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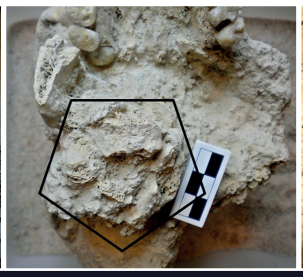


ÍNDICE





EL GENIL.
SEMANARIO DE LITERATURA.
LA CUEVA DE MENGA.


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Tomb 2 at Perdigoes site (Portugal).
Photo: Antonio Carlos Valera.

MORTUARY PRACTICES IN PERDIGÕES (REGUENGOS DE MONSARAZ, PORTUGAL): BIO-ANTHROPOLOGICAL APPROACH TO TOMB 2

Ana Maria Silva[1], Mariana Garcia[2], Inês Leandro[3], Lucy Shaw Evangelista[4], Tatiana Rodrigues[5] and António Carlos Valera[6]

Abstract:

Tomb 2 belongs to a tholos-type necropolis built in the eastern side of Perdigões enclosure during the Chalcolithic period. The exhaustive analysis of the human remains allowed to obtained various insights about the way this tomb was used during the third millennium BC and data about the individuals found here. In the present study, the samples exhumed from the Atrium and the Chamber of this tomb were considered separately. Both bone assemblages, were recovered commingled, very disturbed and with high levels of fragmentation. The bones were found sprinkled with red pigments, including ochre and cinnabar. A minimal number of, respectively, 26 and 30 individuals were identified in the Atrium and Chamber, including both sexes and all age groups, although an under-representation of non-adults younger than 5 years was identified. A good dental health is suggested by the low prevalence of oral pathologies. Tomb 2 corresponds to a deeply revolved and manipulated funerary context, with several evidences of the co-existence of different mortuary practices. Primary burials, secondary deposition of body parts, and removal of bones are all plausible funerary practices.

Keywords: Perdigões, Tholos-type Tomb, Chalcolithic, Mortuary Practices, Human remains.

PRÁCTICAS FUNERARIAS EN PERDIGÕES (REGUENGOS DE MONSARAZ, PORTUGAL): ANÁLISIS BIO-ANTROPOLÓGICO DE LA TUMBA 2

Resumen:

La Tumba 2 pertenece al tipo *tholoi* de la necrópolis de la Edad del Cobre localizada en la zona oriental del recinto de fosos de Perdigões. El análisis exhaustivo de los restos óseos humanos ha permitido investigar cómo se utilizó esta tumba durante el tercer milenio AC y obtener información sobre los individuos allí enterrados. En este trabajo se analizan de forma independiente las muestras exhumadas del Atrio y de la Cámara. Las dos colecciones de huesos aparecieron mezcladas, muy alteradas, con un índice muy alto de fragmentación y con restos de pigmentos de color rojo, incluidos ocre y cinabrio. Un número mínimo de 26 y 30 individuos fueron identificados en el Atrio y en la Cámara respectivamente, incluyendo ambos sexos y categorías de edad, aunque se documenta una infrarrepresentación de individuos subadultos menores de cinco años. La poca prevalencia de patologías orales sugiere una buena salud dental. La Tumba 2 se corresponde con un contexto funerario profundamente alterado y manipulado presentando evidencias de coexistencia de diferentes prácticas mortuorias. Enterramientos primarios, depósitos secundarios de partes del cuerpo y remociones de huesos son todas prácticas funerarias plausibles.

Palabras Clave: Perdigões, *Tholos*, Calcolítico, Prácticas funerarias, Restos óseos humanos.

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1. INTRODUCTION

Recent years have increased our knowledge about human populations that lived in Southwest Iberia during the 3rd millennium cal BC. Relevant information about demography, health status and mortuary practices from these individuals are gradually becoming available. Burial practices reveal to be more diversified and complex than previously thought, and evidence of co-existing different mortuary practices are becoming more common (Silva, 2002, 2003; Díaz-Zorita Bonilla *et al.*, 2012; Boaventura *et al.*, 2014; Valera *et al.*, 2014; Silva *et al.*, 2015; Fernández-Crespo, 2016; Robles Carrasco *et al.*, 2017). The increasing number of excavated sites in the last decade with more rigorous field procedures and notes, both in rescue archaeology but also in the context of research projects as it happens in Perdigões (Valera *et al.*, 2008) were the main factors responsible for these changes. This practice increased the potential of the laboratory study of the recovered bones. Moreover, the combination of appropriate anthropological methodologies and procedures specifically adapted to these funerary contexts allowed to obtain the potential information that these human remains enclosed (Silva and Ferreira, 2016-17; Silva, 2017).

The Perdigões archaeological site (Évora, South Portugal), a 16 ha ditched enclosure dated from 3500-2000 cal BC, revealed several funerary structures with traces of different mortuary practices (Valera *et al.*, 2014) (Fig. 1). During the Chalcolithic, a necropolis with several tholoi type tombs, including Tomb 2, was built in the eastern side of the enclosure (Valera, 2016). The excavation was based on an integrated bio-archaeological research design, and maximized contextual stratigraphic and taphonomic data. This approach provided a valuable opportunity for the better understanding of human populations that lived in the 3rd millennium BC in southwest Iberia. The exhaustive study of their remains may yield important information about their demographic structure, health status, pathologies, experience of childhood stress and mortuary practices (Silva, 2017). Thus, the aim of this paper is, through the anthropological analysis of

