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Aurignacian animal exploitation at Solutré (Saône-et-Loire, France)

Céline BEMILLI* & Grégory BAYLES**

ABSTRACT

The creation of an archaeological park at the site of Solutré required a rescue operation in 2004 and two Aurignacian layers were discovered (Connet *et al.* 2005). The richest one (layer 2, presented here) yielded several thousands of large mammals remains very well preserved; Horse and Reindeer are the two main species. The presence of nearly complete skeletons indicates that the animals were transported to, prepared at, and probably, consumed at the site (or into close vicinity). Foetal bones and deciduous teeth would indicate that hunting took place at several occasions during the year, though more often, at the end of Autumn. That is why it is possible to assume that the site was occupied on several occasions, and that the duration of each occupation lasted several weeks to several months. The zooarchaeological analysis provides some evidence of bone industry (smoother, burnishers and retouching tools), bone and ivory ornaments, as well as a minimal exploitation of Reindeer antler. These objects demonstrate distinct functions or uses and yield various information about the activities that may have occurred at the site. This article also examines the Aurignacian exploitation of the two main species (*i.e.* Horse and Reindeer) and investigates the interpretation of a bone assemblage, minimally distorted by differential preservation.

KEY WORDS: Aurignacian; Zooarchaeology; Horse; Reindeer; Subsistence pattern; Animal exploitation

RÉSUMÉ - L'exploitation des ressources animales durant l'Aurignacien à Solutré (Saône-et-Loire, France)

Le projet d'aménagement du site de Solutré en parc archéologique a engendré une opération de sauvetage au printemps 2004 (Connet *et al.* 2005). La fouille a permis de mettre au jour deux couches aurignaciennes dont le niveau le plus riche (couche 2) est présenté ici. Plusieurs milliers de restes très bien conservés de grands mammifères y ont été découverts, les deux principales espèces étant le Cheval et le Renne. La présence de toutes les parties squelettiques, sans sous-représentation significative, témoigne que les animaux ont été chassés, préparés et probablement consommés sur place ou dans une zone très proche de la surface fouillée. Les indices de saisonnalité (os de fœtus et dents lactéales) témoigneraient d'abattages à plusieurs moments de l'année, plus particulièrement à la fin de l'automne, ce qui rend envisageable des occupations à plusieurs reprises lors de séjours allant de quelques semaines à plusieurs mois. Lors de l'analyse archéozoologique, certains éléments d'industrie en matière dure animale (lisseur, brunissoir et retouchoirs en os ; parure en os et en ivoire) ont été identifiés, contrastant avec la rareté des fragments de bois de renne (néanmoins exploités). La nature de ces objets témoigne d'utilisations ou de fonctions distinctes et apporte des informations supplémentaires quant aux activités qui se sont déroulées sur le site. Ils mettent en lumière une exploitation globale de l'animal et pose certaines questions relatives à la nature et à la fonction du site. Cette présentation est l'occasion d'exposer la nature de l'exploitation des deux espèces principales par les Aurignaciens et d'évoquer les questions d'interprétation et de représentativité d'un assemblage osseux faiblement altéré par les phénomènes de conservation différentielle.

MOTS CLÉS : Aurignacien; Archéozoologie; Cheval; Renne; Comportements de subsistance; Exploitation de l'Animal

INTRODUCTION

The French Site of Solutré is located in Saône-et-Loire, near the town of Mâcon (Fig. 1). It was discovered in the middle of the XIXth century by H. de Ferry, who excavated it with A. Arcelin during many years. Solutré was chosen as the eponymous site of the Solutrean culture, characterized by large bifacially retouched blades. Excavations conducted between 1968 and 1998 under the direction of Jean Combier and Anta Montet-White brought several Upper Palaeolithic

levels to light (Combier & Montet-White 2002). Thus, the occupation sequence is documented from the Mousterian to the Magdalenian periods. Moreover, the main levels are Aurignacian and Magdalenian. Many hypotheses have been put forward on the matter of big Horse accumulation. The best known hypothesis derives from a novel by Mr Arcelin in which Horse herds were pursued by hunters up to the edge of the cliff and forced to jump (Poplin 1990). This interpretation has remained very widespread up to now,

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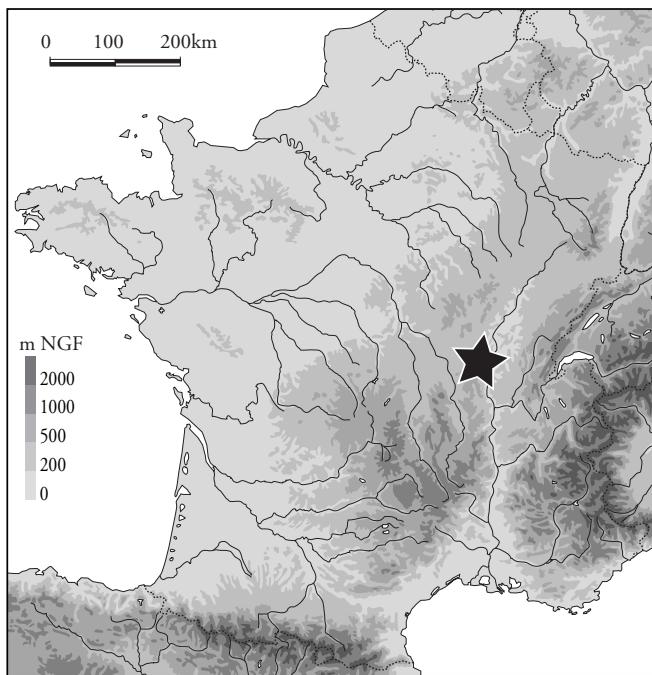


Figure 1: Site location

yet it is based on unaccurate evidence. First, the “Horse magma” is too far from the bottom of the cliff as it would be expected and, second, zooarchaeological studies showed that the bones did not present any of the typical fractures they were expected after such a fall (Olsen 1989, Turner 2002).

