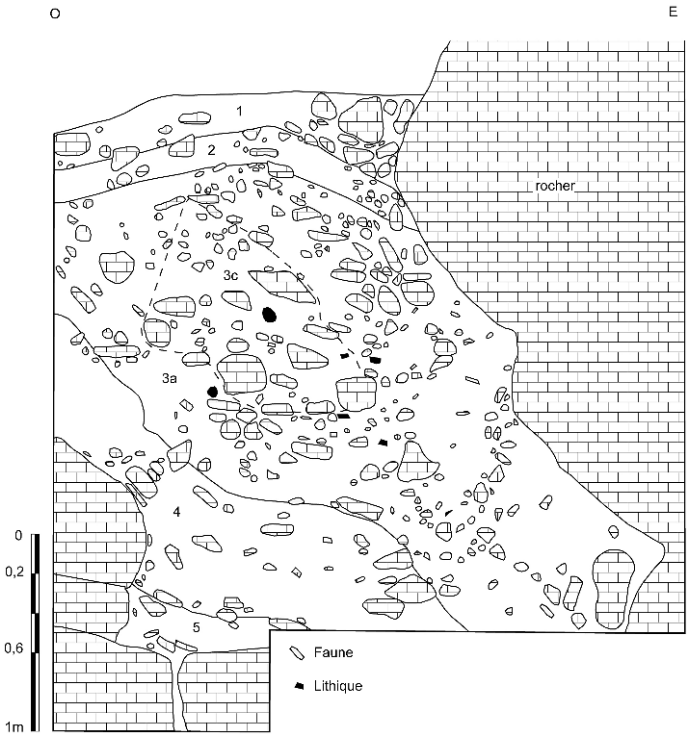
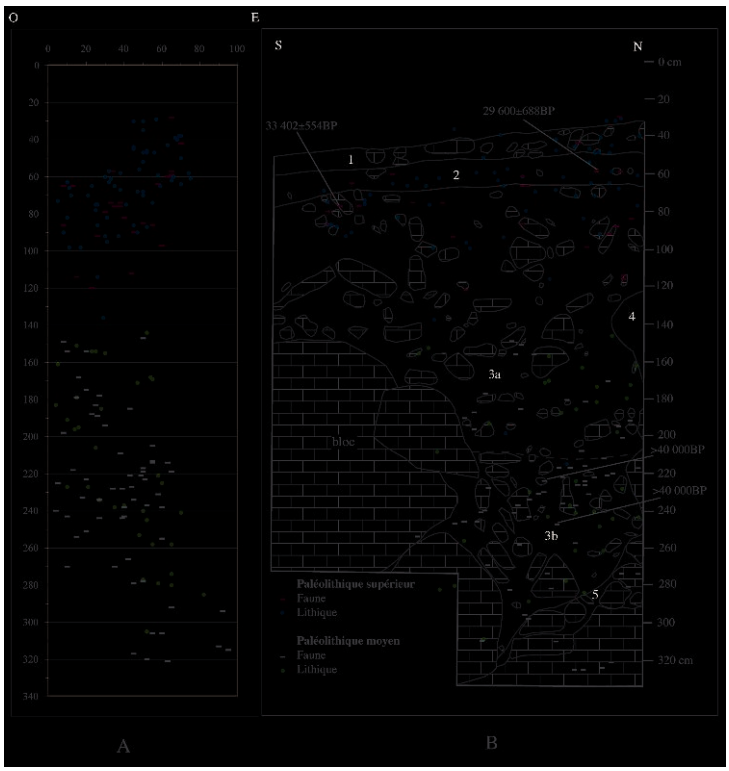


Figure 7 - Horizontal projection of artefacts according to an axis west/east (A) and south/north (B).



3 - Radiometric dating

9 Five samples were selected for AMS dating. They are osseous remains of horses and reindeers from the upper and the lower levels. One of the two samples from the upper group could not be dated (lack of collagen). The Middle Palaeolithic dating was done on a horse and a reindeer bone from layer 3b. The resulting ages are greater than 40,000 BP (Wk 15953 and Wk 15954), over the limit of the method. For the upper group, dates were obtained from a horse bone from layer 3a and from a horse bone from layer 2. They confirm the observations on the lithic objects; the first result was 33 402 ± 554 BP (Wk-17109) and the second 29 600 ± 688 BP (Wk-15952). These dates confirm that this archaeological group belongs to the beginning of the Upper Palaeolithic. If the first date falls within the chronological period of the Chatelperronian, the second one could indicate the very end of the Chatelperronian or the Aurignacian or even an ancient Gravettian.

10 An occupation of the shelter during the Gravettian is possible especially as the lithic industry did not yield any characteristic Aurignacian element, and as the Aurignacian is nearly absent regionally while the ancient Gravettian site of Le Sire in Mirefleurs yielded similar dates to the most recent one in Chauriat (Surmely *et al.* 2003 and 2011).

4 - Chauriat's micromammals, palaeoenvironmental and biochronological implications (V.M.)

11 Studies of quaternary micromammals in the Massif Central suffer from scarce data. The richness of the Chauriat site is an exception and allows developing the beginning of what might become a reference chrono-climatic sequence. Furthermore, as pollens are absent, animal remains and especially rodents and insectivores are until now the only elements to allow reconstruction of the various climates and landscapes around the Chauriat site while it was forming.

4.1 - Material and methods

12 Nearly all the sieving residues were sorted under a binocular microscope. Only one re-sampling had to be done for sub-layer 11 of layer 4 because of the very great density of dental remains.

13 Specific determinations were done mostly on dental remains from the criteria established by J. Chaline (1972), J. Chaline *et al.* (1974) and from J.-D. Vigne (1996) for the post-cranial remains of the large size rodents (*Glis glis*, *Eliomys quercinus* and *Arvicola*). The insectivores of the *Sorex, Crocidura* and *Neomys* genera were determined from their dental remains as well as from the post-cranial remains. For some morphologically close species, only the genus is mentioned. The siciste jaw bone was determined after J. Chaline (1972).

14 The frequency of each taxon is given in table 1 as minimal number of individuals (MNI). The palaeoenvironmental data from two sub-layers are to be taken with caution : layer 3 sub-layer 1 and layer 3 sub-layer 2, as their MNI are 30 and 31.

15 The methods of palaeoenvironmental reconstruction are the same as the ones used by J.-D. Vigne and H. Valladas (1996) and are based on the apparition/disappearance of taxa as well as on the variation of the quantities of the various micromammals.

16 Determination of environmental stages and their relation with the isotopic stages were done by comparison with the work of J.-Cl. Marquet (1993), the only synthesis available with that of J. Chaline (1972) about Pleistocene micromammals in France.

4.2 - Taphonomic study of the assemblage

17 The taphonomic origin of the assemblage was determined from the quantification of the digestion traces visible on the small rodent incisors and on the microtidae molars that react in the same way to gastric juices attacks. The representation criteria of the skeletal parts and of fragmentation are too dependent on post-depositional processes, on the techniques for sampling and for treating the samples (Mistrot 2001).

18 The analysis of digestion traces was carried out on 10,016 dental remains, with variations ranging from 48 (layer 3 sub-layer 1) to 2419 remains (layer 4 sub-layer 10). As the samples from layer 3 sub-layer 1 and layer 3 sub-layer 2 yielded few usable remains, the conclusions on these sub-layers are less sure, but they follow the same pattern as the whole of the site.

19 The digestion rate 0 is always widely in the majority, between 90.48 % and 98.07 %, the digestion rate 1 varies between 0 and 5.17 % of the remains. The rate 2 varies between 0 and 4.24 % and the rates 3 and 4 remain minor with a maximum of 2.05%.

20 According to P. Andrews (1990), the less corrosive gastric attacks (rate 0) can be due to the barn owl (*Tyto alba*), to the snowy owl (*Nyctea scandiaca*) or to the long-eared owl (*Asio otus*) or the short-eared owl (*Asio flammeus*). A predator with slightly more corrosive gastric juices (rate 1) is the tawny owl (*Strix aluco*). High levels of digestion (2 to 4) correspond to diurnal birds of prey or to small carnivores.

21 The two types of owl can be eliminated straight away as they never nest in caves. The short-eared owl nests on the ground on a heap of vegetation, and the long-eared owl reuses old magpie or crow nests found on the edges of forests or in thickets.

22 Some of the species of prey found are strongly connected to snow falls (*Dicrostonyx torquatus, Microtus gregalis*), and that excludes the barn owl as an accumulating agent as this species cannot survive more than a week with a snow cover over 5 cm.

23 Several predators may well be the origin of the micromammal accumulations at Chauriat : the snowy owl and some small carnivores for an insignificant proportion (Andrews' digestion categories 3 and 4).

24 The snowy owl appears to be an ubiquitous hunter on its territory, unconstrained by the presence or absence of lemmings (Andrews 1990 - p. 182 : « *The favoured prey consists of the dominant microtine species in the vicinity* »), with a spectrum of prey that includes insectivores (Gross 1944 ; Chamberlain 1980); this makes the palaeoenvironmental reconstruction of the Chauriat site from micromammals relevant, albeit with an under-representation of forest species (Mebs 1994).

