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TITO BUSTILLO, A NEW *URSUS SPELAEUS* ROSENMÜLLER, 1794 CAVE ASSEMBLAGE IN ASTURIAS (NORTHERN SPAIN)

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Abstract: The cave named Tito Bustillo (Ribadesella, Asturias, Spain) has been known for decades because of its Magdalenian rock-art. It is a large karstic system by the Atlantic shore of northern Spain; the entrance is almost at sea level and its lower levels are submitted to tidal action. Currently a show cave, an assemblage of bear *Ursus spelaeus* bones was discovered when improving on the walkways in the 80's, and subsequently excavations were carried out. This is the only cave bear site documented so far in the Asturias region of northern Spain. Here we describe the site and the bear population excavated, and briefly compare it with other cave bear sites in the neighbouring regions.

Key words: *Ursus spelaeus*, *U. s. parvilatipedis,* Cantabrian mountains, Late Pleistocene.

INTRODUCTION

Cave bears were probably present throughout the Atlantic regions of northern Spain. Several cave bear sites have been excavated and published, most of these either in the eastern range of the area, at the Basque Country region (eg. Arrikrutz, Ekain, Letxetxiki, Troskaeta) (Torres, 1984; Torres *et al.,* 1988; Torres & Salazar, 1991) and others in the western area of the range, in the Galician region (eg. Eirós, Liñares, A Ceza) (Grandal d'anglade, 1993a; 1993b; 1993c; Grandal d'Anglade & Vidal Romaní, 1997; Grandal d'Anglade & López González, 1998). Here we describe a new cave bear cave, so far the only one recorded in the Asturias region of the Cantabrian Mountains, centrally occupying a position regarding other cave bear sites to the west (Eirós, Galicia) and to the east in the Basque country (fig. 1).

Tito Bustillo is a long cave (fig. 2), almost at sea level by the Atlantic coast, in the karstified carboniferous limestone of the eastern Asturias, and is part of the massif know as Macizo de Ardines. It was carved by the river San Miguel that still runs through its lower levels. At times of strong rain, the river overflows into the main gallery and if this was the case in the past it may have affected too the cave bear assemblage as discussed later.

The cave itself is renowned by its outstanding Magdalenian rock and mobile art (Moure Romanillo, 1992; Balbín *et al.,* 2003) and can be visited as a show cave. The cave bear assemblage is in the central area of the cave, quite separated from the archaeological site. It seems that the cave bear occupation of Tito Bustillo is much earlier in age than these Magdalenian occupations and quite unrelated to them.

Works carried out at the main gallery of the cave, aiming on improving public access, unearthed an assemblage of bones found to be of cave bears. Excavations were carried out there in 1998 and 1999, using the archaeological method (Pinto Llona, 2001; Pinto *et al.,* 2005). Cave bears are the only species so far identified in this assemblage.

The excavation was carried in a limited area bordering the access path (Paso Turistas in fig. 3), and extending to the wall in the north (Cata Norte). We carried out a test excavation at square B4 that reached 3 m. depth; only one fertile level was found, in the upper part of the sequence. Excavations were carried then in an extension of 20 m^2 and cave bear bones were recovered in a single cave earth layer, from depths ranging -29 cm to -124 cm.

A flowstone sealed the deposits, and it has been dated by Uranium series analysis, yielding an age older than 61±

