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Cave Bear (*Ursus spelaeus* Rosenmüller Heinroth, 1794) and Humans During the Early Upper Pleistocene (Lower and Middle Palaeolithic) in Lezetxiki, Lezetxiki II and Astigarragako Kobea (Basque Country, Spain). Preliminary Approach

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Cave bear (*Ursus spelaeus* Rosenmüller-Heinroth, 1794) are the most abundant taxon in the lower levels of many archaeological sites in Cantabrian Area. Through the scientific literature, archaeological levels have been consistently assigned to the different cultural periods, depending on the identified stone tools. In this paper, we would like to contribute to the interpretation of these sequences, through the accurate analysis of their archaeozoological accumulations. By presenting three examples, Lezetxiki, Lezetxiki II and Astigarragako Kobea, we will try to bring new data to this problem. Archaeozoological analysis carried out at these three stratigraphical sequences, have shown the existence of intense bears (*Ursus spelaeus deningeroide* Mottle, 1964 and *Ursus spelaeus* Rosenmüller-Heinroth, 1794) occupation and human groups ephemeral presence (through the presence of lithic implements), in the oldest levels (Lower Palaeolithic) stratigraphic series of the three cavities. Our aim is to present the preliminary archeozoological and taphonomic results of these three sequences.

Keywords: *URSUS SPELAEUS DENINGEROIDE, URSUS SPELAEUS,* EARLY UPPER PLEISTOCENE, LOWER PALAEOLITIHIC, LEZETXIKI, LEZETXIKI II, ASTIGARRAGAKO KOBEA, ARCHAEOZOOLOGY, TAPHONOMY

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Introduction

This paper presents the archaeological and taphonomic research of Lezetxiki, Lezetxiki II (Arrasate, Gipuzkoa) and Astigarragako Kobea (Deba, Gipuzkoa) lower layers. These sites are good examples of caves located in northern Spain with long stratigraphic sequences. In these three cases, the sites were occupied alternately by carnivores and humans.

In this paper we shall refer to the material recovered at the lower levels (L, M, N, O) of Lezetxiki during the 2005-2010 excavation seasons. The correspondence between these levels established by the modern excavations and levels VII-VIII in the classic sequence (Altuna, 1972) is still being studied. Several carnivore species employed the cave periodically, including the cave lion (*Panthera spelaea*), an unusual taxon in the Iberian Peninsula. However, the predominant species in the lower levels of Lezetxiki and Lezetxiki II was the cave bear (*Ursus spelaeus*) (Arrizabalaga *et al*., 2010). In turn, Astigarragako Kobea was inhabited by carnivores *Lynx lynx* and *Cuon alpinus* from Upper Palaeolithic (Layer II), until the base of the sequence (IV and V leyers), with predominance of *Ursus spelaeus* remains (Castaños, 2009).

The presence of human remains at these sites is attested by proto-historical burials (Astigarragako Kobea and Lezetxiki) and isolated dental remains of *Homo neanderthalensis* (Basabe, 1970) and a pre-neandertal humerus (Basabe, 1966), as well as lithic assemblages attributed to different phases of the Upper, Middle and Lower Palaeolithic. The first human occupations were sporadic (Villa & Soressi, 2000; Brugal *et al*., 2006) and short-lasting to more stable until de Middle and Upper Palaeolithic, which caused the progressive displacement of *Ursus spelaeus* from the caves, until the extinction (Orlando *et al*., 2002)

Location of the sites, chronology and history of research

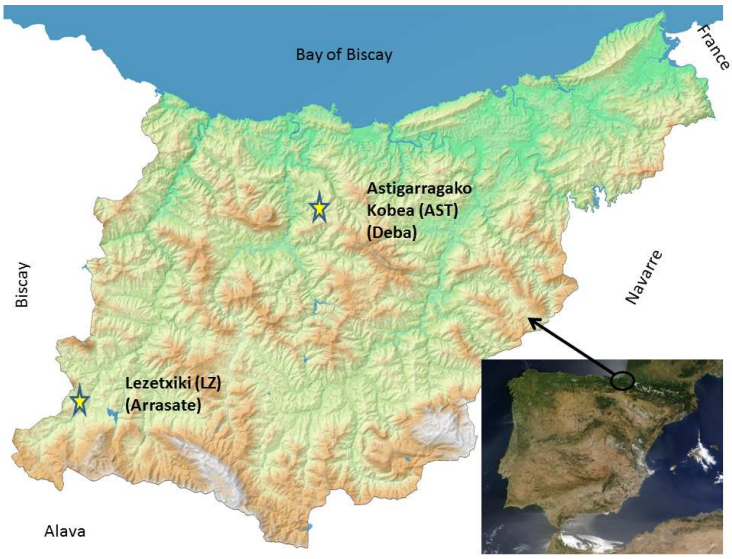
The three sites are located in the Basque Country, in the eastern part of the northern Iberian coast. During the Upper Pleistocene, this region is placed over a natural corridor between continental Europe and the interior of the Iberian Peninsula. It was consequently densely occupied by human groups from the Lower Palaeolithic onwards (Arrizabalaga, 2005), and a wide range of macrommals (continental and peninsular), thus shaping a varied ecosystem (Altuna, 1992; Castaños, 2005; Fosse & Quiles, 2005; Villaluenga, 2009, 2011).

Astigarragako Kobea

The site of Astigarraga is located in the middle valley of the Urola river. Together with the neighbouring Deba valley, this was a major nucleus of human occupation from the Lower Palaeolithic; Irikaitz (Arrizabalaga & Iriarte, 2002, 2010) and Astigarragako Kobea, with continuity in the Middle Palaeolithic; Amalda (Altuna *et al*., 1990; Yravedra, 2007), Urkulu and Zerratu (Sáenz de Buruaga & Mujika, 2005). During Upper Palaeolithic; Amalda, Praileaitz I (Peñalver & Mujika, 2003, 2005a, 2007-2008), Ekain and Urtiaga (Barandiarán Ayerbe, 1947, 1948, 1960a), Zerratu (Sáenz de Buruaga & Mujika, 2005) and Aldatxarren (Sáenz de Buruaga, 2006, 2008) and Holocene; Linatzeta (Tapia *et al*., 2008) and Ekain were inhabited during the Mesolithic.