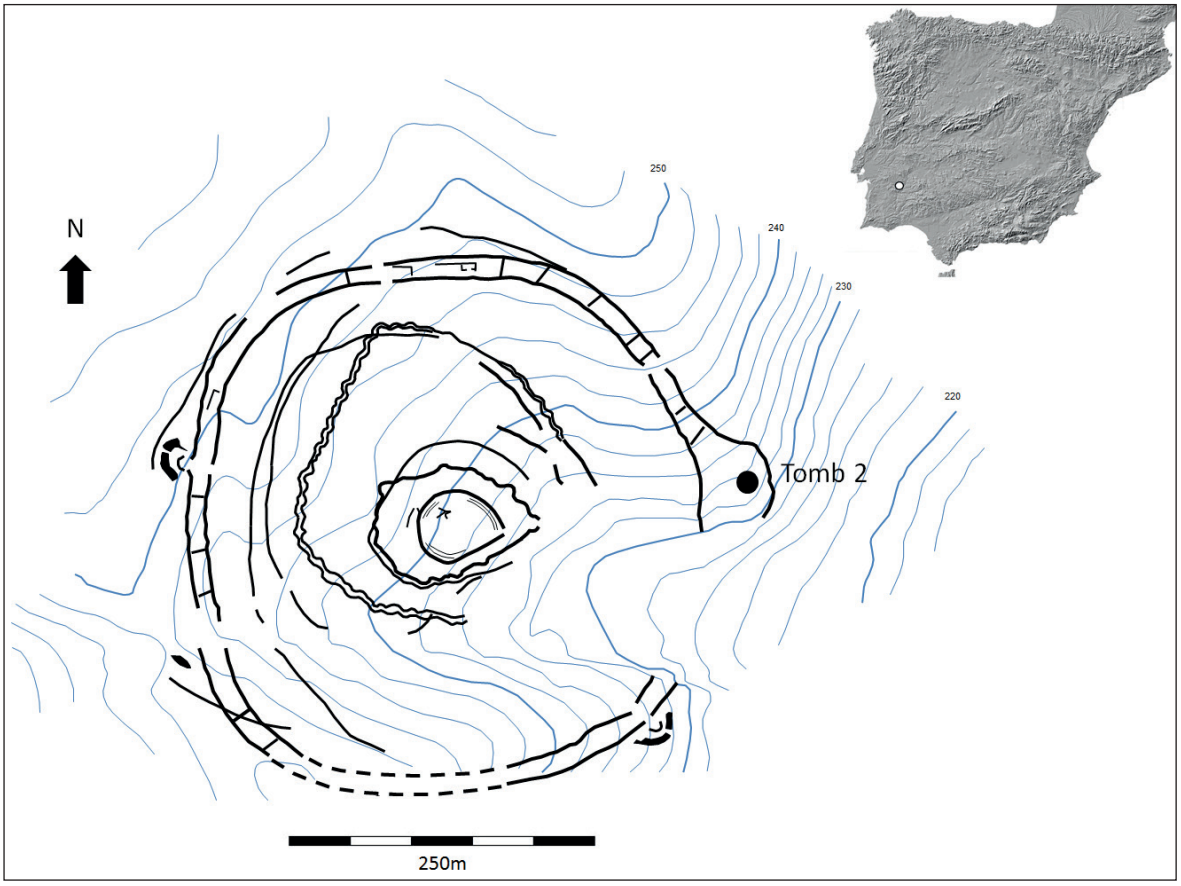

Fig. 1. Map of Perdigões with the location of Tomb 2.

Fig. 2. Tomb 2. Last phase of use of the chamber (Photo: António Valera).

the human remains recovered from Tomb 2, improve the anthropological portrait of these Chalcolithic human groups, including the understanding of their funerary behaviours.

The human bones were recovered from all parts of the tomb, namely Corridor, Atrium and Chamber. Also, a considerable number of bone fragments have no indication of their original provenance. This is due to the loss of the identification labels or because they were recovered from disturbed superficial levels by the action of ploughing carried out in 1997. Since their study is still ongoing, in the present work the obtained data for the Atrium and Chamber samples were compared.

2. ARCHAEOLOGICAL BACKGROUND OF TOMB 2

Tomb 2 is a *tholoi* type monument, with a circular chamber, small orthostatic corridor and a small oval atrium. Both the chamber and the atrium are walled with schist slabs (Valera *et al.*, 2007, 2014).

The monument had a first phase of use of the chamber, dated from the first half of the 3rd millennium BC (2860-2500 cal BC) (Fig. 2). Then, the chamber seems to have been partially emptied, and later reused together with the atrium. This second phase of use is dated from the middle-third quarter of the 3rd millennium BC (2570-2200 cal AC) (Valera *et al.*, 2014). The use of the atrium can also be divided in two phases: one before the fall of the schist slab used as door of the corridor, and another after. In fact, as Tomb 1 (Valera et al., 2014), the monument went through several episodes of ruin of the wall slabs that fell over the bone depositions without being repaired, while depositions continued. This indicates a prolonged and complex use of the monument and is an important circumstance to the interpretation of its nature of use.

The deposition of human remains were accompanied by the depositions of faunal remains (Cabaço, 2009) and by a great variety of votive materials, namely of exogenous origin (Valera, 2017): ivory items (namely *lunulae* and zoomorphic figurines), limestone pots and cylinder idols, arrowheads, few long blades, pottery, beads (in diverse raw materials) and gold foils, the later exclusive of the second phase of use.

3. MATERIAL AND METHODS

The human bone assemblage analysed was unearthed from the different physical spaces of Tomb 2: atrium, corridor and chamber. After cleaning, labelling and marking, an extensive inventory of the bone and tooth sample was prepared on an excel database. The sample from the corridor is very scare (n= 222 bones and teeth fragments) and was studied together with the collection exhumed from the atrium, and from now on, designated as atrium sample and compared to the one recovered from the chamber.

The minimal number of individuals was estimated following Herrmann *et al*. (1990) adapted by Silva (1993). For the non-adult sample, maturation was also taken into account, as recommended by Silva (1996, 2002). Others parts of the skeleton, such as atlas, axis, *pars petrosa*, were also considered, due to their particular characteristics that allow them to be identified as belonging to one individual. Tooth count was also relevant in the estimation of this parameter, including *in situ*, loose dentition and *antemortem* tooth loss, as recommended by Silva (2002).

