



The Rabbits of Picareiro Cave: Small Mammal Hunting During the Late Upper Palaeolithic in the Portuguese Estremadura

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This paper analyses nearly 9000 rabbit (*Oryctolagus cuniculus*) bones recovered from Picareiro Cave, central Portugal. The majority of the rabbit bones were recovered within the remains of two hearth features dating between 11,800 and 12,300 BP. Element patterning indicates that entire rabbit carcasses were carried to the cave for processing and consumption. The patterning of burned bones suggests that the carcasses were roasted whole over or within hot coals. A total of 400 tibia, femur, and humerus shafts were recovered, which indicates that marrow was systematically extracted from these long bones. A nutritional comparison of rabbit, pork, and deer meat shows that rabbit meat is as nutritionally balanced as deer meat, and considering that extra fat was extracted from the long bones of most of the carcasses consumed in the cave, rabbit was not a “starvation food”. Rabbit hunting provided the Late Upper Palaeolithic peoples of central Portugal with substantial calories, a relatively balanced diet of protein and fat, and several important minerals such as calcium. While small mammal hunting was important to the Late Upper Palaeolithic peoples of central Portugal, additional research is required on earlier occupations before we know whether the hunting of small prey intensified through time in this region of southwest Europe. © 2000 Academic Press

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Introduction

Subsistence studies over the past two decades have documented the diverse nature of European Upper Palaeolithic faunas through both space and time (Straus *et al.*, 1980; Gamble, 1983; Simek & Snyder, 1988; Straus, 1990; West, 1997; Grayson & Delpech, 1998; Stiner *et al.*, 1999). Numerous sites such as La Riera Cave in Spain (Straus & Clarke, 1986) and those in the Perigord region of southwestern France (Simek & Snyder, 1988) document diversity throughout the Upper Palaeolithic in the kinds of large animals (e.g. reindeer, horse, red deer, roe deer, wild boar, bison, ibex, chamois) and small animals (e.g. fish, mollusks, rabbits) exploited. It is probably safe to say that archaeologists will continue to document spatial and temporal diversity in the kinds of large and small animals exploited by Upper Palaeolithic peoples of Europe.

One region which promises to add important information about European Upper Palaeolithic economies, including the role that small animals played in the diet,

is the Estremadura region of central Portugal. This region of southwestern Europe is relatively rich in caves containing well-preserved faunas. In addition, the Iberian Peninsula is the homeland of the European rabbit (*Oryctolagus cuniculus*), and more rabbits are found here than anywhere else in Europe (Delibes & Hiraldo, 1979). Because central and southern Iberia were less affected by the large-scale changes in climate, habitats, and their associated faunas experienced by northern Europe during the Pleistocene (Zilhao, 1990; Straus, 1991; Bicho, 1994), small mammals such as the rabbit probably have been abundant and readily available to prehistoric hunters in central and southern Iberia for many thousands of years. Additionally, European rabbits excavate burrows and live in densely-packed warrens, which make them easily detectable to human hunters. Central Portugal, therefore, holds tremendous potential to address the diachronic use of small mammals in southern European prehistory.

In this paper, an extraordinarily rich assemblage of rabbit bones recovered from Picareiro Cave in the Estremadura region of central Portugal is analysed.

