

A population study on the Cave Bears (*Ursus spelaeus* Rosenmüller-Heinroth) from Galician caves, NW of Iberian Peninsula

Estudio poblacional del Oso de las Cavernas (*Ursus spelaeus* Rosenmüller-Heinroth) de cuevas gallegas, NW de la Península Ibérica

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Abstract

A population study of two contemporary sites of *Ursus spelaeus* from Serra do Courel (Galicia, NW of Iberian Peninsula) has been carried out. The different morphology of the sites, as well as the taphonomical processes that affected the deposits produce a biased preservation of the bone remains that is interpreted in this paper.

Key words: Galicia, Pleistocene, *Ursus spelaeus*, population study

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INTRODUCTION

The Cave Bear became widely distributed throughout Europe during the Pleistocene (KURTÉN, 1958; MUSIL, 1981). The findings are restricted almost exclusively to calcareous areas, and more specifically in karstic cavities which they tended to occupy during hibernation. The westernmost limit of the distribution reach Galicia, in the NW of the Iberian Peninsula (GRANDAL, 1993). Most of the galician sites in which this species is present are situated in the Serra do Courel (Fig. 1).

This is a mountain block situated bet-

ween the NE of the province of Lugo and the NW of the province of León, (NW of the Iberian Peninsular). Morphologically, it is made up of a NE-SW mountainous crest, with exposures of closely fractured and faulted slates. Amongst the system of fractures parallel NE faults stand out along which run the rivers Lor, Lóuzara, Selmo and Soldón. The drainage network of these rivers define the distribution of valleys and ridges of the sierra. The highest points in this area is the horn Formigueiros (1.643m).

The main lithologic component of this area are green slates of Lower Paleozoic age with NW-SE orientation (IGME, 1980)

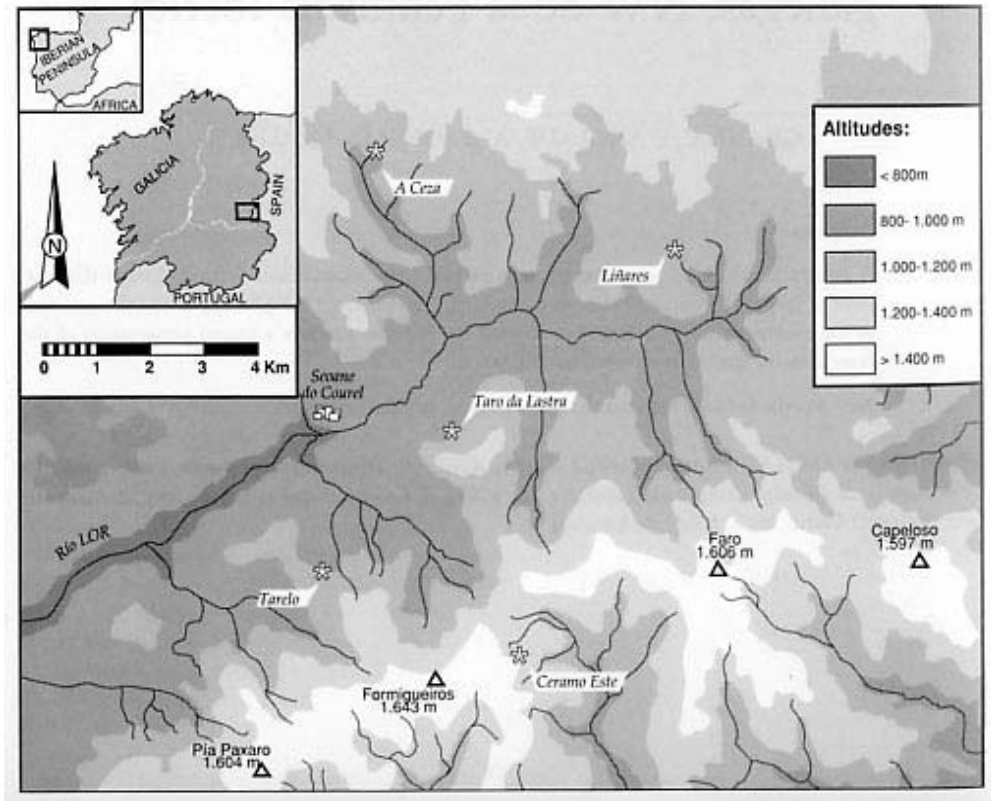


Fig. 1. Localization of Serra do Courel and mentioned sites.

interbedded with limestone bands where is common the development of carstic caves. Most of these caves contain bone remains preserved in their infillings, frequently ursids and ungulates. But not all these sites have pleistocene species, due to the glacial activity (GRANDAL D'ANGLADE *et al.*, 1997).

