Through time Iberian *Ursus spelaeus* Ros. Hein. cheek-teeth size distribution

Distribución temporal del tamaño de los molariformes de *Ursus spelaeus* Ros.-Hein. ibérico

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ABSTRACT

This paper deals with a metrical comparison of cheek-teeth length of *Ursus spelaeus* Ros.-Hein.Iberian population representatives.

Key words: cheek-teeth length, *Ursus spelaeus,* Spain

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INTRODUCTION

It looks so evident that cave bear teeth from diffferent localities of the Iberian Peninsula show different sizes and morphologies and this will need an explanation in spite of to compare dental sizes was a process full of uncertainties. On one hand some uncertainties lie on the lack of (radioactive) datings on the other hand sex-dimorphism influence and size-trends could be the origin of constraints. But in any case a very important series of morphological and metrical differences among different cave bear population (caves) was found affecting both dentition and skeleton. Due to the lack of dating of the different *Ursus spelaeus* populations these differences were interpreted in some ways as polytypism, archaic-like forms etc. In this paper we will compare dental sizes of *Ursus spelaeus* cheek teeth from a wide number of Iberian localities but before we will test the normality – no sex dimorphismism controlled or binormality-sex dimorphism on dental size distributions.

IBERIAN *URSUS SPELAEUS* GEOGRAPHICAL DISTRIBUTION

Spanish cave bear localities are grouped on four different areas: Atlantic Border, Mediterranean Border, Pyrenees and Outback, TORRES (1989) which we tentatively suppose connected during palaeoenvironmental *optimi* periods, but being isolated during the most of their existence due to climate worsenings. It is possible to interpret that the cave bear population was on borrowed time in the Iberian Peninsula, in fact at the species border, being strongly affected by sudden palaeonvironmental worsenings and growing human (Middle and Lower Palaeolithic representatives) pressure.

IBERIAN *URSUS SPELAEUS* CHRONOLOGY

Recently amino acid (mostly aspartic acid) racemization has been proved to be a powerful tool for the dating of *Ursus deningeri* Von Reich. and *Ursus spelaeus* populations of the Iberian Peninsula. According to TORRES *et al.* (1999, 2000) aminochronological data, Iberian *U. spelaeus* localities are clearly differentiated from *U. deningeri* ones which can be considered as the true Iberian *Ursus spelaeus* ancestor being both grouped into two highly different aminozones whith high different aspartic acid racemization ratios. *Ursus spelaeus*'s aspartic acid racemization values cluster clearly in two very well differentiated aminozochronostratigraphical periods (sub-aminozones). Two among them, El Reguerillo (TT) and Arrikrutz (AA) are placed at the 6th Oxygen Isotope Stage (Uppermost Riss) while La Lucia cave (LU) appeared at the end of the 5th Oxygen Isotopic Stage (Eem). The remaining localities are scattered at the uppermost part of the 4th Oxygen Isotope Stage (Würm). Probably it would be possible that this occupation time span could be reflected into dental size differences.

SAMPLING

Teeth from caves from the four Iberian occupation areas, figure 1, Atlantic Border, Mediterranean Border, Outback

and Pyrenees have been measured: In the Atlantic Border area *U. spelaeus* appear in Eirós-EE (Triacastela, Lugo), La Lucia-LU, La Pasada-SS (Guriezo, Cantabria), Arrikrutz-AA (Oñate, Guipuzcoa), Ekain-KK (Deba, Guipuzcoa), Troskaeta-TR (Ataun, Guipuzcoa) and Amutxate-AX (Aralar, Navarra). In the Mediterranean Border there are not many caves with cave bear remains El Toll-XX (Moiá, Barcelona). In the Outback: El Reguerillo-TT (Torrelaguna, Madrid) is the only important locality in the area. In the Pyrenees: Coro Tracito-TE (Tella, Huesca) represents a high mountain locality. Almost the whole metric data come from TORRES (1980, 1989) TORRES *et al.* (1991, 1998) and unpublished data (Amutxate cave). Data from Eirós cave came from GRANDAL d´ANGLADE (1993a).