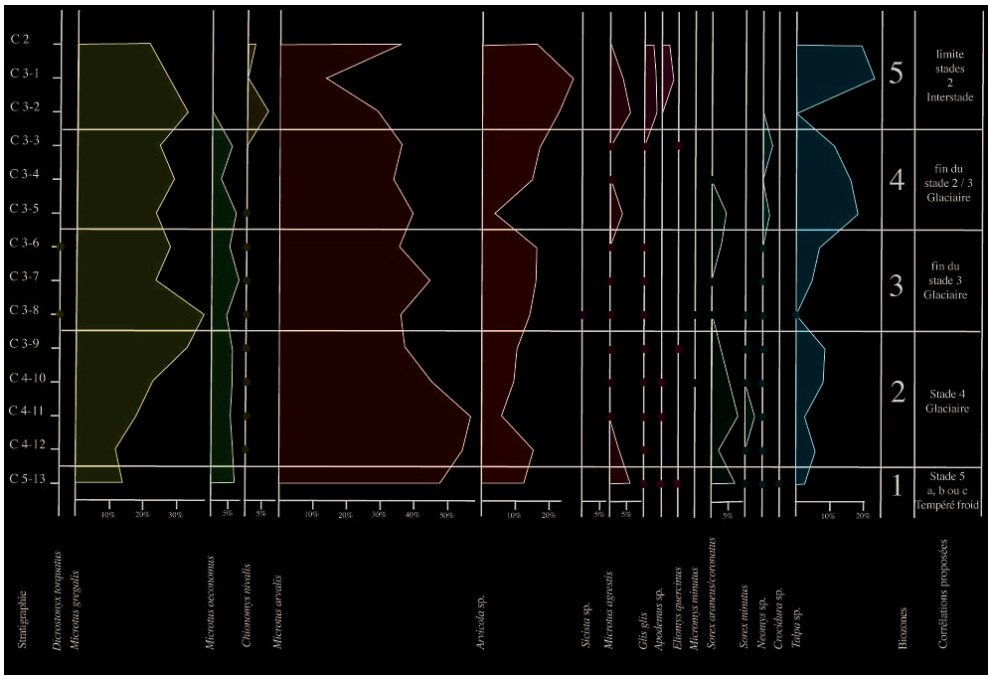
Table 1 - Frequency of taxa (Minimal Number of Individuals)

	Talpa europaea	*Sorex araneus/coronatus*	*Sorex minutus*	*Neomys fodiens*	*Crocidura* sp.	*Eliomys quercinus*	*Glis glis*	*Arvicola* sp.	*Microtus arvalis*	*Microtus agrestis*	*Microtus oeconomus*	*Microtus gregalis*	*Dicrostonyx torquatus*	*Chionomys nivalis*	*Sicista* sp.	*Micromys minutus*	*Apodemus* sp.	**Total**
Total C.2	***8***						***1***	***7***	***15***			***9***		***1***			***1***	***42***
C3 Dec. 1	7						1	8	4	1		8					1	**30**
C3 Dec. 2							1	7	9	2		10		2				**31**
C3 Dec. 3	6					1	1	9	19	1	3	13						**53**
C3 Dec. 4	12	1		2				11	26	1	2	22						**77**
C3 Dec. 5	10	2						2	22	2	4	13		1				**56**
C3 Dec. 6	10	3		3			2	22	49	2	7	38	1	1				**138**
C3 Dec. 7	8	1		1			1	26	73	1	13	38		2				**164**
C3 Dec. 8	1	3	3	2			1	30	77	3	10	81	1	1	1	1		**215**
C3 Dec. 9	31	9	2	1		1	3	37	133	4	21	115		1				**358**
Total C.3	***85***	***19***	***5***	***9***	***0***	***2***	***10***	***152***	***412***	***17***	***60***	***338***	***2***	***8***	***1***	***1***	***1***	***1122***
C4 Dec. 10	55	34	5	6			2	66	315	10	41	154		4		1	3	**696**
C4 Dec. 11	16	44	16	5				31	334	7	33	104		1			2	**593**
C4 Dec. 12	11	4	1	1			1	29	104	5	12	22		2				**192**
Total C.4	***82***	***82***	***22***	***12***	***0***	***0***	***3***	***126***	***753***	***22***	***86***	***280***	***0***	***7***		***1***	***5***	***1481***
C5 Dec. 13	17	41	5	6	1	2	4	74	280	34	40	81					5	**590**
Total C.5	***17***	***41***	***5***	***6***	***1***	***2***	***4***	***74***	***280***	***34***	***40***	***81***	***0***	***0***		***0***	***5***	***590***
Total général	***192***	***142***	***32***	***27***	***1***	***4***	***18***	***359***	***1460***	***73***	***186***	***708***	***2***	***16***	***1***	***2***	***12***	***3235***

4.3 - Biostratigraphy and palaeoenvironmental implications

25 Biostratigraphy allows us to define a succession of biozones (areas of ground with characteristic associations) formed during successive stages. The taxa associations that characterise each biozone, and thus each stage, allow us to address environmental questions. Five main stages can be defined in Chauriat (fig. 8).

Figure 8 - Fauna diagram of the site of Chauriat.



“Chauriat 1” Stage

26 It is equivalent to layer 5 sub-layer 13. It is characterised by much taxonomic diversity (13 species) that represent a large variety of biotopes (Valverde 1964). *Microtus arvalis* is dominant ; *M. gregalis* is rather poorly represented; *Chionomys nivalis* comprises less than 2% of the assemblage and all the insectivore species are found, especially *Crocidura sp.,* only present in this layer. The climate is still temperate but rather cold.The landscape is open, with limited wooded areas. The environment is somewhat humid. This type of association is found during Isotopic Stage 5 (Marquet 1993), during a rather temperate phase.

“Chauriat 2” Stage

27 It is equivalent to layer 4 (sub-layers 10 to 12) and to the sub-layer 9 of layer 3. *Microtus arvalis* is still dominant in the faunal spectrum. *M. gregalis* expand rapidly during this stage. *Crocidura sp.* disappears. Forest species (*Microtus agrestis, Apodemus sp.* and *Glis glis*) are on the decline or do not appear any more. Insectivores decrease following a fall in temperatures. This stage is clearly a cooling stage with a diminution of wooded areas. Humidity remains at the same level as in stage 1. It seems to tally with Isotopic Stage 4.

“Chauriat 3” Stage

28 It is composed of sub-layers 6 to 8 (layer 3). Its special characteristic is competition negative relation between the *Microtus arvalis* and *M. gregalis* that make up nearly 70% of the faunal spectrum. *Dicrostonyx torquatus* is only present in this stage. Out of the forest species, only *Microtus agrestis*is still found but in small quantity. As this species lives in scattered woodland, just as *Sicista sp.*, wooded areas must have been nearly

absent around the site. The presence of *Glis glis* is not contradictory, as this species appreciates deciduous woodland and also bush land (Saint-Girons 1973). Stage 3 is a pleniglacial stage, rather dry, found at the end of Isotopic Stage 3, during a migration of *Sicista sp.* and *Dicrostonyx torquatus* (Marquet 1993).

"Chauriat 4" Stage

29 It is includes sub-layers 3, 4 and 5 of layer 3. *Chionomys nivalis* disappears while *Microtus agrestis, Sorex araneus/coronatus* and *Neomys sp.* become common again. This stage is the continuation of the previous one but with slightly more trees (*M. agrestis*) and clearly more humidity. The disappearance of *Dicrostonyx torquatus* and a strong increase of *Talpa sp.* could indicate a slight warming and a reduction in frozen soils. This biozone is found at the end of Isotopic Stage 3 and probably tallies with a warmer and more wooded interstadial.

"Chauriat 5" Stage

30 This stage fits with the upper part of the sequence, layer 2 and the sub-layers 1 and 2 of layer 3. We can see woodland spreading again with the reappearance of *Apodemus sp.* and an increase of *Glis glis*. *Microtus agrestis* increases slightly. The soils are warming up and *M. gregalis* starts declining, which favours the burrowing species *Arvicola sp.* and *Talpa.* The environment becomes dryer (disappearance of *Microtus oeconomus, of the Sorex and the Neomys*) which favours the reappearance of *Chionomys nivalis.* This biozone seems to be an interstadial stage contemporary of the limit between Isotopic Stages 3 and 2.

31 The filling up of the Chauriat site can thus be placed in the first part of the last glacial cycle, between the end of Isotopic Stage 5 and the beginning of Isotopic Stage 2. Starting with a temperate cold and humid climate, there is a progressive cooling of the climate, then in a third stage a nearly complete disappearance of woodlands. In a fourth stage, the climate is progressively drying before a very dry stage in which woodland spreads again.

5 – Study of the macrofauna (S. C.)

32 The macrofauna studies here come from the cleaning of the section along with bones collected by the owner during construction work. All of the recorded osseous material was subjected to archaeozoological and taphonomical studies. As for the remains found out of stratigraphy or during sieving, only those recognisable at least by their genus have been included in the database. Some fragments with specific traces that could help understanding the formation of the bone assemblage were also isolated and taken into account in the study.

5.1 - General presentation of the bone material

Table 2 – Number of remains studied in the various levels.

	Ensemble supérieur	Ensemble inférieur	Total
Couche 1	1		1
Couche 2	21		21
Couche 3	47	109	156
Couche 4		26	26
Couche 5		30	30
Total	**69**	**165**	**234**

33 Out of the remains found in the excavation, only 234 were subjected to taphonomical observation out of which 164 were determined for their taxa (tabl. 2). Hundreds of unidentifiable fragments present in the sieving show the osseous material was extremely fragmented.

5.2 – Species found

Table 3 - Identified taxa in the various levels (Number of Remains).

	Ensemble Supérieur		Ensemble inférieur		
	Couche 2	Couche 3	Couche 3	Couche 4	Couche 5
Ursus sp.				1	1
Canis lupus				1	
Vulpes vulpes	1	7	15	3	2
Carnivores indéterminés		1	1		1
Sus scrofa			2	1	
Bovinae		4	9	2	6
Rangifer tarandus	7	10	9		
Cervus elaphus	2				
Megaceros giganteus		1			
Cervidés indéterminés	1	1	2		1
Equus caballus	1	11	36	5	11
Coelodonta antiquitatis			1		1
Total	**12**	**35**	**75**	**13**	**23**

Table 4 - Identified taxa among the out-of-stratigraphy remains (Number of Remains).

