The Roman cremation burials of Encosta de Sant'Ana (Lisbon)

DAVID GONÇALVES[1,2]
CIDÁLIA DUARTE[2]
CLÁUDIA COSTA[3]
JOÃO MURALHA[2]
VANESSA CAMPANACHO[1]
ANA MARIA COSTA[4]
DIEGO E. ANGELUCCI[5]

ABSTRACT Excavations of a Roman cemetery at Encosta de Sant'Ana in Lisbon uncovered a small number of cremation burials. Information about cremation practices during this particular period comes mostly from the writings of classical authors such as Pliny or Cicero. Opportunities to confirm their descriptions in Portugal 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 the material culture itself. A bioarchaeological approach was adopted in order to infer the funerary behaviour of the inhabitants of *Olisipo*, Roman Lisbon, through their burned skeletal remains. In addition, a new frame of reference was developed to assist in 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 enriquecer esses conhecimentos a partir dos achados aí encontrados e que incluem artefactos e restos osteológicos humanos e faunísticos. Adoptou-se uma abordagem bio-arqueológica 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.

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 subjected to two archaeological campaigns: the first in 2002 and the second in 2004/2005. The 2002 campaign was directed by two of us (JM and CC, of the Archaeological Service of the City Museum; Municipality of Lisbon). Our excavation aimed to minimize the impact caused by construction works (Muralha, Costa & Calado, 2002; Muralha & Costa, 2004).

The excavation revealed an occupation ranging from the 5th millennium cal BC (Muralha & Costa, 2006) 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 to the 1st century AD with a set of secondary cremation structures and two half destroyed inhumation structures from the Late Roman Period. Part of a north-south oriented pathway was also detected. This cemetery is the enlargement of the main cemetery of *Olisipo*, 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 of an *ustrinum*, five urns of common pottery or made out of amphorae and a *bustum*. The first structure comprises the remains of the pyre used for the cremation of the deceased (González Villaescusa, 2001) while the remaining structures are burials. The urns are secondary depositions while the *bustum* is a primary burial at the place where the cremation pyre had been built and ignited (González Villaescusa, 2001). The *bustum* was used repeatedly as an *ustrinum* and then as a *bustum* during its final use (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).

Besides the ESA structure (Angelucci, 2008), there are few published records of Roman cremation pyres in Portugal. 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 to the second half of the 1st century AD/

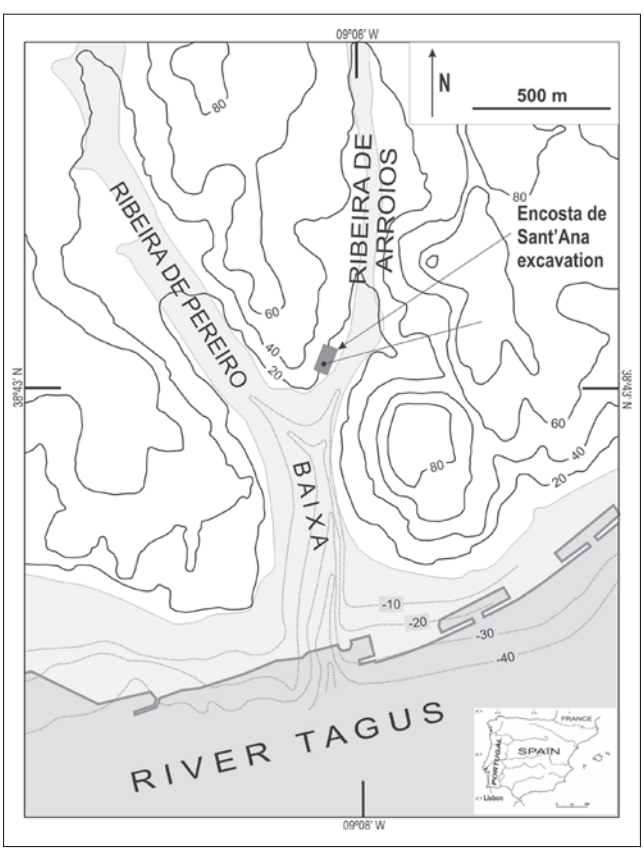

Fig. 1 Location and topography of present-day central Lisbon. Contour line intervals are 20 m; the shaded area represents the extension of Quaternary sediments; dotted lines correspond to the depth of the boundary between quaternary sediments and pre-quaternary (Miocene) bedrock (after Angelucci, 2008,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

early part of the 2nd century (Almeida, 1984). Another *bustum* was detected by Corga & *alii* (2007) at Monte da Vinha 2, S. Manços (Évora). A sub-rectangular opening with charcoal residues and an assemblage composed of pottery and glass artefacts was found on this site. In contrast, Roman sites with cremation urns are common in Portugal and their distribution extends throughout much of Portugal (Almeida, 1984; Frade & Caetano, 1993; Encarnação & Fernandes, 1997).

