The Roman Cremation Burials of the Encosta de Sant'Ana (Lisbon, Portugal)

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Abstract

A Roman cemetery found at Encosta de Sant'Ana in Lisbon yielded a small number of cremation burials. Information about the cremation practices during this particular period comes mostly from the writings of classical authors such as Pliny or Cicero. The opportunities to confirm these descriptions in the Portuguese territory by direct observation in the archaeological record have been rare. Therefore, the burials from Encosta de Sant'Ana offer the chance to add new knowledge to the picture obtained from faunal and human remains and material culture itself.

A bioarchaeological approach was adopted in order to infer the funerary behaviour of the populations from *Olisipo*, the Roman name for Lisbon, through their burned skeletal remains. In addition, a new reference frame was developed to assist on the analysis of bone weight of the urned cremations. These allowed the reconstruction of funerary rituals and cremation practices.

Resumo

Um reduzido número de cremações foi encontrado no cemitério Romano localizado na Encosta de Sant'Ana em Lisboa. Os nossos conhecimentos acerca da prática da cremação neste período em particular resultam principalmente dos relatos de autores clássicos como Plínio ou Cícero, mas apenas em raras ocasiões estes foram confrontados com o registo arqueológico referente ao actual território português. Os enterramentos da Encosta de Sant'Ana oferecem-nos agora a possibilidade de

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enriquecer esses conhecimentos a partir dos achados aí encontrados e que incluem artefactos e restos osteológicos humanos e faunísticos.
Adoptou-se uma abordagem bioarqueológica de forma a reconstruir o comportamento funerário das populações de *Olisipo*, a designação Romana de Lisboa, a partir dos ossos humanos cremados. Além do mais, procedeu-se ao desenvolvimento de um quadro de referência para assistir na análise do peso osteológico das cremações em urna. Este procedimento permitiu a reconstituição do ritual funerário e das práticas referentes ao processo de cremação.

Keywords: Roman Epoch; burned bones; *bustum*; *ustrinum*; *Olisipo*.

1. Introduction

The archaeological site of Encosta de Sant'Ana (ESA) is located in Lisbon's downtown, in the present Martim Moniz square (Fig. 1). The site was subject to two archaeological campaigns: the first one was undertaken in 2002 and the second in 2004/2005. The 2002 campaign was supervised by two of the authors (JM and CC), as members of the Archaeological Service of the City Museum (Municipality of Lisbon), and it aimed to minimize the impact caused by the construction works of an urban project (Muralha, Costa & Calado, 2002; Muralha & Costa, 2004).

The excavation revealed an occupation ranging from the 5th millennium cal BC (Muralha & Costa, 2006) up to the Modern Period including the city's reconstruction after the 1755 earthquake (Angelucci, Costa & Muralha, 2004). The Roman occupation consists of a cemetery nucleus dated from the 1st century AD with a set of secondary cremation structures and two half destructed inhumation structures from the Late-Roman Period. Part of a north-south oriented pathway was also detected. This cemetery is the enlargement of the *Olisipo*'s main cemetery, which was detected in the 1950's in Praça da Figueira, located a few meters south from ESA. The assemblage from the earliest phase of the cemetery is composed by an *ustrinum*, five urns of common pottery or made out of amphorae and a *bustum*. The first structure was part of the technology used in the cremation of cadavers and bones (Villaescusa, 2001) while the remaining are part of individualized burials. The urns are secondary depositions while the *bustum* is a primary burial at the place where the cremation pyre has been built and lightened up (Villaescusa, 2001). The latter was used repeatedly as an *ustrinum* and then as a *bustum* on its final handling (Angelucci, 2008). We used the designation that reflects its last function as the present paper focuses on the analysis of the burials. It is noteworthy, however, that this structure has been previously designated as *ustrinum* by Angelucci (2008).

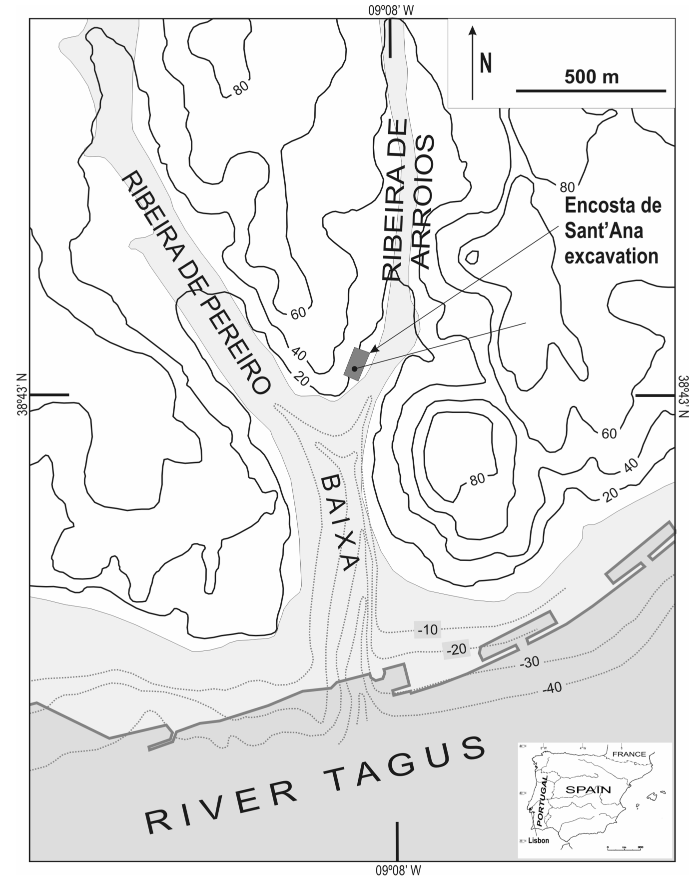

Fig. 1 - Location and topography of present-day central Lisbon. Contour line intervals are 20 m; the shaded area represents the extension of Quaternary sediments; dotted lines correspond to the depth of the boundary between Quaternary sediments and pre-Quaternary (Miocene) bedrock (after Angelucci, 2008, fig. 1.

Beside the ESA structure (Angelucci, 2008), there are few published records of Roman cremation pyres in Portuguese territory. Nine rectangular openings in the ground coated in stone and covered by ashes were found at the necropolis of Horta de Pinas located in Elvas (Frade & Caetano, 1993). These openings were interpreted as cremation structures by Viana (1950) who excavated the site in the mid 20th century but made no reference to the presence of human bones. Also, several *busta* were detected at the necropolis of Gondomil (Valença) dated from the second half of the 1st century AD to the beginnings of the 2nd century (Almeida, 1984). Another case of a *bustum* was detected by Corga et al. (2007) at Monte da Vinha 2, S. Manços (Évora). A subrectangular opening with charcoal residues and an assemblage composed of pottery and glass artefacts were found on this site. By contrast, Roman sites with cremation urns are common in Portugal and its distribution extends to the larger part of the territory (Almeida, 1984; Frade & Caetano, 1993; Encarnação & Fernandes, 1997).