The representativeness of the adult bones was analysed in more detail for inferences about the burial practices. Bones of all skeletal parts were included, as cranial, axial and long bones. The most highly represented bone was considered as representing 100%. For paired bones, the results for both sides were considered, and interpreted. However, this collection, as many coeval ones, includes a variable number of bones that are mostly reduced to tiny pieces, being impossible to reach their exact identification and thus making it impossible to include them in the representativeness study. This can leave to erroneous interpretations. To surpass this problem, bone weight was used to check for abnormality in bone representation. In this methodology, bones are weighed according to their category and the obtained values converted to percentages. These are compared with the reference values obtained by Silva *et al*. (2009) based on 100 individuals (both sexes and several age groups) from a Portuguese Identified Skeletal Collection (CEI), housed in the nowadays Department of Life Science of the University of Coimbra. This approach has several advantage since it is not necessary to obtain the complete identification of the bone (or side). So, all recovered bone fragments can be included. In addition, in case of greater fragmentation, it is possible to consider major bone groups, as long bones. For that, it is only necessary to sum up the percentages of the involved types of bones. In the present analysis the following categories were considered: skull (including loose upper teeth), mandible (including loose lower teeth), long bones, hand bones, foot bones and other bones (all other bones of the skeleton) (Tab. 1). The fragments were weighed in a digital high precision balance (Model AND FX5000i; d=0,01g). This approach can only be used for adult individuals, since no reference values are available for non-adults.

Bone category	% of weight
Skull	17.75
Mandible	1.79
Long bones	42.12
Hand bones	2.62
Foot Bones	5.69
"Other" bones	29.36
TOTAL	**100**

Table 1. Percentage of skeletal weights used as reference values (obtained by Silva *et al*. 2009 in the CEI sample).

The demographic analysis, namely age-at-death estimation and sex diagnosis, is an essential step in the anthropological study of past population, since it is an important variable for the interpretation of other data, as the impact of pathology and lesions in the well-being of the individuals. The age-at-death of non-adult was estimated using dental mineralization according to AlQahtani *et al*. (2010) and Smith (1991), and long bone and *Os ilium* development, following Ubelaker (1989). For adult individuals, the fusion of the sternal end of the clavicle (MacLaughlin, 1990) allowed the identification of young adults (< 30 years) and individuals that died with more than 30 years of age. Sex diagnosis was obtained through the width of the distal end of the humerus (Wasterlain, 2000) and the maximum length of the talus and the calcaneus (Silva, 1995).

A more detailed study of the mortality profile of non-adults was performed by comparing their mortality coefficients to the expected ones according to the mortality tables by Ledermann (1969). For the interpretation of this approach, the estimation of the juvenile index following Bocquet-Appel and Masset (1977; 1996) and the fertility rate according to McFadden and Oxenham (2017) were included.

Sample	Bone fragments	Tooth fragments	Signs of fire	Signs of red pigment
Atrium	6083	250	5 (0.08 %)	152 (2.5%)
Chamber	8597	327	22 (0.26%)	3643 (42.4%)
TOTAL	**14680**	**557**	**27**	**3795**

Table 2. Bone and teeth count for the samples recovered from Tomb 2 of Perdigões.

Morphological analysis included metric parameters, as estimation of the platimeric and platicnemic indices (Martin and Saller, 1956) to provide data about the flatness of lower long bones, and thus inferences about daily behaviours. To assess the variability and affinity of these individuals, several non-metric postcranial traits were scored following Saunders (1978) and Finnegan (1978).

For insights on the health status of these individual, cariogenic lesions (Lukacs, 1989) and *antemortem* tooth loss were registered. Dental wear was scored according to Smith (1984), adapted by Silva (1996). To evaluate the childhood illness experience of these individuals, enamel hypoplasia (a non-specific stress indicator) were recorded.

4. RESULTS

Around 15,109 bones or tooth fragments of adults and non-adults were analysed in the present study (Tab. 2) (Garcia, in preparation; Rodrigues, 2017). These were recovered fragmented and commingled. With the exception of a right foot belonging to an adult female (Fig. 3), recovered from the Atrium (layer 2i), no other primary deposition or anatomical connection were identified during fieldwork. According to field notes, several ossuaries were identified in the chamber with signs of bone selection (Valera *et al.*, 2014), labelled as cluster, and still under analysis. Despite the fragmentation, complete bones were recovered from both samples. These include mostly small hand and foot bones, besides 3 non-adult long bones from

Fig. 3. Anatomical connection of a right foot belonging to an adult female recovered from the atrium of Tomb 2 of Perdigões (adapted from Rodrigues, 2017).

Bone	Atrium		Chamber	
	MNI	%	NMI	%
Pars petrosa	2	12.5	10	55.6
Atlas	16	100	11	61.1
Axis	7	43.75	7	38.9
Manubrium	6	37.5	5	27.8
Hyoid bone	1	6.25	3	16.7
Clavicle	14	87.5	13	72.2
Humerus	6	37.5	9	50
Radio	7	43.75	12	66.7
Ulna	13	81.25	15	83.3
Scaphoid	3	18.75	8	44.4
Semilunar	6	37.5	6	33.3
Trapezium	6	37.5	4	22.2
Trapeziod	3	18.75	6	33.3
Capitate	5	31.25	7	38.9
Pisiforme	1	6.25	6	33.3
Hamate	2	12.5	3	16.7
1st MC	7	43.75	6	33.3
2nd MC	9	56.25	8	44.4
3rd MC	8	50	4	22.2
4th MC	8	50	4	22.2
5th MC	6	37.5	10	55.6
Femur	4	25	8	44.4
Tibia	3	12	8	44.4
Fibula	8	50	7	38.9
Patela	12	75	18	100
Talus	12	75	17	94.4
Calcaneum	8	50	15	83.3
First cuneiforme	10	62.5	8	44.4
Second cuneiforme	5	31.25	6	33.3
Third cuneiforme	7	43.75	4	22.2
Cuboid	9	56.25	5	27.8
Navicular	8	50	12	66.7
1st MT	8	50	9	50
2nd MT	8	50	9	50
3rd MT	8	50	8	44.4
4th MT	8	50	11	61.1
5th MT	8	50	9	50

Table 3: Bone representativeness of the adult bones recovered from Tomb 2 of Perdigões.