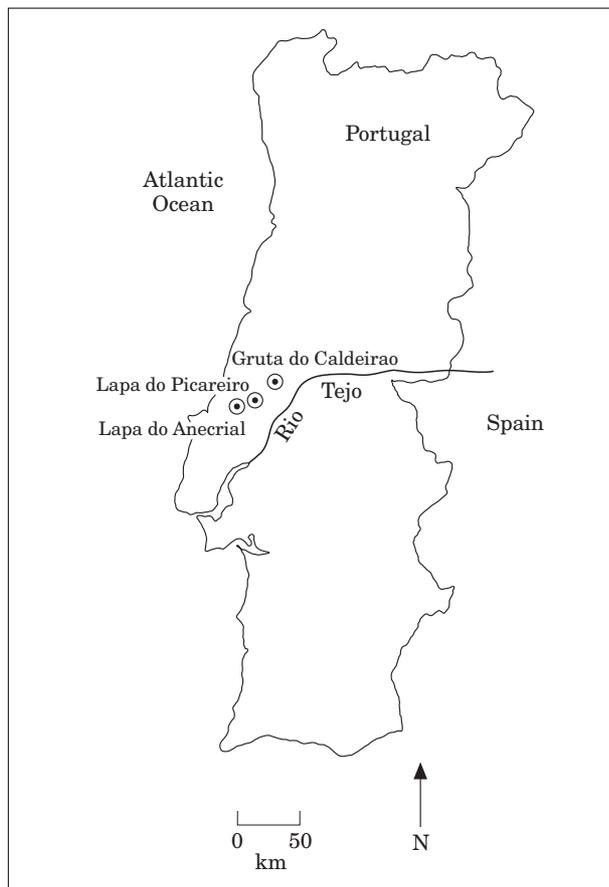


Figure 1. Selected sites in central Portugal: Picareiro Cave, Lapa do Anecrial, and Gruta do Caldeirao.

The majority of these rabbit bones were recovered from within or adjacent to two large hearths or fire-pit features. Dating between approximately 11,800–12,300 BP, these bones document the important role small animals played in the diet of Late Upper Palaeolithic hunter–gatherer groups in central Portugal.

Picareiro Cave: Stratigraphy and Chronology

Picareiro Cave is a karstic cavity, located 520 m above sea level, in the limestone mountain known as Serra d’Aire, some 100 km northeast of Lisbon (Figure 1). The entrance of the cave opens to the northwest, overlooking a wide valley. The opening is a horizontal fissure *c.* 1 m high and close to 6 m in width, showing clear evidence of a much wider entrance before the cave was filled with sediment.

Presently, the interior of Picareiro has a roughly triangular shape, about 8 by 10 m in length, with its vertex located away from the entrance. The ceiling is very jagged, climbing steeply from the ground to two closed sink holes 10 m high near the vertex.

The cave stratigraphy is marked by the presence of variable sizes of *eboulis sec.* Each geologic layer is characterised by different amounts of finer sediment,

ranging from clays to silts filling the spaces between the *eboulis*. In addition to the sediment, there are large amounts of charcoal and ashes, more so in those levels where hearths are present. In specific areas within levels the sediment is extremely packed and compressed, possibly due to human activities. The deposits slope toward the east wall and dip toward the back of the cave, starting in a well-developed cone under the drip line. This cone is composed of large limestone blocks that seem to have fallen off from the limestone cliff in proto-historic times.

There are ten recognised geologic strata inside the cave (Figure 2). The top three, designated A to C, are dated to protohistoric times, probably Bronze Age. They have ceramics, few stone tools, and rare terrestrial fauna and marine shell. Stratum D is 5 to 10 cm thick and is composed mostly of fine sediment with rare lithic material and a few perforated marine shells. It is dated to *c.* 8000 BP (Table 1).

Stratum E is about 50 cm thick. Because all archaeological materials larger than 1 cm are piece plotted, it was possible to identify three archaeological levels in this stratum, separated by thin sterile levels. The top level is dated to *c.* 10,000 BP, while the others are dated to approximately 11,600 BP. Stratum F is dated between about 11,800 and 12,100 BP. This layer is very rich in large and medium size fauna, as well as in shell and marine fish. There are two hearths present in this stratum, but only one was excavated. This hearth, dated to about 12,000 BP, was about 25 cm thick, and was full of charcoal and some burnt bone. Its boundary is lined with a series of small to medium sized limestone slabs, forming a semi-circle of about 2.5 m wide, resting on the sloping surface of the *eboulis* of stratum I.