The cave was discovered in 1967 by members of the Munibe Group of Azpeitia. At this time the members of this group dug

Figure 1. Map of location of the sites in the province of Gipuzkoa (Basque Country, Spain)



a 1x1m test pit in the cave entrance and found bones of *Rangifer tarandus* and *Ursus spelaeus*. It was not until 2005 when the group and the Prehistory Area of the University of the Basque Country (UPV-EHU) studied the cavity. Four square metres (4 m^2) excavation with a stratigraphic sequence of 2.5 m. At the base of the stratigraphy the archaeological works were stopped by a large limestone block. The interim results of this excavation indicate that the sequence consists of at least five levels (Alberdi *et al*., 2010).

Level I (NRT: 551), 30cm thick, is formed by a Bronze Age burial sub-level (1a) and an Azilian occupation (1b). Level II is about 80 cm thick (NRT: 979, NISP: 508; MNI: 32). The human occupations in this level indicate the site was used sporadically during the Upper Palaeolithic, with a more intense use in the Solutrean (16.975±145BP) (García-Díez *et al*., 2011).

In addition, during 2009 field season, at Astigarragako Kobea were discovered a series of paired marks on the cave wall next to the excavation area (García-Díez *et al*., 2011).

Level III is formed by a bed of clay 30 cm thick (NRT: 201, NISP: 148, MNI: 32). The evidence of industry (side-scrapers and flakes) and their morpho-technological characteristics are attributed to the Mousterian. Level IV, 20 cm thick, is characterised by a palaeontological accumulation of *Ursus spelaeus* bones (NISP: 264, MNI: 8).

Finally, Level V (NRT: 41, NISP: 31, MNI: 4), with a thickness of a metre, has yielded faunal remains, as well as some twenty flakes, notches and denticulates, and side-scraper fragments. Their presence seems to be the result of repeated occupation of the cave by different human groups. While the industry is not characteristic, it can be attributed to the late Lower Palaeolithic and

Middle Palaeolithic. The reduced sample of this level (NRT: 41) and the few remains of bear (NISP: 14; MNI: 1) do not allow us to made a taxonomical adscription between (*Ursus spelaeus deningeroide* Mottle 1964 or *Ursus spelaeus* Rosenmüller-Heinroth, 1794).

Lezetxiki

Lezetxiki caves (Lezetxiki and Lezetxiki II) are placed on the slope of Bostate hill, at the confluence of Aramaio and Deba river. These caves are in an ideal position over the surrounding valley area, to control ungulates movements. In addition, at few kilometres, Kurutzeta mountain-pass links Atlantic and Mediterranean watersheds, Cantabrian area and the interior of the Iberian Peninsula, through the Ebro river valley.

Lezetxiki was placed over the path which communicated Gipuzkoa and Alava. The first archaeological remains were recovered by people of Garagarza (Arrasate) at the beginning of XX century. In 1927, J.M. Barandiarán collected flint and bone fragments, these remains encouraged a first archaeological test pit in 1928 (Barandiarán Ayerbe, 1960b).

The excavation at Lezetxiki began in 1956 and continued until 1968 (nowadays this excavation is known as the "*classical excavation*" of Lezetxiki). When it finished, eight archaeological levels had been discovered. These main layers, were divided into sub-levels, depending on the presence or absence of lithic industry remains. During this intervention 100 m^2 were dug, along a stratigraphy of 10 m. This sequence was not homogeneous, VII and VIII (-8 m) layers were divided by a limestone overhang (squares 9A and 11A). The bottom of the VII layer and the VIII layer filled completely another cave (Cueva de Leibar) (Barandiaran Ayerbe, 1959, 1960b, 1963, 1964, 1965; Barandiaran Ayerbe & Altuna, 1965, 1966, 1967a, 1967b, 1970; Barandiaran Ayerbe & Fernández Medrano, 1957). Inside this cave was found a human humerus, attributed to a pre-neandertal (Basabe, 1966, 1970; Arrizabalaga & Iriarte, 2011).

During the "*classical excavation*" and the following years, different research projects were developed and papers were published with Lezetxiki materials (Chaline, 1970; Kornprobst & Rat, 1967), other analysis, as the dating by C14 were not satisfactory (Mariezkurrena, 1990). Later, until 1996, no further systematic fieldworks were carried out. During the three decades that separates both interventions, the knowledge about the quaternary have had a major an important development. Multiple analyses have been made with materials (Altuna & Lazuén-Fernández, 2012; Álvarez-Alonso & Arrizabalaga, 2012; Arrizabalaga, 1995; Baldeón, 1987, 1993) and samples (Sánchez-Goñi, 1991) from Lezetxiki's "*classical excavation*". Due to the inconsistency and contradictory results of several of the studies, a new excavation project was planned over a small surface (6 m^2) in order to carry out a multi-disciplinary study on a single part of the deposit. This intervention is coordinated by one of the present authors (Arrizabalaga, 2006a, 2006b; Arrizabalaga *et al*., 2005; Falgueres *et al*., 2006). Because of the complex form of the cave, the excavation has been extended to cover an area of 20 m^2, during 2012 field season.

As the archaeological work advanced, the classic stratigraphic sequence has been revised, during 2006 field season was dug the equivalent the level VI (which was the base of the sequence in the "*classical excavation*" at the south profile, where is placed the actual excavation). Beneath this point, all the levels identified (L,M,N,O) (NRT: 6125, NISP: 803, MNI: 40), that should be the equivalent to the level VII of

the classical sequence. During 2007, a level of collapse was found (Level M), this formation is indicative to understand a change in the dynamic of occupation of the space at Lezetxiki. In the lower levels of Lezetxiki becomes in an accumulation with a high proportion of *Ursus spelaeus* remains (% NISP 93.77; %MNI 50) becoming in the main taxon in these layers. The conservation of this sedimentary level is outstanding (Arrizabalaga *et al*., 2009).