Although cremation burials were relatively common during the Roman occupation of the current Portuguese territory, little has been written regarding the bioarchaeology of the burned human bones present at these burials. Two main reasons explain the current state of affairs. First, much of the human remains found at the Roman burial grounds were un-recovered, lost or forgotten at the museums where they were stored. Many of these sites were excavated in past decades before the archaeological method was not systematised and intensive recovery or detailed recording were not as thoroughly practised as today. In addition, burned bones have been neglected for decades by biological anthropologists due to the severe fragmentation caused by extreme temperatures. This neglect probably lead archaeologists to disregard burned human bones as a valuable source of data, maintaining the preconceived assumption that no information could be extracted from these. The general absence of this kind of human remains in our museums suggests that most of the bones from cremation burials were probably never even brought to the stores. Instead, these were probably abandoned near the excavation sites.

The ESA funerary assemblage constitutes an opportunity to approach Roman funerary behaviour through the analysis of the cremation practice. Besides the descriptions from the Roman classical authors such as Pliny or Cicero, our knowledge of the Roman funerary practices on the Western Iberia results essentially from the analysis of inhumation burials. The results obtained from the bioarchaeological analysis of the burned human remains recovered at ESA, constitutes therefore an additional contribution for the understanding of Roman funerary practices.

2. The Cemetery

The roman necropolis of ESA is located in the Sectors A, C and E of the excavation, at the southern face of the Torre da Pela located in the inner side of the medieval wall (Fig. 2). The funerary structures - *bustum*, partially destructed *ustrinum* and cremation urns Urn 1, Urn 2, Urn 3 and Urn 4 – were build directly into the local bedrock composed of Miocene marls at Sector A (Table 1).

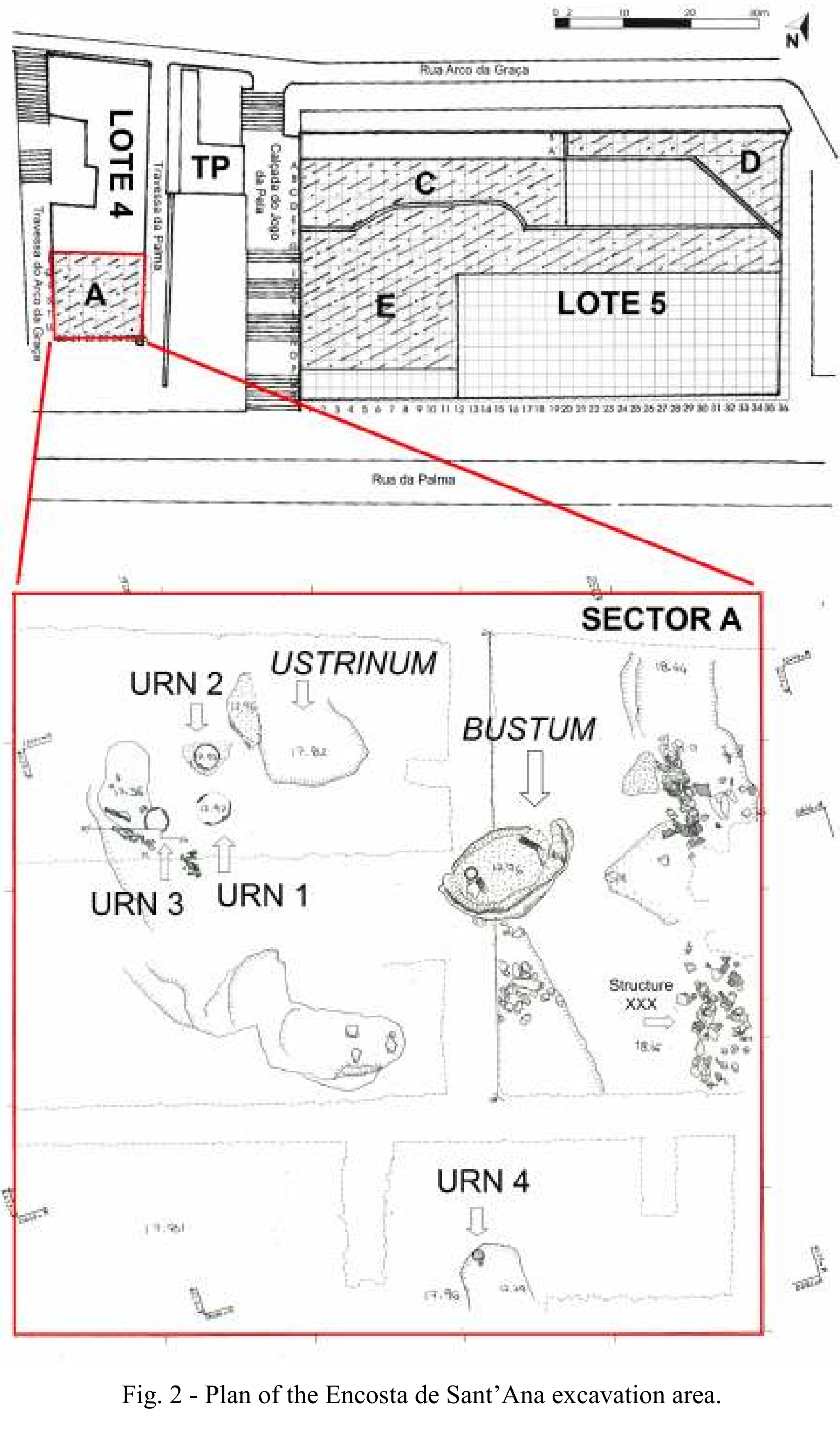

Fig. 2 - Plan of the Encosta de Sant'Ana excavation area.

The nucleus of Sector A was enlarged to Sector C where another urn was detected (Urn 5), and to Sector E where two inhumation structures were found from a later period, probably Late-Roman, although partially destructed. Only one of these had some human bones, but lacking anatomical connection. These inhumation burials are not part of the present study which focuses only on the burned human remains.

The *ustrinum* contained no materials and was severely damaged probably during the Islamic occupation of the site on the 11th and 12th centuries (Calado & Leitão, 2005). This *ustrinum* was similar to the *bustum* which had an oval layout excavated into the bedrock's marl (Fig. 3). It had a North/South orientation and contained ashes, charcoal, cremated bones and artefacts. The latter included ceramics, a glass-made unguentarium (Isings 8), thin-walled pottery (Mayet XXXIV), a lamp (Bailey's III), a *terra sigillata* plate (sud-galic, Drag 18) and a ceramic-made common pot (1-b: Nolen, 1985). A number of nails probably used for the construction of the pyre were also present (Muralha & Costa, 2004). In addition, an assemblage composed by the remains of *Equus asinus* (ass) was found next to the *bustum*.