Although cremation burials were relatively common during the Roman occupation of present day Portugal, little has been written about the bioarchaeology of the burned human bones present in 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 in the museums where they were stored. Many of these sites were excavated some time ago before archaeological methods were systematic and intensive recovery or detailed recording were practised as they are 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 them. The general absence of these kinds of human remains in our museums suggests that most of the bones from cremation burials were probably never even brought to museum stores. Instead, they were probably abandoned near the excavation sites.

The ESA funerary assemblage provides an opportunity to approach Roman funerary behaviour through the analysis of the cremation practice. Besides the descriptions of the Roman classical authors like Pliny and Cicero, our knowledge of Roman funerary practices in the Western part of the Iberian Peninsula results essentially from the analysis of inhumation burials. The results obtained from the bioarchaeological analysis of the burned human remains recovered at ESA, therefore constitutes an additional contribution to our understanding of Roman funerary practices.

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 destroyed *ustrinum* and cremation urns Urn 1, Urn 2, Urn 3 and Urn 4 — were built directly into the local bedrock composed of Miocene marls at Sector A (Table 1).

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 it is partially destroyed. Only one of these contained some human bones, but these lacked 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 during 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 artefacts included ceramics, a glass *unguentarium* Isings 8), thin-walled pottery (Mayet XXXIV), a lamp (Bailey's III), a plate of south Gaulish Samian ware (Drag. 18) and a ceramic 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 of the remains of *Equus asinus* (ass) was found next to the *bustum* (Costa, Duarte & Muralha, 2006).