Lezetxiki II

The excavation of the deposit of Lezetxiki II began in 1999, with the aim of identifying the origin of the sedimentary context of the fossil human humerus (Arrizabalaga, 2006b). This cave is connected physically to the classic deposit though Leibar cave, which was filled by VII and VIII layers of the "*classical excavation*". The excavated area is a trench 1x4 m, upper part of the stratigraphy has been dated older than 74,000 BP (level D is a calcite formation) (Falgueres *et al*., 2006). The identification of a number of sedimentary and erosional episodes has succeeded in reconstructing a complicated formation sequence.

The deposit has yielded an interesting but small lithic assemblage belonging to the Middle and Lower Palaeolithic, as well as a large number of *Ursus spelaeus* (NISP: 261,

Figure 2. Exceptional preservation of a Ursus spelaeus *skeleton at Lezetxiki recovered during 2008-2009 field seasons.*

MNI: 13) remains. Other large mammals are scarcely represented (NISP: 36, MNI: 19), but some of them provide significant palaeo -environmental information as a *Macaca sylvanus* hemimandible (Castaños *et al*., 2011). However, a first analysis of small mammals from Lezetxiki II lower level, gave an interesting collection with a first citation of *Sicista betulina* at the Iberian Peninsula (Rofes *et al*., 2012), this discipline will bring more significant information in a near future.

Materials and Methods

The lower levels in these three deposits will be compared here, as they encompass the transition between the end of the Middle Pleistocene and the early Upper Pleistocene. Their geographical proximity, similar location in caves within long stratigraphic sequences, and the archaeozoological composition (with a predominance of bears in the *Ursus spelaeus-deningeri* evolutionary line and with intermediate morphological characteristics between both species) enables a comparative study. However, as they are still undergoing excavation and research, we are only able to make an approximate study susceptible to correction or modification in coming years.

In this paper we will make a comparative study of the basal levels of Lezetxiki, Lezetxiki II and Astigarragako Kobea. These sites are similar in multiple aspects: chronological attribution, material record (few lithic remains and large faunal assemblages), probable taphocenosis (alternating between bears and human groups), and similar geographic context. Likewise these three archaeological sites were dug out with a systematic methodology including screening with 1 mm sieves.

Methods

The main part of the analysis is dedicated to the archaeozoological assemblages. The taxonomical and taphonomic composition of both levels will be analyzed in order to understand of their formation. Astigarragako Kobea, faunal collection was revised in the "Depósito temporal de materiales Arqueológicos y Paleontológicos de Gipuzkoa" of Saint Sebastian (Gipuzkoa) during 2010. Lezetxiki and Lezetxiki II collections were studied at the University of the Basque Country (Vitoria-Gasteiz). Taxonomy was established using the osteological collection of Aranzadi Science Society (Saint Sebastian, Gipuzkoa) and different anatomical comparison atlas (Barone, 1976; Pales & García 1981; Schmid, 1972; Varela & Rodríguez, 2004). The biometric measures (Driesch, 1976) were recorded with a digital caliper (*Mitutoyo*) and used for descriptive statistics (distribution, media, etc.) and more complex statistic procedures as Mixture Analysis (*PAST* software) (Hammer *et al*., 2001) specifically applied to identify sexual dimorphism (Monchot, 1999, Quiles & Monchot, 2004; Arceredillo *et al*., 2011) and age (Stiner, 1998; Weinstock, 2009) among cave bears. Taphonomical alterations were observed and photograph with a digital macroscope (*Nikon MSZ 1500*) and a digital photo camera (*Sony* α350, 75-200 mm). Different works were used to interpret taphonomical modifications (Blasco Sancho, 1992; Cáceres, 1995; Waldron, 2008), to quantify (Klein & Cruz Uribe, 1984; Dong, 1997; Lyman, 2008) and to understand the nature and characteristics of *Ursus spelaeus* bone accumulations (Haynes, 1980, 1983, 1988; Quiles, 2002; Quiles *et al*., 2006).

Taxonomy

Astigarragako Kobea

As mentioned above, the sequence at Astigarragako Kobea consists of five archaeological levels in which 2213 osseous remains were recovered; of these 1287 could be classified taxonomically, while 926 were unidentifiable. Apart from Layer I and the top of the level II first 15 cm, with proto-historical remains and predominance of *Ovis/Capra* (45.92% at the layer I). The best represented taxon at Astigarragako Kobea archaeological levels (II, III and V) and the palaeontological layer (IV) is the *Ursus spelaeus* (NISP: 630, MNI: 31).

Anthropic activity in Levels II (Upper Palaeolithic) and III (Middle Palaeolithic) was concentrated on the taxa *Capra pyrenaica* (n: 15) at the layer II. This taxon reaches proportions of 22.63% and 20.27% in these levels,. The diversification in the taxonomical distribution in Level II (16 taxa, NRT: 979) should also be noted, although the *Lynx lynx* remains (n: 56) belong to a single practically-whole specimen.

Level IV yielded 271 identifiable remains, of which 264 (MNI: 8, 97.41%) belong to *Ursus spelaeus*, as this is a palaeontological accumulation. Level V cannot be assessed due to the small archaeozoological (NRT: 41) and lithic assemblages that have been found.

For the sequences at Lezetxiki and Lezetxiki II we have analysed the results of the last five field seasons (2005-2010). These levels have been attributed to the early Upper Pleistocene and/or the late Middle Pleistocene.

Lezetxiki II

The bone assemblage from Lezetxiki II consists of 1085 remains, of which 297 are identifiable (27.37%) the 87.87% of these remains, belong to *Ursus spelaeus* (NISP: 261, MNI: 13). The archaeozoological remains were concentrated in the central levels (F,G,H,I), upper (A,B,C,D,E) and lower (J, K) levels, specially these ones, are quantitatively less important, but qualitatively most significant, paleo-environmental information came from these levels (J, K). A left mandible of female *Macaca sylvanus* (Castaños *et al*., 2011) and a molar of *Sicista betulina* (Rofes *et al*., 2012) are the best examples.

Lezetxiki II was occupied by carnivores (*Ursus spelaeus*) and humans during Middle and Lower Palaeolithic. The evidences of anthropogenic presence in Lezetxiki II have had to be found in lithic implements and three bone fragments (2 in level F and 1 in level J) with signs of fracturing by percussion. In turn, the activity of carnivores (pits, punctures and scores) was responsible of the modifications documented over ungulate and cave bears remains.

