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fauniques de l'Abric Romani (Paléolithique moyen, Espagne)*

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# INTRA-SITE CHANGES IN SEASONALITY AND THEIR CONSEQUENCES ON THE FAUNAL ASSEMBLAGES FROM ABRIC ROMANÍ (MIDDLE PALAEOOLITHIC, SPAIN)

María Cristina FERNÁNDEZ-LASO<sup>1</sup>, Florent RIVALS<sup>2</sup> & Jordi ROSELL<sup>1</sup>

## ABSTRACT

The Middle Palaeolithic site of Abric Romaní (North Eastern Spain) was selected to test the hypothesis that seasonal behaviour of Neanderthal groups will induce differences in the faunal assemblages. The site has a long stratigraphical sequence representing a short chronology, but we focused on levels K, L, and M. The study of seasonality in ungulates indicates that the game was hunted at different periods of the year in each level. Combination of zooarchaeological analyses shows that in all levels the pattern of game procurement and transport to the shelter is similar. In the same way, there is no significant difference related to animal processing. The carcasses introduced into the shelter are used in an exhaustive and systematic way. Although seasonality in the occupation are changing, there are no significant differences in the activities of the Neanderthal groups in the three levels. We conclude that the presence of Neanderthals at Abric Romaní is highly seasonal and their displacements are strongly conditioned by the presence of game preys in the territory.

**Keys-words:** Middle Paleolithic, Neanderthal behaviour, late Pleistocene, seasonality, zooarchaeology.

## RÉSUMÉ

VARIATIONS SAISONNIÈRES INTRA-SITE ET LEURS CONSÉQUENCES SUR LES ASSOCIATIONS FAUNIQUES DE L'ABRIC ROMANÍ (PALEOLITHIQUE MOYEN, ESPAGNE)

Le site pléistocène moyen de l'Abric Romaní (Nord-Est de l'Espagne) a été choisi pour tester l'hypothèse qu'un comportement saisonnier des Néandertaliens se traduit par des différences dans les associations fauniques. Le gisement recèle une longue séquence stratigraphique qui représente une courte période chronologique, mais nous comparerons les données des niveaux K, L, et M. L'étude de la saisonnalité d'occupation à partir des ongulés indique que le gibier a été chassé à différentes époques de l'année dans chaque niveau. La combinaison des analyses archéozoologiques montrent que le mode d'acquisition du gibier et de son transport au gisement est le même dans les trois niveaux. De même, il n'y a pas de différence dans le traitement des carcasses, elles sont utilisées de manière exhaustive et systématique. Même si la saison d'occupation du site varie dans les trois ensembles considérés, il n'apparaît pas de différence significative au niveau des activités des groupes humains. La présence des Néandertaliens à l'Abric Romaní est saisonnière et leurs déplacements sont fortement conditionnés par la présence de gibier sur leur territoire.

**Mots-clés :** Paléolithique moyen, comportement des Néandertaliens, Pléistocène supérieur, saisonnalité, archéozoologie.

## 1 - INTRODUCTION

It is established that Neanderthals were forming groups with a high mobility and had a behavioural ecology marked by seasonal movements related to the procurement of biotic resources, both vegetal and animal (Conard, & Prindiville, 2000; Costamagno *et al.*, 2006; Fernandes *et al.*, 2008; Gaudzinski, 2000; Lieberman, 1998). The purpose of this paper is to test the hypothesis that seasonal behaviour of Neanderthal groups will induce differences in the faunal assemblages recovered from a site. To test our hypothesis we selected a site which meets several requirements: (1) a long stratigraphy corresponding to the Upper Pleistocene, (2) presence of various archaeological levels

belonging to the same cultural phase (Chacón *et al.*, 2007; Fernández-Laso *et al.*, in press), (3) levels well excavated and well dated, and (4) large samples of various herbivorous ungulate species available in all levels. We selected the Abric Romaní because there is a long stratigraphical sequence representing a short chronology i.e. all levels belong to the same culture (except level A) and to Neanderthal occupations. This study focus on levels K, L, and M which were dated by U-Series to  $52.2 \pm 1.6$  ka BP (USGS n°53) at the base of level L and to  $54.9 \pm 1.7$  (USGS n°54) at the base of level M (Bischoff *et al.*, 1988, 1994). From a geological point of view it is a relatively short time frame during which occur various human occupations. We selected these levels because we think that hunting at

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various seasons will have consequences on the fossil assemblages.