ABOUT SIZE DIMORPHISM IN CHEEK TEETH

Metrical (and morphological) variability of cave bear teeth is so astonishing that EHEREMBERG (1928 a, b) was convinced that the measurements of the teeth are absolutely untrustworthy as a character for the determination of the cave bear species and that the use of mean values was therefore inadvisable. In the same way was ERDBRINK (1956) in his monumental review (from a bibliographical point of view) of fossil and recent bears of the Ancient World. In fact he pointed the inexistence of sexual dimorphism on both skeleton bones and teeth o bears, canines included. At the same time KURTEN (1955a, 1955b, 1969, 1972) published a very impressive number of data concerning sex dimorphism on dentition, skull
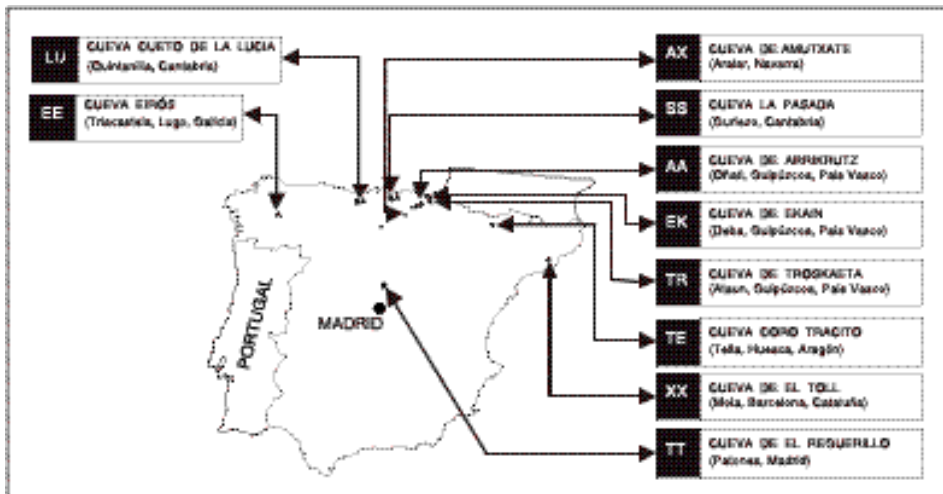

Figura 1. Geographical situation of *Ursus spelaeus* localities.

and postcranel skeleton. But in spite of he published differences among average sizes of male and female cheek- teeth KURTEN (1995b), according to him such differences were small, almost negligible, and in fact did not allow him to speculate about cave bear dentition size trends across Europe or and altitude-linked second upper molar size distribution. Furthermore KURTEN (1957) published a "case of darwinian selection in bears" based on size vartiation according to the age of death of cave bear. According to him it seemed that juvenile dead bears showed smaller teeth than adult dead bears did being this another restrictive factor on size comparison.

KURTEN's ideas influence can be seen in TORRES (1989) where possible sex dimorphism on lower cheek teeth was described from a nonhomogeneous iberian sample of mandibles previously sexed through eitheir lower canine transversal diameter or mandible absolute sizes. In fact some sex-linked differences were found in the average length and width values of the fourth lower premolar male and female lengths. Much later trying to avoid possible sex dimorphism influence GRANDAL d'ANGLADE (1993b) and GRANDAL d'ANGLADE & VIDAL ROMANÍ (1997), through histograms and principal component analysis of Eirós (EE) cave material distinguished between male and female teeth.

In the present paper we raise a different possibility: there is not any sex dimorphism in the length and width of most of the cave bear cheek teeth, making it unnecessary to establish a previous, and doubtful, sex differentiation in the sam-

ple. There are some references supporting this hypotesis: SPAHNI (1958) after jaw analyses concluded that there is not a univoque metrical relationship between the lengths of cheek teeth from the same mandible: the longest lower carnassials can coexist either with long or short lower second molars. Probably more significant is ABEL´s (1931) assertion that in humans from Africa it was possible to observe robust mandibles with small teeth; EHEREMBERG (1928a, b) the *U. spelaeus* Mixnitz material noted small mandibles (females) with long cheek teeth, which produced a characteristic teeth torsion ("kulissenstellung"). EDBRINK (1956, p. 500) proposed a new term word "symmictism" to describe this hereditary coexistence of different morphological traits in mandible and dentition.