Lezetxiki

Taxonomical composition at Lezetxiki undergoes a radical change between upper (A-K) and lower (L-M) levels. Firsts are a typical accumulation of the Middle and Upper Palaeolithic, with alternative presence of humans and carnivores. This archaeological and faunal context is similar in both excavations (Altuna, 1972; Altuna & Lazuén-Fernández, 2012).

The excavation of the lower levels, was completed between 2006 and 2010, nowadays (2012) this collection has been increased with more remains (actually under analysis) coming from the 2011 and 2012 field seasons. Another level have been identified (P), composed by *Ursus spelaeus* (or *Ursus spelaeus deningeroide*) remains and a few

quantity of Bovini elements with anthropogenic alterations.

The archaeozoological composition of Lezetxiki lower levels (NRT: 6125) is formed by a slight collection of ungulate remains (n: 12; %NISP: 1.49), the represented taxa are *Bovini* (*Bos primigenius/Bison priscus*) (n: 6, %NISP: 0,.4) *Rupicapra pyrenaica* (n: 4, %NISP: 0.49) and *Cervus elaphus* (n: 2, %NISP: 0.24). However, the most frequent species are carnivores (%NISP: 97.01; %MNI: 77.5) and the *Ursus spelaeus*, which makes up virtually the totality of the assemblage (%NISP: 93.77; %MNI: 50). This presence increases exponentially from level L (%NISP: 67.53; %MNI: 54.54) to, M, N and O layers where the cave bear remains there are the 95% (%NISP: 95.51; 96.65 and 97.82 %MNI: 57.14; 52.94 and 60) of the faunal remains, with a total of 753 identified remains, divided in 20 individual. In addition, other carnivore taxa (*mustelidae*, *canidae* and *felidae*), are represent in small number (n: 24, MNI: 11) becoming more abundant at the level N.

Dimorphism and distribution

We have studied the sexual dimorphism in cave bears by measuring the transversal diameter (TD) at the height of the neck of the upper canine (C^S). This is, the most dimorphic and frequent element at Lezetxiki (n: 30) and Astigarraga (n: 14), although the reduced sample of Lezetxiki II (n: 4) did not allowed an analysis.

Ursus spelaeus adults dominated Lezetxiki and Astigarragako Kobea age distribution. At Lezetxiki, males (67.85%) are more abundant than females, whereas at Astigarragako Kobea females are slightly more common (54.54%). At the eastern sector of the Cantabrian Range (Gipuzkoa), some paleontological sites and layers have been analysed (Torres, 1984; Torres *et al*., 1991, 2007). Only Arrikrutz (79% of males) follows the same pattern as Lezetxiki, whereas at Ekain (71%) and Troskaeta (60%) females are more abundant. The case of Astigarraga (54.54%-45.45%) approaches the ideal model (50-50%) in which both sexes should be found in the same proportion (Torres *et al*., 1991). However, it is possible that this percentage should be due to random causes due to the small size of the sample, specially at Astigarragako Kobea.

The great sexual dimorphism in *Ursus spelaeus* has been noted repeatedly (Kurtén, 1976; Quiles, 2002; Quiles & Monchot, 2004; Pinto *et al*., 2005, 2006; Torres, 1984). Previous work on Quaternary bears in Cantabrian Spain (Grandal, 1993; Grandal & Vidal-Romaní, 1997; Grandal & López-González, 2005; Pinto *et al*., 2005, 2006; Torres, 1988, 1984; Torres *et al*., 1991,; Villaluenga, 2009, 2011; Villaluenga *et al*., 2012), situate the boundary between both sexes in 18 mm (TD at the neck of C^S). However, in our case the minimum transversal diameter (DTmin: 13.35 mm) of the females and the maximum transversal diameter of the males (DTmax: 23.90 mm) is somewhat less than the mesures given for the bears at Eirós (13.5 and 25.4 mm) (Grandal, 1993; Grandal & Vidal-Romaní, 1997).

The age group composition (juveniles, sub-adults and adults) of both assemblages we find few juveniles (TD: 4.5-8.6 mm) remains, between neonates and one year cubs. Sub-adults are practically absent and we have only identified some canines (TD: 11.7-13.5 mm) at Astigarragako Kobea, corresponding to immature individuals.

The mean of the transversal diameter (TD) at the upper canine (C^S) have got an

Astigarragako Kobea	I Superficial			II Upper Pal.			III Middle Pal.			IV Paleontologic			V Lower Pal.			SUBTOTAL			
Concept	NISP	MNI	% NISP	NISP	MNI	% NISP	NISP	MNI	% NISP	NISP	MNI	% NISP	NISP	MNI	% NISP	NISP	MNI	% NISP	% MNI
Bos Taurus	24	1	6.52	2	1	0.39										26	2	1.17	2.53
Ovis/Capra	169	3	45.92	5	1	0.98										174	4	7.86	5.06
Equus caballus				1	1	0.19										1	1	0.04	1.26
Bovini	1	1	0.27	9	1	1.77										10	2	0.45	2.53
Capra pyrenaica	112	4	30.43	115	3	22.63	30	1	20.27	3	1	1.10	2	1	6.45	262	10	1.18	12.65
Rupicapra pyrenaica	6	1	1.63	59	2	11.61	10	1	6.75	2	1	0.73	14	1	45.16	91	6	4.11	7.59
Cervus elaphus	23	1	6.25	11	1	2.16	7	1	4.72							41	3	1.85	3.79
Rangifer tarandus				1	1	0.19										1	1	0.04	1.26
Capreolus capreolus				1	1	0.19										1	1	0.04	1.26
Sus sp.	8	2	2.17	1	1	0.19										9	3	0.40	3.79
Subtotal	343	13	93.20	205	13	40.35	47	3	31.74	5	2	1.84	16	2	51.61	575	35	25.98	44.30
Ursus spelaeus	18	4	4.89	237	13	46.65	97	5	65.54	264	8	97.41	14	1	45.16	630	31	2.84	39.24
Panthera pardus				2	1	0.39										2	1	0.09	1.26
Lynx lynx	2	1	0.54	56	2	11.02	4	1	2.70							64	4	2.89	5.06
Felis silvestris	1	1	0.27													1	1	0.04	1.26
Canis lupus	4	1	1.08	1	1	0.19				1	1	0.36	1	1	3.22	7	4	0.31	5.06
Cuon alpinus				4	1	0.78										4	1	0.18	1.26
Vulpes vulpes				3	1	0.59										3	1	0.13	1.26
Subtotal	25	7	6.79	303	19	59.64	101	6	68.24	265	9	97.78	15	2	48.38	711	43	32.12	54.43
Marmota marmota										1	1	0.36				1	1	0.04	1.26
Subtotal										1	1	0.36				1	1	0.04	1.26
Identifiable	368	18	99.99	508	32	99.99	148	6	99.98	271	12	99.95	31	4	99.99	1287	79	58.15	99.99
Non identifiable	183			471			53			209			10			926		41.84	
TOTAL (NRT)	551			979			201			480			41			2213		99.99	

Table 1. Taxonomy of Astigarragako Kobea.