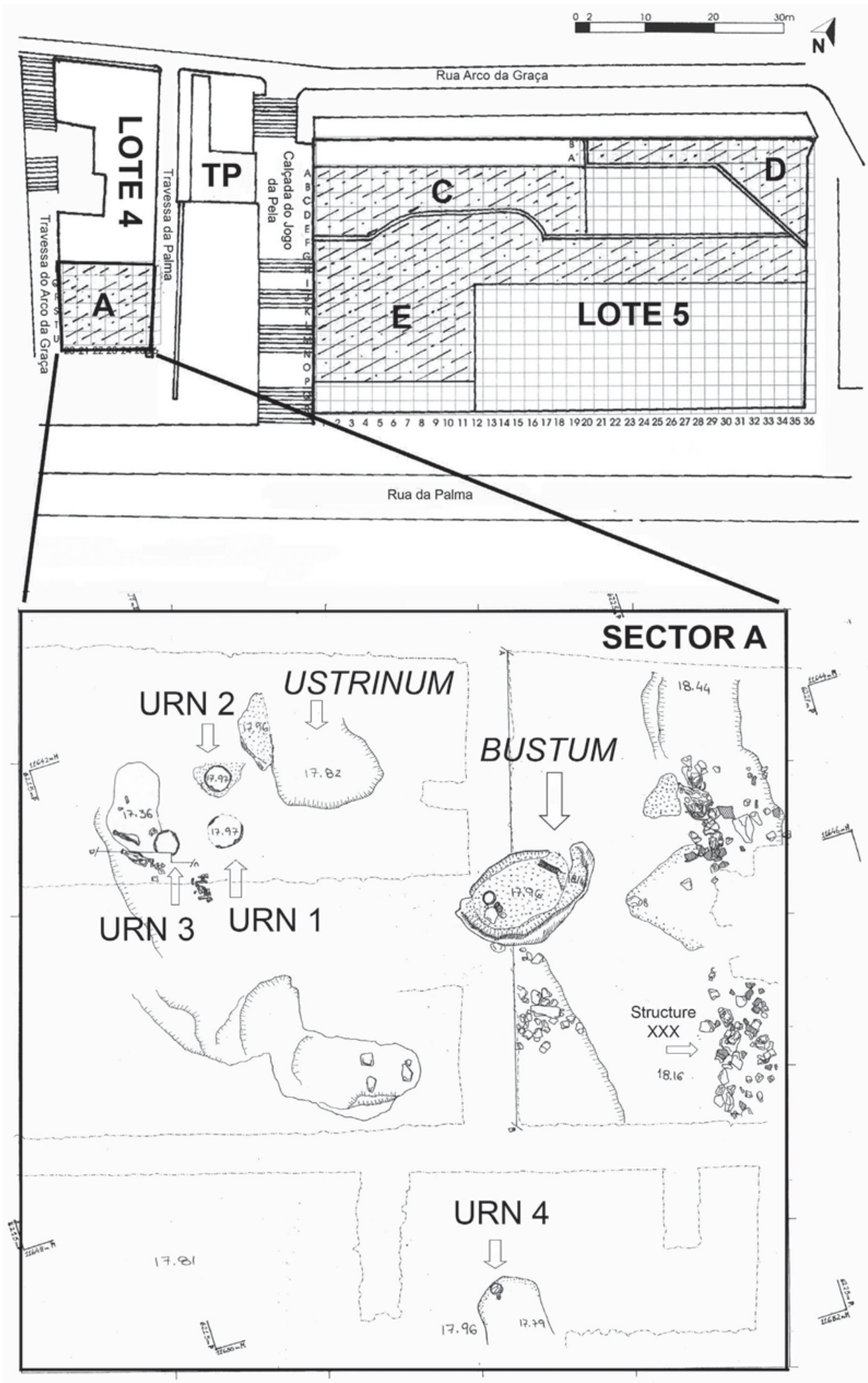

Fig. 2 Plan of the Encosta de Sant'Ana excavation area.

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 of 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 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 within 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 as well as a pig or sheep bone (identification by Marta Moreno García). An unburned mandible of *Equus asinus* was present in the grave associated with the urn. Urn 4 was buried 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.

As already mentioned, 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 less than one meter north of the *bustum*'s position and comprised a 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, making a total of 33 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 sector A in the pit where Urn 3 was deposited, and it comprises 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).

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

Methods

The excavation of the cremation burials

The urns were removed intact from the site and excavated subsequently in the laboratory. A CT-scan[6] for Urn 1 and a gamma-ray scan for Urn 2 were performed in order to see if their contents included bones and artefacts following the procedure recommended by Anderson & Fell (1995). The remaining urns were not submitted to radiological inspection because they had already been excavated when the procedure was added to the protocol of analysis. The scan of Urn 1 revealed fragments of ceramics which had broken from the urn itself and what appeared to be bone fragments (Fig. 4). This was confirmed afterwards by the excavation. Unlike that of Urn 1, the scan of Urn 2 established that it had no osteological remains.

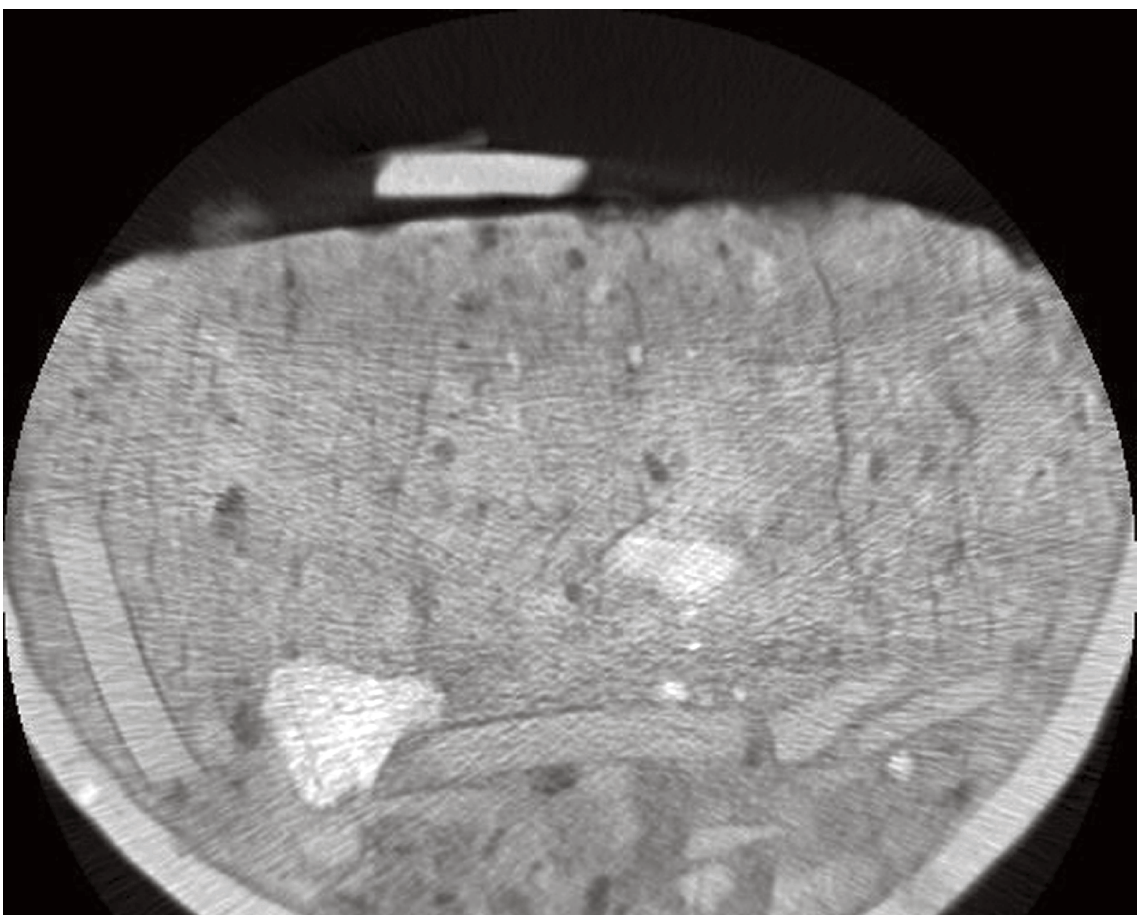

Fig. 4 CT-scan of the Urn 1 cremation.