	% Obtained		% Obtained	
	Atrium	Chamber	% Expected	Total
Upper Single rooted teeth	37	22	25	29
Upper Double/Multi rooted teeth	16	27	25	22
Lower Single rooted teeth	35,5	27	31.2	31
Lower Multi rooted teeth	11,5	24	18.8	18

Table 4. Percentages for single versus double/multi rooted permanent teeth from Tomb 2 of Perdigões.

the Atrium and 16 (14 adults; 2 non-adults) from the Chamber. The non-adult sample stands out by the presence of seven complete *Os ilium*.

Among the taphonomic alterations observed in these assemblages are the presence of carbonate concretions over bone surfaces, the presence of red pigments and a few bones altered by fire (Tab. 2). The latter, with the exception of two fragments recovered from the Chamber that exhibited white colour (> 600ºC, Gómez Bellard, 1996) are all black (300-400ºC, Gómez Bellard, 1996). No signs of fire were observed in the sediments of the tomb. Evidence of red pigment in bones was scored for both spaces. Yet, it is much more common in the Chamber sample, were 42.4% of the bones were speckled with red pigment against only 2.5% of the Atrium sample. In both samples, these alterations were scored in adult and non-adults bones, as well as, bones from all parts of the skeleton.

The estimated number of individuals is 26 and 30, respectively for the Atrium and the Chamber. For the Atrium, it was the atlas (n= 16), that allowed the final estimation of adult individuals. Ten non-adults (38.5%) were identified based on tooth development and the two youngest, by the presence of two left *Os ilium*. The patella permitted to recognize 18 adults in the chamber, and the tooth sample, established the final number of 12 non-adult individuals (40%) in the chamber. To obtain the osteological profile of the two assemblages, the data of adult bones were assessed, in more detail, in terms of their representativeness (Tab. 3).

The presence of four hyoid bones (one in the Atrium and the remaining in the Chamber) has to be highlighted as, the low representativeness of *pars petrosa*, femur and tibia, more pronounced in the Atrium. This deficiency is striking, since identification was not an issue with these bones, and they represent bones that normally are better preserved.

Tooth representativeness was also analysed. The percentages obtained for the Atrium ensemble are very far from the expected ones: single rooted teeth from both maxillae are above the expected value, especially upper ones. The reverse trend in observed in double/multi rooted teeth, again more pronounced in the upper ones. The sample from the Chamber reveals an opposite trend: single rooted teeth from both maxilla display percentages below the expected and, double/multi-rooted teeth, above. However, the magnitude of the difference is much lower. Interestingly, if we considered the two samples as a whole (last column of Tab. 4), the percentages converge to the expected values, particularly for mandibular teeth that became almost identical to the expected one. We will return to this issue in the discussion section.

Results for bone weight show relevant data (Fig. 4). Overall, percentages are very similar for both assemblages, revealing the same trend, and being close to the expected one. The cranial and long bone display percentages below the expected values, more pronounced for the skull category, and foot and "others" bones", above.

The next step was to get some inferences about the demographic structure of these samples. Concerning sex ratio of the adult individuals, the more reliable anatomical regions for sex diagnosis, as *Os coxae* and cranial bones were too fragmented and reduced to small pieces, to be used. Some data were obtained from the length of the talus bone (Fig. 5) and the width of the distal extremity of the humerus. These, confirm the presence of individuals of both sexes, in an apparent similar proportion in both funerary spaces from this Tomb. The same trend is suggested by the results of the width of the distal end of the humerus (results not shown).

The obtained age-at-death structure is very similar (Fig. 6). The youngest individual detected in the Atrium sample was an individual whose death occurred between 6-12 months (based on the width of a left *Os ilium*), and in the Chamber, a mandibular fragment confirm the presence of a child with an age at death around 2.4-2.5 years.

Among adults, the external epiphysis of clavicles confirms that the majority of adults died with more than 30 years. For the atrium sample, the percentage is 66.7% (6/9) and 83.3% (10/12) for the Chamber (Fig. 7). Other evidence of young adults was noted by the presence of several vertebrae without the fusion of the ventral arch and the ongoing fusion of the iliac crest.

The age at death profile for non-adults allowed a more detailed analysis of their mortuary profile, by comparing the mortality coefficients to the expected ones according to the mortality tables by Ledermann

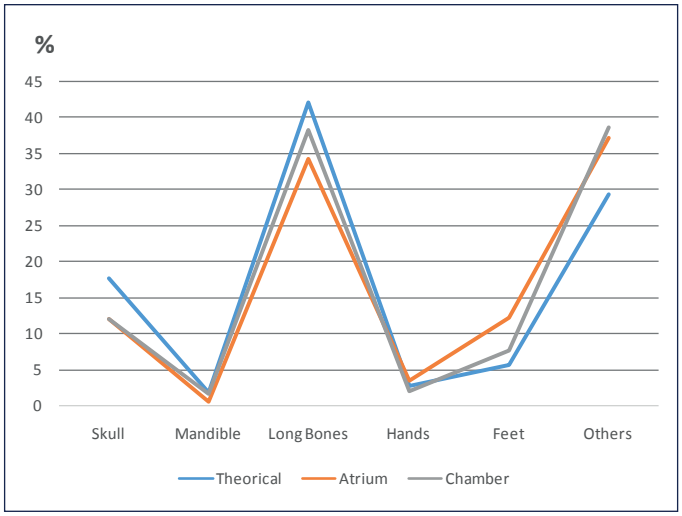

Fig. 4. Results for bone weight of the adult bones recovered from Tomb 2 of Perdigões. The values are compared with the theoretical (expected) values develop by Silva et al., 2009.