At the end of the Pleistocene glacial phenomena of alpine type develops in O Courel (VIDAL ROMANI, 1996; VIDAL ROMANÍ *et al.*, 1992). These kind of glaciers showed positive temperature on the surface of the glacier all the year. As a result the melt water circulated as subglacial flows that have played a very important role shaping the Sierra, and excavating carstic systems at deep. At present, some fossil or inactive caves are located at unusual heights above the current base level. They were functional only during the last local glacial event, when the ice covered them (VIDAL ROMANI *et al.*, 1992; GRANDAL D'ANGLADE *et al.*, 1997). The situation of these caves under ice made them uninhabitable until the end of the glacial period. As a result, only remains of holocene species have been found. This is the case of **Ceramo Este**, with *Ursus arctos*, *Bos taurus*, *Ovis aries* and *Sus scrofa*., and **Tarelo**, with remains of holocene *Ursus arctos* (GRANDAL D'ANGLADE *et al.*, 1997)

Some caves, even though situated next to the glacial areas, were out of reach of the glacial ices. Bone remains of different Pleistocene species are preserved into the filling of most of these caves. For instance, the cave **Taro da Lastra**, were a deposit of *Ursus spelaeus* and *Cervus elaphus* was found, although only a small number of remains.

A more detailed study of the caves **Liñares** and **A Ceza** was made, attending to the number of remains that were found. Both of them were used as dens by *Ursus spelaeus*. Both caves, even closely situated, have different physiographical conditions. The taphonomical processes implied in the formation of the deposits differ from one cave to the other. Both populations, although almost contemporary, present a different structure that is studied and compared in this paper.

Description of the sites

Liñares

Liñares is a small cave that develops in the Vegadeo Limestones of Lower-Middle Cambrian age. It is situated at 1,115 m above sea level. It presents a rectilinear development with NE orientation. The cave profile descends, reaching at the end a deepness of 15 m below the surface. The topography of this cave is really marked by the stratification of the rocks, dipping towards W.

The infilling of the main gallery is a heterogenic material, colluvial type, sealed at the top by a stalagmitic soil, that occasionally include large slate and limestone blocks. The thickness of this calcareous crust can reach 15 cm in some points. The studied area corresponds to a deposit placed in a lateral hole running downwards, progressively narrow and filled in with limestone and slate blocks, clays and bones, intercalated with thin stalagmitic floors (LOPEZ GONZALEZ, 1996; LOPEZ GONZALEZ *et al.*, 1997). The bones and the blocks moved down, toget-

her with the clay, along this hole by gravity and sporadic slides. A marked difference is observed on the position of the bones: the large ones, like cave bear or male deer skulls, are at the beginning of the hole, almost closing the entrance, whilst the smaller are in lower positions, reflecting the strong selection of sizes along the slope.

Up to now 1293 bones were found, 30.9% of them belonging to *Ursus spelaeus* and 50.0% to *Cervus elaphus*. There are also present *Bison prisus*, *Equus caballus* and *Sus scrofa* remains, although in a smaller proportion (less than 1%). There is also a 18,1% of unidentified fragments of bone. None of the bones show anthropic action or scavengers activity.

The datings ^{14}C AMS carried out on two *Ursus spelaeus* bones have given the ages 35,220 years BP and >38,000 years BP.

A Ceza

This large cave develops in the Candana limestones, of Lower Cambrian age. These limestones present intercalations of slates, like the Vegadeo Limestones where the cave Liñares is developed. A Ceza cave has a main rectilinear gallery through which a large river flows. The topography is markedly longitudinal with an orientation SE-NW. It is situated at 1,004 m over sea level. In a narrow lateral gallery there is a small chamber where the bone remains were found. It has a very slight slope towards the main gallery, almost unappreciable in the Chamber.