The project of building an archaeological park around the Site's Museum led to a rescue excavation during the Spring of 2004 under the direction of Nelly Connet (Connet *et al.* 2004). This excavation concerned two Aurignacian levels. We shall present here the faunal analysis of the oldest and richest one (layer 2). Out of a surface of area 70 square meters affected by the future buildings, only 15 m² of archaeological surface were preserved (Fig. 2), due to the numerous former trenches dug and the presence of a filling pit. The deposit was homogeneous and constituted of little gravels and limestone slabs embedding brown sandy clay (Fig. 3). An ashy layer appeared at the bottom of that level. It could correspond to layer 6 of Combier's excavations area M12. The original soil in this part of the site is sloping and presents some undulations. This undulating topography may have affected the dynamics of the archaeological deposit by slightly trapping the bones into these small depressions. Layer 2 yielded 695 lithic artefacts and more than 40,000 faunal remains; Since most of them are very small, only 3594 fragments were identified. No hearth was recognized, but a burnt layer was identified at

the base of this level (*cf. supra*). Associated to the lithic and faunal remains were a few elements of bone industry and ornament. Consequently, it is allowed that animal exploitation at the site was focused exclusively on food procurement.

CONTEXT OF THE FAUNAL REMAINS

Nearly 7,000 bone fragments were recorded. All the sediments were sieved so that the smallest fragments were collected, but not counted. For that reason, the real number of the very small fragments is unknown but their number was estimated to more than 40,000 and 9% are burnt. The bones are very well preserved, as indicated by the presence of hyoid, breast and foetus bones. No superficial modifications due to weathering are present while, in contrast, frequent alteration due to percolation is observed. Traces of concretion are few as are root-etching (1,63% NISP), carnivore gnawing and digestive corrosion marks (0,34% NISP). On the other hand, *in situ* bone fragmentation is very important, which is due to the falling of stones (some bones were observed encrusted with little pebbles), and it has been distinguished from human action. We observed some bones in anatomical connection, which points out a limited movement of the remains after deposition. However, all taphonomic data suggest that the bones were covered very quickly after deposition. Such a taphonomic analysis allowed us to carry out a reliable study of the faunal assemblage.

COMPOSITION AND ORIGIN OF THE ASSEMBLAGE

The faunal assemblage is composed of several species of large and small mammals, birds and fish (Fig. 4). Only the larger mammals are described in this article. A total of 3,594 remains have been identified, belonging to Horse (*Equus ferus* 62,8% NISP), Reindeer (*Rangifer tarandus* 34,5% NISP), Wolf (*Canis lupus* 0,3% NISP), Fox (*Vulpes vulpes* or *Alopex lagopus* 0,4% NISP), Mammoth (*Mammuthus primigenius* 0,8% - only documented by ivory), Hare (*Lepus sp.* 1% NISP), Marmot (*Marmota marmota* 0,03% NISP). Birds and fish are rare. Distinguishing between Red and Arctic Foxes and between Brown and Arctic Hares was not possible, but the presence of Reindeer and European Ground Squirrel (*Spermophilus citellus*) indicates a cold climate (Nicolot in Connet *et al.* 2005). The assemblage can not result from Carnivore activity since both Carnivore remains (0,7% NISP; Fig. 5) and Carnivore gnawing, punctures and