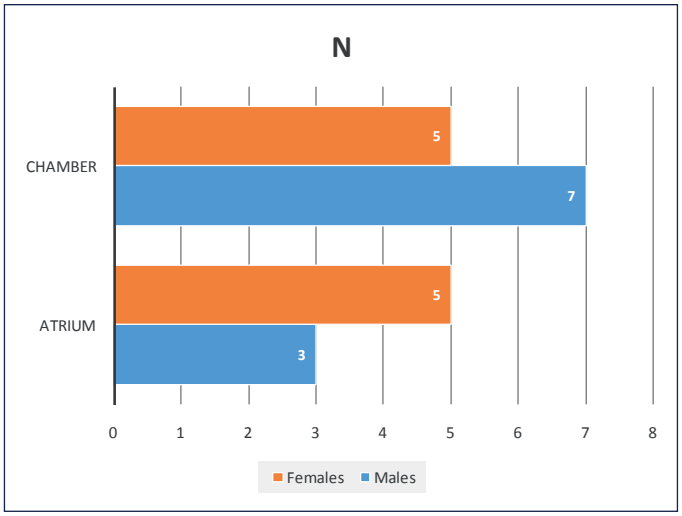

Fig. 5. Results of sex diagnosis for the adult individuals unearthed from the Atrium and Chamber samples from Tomb 2 of Perdigões based on the maximum length of the talus.

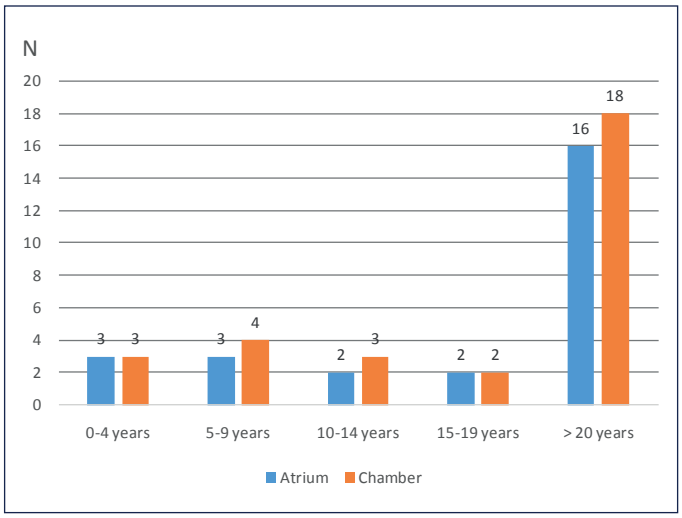

Fig. 6. Age at death profile for the individuals exhumed from the Atrium and Chamber samples from Tomb 2 of Perdigões.

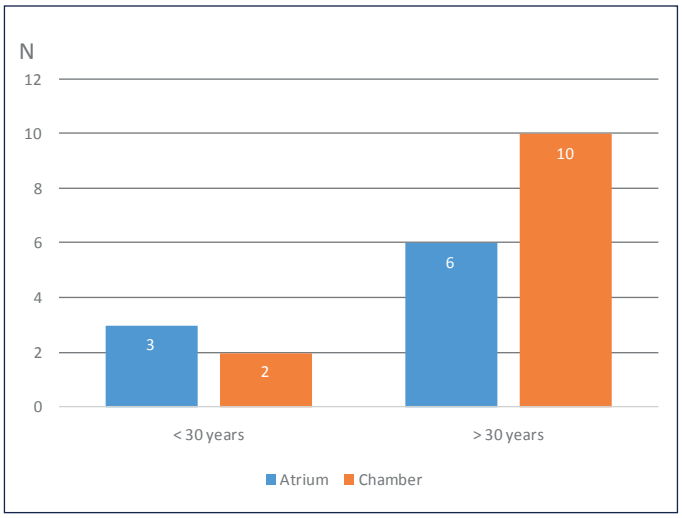

Fig. 7. Age structure of the adult individuals exhumed from Tomb 2 of Perdigões according to the fusion of the sternal end of the clavicle.

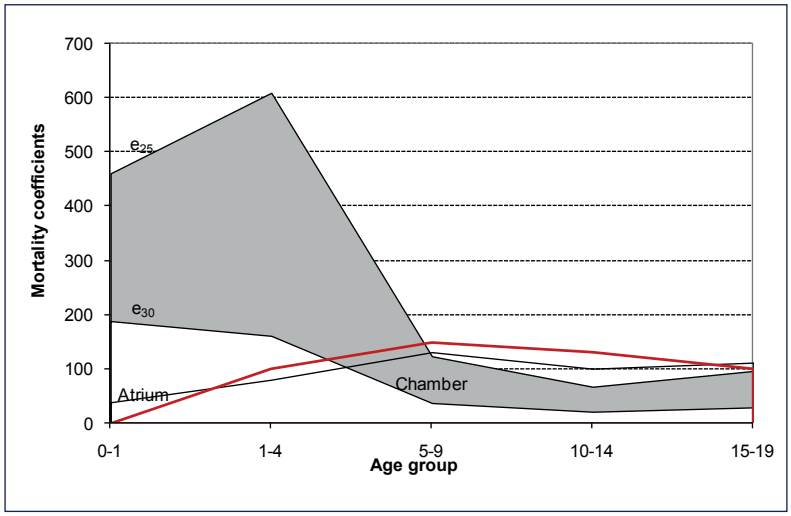

Fig. 8. Mortality coefficients for the non-adult recovered from the Atrium and Chamber of Tomb 2 of Perdigões compared with 95% confidence interval of superior limit of eo = 25 and inferior limit of eo=30, according to the life tables of Ledermann (1969).

(1969) (Fig. 8). Demographic analysis revealed a clear under-representativeness of infants, particularly those less than 5 years old in comparison to the theoretical mortuary curve based on mortality frequencies of pre-industrial populations for both samples. On the contrary, the remaining age groups are over-represented when compared to the expected mortality rates, specially the 10-14 age group (Ledermann, 1969). If we considered the outline of the mortality curve, it is the curve for the Chamber that is closer to the expected one for natural populations, except for infants younger than 5 years (Ledermann, 1969; Silva, 2002; 2003).