Table 1 - Provenance of the funerary structures and artefacts.

	Bustum	*Ustrinum*	Urn 1	Urn 2	Urn 3	Urn 4	Urn 5
Sector	A	A	A	A	A	A	C
Square	R22;R23; S22;S23						
Stratigraphic Units	31;32;33;76				46;47; 48;49	14	
Structure	XXXI	XXXII	XXXIV	XXXV	XXXVI	XXXIII	XXXV

The *ossilegia* (urns) were composed by three amphora sectioned at the bulged segment and are of Dressel 20 typology (Muralha, Costa & Calado, 2002; Muralha & Costa, 2004) with the exception of the Urn 4 burial which is composed by a common pot. Urn 1 was buried in an opening on the bedrock filled with cremation residues. No artefacts were found in the grave or in the content of the urn. The latter was damaged at its bottom. Urn 2 was buried in the same way, but without cremation residues covering the grave. Fragments of a glass balsam container were present inside the urn and remains of *Equus asinus* were found in the same opening as the urn. Urn 3 was placed in an opening on the bedrock filled with residues from the pyre. The urn contained fragments of metal, ceramics and glass. A pig or sheep bone was also found on the content (identification by Marta Moreno-García). An unburned mandible of *Equus asinus* was present in the grave associated to the urn. Urn 4 was buried associated with a pot of common pottery. A coin was recovered from its content. Finally, Urn 5 was recovered in sector C, near the roman pathway, in a colluvial deposit with no associated artefacts.

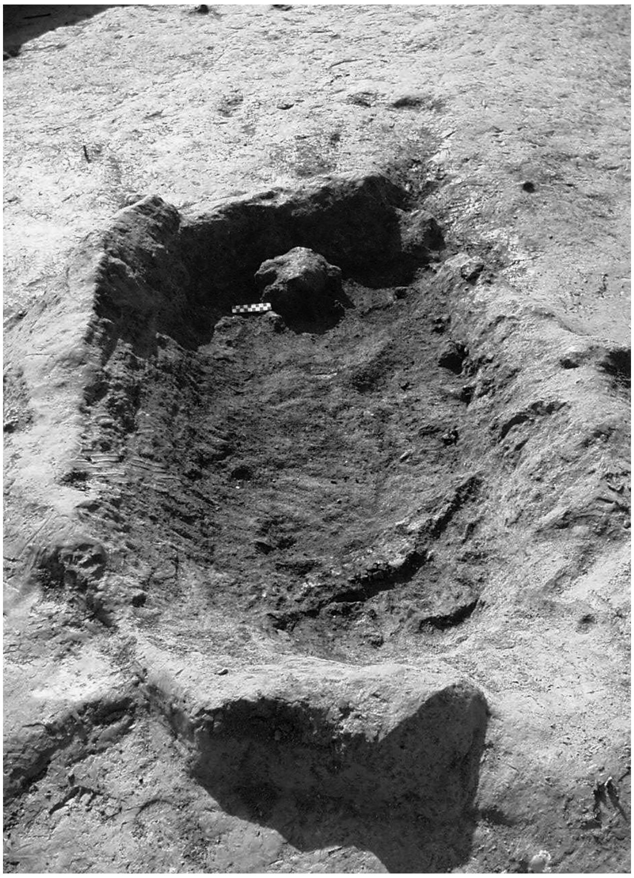

Fig. 3 - The *bustum* located on sector A of Encosta de Sant'Ana.

As mentioned before, there were two bone assemblages of *Equus asinus* in the same context of the cemetery, one related to the *bustum* (assemblage 1) and the second in the same pit of Urn 2 and Urn 3 urns (assemblage 2). Assemblage 1 was located at less than one meter north from the *bustum's* position and was composed by the skull, a left scapula, eighteen ribs, two cervical vertebrae, two thoracic vertebrae, one lumbar vertebra, a complete pelvis, a left calcaneum and other left tarsals, in a total of thirty three bones. The remains were anatomically unconnected and organized into a pile with the skull at the top. Assemblage 2 was located in the southern part of the sector A in the pit where Urn 3 was deposited, and it is composed by the skull, a mandible, four cervical vertebrae including atlas and axis, one thoracic vertebra and three lumbar vertebrae. As seen in the first assemblage, these remains were anatomically unconnected and randomly deposited (Costa, Duarte & Muralha, 2006).

3. The Methodology

3.1. The Excavation of the Cremation Burials

The urns were taken intact from the site and excavated at the laboratory. A CT-scan[6] for Urn 1 and a gamma-ray scan for Urn 2 were performed in order to visually scrutinize if their content included bones and artefacts following the procedure adopted by Anderson and Fell (1995). The remaining urns were not submitted to radiological inspection because they had already been previously excavated when the procedure was added to the protocol of analysis. The scan detected pieces of ceramic from the urn itself and what looked like bone fragments were perceived in Urn 1 (Fig. 4). This was confirmed afterwards by the excavation. On the contrary, the scan of Urn 2 established that it was void from any osteological remains.

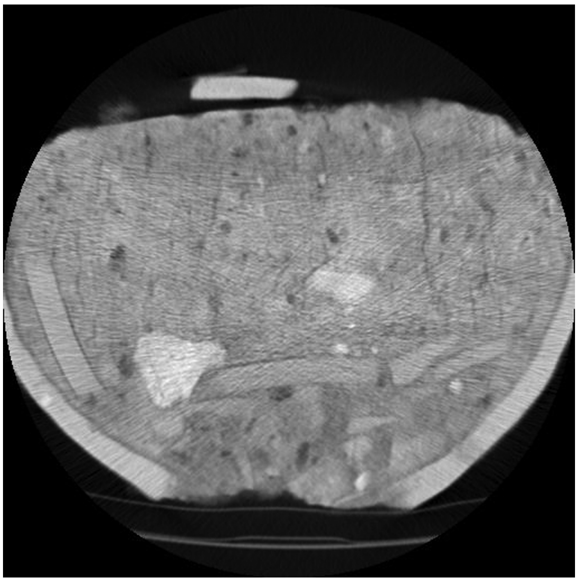

Fig 4 - CT-scan of the Urn 1 cremation.

[6] Protocol for the CT-scan: 120Kv; 110Ma; 5mm.