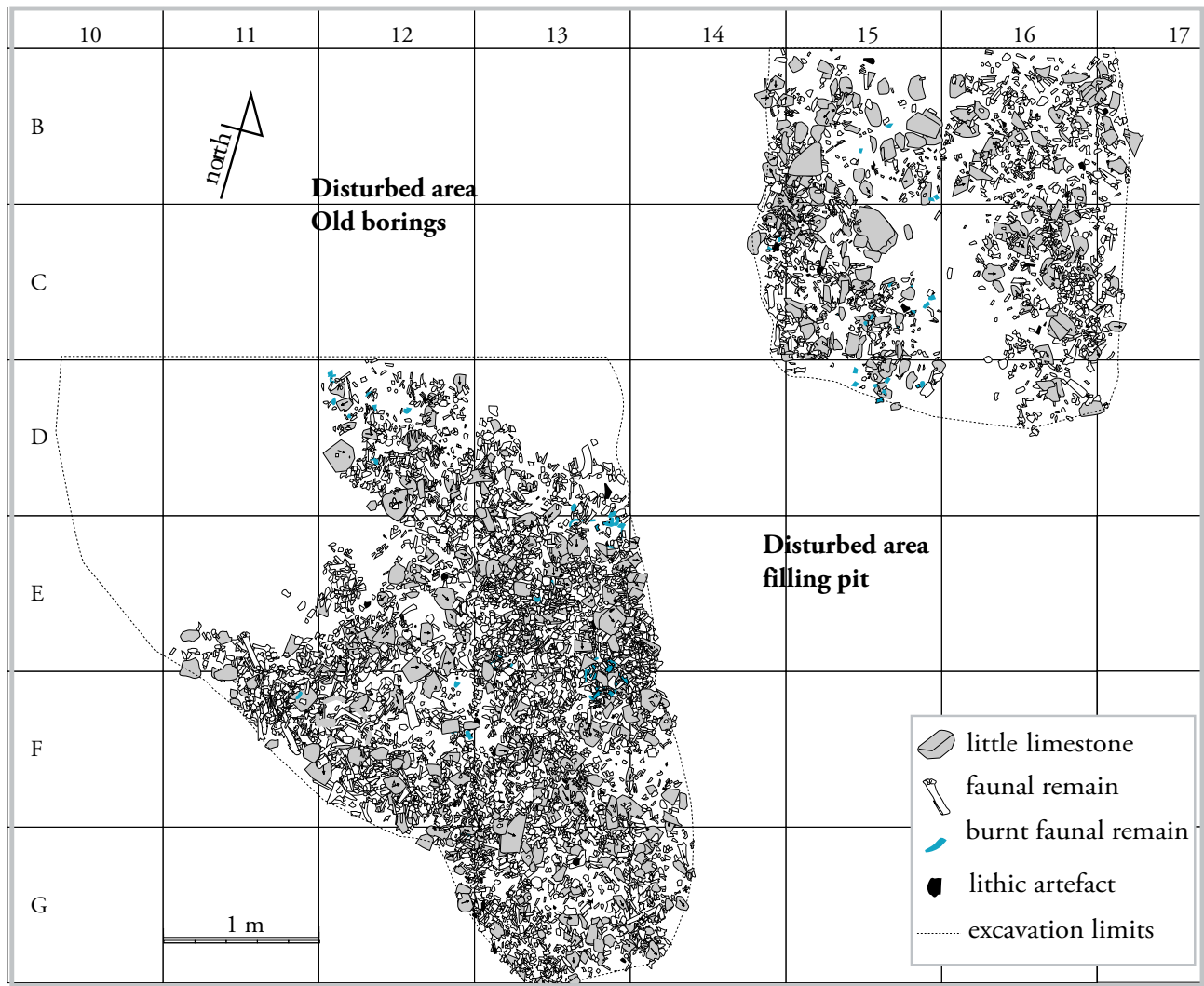


Figure 2: Solutré, 2004. Map of layer 2 (from Connet *et al.* 2005)

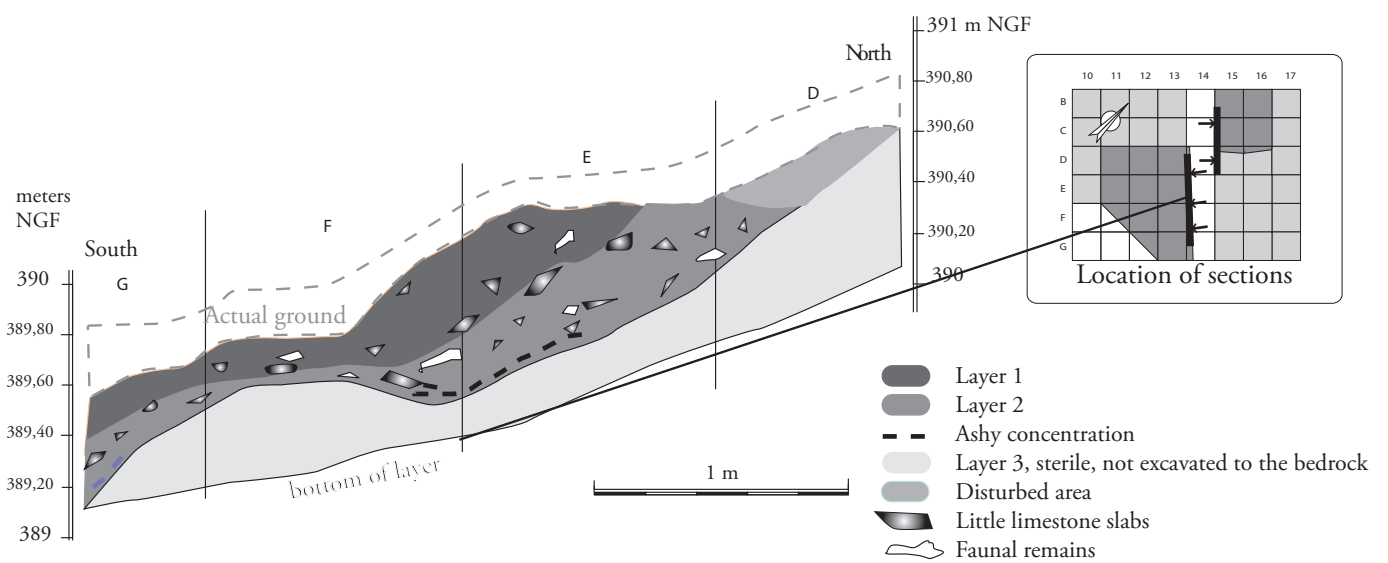


Figure 3: Solutré, 2004. Geological context (from Connet *et al.* 2005)

		NISP	% NISP	MNIf	% NMIf	MNIc
Horse	<i>Equus ferus</i>	2257	62,1	18	52,9	29
Reindeer	<i>Rangifer tarandus</i>	1241	34,2	10	29,4	12
Wolf	<i>Canis lupus</i>	10	0,3	1	2,9	1
Fox <i>sp.</i>	<i>Vulpes/ Alopex</i>	15	0,4	2	5,9	2
Mammoth	<i>Mammuthus primigenius</i>	27	0,7	1	2,9	1
Hare <i>sp.</i>	<i>Lepus europaeus?</i>	35	1,0	1	2,9	1
Marmot	<i>Marmota marmota</i>	1	0,03	1	2,9	1
Bird	<i>Aves</i>	4	0,1	.	.	.
Fish		4	0,1	.	.	.
Tot Det.		3594	100	34	100	
Unidentified		3274				
Smallest fragments *		41020				
Total NISP		47888				