The excavation of the various bone-containing cremation burials was accomplished by different researchers, rendering the technique somewhat heterogeneous. The *bustum* was excavated using 2 cm artificial levels while scrutinizing natural layers. Materials were 3D-plotted. The urns were excavated in the laboratory using a similar method, although in some cases 5 cm levels were adopted. Urns 1 and 5 were carefully and permanently attached to stable pedestals in the laboratory in order to facilitate 3D plotting measurements of exhumed materials. This procedure was not followed for Urns 3 and 4. Sediments removed from the urns were sieved with a 2 mm mesh and demineralised water in order to retrieve all bone fragments. After drying, the anatomical identification of the bone fragments was determined. Then, these were counted and were weighed using a Kern EW3000-2M scale (3000 x 0,01 g). Bones were measured with a NTD12-12C Mitutoyo digital calliper. Finally, the infill of the urns was described using geoarchaeological criteria (Angelucci, 2003) in order to reconstruct the depositional sequence related to the burial (Leonardi, 1992).

The study of the human bones

Two sets of questions relate 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. Sex was determined via the morphological features of the pelvis (Buikstra & Ubelaker, 1994) and standard measurements of the humerus and femur (Gonçalves, *submitted*). Age-at--death was estimated via the fusion of the epiphyses (Scheuer & Black, 2000; Albert & Maples, 1995; MacLaughlin, 1989) along with the state of degeneration of the pubic symphysis (Suchey & Brooks, 1990). The palaeobiological profile also included the description of degenerative joint disease (Crubézy, 1988) and oral disease (Lukacs, 1989; Moore & Corbett, 1978).

The second set of questions relates to funerary behaviour. Heat-induced changes to the bone were examined to assess the cremation temperature. Along with the body position in the grave, these changes were also used to infer the condition of the cadaver prior to cremation. The post-cremation behaviour was then deduced from the patterns of bone recovery from the pyre and deposition of the remains inside the urn. In order to offer a frame of reference for the interpretation of the bone recovery patterns, we statistically analysed some preliminary data regarding human cremations collected at a modern crematorium undertaken as part of a PhD study in progress by one of the authors (DG). The remains of 86 individuals with an average age of 70 years (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%. For this procedure, the lowest identification rate was of 25% and the highest was of 65%. Data were statistically analysed using SPSS, version 14.0 (SPSS Inc., Chicago IL).

This bioarchaeological approach is especially useful for the analysis of cremations, because besides the usual palaeobiological information obtained via the methods used by conventional Biological Anthropology, it also allows the interpretation of human behaviour based on bone changes and burial specificities particular to burned human bones.

The analysis

The heat-induced changes to the bone

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 645 °C (Shipman, Foster & Schoeninger, 1984; Etxeberria, 1994; Mays, 1998; Walker & Miller, 2005). Remains from the *bustum*, Urn 3 and Urn 5 display a wider array of colours ranging from brown to white which indicates combustion heterogeneity at the funerary pyre.

All ESA cremations display heat-induced fractures. From these, *thumbnail* fractures were present in all cremations. These, according to the literature, are exclusive to the cremation of fresh bones or bones in-flesh (Binford, 1963; Buikstra & Swegle, 1989). Additionally, heat-induced warping was also found in some of the ESA burials. According to some authors, this is 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, there has been little experimental work done, with the exception of a few studies using very small samples, so results should be regarded with caution.

Shrinkage is suspected to have occurred in a number of bones but this heat-induced change can only be detected with confidence if bones from both sides of the same skeleton 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 of Duday & *alii* (2000) in which the total weight of the cremation is divided by the amount of fragments (Table 2). The fragmentation rate is the product of all pre- and post-depositional destructive factors such as combustion, pyre collection, burial, post-depositional changes, archaeological excavation, transport and laboratory analysis. Urn 5 and the *bustum* have the lowest fragmentation rates which are suggestive of very poorly 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%

Osteobiographic data

The burials from ESA include at least 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 palaeopathological 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-aged adult ranging from 28 to 50 years-old according to skeletal development and degeneration (Fig. 6). A more precise age-at-death estimation was not achieved for the remaining three adults present in Urn 3, Urn 5 and in the *bustum*. Sex determination was only accomplished for the skeletal remains from Urn 4 which belonged to a female — based upon both pelvic traits and osteometric features. The greater schiatic notch has a female configuration (Fig. 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 of 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 suggest that the Urn 4 burial belonged to a female.

