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CHARACTERIZATION AND EXPLOITATION OF THE ARCTIC HARE (*LEPUS TIMIDUS*) DURING THE MAGDALENIAN: SURPRISING DATA FROM GAZEL CAVE (AUDE, FRANCE)?

Laure FONTANA*

Abstract: The Magdalenian layers of Gazel Cave yielded more than 8,000 bones and teeth of arctic Hare (*Lepus timidus*) representing at least 84 animals which were brought to the site by humans. Rare cutmarks on the bones and hypotheses about the dismembering patterns suggested 1) a main exploitation focusing on fur and 2) a secondary consumption of cooked (not roasted) meat. The site function and the regional cultural context lead us to consider a specific procurement connected to the exchange of fur.

Résumé: Les niveaux magdaléniens de la grotte Gazel ont livré plus de 8 000 restes de Lièvre variable (*Lepus timidus*) identifiant un minimum de 84 individus, gibier apporté par l'Homme sur le site. Les rares traces présentes sur les os et le schéma de désarticulation reconstitué ont permis de proposer une exploitation ciblée sur la récupération de la fourrure et une consommation plus accessoire de viande cuite non rôtie. La caractérisation du site et du contexte culturel régional a laissé envisager la possibilité d'une acquisition particulière, liée à l'échange de fourrures.

INTRODUCTION

Exploitation of small mammals by Upper Palaeolithic societies is badly documented, for two reasons. Firstly, the proportion of these small game remains (carnivores or lagomorphs) in Palaeolithic sites is often low. Secondly, their study appeared as devoid of interest even if their remains were abundant, and large herbivores have been studied more often. The case of lagomorphs, especially the Hare, is particularly representative since the rare faunal assemblages from European Palaeolithic sites which contain a great amount of Hare remains have seldom been studied in the perspective of patterns of exploitation by humans.

Gazel Cave, located near the foothills of eastern French Pyrénées, 200 meters high (Fig. 1), is rightly one of the rare sites for which the Magdalenian levels delivered more than 8,000 bone and tooth remains of Hare. These remains, corresponding to at least 84 individuals, were associated, in Level 7 (Gif 2655: 15,070 ± 270 BP), with numerous remains of large herbivores (Fig. 2), as well as other less numerous remains of carnivores which probably don't have any link with the human occupation (Fontana, 1998; 1999).

As part of the whole zooarchaeological analysis, the study of this particular assemblage of Hare remains was interesting for several reasons. On the one hand, we had to determine specifically the species of Hare considered and the origin of this sample, either anthropic or natural. In the case of a human activity, it was absolutely necessary to characterize the patterns of procurement and exploitation of this small game in order to understand its status: a game hunted for substitutive or main food or a special game hunted seasonally? Finally,

the comparison of these data with those from rare published studies (e.g., Champréveyres, Robin Hood Cave, Belvis) should allow us to identify similar or diverging patterns of exploitation.

SPECIES IDENTIFICATION

Arctic Hare is well identified during the Würm IV in many French sites from the South-West and the Pyrénées: La Vache (Koby, 1959; Pailhaugue, 1996), Les Eglises (Delpech & Le Gall, 1983), Gourdan (Clot, 1984), Belvis (Fontana, 1998; 1999), La Madeleine, Bois-Ragot (Donard, 1982), Le Fourneau du Diable (Peyrony, 1932; Madelaine, 1989; Fontana, 2001), Laugerie-Haute, le Flageolet I, Roc de Combe (Delpech, 1983). It is more seldom identified in the Massif Central (Abri Durif: Delpech *in* Bourdelle, 1979), in the French Alps (Saint-Thibault-de-Couz: Lequatre, 1994) and in the Paris Basin (Pincevent: David, 1994). In the rest of Europe, it is identified in the Cantabrian area (Altuna & Marriekura, 1996), in Belgium (Cordy, 1992), in Germany (Petersfels: Albrecht *et al.*, 1983), in the United Kingdom (Robin Hood Cave: Charles & Jacobi, 1994; Gough's Cave: Carrant, 1986), and especially in Switzerland (Champréveyres: Morel & Muller, 1997; Rislisberghöhle: Stampfli, 1983; Kesslerloch: Hescheler, 1907; Büttenloch: Schibler & Sedlmeier, 1993; Hollenberg-Hohle 3: Kaufman, 1982; Kastelhöhle: Stampfli, 1959).

In fact, in all of these sites, the brown Hare (*Lepus europaeus*) is not clearly identified¹ and all the large assemblages are related to the arctic Hare. This would indicate that before the end of the Lower Dryas in Western Europe, brown Hare

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¹ Beside arctic Hare remains, other remains of Hare are often grouped by scholars in a category *Lepus sp.*

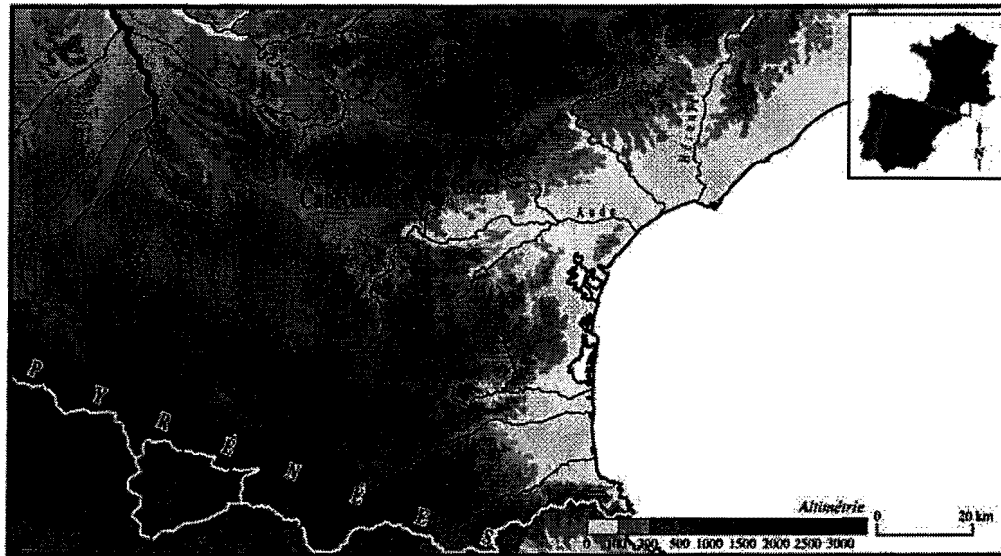


Figure 1: Location of Gazel Cave.

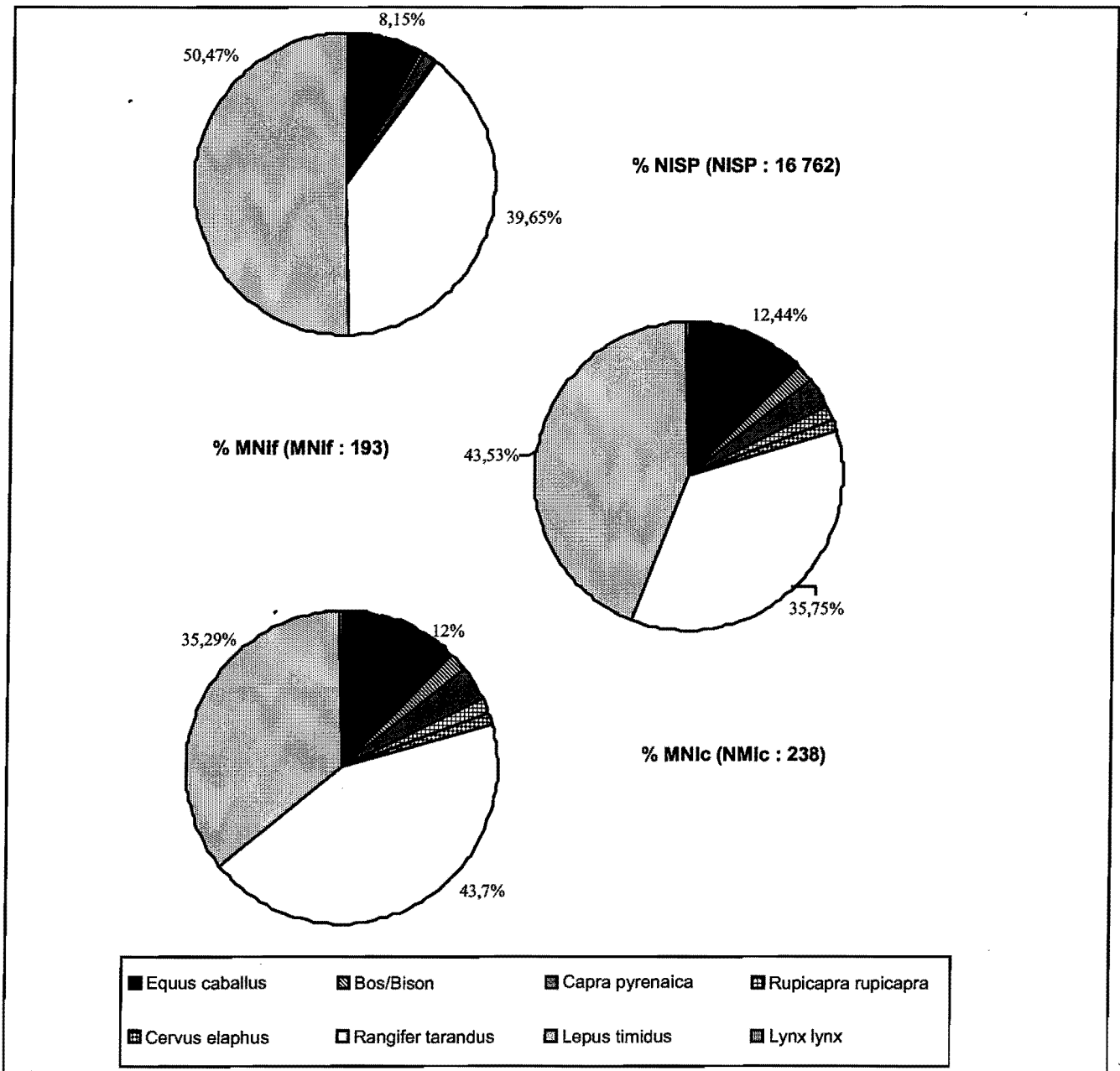


Figure 2: Representation of hunted species at Gazel Cave.