Figure 4: Solutré, 2004, Layer 2. Counts of the faunal remains (*NISP estimated)

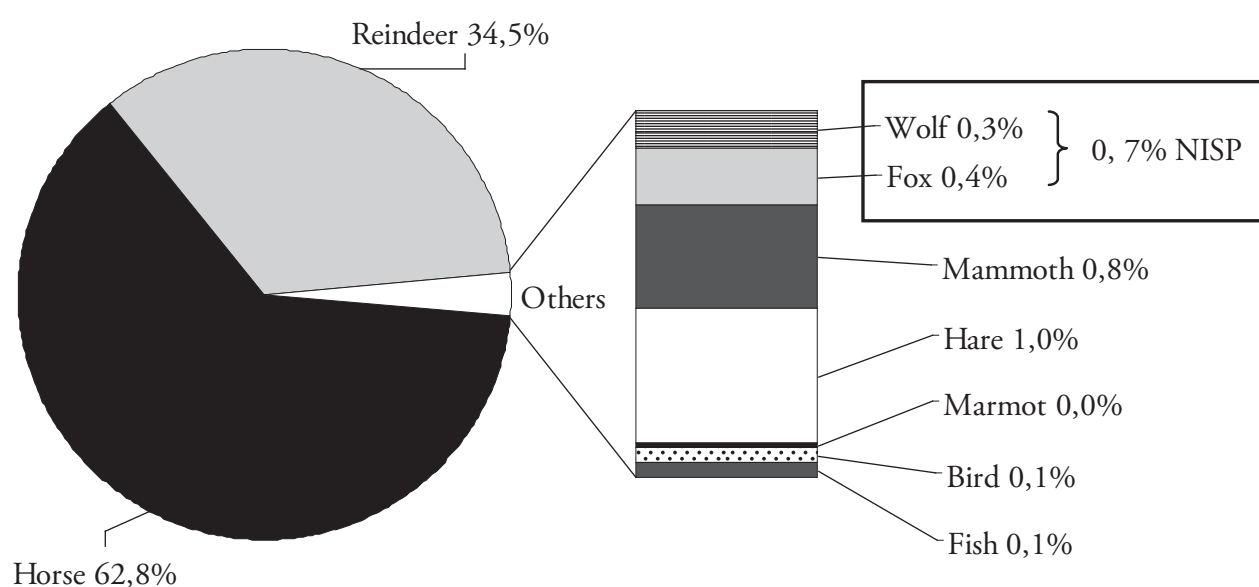


Figure 5: Solutré, 2004. Part of Carnivores in the faunal assemblage (N=3,594)

digestive corrosion are rare (0,35% NISP) in the faunal assemblage, as are complete bones. Finally, according to the criteria of Bunn (1986), Blumenshine and Marean (1993), the rate of bone-shaft is high compared to the articulation (65,8% for Horse and 3% for Reindeer).

All these observations lead to conclude that Carnivores are not responsible for the deposit. On the contrary, humans are the only responsible agent for the faunal deposit, even if the number of cut-marks is low (2% for Horse and 3% for Reindeer).

HORSE REMAINS

A number of 2,257 Horse (*Equus ferus*) remains were recovered, which account for 62,8% of the total of identified bones (Fig. 4). The few anatomical connections concern mostly the end of limbs. Horse bones were not systematically broken. All the skeletal parts are represented, even the more fragile as hyoid bones (Fig. 6). The % survivorship value plot against the density value (Lam *et al.* 1999) of each skeletal part gives a positive but non significant correlation coefficient ($r=0,2099$, $ddl=21$). Thus the representation of skeletal parts can be interpreted in terms of human behaviour rather than taphonomic processes. Horses were killed and prepared at the site or close-by. Two facts seem to emerge: the low rate of cervical vertebrae and the low rate of the humeri and femuri, the two richest bones. These two parts may have been prepared differently or somewhere else at the site. A number of 45 cutmarks were recorded during the preliminary analysis and correspond to the different steps of butchering: skinning, disarticulation and defleshing, marrow extraction (well

documented on the long bones, even if not systematic). It seems that Aurignacians dismembered the carcass as much as possible (the majority of cutmarks are disarticulation marks) in order to preserve the bones carrying the most important muscular mass (humerus *versus* femur). They not only took the flesh but they also used some Horse bones as tools, as it is illustrated by several retouching tools made on bone shaft fragments, and a smoother made on a rib.

The higher post-cranial MNIf (18) was obtained on the talus but the comparison of the different ages (MNIfc) allows estimating a minimum of 29 horses. The age of these animals (Fig. 7) was estimated according to eruption (Cornevin & Lesbre 1894, Guadelli 1998, the collections of National Museum of Natural History in Paris) and wear patterns (Levine 1982, Bignon 2003) and also owing to the presence of foetus bones (Habermehl 1975). Thus several young individuals of different ages are