Sex dimorphism, if present, must be determined through statistical methods that allowed to ascertain if a variable, tooth measurement, shows an unquestionable bimodal character. A single (or more) histogram from measurements taken on a real small sample can be never used to even suggest sex dimorphism presence.

To check sex dimorphism we have selected teeth from two localities which, according to the canine transversal diameter, show an opposite sex ratio distribution with sample sizes big enough to have statistical significance.

The two analyzed localities were Arrikrutz (AA) cave where, according to the canine transversal diameter size, an overwhelming male dominancy (83%) was found, TORRES (1989), and Ekain

(KK) cave where female strong dominancy (75%) was registered. TORRES (1995).

The analyzed variables were: P^4 length and width; M^1 total length and talus width; M_2 total length and trigonid with; P_4 total length and width; M_1 total length and talonid width; M^2 total length and talonid width; M_3 maximum length and maximum width. For comparison the canine transversal diameter distribution was also analyzed.

The measurements were analyzed through using the Statgraphics program The obtained results appear in table 1. There it is possible to observe that, with the sole first upper molar talus width exception, the calculated standard skewness values of the different measurement taken on cheek teeth from both sites are comprised between 2 and –2, meaning that a normal unimodal distribution can be interpreted for both cave bear population cheek teeth measurements.

The aforementioned conclusions can be reinforced with the obtained results of the normal probability plots of the cheek teeth lengths which are in the figure 2. According to this it is possible to establish three groups according to the distribution shape:

-S-shaped distribution which can be taken as typical from a bimodal distribution: this is the case of the transversal diameter of the canine from both localities: Ekain (KK) and Arrikrutz (AA).

-Lineal distribution. The sizes distribution adjusts very well to a straigth line. As it happens in P^4, M^2, P_4, M_2 and M_3 in Ekain (KK) sample and in M^1, M^2 and M_3 in Arrikrutz (AA) sample. These are cases of single normal distribution.

-Lineal distribution but with end(s) curving. We interpret these as single normal distribution but with a sligth "hipermale" and/or "hiperfemale" metrical influence.

METRICAL COMPARISON

Prior to analyze metrical differences we have calculated the mean values of length and width of every premolar and molar of each locality, see table 2. Samples from Lucia cave LU and Amutxate cave (AX) are smaller than desirable for an statistical analysis. In a first glance differences between mean values are not too big never being greather than 1mm. But this will nedd a more detailed discussion.

According to TORRES *et al*. (2000) there are two cave bear localities which can be dated at the 6th OIS (Oxigen Isotope Stage): In both localities, Arrikrutz (AA) and Reguerillo (TT) caves, average aspartic acid racemization and standard deviation values are very similar making possible to interpret both as isochronous. In any case it is possible to realize that all average cheek teeth lengths and widths appear to be bigger than those from Reguerillo (TT). This can be interpreted as a paleoenvironment-linked trend, suggesting that environmental conditions near de Atlantic Border of the Iberian Peninsula were less severe than the ones existing in the Outback.