### 1.1 - PRESENTATION OF THE SITE

Abric Romani is located in the NE part of the Iberian Peninsula, 50 km west of Barcelona. It is one of many cavities located in the travertine complex known as Capelló Cliff, and it is located on the right bank of the Anoia River, at an elevation of 317 m a.s.l. and 50 m above a narrow gorge of the river (fig. 1). This gorge constitutes a strategic passage between mountainous inland and coastal plain. Three main ecosystems occupy the area around the shelter: riverside, mountain uphill, and plain beyond the gorge. This territory provides a great variety and quantity of vegetation, faunal and lithic resources to hominids that occupied the site.

The stratigraphic sequence is about 20 m thick. During the excavations 27 archaeological levels were identified, from which 15 were excavated up to now (A-O). All levels are belonging to the Middle Palaeolithic except the uppermost level A, which belongs to the Early Upper

Palaeolithic. The sequence was dated by U-Series to 40-70 ka BP (Bischoff *et al.*, 1988, 1994). The sequence is formed by a succession of well stratified travertine platform, where the archaeological levels appear as sandy layers interstratified and well delimited in between those platforms. In this sedimentary context the sedimentation is fast. The deposits are forming with a rate estimated to 60 cm per thousand years (Bischoff *et al.*, 1988). The first eight meters of the infilling would represent about 10 000 years (Vaquero *et al.*, 2001).

### 1.2 - VEGETAL RESOURCES

Levels K, L, and M belong to OIS 3 (56.8-49.5 ka BP) which is characterized as a cold period, alternating with warmer and more humid phases (Burjachs & Julià, 1994). Results from charcoal analysis (carbon fragments recovered from the hearts), indicate there is no variability in the different levels (tab. 1). *Pinus* type *sylvestris/nigra* (Scots/Austrian pines type) is the most abundant, followed by *Pinus* type *sylvestris/uncinata* (Scots/mountain pines type). Those species are pines growing from an

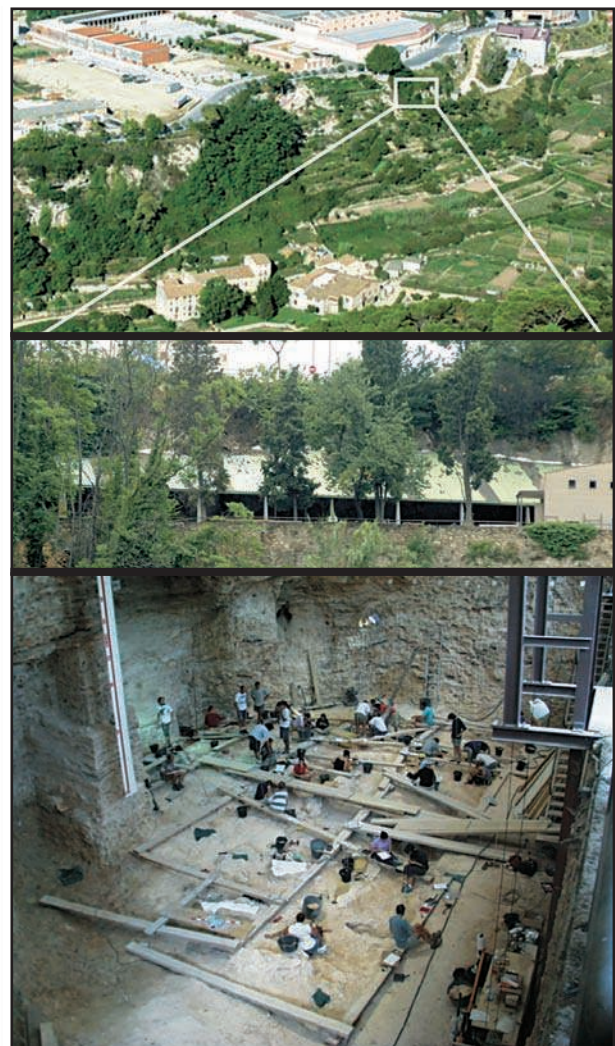
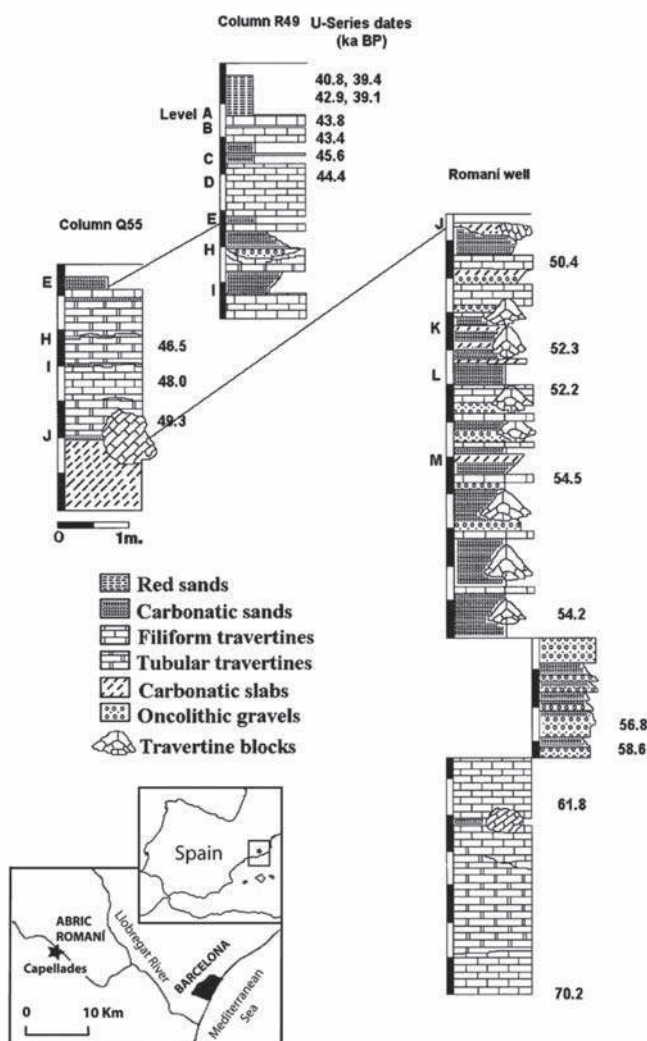