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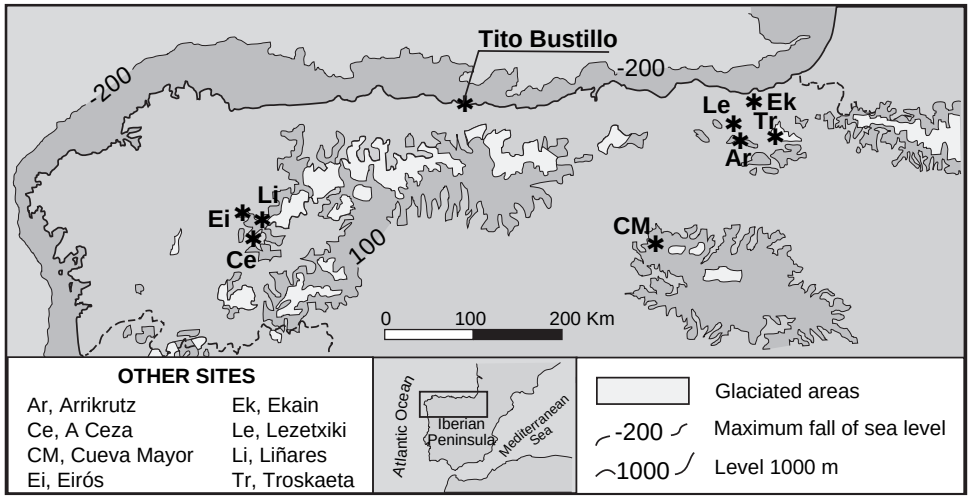

Figure 1. Bottom left: The Iberian Peninsula and the Cantabrian area in northern Spain. Above, localization of the cave bear sites mentioned in the text. Right cluster, sites in the Basque Country; left cluster sites in the Galician region; Tito Bustillo is at the present coastline and almost at sea level, in the Asturias region, the most mountainous. CM are *Ursus deningeri* from Cueva Mayor (Atapuerca), a site that is placed more southerly, in the region of Burgos.

3 ka BP (Schwarcz, TB99-1). C14 AMS analyses offered a coincident date older than 55.300 BP (OxA-9689).

The cave is periodically submitted to inundations from the river San Miguel that flows in the lower galleries. Therefore, it can not be discarded that the fossil assemblage may have been submitted to some degree of transport. However we have found limb bones in anatomical connexion (femur plus tibia plus patella, series of vertebras) suggesting that secondary movements, if any, could have been limited in extent.

MATERIALS AND METHODS

During the excavations, 1015 cave bear bones were recovered and plotted three-dimensionally; of these 228 were long bones (95 of adults and 133 of infants), representing (MNI) a minimum of 13 adults/subadults and 20 infants. In general the bones are complete or almost complete, although upon drying they proved to be in very poor condition, requiring routine use of preservers. No complete skull has been recovered although some could be restored by adding artificial filling materials. Sediment

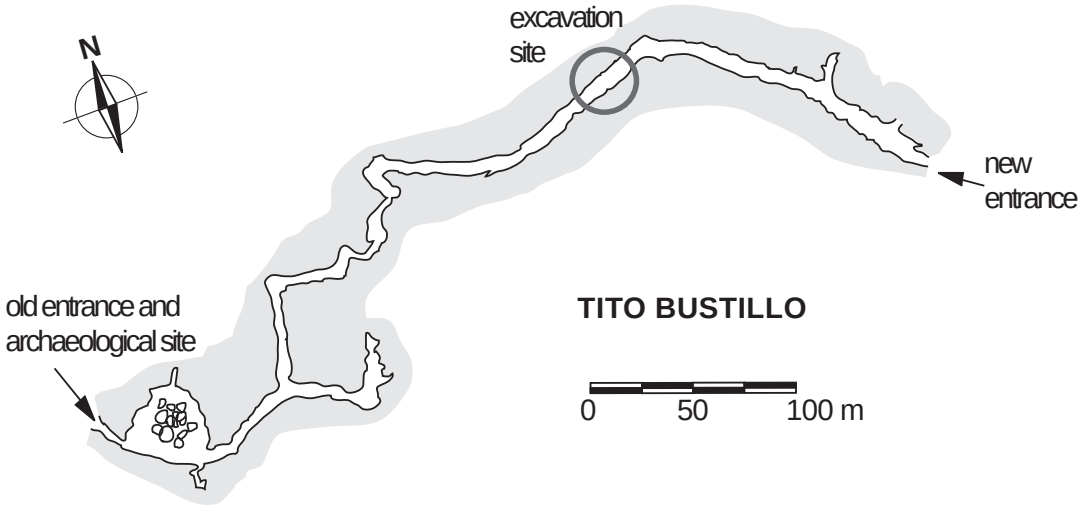

Figure 2. Plan map of Tito Bustillo. The new entrance is an artificial tunnel, with a succession of iron gates blocking air flow from the exterior. Rock art -painting and also engraving- appear throughout the cave, and an archaeological assemblage was excavated in the western area (original entrance to the cave) dated the Magdalenian.