For a general comparison we chose as standard the Ekain (KK) average size values. We base this election in the big size of Ekain's (KK) sample and because according to their aspartic acid racemization mean value is the youngest Iberian

Ekain Cave (KK)

	$C^5 + C_3$	P^4 L	P^4 W	M^1 L	M^1 W	M^2 L	M^2 W	P_4 L	P_4 W	M_1 L	M_1 W	M_2 L	M_2 W	M_3 L	M_3 W
N	96	119	110	124	113	110	110	117	117	190	186	208	200	134	129
Ave.	17.78	21.24	14.97	29.30	20.20	45.35	23.36	15.64	11.38	30.89	14.72	31.32	16.14	27.10	19.36
Var.	5.44	1.67	1.33	3.37	1.80	6.57	1.67	18.20	8.53	2.53	0.83	2.81	1.33	3.19	1.48
Std.	2.33	1.29	1.15	1.83	1.34	2.56	1.30	1.38	0.98	1.59	0.91	1.68	1.13	1.78	1.22
Min.	14.60	18.20	12.20	25.20	17.00	40.00	20.50	12.20	9.30	27.10	12.70	27.40	13.50	21.80	16.30
Max.	23.20	24.30	17.70	34.00	23.80	52.80	26.60	18.40	14.20	34.70	17.50	36.30	19.20	31.60	22.50
Std skw.	3.62	0.65	0.09	0.72	0.70	1.55	1.06	-0.58	0.77	0.92	1.47	1.07	1.47	0.71	0.67
Std. kurt.	-0.85	-0.67	-0.72	-1.46	-0.78	-0.47	-0.62	-0.52	-1.16	-1.21	-0.22	-0.01	-0.48	-0.30	-0.27

Arrikrutz Cave (AA)

	$C^5 + C_1$	P^4 L	P^4 W	M^1 L	M^1 W	M^2 L	M^2 W	P_4 L	P_4 W	M_1 L	M_1 W	M_2 L	M_2 W	M_3 L	M_3 W
N	134	49	49	55	49	61	61	32	32	54	52	87	90	83	79
Ave.	21.08	20.43	14.11	28.95	20.11	45.15	23.40	15.86	10.85	30.44	14.90	30.42	16.82	26.65	19.76
Var.	7.18	2.30	1.13	3.50	1.84	4.63	1.22	0.99	0.82	2.87	8.33	2.14	2.09	3.78	1.53
Std.	2.68	1.52	1.06	1.86	1.36	2.15	1.11	0.99	0.90	1.69	0.97	1.46	1.44	1.94	1.24
Min.	15.50	17.50	11.70	25.60	16.70	41.30	19.80	13.50	8.00	25.90	12.60	26.50	12.20	22.20	17.30
Max.	25.00	23.80	16.30	33.00	23.00	49.70	25.40	17.60	12.90	33.20	16.60	33.90	20.00	30.50	22.50
Std skw.	-4.09	0.01	-0.44	-0.087	-2.16	0.87	-1.46	-0.20	0.94	-1.88	-0.64	-1.86	-1.20	-0.48	-0.38
Std. kurt.	-0.89	-0.70	-0.91	-0.98	0.76	-0.76	0.83	0.022	0.17	-0.46	-0.97	0.12	0.99	-1.11	-1.52