The excavation of the different bone-containing cremation burials was accomplished by different researchers, rendering the technique somewhat heterogeneous. The b*ustum* was excavated using 2 cm artificial levels while scrutinizing natural layers. Materials were 3D-plotted. The urns were excavated at the lab using a similar methodology, although in some cases 5 cm levels were adopted. An unchanging position was attained for Urn 1 and Urn 5 to allow for the 3D coordination of the exhumed materials. This procedure was not followed for Urn 3 and Urn 4. The sediment removed from the urns was sieved with a 2 mm mesh and demineralised water in order to retrieve all bone fragments. After anatomical identification, these were counted and weighed using a Kern EW3000-2M scale (3000 x 0,01g). The bone measurements were performed using a NTD12-12C Mitutoyo digital calliper. Finally, the infilling deposit of the urns was described following geoarchaeological criteria (Angelucci, 2003), in order to reconstruct the depositional sequence related to the burial (Leonardi, 1992).

3.2. The Human Bone Analysis

Two sets of questions presided to the osteological examination of the ESA cremation burials. The first set is related to the analysis of the paleobiological and paleodemographical aspects of the context. Minimum number of individuals was estimated based on the anatomical features present at each burial, considering bone repetitions as well as age, sex, robustness and paleopathological inconsistencies. The sex determination was attempted based on the morphological features of the pelvis (Buikstra & Ubelaker, 1994) and on standard measurements from the humerus and the femur (Gonçalves, *submitted*). The age-at-death was estimated based on the union and fusion of the epiphyses (Scheuer & Black, 2000; Albert & Maples, 1995; MacLaughlin, 1989) along with the degenerative process of the pubic symphysis (Suchey & Brooks, 1990). The paleobiological profile also included the description of degenerative joint disease (Crubézy, 1988) and oral disease (Lukacs, 1989; Moore & Corbett; 1978).

The second set of questions is related to funerary behaviour. Heat-induced changes to the bone were examined to assess the cremation temperature. Along with the body position at the grave, these changes were also used to infer the condition of the cadaver previous to the cremation. The post-cremation behaviour was then deduced from the patterns of bone recovery from the pyre and the deposition of the remains inside the urn. In order to offer a reference frame for the interpretation of the bone recovery patterns, we statistically analysed some preliminary data regarding human cremations collected at a modern crematorium under the scope of a PhD currently in progress by one of the authors (DG). The remains of 86 individuals with an average age of 70 years-old (min. 34; max. 97), cremated at a modern crematorium, were examined in order to assess their skeletal weights. The sample was composed of 32 females and 54 males and their remains were sieved using a mesh of 2 mm. The sample was then divided into three different groups regarding the percentage of anatomically identified bone weight: less than 35%; 35% to 50%; and more than 50%. The lowest identification rate was of 25% and the highest was of 65%. Data was statistically analysed using the SPSS software, version 14.0 (SPSS Inc., Chicago IL).

This bioarchaeological approach is especially useful for the analysis of cremations, because beside the usual paleobiological information extracted through the methodologies adopted by conventional Biological Anthropology, it also allows the interpretation of human behaviour based on bone changes and burial specificities particular to burned human skeletal remains.

4. The Analysis

4.1. The Heat-Induced Bone Changes

All the ESA burials were composed of bones exhibiting a white coloration. Several experiments confirmed that this feature is characteristic of bones submitted to temperatures greater than at least 645ºC (Shipman, Foster & Schoeninger, 1984; Etxeberria, 1994; Mays, 1998; Walker & Miller, 2005). The remains from the *bustum*, Urn 3 and Urn 5 display a wider array of colours ranging from brown to white which are indicative of combustion heterogeneity at the funerary pyre.

All ESA cremations display heat-induced fractures. From these, *thumbnail* fractures were present in all cremations. These are pointed out on the literature as being exclusive to the cremation of fresh bones or in-flesh bones (Binford, 1963; Buikstra & Swegle, 1989). Additionally, heat-induced warping was also found in some of the ESA burials. This is also indicated by some authors to be absent from dry bone cremations (Baby, 1954; Binford, 1963; Etxeberria, 1994) although others have contested this conclusion (Buikstra & Swegle, 1989; Spenneman & Colley, 1989; Whyte, 2001). Even for the thumbnail fractures, experimental work has been rare and carried out by using very small samples, so results should be regarded with caution.

Shrinkage is suspected to be present in a number of bones but this heat-induced change is only possible to be detected with confidence if both antimeres are found. Nevertheless, previous research demonstrated that shrinkage is present in most burned bone although its impact ranges from 0-2% for non-calcined bones and 0-30% for calcined bones (Bradtmiller & Buikstra, 1984; Shipman, Foster & Schoeninger, 1984; Holland, 1989; Gruppe & Hummel, 1991).

Fragmentation of the ESA skeletal remains is severe and was quantified following the procedure carried out by Duday et al. (2000) consisting on the division of the total weight of cremation by amount of fragments (Table 2). The fragmentation rate is the product of all pre- and post-depositional destructive factors such as combustion, pyre recollection, burial, post-depositional taphonomy, archaeological excavation, transport and laboratorial analysis. Urn 5 and the *bustum* have the lowest fragmentation rates which are suggestive of worse preserved contexts. Table 2 displays the percentage of successful anatomical bone identification according to bone weight. The best results were obtained for Urn 4.

Table 2 - Number, weight, rate of fragmentation and rate of anatomical identification according to the weight of bone fragments.

	Number of fragments	Weight of fragments (g)	Fragmentation	Anatomical ID
bustum	3323	529.85	0.16	41.4%
Urn 1	12	2.97	-	-
Urn 3	1763	838.88	0.48	29.5%
Urn 4	2065	1427,62	0.69	65.5%
Urn 5	3636	525.02	0.14	37.5%

4.2. Osteobiographic Data

The burials from ESA include a minimum number of six individuals. All burials contain the remains of a single individual with the exception of Urn 4 which includes bones from two different skeletons. Two C-2 vertebrae were present in this assemblage (Fig. 5). Table 3 gives information about age-at-death, sex determination and paleopathological features found in the collection.

The remains of four individuals indicate they belonged to adults. For the remaining two, age-at-death could not be determined. The Urn 4 cremation includes at least one middle adult ranging from 28 to 50 years-old according to skeletal biological development and degeneration (Fig. 6). A more precise age-at-death estimation was not achieved for the remaining three adults present at the Urn 3, Urn 5 and at the *bustum*. Sex determination was only accomplished for the skeletal remains from Urn 4 which belonged to a female according to both pelvic traits and osteometric features. The greater schiatic notch has a female configuration (Figure 7). The vertical diameter of the humeral head measures 36.3 mm and the transverse and vertical diameters of the femoral head measure 36.4 mm and 36.6 mm respectively. These figures are consistent with female dimensions on unburned skeletons (Wasterlain & Cunha, 2000). However, these references must be considered with caution due to heat-induced shrinkage. Gonçalves (*submitted*) compared the mean values obtained by Wasterlain & Cunha (2000) with analogous values for present-day burned skeletons and found statistically significant differences for the three abovementioned standard measurements. All of these presented lower mean dimensions due to heat-induced shrinkage. Nonetheless, the Urn 4 results are considerably lower than the mean dimensions obtained for burned bones by Gonçalves (*submitted*). Although the comparison of a modern with an archaeological population is not straightforward, our data strongly suggests that the Urn 4 burial belonged to a female.