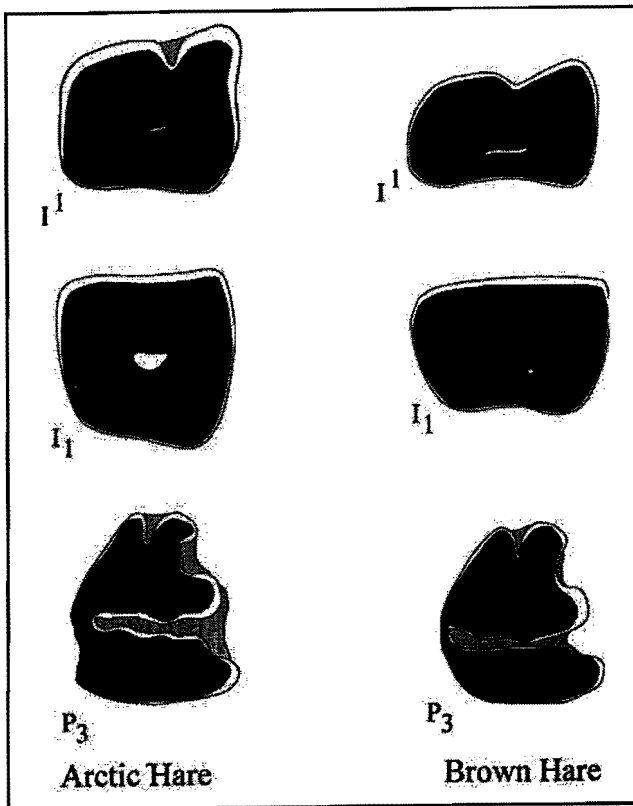


Figure 3: Morphology of *Lepus timidus* and *Lepus europaeus* premolars and incisors (after Donard, 1982, Koby, 1959, and Morel & Muller, 1997).

was missing, at least in the South-Western part (Donard, 1982).

Nevertheless, we had to assure the specific species of Hare present at Gazel Cave, by characterizing the morphology of some teeth and by analyzing the osteometric data.

The morphology of incisors (and the measurement of their section) and some premolars allow us to distinguish arctic Hare from brown Hare (Koby, 1959) (Fig. 3). Based on these distinctive criteria, two major assemblages of Hare remains, i.e., La Madeleine and Bois Ragot, have been identified by E. Donard (1982) as arctic Hare. Her study confirmed that if actual brown hares are larger than actual arctic hares, these latter ones were, during the Upper Palaeolithic, larger than any populations of brown Hare which followed.

In a first step, we observed the features typical of the Gazel Hare lower third premolars (see Fig. 3). These features correspond to *Lepus timidus*. Measurements of the extremities of long bones and of some tarsial bones and girdles confirmed this result. Indeed, values from numerous remains of Gazel (Fig. 4 to 8) fit well within the range of variability of arctic Hare from the end of the Upper Palaeolithic. Similar data have been obtained on Hare remains from Canecaude, Belvis, La Madeleine, Bois Ragot, Champréveyres and Rislisberghöhle (Tabl. 1). If some

Table 1: Osteometric Data on arctic Hare from Gazel, Canecaude, Belvis, La Madeleine, Bois Ragot, Rislisberghöhle and Champréveyres (after Fontana, 1998; Donard, 1982; Stampfli, 1983; Morel & Müller, 1997) DT : breadth / DAP : depth.

SITES	GAZEL				CANECAUDE				BELVIS		LA MADELEINE				BOIS RAGOT				RISLISBERHÖHLE				CHAMPREV.			
	N	Min	Max	X	N	Min	Max	X	N	Min	N	Min	Max	X	N	Min	Max	X	N	Min	Max	X	N	Min	Max	
Scapula																										
DAP neck	97	7,1	9	8							9	7,4	8,6	8,1	24	7,2	8,9	8,2	21	6,3	8,2	7,3				
Humerus distal																										
DT	99	12	13,8	13	5	13	13,1	3	12	45	11,4	13	12	51	11,7	13,8	13	27	10,5	12,9	11,9	5	12	13,2		
DAP	99	8,7	10,5	9,6	5	9,6	10	3	9	45	8,8	10	9,6	49	8,6	10,8	9,7									
Radius proximal																										
DT	74	8,7	9,9	9,3	3	9,1	9,6	3	8,6	44	8,9	10	9,4	40	8,6	10,5	9,5	24	7,9	9,4	8,8	9	8,5	9,2		
DAP	74	5,3	7,2	6,4	3	6,4	6,6	3	5,9	44	5,8	6,7	6,2	40	5,7	7,3	6,2									
Radius distal																										
DT	33	9,2	11,2	10						28	9,9	11	11	20	10,1	12,1	11									
DAP	33	5,6	6,7	6,1						28	5,5	6,7	6,1	20	5,3	6,9	6,1									
Ulna olecranon																										
DAP	81	12	13,7	13						7	12,6	13		12	12,6	13,8	13	16	10,5	12,2	11,4					
HT	75	10	12,4	11	1	11	11	2	12	6	11,3	12		12	10,6	12,1	11									
Pelvis cotyloid																										
DT	75	11	12,4	11	1	10	10,1			25	10,5	12	11	17	10,5	11,8	11									
DAP	75	11	13,3	12	1	11	11,1			25	11,4	13	12	17	11,5	13,3	12									
D Femur end																										
DT	41	19	23	21						10	19,8	21	20	3	19,8	22		4	18,3	20,1						
P Tibia end																										
DT	36	19	22,2	21						6	20,5	23		6	20,8	22,4		3	17,8	22						
DAP	21	20	22,4	20						5	20,5	22		5	19,4	21,6										
D Tibia end																										
DT	62	15	17,2	16	1	16	16,3			20	15	16	16	9	15,2	18,2		8	14,1	15,9		2	14	15		
DAP	62	9,1	10,9	10	1	10	10			23	8,5	9,7	9,1	8	8,5	9,7										
Calcaneum																										
length	77	31	35,1	33						28	31	36	34	29	31,9	36,1	34	22	30,5	34,1	33,1	4	32	33,6		
breadth	76	13	14,5	14						28	12,1	14	13	26	12,1	14,4	13									
Astragalus																										
length	82	16	18,5	17	2	17	17,5	3	17					32	16,5	18,3	18					2	16	15,8		
breadth	82	7	8,5	7,9	2	7,1	8,4	3	7,4					30	6,7	7,8	7,3									
Metatarsal length																										
II	34	50	58,6	55						37	50,5	57	54	17	51	61,8	55									
III	27	52	58,4	55						33	51,6	57	55	19	51,3	59,6	54									
IV	32	50	57	54						36	50,7	57	53	16	50,2	56,2	53									
V	35	45	51,2	47						23	45,2	50	47	13	45,5	51,8	48									

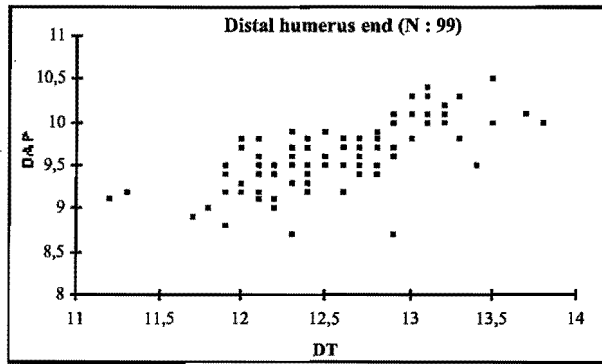


Figure 4: Scatter diagram distribution of arctic Hare humerus measurements (in mm) at Gazel Cave.

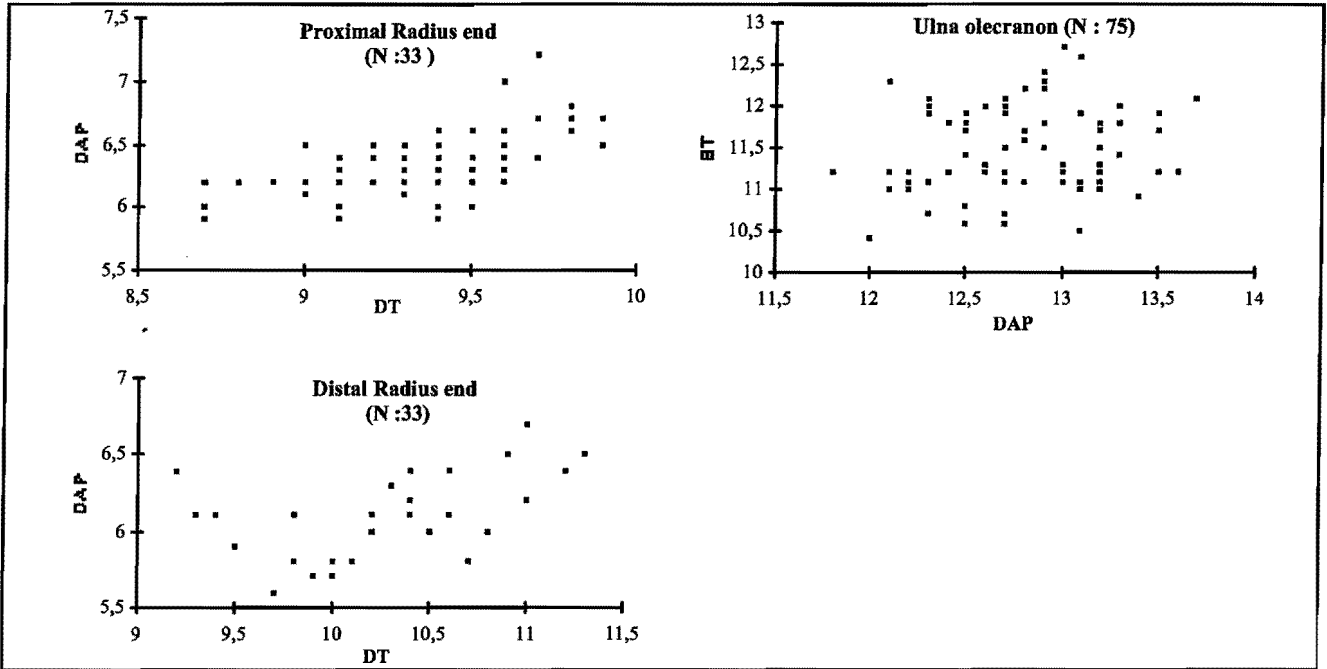


Figure 5: Scatter diagram distribution of arctic Hare radius and ulna measurements (in mm) at Gazel Cave.