Table 1. Descriptive statistics (N= number; Ave.= average; Var.= variance; Std.= standard deviation; Min.= minimum; Max.= maximum; Std. skw.= standard skewness; Std. kur.= standard kurtosis) from *U. spelaeus* canine and cheek teeth (C-transversal diameter of the crown; P^4-length and width; M^1-length and heel width; M^2-length and trigon width; P_4 length and width; M_1 and M_2-length and trigonid width; M_3 length and width). Measures are in mm.
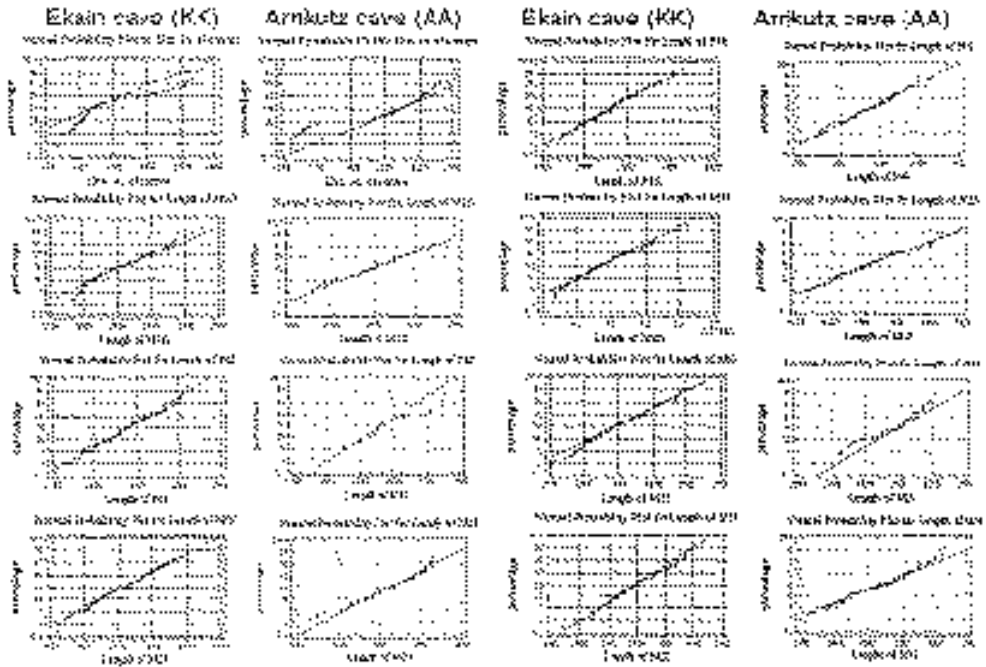
Figure 2. Normal probability plots for Arrikrutz and Ekain teeth measurements: Canine (transversal diameter); fourth upper premolar-P4S (total length and maximum width); first upper molar-M1S (total length and heel width); second upper molar-M2S (total length and trigon width): fourth lower premolar-P4I (total length, maximum width); first lower molar- M1I (total length and talonid width); second lower molar-M2I (total length and talonid width) and third lower molar-M3I (Total length and maximum width).

population. An other argumen lies on their well known female dominancy, according to the canine transversal diameter distribution (TORRES *et al*. 1980). We can expect that if there is a female-linked size control it will be reflected when compared with mean values from other Iberian localities where a less marked female dominancy or even a male dominancy has been found.

For metrical comparison we will use average values of maximun length and maximun width of each cheek teeth, figure 3 where average value ± 1 of ech measurement of each premolar and molar from the different sites have been plotted together, and t-Student's signifiance test values of table 3.

It is possible to observe that Ekain (KK) mean values are not bigger than the Arrikrutz (AA) ones a markedly older locality

Troskaeta (TR) mean values are usually shifted towards the smaller sizes and premolar and molar individual lengths mainly appear as the bigger ones of all localities distribution.