Lezetxiki II	A		B		C		D		E		F		G		H		I		J		K		SUBTOTAL	
	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI
Bovini					1	1					6	1	2	1					1	1	1	1	11	5
Cervus elaphus																			1	1			1	1
Rupicapra pyrenaica					4	1					3	1											7	2
Capra pyrenaica					1	1																	1	1
Subtotal					6	3					9	2	2	1					2	2	1	1	20	9
Canis lupus											1	1									1	1	2	2
Panthera spelaea											2	1											2	1
Mustela sp.											1	1									1	1	2	2
Lynx sp.					4	1					1	1											5	2
Ursus spelaeus					2	1					110	4	23	1	57	3	43	2	11	1	15	1	261	13
Subtotal					6	2					115	8	23	1	57	3	43	2	11	1	17	3	272	20
Marmota marmota											2	1									2	1	4	2
Macaca sylvanus																					1	1	1	1
Identifiable					12	5					126	11	25	2	57	3	43	2	13	3	21	6	297	32
Non identifiable	22		45		17				3		311		109		108		113		30		30		788	
Total	22		45		29		0		3		437		134		165		156		43		51		1085	

Table 2a. Taxonomy of Lezetxiki II (NISP, MNI).

Lezetxiki II (%NISP, MNI)	**A**		**B**		**C**		**D**		**E**		**F**		**G**		**H**		**I**		**J**		**K**		**SUBTOTAL**	
	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI
Bovini					3.44	20					1.37	9.09	1.49	50					2.32	33.33	1.96	16.66	1.01	15.62
Cervus elaphus																			2.32	33.33			0.09	3.12
Rupicapra pyrenaica					13.79	20					0.68	9.09											0.64	6.25
Capra pyrenaica					3.44	20																	0.09	3.12
Subtotal					20.67	60					2.05	18.18	1.49	50					4.65	66.66	1.96	16.66	1.83	28.12
Canis lupus											0.22	9.09									1.96	16.66	0.18	6.25
Panthera spelaea											0.45	9.09											0.18	3.12
Mustela sp.											0.22	9.09									1.96	16.66	0.18	6.25
Lynx sp.					13.79	20					0.22	9.09											0.46	6.25
Ursus spelaeus					6.89	20					25.77	36.36	15.43	50	34.54	100	27.56	100	25.58	33.33	29.41	16.66	24.05	40.62
Subtotal					20.68	40					26.31	72.72	15.43	50	34.54	100	27.56	100	25.58	33.33	33.33	49.98	25.06	62.5
Marmota marmota											0.45	9.09									3.92	16.66	0.36	6.25
Macaca sylvanus																					1.96	16.66	0.09	3.12
Identifiable					41.37	100					28.83	99.99	18.65	100	34.54	100	27.56	100	30.23	99.99	41.17	99.96	27.37	99.99
Non Identifiable					58.62						71.16		81.34		65.45		72.43		69.76		58.82		72.62	
Total					99.99		--		100		99.99		99.99		99.99		99.99		99.99		99.99		99.99	

Table 2b. Taxonomy of Lezetxiki II (%NISP, MNI).

important divergence (17.65 mm at Astigarragako Kobea and 18.98 mm at Lezetxiki). This patron is repeated with females, with a wider distribution (Stdev 1.95) and a larger mean diameter at Astigarragako Kobea (17.65 mm) than at Lezetxiki (Stdev 0.73. TD: 15.19 mm).

Results and Discussion

Astigarragako Kobea and Lezetxiki have been observed an over-representation of adults and scarcity of juveniles and sub-adults (Stiner, 1998). This phenomenon of differential conservation may be due to the location of both assemblages in cave environments where the composition of the fossil record has been affected by taphonomic processes. Indeed, the substrate itself may have suffered movements or transportation processes (Waldron, 2008). For example, at Lezetxiki, the fact that, bones were found in a sub-horizontal position but with multiple examples of anatomical connections, would attest to the existence of slight sedimentary lateral movements (Blasco Sancho, 1992; Cáceres, 1995; Yravedra, 2006).

However, at Astigarragako Kobea, where females amount to 54.54%, employing the cave to hibernate and reproduce, the expected age profile would be attritional, in which juveniles formed the largest age group, followed by sub-adults and adults (Klein, 1982). Therefore, the presence of sub-adults and adults in similar proportions could indicate a natural high level of mortality among the immature animals, which died during their first year hibernating alone, as occurs amongst extant and extinct bears (Clevenger & Purroy, 1991; Quiles *et al*., 2006; Pérez-Rama *et al*., 2011; Stiner, 1998; Weinstock, 2011).

Taphonomy

As the taphonomic study of the three sites is still not complete, here we shall only refer to the observations made of the material recovered at Lezetxiki in the 2008 season. We have selected this assemblage because it is the best conserved. In this season a whole skull was recovered as well as a skeleton and other limb bones in anatomical connection.

Conservation

Despite this excellent level of conservation, transportation phenomena have occurred at Lezetxiki and Astigarragako Kobea. At the latter site, the sedimentary composition and morphology in Levels IV and V, with abundant gravel and small clasts, indicates the existence of running water inside the cave.