Fig. 1: Abric Romani geographic location and schematic lithostratigraphy of the sequence with the U-Series dates. General view of a part of the "Cinglera de Capello", front of the site and general view of the excavation in the level M.

Fig. 1 : Localisation de l'Abric Romani et lithostratigraphie schématique de la séquence avec les datations par les séries de l'Uranium. Vue générale d'une partie de la «Cinglera de Capello», entrée du site, et vue générale de la fouille du niveau M.

Taxa	K		L		M	
	Nb. of fragments	%	Nb. of fragments	%	Nb. of fragments	%
<i>Pinus type sylvestris/nigra</i>	132	54.1	155	61.0	154	59.2
<i>Pinus type sylvestris/uncinata</i>	1	0.4	7	2.8	4	1.5
<i>Pinus sp.</i>	23	9.4	17	6.7	17	6.5
Undetermined conifer	49	20.1	59	23.2	68	26.3
Undetermined	39	16.0	16	6.3	17	6.5
Total	244		254		260	

**Tab. 1: Results of charcoal analysis at levels K, L, and M (from Allué, 2002).**

Tab. 1 : Résultats de l'analyse anthracologique des niveaux K, L, et M (d'après Allué, 2002).

altitude of 500 m (Austrian pine) up to 2000 m (mountain pine).

Pollen analysis revealed a higher number of taxa that were probably located in the surroundings of the shelter. Open habitat taxa were identified, such as Poaceae, *Artemisa*, and *Pinus*, whereas in the more temperate periods taxa like *Quercus*, *Juniperus*, *Olea-Phillyrea*, *Pistacia*, or *Cistus* are dominant (Burjachs & Julià, 1994). Evidences are indicating that vegetal resources use focussed on the collect and exploitation of wood as firewood. The importance of the hearths in the daily activities of the Neanderthal groups made wood a needed resource and easy to get. Wood is gathered in the surroundings of the shelter. It is also possible that vegetal resources were used in the diet, but also for producing tools (Allué, 2002).

### 1.3 - ANIMAL RESOURCES

From an ecological point of view, Abric Romaní is located in an ecotone. The presence of various habitats in a limited area gives to hominids a large and diversified variety of resources. The knowledge of the territory

allows them to get a high diversity of game in a close range around the shelter. Horse and rhino would be present in the open areas on both sides of the *Capellades Strait*, and would seasonally move across the Anoia River. Cervids, having a similar behaviour, would be in the open forested areas of conifers, whereas bovids would be more probably in the plains and near the Anoia River. Finally, ibex and chamois would occupy more rocky and steep grounds. In all the archaeological levels excavated, hominids show a clear preference for two species: red deer and horse (tab. 2) (Carbonell *et al.*, 1996; Cáceres *et al.*, 1998; Vaquero *et al.*, 2001; Vallverdú *et al.*, 2005; Chacón *et al.*, 2007; Fernández-Laso *et al.*, in press).