Taxons	Nombre de restes
Ursus sp.	3
Canis lupus	5
Vulpes vulpes	9
Sus scrofa	1
Bovinae	28
Capra ibex	3
Rangifer tarandus	24
Cervus elaphus	6
Megaceros giganteus	1
Capreolus capreolus	1
Equus caballus	50
Lepus sp.	2
Total	**133**

34 In layer 5, Horses and Bovinae are dominant; Reindeer are absent just as in layer 4 which is also dominated by horses (tabl. 3). In layer 3 - Middle Palaeolithic - Reindeer are found in significant quantities together with Horses which are still dominant. Two remains of Wild Boars and a Rhinoceros tooth were also found. The dominance of Horses continues in layer 3 - upper group - in which Reindeers are still abundant. A Megaloceros dropped antler was also identified. In layer 2, on the other hand, Horses are only represented by one specimen and Reindeer dominate, while Red Deer appear.

35 Carnivores are present at the base of the sequence, especially in layers 4 and 5, which yielded Bear, Wolf and Fox remains.

36 The out-of-stratigraphy objects (collected by the owner) do not modify significantly the identified faunal spectrum (tabl. 4). Horses remain the dominant species, followed by large Bovidae and Reindeer. A fragment of Megaloceros mandible was identified as well as a tooth from a Wild Boar. Red Deer is also found as are the three large carnivores identified in the newly excavated material. Three new taxa are included here, however: Ibex, Roe Deer and Hare.

5.3 - Palaeontological observations

37 Because of the small sample and the intense fragmentation of the bone remains, conclusions from the palaeontological data must be limited.

Horses (*Equus caballus* cf. *germanicus*)

Table 5 - Skeleton elements of horse as number of remains.

	Ensemble supérieur		Ensemble inférieur		
	Couche 2	Couche 3	Couche 3	Couche 4	Couche 5
Crâne		1	1		
Dents	1	1	5		1
Côte			3	1	
Scapula		1	3		
Humérus		1	1		3
Radius		1			
Ulna			1		
Métacarpien		2	6		1
Pelvis			1		1
Fémur			8	1	1
Tibia			6	2	
Petit cunéiforme		1			
Métatarsien		1			
Métapode		1			
Métapode vestigiel		1			
Os long			1		

Table 6 - Equus caballus - First superior molar, dimensions in mm (DMDo: mesiodistal occlucal diameter, DVLo: vestibulo-lingual occlusal diameter, DMDp: mesiodistal diameter in point p, DVLp: vestibulo-lingual diameter in point p).

	Chauriat c. 5	Combe-Grenal c. 35 à 1 *E. cab. germanicus* Guadelli 1987	Mirefleurs Sondage 14 c. 6 *E. cab. germanicus* Beauval 2003	Mirefleurs Sondage 16 c. 6 *E. cab. germanicus* Beauval 2003	Camiac Würm anc/réc. *E. cab. gallicus* Guadelli 1987	Jaurens Würm réc. inf. *E. cab. gallicus* Mouré-Chauviré 1980	Solutré Würm réc. inf. *E. cab. gallicus* Guadelli 1987
DMDo	1 24,7	41 23,0 - 29,0 26,33 ± 0,48	24 24,5 - 33,5 28,23	4 26,7 - 28,0 27,2	14 24,0 - 27,0 25,41 ± 0,51	21 23,0 - 27,3 25,32	6 24,5 - 28,0 26,37 ± 1,66
DVLo	1 26,6	36 24,5 - 29,5 27,17 ± 0,44	15 23,3 - 29,4 26,21	3 25,1 - 27,0 26,3	14 25,0 - 28,2 26,75 ± 0,48		6 25,7 - 27,2 26,72 ± 0,59
DMDroto.o	1 12,2	41 11,0 - 16,0 13,55 ± 0,39	21 12,5 - 16,6 14,72	3 12,3 - 14,4 13,57	14 12,0 - 15,3 13,3857 ± 0,56		6 13,0 - 15,5 13,80 ± 0,97
DMDp	1 24,6	27 25,0 - 28,0 25,78 ± 0,54	25 24,8 - 28,2 26,16	4 25,2 - 26,9 26,1	11 23,2 - 26,4 24,84 ± 0,74	17 24,2 - 26,9 25,19	31 23,5 - 26,2 24,86 ± 0,29
DVLp	1 27	27 25,0 - 30,0 27,39 ± 0,47	15 25,1 - 29,1 26,74	3 26,1 - 27,6 26,97	10 25,0 - 28,3 26,79 ± ,69	17 24,0 - 28,1 26,09	

Table 7 - Equus caballus - Second superior molar, dimensions in mm (DMDo: mesiodistal occlucal diameter, DVLo: vestibulo-lingual occlusal diameter, DMDpostflex: mesiodistal diameter &).

	Chauriat HS	Combe-Grenal c. 35 à 1 *E. cab. Germanicus* Guadelli 1987	Mirefleurs Sondage 14 c. 6 *E. cab. germanicus* Beauval 2003	Mirefleurs Sondage 16 c. 6 *E. cab. germanicus* Beauval 2003	Camiac Würm anc/réc. *E. cab. gallicus* Guadelli 1987	Jaurens Würm réc. inf. *E. cab. gallicus* Mouré-Chauviré 1980	Solutré Würm réc. inf. *E. cab. gallicus* Guadelli 1987
DMDo	1 27,6	55 25,0 - 33,0 28,45 ± 0,47	40 25,1 - 33,2 28,45	9 26,3 - 35,1 29,42	8 25,0 - 27,3 26,26 ± 0,59	29 22,7 - 28,2 26,07	13 24,8 - 29,5 27,17 ± 0,96
DVLo	1 14,5	56 13,0 - 18,0 15,34 ± 0,27	34 11,3 - 16,8 14,52	10 13,7 - 20,1 15,26	8 14,,0 - 16,8 15,30 ± 0,94		12 12,7 - 15,8 14,16 ± 0,54
DMDpostflex.	1 11,4	54 8,0 - 13,5 11,04 ± 0,36	40 8,6 - 15,0 11,95	11 7,6 - 15,7 11,86	8 7,0 - 9,5 8,87 ± 075		14 8,7 - 14,0 12,11 ± 0,85

38 Only two dental remains (one of them out of stratigraphy), a small cuneiform and a complete metatarsal allowed measurements (tabl. 5). The other remains are for most diaphysis fragments of long bones or complete long bones of foetuses.

39 The two jugal teeth show the morphologic characteristics of caballin horses and are within the variation range of *Equus caballus germanicus* and of *E. caballus gallicus* (tabl. 6 and 7). The complete third metatarsal found in Chauriat is quite large in size. Its total length, although fitting within the variation range of *E. caballus gallicus*, is largely over the average metatarsal lengths of the horses from Camiac and Solutré (tabl. 8 and 9). The horse from Chauriat could well belong to the *germanicus* subspecies.

Bovinae

40 Only a few dental remains permit measurements (tabl. 10). In Chauriat, the Bovine bones found are only diaphysis fragments that do not allow distinguishing between the Bos and Bison genera (tabl. 11). According to R. Slott-Moller (1990), in Bison (*Bison priscus*), the upper molars entostyle is short and usually pinched between the lobes around the neck while in Aurochs (*Bos primigenius*), it is longer and often larger. The out-of-stratigraphy upper M1/2 n°976 show a Bison type morphology. However, it would be rash to attribute the Bovidae remains from Chauriat to the Bison genus on the basis of only this piece.

Ibexes (*Capra ibex*)

41 Three ibex remains were found out of stratigraphy. They are one phalanx and two dental remains.

Reindeer (*Rangifer tarandus*)

42 The Reindeer is essentially represented by dental remains and diaphysis fragments of long bones (tabl. 12, 13 and 14). All the antler fragments (NR = 11) were collected out of stratigraphy. They belong, by looking at the circumference of their pedicle (Bonnissent 1993) to at least five individuals : two stags, one young stag and two adult females or two young males. All, except one male dropped antler, are from slaughtered animals.

Table 8 - Equus caballus - Metatarsian III, dimensions in mm (LT: total length, Lext: external length, DTparti: articular proximal transverse diameter, DAPpmax: maximal proximal antero-posterior diameter, DTmildia: transverse diameter in the middle of the diaphyse, DAPmildia: antero-posterior diameter in the middle of the diaphyse, DTdsus: distal sus-articular transverse diameter, DTdarti: articular distal transverse diameter, DAPmaxint: maximal antero-posterior diameter of the internal condyle, DAPminant: minimal antero-posterior diameter of the condyle interns).

	Chauriat C. 3 déc. 1	Pair-non-Pair *E. cab. germanicus* Prat 1968	Mirefleurs Sondage 14 c. 6 *E. cab. germanicus* Beauval 2003	Camiac *E. cab. gallicus* Guadelli 1987	Solutré Auri./Péri. *E. cab. gallicus* Guadelli 1987
LT	1 273,7	25 260,0 - 276,5 268 ± 2,42		8 258,9 - 278,2 264,90 ± 5,17	17 255,0 - 279,0 234,21 ± 3,41
Lext	1 271			6 256 ; 257 ; 270,9	6 253,0 - 273,0 262,75 ± 0,80
DTparti	1 52,4		12 49,4 - 60,1 54,51	8 50,0 - 57,3 53,26 ± 2,29	24 49,0 - 58,5 52,82 ± 0,91
DAPpmax	1 49,4		10 40,6 - 45,6 43,15		8 40,6 - 47,0 44,25 ± 1,79
DTmildia	1 35	25 32,0 - 40,0 36,5	5 34,8-40 36,32	6 34,6 - 39,0 37,22 ± 1,80	17 34,3 - 39,5 36,42 ± 0,77
DAPmildia	1 33,3		3 34,3-37,9 35,87	7 32,2 - 36,2 33,90 ± 1,31	6 32,0 - 35,0 33,48 ± 1,23
DTdsus	1 50,5	25 46,5 - 56,0 52,5	13 49,5-56,1 52,08	7 50,5 - 54,5 52,40 ± 1,37	16 50,0 - 55,5 51,91 ± 0,80
DTdarti	1 51,6	25 48,0 - 56,5 53,7	12 49,2-55,1 52,29	53,6 ; 53,9 ; 49,6 52,0 ; 54,9	16 49,5 - 55,0 53,41 ± 0,63
DAPmaxint	1 33,1		14 31,7-36,6 33,13	31,3 ; 32,3 ; 34,9	32,5 ; 32,5 ; 33,0 33,0 ; 33,2
DAPminint	1 28,8		14 27,8-32,7 29,92		6 29,7 - 30,8 30,05 ± 0,41

Tableau 9 - Equus caballus - Small cuneiform, dimensions in mm (L: length, DT: transverse diameter).