Table 1
Sites discussed in the text, suggested dates, altitude over sea level and references.

Tito Bustillo	c. 60 Ky BP	At sea level	Pinto & Andrews, 2004
Cova Eirós	c. 24 Ky BP	780 m.	Grandal & Vidal, 1997
A Ceza	c. 35 Ky BP	1004 m.	Grandal & Lopez, 1998
Liñares	c. 35 Ky BP	1115 m.	Grandal & Lopez, 1998
Troskaeta	c. 58 Ky BP	580 m.	Torres *et al.,* 1991 2003
Ekain	Upper Pleistocene	90 m.	Torres, 1984
Arrikrutz	Upper Pleistocene	450 m.	Torres, 1984
Lezetxiki	Middle Pleistocene		Altuna, 1972
Cueva Mayor	Middle Pleistocene		Torres, 1988

samples that were taken, dried and sieved yielded no further materials or any microfauna.

Earlier research on scavenging modifications on the bones of the Tito Bustillo bears has shown that they did scavenge to a degree on the carcasses of other bears, and that this scavenging was carried out following a readily identifiable pattern, that affects in the same manner both adult and infant bones, and that is neatly distinct from scavenging patterns by other large carnivores. Identical scavenging pattern has been found to affect to other mono-specific cave bear sites of northern Spain, and it differs greatly when other carnivores such as wolves or hyenas were also at play modifying bones. (Pinto Llona, 2001; Pinto Llona & Andrews, 2004a; 2004b; Pinto Llona *et al.,* 2005).

Bone measurements have been taken for Tito Bustillo and then compared with those published for other cave bear sites in northern Spain. For bone measurements we followed generally Von den Driesch (1976) and the measures proposed by Tsoukala & Grandal d'Anglade (2002) on long bones, including metapodials, and on the 1st low molar. We choose this tooth because of its special interest from an evolutionary point of view: it reflects better the evolutionary degree, and is also most adequate to characterize each population (Grandal d'Anglade, 1993a; 1993b; 1993c; Grandal d'Anglade & López González, 2004). The number of lower M1's measured is as follows: Tito Bustillo, 22, Troskaeta 9, Ekain 23, Arrikrutz 16, Eiros 35, Liñares 10, A Ceza 11. Mean data of Lezetxiki and Cueva Mayor are from the literature (Altuna, 1972; Torres, 1988). Table 1 shows known dates, altitudes over sea level and references on these sites.

RESULTS

Metric analyses of Tito Bustillo adult long bones has shown that these belong chiefly to females. All the long bones appear within the range represented by females in other peninsula samples. Some metapodials reach sizes that are typical for males within the Iberian Peninsula, and therefore there were also some males at Tito Bustillo (tab 2). The presence of a majority of females amongst the adults of Tito Bustillo is consistent with the important presence of infants.

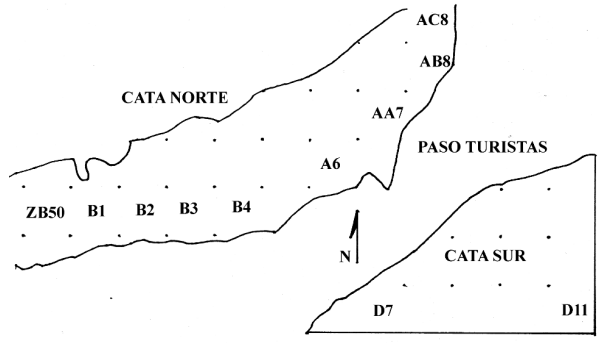

Figure 3. Excavation trenches at Tito Bustillo. The remains analyzed here proceed chiefly from the "Cata Norte" (north trench). Points signal the grid of 1m^2 squares.