As for palaeopathology, the remains from Urn 4 displays 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 used to determine age*	*Sex*	*Method used to determine sex*	*Pathology*
Bustum	1	adult	Vertebral rings development (Albert & Maples, 1995)	unknown	–	none
Urn 1	1?	unknown	–	unknown	–	none
Urn 3	1	adult	Vertebral rings development (Albert & Maples, 1995)	unknown	–	none
Urn 4	2	1 middle adult + 1 unknown	Fused sternal end of the clavicle (Maclaughlin, 1990) + pubic symphisis (Suchey & Brooks, 1990) + vertebral laminar spurs (Crubézy, 1988)	1 Female + unknown	Greater schiatic notch and pre-auricular sulcus (Buikstra & Ubelaker, 1994) + Osteometry of the humeral and femoral heads (Gonçalves, submitted)	Tooth cavity (Lukacs, 1988) + vertebral laminar spurs (Moore & Corbett, 1978)
Urn 5	1	adult	Fused humeral distal end (Scheuer & Black, 2000) + Vertebral rings development (Albert & Maples, 1995)	unknown	–	none

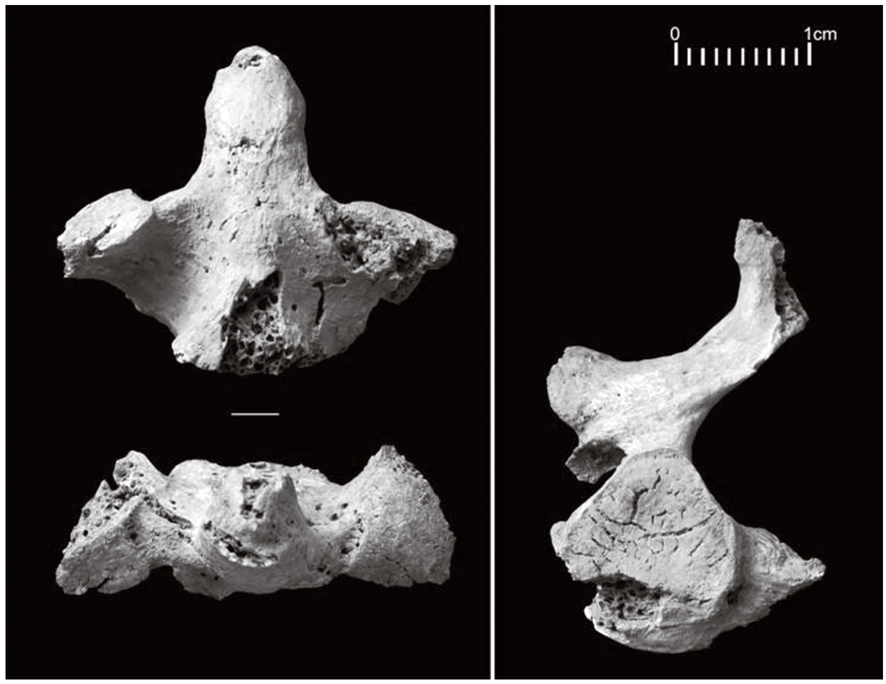

Fig. 5 Two C-2 vertebrae found on the Urn 4 urned cremation.