	Chauriat c. 3 déc. 1	Mirefleurs Sondage 14 c. 6 *E. cab. germanicus* Beauval 2003	Mont Dol Eémien *E. cab. Germanicus* Simonet 1991	Camiac Würm anc/réc. *E. cab. Germanicus* Guadelli 1987	Solutré Würm réc. inf. *E. cab. gallicus* Guadelli 1987	Solutré Würm réc. sup. *E. cab. arcelini* Guadelli 1987
L	1 38,7	1 >35	5 39,6-41,8 40,62	1 37,5	3 34-37,4 35,87 1,72	2 31,4 - 35,6
DT	1 17,7	1 16	5 18,2-21,3 19,94	2 12,4-12,4	3 17-20 19 1,73	2 16 - 17,3

Tableau 10 - Bovinae - dental remains, dimensions in mm (UP. superior premolar, UM: superior molar, LM: lower molar, DMDocc: mesiodistal occlusal diameter, DVLocc: vestibulo-lingual occlusal diameter, DMDp: mesiodistal diameter in point p, DVLp: vestibulo-lingual diameter in point p)

N°	Dent	DMDocc	DVLocc	DMDp	DVLp	Hméta
07HS	UP3	19,6	19,6			19,6
914HS	UM1	2,3			26,4	22,8
133 c.3 dec.7	UM1/2	29,8	25,9	29,7	27,5	18,2
1345HS	UM3	34,1	25,6	34,1	27,1	27,1
c.3 dec.13	LM1	28,1	13,8	25,2	16,8	37,5
108 c.3 dec.6	LM1/2	35,9	12,8	26,7	16,8	50,7

Tableau 11 - Skeleton elements of bovinae as number of remains.

	Ensemble supérieur		Ensemble inférieur		
	Couche 2	Couche 3	Couche 3	Couche 4	Couche 5
Dents		4	6	1	2
Humérus			1		
Métatarsien					1
Radius			1		1
Tibia			1	1	2

Tableau 12 - Skeleton elements of reindeer as number of remains.

	Ensemble supérieur		Ensemble inférieur
	Couche 2	Couche 3	Couche 3
Crâne		1	
Dent	5	3	3
Vertèbre		1	
Scapula			1
Humérus	1		
Ulna			1
Unciforme		1	
Métacarpien		1	
Fémur			2
Patella			1
Petit cunéiforme		1	
Métatarsien	1	1	
Métapode vestigiel			1
Phalange 2		1	

Tableau 13 - Rangifer Tarandus - Dental remains, dimensions in mm (UP. superior premolar, UM: superior molar, LM: lower molar, DMDmax: maximal mesiodistal diameter, DVLmax: maximal vestibulo-lingual diameter, DMDcol: mesiodistal diameter at the collar, DVLcol: vestibulo-lingual diameter at the collar, H: height).

N°	Dent	DMDmax	DVLmax	DMDcol	DVLcol	H
c.3 dec.3	UP3	14,3	13,8	12,9	14,5	10,2
1369HS	UP3	14,1	15,6	13	15,1	10,6
1365HS	UM3	20,6	18,3			14,2
918HS	LM1	17,2	11	16,3	10,3	7,2
913HS	LM2	21	11,4	18,8	11,6	11,3
913HS	LM3	25	11,3			13,7

Red Deer (*Cervus elaphus*)

43 Two dental fragments were found in layer 2 and six other remains were identified out of stratigraphy. The only measurable specimen, a large cuboid-navicular

(Anteroposterior Diameter = 48,1; Transversal Diameter = 50,1) can be attributed to *Cervus elaphus* , not to *Cervus simplicidens* (Guadelli 1987).

Roe Deer (*Capreolus capreolus*)

44 Only one specimen from excavation spoil might belong to this species; it is a distal extremity of a tibia (Anteroposterior Diameter = 21,6 ; Transversal Diameter = 28,6).

Megaloceros (*Megaceros giganteus*)

45 Two remains can potentially be attributed to Megaloceros. The first one is a dropped antler found in layer 3 (sub-layer 3) characterised by a pedicle that is relatively more narrow crosswise (83 X >100) than the Megaloceros antlers from Bruguières (108 X 109) and Isturitz (103 X 104) (Bouchud 1965). This piece is problematic for its specific determination, but jawbone mandible fragment found out of stratigraphy can be attributed without doubt to this species thanks to the dimensions of its teeth (tabl. 15).

Wild Boars (*Sus scrofa*)

46 There are four remains for this species : three dental fragments, one of which out of stratigraphy and a second phalanx.

Rhinoceros (*Coelodonta antiquitatis*)

47 In layer 3, a lower molar from a rhinoceros was identified. Because of severe wear, the hypsodont level is difficult to quantify. The rough enamel and the morphology of the V-shaped striations appear characteristic of the species *Coelodonta antiquitatis* (Guérin 1980).

Wolves (*Canis lupus*)

48 Six wolf remains were identified: one in the material from the excavation (*capitatum*), the five others out of stratigraphy.

Foxes (*Vulpes vulpes*)

Tableau 14 - Rangifer Tarandus - Scaphoid, dimensions in mm (DAP: antero-posterior diameter, DT: transverse diameter, H: height).

N°	DAP	DT	H
50 c.3 dec.1	21	18,1	16,8

Tableau 15 - Megaceros giganteus- Lower molars, dimensions in mm (DMDmax: maximal mesiodistal diameter, DVLmax: maximal vestibulo-lingual diameter, DMDcol: mesiodistal diameter et the collar, DVLcol: vestibulo- lingual diameter at the collar).

	Première molaire inférieure			Deuxième molaire inférieure		
	Chauriat HS	Isturitz Moustérien Bouchud 1965	Achenheim Wernert 1958	Chauriat HS	Isturitz Moustérien Bouchud 1965	Achenheim Wernert 1958
DMDmax	31,6			34,1		
DVLmax	19,8			25,2		
DMDcol	28,1	28,8	26	30,9	32,7	30,4
DVLcol		19	19,9		21	21,8

Tableau 16 - Skeleton elements of Fox as number of remains.

	Ensemble supérieur		Ensemble inférieur			
	Couche 2	Couche 3	Couche 3	Couche 4	Couche 5	Hors stratigraphie
Crâne			1	1		
Maxillaire						1
Dent	1	3	4		2	1
Vertèbre			2			2
Sternèbre		1				
Humérus		1				
Radius			1			
Ulna				1		2
Carpien			1			
Métacarpien						1
Pelvis		1				
Fémur		1	2			1
Tibia						1
Tarsien			2			
Métapode			1			9
Phalange 3			1			

49 Fox is found throughout the sequence with 37 remains, 9 of which are out of stratigraphy (tabl. 16).

50 Some dental remains allow taking measurements (tabl. 17). The upper canine is too worn to allow distinguishing between *Vulpes and Alopex*. On the other hand, the lower canine could have belonged to a red fox (*Vulpes vulpes*) because of the height of its crown on the external side (16 mm) (Poplin 1976). The length of the external wall of the upper carnassial (14.4 mm) fits with the lengths encountered on the large size carnassials of Red Foxes. According to Poplin (1976), the most useful isolated tooth for discriminating the two genera is the second lower molar. In *Alopex* the two mesial tuberosities are next to each other and the labial is the largest, while in *Vulpes*, the lingual, which is shifted distally, is the bigger. In Chauriat, the two lower M2 are characteristic, by their morphology, of *Vulpes vulpes*. The dimensions of these two specimens fall within the variation range of the Red Fox (fig. 9), which strengthens this specific attribution.

Bear (*Ursus sp.*)

51 The three remains attributable with certainty to an ursidae were found out of stratigraphy (tabl. 4). Two decidual canines found in layers 4 and 5 could also be from a bear.

Tableau 17 - Vulpes vulpes- Dental remains, dimensions in mm (UP: superior premolar, UM: superior molar, LM: lower molar, DMD: mesiodistal diameter, DVL: vestibulo-lingual diameter).

N°	Dent	DMD	DVL	L muraille ext.
1341HS	UP4	15,6	6,5	14,4
c.2 Ouest	LM2	8	5,5	
c.3 dec.7	LM2	7,7	5,9	

Figure 9 - Vulpes vulpes- Scatter diagram according to the vestibulo-lingual diameter (DVL) and the mesio-distal diameter (DMD) of the second lower molar (modified according to Poplin in 1976).