## 2 - FAUNAL REMAINS

### 2.1 - METHODS

The high level of bone fragmentation makes the anatomic and taxonomic identification of the bone remains more difficult. In order to get the maximum

	A	B	C	D	E	F	G	H	I	J	K	L	M
Prosboidea	-	-	-	-	●	-	-	-	-	-	-	-	-
<i>Stephanorhinus hemitoechus</i>	-	-	-	-	-	-	-	●	-	●	-	-	-
<i>Equus ferus</i>	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Bos primigenius</i>	●	-	-	-	●	-	●	-	-	●	●	●	●
<i>Cervus elaphus</i>	●	●	●	●	●	●	●	●	●	●	●	●	●
<i>Rupicapra pyrenaica</i>	●	●	-	●	●	●	●	●	-	●	-	-	-
<i>Crocota crocota</i>	☐	●	-	-	●	-	-	-	-	-	-	-	-
<i>Panthera leo spelaea</i>	-	-	-	-	-	-	-	-	■	-	-	-	-
<i>Panthera pardus</i>	-	-	-	■	-	-	-	-	-	-	-	-	-
<i>Lynx sp.</i>	●	●	-	-	●	-	-	-	-	-	-	-	-
<i>Felis silvestris</i>	●	-	-	●	-	-	-	-	-	-	-	-	●
<i>Canis lupus</i>	-	●	-	-	●	-	-	-	-	-	-	-	-
<i>Ursus sp.</i>	-	●	-	-	-	-	-	-	-	-	-	-	●

**Tab. 2: Identified taxa at the three archaeological levels.**

☐ Travertine platform under the archaeological level; ● Travertine platform above the archaeological level (modified from Carbonell *et al.*, 1996).  
Tab. 2 : Taxons identifiés dans les trois niveaux archéologiques. ☐ Plateforme de travertin au-dessous du niveau archéologique; ● Plateforme de travertin au-dessus du niveau archéologique (modifié d'après Carbonell *et al.*, 1996).

information from the assemblages, we are using size groups according to the weight and age of the animals. Taking into account the taxa identified in levels K, L, and M, we distinguish between animals of various sizes: large-sized (weight  $\geq 300$  kg), medium-sized (between 300 and 100 kg), and small-sized (weight  $\leq 100$  kg). The skeletal elements are grouped together into large anatomical segments: cranial elements (skull and mandible), axial skeleton (vertebrae and ribs), scapulae and pelvis, long bones of the upper limb (humerus, radio-ulna, femur, and tibia), long bones of the lower limb (metacarpal, metatarsal and phalanges), and compact foot bones (carpal and tarsal).

The number of remains (NR) corresponds to the number of identified specimen per taxa (NISP) plus the unidentified remains. The minimum number of individuals (MNI) was calculated from dental remains taking into account age and size. The minimum number of elements (MNE) was calculated from dental and bone remains taking into account age, size and portion (Lyman, 1994; Reitz & Wing, 1999). To determine the animals' age at death, the best indicator in this study has been replacement and dental wear (Silver, 1969; Bökonyi, 1972; Azorit *et al.*, 2002). Nevertheless, the degree of epiphysation of the bones has also been used in some cases (Silver, 1969; Barone, 1986), as well as the type of cortical tissue (compact in adults or more porous in young animals).

Studying the hunting season of ungulates can provide some clues on when a site was occupied. However, identifying a single hunting season does not make possible to discern between occupations lasting only few days and longer occupations of few months. It is also impossible to distinguish between occupations of the site by the same group or different human groups. If an assemblage contains animals that were hunted during one season, then the data indicate a minimum estimate of seasonal use. Of course, absence of game from another seasons does not prove that the site was then unoccupied. It is important that seasonality studies incorporate as many hunted species as possible. We included all specimens available for horse, red deer, and aurochs.

Game hunted by prehistoric populations comprised mainly large ungulates of various age classes. It is possible to estimate the killing season for each species using maxilla, mandibles, and isolated teeth, which after a period of growth, wear almost continuously during an animal's life (Kurtén, 1953). Tooth crown height becomes progressively reduced by use-wear, and thus provides a means of establishing seasonality in the killing of hypsodont ungulates (Kurtén, 1953). The season of occupation can also be determined from cervid skulls since the developmental cycle of antlers starts (or ends) when they fall, at the same period every year. As a result, antlerless skulls indicate the period when the animal was killed. For example, a red deer killed at the end of winter can be expected to have had no antlers if we assume their development was identical to present day one.