The Tito Bustillo metapodials are on average of smaller size than those of other cave bear collections from northern Spain (tab. 3), and similar to the smaller subspecies *Ursus spelaeus parvilatipedis* described by Torres and colleagues in Troskaeta cave (Basque Country) (Torres *et al.,* 1991).

The average values of the measures on the lower 1st molar are also similar to the smaller sub-species *U. s. parvilatipedis* (tab. 4 and fig. 4). The Talonid Convergence Index (CI Tal) correlates well with the chronology offered for these populations and with the degree of dental evolution in each one of them (Grandal D'Anglade & López González, 2004) which also is similar to the one reached by the Troskaeta bears.

Table 2

HUMERUS

Measure	mean	std. Dev.	Min.	Max.	n
L abs	378.60	11.24	367.00	391.00	5
DAP cap	83.06	3.82	80.36	85.76	2
DAP prox	90.28	3.53	87.79	92.78	2
DT cap	66.77	3.67	64.54	71.01	3
DT prox	73.64	3.25	70.84	78.17	4
DT dia inf	42.57	1.09	40.97	43.90	5
DT dist	103.82	3.37	100.19	109.05	6
DT art dist	75.75	2.44	72.12	78.57	5
Alt art	32.88	1.63	30.51	35.60	6

ULNA

Measure	mean	std. Dev.	Min.	Max.	n
L	330.25	11.90	314.00	342.00	4
DT ol	39.23	2.20	36.69	40.50	3
DAP ol	69.09	2.01	67.26	70.92	4
DT pr.art.	51.32	11.12	34.82	58.74	4
D int.sem.	39.16	3.88	36.24	46.57	6
DAP dia	35.34	1.41	33.54	37.40	6

RADIUS

Measure	mean	std. Dev.	Min.	Max.	n
L abs	249.42	40,39	228.20	310.00	4
DT prox	44.09	-	44.09	44.09	1
DAP prox	43.27	3.31	40.44	48.87	5
DT dia	31.36	0.67	30.46	32.04	6
DT dist	65.61	1.84	64.10	68.25	4
DAP dist	40.62	0.75	39.88	41.66	4
DT art dist	46.73	1.56	45.44	48.71	4
DAP art dist	34.52	1.79	32.18	36.35	4
DT coll	33.84	1.31	32.19	35.07	5

FEMUR

Measure	mean	std. Dev.	Min.	Max.	n
L abs	377.00	-	377.00	377.00	1
L int troc	85.55	6.47	77.20	91.23	4
L collum	73.98	3.26	71.25	78.38	4
DT prox	103.00	2.77	99.12	105.50	4
DT caput	47.83	2.40	45.98	51.36	4
DT dist	84.64	2.02	81.45	87.04	5
DT dia	38.23	3.06	36.06	40.39	2
DAP dist	76.18	3.60	71.59	80.34	4
DT epicond	86.05	1.25	84.21	86.87	4

TIBIA

Measure	mean	std. Dev.	Min.	Max.	n
L abs	267.25	15.61	255.00	290.00	4
DAP prox	68.80	0.44	68.49	69.11	2
DT dia	30.89	3.46	28.82	34.88	3
DT prox	83.01	5.45	75.04	87.30	4
DT dist	65.56	2.39	63.67	69.05	4
DAP dist	36.04	4.43	29.58	39.62	4
DAP art dist	30.33	4.05	24.53	33.28	4
DT art dist	50.67	1.44	49.48	52.27	3