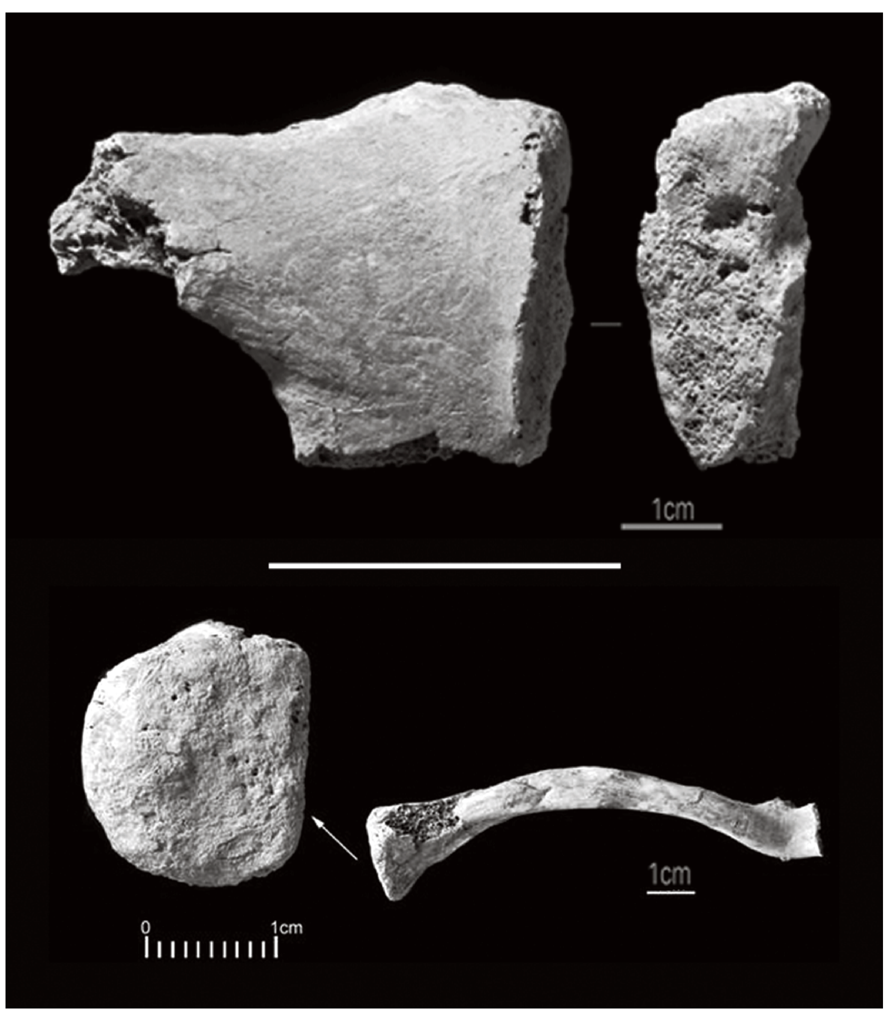

Fig. 6 At the top, the pubic symphysis from the adult individual from the Urn 4 burial; at the bottom, a clavicle with a fully matured sternal end from the same individual.