The hunting season was estimated by observing both the lacteal and permanent teeth with a reduced use-wear, i.e. a stage corresponding to tooth eruption out of the gum. In this study, we selected the most abundant species of ungulates in levels K, L, and M: horse (*Equus ferus*), aurochs (*Bos primigenius*), and red deer (*Cervus elaphus*). For the horse, we used extant plains zebra (*E. quagga*) and Burchell's zebra (*E. burchelli*) whose eruption date of each tooth after animal birth is known (Spinage, 1972; Smuts, 1974). For *Bos primigenius* we have used data established on domestic *Bos taurus* (descendant of the aurochs) and wild *Bison bison* (Grigson, 1982; Johnson *et al.*, 2005). For *Cervus elaphus*, we used the extant red deer whose eruption date of each tooth after animal birth is known (Mariezkurrena, 1983; Carter, 1998, 2001; Azorit *et al.*, 2002).

Birth months assumed for extant species are the following. For the domestic horse, births occur throughout the year, but there is a peak from April to June (Nowak, 1999). As far as wild species are concerned, zebras birth peak occurs from December to February i.e. in late spring and early summer of the southern hemisphere (Hayssen *et al.*, 1993). For several species of *Bos* in Eurasia birth period span from May to June, the same as observed for the wild bison from North America (Nowak, 1999). For *Cervus elaphus*, in Europe and North America, birth occurs in the late spring i.e. May-June (Nowak, 1999).

Age estimation from dental wear can be limited by changes in diet that may induce a differential wear in animals of the same age (Every *et al.*, 1998; Fandos *et al.*, 1993). Dietary traits of the species from levels K, L, and M were analyzed through dental microwear. The effect of diet on differential wear can be discarded at Abric Romaní because there is no significant difference in the dietary traits (levels of abrasiveness) for any of the three species between levels K, L, and M (Fernández-Laso *et al.*, in press).

## 2.2 - RESULTS

In the three archaeological levels analysed in this study there are important differences concerning the number of remains (NR) recovered at each level (tab. 3). Level M has the highest NR (tab. 3), which is similar to the NR reported for the overlying level Ja (Vaquero *et al.*, 2001). Taphonomic data attest to the excellent state of bone preservation. We did not identify any differential conservation in relation to bones density and we did not observe destruction by post-depositional processes. This is related to the high sedimentary rate at Abric Romaní (Carbonell *et al.*, 1996). We can conclude that bone destruction occurred during site occupations as a result of intense bone processing by hominins. The level of fragmentation of the bones is high. In level L and M, 70% of the remains are  $\leq 3$  cm in length, and 60% in level K. In all levels we identified cervids, equids, and in a lower proportion, bovids. Other taxa were identified in level M: *Felis silvestris* and *Ursus* sp. (tab. 2).

Cervids are the animals most abundant in the assemblage with a MNI similar in levels K and M. The second most represented species is the horse. In level M, the MNI for horse and red deer is not as different as it is for levels L and K. Bovids are under-represented, except in level M (tab. 3).

Considering age groups, in all levels adults are the most abundant. Infantile and juvenile animals are also well represented (especially in level L). The highest diversity in age groups is observed for medium-sized animals; however this size group is also the most abundant. Old adults are underrepresented (tab. 4).

A similar situation is observed when considering the skeletal elements identified in levels K, L, and M. Skeletons are not integrally represented. Large-sized animals

are represented with proximal limb elements and cranial elements, especially isolated teeth. Medium-sized animals are those having the most complete skeletal representation; however there are differences in the axial elements. In all size groups, we observed scarce numbers of epiphyses and compact foot bones (carpal and tarsal) (tab. 5). This pattern was observed in the other levels at Abric Romani and interpreted resulting of the bones used as fuel and/or activity of carnivores (Rosell, 2001; Cáceres, 2002).