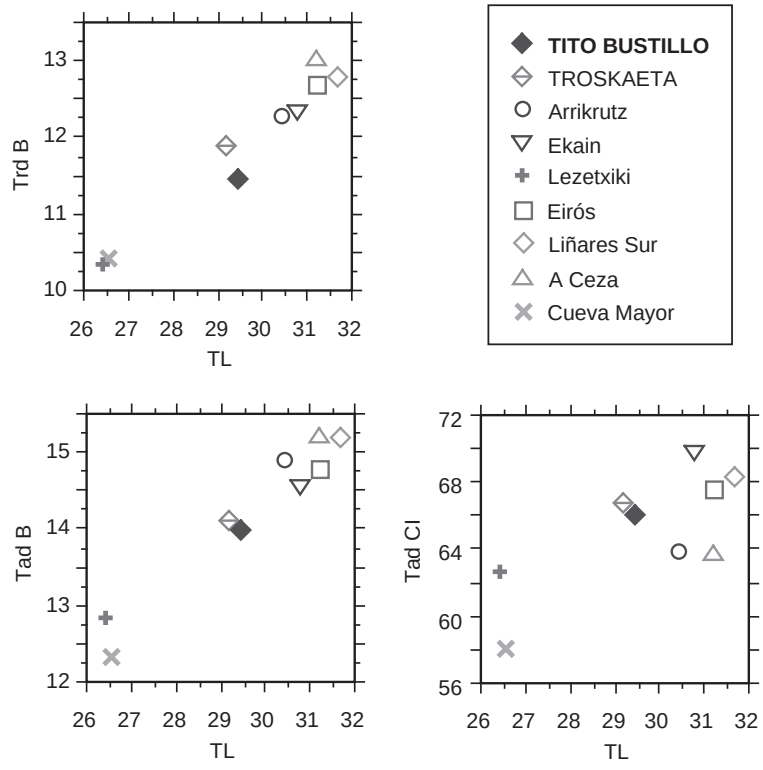

Figure 4. Metric data (mean values) of the Lower Carnassial from Tito Bustillo and other sites in the northern Iberian Peninsula. Talonid Convergence Index was calculated as distance Hypoconid-entoconid *100/Talonid breadth.