Stratum G is dated to 12,300 BP. It is an extremely compact mass of small *eboulis*, charcoal, ash, burnt bone and a few stone tools. The stone tools show a fairly high presence of broken backed bladelets that were probably projectile points. This layer is the result of the concentration of burnt materials probably caused by the removal of burnt bone and charcoal from a hearth located somewhere inside the cave in an area that has not yet been excavated. Stratum G does not completely underlay stratum F, so in places stratum F is in direct contact with stratum I. A thin travertine layer (H) has formed between the contact of strata G and I.

Strata I and J are very similar. They do not contain fine sediment, but large fauna and some lithic artefacts are present. One AMS date on charcoal was obtained from stratum J. Unfortunately, the result does not agree with the other dates, nor with the stratigraphy. Thus, the charcoal sample used for this date most likely came from stratum F through the interstices of the *eboulis*, since stratum F directly overlays I in the area where the sample was collected. The lithic artefacts do not suggest any specific chronology, but the sediments, similar to a cave nearby (Lapa do Anecrial;

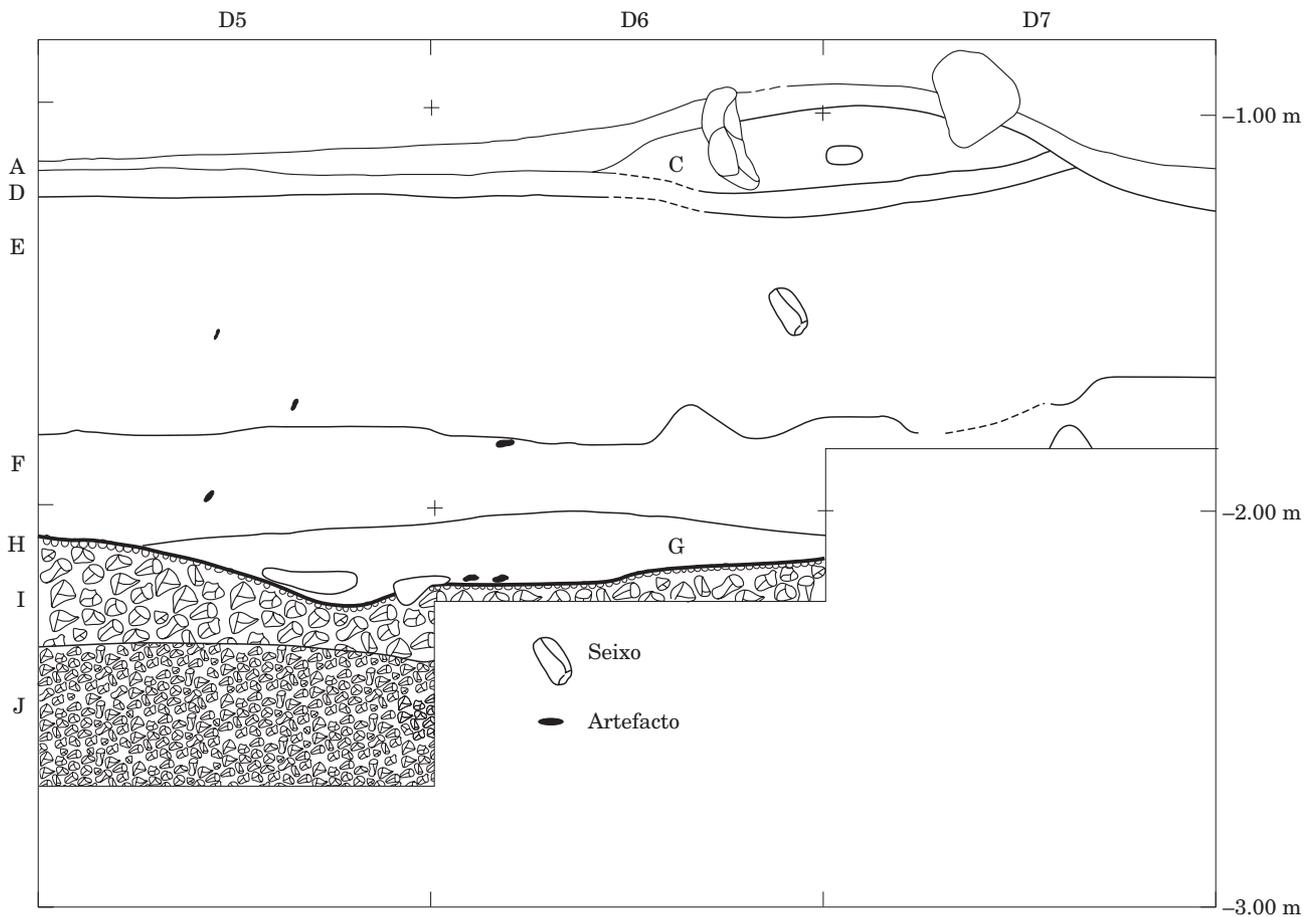


Figure 2. South wall profile of units D5, D6, and D7, Picareiro Cave, central Portugal, indicating the strata.

Table 1. Radiocarbon dates from Lapa do Picareiro

Stratum	C-14 date (BP)
D	8310 ± 130
E (upper)	10,070 ± 80
E (middle)	11,700 ± 120
E (lower)	11,550 ± 120
F (upper spits)	11,780 ± 90
F (lower spits)	12,120 ± 100
G	12,320 ± 90

see Zilhao, 1995), seem to point to sometime around the Last Glacial Maximum. Bedrock has not yet been reached, and excavations continue in the cave.

Methodological Considerations

The majority of rabbit bones recovered from stratum I came from the top 3–5 cm of the deposit. It was apparent that rabbit bones from the bases of strata F and G had fallen into the crevices of the relatively large spalls which characterise stratum I. The majority of the