Detailed results of the seasonality study are presented in table 6 for individual species. Levels K, L, and M are found to correspond three different seasons when the young individuals were hunted: summer, spring and autumn - early winter, respectively (fig. 2). In levels K

Taxa	K			L			M		
	NISP	MNE	MNI	NISP	MNE	MNI	NISP	MNE	MNI
Equidae	56	11	4	34	9	4	58	15	6
Bovidae	15	8	1	6	6	1	15	10	3
Cervidae	335	70	8	96	39	5	479	110	9
Ursidae	-	-	-	-	-	-	1	1	1
Felidae	-	-	-	-	-	-	1	1	1
Large-sized	60	10	-	60	9	-	123	17	-
Medium-sized	957	27	-	214	18	-	555	56	-
Small-sized	158	17	-	59	11	-	423	41	-
<b>Unidentified</b>	983	-	-	669	-	-	5959	-	-
<b>Total (NR)</b>	2564	143	13	1002	92	10	7614	251	20

**Tab. 3: Number of remains (NR), number of identified specimens per taxon (NISP), weight sized and unidentified remains, minimum number of individuals (MNI), minimum number of elements (MNE) of the taxa identified recovered at levels K, L, and M.**

*Tab. 3 : Nombre de restes (NR), nombre de restes identifiés par taxon (NISP), restes identifiés par classe de poids, et restes non identifiés, nombre minimum d'individus (MNI), nombre minimal d'éléments (MNE) des taxons identifiés dans les niveaux K, L, et M.*

NMI	Large-sized	Level K			Level L			Level M		
		Medium-sized	Small-sized	Large-sized	Medium-sized	Small-sized	Large-sized	Medium-sized	Small-sized	
Infantile	-	2	1	-	2	1	-	1	2	
Juvenile	-	1	-	-	1	-	1	1	-	
Adult	3	5	-	3	1	-	6	5	-	
Old adult	-	1	-	-	2	-	-	2	-	

**Tab. 4: Minimum Number of Individuals (NMI) per age class according to weight size: large-sized (>300 kg), medium-sized (between 100 and 300 kg) and small-sized (<100 kg) recovered from levels K, L, and M.**

*Tab. 4 : Nombre minimum d'individus (NMI) par classe d'âge et classe de poids: grande taille (>300 kg), taille moyenne (entre 100 et 300 kg) et petite taille (<100 kg) pour les niveaux K, L, et M.*

	Large-sized			Medium-sized			Small-sized		
	K	L	M	K	L	M	K	L	M
Cranial elements	2	8	14	9	10	27	2	1	3
Axial skeleton	3	2	-	11	3	9	2	1	7
Pelvis and scapula	2	1	2	3	2	5	-	-	-
Upper limb	14	7	10	21	17	42	2	-	5
Lower limb	2	2	4	22	9	28	-	-	3
Compact foot bones	1	-	-	6	-	9	5	-	4

**Tab. 5: Minimum number of elements (MNE) recovered at levels K, L, and M, grouped by anatomical segments.**

*Tab. 5 : Nombre minimal d'éléments (MNE) groupés par segments anatomiques pour les niveaux K, L, et M.*

and L, results are supported by data from two species. In level M, we only have one species but a larger number of individuals. No other isolated remain is indicating other season for those levels.

These individuals were hunted during a short period of time in both levels K and L, whereas in level M that period appears to be longer.

When comparing proportions of young individuals versus adults, the highest percentage appears in level L

(40%). Both levels K and M show significantly lower proportions (31% and 28% respectively).

### 3 - NEANDERTHAL ACTIVITIES

Activities related to game processing and consumption are documented through the observation of cutmarks on the bone cortical surface, intentional brea-

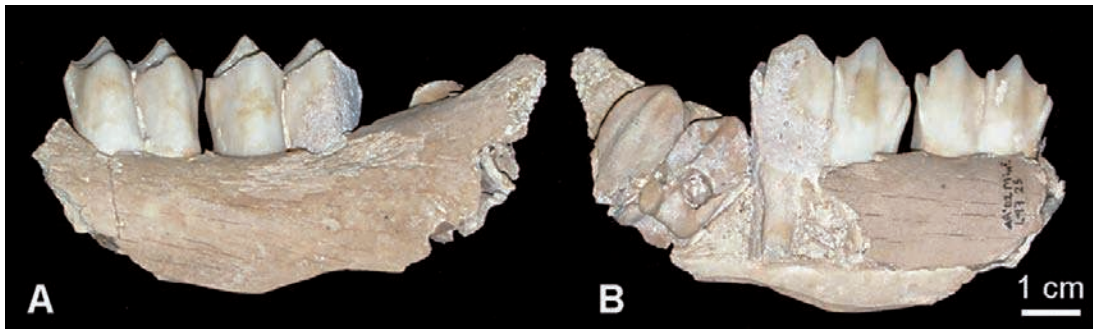


Fig. 2: Right mandible of red deer (*C. elaphus*) with m1, m2 partially unworn, and m3 in eruption (level M, L47-25). Age estimated to 15-17 months. (A) buccal view. (B) lingual view.