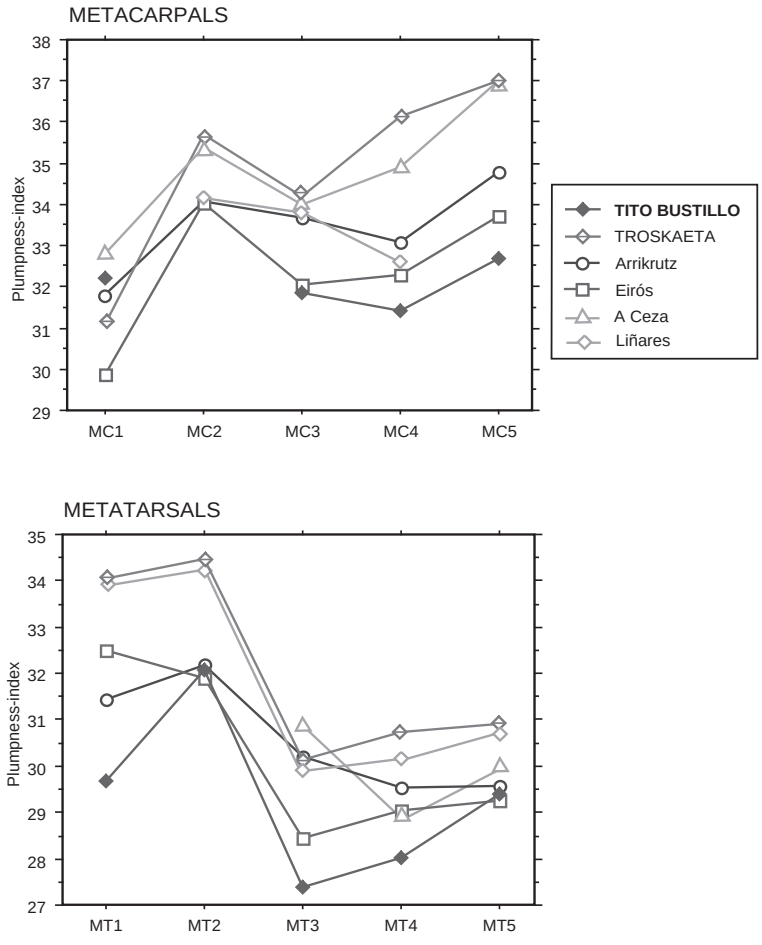

Figure 5. Plumpness index of the metapodials from Tito Bustillo and other sites calculated following Withalm (2001): PI=Distal transversal diameter*100/Absolute length.

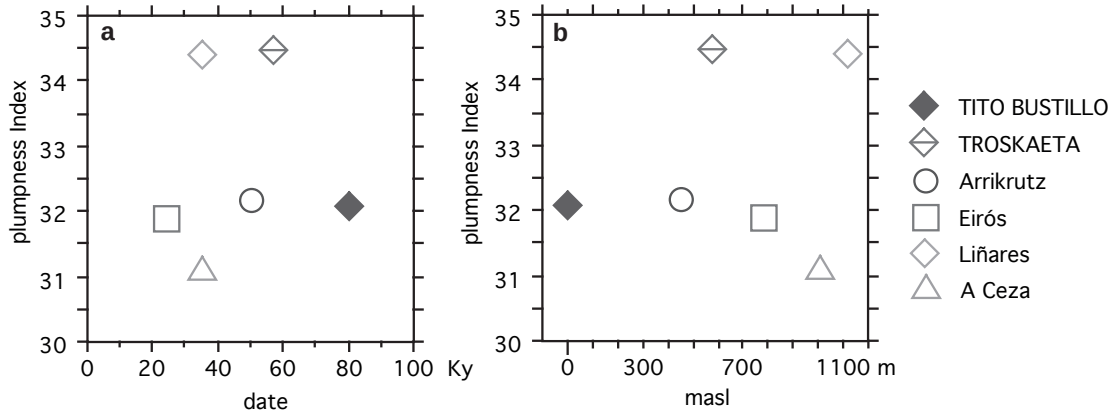

Figure 6. Average plumpness index versus chronology (a) and altitude above sea level (b).

All the above withstanding, the long bones and also the metapodials from Tito Bustillo are more gracile than those of Troskaeta, which typically are robust. We applied the Plumpness Index (Withalm, 2001) to Tito Bustillo and other Iberian cave bear sites; Tito Bustillo metapodials are rather gracile when compared with the more robust ones from Troskaeta and the other sites considered here (fig. 5). The Plumpness Index was considered by Withalm (2001) as a bio-stratigraphic index that correlates well with the age of the Alpine cave bear populations studied by the author. According to his work, robustness increases with recentness of population. However we applied this Index to several cave bear sites at the Iberian Peninsula and there does not exist a comparable correlation. The regression of the Average Plumpness Index and the age of each site yields a value of R2 = 0,111 which suggests the low correlation amongst both parameters (fig. 6 a). Particularly noteworthy is the disparity in robustness between Tito Bustillo and Troskaeta, despite bears at both sites being of smaller size, both being chronologically very close and with a very similar morphology of their 1st low molar.

It could be suggested that metapodial robustness is an adaptation to high or rough country, thus the metapodials of bears from higher caves or rougher landscapes would be more robust. However, as fig. 6 b shows, there does not appear to be any clear relation amongst the altitude of the bear caves and the robustness (R2 = 0,231). Alternately, this feature could relate to the roughness of the country the bears lived on, independently of altitude.