rabbit bones originally assigned to the top of stratum I came from units in which stratum I lay directly beneath strata G/H, rather than beneath stratum F. Thus, most rabbit bones originally assigned to the top of stratum I, or approximately 2% of the total number of rabbit bones recovered from the cave, belong to the base of Stratum G, rather than the hearth which constitutes stratum F. For this reason, the rabbit bones originally assigned to stratum I were combined with those recovered from stratum G for the analysis which follows. Combining rabbit bones in this manner undoubtedly mixed a small number of bones originally deposited in stratum F into the G/I sample, but it will not adversely impact the analysis presented below.

Stratum E was relatively thick, and as argued above, likely represents three distinct archaeological samples of time. Because the top of stratum E dated approximately 1500 years younger than the lower two levels, and because the analysis presented below focuses on broad patterns of small mammal use during the Late Upper Palaeolithic, the rabbit bones from the “middle E” and “lower E” spits were combined and analysed separately from those recovered from the “upper E” spits. Future analysis of the rabbit bones

Table 2. Number of rabbit bones per stratum at Lapa do Picareiro

Stratum	NISP	MNE	MAU
A	3	3	1
D	40	32	4
E (upper)	519	309	17
E (lower)	774	406	14
F	5511	3551	101
G/I	1897	1215	45
J	237	130	7
Total	8981	5646	189

from Picareiro Cave, focusing on short-term variability in hunting strategies, may warrant dividing the bones into “upper E”, “middle E”, and “lower E” analytical units.

Taphonomy of the Rabbits from Picareiro Cave

Approximately 9000 rabbit bones have been recovered from Picareiro Cave (Table 2). As noted above, strata F and G in Picareiro Cave represent the remains of two large hearths or firepits dating to the Late Upper Palaeolithic, c. 11,800–12,300 BP. A total of 7408 rabbit bones, representing at least 4766 elements, were recovered directly from within or just outside the confines of these two features. These bones represent the remains of at least 146 individual rabbits. A minimum of 189 individual rabbits have been recovered to date from the cave (Table 2).