Fig. 2 : Mandibule droite de cerf (*C. elaphus*) avec m1, m2 partiellement usée, et m3 en éruption (niveau M, L47-25). Age estimé à 15-17 mois. (A) Vue buccale. (B) Vue linguale.

Level	Species	Teeth	Lat.	Wear Stages (1)	Tooth development scores (2)	Age (months)	Estimated months	Season
Level K	<i>Cervus elaphus</i>	m3	R	1 - 2	4/5	12-14	July/Aug./Sept.	Summer
		m3	R	2	5	13-14	Aug./Sept.	
		dp3-dp4	L	4 - 4	7 - 7	1-2	July/Aug.	
		dp2-dp3-dp4	R	4 - 4 - 5	7 - 7 - 7	1-2	July/Aug.	
	<i>Bos primigenius</i>	M2	R	2	N/A	15-16	Aug./Sept.	
Level L	<i>Cervus elaphus</i>	dp3-dp4	L	4 - 3/4	-	0	June	Spring
		dp4	L	3	-	0	June	
		dp4-p4	R	5 - 1	7	10	May	
	<i>Equus ferus</i>	m3	L	3/4	N/A	20-24	March/June	
		dp4	R	2	N/A	prenat.-0	May/June	
Level M	<i>Cervus elaphus</i>	p4-m1-m2	L	1/2 - 4 - 3	4/5 - 7 - 6	15-17	Sept./ Nov.	Autumn - early winter
		m3	L	3	5/6	16-18	Nov./Dec./Jan.	
		dp4	R	2	9	4-6	Nov./Dec./Jan.	
		m1	L	4	7	5-6	Dec./Jan.	
		m2	R	3	4	5-6	Dec./Jan.	
		m3	L	1/2	4/5	16-17	Oct./Nov.	

Tab. 6: Results of the seasonality analysis in levels K, L, and M. (1) Wear stages from Rivals *et al.* (2004); (2) Tooth development scores for *C. elaphus* from Carter (1998 and 2001). N/A = not applicable.

Tab. 6 : Résultats de l'étude de la saisonnalité dans les niveaux K, L, et M. (1) Stades d'usure d'après Rivals *et al.* (2004); (2) Stades de développement dentaire pour *C. elaphus* d'après Carter (1998 et 2001). N/A = non applicable.

kage, and burning damages on bones of animals of all sizes (tab. 7).

Cutmarks are primarily associated to defleshing, but also to disarticulation and evisceration. According to Villa & Mahieu (1991) the majority of the bone fracturing occurs on fresh bones, most of the fracture surfaces are spiral or longitudinal, with oblique angles and smooth surfaces. The presence of numerous impact points with crescent-shaped notches indicates that Neanderthals intensively exploited the bones to extract and consume the bone marrow (tab. 7).

	K	L	M
Cutmarks	4.7	6.8	3.1
Intentional fracturation	10.5	3.2	2.9
Burning damage	50.7	51.2	61.3

**Tab. 7: Hominid activities (% NR) recovered at levels K, L, and M.**  
*Tab. 7: Traces d'activités anthropiques (% NR) dans les niveaux K, L, et M.*

The percentage of burned elements is significant (tab. 7). Bone remains display various degrees of colouration in relation to the time of heating and their location in the hearth (Stiner *et al.*, 1995). Also, there is a correlation between elements size and the time of heating in the fire. The smallest and calcined fragments are located at the centre of the hearths. In general at Abric Romaní, burned bones are included in the lower degrees of burning and are located around the hearths, in relation to activities of processing and cooking.

#### 4 - DISCUSSION AND CONCLUSION

The selection of the place to establish the settlement is directly related to the availability of resources which assure the survival of the group (Díez & Rosell, 1998). Abric Romaní is a strategic place which offers a large diversity of biotic resources without requiring large displacements around the site. Resources procurement depends of factors such as the procurement strategies, group size, time and energy investment, and availability of the resources.

Combination of zooarchaeological analyses on levels K, L, and M shows that, among the specific diversity existing in the surroundings of the shelter, Neanderthals have preferences for cervids and horse. They have a good knowledge of their territory (Chacón *et al.*, 2007; Fernández-Laso *et al.*, in press) where they realize a differential procurement of the available biotic resources.

Data from each level analyzed (levels K, L, and M) indicated that the game (or at least the young individuals) were hunted during three different periods of the year. Our hypothesis to be tested is that this changes in seasonality will lead to differences in the faunal assemblages which can be characterized through zooarchaeological analyzes.