Certain demographic indexes were calculated in order to obtain more details about the demographic attributes of these individuals as, fertility and patterns of infant mortality (Tab. 5). In both samples, the juvenile index proposed by Bocquet-Appel (1977), D5-9/ D10-14, is very below the value of 2, which is characteristic of pre-Jennerian population (Bocquet-Appel and Masset, 1977). Moreover, the estimated fertility rate of this sample is 2.46 and 4.80, respectively for the Atrium and Chamber samples (McFadden and Oxenham, 2017), values that are considered moderate and low fertility. Life expectancy at birth revealed unbelievably low values, less than 16 years, incompatible with survival of human groups.

The mean value of the platymeric and platicnemic indexes of the long bones fall in the range of presence of flatness. For the Atrium, these indexes were only possible to score in a right tibia (platicnemic index: 71.43). Flatness of both lower limb bones were also register for the Chamber sample, with the mean value of 81.7 (n=4) for the platymeric index, and 67.4 (n=9), for the platicnemic.

Non-metric traits were only possible to score in the infra-cranial skeleton (Tab. 6), since the high fragmentation of the skull makes the observation of these traits infeasible. The majority of traits were not observed and if present, are in low percentage. The most common observed non-metric trait in both sample was the septal aperture, although the low number of observations has to be considered.

	Atrium	Chamber
D_{5-14}/ D_{20-x}	0.31	0.39
D_{5-9}/ D_{10-14}	1.50	1.33
Fertility rate	2.46	4.80

Table 5. Results of the Juvenile indexes and fertility estimated for the two samples exhumed from Tomb 2 of Perdigões.

	Atrium	Chamber
Presence of romboid fossa (clavicle)	0/9	0/24
Presence of supraclaviculaperfuration (clavicle)	0/8	0/24
Presence of septal aperture (humerus)	2/3	2/9
Presence of third trochanter (femur)	1/2	0/5
Presence of hypotrochantic fossa (femur)	1/2	1/6
Presence of ostrigonum (talus)	1/17	0/19
Presence of calcaneumsecundarium (calcaneum)	0/10	1/15
Absence of anterior calcaneal facet (calcaneum)	4/12	0/16
Peroneal tubercle of calcaneum (calcaneum)	1/10	3/10

Table 6. Infra-cranial non-metric traits observed in the bones exhumed from Tomb 2 of Perdigões.

	Atrium	Chamber
Dental wear	1.69 (n=213)	1.8 (n=264)
Cariogenic lesions	0/213	4/266 = 1.5%
Antemortem tooth loss	0/26	0/49
Linear enamel hypoplasia - Permanent teeth	3/212 = 1.4%	2/266 = 0.8%
Enamel hypoplasia – pit defect - deciduous teeth	0/11	1/22 = 4.5%

Table 7. Oral pathologies and enamel hypoplasia observed in the samples recovered from Tomb 2 of Perdigões.

Concerning oral pathologies (Tab. 7), cariogenic lesions were found only for the Atrium sample, but in very low frequency (two upper and two lower posterior teeth). No *antemortem* tooth loss was registered, although this result has to be analysed with caution since the preserved alveolus are very low. Mean dental wear is very similar and low for both samples. The prevalence of linear enamel hypoplasia (LEH) is low, and equally distributed between anterior and posterior dentition (teeth FDI 12, FDI 23 and FDI 44 from the Atrium sample; teeth FDI 16 and FDI 44 for the Chamber sample). Among the deciduous dentition, only one lower right deciduous canine from the chamber revealed an enamel hypoplasia defect in form of a small pit.

5. DISCUSSION

The present study is the first step of the two-fold analysis of this funerary monument, were the data of the different spaces of the monument used as burial place were compared. This is not a common approach, since usually these tombs are studied as a whole. Moreover, the analysis of the non-referenced part of the collection (as mentioned above) is still in course. Therefore, all following comparisons with other tombs have to be considered with these two issues in mind.

A similar number of individuals were scored in both spaces of Tomb 2: 26 individuals in the Atrium and 30 in the Chamber, being all age classes and both sexes represented. The adult/non-adult proportion of both samples are among the highest documented for similar tholos type monuments (Fig. 9), but in accordance with the expected non-adult ratio in archaic populations of 36% to 50% (Acsádi and Nemeskéri, 1970). The ratio, is even higher in the neighbour Tomb I of Perdigões, were 46.6% of the exhumed individuals were less than 15 years old (Evangelista, in preparation).

Although all age groups are represented, a more detailed analysis of the non-adult samples shows several irregularities. Although young children were identified in the Atrium and Chamber (the youngest respectively, 6-12 months and 2.4-2.5 years), they are present in low numbers. This tendency, suggested by their age profile was confirmed by the analysis of their mortality coefficients. For both samples, the demographic analysis revealed a clear under-representativeness of infants less than 5 years old in comparison to the theoretical mortuary curve based on mortality frequencies of pre-industrial populations. On the contrary, the 5-9 and 10-14 age groups are over-represented when compared to the expected mortality rates, especially the Atrium sample. This trend was previously described for other coeval samples, as the *Tholoi* of Paimogo I and Cabeço da Arruda II, although in lesser magnitude (Silva, 2002, 2003). Moreover, in these last two coeval series, the 5-9 and 10-14 age groups are in the upper limit of the expec-