Table 3 displays the minimum numbers of each rabbit element recovered from the cave. All elements

are well represented except for the sacrum, including the lower leg and foot elements. These data indicate that whole rabbit carcasses probably were brought to the cave for processing and consumption. There is no clear evidence for the natural accumulation of rabbit bones in Picareiro Cave other than from the surface of the site. No rabbit bones from the subsurface deposits display evidence of puncture marks, corrosion damage from gastric fluids, thinning, or polishing, all of which characterize leporid bone assemblages which have accumulated via raptor pellets and mammalian carnivore scats (Andrews & Evans, 1983; Schmitt & Juell, 1994; Hockett, 1995, 1996). In addition, front and hind limb elements and cranial bones are all abundantly represented. Rabbit bone accumulations beneath raptor roosts generally exhibit unequal distributions of these elements (Hiraldo *et al.*, 1975; Hockett, 1995; Schmitt, 1995; Cruz-Urbe & Klein, 1998).

Small carnivores such as the lynx (*Lynx pardina*) and badger (*Meles meles*) are known to hunt rabbits and to accumulate rabbit bones in Iberian caves (Ripoll, 1993; Mathias *et al.*, 1998). These assemblages may be characterised by the accumulation of entire rabbit carcasses to caves, which is similar to the element representation in Picareiro Cave. Rabbit bone assemblages created by small carnivores in Iberia may also be characterised by relatively large numbers of complete or nearly complete limb elements (Ripoll, 1993; Hockett, 1999). In contrast, only 64 of the 1694 (3.7%) femur, tibia, humerus, radius, and ulna specimens recovered from the hearth features were complete elements (Table 4). Only a single complete rabbit limb bone was recovered from strata A, D, E, and J combined. In addition, small carnivores in Iberia may puncture the ends of

Table 3. Minimum number of rabbit elements recovered per stratum at Picareiro Cave

	A	D	Stratum E		F	G/I	J	Total
			Upper	Lower				
Mandible	0	3	5	10	143	62	2	225
Maxilla	0	0	0	1	111	37	8	157
Innominate	0	3	9	9	201	83	8	313
Patella	0	0	4	16	49	5	5	79
Femur	0	2	9	10	86	65	7	179
Tibia	2	4	13	10	98	53	8	188
Calcaneus	0	7	33	28	146	89	5	308
Astragalus	0	1	29	20	109	44	13	216
Scapula	0	0	2	5	156	60	4	227
Humerus	0	1	11	9	105	45	7	178
Radius	0	2	16	10	152	72	2	254
Ulna	0	1	9	12	172	67	2	263
Carpal/tarsal	0	0	12	16	109	29	3	169
Metapodial	1	3	37	64	610	148	20	883
Phalange	0	4	110	169	1012	287	25	1607
Rib	0	1	6	9	145	42	7	210
Vertebra	0	0	4	8	141	27	4	184
Sacrum	0	0	0	0	6	0	0	6
Total	3	32	309	406	3551	1215	130	5646

Table 4. Limb bone portions recovered from the hearth features (strata F and G/I), Picareiro Cave

	Midshaft	Proximal	Distal	Complete	Total
Stratum F					
Femur	79	83	71	3	236
Tibia	98	66	81	0	245
Humerus	62	30	98	7	197
Radius	62	129	55	23	269
Ulna	7	151	28	21	207
Stratum G/I					
Femur	64	24	22	1	111
Tibia	53	20	36	0	109
Humerus	44	12	41	1	98
Radius	59	67	20	5	151
Ulna	0	64	4	3	71
Total	528	646	456	64	1694

rabbit limb bones, and in particular the distal end of the femur and the proximal end of the tibia, during feeding (Hockett, 1999). No bones from the subsurface deposits of Picareiro Cave exhibit puncture marks.

Natural fires can ignite vegetation within caves and rockshelters and char bones which were deposited earlier in the site (e.g. Aikens, 1970; Hockett, 1989). In this case, the probability that any particular element or any portion of an element will be burned should be relatively equal. In contrast, when small animal carcasses such as rabbits are roasted over or within hot coals, bones of the front and hind feet and the ends of limb bones are typically blackened or calcined white in colour in greater frequencies than other bones or bone portions (Dansie, 1991; Hockett, 1992). The element patterning of charred rabbit bones recovered from the hearth features indicates that the rabbit carcasses in Picareiro Cave were probably roasted whole within or over hot coals, after which the cooked carcasses were dismembered and the meat consumed. Table 5 shows the distribution of burned rabbit bones from strata F and G/I. The vast majority of all charred rabbit bones were foot elements (137 out of 205, or 69%), and many more proximal and distal limb portions were burned than midshaft portions (Table 5).