The young animals recovered from level M were hunted during a period covering an estimated duration of 6 months. This estimation does not have any significant value because it is based on the dental development of

animals' modern relatives. However, in levels K and L the time span covered by our estimation only corresponds to 3 months. In all levels the NMI of the individuals used for seasonality is more or less the same (3 or 4 individuals) whereas the total number of individuals (young to old adults) varies significantly from 10 to 18. In level M, the NMI is the highest (18 individuals), and it is also the level where the seasonality seems to be the longest and the occupation the most intense.

Level L is reported to be the level where the proportion of young individuals is the highest (40% in L vs. 31 and 28% in K and M, respectively), and seems to correspond to an occupation during spring i.e. the season of birth of these animals. These could explain the fact that half of the specimens we studied from that level were attributed to foetus (few weeks before birth) or neonates (0 to 2 months). In the other levels, the proportion of young animals decrease and correspond to seasons when animals are already weaned and maybe more difficult to capture.

In all levels the pattern of game procurement and transport to the shelter is similar. There is a deficit in axial elements. Generally, limb and skull are the only parts to the site. However, medium-sized animals have skeletons more complete. Consequently, animals are first processed at kill-site and the elements having high levels of meat are selected to be transported. This strategy may vary depending on the distance from the shelter, the group size, and the type of processing realized (Binford, 1978, 1988). This procurement and processing behaviour is observed through the whole sequence at Abric Romaní (Carbonell *et al.*, 1992, 1996, 2002; Aïmene *et al.*, 1996; Cáceres, 1998; Cáceres *et al.*, 1998; Rosell, 2001; Vaquero *et al.*, 2001; Cáceres, 2002; Valleverdú *et al.*, 2005; Chacón & Fernández-Laso, 2005a, b; Chacón *et al.*, 2007; Fernández-Laso *et al.*, in press).

In the three levels analysed, there is no significant difference related to animal processing. The elements introduced into the shelter are used in an exhaustive and systematic way for all animal size categories. Activities take place preferentially in natural cavities protected by the ledge of the shelter and are always associated to one or more hearth. In level K it was suggested the existence of two types of remain accumulations: one in the exterior part where are realized the initial processing of the skeletal parts brought to the shelter, and other accumulations inside the shelter corresponding to the final processing and consumption (Chacón *et al.*, 2001; Chacón & Fernández-Laso, 2007). Such patterns of space structuring and activities organization was documented in other middle Palaeolithic sites such as el Salt (Galván *et al.*, 2001), Tor Faraj (Henry *et al.*, 2004), Wallertheim (Adler & Conard, 2005), Les Canalettes (Meignen, 1993) and Grotte Vaufray (Rigaud & Geneste, 1988). They also indicate similar characteristics to those identified in ethnoarchaeological works about hunter-gatherer groups (Binford, 1988; Yellen, 1977; O'Connell, 1987; O'Connell *et al.*, 1991).

This strategy of game procurement and processing requires not only a good knowledge of the territory and



of the game behaviour, but it requires also planning, anticipation, and cooperation of the group.

In levels K, L, and M we only observed small changes in the composition of the animals hunted (different proportions of young individuals). This may be more related to the hunting season (period of occupation at the shelter) than to distinct behavioural patterns of the Neanderthals. There are no significant differences in the activities of the Neanderthal groups in the three levels. We observe the repetition of the same patterns of procurement, processing, and consumption which suggest the existence of a regional pattern of procurement, mobility, and processing of the animal resources. The same behaviour is reported for the vegetal resources which are selected in the surroundings of the shelter (Allué, 2002). Consequently, it exists a preference for particular biotic resources (animal and vegetal), which are selected in a wide variety of available resources.

Except in winter, Neanderthals selected Abric Romaní as a place for their occupations and their settlement patterns keep recurring through time. This behaviour, as suggested by Gamble (1990) and Adler *et al.* (2006), is transmitted from a generation to the next one. Neanderthals are carrying on the knowledge of their territory and it procures a guarantee for their success and survival.

The study of seasonality on assemblages of large mammals brings a better understanding of hominids behavioural ecology. It reveals patterns of site occupation related to the seasons of game migration. The behavioural ecology of hominids was particularly influenced by seasonal changes, especially when seasonality increased cooling periods in Europe (Klotz *et al.*, 2004). The presence of Neanderthal groups at Abric Romaní is thus highly seasonal and the presence of game preys in the area is an important factor conditioning their displacements through the year.

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