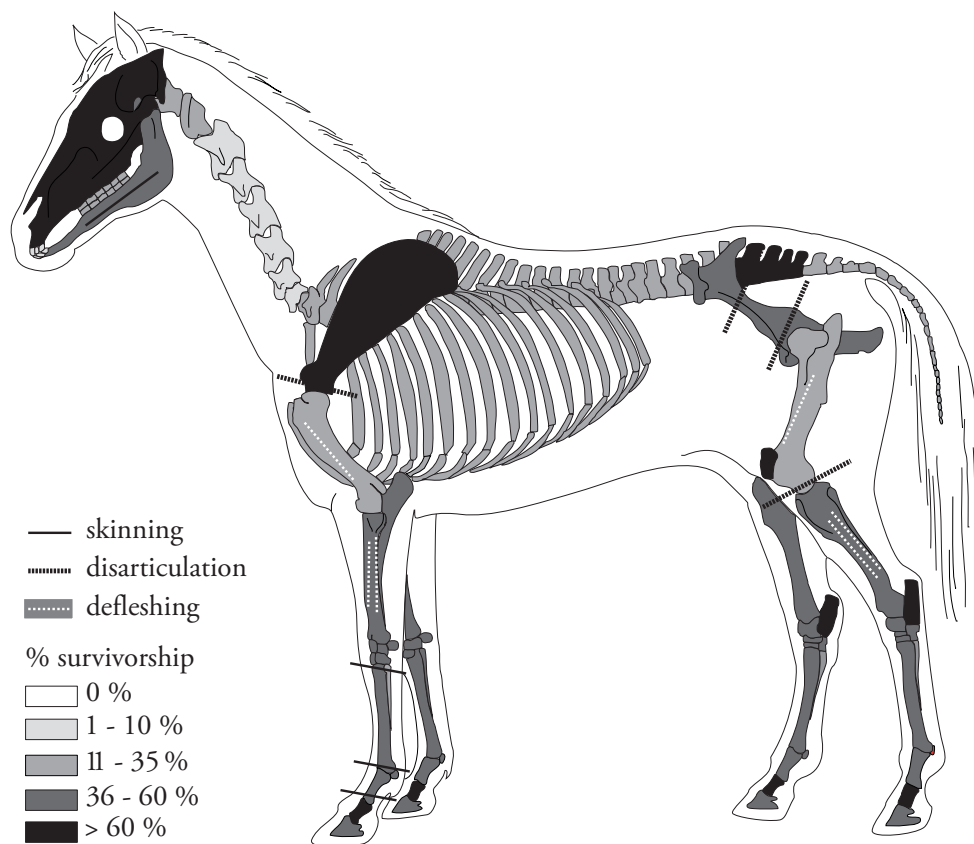


Figure 6: Solutré, 2004. Horse survivorship and exploitation (NISP = 2,257)

documented (Fig. 8). Eight Horse foetus bones are present, corresponding to two animals. One is 20 to 23 weeks old and the other is 23 to 26 weeks old, which suggest that the mother was hunted between October and December. Such observations on Horse ages show that the animals were killed all year round, more frequently at the end of Autumn and during Winter. The site was occupied at the end of Spring and the beginning of Summer as well at the end of Autumn and the beginning of Winter (Fig. 9). The population is composed of adult females and young individuals: the only male is a young horse.

REINDEER REMAINS

Reindeer (*Rangifer tarandus*) is documented by 1,241 remains (34,5% NISP). All skeletal parts are present except the second cervical vertebrae; Absence certainly due to the disarticulation process (Fig. 10). The metacarpal is weakly represented, probably because of its high degree of fragmentation. Antlers are also weakly represented in terms of survivorship (even if we count 77 little fragments). 38 Reindeer remains wear some cut-marks which document every step of carcass preparation (skinning, disarticulation, defleshing and marrow extraction) (cf. Fig. 10), as in the

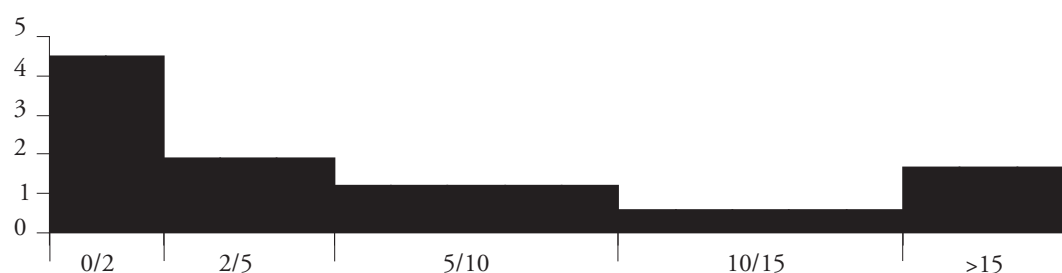


Figure 7: Solutré, 2004. Ages of death of horses (MNI= 29)

Species	Skeletal part	Lat.	Age
Horse	d2 & d3	L	≈ 20 months
Horse	d2, d3 & d4	L	7/10 months
Horse	d2, d3 & d4	R	12/17 months
Horse	d2, d3 & d4	L	6/9 months
Horse	d3 & d4	R	5/9 months
Horse	d2, d3, d4, M1 & M2		23/26 months
Horse	d2	R	≈ 7 months
Horse	d2	R	≈ 14 months
Horse	femur	R	20/23 weeks
Horse	femur	L	fœtus
Horse	humerus	L	23/25 weeks
Horse	metapodial 3	?	23/25 weeks
Horse	radius	R	20/23 weeks
Horse	tibia	L	fœtus
Horse	calcaneum	L	fœtus
Horse	metapodial 3	?	fœtus
Horse	incisive 1	?	<10 months
Horse	incisive 1	?	<10 months
Horse	incisive 1	?	≈ 2 years
Horse	incisive 1	?	10/24 months
Horse	incisive 2	?	≈ 40 days