As for paleopathology, the remains from Urn 4 displayed a grade 2 tooth cavity on an upper left first pre-molar (Lukacs, 1989) located at the cervical distal inter-proximal surface (Moore & Corbett, 1978). In addition, laminar spurs of grades 2 to 3 were present in a thoracic vertebra (Crubézy, 1988).

Table 3 - Osteobiographic results from the skeletal analysis of the burials of Encosta de Sant'Ana.

	MNI	Age-at-death	Method/Age	Sex	Method/Sex	Pathology
Bustum	1	adult	Vertebral rings development (Albert and Maples, 1995)	unknown	-	none
Urn 1	1?	unknown	-	unknown	-	none
Urn 3	1	adult	Vertebral rings development (Albert and Maples, 1995)	unknown	-	none
Urn 4	2	1 middle adult + 1 unknown	Fused sternal end of the clavicle (Maclaughlin, 1990) + Pubic symphisis (Suchey and Brooks, 1990) + Vertebral laminar spurs (Crubézy, 1988)	1 Female + unknown	Greater schiatic notch and pre-auricular sulcus (Buikstra and Ubelaker, 1994) + Osteometry for humerus and femur (Gonçalves, submitted)	Tooth cavity (Lukacs, 1988) + vertebral laminar spurs (Moore and Corbett, 1978)
Urn 5	1	adult	Fused humeral distal end (Scheuer and Black, 2000) + Vertebral rings development (Albert and Maples, 1995)	unknown	-	none

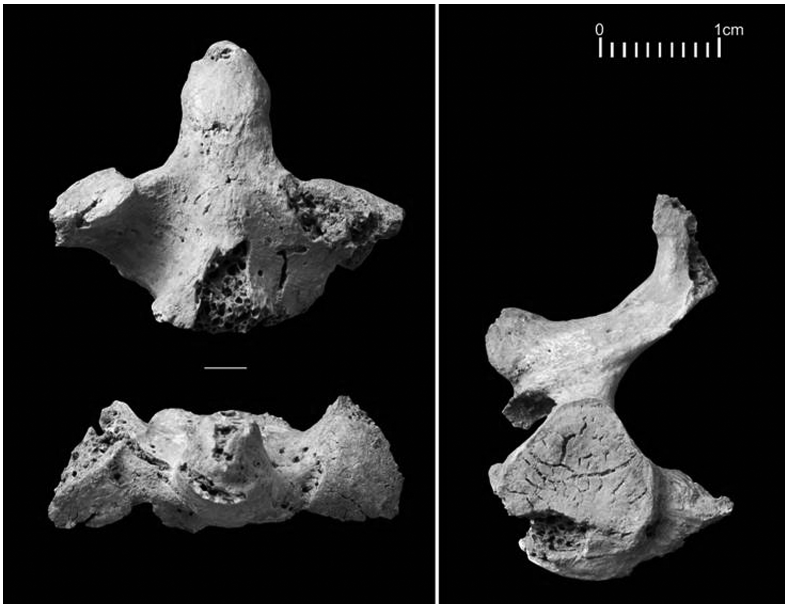

Fig. 5 - Two C-2 vertebrae found on the Urn 4 urned cremation.

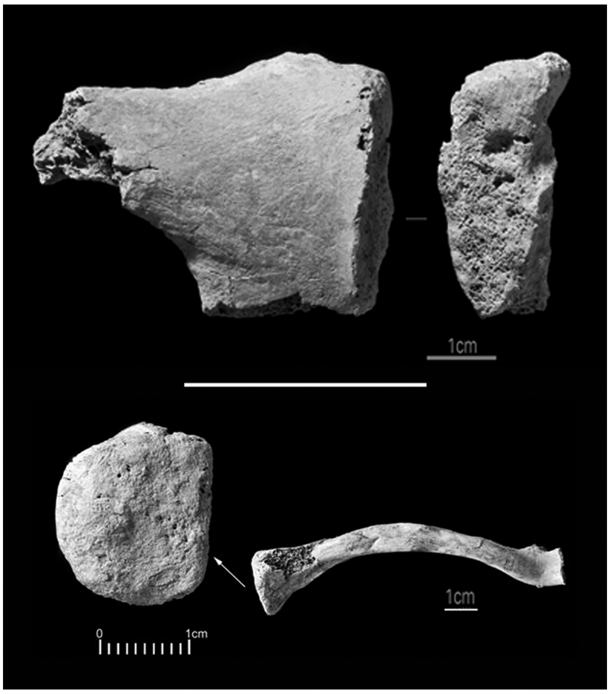

Fig. 6 - At the top, the pubic symphysis from the adult individual from the Urn 4 burial; at the bottom, a clavicle with a fully matured sternal end from the same individual.

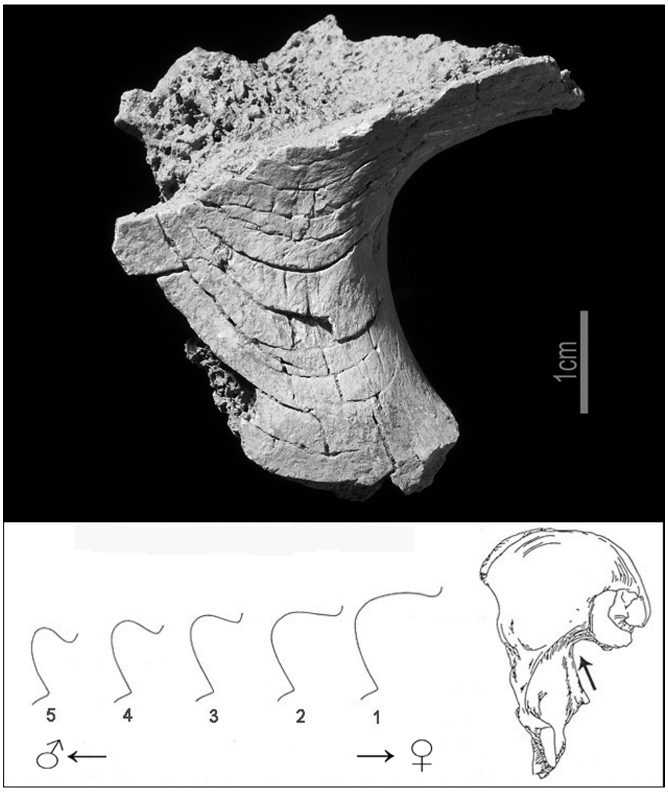

Fig. 7 - A greater schiatic notch from the pelvic bone of the adult individual from the Urn 4 burial.