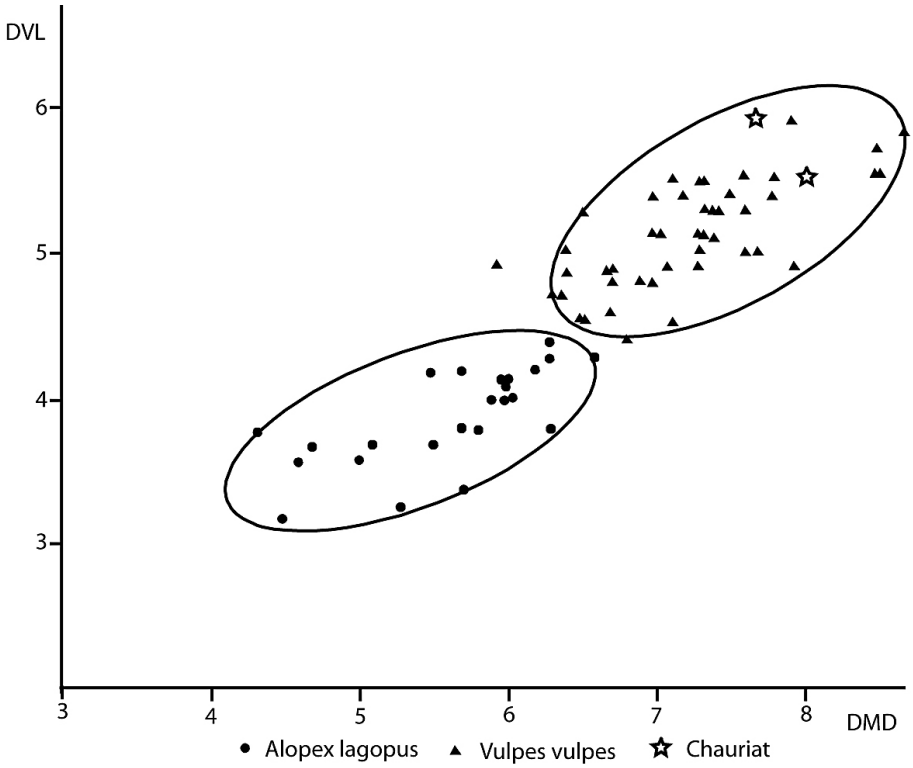


Tableau 18 - List of foetus bones.

	Couche 3 - Ensemble inf.	Couche 4	Couche 5	Hors stratigraphie
Côte	-	1	-	-
Scapula	2	-	-	-
Humérus	2	-	3	2
Radius	-	-	-	2
Ulna	1	-	-	-
Métacarpien	7	-	1	-
Pelvis	1	-	1	-
Fémur	8	1	1	3
Tibia	1	1	-	1

Tableau 19 - Taxa wearing carnivores marks.

Taxon	Nombre de restes
Bovinae	1
Caprinae	1
Cervus elaphus	1
Rangifer tarandus	1
Equus caballus	4
Ongulé de taille moyenne	4
Lepus sp.	1

5.4 - Taphonomical and archaeozoological observations

52 Although some pieces are characterised by a fresh aspect, for the most part the bone remains show rather badly preserved surfaces. Numerous elements bear traces of desquamation often in association with more or less intense blunting traces especially in layer 3. Root traces, generally rare, take over the whole of the bone surface on some pieces making them impossible to observe. The bone surfaces are badly preserved but on the other hand the conservation of the bones themselves seems excellent as many foetus bones of horses were identified (tabl. 18).

53 Carnivore traces were only noted on bones found out of stratigraphy (NR=14) or coming from layer 5 (NR=3). Besides ungulate bones, a coxal bone from a hare shows teeth marks (tabl. 19).

54 The anthropic traces, rare in all the studied levels, consist of butchering cutmarks and percussion traces mostly found on large size ungulates (tabl. 20). Four burnt pieces (including the sieved material) were found in the Upper Palaeolithic levels. In the Middle Palaeolithic levels, three specimens show localised brown stains that could have resulted from light combustion.

Tableau 20 - Inventory of remains wearing streaks or percussion marks.

Unité stratigraphique	Elément squelettique	Traces anthropiques
Couche 3 Ensemble supérieur	Fgt de diaphyse d'os long d'ongulé de grande taille	Stries
	Fgt de diaphyse d'humérus de Renne	Encoche de percussion
	Fgt de diaphyse d'os long d'ongulé de grande taille	Encoche de percussion
Couche 3 Ensemble inférieur	Fgt de diaphyse d'os long d'ongulé de grande taille	Stries
	Fgt de diaphyse d'os long d'ongulé de taille moyenne	Stries
	Fgt de diaphyse de fémur de Renne	Stries + encoche de percussion
	Fgt de diaphyse d'humérus de Boviné	Encoche de percussion
Couche 4	Fgt de côte de Cheval	Stries
	Fgt de diaphyse d'os long d'ongulé de grande taille	Stries
	Fgt de diaphyse de métacarpien de cheval	Encoche de percussion
Couche 5	Fgt de diaphyse d'os long d'ongulé de grande taille	Stries
Hors stratigraphie	Fgt de diaphyse de tibia de Cheval	Stries
	Fgt de côte de Cheval	Stries
	Fgt de diaphyse de métatarsien de Boviné	Stries
	Fgt de diaphyse d'os long d'ongulé de grande taille	Stries
	Fgt de diaphyse d'os long d'ongulé de grande taille	Stries + encoche de percussion
	2 fgts de diaphyse d'humérus de Cheval	Encoche de percussion
	Fgt de diaphyse de fémur d'ongulé de grande taille	Encoche de percussion
	Fgt de diaphyse d'os long d'ongulé de grande taille	Encoche de percussion

5.5 - Palaeoenvironmental reconstitutions and biostratigraphic attributions of the lower group

55 In layers 4 and 5, the presence of Bovinae, probably Bison, and of Horses seem to indicate large steppic areas around the site (Delpech 1983). Reindeer in layer 3 could indicate the setting up of colder climatic conditions compared with the ones of the underlying layers.

56 The usable data for a chronological attribution of the deposits are very limited. Isotopic Stage 4, in which Reindeer often dominate, is characterised by a colder climate than Isotopic Stage 5. Layers 4 and 5 are closer to the associations of Stage 5 due to their steppic appearance. However, the presence of the Woolly Rhinoceros suggests a relatively cold episode within an otherwise temperate stage, which could correspond to the isotopic sub stages 5d or 5b. Layer 3 - Middle Palaeolithic- appears colder than the underlying deposits and could have been formed during Isotopic Stage 4. The horse remains have been attributed to *E. caballus* cf. *germanicus* on the basis of a relatively large third metatarsal. As a representative of the leading lineage, the presence of this species in layer 3 would support an attribution of the deposits to Isotopic Stage 4. But on the basis of just one bone, hypotheses remain open especially as, on the one hand, the length of the metatarsal falls within the variation range of d'*Equus caballus gallicus* and, on the other hand, this specimen was collected in the sub-layer 1 of layer 3, that is to say in the Chatelperronian layer (Isotopic Stage 3).

5.6 - Taphonomic and palaeoethnological remarks

57 The scarcity of carnivore traces on the bones and the small number of carnivore remains found seem to exclude the hypothesis that the bone assemblage could have been accumulated by non-human predators. Although the anthropic traces are equally scarce on the studied material, the extreme fragmentation of the bones makes us consider an anthropic origin for the fauna. Indeed, most of the diaphysis fragments

show breakages on fresh bone sometimes in association with impact points related to the extraction of the marrow. Besides, the presence of whole foetal bones indicates that postdepositional phenomena played a minimal role in the fragmentation of the bone assemblage. Indeed, if part of the fragmentation of the adult long bones resulted from this process, the very fragile foetus bones should have been affected. The question of the source of the fox is not solved.

58 According to various ethological sources on horses (e.g., Berger 1986 ; Tyler 1972), the females would be on heat from May to July. The foetal bones in the Middle Palaeolithic levels are very small in size; for example, the femurs are between 16.9 and 42.9 mm in length. For horses, gestation lasts eleven months, so these foetuses were probably at between two and four months when the mares were hunted. The gravid females could have been killed by the *Neanderthals* during the summer and the beginning of the autumn (July to November). The antlers from reindeer kills found out of stratigraphy also indicate individuals slaughtered in summer or autumn. If we allow that the dropped antler was collected shortly after it fell off, this piece could indicate occupation later in the year, in December or January (Bonnissent 1993).

59 Finally, the numerous horse foetus remains show that there were several individuals that could have been brought accidentally to the site through the transport of whole carcasses of gravid mares. However, due to the scarcity of horse post-cranial axial skeleton, another possible hypothesis is that the foetuses were brought deliberately to the site. The small quantity of the material and the limited extent of the excavation do not allow conclusions beyond these suppositions.

6 - Study of the avifauna (V.L.)

60 There are only 12 bird remains we studied here, out of which 11 come from the cleaning of the section and one from the finds of the owner. Nine remains could be determined taxonomically (tabl. 21). We also note that numerous remains, not included in the present study, were isolated by V. Mistrot and belong mostly to Passerines.

61 In the upper levels, two remains belong to a type of Lagopus, *Lagopus sp.*. They are two tarso-metatarsals that could not be measured (specifically determined)due to their extreme fragmentation.

62 The Middle Palaeolithic levels yielded six taxonomically determined remains. An ulna fragment and a tibia-tarsus from a young individual belonged to a small falcon (the size of a common Kestrel) *Falco sp.*. The Galliformes are represented by two ulna fragments of a Grey Partridge (*Perdix perdix*) and a femur fragment that could not be determined beyond its order. A fragmentary humerus could be from an Eurasian Dotterel (cf. *Eudromias morinellus*). Without sufficient material for comparison during the study, the determination of this species remains uncertain.

Tableau 21 - Avian taxa determined in the various levels (as number of remains).

	Ensemble supérieur		Ensemble inférieur			Hors stratigraphie
	Couche 2	Couche 3	Couche 3	Couche 4	Couche 5	
Falco sp.				2		
Lagopus sp.	1	1				
Perdix perdix				1	1	
Galliforme indet.					1	
Cf. *Eudromias monnellus*			1			
Corvus corax						1
Indéterminés		1	1		1	
Total	1	2	2	3	3	1

Tableau 22 - General count of the Middle Paleolithic industry.