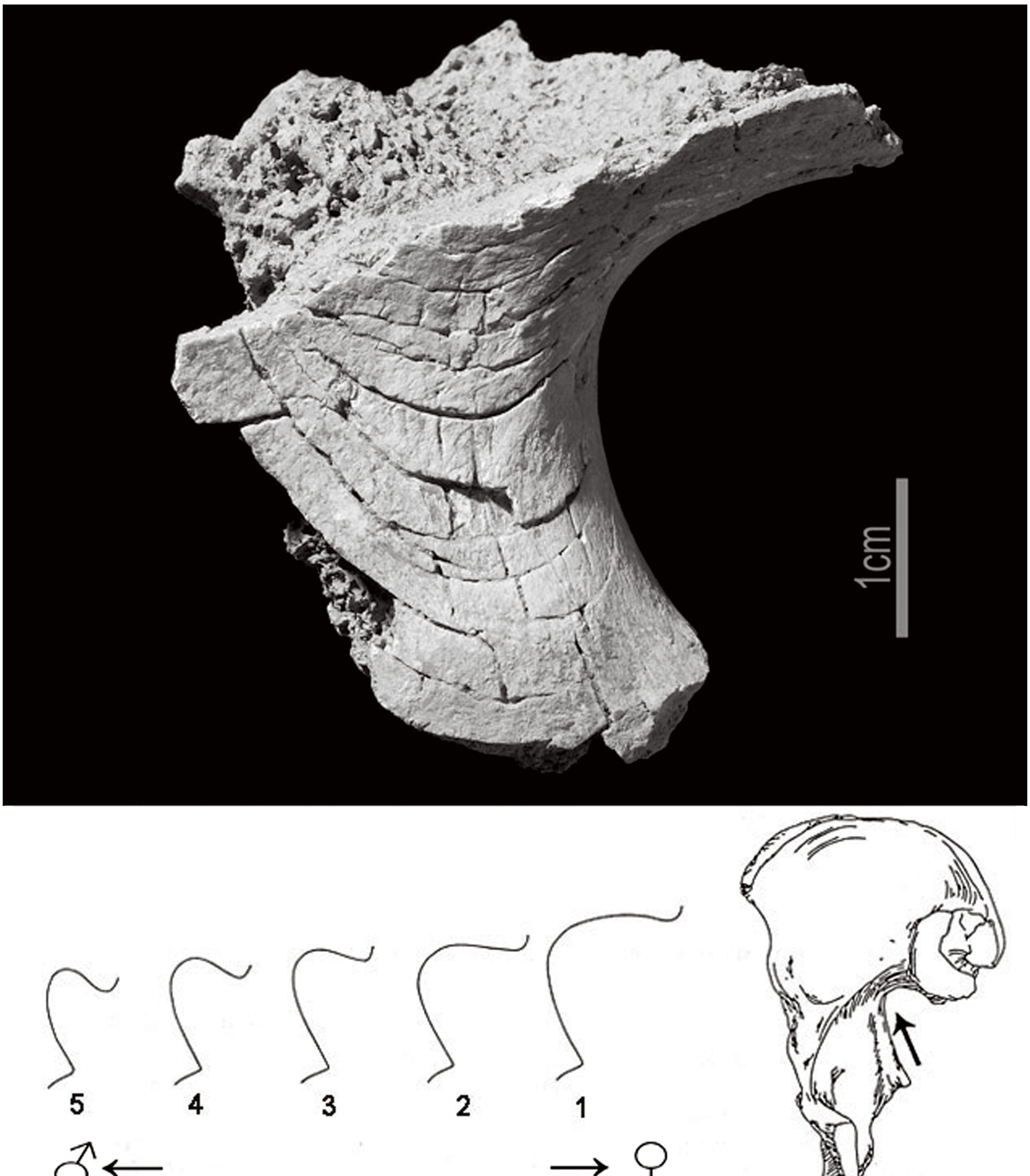

Fig. 7 A greater schiatic notch from the pelvic bone of the adult individual from the Urn 4 burial (adapted from Buikstra & Ubelaker, 1994).

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 limit	*Upper limit*		
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	

Characteristics of the sediment filling the urns

The deposits found inside the urns from ESA showed certain similarities, even if their overall arrangement varied. Only one urn contained 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 explanation seems more plausible due to the systematic presence of anthropic inputs such as charcoal fragments or lumps of thermally-altered sediment.

The lower layers found in Urns 1 and 5 were formed from 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 from 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.

The bioarchaeological interpretation of the funerary ritual

The pyre

Only one individual was present in each ESA cremation although the C-2 vertebrae of two individuals were present in Urn 4. However, this was the only repeated bone and was probably the result of unintentional intermingling of two individuals cremated in the same *ustrinum*. Most probably, the bones of one of the individuals were not completely collected after the pyre was extinguished and some of its remains were accidentally included with the cremation that followed.

All cremated individuals were 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 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 to indicate that animal offerings or sacrifices were made. Apparently, only artefacts were added to the cremation which was sufficiently intense to cause the calcination of most of the skeleton of each burial. Temperatures above 645 °C (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. Although glass usually melts at temperatures hardly achieved in a cremation pyre, glass composed of other elements such as lead can melt at lower temperatures such as 600–700 °C (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 mouth of the deceased. This was how the Boatman Charon was paid to cross the river Styx separating Earth from the Underworld (Toynbee, 1971).

The recovery of bone from the pyre

The ESA burials include one primary deposition but all the others are urned secondary depositions. In all cases 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 excluding fragments less than 2 mm. 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 two skeletons from *busta* which were allegedly only partly recovered 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 may explain its low skeletal weight. However, a hypothetical secondary burial for 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 originally present inside 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 what we observed in Urn 1 but not to the one found in 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 incompleteness of the ESA urned remains is most probably due to the lack of 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 in 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.

The selection of parts of the skeleton

Some researchers have attempted to detect specific patterns of bone recovery from the pyre by calculating the proportions by weight 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, *apud* Krogman & Işcan, 1986; Silva, Crubézy & Cunha, 2009) and we do not know if these are suitable 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 each represent 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 was 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 more 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 of Silva, Crubézy & Cunha (2009). This suggests 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 with a biased inflation of the cranial proportion with prejudice to the other skeletal regions. This procedure can lead to misleading interpretations of cremation burials — one in which one supposes 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 & alii (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 & alii, 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 bones from a modern crematorium also allowed us to discriminate between the results dependent upon the rate of successful anatomical identification (Table 4). The results demonstrate that an increase in the identification rate is followed by an increase of the proportions of skeletal regions. 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, *apud* Krogman & Işcan, 1986; Silva, Crubézy & Cunha, 2009).

The cranium was the fraction with least 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 their 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 from the pyre of specific parts of the skeleton (Table 6). The proportions of different parts of the skeleton allocated inside the urns are well inside or at least near the 95% confidence intervals. Although the Urn 4 burial displays slightly larger proportions of trunk and the lower limb bones 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 us to make significant inferences but we can confirm that these three cases always presented 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 specific parts of the skeleton.

Table 6. Proportions by weight of the skull, trunk, upper limbs, 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	

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 of unburned artefacts and animal remains demonstrates that this interment was probably a legitimate grave in contrast to a non-funerary interment. This suggests that the remains of the individual from the *bustum* may have been placed in two different locations. This was found for the Roman necropolis of Sainte-Barbe (Marseille, France) by Richier (2005).