4.3. Data from Contemporary Cremations

The proportion in percentage of each skeletal region– cranium, trunk, upper limbs and lower limbs – is presented on Table 4. It demonstrates a gradual increase to the proportion of every skeletal region which accompanies the increase of the identification rate. The One-Way ANOVA testing of all skeletal regions confirmed that there is a statistically significant difference between the three interval groups regarding the percentage of anatomically identified bone weight.

Table 4 - Descriptive statistics of the rating intervals for the proportion of anatomically identified bone fragments according to weight and inferential statistics (One-Way ANOVA) regarding the difference between those intervals.

	Proportion of Anatomically Identified Bones	N	Mean	SD	95% Confidence Intervals		Skewness	One-Way ANOVA
					Lower Bound	Upper Bound		
Cranium	<35%	26	11.1%	3.1	9.8%	12.4%	.369	F = 4.372 p = .016
	35-49.9%	47	13.0%	3.0	12.1%	13.9%	.461	
	>50%	13	13.6%	2.7	12.0%	15.3%	-.034	
Trunk	<35%	26	5.1%	1.8	4.3%	5.8%	.096	F = 10.802 p = .000
	35-49.9%	47	6.1%	1.8	5.6%	6.6%	-.097	
	>50%	13	8.1%	2.2	6.7%	9.4%	.656	
Upper Limbs	<35%	26	3.7%	1.2	3.3%	4.2%	.499	F = 51.934 p = .000
	35-49.9%	47	5.6%	1.6	5.1%	6.1%	.017	
	>50%	13	8.9%	1.6	7.9%	9.8%	.177	
Lower Limbs	<35%	26	11.4%	2.6	10.3%	12.4%	-.345	F = 59.932 p = .000
	35-49.9%	47	17.3%	3.9	16.1%	18.4%	-.071	
	>50%	13	24.1%	3.6	21.9%	26.3%	.314	

4.4. Characteristics of the Sediment Filling the Urns

The deposits found inside the urns from ESA showed similarities among them, even if their overall arrangement varied. Only one urn showed a homogeneous deposit (Urn 4), while the other ones featured stratified deposits, with two (Urn 1 and Urn 5) or three layers (Urn 3).

The urns with stratified infilling (Urn 1, Urn 3 and Urn 5) contained, in their upper part, sediments with characteristics (sandy-silty grain size with rare small limestone fragments, olive brown to light olive brown colour, post-depositional features such as carbonate accumulations) similar to the local slope deposits, which are fed by the Miocene bedrock (*Areolas da Estefânia* Formation – Almeida, 1986). These upper layers may derive from sediment that was transported along the slope and washed into the open urns, or from their intentional packing. The second scenario seems more plausible due to the systematic presence of anthropic inputs as charcoal fragments or lumps of thermally-altered sediment.

The lower layers found in the urns Urn 1 and Urn 5 were formed by dark organic sandy-silt without limestone fragments and included ash, small charcoal fragments and lumps of thermally-altered sediments. The components indicate that these units derived from the cleaning of incineration features.

The case of Urn 3 is more complex. Below the top layer, described above, two other strata were found. The intermediate one is essentially formed by two distinct fractions (ash and thermally-altered fragments of bedrock) and was probably derived from the cleaning of the bottom of an incineration feature. The lower layer was rich in ash and showed the same features as the bottom part of Urn 1 and Urn 5.

The filling of Urn 4 was similar to the top layers found in both Urn 1 and Urn 3 and included charcoal fragments and cremated bones but no ash. This may indicate the partial cleaning of bones before their accumulation inside the urn.

5. The Bioarchaeological Interpretation of the Cremation Practice

5.1. The Pyre

The ESA pyre cremations were all single although the C-2 vertebrae of two individuals were present at Urn 4. However, this was the only repeated bone and was probably the result of unintentional intermingling of two individuals cremated at the same *ustrinum*. Most probably, the bones of one of the individuals were not completely recollected after the pyre was extinguished and some of its remains were accidentally included on the cremation that followed.

The cremated individuals were all adults. Although the presence of heat-induced thumbnail fractures and warping is not an unequivocal evidence of in-flesh burning, this and the approximately anatomical connection of the *bustum* individual both point to the cremation of the deceased not long after death. This is consistent with known descriptions of the Roman funerary practices (Toynbee, 1971).

Although, for some cases, the corpses were not left on the pyre without associated offerings, since melted glass was found on the *bustum* and the Urn 3 burials, we have no evidence that animal offerings or sacrifices were made. Apparently, only artefacts were added to the cremation which was sufficiently intense to cause the calcination of the most part of the skeleton in every burial. Temperatures above 645ºC (Shipman, Foster & Schoeninger, 1984; Etxeberria, 1994; Mays, 1998; Walker & Miller, 2005) are needed for bones to attain this condition and the presence of melted glass corroborates this assumption. Although glass usually melts at temperatures hardly achieved in a cremation pyre, glass composed by other elements such as lead can melt at lower temperatures such as 600-700 ºC (McClure *& alii*., 2006) and this can be the case for the ESA burials. The coin present on the Urn 3 burial may be related to the funerary custom of placing a coin in the deceased mouth. This was to be used to pay for the services of Boatman Charon regarding the crossing of the river Styx separating Earth from the Underworld (Toynbee, 1971).

5.2. The Bone Recovery from the Pyre

The ESA burials include one primary deposition but all of the others are urned secondary depositions. For all of them, the skeletal weights were below the average results obtained for modern crematoria. McKinley (1993) recorded an average weight of 1752.6 g for 15 cremations after exclusion of less than 2 mm fragments. Warren and Maples (1997) documented an average weight of 2430 g using a larger sample of 91 adults and including all bone fragments. Although expected for the secondary urned burials, the low weight of the remains in the primary cremation is somewhat unanticipated. Richier (2005) reported the presence of two *busta* allegedly submitted to partial skeletal recovery probably with the purpose of burying these remains in secondary graves. This was detected on the Sainte-Barbe Roman necropolis (Marseille, France) from the 1st and 2nd centuries AD. Both *busta* had unburned funerary artefacts evidencing their funerary character leading the researchers to interpret these contexts as possible cases of double burial. An attempt to achieve bone reconstruction using fragments found in both primary and secondary burials was nevertheless unsuccessful. A similar interpretation could be used for the ESA *bustum* and explain its low skeletal weight. However, a hypothetical secondary burial regarding these remains was not detected at the excavated site.