	C. 3	C. 4	C. 5	H.S.	TOTAL
Blocs, plaquettes testés	3	1		2	6
Éclats corticaux	9	1	5	11	26
Éclats à dos cortical		1	1	4	6
Éclats indifférenciés et fragments	17	3	27	55	102
Éclats prédéterminants Levallois		1	8	14	23
Éclats Levallois	1	1	1	4	7
Éclats de plein débitage discoïde	1		1	2	4
Éclats débordants	2	2	3	11	18
Nucléus Levallois		2		2	4
Nucléus à surfaces sécantes		1		4	5
Éclats de retouche				2	2
Éclats <2 cm	70	23	20	8	121
Débris	5	1		1	7
Galets		1			1
TOTAL	108	38	66	120	332
Outils	2	1	1	2	6

7- The lithic industry of the lower levels (J.-F.P.)

7.1 - Presentation

63 The Middle Palaeolithic industry has a total of 332 pieces (tabl. 22). The state of conservation is altogether satisfactory. However, the conditions of the surfaces are varied with patina on some elements, frost damage on some others, and crushed edges on some pieces. None of the pieces are burnt.

7.2 - Raw materials

64 Except for a granite pebble fragment and a veined quartz cortical flake (0.6 %), the industry is nearly exclusively made of flint from the local Oligocene tertiary formations. Only one object is made of Jurassic flint (0.3%). This material is found in

secondary position on the banks of the Allier River that is flowing 5 km west of the site. Thus the objects in Oligocene tertiary flint from the Auvergne make up most of the series (n= 329 or 99.1%). These flints are found naturally as 2 to 3 cm thick plaquettes or quadrangular blocks, with varied textures and colours. Prospecting in the region showed that prehistoric raw material provisioning was from local formations, mostly within 0 to 5 km around the site. The limestone at the shelter itself includes flint plaquettes, few of which were used by prehistoric people. For their supplies, the site occupiers seemed to have favoured proximity over quality. Badly silicified and grainy-textured flints are relatively frequent in the Middle Palaeolithic level while they are absent from the Upper levels. The energetic investment of Middle Palaeolithic people for their raw material supplies is much lower than that of Upper Palaeolithic people (*see below*).

7.3 - Techno-typological study

65 Because of the small size of the sample, we will mostly be take a qualitative approach to this material. It is important to bear in mind that the excavation was on a small area located at the border of the shelter, in an area that could have been used as a specific activity area. The presence of the different categories of products shows that a large part of the débitage activities took place within the shelter. This is confirmed by less mobile elements such as cores, retouch flakes and elements below 2 cm in size, as well as by a granite hammer (tabl. 22). Blocks and plaquettes seem to have been brought to the site without previous preparation.

66 Two types of production are found but it is not possible to isolate them stratigraphically. The first one corresponds to a recurring centripetal Levallois débitage applied to blocks or plaquettes (fig. 10, n° 3 and 4). The striking platforms were prepared by small removals found on the periphery of the core. The presence of thin and twisted predetermining flakes within the series proves a preparation of the débitage surface. The few identified Levallois flakes are rather small and with a flat butt for most of them (fig. 11).

67 The second type is a débitage by secant surfaces on blocks or flakes that can be related to the discoid débitage types (fig. 10, n° 1 and 2). The striking platforms do not show any specific care, they are natural or the negative scar from a larger removal. Detaching thick flakes with flat butts is done from one or several débitage surfaces without previous shaping. The full flakes are certainly issued, for the largest of them, from this type of débitage.

68 Retouched tools are few (n= 6) and except for a granite hammer, the series is only composed of simple scrapers (fig. 12). There does not seem to be a selection of the blanks according to technical criteria as the main types of product have been retouched (2 undifferentiated flakes, 1 Levallois flake and 1 cortical). In three cases, the cutting edge of the scraper was worked by short retouch removals, rectilinear in profile. Only one piece shows two series of long removals, convexo-concave in profile (fig. 12, n° 5).

69 In spite of a Neanderthal occupation of the shelter for several tens of thousands of years, the lithic industry, unfortunately very scarce, shows a rather monotonous homogeneity.

Figure 10 - Chauriat, lower set. 1 and 2: secant surfaces cores ; 3 and 4: Levallois cores (drawings P. Alix).

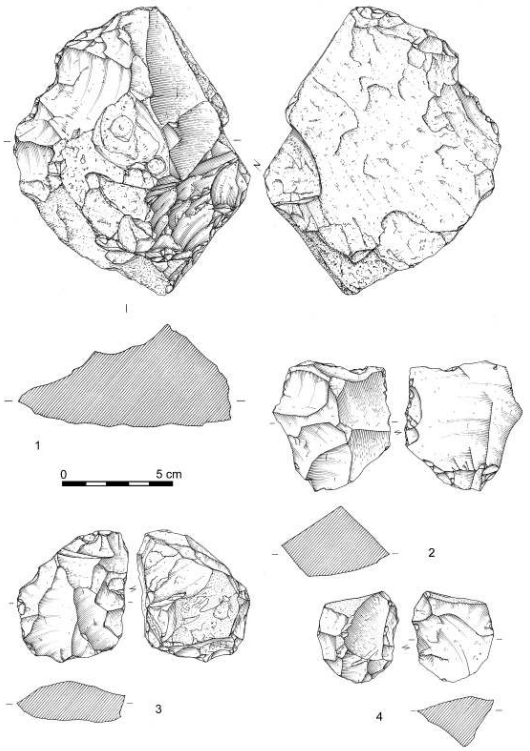


Figure 11 - Chauriat, lower set. Flakes (drawings P. Alix).

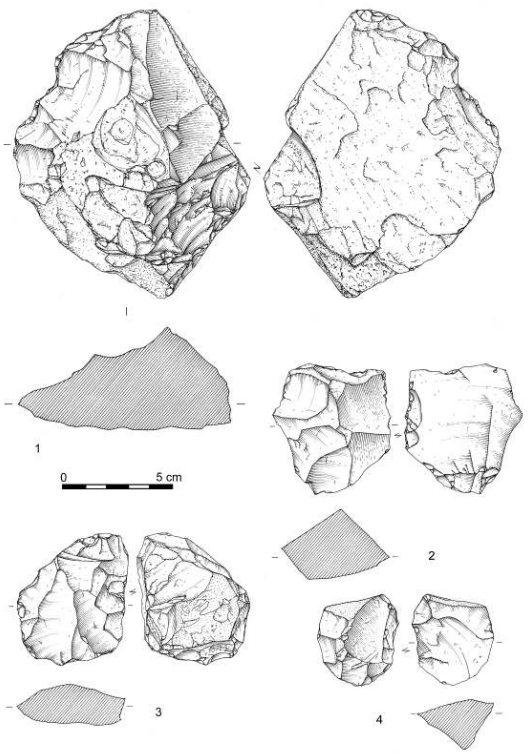
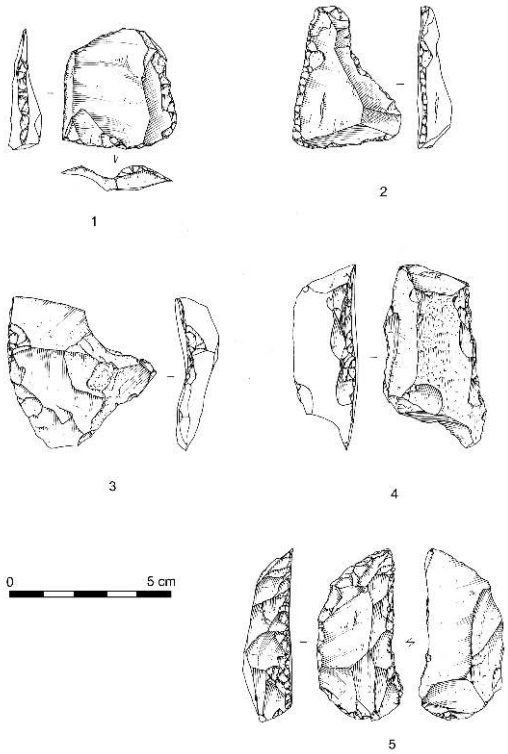


Figure 12 - Chauriat, lower set. Scrapers (drawings P. Alix).



8 - The lithic industry of the upper levels (J.-F.P.)

8.1 – Presentation

70 Some caveats must be given about the study of the industries from the upper levels. The characterisation of the material was done mostly from non-recorded pieces, as the material from the excavation was too small in quantity and often non-characteristic (tabl. 22). Thus the Chatelperronian and the Upper Palaeolithic that follows it show different technical characteristics in association with specific raw materials (a type of tertiary flint for the former and a foreign marine flint for the later). The two occupations could be positioned more or less precisely by examining the stratigraphic position of these specific raw materials. As the stratigraphic separation of the Chatelperronian and Upper Palaeolithic objects was rather blurred, we decided on a qualitative approach to the remains. The quantitative data are given for information only.

71 The industry has a total of 763 pieces (tabl. 23). The state of conservation of the material is overall similar to the Middle Palaeolithic levels. Some elements with a slight patina are found, mostly in layer 1, and others with crushed edges. No burnt pieces or frost traces were noticed.

8.2 - Raw materials, origin and collecting

72 The raw material types are slightly different from those used in the Middle Palaeolithic. Objects made of local Oligocene tertiary flints (0-5 km) still dominate (n=482 or 63.17%),

but two other flint types from further origins are also found. One is an Oligocene flint, grey-black in colour with grey or white cortex. One of the known source of this material is located about fifteen kilometres away from the site. It seems to have been exclusively used by the Chatelperronians. If we can rely on its representativeness within the assemblage (n=215 or 28.17 %), its introduction to the site can be seen as a planned action and not as opportunistic gathering.