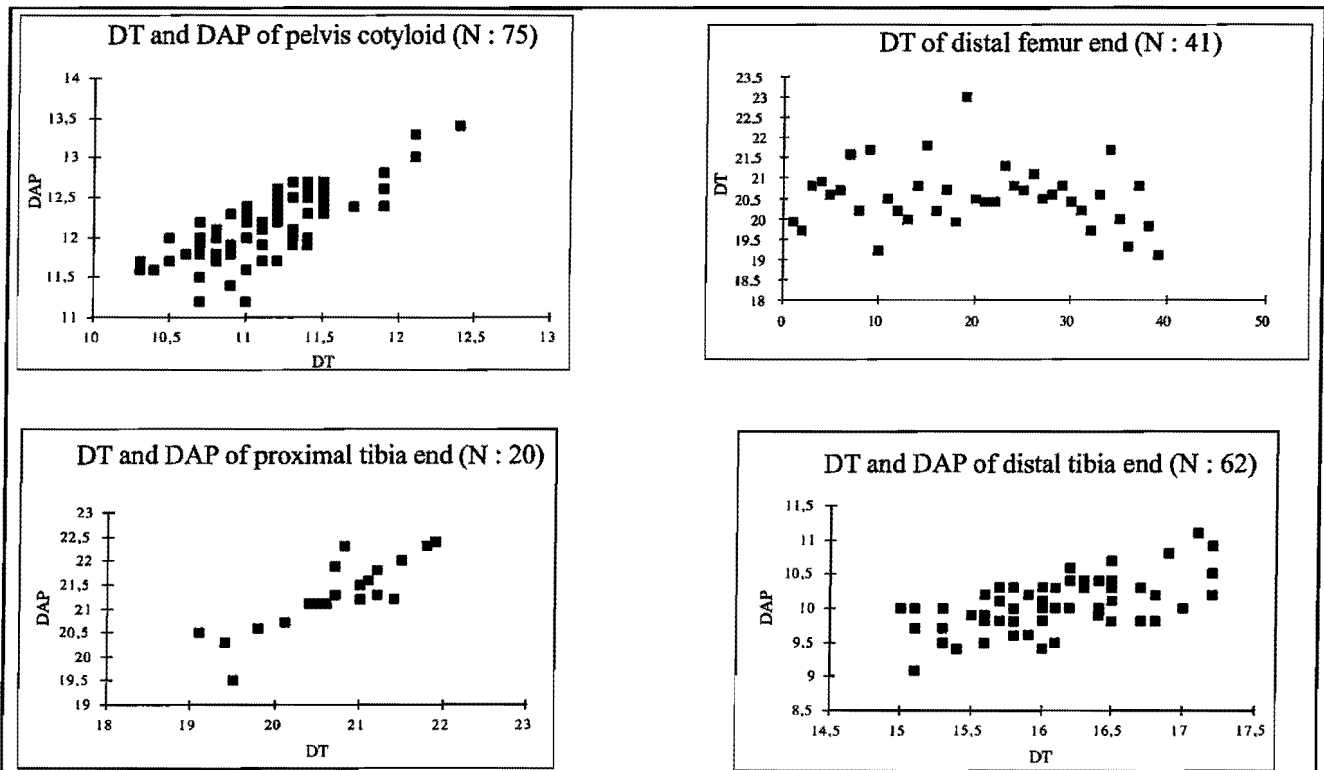


Figure 6: Scatter diagram distribution of arctic Hare pelvis, femur and tibia measurements (in mm) at Gazel Cave.

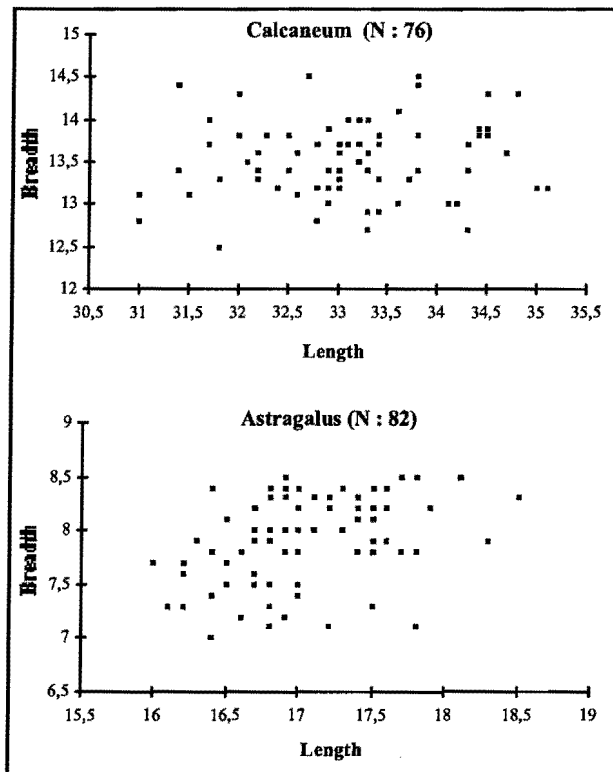


Figure 7: Scatter diagram distribution of arctic Hare calcaneum and astragalus measurements (in mm) at Gazel Cave.

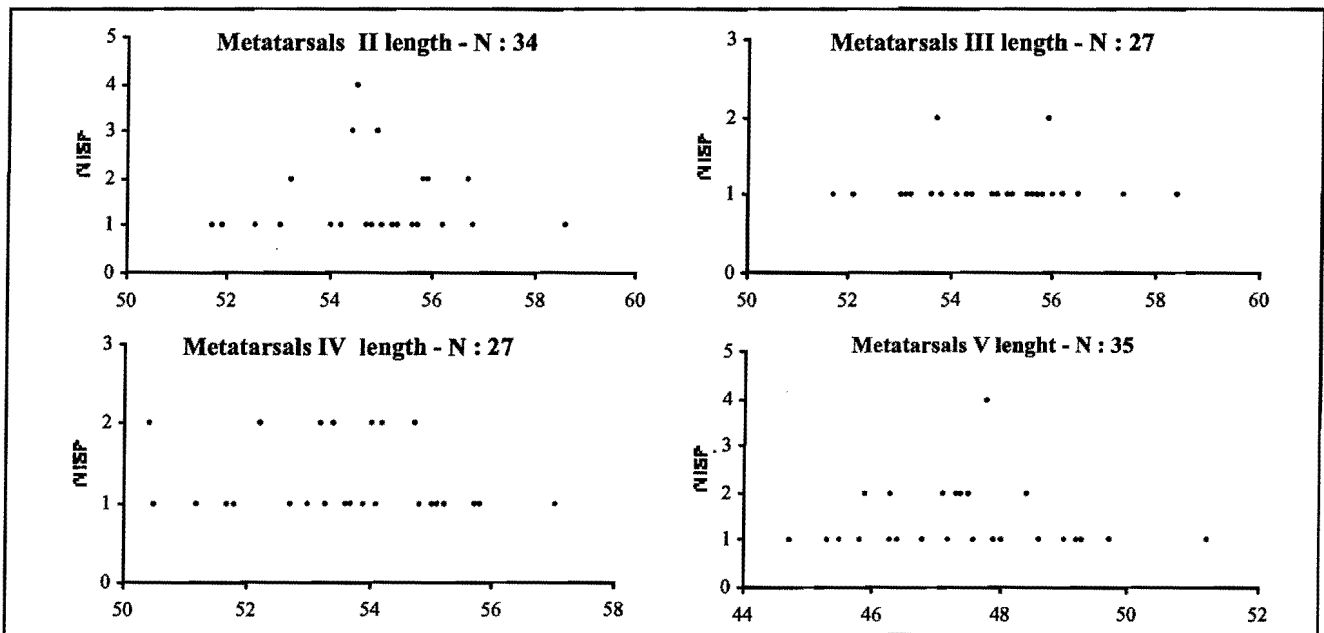


Figure 8: Scatter diagram distribution of arctic Hare metatarsals measurements (in mm) at Gazel Cave.

remains have not been measured (such as ribs, the skull, fractured, phalanges and vertebrae), they have nevertheless been considered as remains of *Lepus timidus*, since they were often found in connection.

The presence of arctic Hare at Gazel Cave confirms the cold nature of the Gazel large herbivorous fauna, which is dominated by Reindeer (see Fig. 2). This cold pattern has probably to do with the Lower Dryas period, but it could also be connected with the hunting season.

ORIGIN OF THE ASSEMBLAGE AND PROCUREMENT PATTERNS

If most taxa identified in Gazel Cave have an anthropic origin, some others have a natural origin (e.g., Rabbit, Hyena, Bear, Wolf, and some birds). The origin of arctic Fox, common Fox and Otter remains has yet to be determined (Fontana, 1998). Based on the proportion of Hare remains (between 35.3% and 50.5% of hunted species, according to the

quantification criteria used, see Fig. 2) it became imperative to solve the question of their origin. We tried to find some evidence of a possible action by humans and/or carnivores, based on 1) an examination of bone surfaces and fragmentation patterns, 2) an analysis of the skeletal parts present, and 3) a study of their spatial distribution.

The presence of some cutmarks (observed with naked eye and binocular) made by a sharp tool revealed immediately a human action on some Hare remains. Does the study of

fragmentation patterns confirm these observations? The pattern of fragmentation of Hare bones is different from that of large herbivores: long bones are less broken (Fig. 9) and a lot of bones are complete or almost complete (vertebrae, carpal and tarsial bones, metapodials, girdles, phalanges). Such characteristics, if observed on large ungulate remains, would lead us to think of a natural origin or a death caused by carnivores. Yet the consumption of this small game does not require a systematic fragmentation of bones, especially if marrow is not wanted. Moreover, the remains don't show