Importantly, large numbers of humeri, femora, and tibiae shafts were recovered from the hearth features in Picareiro Cave. Jones (1983) documented ethnographically that people may create small animal limb shafts by snapping or biting off the proximal and distal ends of humeri, femora, and tibiae to extract bone marrow from the medullary cavity. Subsequently, it has been well documented that prehistoric inhabitants throughout the Great Basin of North America created jack-rabbit (*Lepus* sp.) tibiae cylinders during the extraction of marrow from these bones (Schmitt, 1990; Hockett, 1991, 1992, 1994). Similarly, Upper Palaeolithic hunters of Iberia extracted bone marrow from the medullary cavity of rabbit long bones, beginning as early as 12,300 years ago, as seen in stratum G in Picareiro Cave (Figure 3), and in the Magdalenian

Table 5. Burned rabbit bones from the hearth features (strata F and G/I), Picareiro Cave

Element	Number burned
Feet	
Phalange	67
Calcaneus	29
Metapodial	21
Astragalus	11
Carpal/tarsal	9
Limb	
Proximal humerus	0
Humerus midshaft	0
Distal humerus	5
Proximal radius	14
Radius midshaft	4
Distal radius	2
Proximal ulna	4
Ulna midshaft	0
Distal ulna	0
Proximal femur	2
Femur midshaft	2
Distal femur	0
Proximal tibia	0
Tibia midshaft	7
Distal tibia	3
Other	
Proximal scapula	7
Mid-scapula	2
Scapula border	1
Innominate	3
Teeth	9
Skull fragments	3
Total	205

levels of Tosal de la Roca and Nerja in Spain (Ripoll, 1993).

Schmitt (1990), Hockett (1991, 1995) and Ripoll (1993) have discussed the creation of hare and rabbit long bone cylinders by humans, and Hockett (1991, 1995, 1999) and Ripoll (1993) have discussed the creation of these bones by raptors, mammalian carnivores and rodents. While mammalian carnivores,



Figure 3. Rabbit long bone cylinders from the two hearth features in strata F and G/I, Picareiro Cave. Top row: femora cylinders; middle row: tibiae cylinders; bottom row: humeri cylinders.

raptors, and rodents occasionally create rabbit long bone cylinders by chewing or breaking off the ends of limb bones, they rarely do so (see, for example, Hockett, 1995). Rabbit long bone cylinders created by rodent gnawing display the taphonomic traces of closely spaced, parallel scour marks created by rodent incisors. Those created by carnivores and raptors may mimic cylinders created by humans, but these bones are vastly outnumbered by complete to nearly complete rabbit limb bones deposited in the same site by these predators (Ripoll, 1993; Hockett, 1995).

In contrast, because humans may deliberately break off the ends of rabbit long bones in order to consume marrow, prehistoric hunters may discard very large numbers of rabbit bone cylinders in archaeological sites. For example, 400 rabbit long bone cylinders were recovered from within the two hearth/burning pits at Picareiro Cave, while only 12 complete femora, tibiae, and humeri were recovered from these same features (see Table 4). A total of 584 proximal and distal ends of femora, tibiae, and humeri were also recovered from the hearths (Table 4 and Figure 4), indicating that natural destruction of the cancellous portions of the long bones was of minimal consequence in the creation of these cylinders. It is also noteworthy that 52 of the 64 (81%) complete limb bones from strata F and G/I were non-marrow filled radii and ulnae. Further, Yellen (1991) documented ethnographically that the



Figure 4. Typical rabbit long-bone ends recovered in the two hearth features, strata F and G/I, Picareiro Cave: proximal femur (top left), distal femora (top right and bottom left), and distal tibia (bottom right).