73 The second new material is a blond flint from the marine Cretaceous (Lower Turonian) formations of the south of the Paris Basin (Berry region, the Cher Valley), more than 200 km away (n=66 or 8.65 %). This flint was imported to the Auvergne continuously from the Upper Palaeolithic until La Tène period (Surmely and Pasty 2003). In Chauriat, it is intimately connected to the occupation that follows the Chatelperronian.

74 The global techno-economic study of the different types of flints found in the upper levels shows some differences in the types of management of these raw materials. For the tertiary flints, the first stages of the débitage "chaîne opératoire" are only seen for the grey-black flint, in spite of its distant origin. This flint appears to have been brought to the shelter without much preparation of the blocks. This is not the case for the other types of tertiary flint as very few cortical elements are found. However, all these materials were worked on site to produce blade blanks. This is confirmed by the numerous non-mobile elements such as the flakes below 2 cm in size and to a smaller extent, the cores.

75 The Cretaceous flint was brought to the site as already knapped products, and possibly as cores. Flakes under 2 cm and the various flakes and fragments show that some knapping activity took place at the site.

Tableau 23 - General count of the Upper set industry.

	C. 1	C. 2	C. 3	H.S.	TOTAL
Blocs, plaquettes bruts ou testés	2	3	6	5	16
Produits corticaux		2	5	44	51
Produits à dos cortical				6	6
Éclats indifférenciés et fragments	5	10	32	62	109
Éclats laminaires			1	8	9
Lames et fragments		3	10	104	117
Lamelles et fragments	4	9	8	17	38
Nucléus à éclats		1		3	4
Nucléus à lames et lamelles				27	27
Éclats <2 cm	6	138	198	16	358
Débris	5	4	18	1	28
TOTAL	22	170	278	293	763
Outils		3	4	20	27

8.3 - Typo-technological characteristics of the occupations

Tableau 24 - Tool count from the upper set.

	C. 2	C. 3	H.S.	TOTAL
Grattoirs			6	6
Burins			1	1
Perçoirs			1	1
Pointes à dos	1	3	5	9
Pièces à dos	1	1		2
Lames retouchées			2	2
Lames tronquées			2	2
Éclat retouché			1	1
Encoches	1		1	2
Pièces esquillées			1	1
TOTAL	3	4	20	27

76 The Chatelperronian material is sufficient to allow reconstituting the operating schemes used by the site occupiers. The débitage was done on blocks or plaquettes. Its main aim was to produce blades, and to a lesser extent, bladelets. These latter were obtained on the same cores, there was no specific "chaîne opératoire". The shaping of the cores by producing crested blades is noted, without it being systematic. The desired blanks were blades with a straight profile and irregular edges, detached with a soft stone hammer from the cores, more often bipolar than unipolar, in a semi-revolving manner (fig. 13 and 14). The débitage was done with care; the striking platforms were prepared and managed (resharpening flakes, abrasion of the overhangs) as well as the blade table (resharpening flakes and neo-crested blades).

77 As for the Upper Palaeolithic that follows the Chatelperronian, the data are paltry as only a few products allow examination of the technical orientations of the "débitage". It is characterised by more or less arched blade blanks, with rather parallel edges, detached with a soft hammer (fig. 15). These pieces are all rather light in contrast to the sturdy Chatelperronian blanks.

78 Retouched tools are not numerous (n= 27) and are, for most, without precise stratigraphic position, which does not facilitate their identification to one or the other of the upper level occupations (tabl. 24). Tertiary flints were the most commonly used to make tools (77 % of the tools). However, the transformation rate of tertiary flint is clearly higher than for the Cretaceous flint (3.01 % against 9.1 %). The study of the tool blanks shows a selection of blades and bladelets (n= 21) rather than flakes (n= 6).

79 Among the tools, backed points are the most numerous and fit within the variability of Chatelperron points (fig. 16). They are made on blades or bladelets and their back is mostly curved, knapped by direct abrupt retouch, or more rarely crossed. The back makes the whole of the edge of the blank or is located at one or both extremities. Two elements classified as backed pieces (tabl. 24) could also be projectiles but their determination is difficult as they are fragments.

80 End-scrapers make up the second category of tools by their number. Two of them are on flakes and can be attributed to the Chatelperronian (fig. 16, n°7).

81 Among the tools assigned with certainty to the unspecified Upper Palaeolithic we find four end-scrapers on blades, a backed blade fragment, two backed bladelet fragments, a

burin on truncation, a truncated blade, a retouched blade, a retouched flake and a splintered piece (fig. 17).

Figure 13 - Chauriat, upper set. Châtelperronian cores (drawings P. Alix).

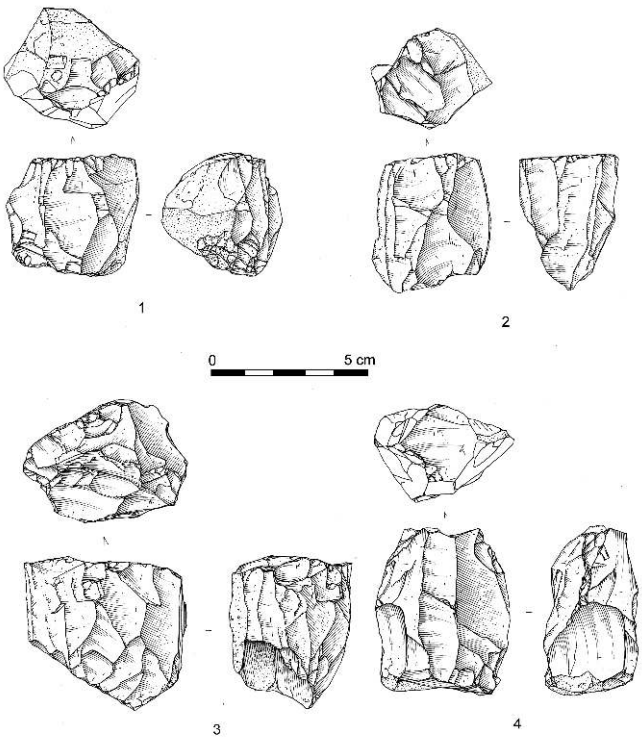


Figure 14 - Chauriat, upper set. Châtelperronian blades (drawings P. Alix).

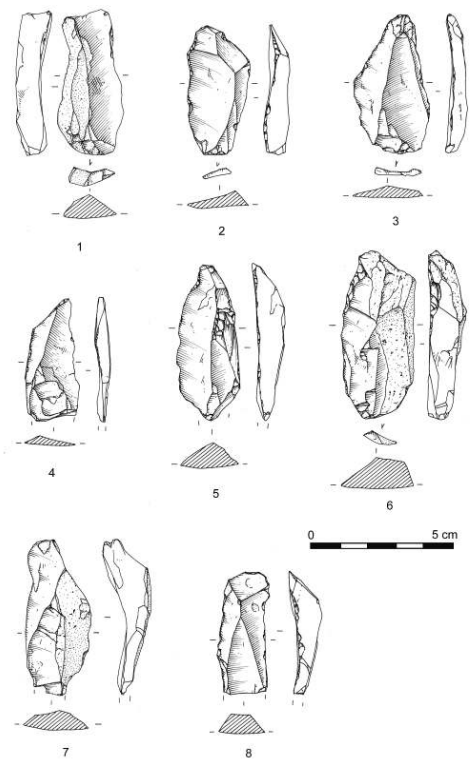


Figure 15 - Chauriat, upper set. Blades (drawings P. Alix).

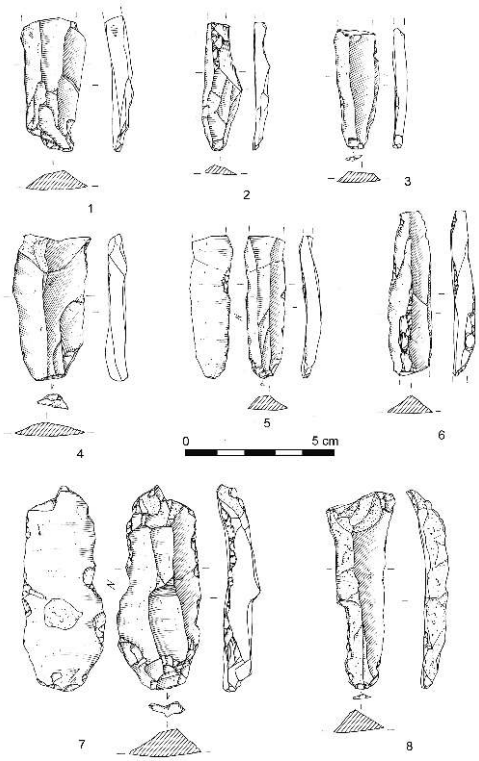
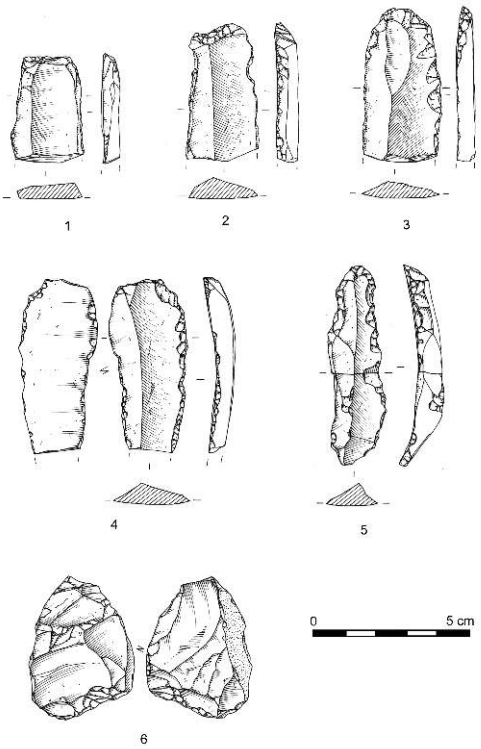


Figure 16 - Chauriat, upper set. Chatelperronian tools, 1-5 backed points; 6: borer; 7: endscraper (drawings P. Alix).