The stratigraphy of the Chamber is very simple. Only one level can be differentiated, about 45 cm depth. It is a detritic

level with limestone blocks and slate slabstones of different size, a coarse matrix made up of gravels and clays, and bones. The filling does not reflect conditions of functional karst with water circulation, and seems to correspond to a dry episode. Some of the bones were found on the surface. Most of these (the larger ones) were fragmented and crashed by the fall of blocks and probably by trampling (the action of the living bears walking through the galleries).

Up until now, 360 bones were identified and about 170 fragments. Most of these remains are from *Ursus spelaeus*, and only the 1% belongs to *Cervus elaphus* and other unidentified herbivores. The ^{14}C AMS dating of one *Ursus spelaeus* bone gave an absolute age of 35,230 (1,430 y BP).

Preservation of the bones

The first difference between both sites is the degree of preservation of the bones. The material of Liñares presents an excellent preservation. The bones are firm and strong enough and, above all, most of them are complete. They don't present marks in their surface that suggest the action of erosive processes. They are not scratched nor broken. Almost all these bones present dark colour due to manganese coatings on their surface. Finally, some of them present marks of rodent way (LOPEZ GONZALEZ, 1996; LOPEZ GONZALEZ *et al.*, 1997). One of the cave bear skeletons was found *in situ*, but most of them are dispersed along the slope. The proportions of bones classified attending to their preservation state (Table 1) seems to indicate the contrary.

However, it must be remarked that 70% of the badly preserved bones are fragments from ribs, too long and fragile bones to be preserved in a whole.

The bones from A Ceza are poorly preserved, in the case of the large and limb bones, moreover those that were found in the surface of the sediment. The small bones are fairly preserved. Most of the bones have a spongy consistence, and some of them presents a spotted surface, probably because of the depositon of manganese, although it would be produced under more dry conditions than the case of Liñares. The kind of fragmentation of the diaphyses of limb bones suggest that the trampling was the responsible. There are no evidences of human or scavengers action.

The proportion of bad preserved bones is high, as shown in Table 1. In this case, not only the fragmentation of the ribs but also of adult limb bones give a proportion of bad preserved bones as high as 71.9%. The smallest bones have a remarkably better preservation.

TABLE 1. Proportions of Cave Bear bones classified attending to their preservation in both sites studied.

Liñares Sur			A Ceza		
Total	Good	Bad	Total	Good	Bad
403	172	231	532	150	382
100%	42.6%	57.3%	100%	28.1%	71.9%

In order to know if the skeletons are complet, although dispersed, the percent of representation of the principal groups of bones attending to their position in the

skeleton and their size was calculated, and compared with the percents of the same groups in case of complet skeletons.

Figure 2 shows that in Liñares the proportion between small bones (teeth, articulars, metapodials and phalanx) and the large ones (skull, trunk and limbs) is not the expected. There is a strong underrepresentation of the smallest parts of the skeleton, such as phalanges, metapodials and the smaller bones from the carpus and tarsus. This fact indicates that because of the natural dispersion after the death of the animal, by gravity force (helped by the deep natural slope) and the process of washing already described for the sediments, the smaller pieces of the skeleton have been lost, probably towards the main chamber with a lake where this hole ends. Until now it was not possible to study the sediments in the bottom of the lake, were, presumably, most of these small bones could be preserved.

TABLE 2. Age distribution in the population of Liñares and A Ceza, according to some groups of remains.

percents	Adults		Juveniles	
	Liñares S	A Ceza	Liñares S	A Ceza
skull	78.0	16.7	22.0	83.3
jaw	82.3	44.5	17.7	55.5
vertebrae	90.9	75.8	9.1	24.2
ribs	83.3	61.7	16.6	38.3
scapula	62.5	37.5	37.5	62.5
pelvis	81.8	50.0	18.2	50.0
limb bones	80.6	43.4	19.4	56.6
carpus+tarsus	100	88.0	0	12.2
metapodials	92.9	96.5	7.1	3.5
phalanges	100	90.0	0	10.0