!Kung San usually leave the front limbs intact during processing of springhare (*Pedetes capensis*) carcasses. Clearly, people deliberately broke off the ends of rabbit femora, tibiae, and humeri in order to consume marrow at Picareiro Cave.

In order to judge the amount of marrow available in rabbit long bones, two whole carcasses of the European rabbit and the Iberian hare (*Lepus granatensis*) were purchased in Lisbon. The two hare carcasses weighed 1780 g and 1860 g, while the rabbit carcasses weighed 712 g and 778 g. The carcasses were skinned, and then the bones were boiled. The proximal and distal ends of each long bone were then broken from the midshafts with a small hammer, the marrow was removed with a stick, and weighed. The six marrow-filled long bones of the European rabbit contained approximately 3.0 g of marrow, while the hare contained approximately 7.0 g of marrow. Thus, simply by extracting marrow from the long bones of the majority of the approximately 190 rabbits consumed in Picareiro Cave, Upper Palaeolithic and Epipalaeolithic hunters could have added nearly 5000 additional calories to their diet. Given that Picareiro Cave probably represents a site with a series of relatively short-term visits, and considering that there may be the remains of hundreds of additional rabbit carcasses in the cave not yet recovered through excavations, consuming rabbit long bone marrow probably added a substantial increase of calories each year to the diet of Upper Palaeolithic hunters of central Portugal.

Table 6. Comparative nutritional values of 3 oz of rabbit, pork, and deer meat (after Anderson & Deskins, 1995)

Animal	Calories	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)	Niacin (mg)	Phosphorus (mg)	Potassium (mg)
Rabbit	168	25	7	16	1.9	7.2	224	326
Pork (loin)	232	28	12	9	1.2	5.9	203	356
Pork (ribs)	338	25	26	40	1.6	4.7	217	272
Deer	134	26	3	6	3.8	5.7	192	284

Season of Use of Picareiro Cave

Of the 684 proximal and distal ends of femora, humeri, and tibiae recovered from Picareiro Cave, 680 (99.4%) had fully fused epiphyses. Adult rabbits (those approximately 9 months of age or older) dominated the Picareiro assemblage. These data can provide information on the seasonal use of Picareiro Cave.

Female European rabbits have a gestation period of about 1 month. Young rabbits have extremely high mortality rates within the first 3 months of life (Southern, 1940). While European rabbits of the Mediterranean region may breed during any season, they display sharp peaks in breeding in the spring and fall (Southern, 1940; Poole, 1960; Soriguer & Rogers, 1979). The bimodal breeding habits coincide with increased precipitation and new growth in vegetation associated with Mediterranean climates (Poole, 1960; Garson, 1979). Breeding drops dramatically during the summer months when conditions are hot and dry. Rabbits born during the summer months have substantially lower survival rates than those born during the spring and fall (Garson, 1979).

Predators, including humans, are likely to find high numbers of subadult rabbits during the spring and fall seasons. Adult rabbits should be comparatively more abundant during the summer and winter months as breeding slows, and because many of the young have fallen to predators during the preceding season. Because the overwhelming majority of rabbit carcasses processed and discarded in Picareiro Cave were from adult animals, this would indicate that the cave was likely used during the summer or winter months, or both.

Discussion and Conclusion

Preliminary analysis of the large fauna from Picareiro Cave indicates that relatively small numbers of primarily red deer (*Cervus elaphus*) and wild boar (*Sus scrofa*) were also consumed in the cave (Haws, 1998). Rabbits, however, were undoubtedly a major component in the diet of Late Upper Palaeolithic peoples in central Portugal. This conclusion is supported by the large numbers of rabbit remains from the Late Upper Palaeolithic deposits of Gruta do Caldeirao, a cave located only 25 km northeast of Picareiro Cave

(Rowley-Conwy, 1992), and from other nearby caves such as Lapa do Anecrial (Zilhao, 1995).