At Lezetxiki, the slight movement of the sediment is reflected by the existence of *charriage à sec* (dry transport), an erosional process described by Koby (1943) at alpine sites with large numbers of cave bear remains. This taphonomic process occurs above all in limestone caves; a gravitational movement of sedimentary levels impregnated with water which turns them into a plastic mass which carries the elements contained in them, including *Ursus spelaeus* remains (Llopis & Elosegui, 1954). This usual phenomenon at Lezetxiki, is difficult to quantify, we have selected the phalanges founded during 2008 field works, a total of 97 phalanges (1st, n: 40; 2nd, n: 28; 3rd n: 29). The 19.88% exhibited signs of abrasion and movement (1st: 27.9%; 2nd: 21.42%; 3rd: 10.34%) which is evidence for an intense *charriage à sec* process. Together with the finds of limb and axial bones in a sub-horizontal position and similar orientation, is evidence of the movement of the sediment.

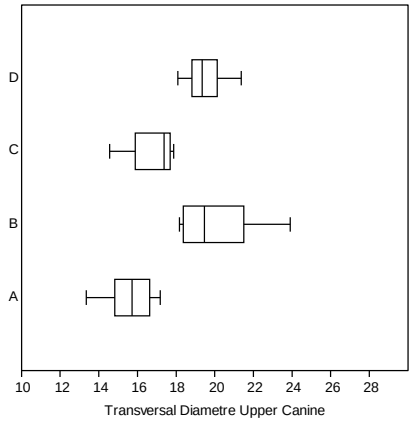
LEZETXIKI	L				M				N				O				Subtotal			
	NISP	MNI	% NISP	% MNI	NISP	MNI	% NISP	% MNI	NISP	MNI	% NISP	% MNI	NISP	MNI	% NISP	% MNI	NISP	MNI	% NISP	% MNI
Bovini	4	1	5.19	9.09					2	1	0.41	5.88					6	2	0.74	5
Cervus elaphus	1	1	1.29	9.09	1	1	0.64	14.28									2	2	0.24	5
Rupicapra pyrenaica					2	1	1.28	14.28	2	1	0.41	5.88					4	2	0.49	5
Subtotal	5	2	6.48	18.18	3	2	1.92	28.57	4	2	0.83	11.76					12	6	1.49	15
Canis lupus									2	1	0.41	5.88					2	1	0.24	2.5
Vulpes vulpes	2	1	2.59	9.09	4	1	2.56	14.28	3	1	0.62	5.88					7	3	0.87	7.5
Cuon alpinus													1	1	1.08	20	1	1	0.12	2.5
Panthera pardus									3	1	0.62	5.88					3	1	0.37	2.5
Panthera spelaea	6	1	7.79	9.09					2	1	0.41	5.88	1	1	1.08	20	9	3	1.12	7.5
Martes sp.									1	1	0.2	5.88					1	1	0.12	2.5
Mustela nivalis	1	1	1.29	9.09													1	1	0.12	2.5
Ursus spelaeus	52	4	67.53	36.36	149	4	95.51	57.14	462	9	96.65	52.94	90	3	97.82	60	753	20	93.77	50
Subtotal	61	7	79.2	63.63	153	5	98.07	71.42	473	14	98.91	82.35	92	5	99.98	100	779	31	97.01	77.5
Marmota	11	2	14.28	18.18					1	1	0.2	5.88					12	3	1.49	7.5
Subtotal	11	2	14.28	18.18					1	1	0.2	5.88					12	3	1.49	7.5
Identifiable	77	11	9.89		156	7	20.55		478	17	13.97		92	5	7.88		803	40	13.11	
Non identifiable	701		90.10		603		79.44		2943		86.02		1075		92.11		5322		86.88	
Total (NRT)	778		99.99	99.99	759		99.99	100	3421		99.99	99.99	1167		99.99	100	6125		99.99	100

Table 3. Taxonomy of Lezetxiki lower levels (L, M, N, O,).

Table 4. Ursus spelaeus *distribution. Torres (1991) studied* Ursus spelaeus *sexual distribution in same caves of Gipuzkoa. At Lezetxiki and Arrikrutz males are more frecuent. On the other hand, at Troskaeta and Ekain females are more usual, and in the middle Astigarragako Kobea has got an equilibrate distribution.*

Sites	Lezetxiki	Astigarraga	Troskaeta	Ekain	Arrikrutz
Female %	32.14	54.54	60	71	21
Male %	67.85	45.45	40	29	79

Graph 1. Sexual dimorphism at Astigarragako Kobea and Lezetxiki. Sexual dimorphism at upper canine (C^S) Astigarragako Kobea (A female and B male) and Lezetxiki (C female and D male). The males upper canine diameter mean is similar in both sites (20.018mm and 19.49mm), with a wider distribution at Astigarraga Kobea (TD max.:23.90mm). Females mean is bigger at Lezetxiki (LZ) (16.92mm) but the distribution is larger at Astigarragako Kobea (13.35mm-17.6mm).

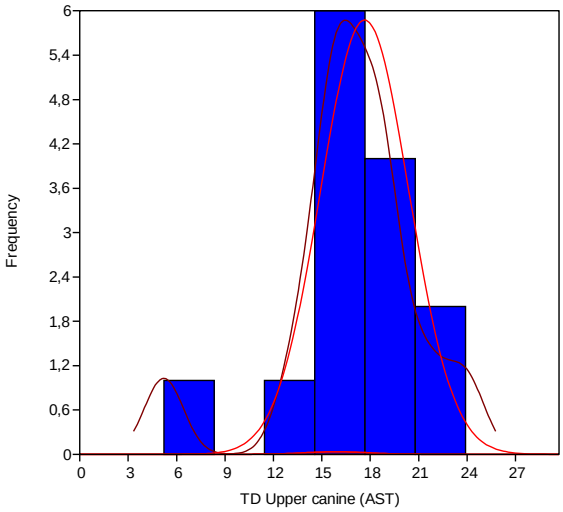


TD C^S (95%)	**Mean**	**Stdev.**	**Prob.**
A: AST (female)	16.849	1.8947	0.86661
B: AST (male)	22.857	1.2255	0.13339
C: LZ (female)	15.183	0.72667	0.06539
D: LZ (male)	18.983	1.1692	0.9346