The Urn 1 burial had a very small amount of bones. This could be the result of the damage at the bottom of the vessel permitting the loss of the remains that were eventually present in it. However, an insignificant amount of burned bones was found on the grave where the urn was placed so it thus seems that the remains were already scarce to start with. Crubézy *& alii* (2000) mention the *pars pro toto* practice which refers to the insignificant recovery of bones from the *ustrinum*, being then deposited in the urn as representation of the entire skeleton. This practice may apply to the scenario found at Urn 1 but not to the one found at Urn 2 where no burned bones at all were found. Only combusted organic matter was present, probably constituting cremation residues set aside from human remains for some undetermined reason.

The incompletion of the ESA urned remains is most probably related with little meticulous bone recovery from the pyre, although Urn 4 constitutes an exception to this rule. In addition, post-depositional preservation may also be responsible for the low skeletal weights present at the burials, although the high resilience of burned bones to dissolution is well known especially on alkaline contexts (Gordon & Buikstra, 1981; Henderson, 1987 Mays, 1998). This is the case for the ESA urned burials for which we obtained pH measurements ranging from 8.5 to 9.3.

5.3. The Selection of the Skeletal Regions

Some researchers have attempted to detect specific patterns of bone recovery from the pyre by calculating the weight proportions of the cranium, the trunk, the upper limbs and the lower limbs present in a given urned cremation (Duday, Depierre & Janin 2000; Richier, 2005). The principle behind this procedure is that any unusual proportion of these skeletal regions may be the result of selective recovery. There are some pitfalls with this approach.

The first obstacle is that the references we presently have for skeletal weights were taken from samples of unburned skeletons (Lowrance & Latimer, 1957 In Krogman & Işcan, 1986; Silva, Crubézy & Cunha, 2009) and we do not know if these are suited for burned skeletons as well. Silva, Crubézy & Cunha (2009) estimated that the cranium weight represents 20% of the skeleton, the trunk and the upper limbs both stand for 17% and the lower limbs correspond to 46%. If the cremation process does not alter these proportions, then similar percentages are to be expected when the anatomical identification of the bone fragments of a given skeleton is almost complete. However, we do not know if the same rule applies to burned skeletons where anatomical identification is inevitably deficient.

A second obstacle is related to the severe fragmentation affecting burned bones which complicates anatomical identification. For instance, the percentage of anatomically identified bone fragments on the Urn 3 burial represented only 29.5% of the total weight of the burned bones. With such a small amount of identified material, the proportion of the skeletal regions is certainly biased and unreliable because the percentage of unidentified fragments is too large for it not to be considered. Richier (2005) attempted to tackle this problem by suggesting a re-distribution of the fraction of undetermined bone fragments to each skeletal region. She therefore allocated half of the undetermined long bones fragments to the upper limbs and the other half to the lower limbs. Half of the remaining undetermined bone fragments were then allocated to the cranium, while a quarter was allocated to the trunk and another quarter to the lower limbs. However, this procedure was purely theoretical and no experimental data are available to validate it. An alternative approach followed by Duday, Depierre & Janin (2000) regards the relative weight of each skeletal region in relation to the total weight of burned bones. This approach seems to be more reliable although, as mentioned before, we still do not know if the current references from unburned skeletons can be applied to burned remains.

The comparison of the weight proportions for each skeletal region from the sample of contemporary cremated individuals with the results on unburned skeletons from Silva, Crubézy & Cunha (2009) demonstrates a considerable difference between the expected and the obtained values. The cranial proportion obtained for the burned sample represents only 63% of the cranial representation obtained from the unburned sample. Therefore, a significant amount of cranial fragments were not determined as such on the burned skeletons sample. The same analysis provided even worse results for the remaining skeletal regions (Table 5).

The results indicate that there are differences regarding anatomical identification between each skeletal region. The cranium is much easily determined than the remaining skeletal regions. For the latter, bone weights represented on average only one third of the expected proportion following the estimated values by Silva, Crubézy & Cunha (2009). This implies that any estimation of the proportion of the skeletal regions relative to the fraction of the anatomically identified bone fragments, while disregarding the undetermined bones fraction, will end up on the biased inflation of the cranial proportion with prejudice to the other skeletal regions. This procedure can lead to misleading interpretations of cremation burials, with a supposition for preferential selective recovery of cranial fragments. Therefore, the analysis of the proportion of the skeletal regions relative to the total skeletal weight is more reliable and thus more informative.

Table 5 - Results for the expected proportion of each skeletal region following Silva et al. (2009) and the actual mean proportion of each skeletal region found on modern cremations. The representation of each skeletal region from modern cremations in comparison to the expected proportions is also presented.

	Expected Proportions (Silva et al., 2009)	Obtained Proportions (Modern Crematorium)	% of the Expected Proportion
Cranium	20%	12.5%	12.5/20*100 = 62.5
Trunk	17%	6.1%	6.1/17*100 = 35.9
Upper Limbs	17%	5.5%	5.5/17*100 = 32.4
Lower Limbs	46%	16.5%	16.5/46*100 = 35.9

The research carried out on a modern crematorium also allowed for the discrimination of the results as a function of the rate of successful anatomical identification (Table 4). The results demonstrate that the increase of the identification rate is followed by an increase of the skeletal regions mean proportions. The skeletal regions proportions obtained from archaeological urned cremations should therefore be compared with the preliminary reference values from table 4 according to their rate of anatomical identification. Although preliminary, this table is more suitable than other references obtained on unburned skeletal samples (Lowrance & Latimer, 1957 In Krogman & Işcan, 1986; Silva, Crubézy & Cunha, 2009).

The cranium was the fraction with less statistically significant difference between the mean values of the three groups (results for the One-Way ANOVA can be conferred on table 4). This reinforces our previous claim that cranial fragments are easier to identify and that fragmentation does not interfere with its anatomical identification as much as with other skeletal parts. As a result, the interpretation of the pattern of bone recovery from the pyre is probably more reliable for the cranium than for the other skeletal regions.

The recovery of the burned remains from the pyre was done randomly. The comparison of the ESA urned cremations with the results obtained from the modern crematorium demonstrates no clear preferential recovery of specific skeletal regions from the pyre (Table 6). The proportions for the skeletal regions allocated inside the urns are well inside or at least near the 95% confidence intervals. Although the Urn 4 burial displays slightly larger proportions for the trunk and the lower limbs than the averages estimated from the sample of contemporary cremated individuals, this could be an artefact produced by some decisions regarding the statistical analysis. The third group includes all individuals with rates of successful anatomical identification larger than 50%. The small number of cases with an anatomical identification rate above 60% did not allow us to form an additional group with sufficient analytical data. Only the remains from three of the 86 individuals presented bone identification rates above 60%. This sample is too small to allow for significant inferences but we can confirm that these three cases presented always larger proportions for all skeletal regions than the 50-65% group. Such results are very similar to those found for Urn 4 which presented a rate of anatomically identified bone fragments of 65%. The enlargement of the sample may eventually allow for a more thorough group configuration in the future. In any case, the analysis based on the reference frame obtained from modern crematorium data indicates that the bone recovery from the pyre was carried out randomly with no preferential selection of a specific skeletal region.