We think the large number of rabbits processed in Picareiro Cave resulted from their availability and ease of capture rather than from stressed hunters taking prey they would otherwise ignore. In the Great Basin of North America, both the cottontail rabbit (*Sylvilagus* spp.) and the jackrabbit (*Lepus californicus*) have high caloric return rates due to their ubiquitous distribution and ease of capture in large numbers (Simms, 1987). The ecology and reproductive behaviour of European rabbits in central and southern Iberia would have attracted human hunters in the day-to-day search for food because: (1) they were abundant throughout the region; (2) reproductive females generally produce offspring twice a year, one litter in the spring and another in the fall; (3) they often live in easily detectable burrows; (4) they often live in densely-packed warrens; and (5) they are easily captured with the use of snares or nets. In fact, foragers near Picareiro Cave could have placed snares outside rabbit burrows, hunted or gathered other food items, and then "gathered" the entrapped rabbits at a later time.

In addition, although rabbits are often referred to as "lean meat" or "starvation food", a closer look at the nutritional value of rabbit meat shows that wild rabbits may have offered nearly equal values of protein and fat per ounce as some of the larger game animals available to prehistoric hunters in central Iberia, such as deer [Table 6; also see West, 1996, for protein and fat issues related to horse (*Equus* sp.) hunting in central and northern Europe]. Rabbit, roe and red deer, and wild boar constituted the bulk of the faunal remains recovered from Picareiro Cave. If the values presented in Table 6 are relatively equal to the nutritional values of their wild Iberian counterparts, then wild boar probably provided the bulk of animal calories and fat to the prehistoric diet in central Iberia based on comparisons of individual carcasses. However, while rabbit meat contains almost as much protein per ounce as pork and deer meat, rabbit meat contains twice the fat of deer meat. Further, as demonstrated above, the prehistoric occupants of Picareiro Cave consistently added an additional 3 g of fat per carcass to their diet by extracting long bone marrow. Finally, rabbit meat is richer in calcium, iron, niacin, potassium, and phosphorus than deer meat, and richer than pork in all of

these vitamins and minerals except for calcium and iron.

While clearly important to the subsistence base of Late Upper Palaeolithic hunters of central Portugal, the intensity of rabbit hunting in other regions of Europe, including other regions of Iberia, is less certain. Zilhao (1990) noted that rabbits were an important component to the prehistoric diet in the Portuguese Estremadura since at least Solutrean times. Rabbits appear to have been relatively unimportant in the diet of Mousterian and Upper Palaeolithic peoples occupying the Cantabrian region of Spain (Altuna, 1986), but Straus (1991) noted that rabbits were a mainstay in the diet during Solutrean times in the Valencia region of Spain. The importance of rabbits to the diet of Lower Palaeolithic, Mousterian, and Early Upper Palaeolithic peoples in southwestern Europe is less certain. Current research is underway on a number of Lower Palaeolithic and Mousterian sites in the Portuguese Estremadura, and these excavations may shed light on this issue. Determining the importance of small game such as rabbits to the subsistence base of these earlier occupations will prove crucial to accurately testing demographic and economic models which account for diachronic changes in the diet of the Upper Palaeolithic peoples of southwest Europe.

In conclusion, the rabbit remains recovered from Picareiro Cave indicate that this small animal was an important source of protein and fat in the diet of the Final Upper Palaeolithic population of central Portugal. Rabbit hunting may have begun much earlier, during the Middle and Lower Palaeolithic, but only in the Upper Palaeolithic did it become important in the diet. Intensification of rabbit hunting during the Tardiglacial (post-18,000 BP) may have been the result of local rabbit ecology as well as new hunting technologies such as the use of snares or nets. However, as mentioned above, additional early Upper Palaeolithic, Middle Palaeolithic and Lower Palaeolithic faunal assemblages must be analysed before we can confidently conclude that rabbit hunting intensified during the Tardiglacial in central Portugal. Though rabbit hunting may provide less amounts of meat than large game hunting, it is clear that this is balanced by the dietary characteristics of rabbit meat and marrow, the lower output of energy required for hunting rabbits, as well as the lower risk of failure and to health compared to hunting large animals such as wild boar or red deer.

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