Pinto *et al* (2005) linked the presence of slight pathologies in the arm bones of cave bears from the same sites of northern Spain (Tito Bustillo 10,2%; Troskaeta 36,4%, Arrikrutz 34%, Eirós 29,9%) with behaviours that could relate either to digging or mountain climbing. In an earlier study (Pinto & Andrews, 2001) comparing gross dental wear features in 1st low molars of cave bears from the same sites and Holocene and extant brown bears of known diet from the same region and known diet, digging for tubers was discarded as an activity of the cave bears since they do not seem to eat tubers at all, although they could dig for other reasons.

The Tito Bustillo cave bears have the smallest percentage of pathological arm bones, which in the light of their metapodial gracility, suggests that these bears inhabited and obtained their resources in the coastal plateau of the north Atlantic coast of the Peninsula, and avoided the rougher terrain of the neighbouring Picos de Europa Mountains, where limestone caves abound but a cave bear site has not yet been documented to our knowledge.

DISCUSSION

Tito Bustillo is a long cave by the coast and at sea level in the Asturias region of northern Spain. The cave is well known by its rich cave art of Magdalenian age.

Older deposits in the cave contain a cave bear *Ursus spelaeus* assemblage. Despite Asturias being the most mountainous part of the Cantabrian Peninsula, with most of the Cantabrian mountains within its territory, and despite these mountains being chiefly limestone, with thousands of caves and many being explored and mapped by speleologists every year, no cave bear cave had been so far described there. Tito Bustillo is the first one, and is placed almost at sea level and by the present coastline.

Earlier research on the cave bears at Tito Bustillo suggests that a degree of patterned cannibalistic scavenging was part of their behaviour. The assemblage made up

Table 3

METACARPALS

FIRST METACARPAL

Measure	mean	std. Dev.	Min.	Max.	n
TL	51.77	5.17	48.12	55.43	2
DT prox	20.68	1.39	19.69	21.66	2
DAP prox	19.16	-	19.16	19.16	1
DT dia	11.18	0.83	10.60	11.77	2
DAP dia	11.55	0.35	11.30	11.80	2
DT dist	16.70	2.00	15.28	18.11	2
DAP dist	15.33	-	15.33	15.33	1
Plumpness-I	32.21	0.65	31.75	32.67	2

SECOND METACARPAL

Measure	mean	std. Dev.	Min.	Max.	n
TL	64.45				1
DT prox	13.58				1
DAP prox	22.67				1
DT dia	13.09				1
DAP dia	9.31				1
DT dist	18.81				1
DAP dist	15.04				1
Plumpness-I	29.19				1

THIRD METACARPAL

Measure	mean	std. Dev.	Min.	Max.	n
TL			73.69	85.05	2
DT prox			19.20	24.93	2
DAP prox			28.71	33.30	2
DT dia			17.07	21.58	2
DAP dia			13.47	16.30	2
DT dist			20.99	29.97	2
DAP dist			19.21	24.05	2
Plumpness-I			28.48	35.24	2

FOURTH METACARPAL

Measure	mean	std. Dev.	Min.	Max.	n
TL	78.34	7.86	72.60	89.49	4
DT prox	22.16	2.45	20.12	25.69	4
DAP prox	31.83	4.02	28.76	37.74	4
DT dia	17.39	1.67	15.70	19.68	4
DAP dia	15.37	1.78	13.90	17.96	4
DT dist	24.56	2.10	22.60	27.53	4
DAP dist	20.73	2.20	19.41	24.02	4
Plumpness-I	31.40	1.30	30.56	33.33	4

FIFTH METACARPAL

Measure	mean	std. Dev.	Min.	Max.	n
TL	78.16	3.29	73.73	81.38	5
DT prox	27.31	0.90	26.70	28.65	4
DAP prox	29.67	1.21	27.96	31.33	5
DT dia	17.38	1.07	15.70	18.23	5
DAP dia	15.18	0.99	14.02	16.59	5
DT dist	25.53	1.02	24.16	26.75	5
DAP dist	19.37	0.30	18.95	19.60	4
Plumpness-I	32.68	0.82	31.63	33.83	5

continued

Table 3 *(continued)*

METATARSALS

FIRST METATARSAL

Measure	mean	std. Dev.	Min.	Max.	n
TL	60.167	0.978	59.040	60.800	3
DT prox	23.450	1.811	21.380	24.740	3
DAP prox	19.497	1.736	17.730	21.200	3
DT dia	13.010	1.594	11.170	13.970	3
DAP dia	11.133	0.958	10.060	11.900	3
DT dist	17.867	1.387	16.270	18.770	3
DAP dist	16.183	0.208	15.950	16.350	3
Plumpness-I	29.675	1.839	27.558	30.872	3