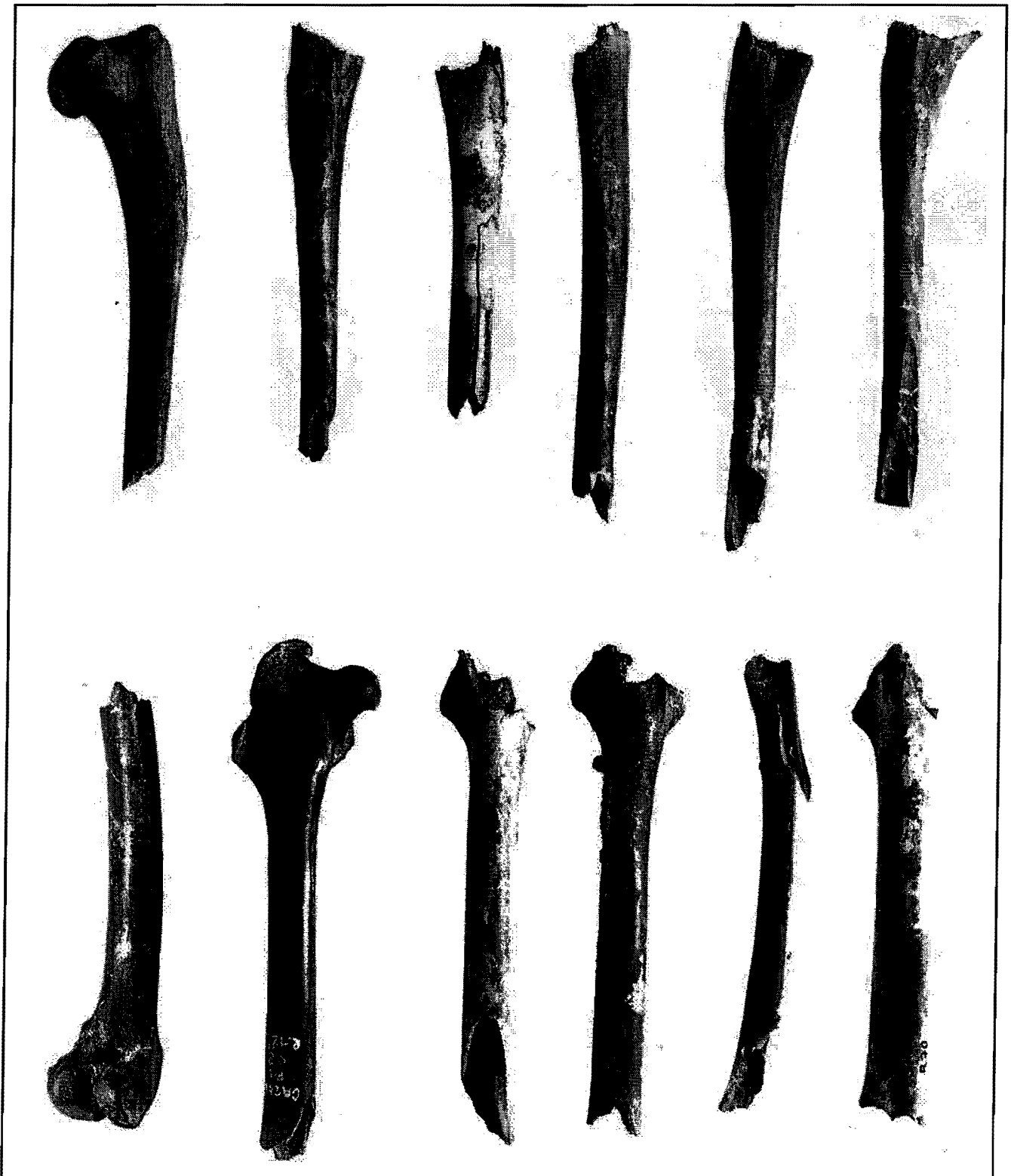


Figure 9: Fragmentation of arctic Hare long bones at Gazel Cave.

Table 2: Detail of main anatomical parts of arctic Hare in connection at Gazel Cave.

Connections	Identified parts
3 metatarsals, 2 sesamoid, 2 phalanges I, 2 phalanges II	1 fore limb end
4 first lumbar vertebrae	part of thorax
4 first lumbar vertebrae	part of thorax
4 first lumbar vertebrae	part of thorax
3 last lumbar vertebrae and 1 pelvis	part of thorax
3 thoracic vertebrae	
7 thoracic vertebrae	
5 last cervical vertebrae	
5 last cervical vertebrae and 12 thoracic vertebrae	3/4 of thorax
4 metatarsals and 5 tarsals	1 fore limb end
25 fragments of ribs	part of thorax

Table 3: Hunting Seasons of main games at Gazel Cave.

	Janu.	Febr.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	References
Reindeer													Fontana, 1999
Equids													
Ibex													
Bovini													
Fishes													

any evidence of action by carnivores, any marks or any fragmentation feature (e.g., cylinder, fragmentation on fresh bone). Finally, if the majority of remains is scattered, many parts of the feet and of the thorax have been respectively discovered in connection as it can be seen in Table 2 (which presents only the most important connections): they correspond to bones in connection discarded altogether, as a result of carcass treatment by humans (see above).

If there is no doubt anymore about the anthropic origin of this assemblage, the lack of evidence did not allow us to understand how this small game was captured (hunting or trapping) or when it was captured (procurement season). In relation to this last issue, even though Hare remains (which are all from sub-adults and adults) did not yield any information, the study of other game brought to Gazel Cave provided some clues. Indeed, Reindeer, Ibex, red Deer and large bovids have all been hunted between the end of Autumn and the Spring. Therefore the major phase of hunting has taken place during the Winter (Tabl. 3). So it is likely that Hare have been hunted during the same time of the year. Does it mean that the main goal of this Winter game procurement was to get fur?

EXPLOITATION PATTERNS

Were arctic hares from Gazel Cave brought entire onto the site? What were they intended to and which were the carcass-processing activities? These latter ones can be revealed 1) by the study of marks sometimes left when skinning, disarticulation, dismemberment and meat extraction take place, but also 2) by the study of skeletal part frequencies, of bone fracturation and of discard patterns.

Is the whole sequence of exploitation present on site?

The analysis of skeletal part frequencies will allow us to answer this question. In many cases, the frequency of skeletal parts is differential and, in theory, it is the results of three factors: What humans brought in, what was preserved and what the zooarchaeologist succeeds to identify. Therefore we tried to identify the role of these various factors in the skeletal part frequencies of Gazel hares. The representation of skeletal parts frequencies is based on the percentage of observed parts² and reveals many important aspects (see Tabl. 4 and Fig. 10):

- All the bones but the caudal vertebrae are present, which demonstrate that entire hares were brought onto the site.
- If frequencies show some differences, they can be explained by the size of the bones. Indeed, the presence of the smallest bones (carpals, little cuneiforms, sesamoids) never exceeds 5% of observed parts, and the proportion of bones which are slightly larger (big cuneiform, patella, first metacarpal, sternum, cuboid, and second and third phalanges) is a bit higher (up to 31% of observed parts), even if it never reaches values close to those of the largest bones. These low values are therefore related to the poor recovery of these bones during the excavation and the sieving (as demonstrated by Shaffer, 1992).

Some other parts which are better represented are still under-represented, such as the skull (35.7%), and the

² Ratio between Minimal Number of Skeletal Parts and expected body parts (compared to the highest value of MNI, which is 84 at Gazel Cave), see Fontana, 1998 and Tabl. 4. That is which Lyman calls the % survivalship values (1994).

Table 4: Skeletal Part Frequencies of arctic Hare at Gazel Cave.

* : number of bones for each skeletal part; ** : % of Observed Parts (% survivorship).

Skeletal parts	NISP				NME				MNif	MNic	b*	%PO**
	R	L	indet.	Total	R	L	indet	Total				
Skull	60	71	403	534	28	32		60	32	32	2	35,71
Maxilla	55	65		120	38	42		80	42	42		
Upper isolated cheek teeth	138	122	57	317	14	11	5	30	17	17		
Upper isolated incisors	32	41		73	0	0		0	0	0		
Total upper jaw	225	228	57	510	52	53	5	110	59	59	2	65,48
Mandible	98	110		208	61	59		120	61	61		
Lower isolated cheek teeth	106	101	38	245	8	5	5	18	11	11		
Lower isolated incisors	21	20		41	0	0		0	0	0		
Total lower jaw	225	231	38	494	100	98	5	138	72	72	2	82,14
Sternabra				30				7	7	7	1	8,33
Ribs				1310				514	28	28	24	25,5
Atlas				38				38	38	38	1	45,24
Axis				41				37	37	37	1	44,05
Cervical III				65				61	61	61	1	72,62
Cervical IV				62				59	59	59	1	70,24
Cervical V				46				43	43	43	1	51,19
Cervical VI				42				41	41	41	1	48,81
Cervical VII				50				48	48	48	1	57,14
Total cervicals III-VII				265				252	59	59	5	60
Thoraïc				369				305	33	33	12	30,26
Lumbar				390				371	31	31	7	63,1
Sacrum				48				34	34	34	1	40,48
V. indet.				54				54				
Total vertebrae				1205				1091				
Scapula	90	89	15	194	74	79	4	157	83	83	2	93,45
Humerus	129	148	17	294	77	84	6	167	84	84	2	99,4
Radius	86	98		184	52	69		121	72	72	2	72,02
Ulna	79	95	1	175	66	72		138	77	77	2	82,14
Carpals				64				64	10	10	16	4,76
Metacarpal I	10	8		18	10	8		18	10	8	2	10,71 (17,86)
Metacarpal II	46	44		90	46	44		90	46	46	2	53,57 (60,71)
Metacarpal III	52	43		95	52	43		95	52	52	2	56,55 (63,69)
Metacarpal IV	55	40		95	55	40		95	55	55	2	56,55 (63,69)
Metacarpal V	44	37		81	44	37		81	44	44	2	48,21 (55,36)
Metacarpal indet.			76	76				60	6	6		
Total metacarpals	207	172	76	455	207	172	60	439	55	55	10	
Pelvis	100	102		202	82	74		156	82	82	2	92,86
Femur	166	160		326	69	67		136	69	69	2	80,95
Patella	26	14		40	26	14		40	26	26	2	23,81
Tibia	158	128	23	309	84	76	6	166	84	84	2	98,81
Calcaneum	56	57		113	56	57		113	57	57	2	67,26
Astragalus	58	56		114	58	56		114	58	58	2	67,86
Naviculo-cuboid	36	32		68	36	32		68	36	36	2	40,48
Cuboid	31	20		51	31	20		51	31	31	2	30,36
Large cuneiform	8	12		20	8	12		20	12	12	2	11,9
Total tarsal	189	177		366	189	177		366	58	58	12	36,31
Metatarsal II	35	27		62	35	27		62	35	35	2	36,9 (52, 98)
Metatarsal III	20	24		44	20	24		44	24	24	2	26,19 (38,69)
Metatarsal IV	39	36		75	39	36		75	39	39	2	44,64 (64,29)
Metatarsal V	32	46		78	32	46		78	46	46	2	46,42 (67,26)
Metatarsal indet.			128	128				116	15	15		
Total metatarsals	126	133	128	387	126	133	116	375	46	46	8	
Phalanx I				640				640	36	36	18	42,33
Phalanx II				366				366	21	21	18	24,21
Phalanx III				393				393	22	22	18	25,99
Sesamoids				20				20	1	3	36	0,66
Total				8.381				5.664	84	84		