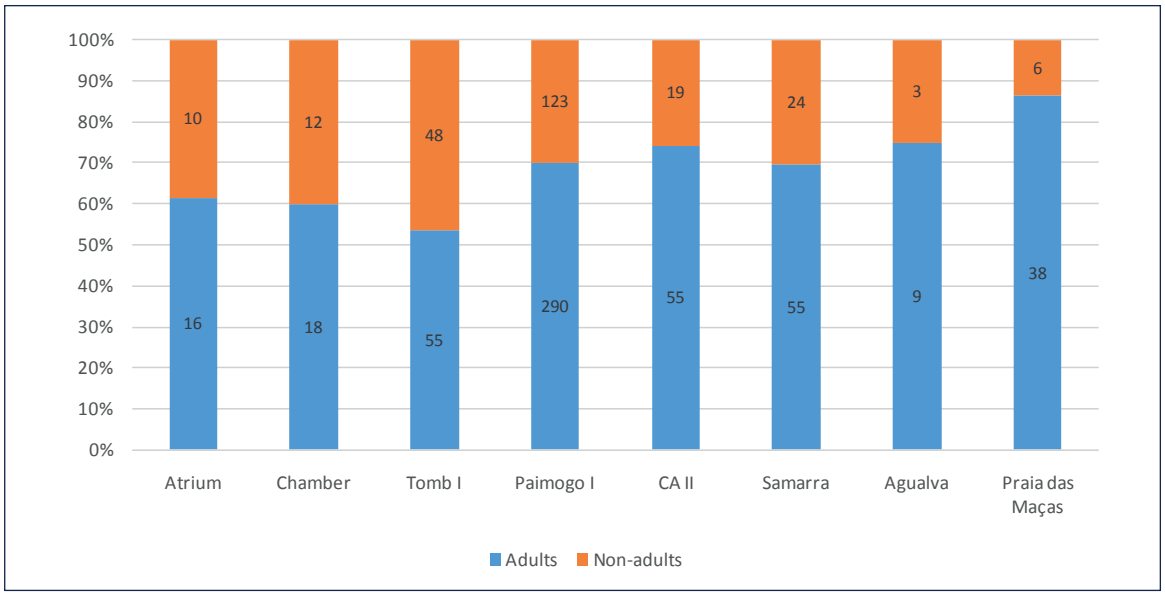

Fig. 9. Proportion of adults (>15 years old) versus non-adults in tholos type monuments from Portugal.
Legend: Tomb I – Tomb I from Perdigões; Paimogo I – *Tholos* of Paimogo I; CAII – Cabeço de Arruda II; The data of Samarra and Praia das Maçãs are only partial.

ted values. For now, it is difficult to interpret these differences but it is important to emphasize that the number of individuals exhumed from these tombs is much higher. The estimated demographic indexes confirmed the described irregularities. Moreover, the estimated life expectancy at birth revealed unbelievably low values (< 16 years) not compatible with survival of human groups. All these anomalies are primarily related with the low numbers of young children whose values influence the estimations of all these demographic parameters. The absence of infants in burials is not unusual. This under-representation has been interpreted by different authors as, the influence of age related mortuary practices, the effect of taphonomic agents causing differential preservation, and incomplete archaeological recovery due to biased excavation techniques (Saunders and Barrans, 1999). In the present case, the two latter seem not to be responsible for this under-representation, since small non-adult bones, as carpal ones, were recovered. Concerning the over-representativeness of the next two age categories, the data could reflect a temporal period of high infant mortality of the human community. Naturally, to interpret the results we also have to take into consideration the nature of the site and of the social practices that were taking place there and that might be responsible for the mortuary patterns that, characterize the tombs, making comparisons with other funerary contexts sometimes misleading.

Although age indicators of adults are scare, the sternal end of the clavicle confirms that the majority of adults died older than 30 years. This fact is contrary to the common belief that prehistoric individuals die young, although it has been previously described for other coeval samples, as the tholos of Paimogo I (Silva, 2002, 2003). Human variation in aging process is a well-known process due to the influence of environmental factors (activity, health, nutrition, among others) in biological age, and thus in the accuracy of age-at-death estimation. This is particularly relevant in older individuals, due to the effects of the accumulation of these extrinsic factors (Garvin *et al.*, 2012). Therefore, the nature of these assemblages combined with these methodological constraints will also difficult the identification of older individuals in these prehistoric samples.

The data based on flatness indexes of the femur and tibia do not reveal a pattern associated with flatness reduction associated with sedentary agricultural populations. However, they are consistent with the trend of flatness in the proximal femur and tibia shafts observed in other coeval Portuguese samples. This led Silva (2003) to suggest a greater mobility of these individuals (at least some) related to daily pastoralist activities or others actions that involved frequent long distance travelling (Silva, 2003, Boaventura *et al.*, 2014).

The variability of non-metric traits detected is scare and similar in both ensembles. The most common observed non-metric trait was the septal aperture of the humerus. However, these samples also stand out by the absence of traits as, the perforation of the supraclavicular nerve and hypotrochantic fossa that, although rare in modern collection are systematically scored in Late Neolithic/Chalcolithic populations from nowadays Portuguese territory (Silva, 1996, 2002, 2003).

Health status of these individuals, concerning dental wear and oral pathologies reveals good health conditions: the mean dental wear is low and scarce cariogenic lesions were scored. Childhood stress

	MNI	Caries	AMTL	LEH (Permanent teeth)	LEH (Deciduous teeth)
Tomb 2 – Atrium (Perdigões)	26	0/213	0/26	3/212 = 1.4%	0/11
Tomb 2 – Chamber (Perdigões)	30	4/266 = 1.5%	0/49	2/266 = 0.8%	1/22 = 4.5%
Tomb 1 (Perdigões)	103	7/1406 = 0.5%	29/539 = 5.3%	143/1369 = 10.4%	2/81 = 2.5%
Tholos Paimogo I	413	72/1073 = 6.7%	507/4221 = 12%	56/5509 = 1%	1/514 = 0.2%
Samarra *	79	28/717 = 3.9%	127/1246 = 10.1%	0/1246	3/53 = 5.7%
Agualva	12	6/20	7/48	0/20	–
Praia das Maças*	44	2/119	42/101	2/15 = 13.3%	–

*Partial collection.

Table 8. Oral pathologies and enamel hypoplasia observed in samples recovered from Tholos type monument from Portugal.

experience of these individuals, measured by the presence of enamel hypoplasia, are among the lowest frequency observed for coeval samples (Tab. 8), and are even absent in the Atrium sample. Curiously, in the neighbor Tomb I of Perdigões, the frequency of this stress indicator is 10%. Moreover, 2.5% (2/81) of the deciduous teeth (FDI 75 and FDI 85) recovered from this tomb, exhibited signs of this stress indicator (Evangelista, in preparation). These data allow to suggest that the individuals deposited in Tomb 2 were not submitted to high environmental stress. This may be supported by the high percentage of individuals that died older than 30 years, and the almost inexistent signs of infection: only one fibula fragment of a non-adult displays signs of remodeled periostitis. Still, following the osteological paradox, these evidences could also correspond to weaker individuals who perished soon after the first exposure (Siek, 2013).