Table 6 - Weight proportions of the skull, the trunk, the upper limbs, the lower limbs and the undetermined bone fraction.

	bustum		Urn 3		Urn 4		Urn 5	
	g	%	g	%	g	%	g	%
Cranium	62.73	11.8	96.27	11.5	219.66	15.4	68.01	13.0
Trunk	18.65	3.5	32.53	3.9	175.32	12.3	28.81	5.5
Upper Limbs	22.04	4.2	15.41	1.8	110.78	7.8	29.85	5.7
Lower Limbs	115.99	21.9	103.48	12.3	429.00	30.1	70.49	13.4
Undetermined	310.40	58.6	591.19	70.5	492.86	34.5	327.86	62.5
Total	529.81		838.88		1427.62		525.02	

5.4. The Burial

ESA displays examples of both primary and secondary urned cremation burials. The primary cremation may have been subject to partial recovery of the human remains, but the funerary assemblage composed by unburned artefacts and animal remains demonstrates that this interment probably was a legitimate grave. This suggests that the remains of the individual from the *bustum* may have been paced in two different locations. This was found for the Roman necropolis of Sainte-Barbe by Richier (2005).

A study was completed for the ESA burials following Duday, Depierre & Janin (2000), who in the past examined the weight distribution of bones in urned burials according to artificial levels of excavation. The main objective of such analysis is to detect if non-random behaviour was adopted during the recollection of bones from the pyre and respective deposition on the vessel. For the ESA case, the organization of each skeletal region inside the urns is random. Therefore, there is no evidence of any specific logic presiding to the deposition of bones into the vessels. With the same aim, 3D coordination was carried out for the Urn 5 urn but although upper limbs seem to be circumscribed to one of the hemispheres, the accommodation of the skeleton inside the urn was apparently done with no deliberate purpose and thus confirms the interpretation of the artificial levels' examination (Fig. 8).

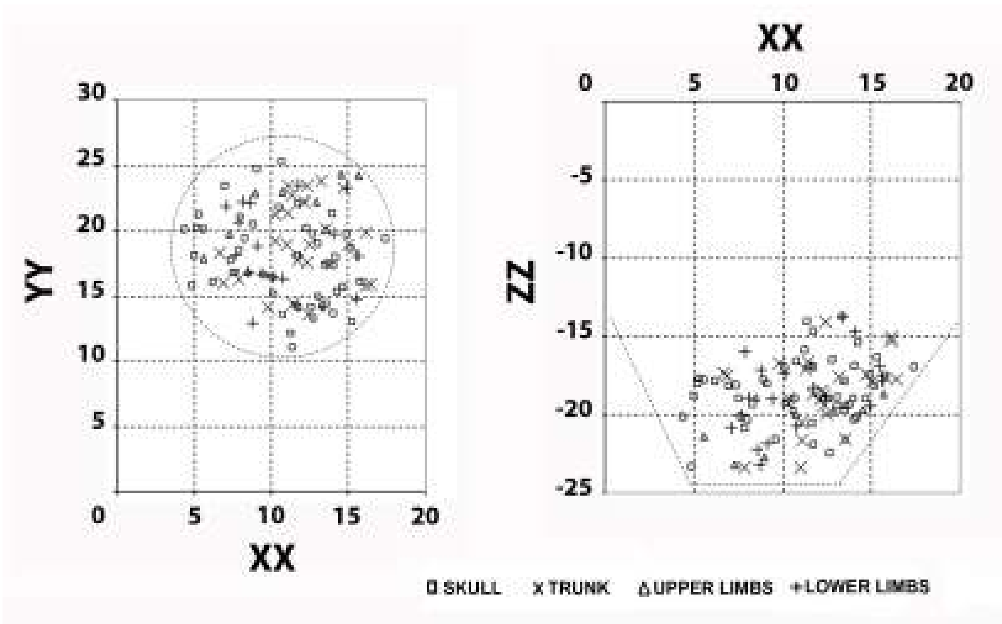

Fig. 8: Spatial dispersion of the bones from the Urn 5 burial according to skeletal region.

The sediment analysis suggests that cleaning of the bones previous to their burial may have occurred for the Urn 4 burial but was not carried out for the remaining urned cremations. This cleansing may have been the indirect result from the libation custom of pouring wine over the remains (Toynbee, 1971).

In most cases, the bone fragments were deposited inside the urn along with some of the residues produced by the cremation. However, the vessels were not completely filled with the remains and the skeleton was only partially represented. There was no concern regarding the complete burial of all bones which suggests that this procedure was not mandatory. The most remarkable example of this assumption is observed in the Urn 1 burial which contained only a few bones and may represent an example of the *pars pro toto* practice.

The presence of artefacts and animal offerings inside the urned cremations was detected for Urn 3 and Urn 4. The first of these included an undetermined bone fragment of pig or sheep. Toynbee (1971) states that a Roman grave would only be considered as such after the sacrifice of a pig, which could explain the animal bone fragment in Urn 3. In addition, remains of *Equus asinus* were associated to the burials. These fauna were part of the funerary ritual, even if not directly related to the cremation itself. The inclusion of animals in funerary rituals has been recurrently identified in the Roman world, but is not well known in Portugal due, in part, to the late development of Cultural Zooarchaeology.

6. Final Comments

If any pattern can be inferred from the small number of the ESA cremation burials is that diversity seems to be the rule for Roman mortuary behaviour. Despite all individuals were adult and cremated singly, other aspects of the funerary practice present some variability. Among these are the optional association of artefacts to the pyre cremation, the variation concerning the bone recovery from the pyre, the artefacts and animal offerings composing the grave assemblage and the type of burial. The reasons for these variations were not determined but among others may be related to age, sex, socio-economical status, specific religious beliefs or random events.

The ESA burials are only a few and do not allow for a broad perspective of the Roman cremation practice in the Portuguese territory. However, the information extracted from these materials must not be neglected and may eventually contribute for a more detailed knowledge of Roman funerary practices, especially if included in larger assemblages with similar chronology. For that purpose, methodologies must be relatively standardized to allow for comparative analysis. Although the adopted paleobiological methods tend to be fairly similar from one biological anthropologist to another, the excavation and analytical approach regarding the reconstruction of past funerary behaviour is not as standard. This renders any comparative analysis difficult to achieve. The standardization of the methodology depends on the availability of references suited to the analysis of burned bones. That is the case for the proportion of each skeletal region in order to make inferences about the patterns of bone recovery from the pyre. A preliminary reference frame regarding this issue was presented here, with consideration of the extreme fragmentation affecting burned bones. Expectantly, its further refinement will permit better interpretations of urned cremation burials.

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