Scavenging

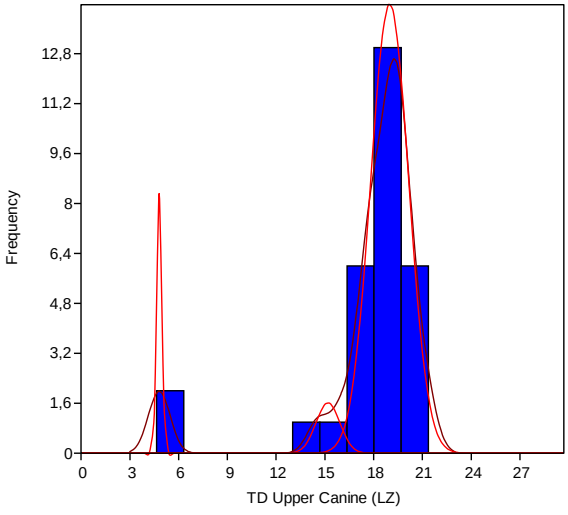
Taphonomic analysis of the cave bear sites (Andrews & Turner, 1992; Quiles, 2002; Quiles *et al*., 2006; Stiner, 1998) have identified and quantified damage attributed to scavenging (Pérez-Rama *et al*., 2010; Pinto *et al*., 2005, 2006). These alterations affect long bones as; scores, punctures, cusps on the bone surface and notches associated with fractures (Rabal-Garcés *et al*., 2012), and punctures at vertebrae bodies and even scores on the head of ribs. However, the morphology of the fractures and damage, are characteristic of the destruction caused by bears (Haynes, 1980, 1983, 1988), produced around the proximal epiphysis. It is likely that this type of damage was caused by the inability of the cave bears to break bones and separate the limbs (Cregut & Fosse, 2001). This would be owing to ther lack of the necessary strength in the masticatory apparatus and absence of suitable dentition for the systematic consumption of bones and meat (Kurtén, 1976; Gaspard, 1971).

Graph 2a. Upper canine (C^s) at Astigarragako Kobea. Mixture analysis (Log.I.Hood: 1,009; AIC: 42.78) of Upper Canine (C^s) transversal diameter (TD) at Astigarragako Kobea. The best represented age group are adults, females (n: 7) are more abundant than males (n: 6), juveniles (n: 1) and sub-adult (n:2) remains are under-represented.



AST (C^S)	Prob.	Mean	Stdev.
Male	0.92469	17.654	2.7371
Female	0.0038781	15.899	1.9595
Juvenil	0.071429	5.21	0
Sub-adult	1.057E-06	13.722	7.6586

Graph 2b. Upper Canine (C^s) at Lezetxiki. Mixture analysis (Log.I. Hood -21.15; AIC 65.5) Upper canine (C^s) transversal diameter at Lezetxiki, males (n: 17) are the best represented age group, juveniles (n: 2) and sub-adults (n: 3) are under represented.



LZ (C^S)	Prob.	Mean	Stdev.
Male	0.86974	18.984	1.168
Female	0.061297	15.19	0.73097
Juvenil	0.068962	4.81	0.16
Sub-adult	3.2899E-06	4.805	0.16

However, taphonomic studies of gnawed bears bones, suggests sporadic scavenging behaviour (Pinto et al., 2005, 2006; Rabal-Garcés *et al*., 2012). Future specific publications, will be enable to quantify the importance of this behaviour in the formation of the fossil record and it reflex over diet (Fernández *et al*., 2001; Pérez-Rama *et al*., 2011; Richards *et al*., 2007; Trinkaus & Richards, 2008).

Human occupations

The anthropogenic activity in the analysed levels is almost exclusively limited to the lithic assemblages. These consist of implements made in abundant local ferruginous materials (limonite), in addition, at Lezetxiki quartzite was employed, (procured in the Ebro Valley fluvial deposits located 20 km away), meanwhile flint during lower Palaeolithic was infrequent.

At Astigarragako Kobea, the lithic assemblage (flakes, denticulates and side-scrapers) used basalt and other local volcanic raw material. This material, vulcanite (originally volcanic ash, posteriorly compacted by sedimentary process, until becoming a stone of concoidal fracture) came from an outcrop in the middle valley of the Urola river. It was gathered in the river bed, in the form of pebbles, used in Lower Palaeolithic to make a wide range of implements, as has been clearly documented at the nearby open-air site of Irikaitz in the town of Zestoa (Arrizabalaga & Tarriño, 2010; Kortabitarte, 2011).

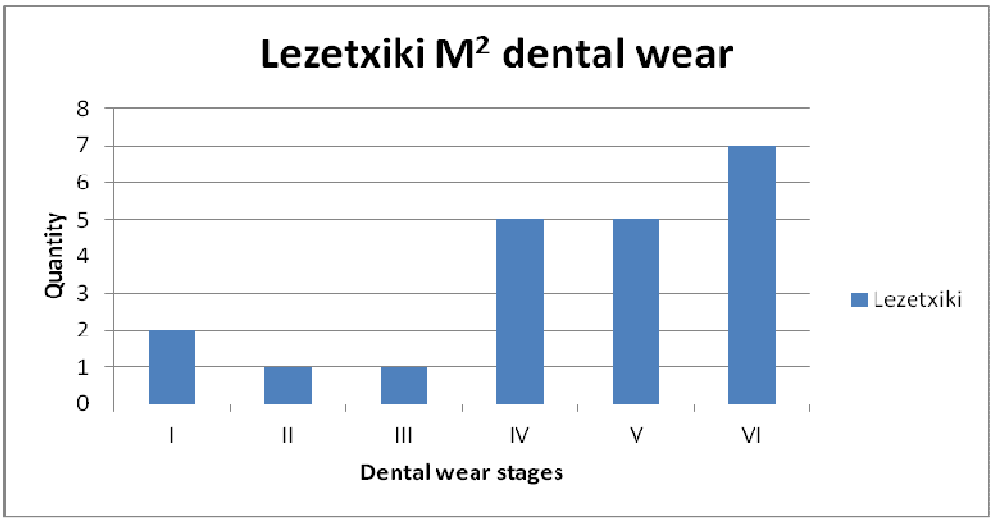
The nature of the archaeozoological assemblages at Astigarragako Kobea and Lezetxiki, together with the poor conservation of the cortex, does not allow to determinate the nature of the anthropic activity. Only some shafts with evidence of percussion (helicoidal fractures) and cut marks have signs of butchery activity. However, with the starting of the excavation of the new level (level P) at Lezetxiki, during the 2011 season, it was possible to document new evidences, several ungulate remains were recovered with helicoidal fractures and signs of combustion, this could be a first evidence of a more significant human presence in future excavation seasons.