Figure 8: Solutré, 2004. Listing of the young Horse skeletal elements

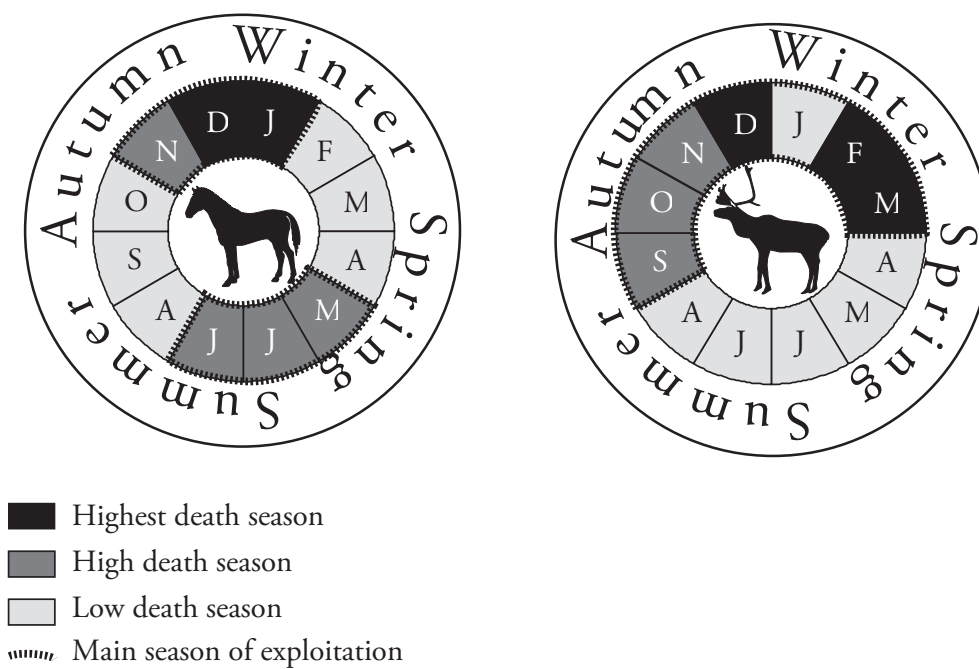


Figure 9: Solutré, 2004. Season of death of horses and reindeers

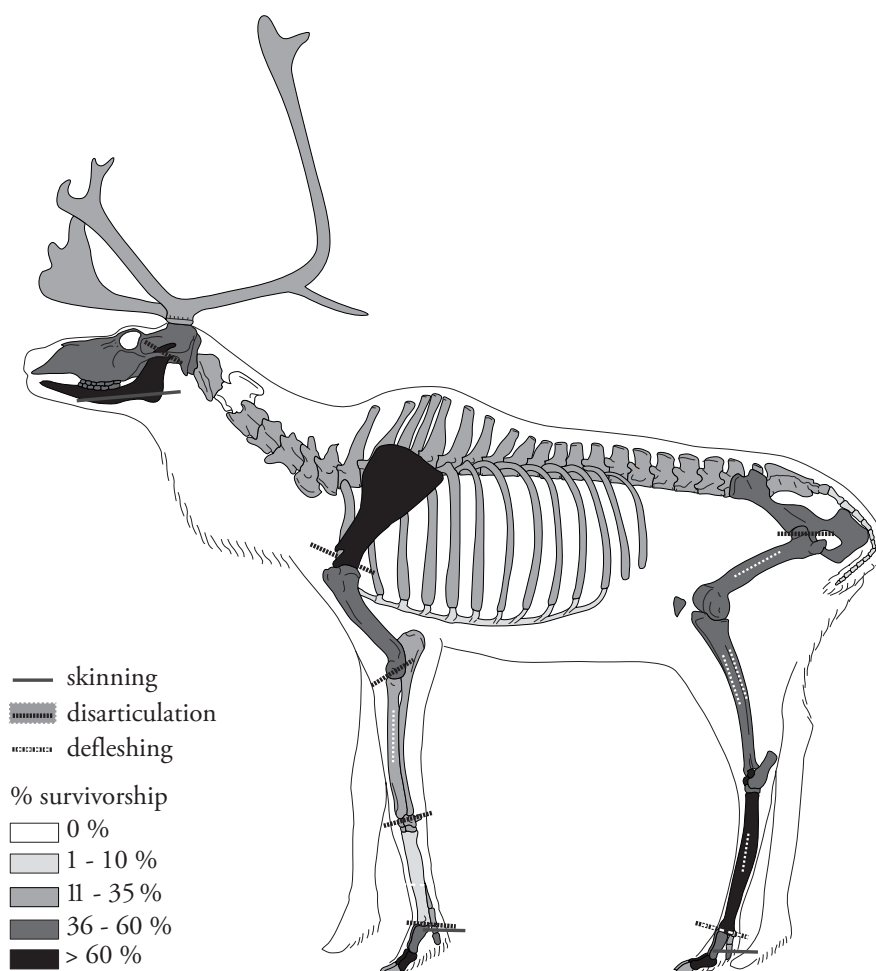


Figure 10: Solutré, 2004. Reindeer survivorship and exploitation (NISP = 2257)

case of horses. Finally, some Reindeer bone-shaft fragments were used as retouching tools and a burnisher was made on antler.

A minimal number of 10 animals was estimated (using the talus) and the combination of the different ages gives a number of 12 reindeers (MNIc, Bouchud 1966). The death profile does not show any particular selection within the herd, but reflects a catastrophic profile (Fig. 11) even if the number of animals is too low to make a statistically reliable curve. There are, inside this population, at least four males, according to the presence of canines. Precision of the death season

could be obtained thanks to the presence of foetus bones (Spiess 1979), which permitted to identify some gravid females killed between February and March, while the age of the young animals indicates a death at different moments of the year (Fig. 12): seven in Autumn/Winter, two between Summer and Autumn and one during Summer.