Figure 17 - Chauriat, upper set. Tools attributed to the indefinite Palaeolithic, 1: burin on truncation ; 2 : truncated blade; 3 and 4: endscrapers; 5: retouched blade; 6: splintered pieces (drawings P. Alix).



9 - General conclusions

82 The aims of this excavation were to specify the chronological and stratigraphic position of the human occupations, to characterise them at a cultural level and to establish the palaeoenvironmental environment within which they developed.

83 Although the concordance between the sedimentary levels and the stages of human occupation are not always obvious, the homogeneity of the lithic assemblages allowed identifying three stages of human occupation belonging to the Middle Palaeolithic (layers 5 to 3a), to the Chatelperronian (top of layer 3a and base of layer 2) as well as to an unspecified Upper Palaeolithic (layer 2). Post-depositional disruptions were noted for layer 3b and probably for the top of the infill, but they appear limited for the rest of the sequence. The presence of rolled osseous pieces next to very fresh ones raises the problem of possible different origins of these bones or of distinct local burying conditions. From the sample we have, it is difficult to go beyond this simple statement.

84 Macrofaunal studies show the essentially anthropogenic character of the bone accumulations within the shelter, even if burning or butchering traces are quite rare as is the case for example in Solutré (Olsen 1989 ; Turner 2002) or at Le Sire (Surmely *et al.* 2003). Frequent breakage of the diaphysises done on fresh bone, sometimes associated with impact points excludes carnivores as accumulating agents. They only seem to play a minor role. For bird remains, no trace of predators was found at all. The very small number of remains does not allow applying the usual qualitative methods to discuss the question of the agent responsible for bringing the avian remains to the site. Thus it is

impossible to conclude the origin of these remains in the infill at Chauriat. As for micromammals, they were mostly brought to the site by the snowy owl, and secondarily by small carnivores.

85 These studies (fauna and microfauna) show a repetitive and probably seasonal frequentation of the shelter - at least for the Middle Palaeolithic occupations - in the first part of the last glacial cycle, between the end of Isotopic Stage 5 and the limit between Isotopic stages 3 and 2.

86 Reconstruction of the bioclimatic and palaeoenvironmental framework is based on the various data provided by the large micromammal samples and by the less abundant data from the large fauna and the avifauna. The Middle Palaeolithic human occupations of the lower levels occured during a temperate episode with a cold tendency. The environment was slightly humid and the landscape open (presence of Bison, Horses and Woolly Rhinoceros) with some restricted wooded areas. The Grey Partridge indicates a rather temperate climate with steppic landscapes, moor land, dunes, peat bogs and mountain meadows. This episode took place during Isotopic Stage 5 ("Chauriat 1" Stage, layer 5) as is confirmed by the faunal data. However, the attribution to a precise sub stage is not clear. The decrease of woodland environments confirms the climatic deterioration that set up consequently ("Chauriat 2" Stage, layer 4). Forest rodents and insectivores diminished or disappeared. This phase seems to correspond to Isotopic Stage 4 but the absence of reindeer within this level raises questions.

87 During the following stage ("Chauriat 3" Stage), the rodents indicate that the forest around the site nearly disappeared. The presence of collared Lemmings and of Reindeer places this stage during a rather dry pleniglacial at the end of Isotopic Stage 3 or 4, depending on whether one looks at the micromammals or at the macrofaunal studies.

88 Conditions become milder during the next stage ("Chauriat 4" Stage) notably with the disappearance of Lemmings and the increase of moles. Woody vegetation increases again and humidity is greater. This stage probably corresponds to an interstadial located at the end of Isotopic Stage 3. No trace of human activities is found on the site during this episode, marks the end of the Middle Palaeolithic occupation. The end of the biozone corresponds to the climatic instability which follows the interstadial and sees the apparition of the Chatelperronian occupation in an environment marked by the presence of Reindeer and Lagopus, both characteristic of a cold climate. As is the case in several sites including the Grotte du Renne at Arcy-sur-Cure, the Chatelperronian at Chauriat seems to be setting up at the end of the inderstadial whose sterile deposits are on top of the Middle Palaeolithic that disappeared during this same interstadial (Girard *et al*. 1990 ; Pelegrin 1995).

89 While the large fauna continues to be witness cold surroundings (presence of Reindeer and Lagopus) up to the top of the sequence (layers 3a and 2 respectively attributed to the Chatelperronian and the unspecified Upper Palaeolithic), the association of micromammals indicates, on the other hand, a warmer and dryer climatic episode with an increase of the tree cover during the last stage ("Chauriat 5" stage). This last stage comprises the base of layer 2 and the top of layer 3a which corresponds to the Chatelperronian occupation itself and is correlated with a more temperate episode of Stage 2. The climatic context provided by the study of the large fauna and the micromammals do not agree for the top of the sequence. It is possible that the small quantity of large faunal elements in these levels does not allow distinguishing short climatic oscillations.

90 The lithic study of the lower levels (Middle Palaeolithic) shows an apparent homogeneity certainly due to the small quantity of the series. At a technological level, two flake production modes (Levallois and discoid) were used. As for the industries of the upper sequence, they are producing straight and short blade blanks, worked with soft stone hammers for the Chatelperronian, and long and curved blade blanks worked with organic soft hammers for the last occupants of the shelter. Besides these obvious differences from a techno-typological point of view, it is at the economic level that the various site occupants differ from each others. Middle Palaeolithic people found raw materials near the shelter without really taking their quality into account, using even the silicifications available in the limestone of the shelter. Chatelperronian people were more concerned with the quality of the siliceous raw materials as they added to local materials a special type of tertiary flint (flint from Authezat), originating from about 15 kilometres from the site. The flint provisioning of the last occupants of the shelter shows a real rupture with the previous occupations; they imported, in small quantity, very good quality extra regional materials, from the Lower Turonian formations of the Berry region.

91 The various studies resulting from this small scale excavation have allowed us to illustrate the potential of the Chauriat site and the contribution larger investigations could have provided. However, the existing data bring new evidence on the climatic and palaeoenvironmental conditions of the first part of the last glacial cycle, and especially for the period usually called “transition period” between the Middle and the Upper Palaeolithic.

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RÉSUMÉS

This article presents results of the excavations carried out in 2004 on part of the rock shelter of La Tour Fondue at Chauriat (fig. 1). The aim of this intervention was to specify the chronological and stratigraphic position of the human settlements, to characterize them at a cultural level and to establish the local palaeoenvironment. The sedimentary deposits were more than 3.20 m deep (fig. 5 to 7). They yielded a large quantity of micromammals associated with macrofauna. Studying these provided a bioclimatic and palaeoenvironmental framework that can be divided into five stages, starting at the end of Isotope Stage 5 and ending between Isotope Stages 3 and 2. The Middle Palaeolithic human occupations found in the upper levels occurred during a temperate episode with a cold tendency in Isotope Stage 5 ("Chauriat 1" Stage) and lasted until the "Chauriat 4" Stage at the end of Isotope Stage 3. For their lithic industries, Middle Palaeolithic people used tertiary flints found next to the shelter without considering their quality. These materials were used to obtain flakes in Levallois and discoid production modes. The upper levels contain Chatelperronian and unspecified Upper Palaeolithic occupations. The Chatelperronian took place in a climate correlated with an interstadial at the limit between Stages 3 and 2 ("Chauriat 5" Stage). Chatelperronian people were different than their predecessors in favouring better quality raw materials, found about twenty kilometres from the site. The industries of the upper levels aimed at producing straight and short blades blanks knapped with a soft stone hammer for the Chatelperronians, and long and curved blades blanks knapped with a soft organic hammer for the last occupiers of the shelter.

INDEX

Keywords : Middle Palaeolithic, Chatelperronian, biostratigraphy, palaeoenvironment, lithic industry, macrofauna, micromammals.

AUTEURS

JEAN-FRANÇOIS PASTY

CNRS, UMR 7269, LAMPEA, INRAP Auvergne, 13b rue Pierre Boulanger, 63100 Clermont-Ferrand - jean-francois.pasty@inrap.fr

SANDRINE COSTAMAGNO

CNRS et TRACES - UMR 5608, Université de Toulouse, Maison de la Recherche, allées Antonio Machado, 31058 Toulouse cedex - costamag@univ-tlse2.fr

VINCENT MISTROT

Musée d'Aquitaine, 20 Cours Pasteur, 33000 Bordeaux - v.mistrot@mairie-bordeaux.fr

VÉRONIQUE LAROULANDIE

CNRS et PACEA - UMR 5199, Université Bordeaux 1, Avenue des Facultés, 33405 Talence cedex v.laroulandie@pacea.u-bordeaux1.fr

PHILIPPE ALIX

INRAP Rhône-Alpes, 11 rue d'Annonay, 69675 Bron cedex - philippe.alix@inrap.fr

CHRISTÈLE BALLUT

CNRS, ArScan - UMR 70401, Université Paris 10, Maison René Ginouvès, 21 allée de l'Université, 92023 Nanterre cedex
christeleballut@hotmail.com

HÉLÈNE PASTY-VANDE WALLE

12, rue du Verger fleuri, 63200 Riom - helene.pasty@hotmail.fr

RENÉ MURAT

INRAP Auvergne, 13b rue Pierre Boulanger, 63100 Clermont-Ferrand - rene.murat@inrap.fr