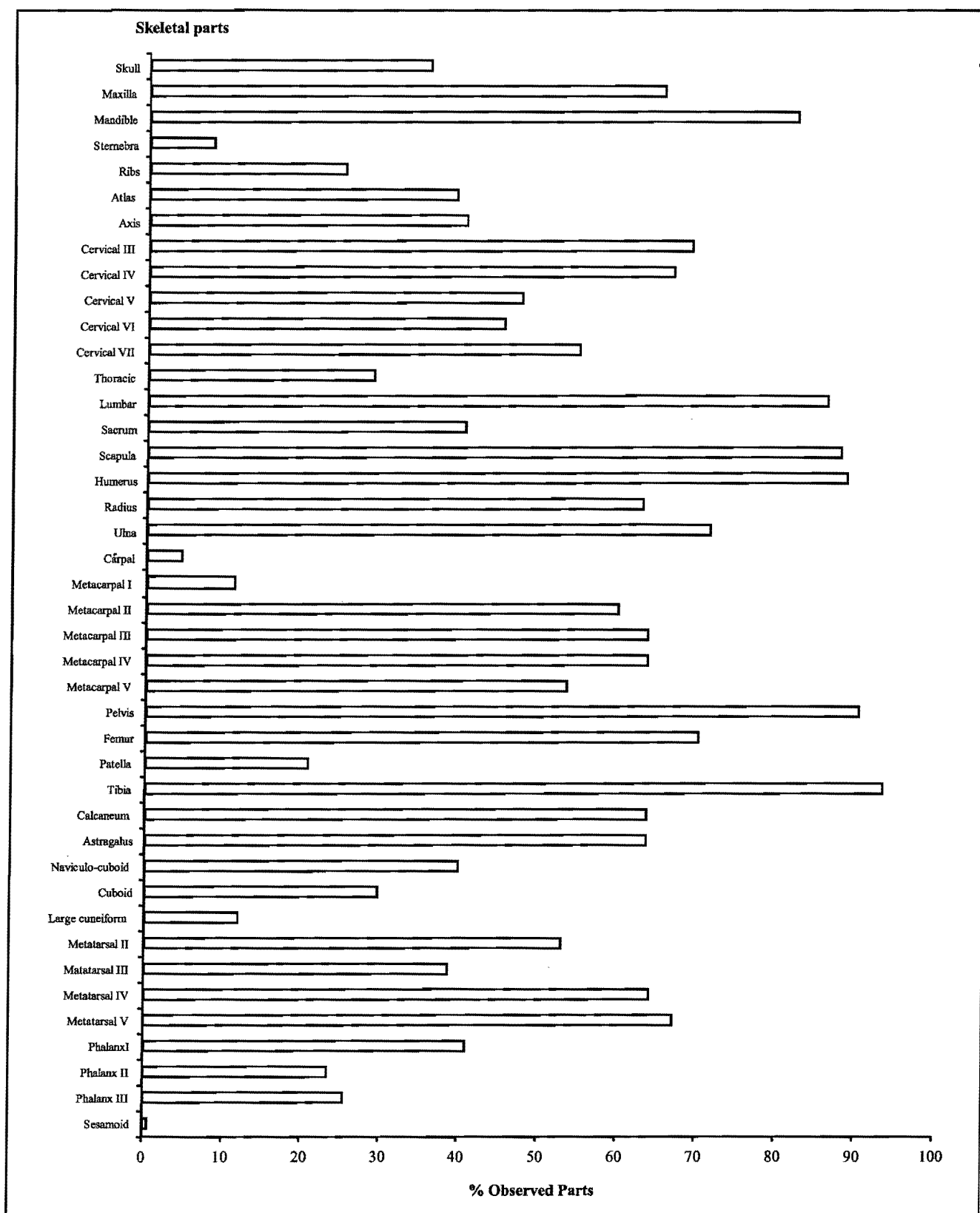


Figure 10: Skeletal Part Frequencies of arctic Hare (NMPS: 5429) at Gazel Cave.

thoracic (30.3%) and sacral (40.5%) vertebrae. Their high degree of fragmentation may be responsible for this apparent under-representation. Ribs are even more broken and it is quite likely that numerous fragments are now among the 200,000 indetermined faunal remains. Among the cervical vertebrae, the atlas and axis are the less represented. This can probably be explained by the fact

that sections of vertebrae and ribs discovered together never include atlas and rarely axis: these bones have been more dispersed (and also more fragmented). Finally, all the other skeletal parts are better represented, reaching consistently more than 60%, and even 80% in the case of the mandible, tibia, humerus as well as the scapula, lumbar vertebrae and pelvis.

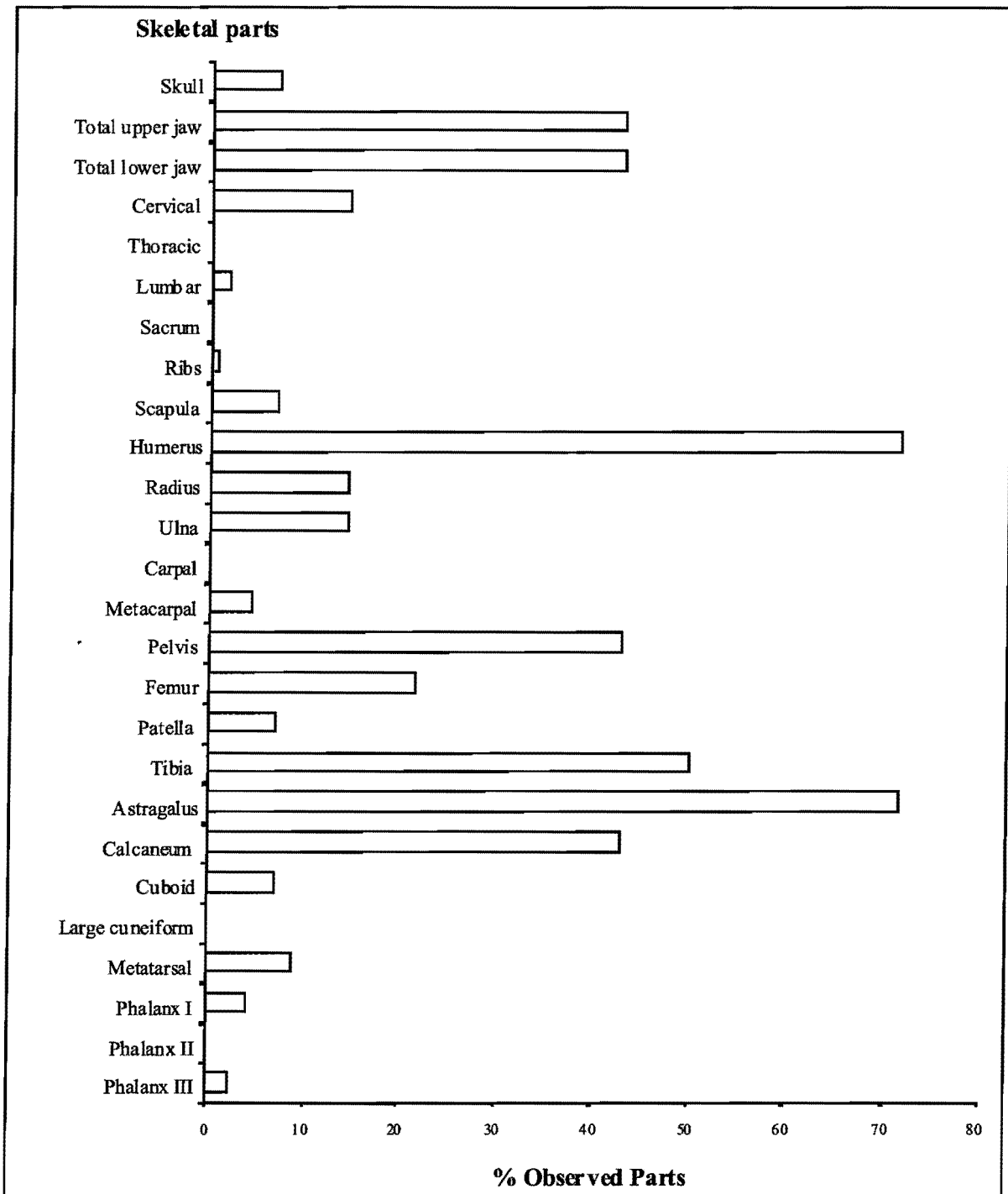


Figure 11: Skeletal Part Frequencies of arctic Hare (NMPS: 96) at Belvis.

It becomes clear then that entire hares have been brought in, and that their complete carcasses have been exploited and left on the site.

In fact, this frequency of skeletal parts makes it different from the others because of its homogeneity which is particularly remarkable for a species hunted by humans. Indeed, despite an important variability in frequencies, the values for the skeletal parts under-represented are consistent when compared to those on hares of Belvis and Champréveyres (Fig. 11 & 12) and especially those of large ungulates, for instance the reindeers of Gazel Cave, also brought entire (Fig. 13). More generally, the skeletal part

frequencies of ungulates killed are not as consistent: values beyond 50% of observed parts are rarely observed, especially concerning the limb bones (Fontana, 1998; 2001). Could this particularity allow us to suggest that the preservation rate of Hare skeletal parts is very close to our values and that this pattern for the Gazel Cave hares represent a good model of preservation which could serve as a reference? Data about the preservation potential of leporid bones are indeed available, such as the recent study by Pavao and Stahl (1999) which concerns the structural density of leporid bones. These studies document that the various skeletal parts don't have the same structural density and that «the majority of high-density leporid scan sites tends to be concentrated in the hind