In conclusion, the different observations on seasonality obtained from Reindeer remains indicate an occupation in Autumn and mostly in Winter. The presence of two female antlers and no male antler fits in with this hypothesis.

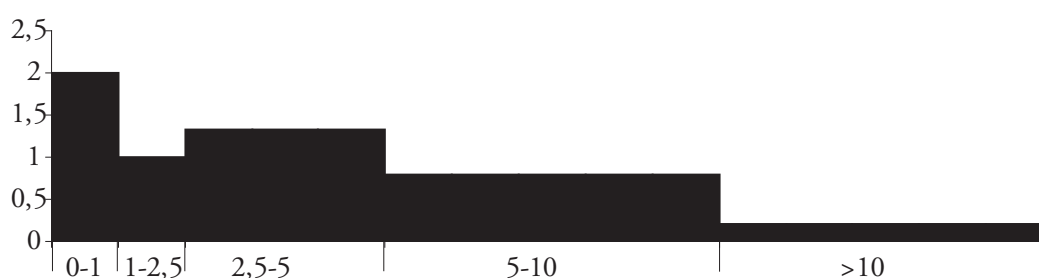


Figure 11: Solutré, 2004. Ages of death of reindeers (MNI= 12)

Species	Skeletal part	Lat.	Age
Reindeer	d3 & d4	R	4/5 months
Reindeer	d4	R	7/8 months
Reindeer	d3	R	7/8 months
Reindeer	d3	L	7/8 months
Reindeer	d2	R	<2 months
Reindeer	d4	L	20/21 months
Reindeer	P4	R	≈ 30 months
Reindeer	M3	R	≈ 30 months
Reindeer	d3 or d4	R	25-30 months
Reindeer	d3 or d4	R	25-30 months
Reindeer	femur	R	fœtus
Reindeer	radius	L	fœtus
Reindeer	femur	R	fœtus
Reindeer	radius	L	fœtus

Figure 12: Solutré, 2004. Listing of the young Reindeer skeletal elements

BONE INDUSTRY AND ORNAMENT

A total of 11 retouching tools are present in the bone assemblage: seven are made on Horse bone and four on Reindeer bone. We also recovered a smoother broken in three fragments, probably made on a Horse rib (Fig. 13) and a burnisher. There are no finished artefacts on antler but we observed streaks on five fragments, almost certainly the result of the preparation of a cutting edge. Another piece wears a strike mark, so that it appears that fabrication took place on site. Ornaments were also found during the excavation: one disk-shaped ivory bead, one ivory basket bead, typical of the Aurignacian, and a broken pendant made in a Marmot tooth (Fig. 14; Connet *et al.* 2005). The two ivory beads have been worn and, even if some ivory fragments were recorded on site, we did not find any fabrication scraps. The fabrication of these ornaments had probably not taken place on site.

ANIMAL EXPLOITATION

There is no doubt about the hunting of horses, reindeers and hares; Yet this is not the case for other species. Indeed, Mammoth remains are only tusk fragments that Humans could have collected out of the site, in order to

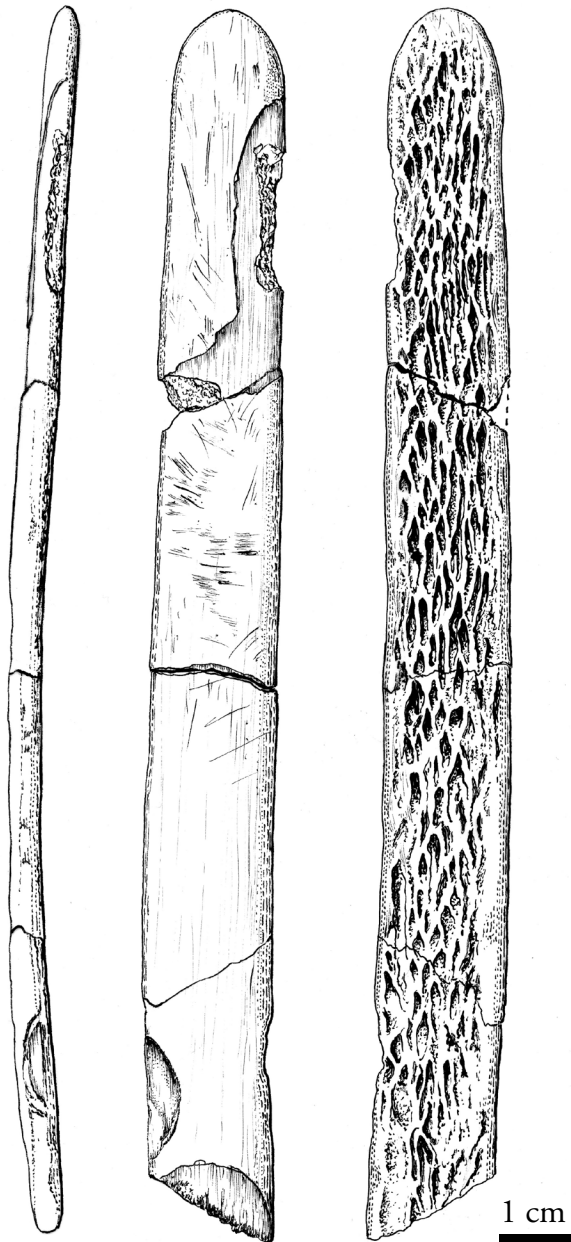


Figure 13: Solutré, 2004. Smoother. Drawing by D. Molez

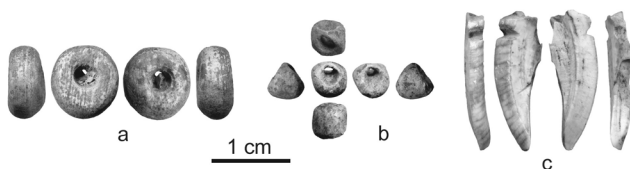


Figure 14: Solutré, 2004. Ornaments. a: disk-shaped ivory bead; b: ivory basket bead; c: Marmot tooth. Photography by M. Vanhaeren.