Conclusions

We have attempted to present an overview of three sites with the oldest human-carnivore presence (Astigarragako Kobea, Lezetxiki and Lezetxiki II) at the eastern side of the Cantabrian Range. They are sites with long stratigraphic sequences, in which the human use ranges from the Lower Palaeolithic to post-Palaeolithic times. Lower levels (Lezetxiki: L, M, N, O; Astigarragako Kobea. IV and V and Lezetxiki II), has been documented human groups presence, by lithic assemblages and scarce archaeozoological evidences. This suggests that the occupations were repeated over time, but short-lasting (Arrizabalaga, 2006b; Arrizabalaga *et al*., 2009).

Large palaeontological assemblages with *Ursus spelaeus* have also been documented, enabling a detailed study of their populations (Altuna, 1972). They are characterised by the presence of adult specimens: Lezetxiki (NISP: 753, MNI: 20) was a cave in which adults, mostly senile individuals (MNI: 7), hibernated; whereas Astigarragako Kobea (NISP: 630, MNI: 35) was used for breeding and the hibernation of sub-adults (47% of the long bone remains), with a high mortality level. Lezetxiki II sequence, probably linked to the dug small

Graph 3. Dental wear at Lezetxiki. Dental wear stages at Lezetxiki (M,N,O,P), we have considered the M^2 (NR: 21). The senile and old individuals are the best represented, this characteristic is compatible with the high percentage of males (63.33%).



Graph 4. Age profile at Lezetxiki and Astigarragako Kobea. To study the mortality profiles we have considered the long bones. Lezetxiki II collection (NRT: 13) was not representative. Both Astigarraga (III, IV and V levels) and Lezetxiki (L,M,N,O) are unusual profiles, probably due to post-depositional processes, as transport and secondary sedimentation. In consequence the smallest bones (most of them juveniles bones) are absent, so the differential conservation over represent the biggest elements (adults limb bones).

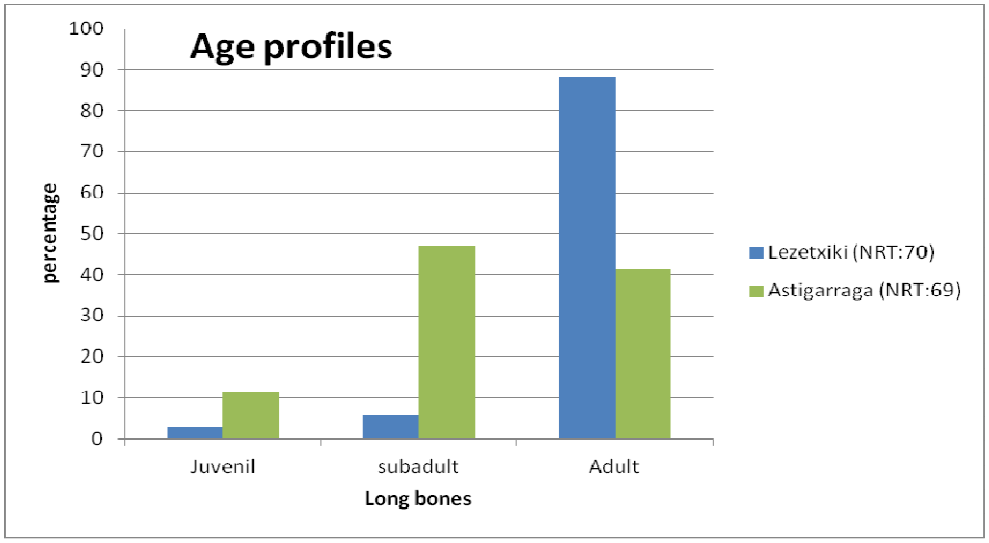


Figure 3. Ursus spelaeus *gnawed radius and femur. Two examples of scavenging over* Ursus spelaeus *radius and femur, from Lezetxiki. Both have got scores at the proximal epiphysis, these modifications were made by other bears, probably at the end of the hibernation (Pinto* et al.*, 2005).*

surface (4 m^2) and to the post-depositional phenomena (sedimentation and erosion successive phase). The archaeozoological sample is fragmentary (NISP: 297, MNI: 32), only the F layer should not be deposited in a second context.

However, phenomena of differential transportation have affected the conservation of these assemblages, favouring the survival of larger anatomical parts (Lyman, 2008). Plasticity of the sediment (mainly composed by clay) meant that at Lezetxiki lower levels (L, M, N, O) *Ursus spelaeus* remains were able to be conserved in anatomical connection (Figure 2). In contrast, the taphonomical evidences of human activities, as cut marks or percussion marks, should be diluted by the effect of *charriage à sec*, which deteriorated the surface of a large number of bone fragments which, to judge from their shape, could have been manipulated by humans.

Related to the cave bear population analysis, a topic to debate has been the ethology (Liden & Angerbjörn, 1999) and the dietary preferences of this taxon. In recent decades, stable isotope analysis has attempted to clarify this problem (Bocherens *et al.*, 1997; Fernández-Mosquera *et al.*, 2001; Richards *et al.*, 2008), and concluded that plants formed the principal component in the diet. However, taphonomic studies have also revealed a series of destructions caused by the bears themselves, attesting to the occasional consumption of the remains of other bears (Pinto *et al.*, 2005, 2006; Pérez-Rama *et al.*, 2010; Rabal-Garcés *et al.*, 2012).

Finally, another problem to be tackled in future publications is the complex phylogenetic assignation of the ursids (Hänni *et al*., 1994; Argant, 1995), as preliminary morphological study of these sites indicate transitional characteristics (unpublished). It will therefore be determined whether these remains belong to *Ursus spelaeus*, the transitional form *Ursus spelaeus deningeroide* or *Ursus deningeri* (Baryshnikov, 1999, 2006; Hofreiter *et al*., 2007; Loreille *et al*., 2001; Orlando *et al*., 2002).

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