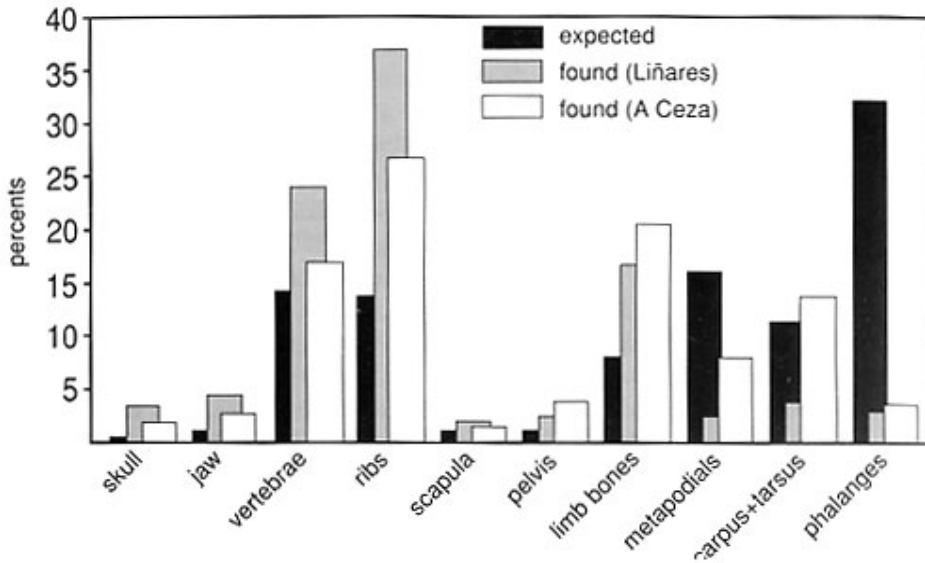


Fig. 2. Proportion of the bones found in both sites compared with those expected, referring to a complete skeleton.

The case of A Ceza is different, since there is not possible to recognise such a marked pattern in the preservation of the groups of bones. Some of the remains (skull, jaw, vertebrae, scapula and pelvis) are present in slightly higher percent than the expected. Ribs and limb bones show higher values than the expected ones, probably because of the overrepresentation caused by the high degree of fragmentation. The bones from the carpus and tarsus, are also overrepresented, although their preservation is very good and they are not fragmented. Finally, the proportions of metapodials and phalanges are lower than the expected, although not as markedly as in Liñares. Being these bones the most pheriferal remains of the skeleton and the most easily dettached from

the body once the bear is dead, and taking into account that the problem of the slope here is not so important in this cave, we could suggest that they were lost by the trampling phenomenon, the pass of a number of bears through the gallery for the hibernation every winter. In any case, the bones would be desplaced towards the main gallery and lost because of the transport by the river that runs along it.

Structure of the populations

Distribution by age

Table 3 shows the distribution by age of the populations according to several groups of bones. Some significative differences between both sites can be observed.

In Liñares the minimum number of

individuals is adults and juveniles. The percent of adult individuals (86,5% in total) is much greater than that of juveniles (13,5%). This is not common in most of the Cave Bear sites. The typical value for most of the European Cave bear sites is around 70% of juvenile individuals (KURTEN, 1955, 1958). Also in other studied sites from Galicia, such as Eirós Cave, where the percent of juveniles is 73% (GRANDAL D'ANGLADE & VIDAL ROMANI, 1997). In our opinion, this phenomenon may be caused by two reasons: First, because of the process of washing that affected the filling. According to this, most of the smallest remains, including the juvenile ones, would have been lost towards the lake at the bottom of the hole. This would be the reason why only the bigger remains of the juveniles have been found, whilst the smaller bones such as phalanges or metapodials are inexistent. The second reason would be that the juveniles were scarce in the population. According to the biggest remains (skull, jaw and limb bones), which are better preserved, the proportion of the juveniles is about 20%. It could be assumed that this would be the real proportion of juveniles in the population.

TABLE 3. Sex distribution in the population of Liñares, according to various kinds of sexable remains, in absolute values (a. v.) and percents (%).

sex	skull		jaw		canines		limb bones	
	a.v.	%	a.v.	%	a.v.	%	a.v.	%
Females	7	100	3	42.8	18	69.2	24	72.7
males	0	0	4	57.2	8	30.8	9	27.3

On the other hand, in A Ceza the minimum number of individuals is 5 juveniles and 3 adults. The proportion of juveniles is higher than in Liñares, although it does not reach the given value of around 70%. Despite of the degree of fragmentation of the adult larger bones, that could give a incorrectly higher proportion of adults, it is possible to recognize a proportion of juveniles around 50 - 60% in jaw, scapula, pelvis and limb bones. These proportions are higher in the case of the skulls, probably due to the fact that the juvenile ones are found in parts, and lower in some smaller bones such as the carpus and tarsus, metapodials and phalanges. This would be caused by the trampling phenomenon already commented.