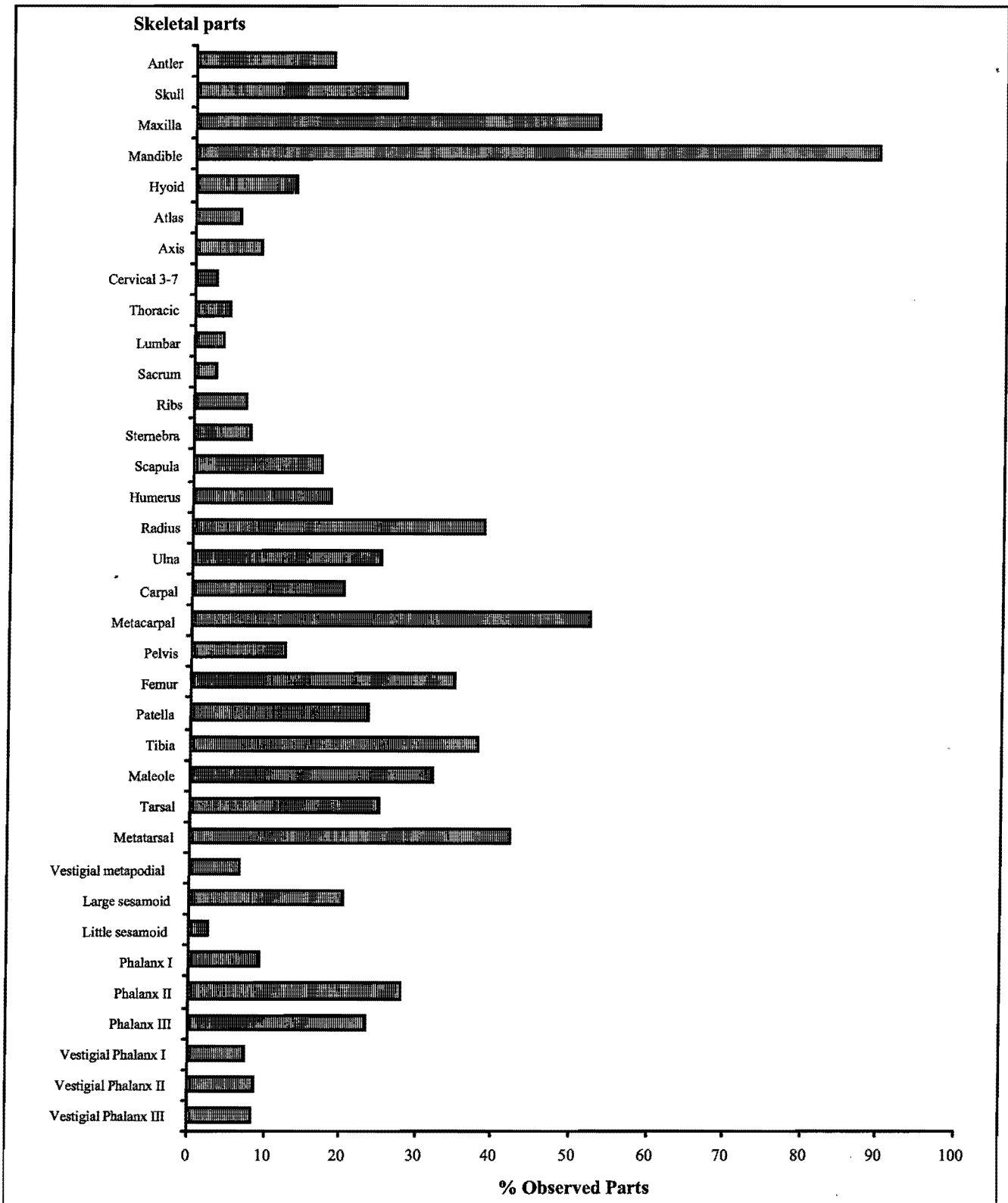


Figure 13: Skeletal Part Frequencies of Reindeer (NMPS: 1971) at Gazel Cave.

Shall we conclude that only a few bones from particular parts have been dismembered? The further analysis of skeletal part connections and frequencies demonstrates that other parts have been dismembered. Indeed, some extremities of hind and fore limb have been found *in situ* and in connection, with sometimes all the bones (see Tabl. 2): carpal/tarsial bones, metapods, phalanges, sesamoids. Yet the tibia and radius/ulna have never been found in connection with

respectively tarsial bones and carpal bones. These data allow us to conclude that the limb extremities were separated from the rest of the body without (but one exception) leaving any cutmarks. Parts of the thorax have also been found in connection: lumbar vertebrae or all thoracic vertebrae, or cervical vertebrae without the atlas, or the whole thorax (without atlas) with the ribs but without the sacrum and caudal bones. Many different cases exist but they all testify that the

Table 5: Detail of butchery and burning marks on arctic Hare bones at Gazel Cave.

Skeletal parts	NISP	NME	Marks NISP	Types	Burning
Scapula (neck)	185	148	10	Dismembering	3
Humerus head			5	Dismembering	
Humerus shaft	271	149	17	Butchering	
D Humerus end			1	Dismembering	
Femur shaft			0		1
Patella	35	35	0		1
P Tibia end			2	Dismembering	
Tibia shaft	293	157	2	Butchering?	
D Tibia end			2	Dismembering	
Calcaneum	107	107	1	Dismembering	1
Astragalus	107	107	1	Dismembering	1
Metatarsal	379	375	0		1
Total	8460	5429	41(0,48%)		8

thorax was detached with the ribs, even though no cutmarks can attest it. Skeletal part frequencies confirm the way hares have been dismembered: radius-ulna, humerus-scapula, talus-calcaneus, pelvis-femur-tibia, phalanx, metapodials, mandibles and maxillars, cervicals III to VII (see Fig. 10 & Fig. 15). Nevertheless, if the splitting of limb extremities, thorax, ribs and limbs becomes obvious, some other aspects need to be clarified. Is the head detached from the first cervical vertebrae, as this latter one has never been found in connection with the others and does not bear any marks? Were the pelvis and thorax kept together?

Because the dismembering process has been documented by cutmarks (even rare ones) and by skeletal part frequencies, we can conclude that not only the few Hare remains which bear cutmarks but all hares have been dismembered at the site. This conclusion is essential because it is a convincing argument for meat consumption which is not evident, as we will see now.

Butchery marks, which gives evidence of meat removal, are very few (19) and are almost always located on a single bone shaft, on the humerus (with two exceptions concerning the tibia) (see Fig. 14). If these marks bear witness to meat removal, it appears to be raw meat. Nonetheless, such a removal has not concerned much meat (no evidence of systematic raw meat scraping), as opposed to cooked meat. If the systematic limb dismemberment and rare cutmarks demonstrate meat consumption, can we characterize more precisely this consumption? First of all, the thorax has almost never been dismembered and the adjoining meat has not been consumed, as many thoraxes were found complete and in connection. Furthermore, burning marks, supporting cooking evidence, are rare: three on scapula, one on talus, one on calcaneus, one on patella, one on metapodial and one on a femur shaft (see Tabl. 5). Limb extremities were probably not connected during cooking, but the small amount of burning marks (notably on distal ends of metapods) is insufficient to document roasting (see Vigne *et al.*, 1981; Vigne & Marinval-Vigne, 1983). Should we then suggest another type of processing, such as boiling? This question

is important because Hare meat is very poor in lipids (in other words in fat) during the Winter, and its proteins are harder to digest (Speth, 1991). If, as we argue, hares at Gazel Cave have been hunted during the Winter, it becomes difficult to believe that the Magdalenians roasted hares, losing in this process the little fat available, which is as essential as proteins (Speth, 1991). It is most likely that hares were consumed following a type of processing which involved boiling³. In the same sense, Charles and Jacobi (1994: 14) note that a way for this dry meat to become tender is «... by hanging and/or soaking the carcass before cooking».

If the Magdalenians from Gazel Cave dismembered hares and removed and boiled the meat before consumption, did they also extract the marrow? Bones are much less fractured than those of Champréveyres and Robin Hood Cave and to a lesser degree from those of Cancaude and Belvis caves. Fracturation of limb bones is very different from that of large herbivores: many long bone shafts are complete (see above); metapodial fracturation is not systematic; and the first phalanges are not broken. As opposed to Champréveyres where Hare bones bear witness to a systematic marrow extraction by the Magdalenians (Morel & Müller, 1997)⁴, at Gazel Cave it seems that marrow extraction has not been systematic⁵, even if the limb bone fracturation and the type of cooking make the consumption of marrow possible. Nevertheless, marrow could have been extracted by other methods, that is not by intense breaking of the bones but just by boiling them.

³ «Rabbit soup» was still one of the dishes consumed in France at the beginning of the 20th Century (M.-C. Marinval, pers. comm.).

⁴ At Champréveyres, «The most fragmented long bones are the humerus, femur and tibia, that is those which have the largest medullary cavity. Metapods and first phalanges are also broken, which is almost never the case for the marmot. One will note in particular that metatarsals show a recurring transversal fracturation just above the distal articulation. All of these bones have a medullary cavity and seem to have been systematically exploited in a more regular manner than those of the marmot» (Morel and Müller, 1997, p. 88)

⁵ It is more difficult to express an opinion for Cancaude and Belvis.

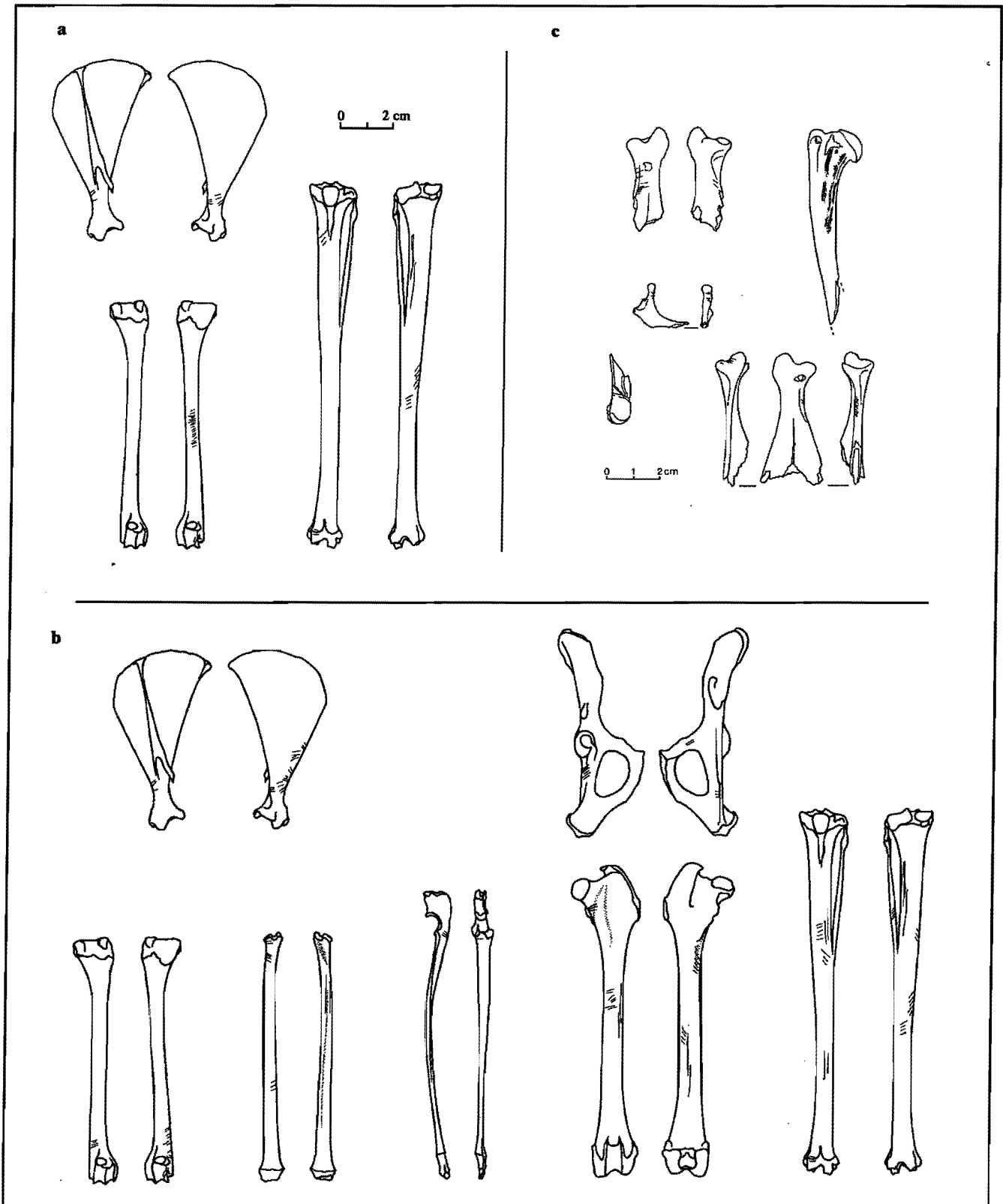


Figure 14: Dismemberment and butchery marks on arctic Hare bones. a: Gazel Cave (redrawing after Morel & Müller, 1997); b: Champréveyres (Morel & Müller, 1997); c: Robin Hood Cave (Charles & Jacobi, 1994).