Cave	P^4 M01(N) M02(N)	M^1 M01(N) M08(N)	M^2 M01(N) M06(N)	P_4 M01(N) M02(N)	M_1 M01(N) M12(N)	M_2 M01(N) M07(N)	M_3 M01(N) M03(N)
KK	21.3(120) 15.0(110)	29.3(124) 20.2(116)	46.3(110) 23.3(137)	15.6(117) 11.4(119)	31.0(195) 14.8(207)	31.3(110) 18.7(137)	27.1(135) 19.4(133)
EE	20.4(23) 14.8(21)	28.2(63) 20.1(35)	45.7(45) 22.9(33)	14.8(19) 10.5(10)	30.6(35) 14.6(30)	30.3(42) 18.8(40)	26.2(24) 18.8(21)
TE	19.3(36) 13.5(31)	28.8(56) 19.2(45)	45.0(36) 23.2(31)	15.3(23) 9.8(24)	29.8(38) 14.3(35)	30.5(39) 18.6(36)	27.0(28) 19.0(25)
AX	19.7(8) 13.6(8)	28.7(14) 19.3(12)	45.2(9) 23.1(10)	14.2(6) 10.8(6)	31.4(8) 15.2(10)	31.3(14) 18.5(14)	25.6(4) 18.9(4)
TR	19.3(31) 14.1(28)	27.1(41) 18.9(35)	43.4(49) 21.3(47)	14.4(32) 10.0(32)	28.7(50) 14.1(56)	29.7(74) 18.4(54)	24.8(52) 18.4(48)
SS	20.4(12) 14.7(12)	28.2(16) 19.4(16)	44.7(22) 22.7(23)	15.2(16) 10.5816)	30.3(21) 14.9(21)	30.4(32) 18.3(32)	25.7(24) 18.3(24)
XX	20.3(38) 13.7(38)	28.0(55) 19.3(51)	44.7(45) 22.8(54)	15.3(45) 10.7(44)	30.2(88) 14.7(98)	29.3(112) 18.6(99)	26.2(72) 19.3(65)
LU	21.5(6) 15.6(6)	27.9(10) 19.8(10)	44.7(8) 22.9(9)	16.0(14) 10.5(14)	30.2(6) 15.0(6)	31.2(20) 18.9(23)	25.3(17) 19.1(17)
AA	20.4(49) 10.6(49)	28.9(55) 20.1(49)	45.4(63) 23.5(64)	15.3(32) 10.6(32)	30.4(54) 14.9(52)	30.4(97) 19.2(90)	26.7(86) 20.0(82)
TT	19.3(58) 13.6(59)	28.6(84) 19.8(70)	44.4(84) 22.6(81)	15.3(39) 10.6(39)	30.1(43) 14.0(42)	30.1(87) 18.6(80)	26.8(89) 19.0(73)

Table 2. Mean and standard values of maximum length and width of cheek teeth of Iberian localities. For key letters see figure 1 and 2.
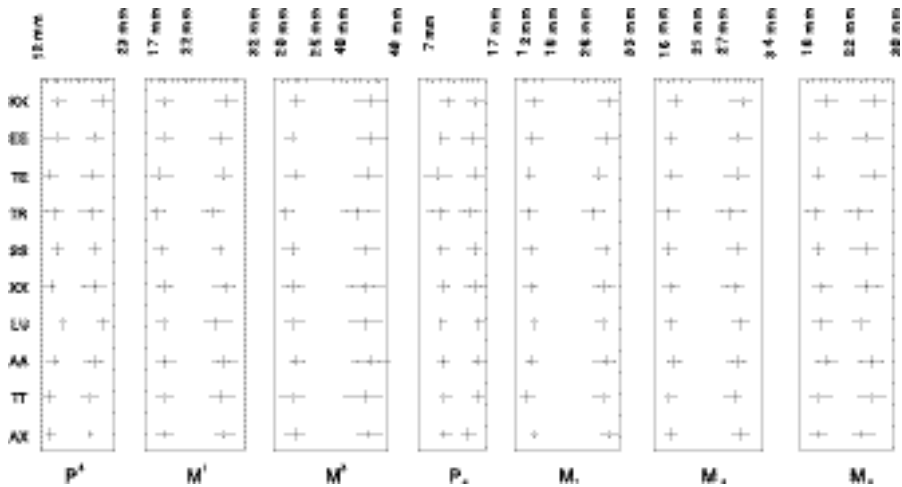

Figure 3. Average ± 1   values *U. spelaeus* cheek teeth sizes (P^4-length and width; M^1-lentgh and heel width; M^2-length and trigon width; P_4 length and width; M_1 and M_2-length and trigonid width; M_3 lengthand width-M03 from: Ekain (KK); Eirós (EE), Amutxate (AX), Troskaeta (TR), La Pasada (SS), El Toll (XX) La Lucia LU), Arrikrutz (AA) and El Reguerillo (TT).

Taking all this into account, the next step was to check if the metrical differences reflected in table 3 and figure 3, have a real statistical signifiance. To do that we have applied the t-Student test for the mean values taking as reference of size the average measurement values from premolars and molar from Ekain (KK) ere the higher average values were usually reached and the sample size is very big.

The obtained results are in table 3 where are differentiated according to their signification degrees (signifiant p>0.05), very signifiant p 0.01; and higly signifiant differences p 0.001).