Finally it is necessary to remark the finding of part of a neonate skeleton preserved in a clayish level of the infilling.

Distribution by sex

The strong sex dimorphism in the cave bears, moreover in the canines but also in

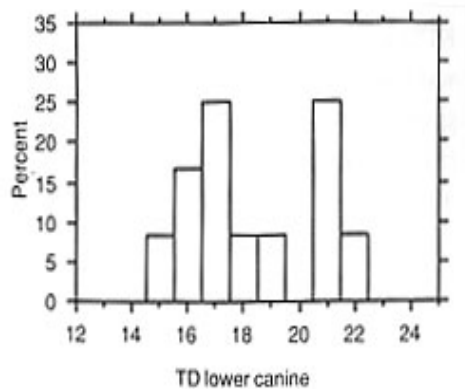


Fig. 3. Transversal diameter of the lower canines in Liñares, showing the typical bimodal distribution caused by sex dimorphism in the Cave bear.

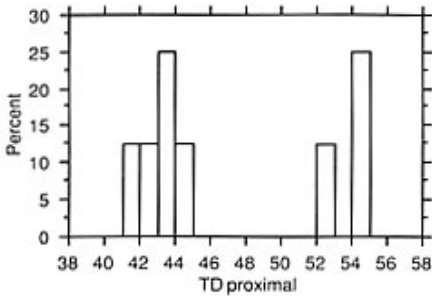


Fig. 4. Transversal proximal diameter of the radius in A Ceza showing two size classes (females and males).

other parts of the skeleton, allows to make an study of the populations by sex.

The cave bear populations present sometimes a very different distribution by sex. There are cases of preferential occupation of the caves by males or females, such as in Westbury (Great Britain), where the males occupied a part of the carstic system whilst the females and juveniles inhabited in a different part (ANDREWS & TURNER, 1991). Some other cases of a different sex ratio are the Drachenhöhle of Mixnitz, Austria, where the number of males exceed that of females (ABEL & KIRLE, 1931), although this conclusion was contested by KOBY (1949) that suggested that this apparent preponderance of males would reflect a bias in collecting. It was suggested, on an ecological ground, that the smallest caves were occupied preferently by females with cubs, whilst the larger caves were inhabited by males (KURTÉN, 1958). Finally, there are more evidences of a balanced sex ratios in most of the caves, because of a non-preferential occupation or, also possible, because the final balance of an alternating occupation

after a long period. This is the case of Eirós cave, in the nearby of the area studied, where both sexes are almost equally represented (GRANDAL D'ANGLADE & VIDAL ROMANÍ, 1997).

The population of Liñares shows a greater number of females than males. The transversal diameter of the canines shows significantly the sex dimorphism (Fig. 3), although the size of the limb bones give a similar result, as shown in Table 3. This is not the case of the skulls and jaws, that give a contradictory result. Only female skulls were found, whilst the number of male jaws is slightly higher than those of females. The sexing was carried out by the transversal diameter of the canine. The low number of these remains, however, does not allow to consider this result as significant.

The poor degree of preservation in A Ceza does not allow to make a detailed study of the distribution by sex. We must remark, however, that in some of the adult bones is possible to recognize two size classes, that could represent the group of females and males (Fig. 4). Also two penian bones were found, confirming the presence of male individuals in the cave.

CONCLUSIONS

The study of a population of Cave Bears have to be based in the study of the bone remains preserved in the deposits of sediments of the cave. The taphonomical processes that affected the bones after the death of the animal may produce a bias in the preservation of the bones. Some of these processes are strongly conditioned

by topography of the cave (such as the size or the slope), the physical conditions (circulation of water...), the activity of animals (scavengers, trampling...). The results of these processes are diverse: preferential loss of the smaller remains, fragmentation of bigger or more fragile bones, could be the principal ones. Only taking into account how these factors affect the preservation of the bones in each case the interpretation of the data can be accurate.

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