SECOND METATARSAL

Measure	mean	std. Dev.	Min.	Max.	n
TL	69.560	4.172	66.610	72.510	2
DT prox	16.267	1.106	15.080	17.270	3
DAP prox	25.137	1.159	23.850	26.100	3
DT dia	16.550	1.510	15.400	18.260	3
DAP dia	12.530	0.411	12.070	12.860	3
DT dist	23.040	1.336	22.190	24.580	3
DAP dist	18.910	0.652	18.320	19.610	3
Plumpness-I	32.078	2.087	30.603	33.554	2

THIRD METATARSAL

Measure	mean	std. Dev.	Min.	Max.	n
TL	72.565	1.438	70.730	74.160	4
DT prox	17.708	0.801	16.790	18.680	4
DAP prox	27.725	1.502	25.710	29.330	4
DT dia	15.072	0.485	14.760	15.790	4
DAP dia	10.730	0.181	10.490	10.880	4
DT dist	19.860	0.924	18.540	20.520	4
DAP dist	16.155	0.143	16.030	16.320	4
Plumpness-I	27.376	1.368	25.380	28.374	4

FOURTH METATARSAL

Measure	mean	std. Dev.	Min.	Max.	n
TL	79.828	5.763	75.870	89.890	5
DT prox	21.310	2.208	18.960	24.230	5
DAP prox	27.322	3.448	24.440	33.130	5
DT dia	16.171	1.646	14.120	18.660	7
DAP dia	14.104	2.935	11.930	20.150	7
DT dist	22.277	1.710	21.190	26.020	7
DAP dist	17.856	1.880	16.710	21.870	7
Plumpness-I	28.034	0.724	27.163	28.946	5

FIFTH METATARSAL

Measure	mean	std. Dev.	Min.	Max.	n
TL	80.490	2.315	78.200	84.380	5
DT prox	26.056	1.666	23.230	27.660	5
DAP prox	25.354	1.343	23.480	26.850	5
DT dia	12.984	0.590	12.220	13.870	5
DAP dia	14.908	1.432	13.180	16.830	5
DT dist	23.624	0.807	22.580	24.690	5
DAP dist	16.898	0.563	16.240	17.740	5
Plumpness-I	29.385	1.671	26.760	30.844	5

Table 4

FIRST LOWER MOLAR

Measure	mean	std. Dev.	Min.	Max.	n
TL	29.454	1.680	25.240	31.960	24
TridB	11.472	0.877	9.860	13.080	27
TaldB	13.994	0.992	11.710	15.690	26
Hyd-End	9.394	0.864	7.810	10.760	22
Tad.CI	66.124	2.896	60.727	71.370	22

chiefly by females and infants. The smaller size of their metapodials reminds of the measures published for the smaller sub-species *U. S. parvilatipedis* from Troskaeta cave in the Basque Country, although more gracile.

The dates obtained for the cave bear use of the cave, and its present position almost at sea level and by the coast, suggest that the bears inhabited the cave in a cold stage earlier than the last glacial maximum (MIS 2). At such time the sea level would be lower than it is today, the coastline would have been further to the north, and the surrounding landscape would be a dry continental platform with smooth and worn relief. This landscape could explain the gracility in the metapodials of the cave bears from Tito Bustillo, when compared with those from other caves or similar or more recent dates, but that are in more abrupt and mountainous areas.

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