In the previous section, the individuals exhumed from the two spaces of Tomb 2 were portrayed in biological terms, including inferences about childhood stress experience and pathologies. But one pertinent question is still not answered. What about the mortuary practices they were submitted?. This discussion is a difficult task. Still, we will examine the obtained data, pointing out the inferences that can be drawn.

Fragmentation of these assemblages is high, with a lower number of complete bones recovered from the Atrium. These include mainly small bones, as carpal and foot bones that, due to their small size, many times survived more easily to fragmentation in very disturbed burial places (Crúbezy *et al.*, 1998; Silva, 1996, 2002).

Starting with the analysis of the bone representativeness of adult bones from both samples, several points stand out: in both, small bones as carpal, hyoid and sesamoid bones are present; simultaneously, skeleton regions that usually are among the better preserved and give few identification problems as, *pars petrosa*, femur and tibia, are present in low frequency. These deviations are more visible in the Atrium sample. The results of tooth representativeness are even more puzzling. Both samples display great divergences to the expected values, again more marked in the Atrium sample, and in opposite directions: the tooth categories that are over-represented in one sample, are under-represented in the other one. The Atrium sample displays a high percentage of upper and lower single rooted teeth. These are usually under-represented, but for different reasons: the former, because they are among the first to decay in the decomposition process due to their anterior and superior position in the arcade. The latter, because being small they are more propitious to decay. The fast decay of upper anterior teeth is frequently the reason why they are missing in secondary deposits since they were lost during the transportation. The under-representation of double/multi rooted teeth in the Atrium is, in part, due to the over-representation of the other group of teeth and perhaps *antemortem* tooth loss, a pathology that affects more posterior teeth and that is not possible to evaluate correctly in these samples due to the lack of maxilla. The situation becomes even more curious if the two samples are considered as a whole, as the percentages converge to the expected ones, especially for mandibular teeth, as it can be seen in Tab. 4, last column.

Bone weight, confirmed all these trends: the percentages are very similar to the expected ones, with skull and long bones, below the values, and particularly foot and "others" above. These results demand more detailed comments. The under-representativeness of skull bones and long bones, was already revealed by the low number of *pars petrosa*, femur and tibia recovered. The over representation of "others" bones in the two spaces has to be highlighted, since this bone category systematically reveal lower weight values than expected. This is related to their lower survival rates due to low density and/or irregular shape (Crúbezy *et al.*, 1998; Silva, 2002; Silva *et al.*, 2009).

So, if all these data are considered what can be said about one of the major questions in collective burials: is it a primary or a secondary burial place of inhumation? There is no evidences of primary depositions. However, tooth proportion and bone weight, and to less degree bone representativeness suggest that the deposition of primary burials could have happened, at least for some period of use of the monument. If so, the human remains were after submitted to intense manipulation. Major deposits probably occurred in the Chamber, where fewer irregularities were observed. The intense manipulation of the human remains probably was accompanied with removal of certain body parts. This would explain the missing of skull, femurs

and tibia. This could also explain why upper single rooted teeth were over-represented in the Atrium: during the removal of the skulls from the Chamber, they ended up failing during the passage through the Atrium to go outside the funerary monument. This "circulation of bones", as skulls, could also be responsible for the high number of atlas recovered in the Atrium, compared to *pars petrosa*. Another indication of an intense circulation inside the sepulchre is the high fragmentation of the bones, except for small hand and foot bones that more easily escape for being crushed. However, the secondary depositions of bones is also strongly suggested by the archaeological stratigraphy and processes of ruin of the monument and by the almost inexistence of preserved anatomical connexions.

In fact, only one anatomic connection was detected during fieldwork which, according to several authors, does not allow to reject the hypothesis of primary burials (Chambon, 2003; Sjögren, 2015), but also doesn't prove it. The presence of articulated bodies or parts of bodies could also explain the high representativeness of "other" parts of the skeleton in this tomb. Moreover, the presence of hyoid and sesamoid bones, bones that even in undisturbed primary burials are frequently not preserved, were present in this Tomb. This allows to suggest that some body parts were introduced in the Tomb, before disarticulation of the decomposition process. Nevertheless, these could also have been introduced as secondary deposits of body parts. This last practice may also explain the presence of the few cremated remains recovered with no associated sedimentological evidence of fire.

Red pigment was found spread over the human remains mostly in the Chamber sample. Although some of this pigment is ochre, Emslie *et al*. (2015) confirmed that cinnabar, a natural mercury sulphide, was also present. The majority of human remains from Tomb 2 analysed by Emslie *et al*. (2015; n=15) were highly contaminated with mercury, which was associated with the cultural use of cinnabar in life.

In sum, Tomb 2 of Perdigões corresponds to a deeply revolved and manipulated funerary context, with possible removal of certain body parts, reflecting the possible co-existence of different mortuary practices. No sex or age criteria of selection of the individuals were detected, except the apparent exclusion of some children younger than 5 years.

6. CONCLUDING REMARKS

The analysis of prehistoric collective burials, a mass of commingled and fragmented bone assemblages, represents a continuous challenge in the search of the best combination of selected anthropological methodologies and procedures. Tomb 2 of Perdigões was not an exception. Although the discussed data have to be a considered provisionally since the non-referenced bones of this Tomb are still under study, some relevant insights on the demographic structure, pathologies and experience of childhood stress were advanced. Mortuary practices were discussed in light of the different data. Tomb 2 corresponds to a deeply revolved and manipulated funerary context, suggesting the co-existence of different mortuary practices, such as plausible primary burials, secondary deposits of body parts and deposition and removal of certain bones.

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