All of these data suggest then that the carcass exploitation was far from intensive, based notably on the selective consumption of some body parts, and perhaps on the low degree of marrow extraction. Does this mean that meat consumption was minor compared to another goal, such as fur procurement?

Fur exploitation

Marks of skin removal have not been identified, which is not surprising: the skull is too fragmented and if limb bone extremities don't bear any marks, it is because skin removal does not always leave any marks. The only clue of such an

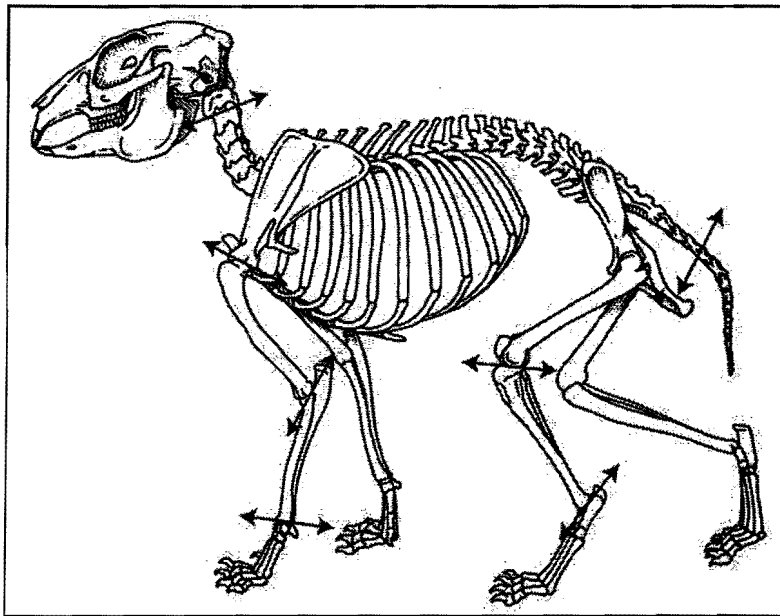


Figure 15: Dismemberment Patterns suggested for arctic Hare at Gazel Cave.

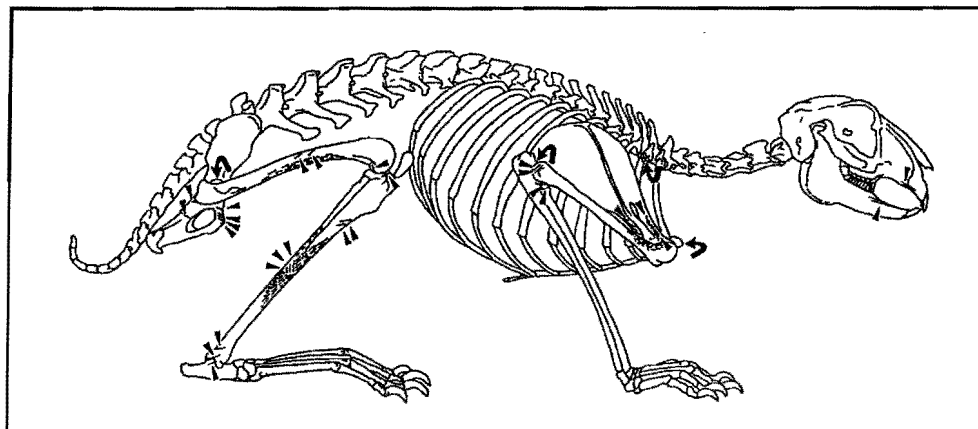


Figure 16: Location and orientation of butchery marks on skeletons of *Lepus timidus* at Robin Hood Cave (Charles & Jacobi, 1994).

exploitation is based on the removal of the tail (associated with the skin) from the rest of the body, which is suggested by the absence of caudal vertebrae (and the small amount of patella?). No taphonomic process can explain the absence of caudal vertebrae, notably the first ones, since their size is larger than that of sesamoids and patella, which are present.

So many evidence lead us to think about Hare skin removal in Gazel Cave: the absence of caudal vertebrae, the great number of hunted hares (even if there are many occupations), the site occupation in the Winter and the obvious significance of such a material during this season.

WHAT IS THE ROLE OF THE ARCTIC HARE AT GAZEL CAVE ?

A targeted exploitation?

We suggest that the consumption of Hare meat was secondary, because of the non intensive exploitation of carcasses,

particular for meat removal, and the low rate of lipids in Hare during the Winter (if hares were effectively hunted during the bad season). Moreover, this procurement of hares took part in hunting activities focusing on large herbivores, mainly Reindeer and Horse (which represent a total of 154 individuals compared to the 84 hares). Large herbivore carcasses have been exploited in a different way than hares: systematic removal of meat, marrow, skins, tendons and antlers. In the same way, the removal of Hare tibia has not been documented, as opposed to Champréveyres which gives great evidence of intensive exploitation similar to that at Robin Hood Cave (where hares were likely to be the only animal consumed: Charles & Jacobi, 1994) (Fig 16).

How can we explain this significant exploitation of hares in Gazel Cave as opposed to other Magdalenian sites? This site is among those which delivered the largest amount of arctic Hare remains with an anthropic origin, in Western Europe⁶.

⁶ We still do not know the number of arctic Hare remains at Bois Ragot, which could be higher than at Gazel Cave.

Was the population size of arctic Hare that large around 15,000 uncal. BP, especially in the Montagne Noire or was the Dryas I period particularly favorable to its abundance? We cannot answer this question due to a lack of comparative material, as the occupation at Gazel Cave is, for now, one of the rare Magdalenian one which delivered dates around 15,000 uncal. BP in all of the Pyrenean area. In Gazel Cave, the large amount of Hare remains, usually associated with a cold environment, may be related to a climatic period particularly cold. Nevertheless, other sites located in South-West France have been occupied during the Dryas I, but hares have not been as intensively hunted as at Gazel Cave (see above). Thus the supposed abundance of this game around Gazel Cave is not the only reason which may explain this important hunting pattern: hares have probably been abundant in other geographical areas and in other Upper Palaeolithic periods; nevertheless they have not generally been captured in such a high amount as at Gazel Cave. Moreover, the arctic Fox (*Alopex lagopus*), another game sometimes hunted for fur and meat, and usually associated with a cold environment, has not been exploited this way, neither in the Montagne Noire nor in the Pyrenean area. Its exploitation is still rarely documented, except in the Alps area, such as Romanelli Cave (Compagnoni *et al.*, 1997). In sum, Gazel Cave hares seem to reflect a real human choice by a Magdalenian group, notably for a small species with fur.

Fur as a trade good?

Was this type of procurement (in this area, in this number, during this season and beside the large herbivore hunting) shaped by the specific purpose of fur? Was the fur intended for clothes worn by the group members or was it considered as trade goods? This question is essential because Gazel Cave is a particular site as indicated by the zooarchaeological study as well as various studies performed on the other archaeological remains (especially the parietal art). This site bears witness to a large and important Magdalenian occupation during the cold season, for probably four or five months (Fontana, 1998; 1999). Remains of lithic and bone industry are numerous, as well as parietal and mobiliary art (Sacchi, 1986; 1990) and jewelry objects, including shells (Taborin, 1994). Gazel Cave is in fact one of the greatest sites of the Pyrénées, dated back to the Middle Magdalenian (Sacchi, 1990; 1991). Analysis and interpretation of our zooarchaeological data had led us to consider that one of the main feature to understanding this site was its geographical location. We had suggested that archaeological sites in the Montagne Noire (including Bize, Canecaude and Lassac) were all sharing similar characteristics: long term occupations, always during the cold season and in strong relation with Reindeer hunting (and arctic Hare at Gazel Cave). We had also put forth the hypothesis that the supposed absence (or rarity) of human groups in this area between the end of Spring and the start of Autumn could be related to group mobility patterns, notably the procurement of the blond flint, which is of non local origin, but its precise source area is still unknown (Fontana, 1998; 1999; in press). But more importantly, Y. Taborin (1994) suggested, based on a her study of shells from various French Upper Palaeolithic sites, that the Western Languedoc area (between the Atlantic

Ocean and the Rhône valley) could have been an intermediate zone in the movement of shells and a very favorable region for trade. Therefore why could other goods such as Hare fur not be exchanged, as they were intended to be worn in the same manner as jewelry? Such a hypothesis could help explain why Gazel Cave is currently the only site in the large Pyrenean area to suggest an intensive exploitation of Hare fur.

CONCLUSION

In the course of this study we tried to identify the precise species of Gazel Hare and its exploitation patterns, and so we wondered about the role of this small game in the economic system of Magdalenian groups who lived on this site. It appears that this exploitation is, in the current state of research, a very special one, for two reasons: 1) a consumption likely of secondary importance in comparison with the main purpose of this procurement, i.e., fur removal, maybe on a large scale; and 2) the possible destination of these fur, treated as important trade goods in this area. The unique pattern in the exploitation of hares at Gazel Cave is obvious when compared to other areas because if the arctic Hare has been hunted there also for meat and fur, this latter exploitation has never been as important as at Gazel.

Does the arctic Hare status in the Magdalenian economic system correspond to an occasional, complementary game hunted for both procurements (meat and fur), with only few exceptions (e.g., Gazel Cave)? Or was fur procurement a more common practice, yet in a different procurement pattern which would not have left any archaeological witness? We could also suggest that fur removal was elsewhere in the settlement system, in specialized activity sites, at the end of a hunting day or after trapping. Finally, was the arctic Hare a seasonal resource? At Gazel and Canecaude caves, hares were probably killed during the cold season, whereas they were captured during the Summer at Belvis Cave and during the Spring and/or Autumn at Champréveyres. Therefore, based on the available data, it appears that some variability exists regarding the season for hunting arctic Hare. If the capture of arctic Hare can be easy (Morel & Müller, 1997), particularly during the Winter (Nelson, 1983, cited in Charles & Jacobi, 1994), the dietary intake in term of meat and fat of this low risk procurement is nevertheless very minimal, especially during the cold season (see above). Hare hunting is also less interesting that Reindeer hunting which is a low risk activity (Fontana, 2000) but a more productive one, particularly if we consider fat and meat as a priority, notably for a diet based otherwise on a consumption of low-fat meat (see above; Speth, 1983; 1991).