A study was completed for the ESA burials following Duday, Depierre & Janin (2000), who examined the distribution by weight 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 recovery of bones from the pyre and respective deposition within the vessel. In the case of ESA, the organization of each skeletal region inside the urns is random. Therefore, there is no evidence of any specific logic concerning the deposition of bones in the vessels. With the same aim, 3D

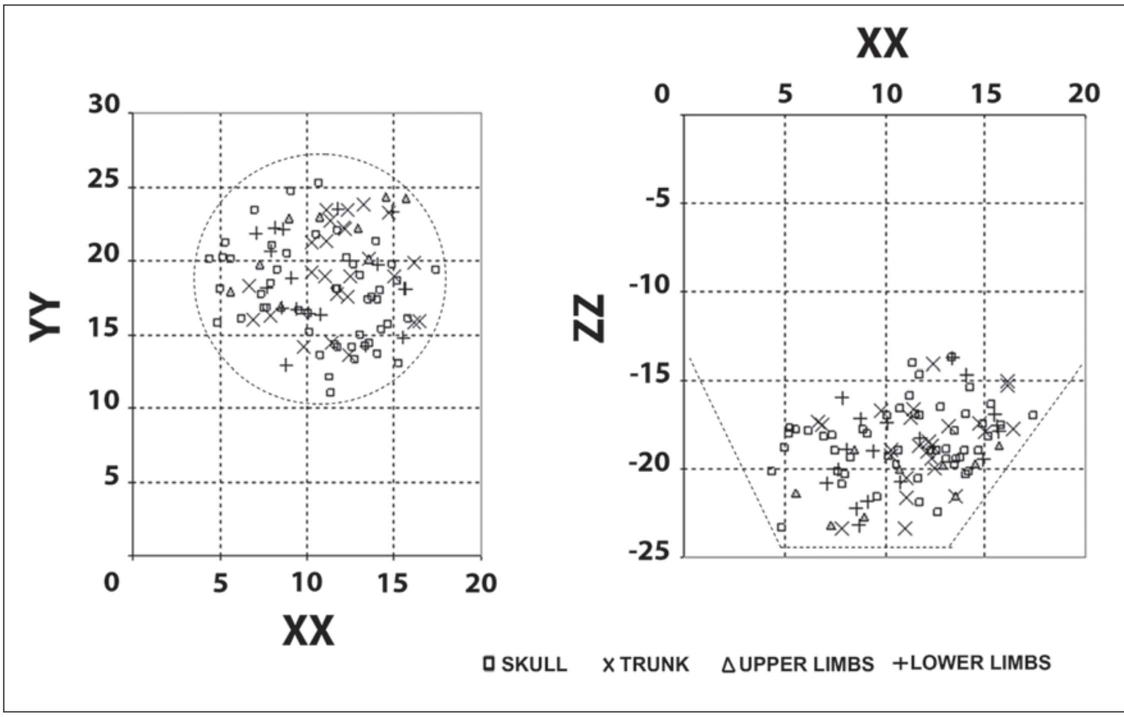

Fig. 8 Spatial dispersion of bones from the Urn 5 burial according to part of skeleton.

plotting was undertaken for Urn 5 but although upper limb bones seem to be restricted 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 examination of the artificial levels (Fig. 8).

The sediment analysis suggests that cleaning of the bones prior 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 of pouring wine over the remains — libation (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 fragment of bone 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 with the burials. These animal remains formed part of the funerary ritual, even if not directly related to the combustion 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 here.

Final comments

If any pattern can be inferred from the small number of the ESA cremation burials, it is that diversity seems to be the rule for Roman mortuary behaviour. Despite the fact that all individuals were adult and cremated singly, other aspects of the funerary practice do present some variability. Among these are the optional association of artefacts with 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 could not be determined but may be related to age, sex, socio-economic status, specific religious beliefs or random events.

The ESA burials are few in number and so do not allow us to draw general conclusions concerning Roman cremation practices in Lusitania. However, the information extracted from these materials must not be neglected and may eventually contribute towards a better understanding of Roman funerary practices, especially if included in larger archaeological assemblages. For that purpose, methods must be relatively standardized to allow for comparative studies. Although the adopted palaeobiological methods tend to be fairly similar among biological anthropologists, the excavation and analytical approach regarding the reconstruction of past funerary behaviour is not so well standardised. This renders any comparative analysis difficult. The standardization of methods depends on the availability of references suited to the analysis of burned bones. That is the case for the proportion of each skeletal region when infering the patterns of bone recovery from the pyre. Here we present a preliminary frame of reference with consideration of the extreme fragmentation affecting burned bones. It is to be hoped that its further refinement will improve interpretation of urned cremation burials.

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NOTES

[1] Centro de Investigação em Antropologia e Saúde (CIAS), Universidade de Coimbra.

[2] Instituto de Gestão do Património Arquitectónico e Arqueológico (IGESPAR, IP).

[3] Bolseira de Doutoramento da FCT. UNIARQ-Universidade do Algarve.

[4] Unidade de Geologia Marinha, Laboratório Nacional de Energia e Geologia.

[5] Dipartimento di Filosofia, Storia e Beni Culturali, Università degli Studi di Trento. Piazza Venezia 41, I-38122 Trento (Italy).

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

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