From a metrical point of view premolars and molars of Arrikrutz (AA) and Ekain (KK) are quite similar, but according to their mean values the fourth upper premolar and first and second lower molars are shorter than their equivalents from Ekain (KK). Reguerillo (TT) premolars and molars are clearly narrrower than the Ekain (KK) ones, with the sole exception of the fourth upper premolar. In some cases they are also shorter (fourth upper premolar, first and second upper molars and first and second lower molars). These metrical differences can be linked to the paleogeographical position of Reguerillo cave (TT) in the Iberian Peninsula Outback which would suggest a metrical trend development during the 6th OIS.

From their meand width values comparison it results to be very noteworthy the fact that all the first lower molars from all compared localities, even those with very small samples, result to have broader talonids than the Ekain (KK) ones. This reinforce our opinion about a "tribal" component in the cave bear populations of the Iberian Peninsula. In the same way Troskaeta (TR) premolars and molars are significantly shorter.

Regrettably the sample from La Lucia cave (LU)- U/Th dated at the uppermost

		KK	AA	TE	EE	LU	XX	SS	TR	TT	AX
P⁴	L	(128) 21.2	(50) >***	(35) >***	(23) >***	(6) <	(36) >***	(13) >**	(27) >***	(50) >***	(15) >
	W	(118) 16.0	(48) >	(31) <***	(21) <	(6) <	(39) >	(12) >	(23) >*	(32) >	(17) <
M¹	L	(124) 29.0	(57) >	(56) >	(43) >***	(10) >*	(56) >	(15) >*	(38) >***	(62) >*	(25) >*
	W	(113) 20.2	(48) =	(45) >***	(33) >	(10) >	(51) >	(16) >	(33) >**	(64) >***	(18) >
M²	L	(118) 45.3	(65) >	(36) >	(45) >	(6) >	(45) >	(23) >**	(45) >***	(34) >**	(27) >***
	W	(118) 23.4	(61) =	(31) >***	(33) >***	(6) >	(46) >*	(22) >	(42) >***	(78) >***	(16) =
P₄	L	(117) 15.6	(30) >	(33) >	(19) >	(14) <	(45) >	(19) >	(38) >***	(39) <	(36) >
	W	(117) 11.4	(32) >***	(18) >***	(19) >***	(14) >***	(44) >***	(16) >***	(38) >***	(40) >***	(19) >
M₁	L	(194) 31.0	(69) >***	(36) =	(34) >**	(6) >	(87) >***	(36) >**	(45) >**	(88) >**	(26) <***
	W	(192) 18.2	(40) <***	(35) <***	(39) <***	(6) <***	(87) <***	(21) <***	(44) <**	(87) <***	(26) <***
M₂	L	(208) 31.3	(68) >***	(39) >**	(42) >	(20) >	(88) >***	(21) >**	(47) >***	(62) <***	(28) =
	W	(208) 18.9	(69) <	(35) =	(40) =	(20) =	(54) >***	(18) >***	(33) <***	(42) >***	(18) =
M₃	L	(196) 27.1	(67) >	(28) >	(24) >**	(17) >***	(82) >***	(24) >***	(58) >***	(66) >	(16) >***
	W	(129) 19.3	(40) >	(35) >	(22) >**	(17) =	(65) >	(24) >	(45) >*	(79) >***	(11) <

Table 3. Results of t-Student's test (* signifiant, ** very signifiant and *** highly signifiant) of cheeck teeth length and width average values taking as standard Ekain cave values.

part of the 5th OIS, is too small and with exception of the aforementioned smaller mean values of the first lower molar talonid width and third lower molar width, which are bigger than in Ekain (KK) no other statistical signifiant differences appear.