We could thus suggest that the procurement of arctic Hare during the cold season was aimed at obtaining a specific kind of fur (preferred to that of Fox, probably less numerous), intended to be exchanged, and maybe carrying a special status. During the rest of the year, Hare procurement would have been different (fewer individuals), related more to meat consumption and fur removal (of a different color). We

suggested a hypothesis concerning the annual organization of large herbivore procurement, in relation with the Reindeer seasonal status in human group economic systems in Southern France, based on the evidence that Reindeer procurement was contributing the least during the end of Spring and the Summer (Fontana, 2000; 2001). We also wondered in favor of which animals this seasonal choice had taken effect: was arctic Hare one of these species? On-going studies of other assemblages will help us to answer this question.

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References

- ALBRECHT, G., BERKE, H. & POPLIN, F., 1983, Restes de mammifères du Petersfels P1 et Petersfels P3, fouilles 1974-1976. In *Recherches scientifiques sur les inventaires magdaléniens du Petersfels, fouilles 1974-1976*, edited by G. Albrecht, H. Berke & F. Poplin. Tübingen: Verlag Archaeologica Venatoria, Institut für Urgeschichte der Universität Tübingen, p. 63-127.
- ALTUNA, J. & MARIEZKURRENA, K., 1996, Faunes de mammifères des gisements magdaléniens du pays Basque et zones limitrophes. In *Pyrénées préhistoriques ; Arts et sociétés*. Actes du 118^e Congrès des sociétés historiques et scientifiques (Pau, 1993). Paris: CTHS, p. 149-162.
- BOURDELLE, Y., 1979, L'abri Durif à Enval : commune de Vic-le-Comte (63). In *La fin des Temps glaciaires en Europe. Chronostratigraphie et Ecologie des cultures du Paléolithique final*, edited by D. Sonneville-Bordes. Actes du Colloque CNRS, n. 271. Paris, vol. 2, p. 523-530.
- CHARLES, R. & JACOBI, R.M., 1994, The lateglacial fauna from the Robin Hood cave, Cresswell crags: a re-assessment. *Oxford Journal of Archaeology* 13 (1), p. 1-32.
- CLOT, A., 1984, Faune de la grotte préhistorique du bois du Cantet (Espèche, Hautes-Pyrénées, France). *Munibe* 36, p. 33-50.
- COMPAGNONI, B., CURCI, A. & TAGLIACCOZZO, A., 1997, Exploitation of the fox in the epigravettian levels of grotta Romanelli. In *Actes du 7^e colloque international d'archéozoologie (1994)*, edited by M. Kokaby & J. Wahl. *Anthropozoologica* 25-26, p. 319-328.
- CORDY, J.-M., 1992, Le contexte faunique du Magdalénien d'Europe du Nord-Ouest. In *Le peuplement magdalénien. Paléogéographie physique et humaine*. Actes du colloque de Chancelade. Paris: CTHS, p. 165-175.
- CURRENT, A.P., 1986, The late glacial Mammal fauna of Gough's Cave, Cheddar, Somerset. *Proceedings University of Bristol Spelaeology Society* 17 (3), p. 286-304.
- DAVID, F., 1994, La faune de mammifères de Pincevent et Verberie. In *Environnements et habitats magdaléniens dans le centre du Bassin parisien*, edited by Y. Taborin. Paris: MSH (DAF 43), p. 105-110.
- DELPECH, F., 1983, *Les faunes du Paléolithique supérieur dans le Sud-Ouest de la France*. Cahiers du Quaternaire 6. Paris: CNRS.
- DELPECH, F. & LE GALL, O., 1983, La faune magdalénienne de la grotte des Eglises (Ussat, Ariège). *Bulletin de la Société Préhistorique de l'Ariège* 38, p. 91-118.
- DONARD, E., 1982, *Recherche sur les léporinés quaternaires (Pleistocène moyen et supérieur, Holocène)*. Thèse de Doctorat, University of Bordeaux I.
- FONTANA, L., 1998, *Mobilité et subsistance au Magdalénien dans le Languedoc occidental et le Roussillon*. Thèse de Doctorat, University of Paris I.
- FONTANA, L., 1999, Mobilité et subsistance au Magdalénien dans le Bassin de l'Aude. *Bulletin de la Société préhistorique française* 96 (2), p. 75-90.
- FONTANA, L., 2000, La chasse au Renne au Paléolithique supérieur : nouvelles voies de recherche. *Paléo* 12, p. 141-164.
- FONTANA, L., 2001, Etude archéozoologique des collections du Fourneau du Diable (Bourdeilles, Dordogne) : un exemple du potentiel des faunes paléolithiques issues de fouilles anciennes. *Paléo* 13, p. 159-182.
- FONTANA, L., in press, Territoires, mobilité et échanges au Magdalénien dans l'Aude et le Massif Central (France) : approche comparative, modélisation et perspectives. Actes du Congrès des Sociétés historiques et scientifiques, Toulouse, avril 2001. Paris: CTHS, 15 p.
- HESCHELER, K., 1907, Die Tierreste im Kesslerloch bei Thayngen, Neue Denkschriften Schweiz. *Natur. Gesellschaft* 43, p. 61-154.
- KAUFMAN, B., 1982, Die Skelettreste der Vögel und Säugetiere. In *Die Hollenberg-Höhle 3. Eine Magdalenien-Funstelle bei Arlesheim, Kanton Basel-Landschaft*, edited by Sedlmeier. Basler Beiträge zur Ur- und Frühgeschichte 8, p. 63-80.
- KOBY, F., 1959, Contribution au diagnostic ostéologique différentiel de *Lepus timidus* Linné et *L. europaeus* Pallas. *Verh. Naturf. Ges. Basel* 70, p. 19-44.
- LEQUATRE, P., 1994, La faune des grands vertébrés. *Gallia Préhistoire* 36, p. 197-204.
- LYMAN, R.L., 1994, *Vertebrate taphonomy*. Cambridge: Cambridge University Press.
- MADLAINE, S., 1989, Contribution des anciennes fouilles à la connaissance des ongulés et de leur milieu durant le Würm récent en Dordogne. *Paléo* 1, p. 36-46.
- MOREL, P. & MÜLLER, W., 1997, *Un campement magdalénien au bord du lac de Neuchâtel. Etude archéozoologique*. *Archéologie neuchâteloise* 23. Neuchâtel: Musée cantonal d'archéologie
- PAILHAUGUE, N., 1996, Faune et saisons de chasse de la salle Monique, grotte de la Vache (Alliat, Ariège). In *Pyrénées préhistoriques, arts et sociétés*, edited by H. Delporte et J. Clottes. Actes du 118^e Congrès des sociétés historiques et scientifiques (Pau, 1993). Paris: CTHS, p. 173-191.
- PAVAO, B. & STAHL, P.W., 1999, Structural density assays of Leporid skeletal elements with implications for taphonomic, actualistic and archaeological research. *Journal of Archaeological Science* 26 (1), p. 53-66.
- PEYRONY, D., 1932, Les gisements préhistoriques de Bourdeilles (Dordogne). *Archives de l'Institut de paléontologie humaine* 10. Paris: Masson.
- SACCHI, D., 1986, *Le Paléolithique supérieur du Languedoc occidental et du Roussillon*. XXI^e supplément à Gallia Préhistoire. Paris: CNRS.
- SACCHI, D., 1990, Bases objectives de la chronologie de l'art mobilier paléolithique dans les Pyrénées septentrionales. In *L'art des objets paléolithiques*. Actes du Colloque de Foix-Le Mas d'Azil. Paris: Ministère de la Culture, p. 13-30.
- SACCHI, D., 1991, Pyrénées et Languedoc méditerranéen. In *Bilan quinquennal de la VIII^e commission de l'U.I.S.P.P.*, ERAUL, p. 223-237.

- SCHIBLER, J. & SEDLMEIER, J., 1993, Die Schneehuhn- und Schneehasenknochen aus dem Abri Büttenloch bei Ettingen (Kanton Basel-Landschaft). Ein Beitrag zur Kenntnis der Jagdbeutenutzung im Spätmagdalénien. *Archäologisches Korrespondenzblatt* 25(1), p. 15-35.
- SHAFFER, B.S., 1992, Quarter-inch screening: understanding biases in recovery of vertebrate faunal remains. *American Antiquity* 57, p. 129-136.
- SPETH, J.D., 1991, Nutritional constraints and the glacial adaptive transformation: the importance of non-protein energy sources. In *The late glacial in North-West Europe: human adaptation and environmental change at the end of the Pleistocene*, edited by N. Barton, N. Roberts & D. Roe. CBA Research Report 77, p. 169-178.
- SPETH, J.D., SPIELMANN, K.A., 1983, Energy source, protein metabolism and Hunter-Gatherer subsistence strategies. *Journal of Anthropological Archaeology* 2, p. 1-31.
- STAMPFLI, H.R., 1959, Die Tierfunde. In *Die Kastelhöhle im Kaltbrunnental, Gemeinde Himmelried (Solothurn)*, edited by Schweizer. *Jahrbuch für Solothurnische Geschichte* 32, p. 62-82.
- STAMPFLI, H.R., 1983, Rislisberghöhle. Archäologie und Ökologie einer Fundstelle aus dem Spätmagdalénien bei Oensingen im Solothurner Jura. Bd. I, *Academica Helvetica* 4.
- TABORIN, Y., 1994, *La parure en coquillage au Paléolithique*. XXIV^e supplément à Gallia Préhistoire. Paris: CNRS.
- VIGNE, J.-D., MARINVAL-VIGNE, M.-C., LAFRANCHI, F. de & WEISS, M.-C., 1981, La consommation du «Lapin-rat» (*Prolagus sardus* Wagner) au Néolithique ancien méditerranéen, Abri d'Araguina-Sennola (Bonifacio, Corse). *Bulletin de la Société Préhistorique Française* 78/7, p. 222-224.
- VIGNE, J.-D. & MARINVAL-VIGNE, M.-C., 1983, Méthode pour la mise en évidence de la consommation du petit gibier. In *Animals and archaeology, 1. Hunters and their prey*, edited by J. Clutton-Brock & C. Grigson. British Archaeological Reports Int. Ser. 163, p. 239-242.