use ivory later. In the same way, Marmot is documented by only one tooth which is also a broken pendant, and it is not possible to prove that the animal from which it comes was eaten on site. There is no cut-mark on the two carnivore bones, so we cannot be sure they were hunted. In this open-air context, carnivore could have been attracted by the smell of flesh and killed by Humans. They probably did not die naturally here, which is maybe the case for the bird. The presence of fish is more problematic.

Horse was thus the main game hunted by the Aurignacians at the end of Spring, at the beginning of Summer and mostly in Winter (cf. Fig. 9). Hunters seem to have selected adult females and young individuals, which correspond to harems, and probably killed them at the site or close-by. Skin has been prepared and hunters seem to have been more interested in meat than grease, since long bones were not systematically broken. The few anatomical parts less documented could indicate particular treatments as drying. One example is the neck, where muscles are well developed, yet it is under-represented, as is shown by the lack of cervical vertebrae. Aurignacians hunted reindeer herds at the end of Autumn and all Winter long, killing young and adults, without a strict selection as shown by the presence of females and males at a season when females and males are dispersed. This also indicates several hunting “episodes”, at least for this period of the year. Their exploitation seems to have been more intensive because of breakage of all skeletal parts to get the marrow. The low number of antlers is surprising but can be explained by the main season of death (Winter) when males (represented in the killed game) lose their antlers. The under-representation of this anatomical part may also be due to a special use as antlers and may have been taken away from the area. The numerous little fragments could also correspond only to “wastes” of technical activity. In conclusion, Reindeer has been mainly used as a source of meat. The use of bones, as a raw material, seems to have been more opportunistic.

The main zooarchaeological studies published on the topic of the Aurignacian focused on the M12 and M13 areas (Olsen 1989) and the Magdalenian area P16 (Turner 2002). Part of the zooarchaeological results study of layer 2 are close to those obtained for the other Aurignacian sectors. Indeed, Horse is the main species and its population is principally composed of females with their young; complete carcasses of horses are represented and we observe a non-intensive exploitation of these carcasses;

Reindeer is always documented in lower proportions; there are skeletal connections; And finally, several moments of hunting in the course of the year are documented. But we observed also some differences. The faunal spectrum is more varied in the 2004 sample; There is the highest representation of young horses/foal and of reindeers; and there are more frequent occupations in Winter. There are also other technological activities than butchering (documented by lithic and bone industry) and the presence of ornament. All this suggests an entire exploitation of animal resources, even if the main goal seems to get meat.

SITE FUNCTION

Horse and Reindeer bone assemblages of layer 2 can be interpreted as a kill-site (animals were hunted close by the area and prepared there) but also as a temporary camp since meat consumption took place in the area. Skeletal representations indicate that the totality of the carcasses were present. All steps of butchering are documented and the presence of bone industry indicates distinct activities: preparation of skin with smoother and burnisher and tool manufacturing flint using a bone retoucher. The ornaments are more an indication of the group stay than technical activity because they probably were lost after having been worn (cf. *supra*).

Finally, the use of fire, documented by the ash layer, contributes to the idea of a diversity of activities. The site function appears relatively complex because all seems to take place at (or close by) the site. Hunters came several times a year, probably for many years, especially and more often during Autumn and Winter. They made use of the site topography to intercept animal herds as they moved through the valley during their migration between the Alluvial Plain of Saône river to the Mâconnais uplands. It is currently accepted that this corridor was a way for Reindeer seasonal migrations (Olsen 1989, Turner 2002). As Horse behaviour is different, it is more likely they were present in the vicinity of the site all year long and thus constituted a regular and abundant

resource for hunters. This could explain such a Horse bone accumulation. We can envisage that hunters ate part of the flesh and marrow on the spot. They may have prepared the remaining part by smoking, which would explain the presence of ash deposit and the absence of spatial organisation of the remains in the 2004 excavation could suggest a “waste area”.

CONCLUSIONS

In conclusion, we can say that the layer 2 of Solutré represents an accumulation of butchery waste deposited over successive hunting events. If the frequentation by one human group cannot be proved, the technological data, very homogeneous, suggest a frequentation by groups carrying the same tradition. All the studies show that Solutré was a big Horse kill-site and was occupied several times during several years. We observe the same behaviour since the Mousterian period, which proves continuity in the knowledge of the territory and the resources and underlines the “charm” of this site.

The originality of this study was to reveal some other activities than butchery, even if it was not possible to distinguish a distinct status between the two main species. In terms of subsistence, horses gave a higher quantity of flesh than reindeers, but in terms of raw material, Reindeer antlers allowed to make a higher diversity of tools than Horse bones. As we underlined, the main hunting season of reindeers is winter, when males do not wear antlers, which could explain the antler deficiency. But female antlers should be there and as hunters killed reindeers in Autumn too, male antlers could be documented too (if the hunted reindeers were males). The few antlers remains probably indicate that they were taken away. Anyway, the research of antlers does not seem to be the main preoccupation of the hunters, and animals were mainly caught for the meat. But, if the utilisation of bones as tools was opportunistic, it allows to light on the multiple activities which took place around the subsistence and to show how animal was the basis of several systems.

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