Aspartic acid racemization mean values from Toll (XX) and Pasada (SS) caves are very coincident but standard deviation in Pasada (SS) cave samples is very high this now can be explained, TORRES *et al.* (submitted) by intrasample error influence: due to the scarcity of canines in Pasada (SS) teeth collection some root from molar germs were sampled and now we know that in recent cave bear samples there is a racemization gradient from the central part of the root (low racmization ratios) toward the root boundaries (cement layer and pulp cavity) and spurious high racemization ratios could be measured. In any case all the lower molars from Toll (XX) are shorter that their equivalents from Ekain (KK) but only the fourth upper premolar is shorter than their homologous from Ekain (KK).

Troskaeta (TR) canines aspartic acid racemization mean value place it near 50 ka with a small standard deviation value. As it has been published (TORRES *et al.* 1991) Troskaeta (TR) cave bear population appear to be a very singular one with small teeth sizes. Almost in all cases mean values of measurements demonstrate that premolars and molars from this locality are sigfiantly shorter and slender that its homologous from Ekain (KK) with the exception of the first lower molar width which results to be broader that the Ekain one.

Amutxate (AX) dental sizes seem not to greatly differ from the Ekain (KK) ones but due to this cave excavation is actually ongoing a wider sample will be available in some months. In any case it is noticeable that in the cases which bigger available sample size, average cheek teeth measurement values from Amutxate (AX) differ in a statistically signifiant way from the Ekain (KK) being notable that the firs lower molars from Amutxate (AX) are longer and wider than the Ekain (KK) ones. Coro Tracito (TE) sample is not very big and only a small number of signifiant metrical differences have been found. In any case in the fourth upper premolar average length value is significantly smaller than the Ekain (KK) value, but the maximun width mean value is signifiantly grather than the Ekain (KK) one. Mean values of measurements taken on the first upper molar, second upper molar and fourth lower molar are signifiantly smaller that the Ekain (KK) ones. As in almos all the localities the mean value of the talonid of the first lower molar is signifiantly bigger that the Ekain (KK) one. Probably the age calculation of Coro Tracito (TE) cave will be further correction because it is the only analysed high mountain locality with a different (lower) thermal history which will produce some lowering in the racemization rate and probably is older than calculated.

Eirós (EE) and Ekain (KK) are almost isochronous localities and a very important number of statistical signifiant differences between lengh and width mean values do not appear. Mean values of the fourth upper premolar length, first upper molar length, second upper molar

talus width, first lower molar length and third lower molar length and width are smaller while the mean value of the talonid of the first lower molar seems to be signifiantly smaller.

CONCLUSIONS

Statistical analysis made on maximun length and maximun width of premolars and molars from two cave bear localities of the Iberian Peninsula where large samples are available, Ekain (KK) and Arrikrutz (AA) allowed us to reject the sex dimorphism effect on size. According to the canine transversal diameter distribution sex ratios from both localities are markedly different: in Ekain (KK) cave there is a female dominancy while y Arrikrutz (AA) there is an overwhelming male predominance but in any case normal, no binormal, distributions have been tested.

Ekain (KK) the most tardive ***Ursus spelaeus*** Iberian population show the biggest average teeth sizes with the sole exception of the first lower molar talonid width which resulted to be smaller than in the other cave bear populations.

Oldest (6th OIS) ***U.spelaeus*** populations, Arrikrtuzt (AA) and Reguerillo (TT), have smaller average teeth size that the more recent one-Ekain (KK) which has been dated at the uppermost part of the 4th OIS. A geographical-paleoenvironmental trend has been detected between the Outback population (El Reguerillo-TT) and the one on the Iberian Peninsula Atlantic Border (Arrikrutz) having the first one bigger average teeth sizes.

We confirm that Troskaeta (TR) population representatives have really small cheek teeth, smaller than in the remaining localities.

Coeval 4th OIS localities show a variable number of significant differences among cheek-teeth length and width average values which can be explained in terms of early isolation Troskaeta (TR) being the best example of this. The cave bears from Cueva de El Toll (XX) show metrical differences which can be explained as a size trend linked to the situation of the cave on the Mediterranean Border of the Iberian Peninsula.

Topographical situation of La Lucia (LU) cave suggest a differential thermal history which will make necessary to correct their asigned age.

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