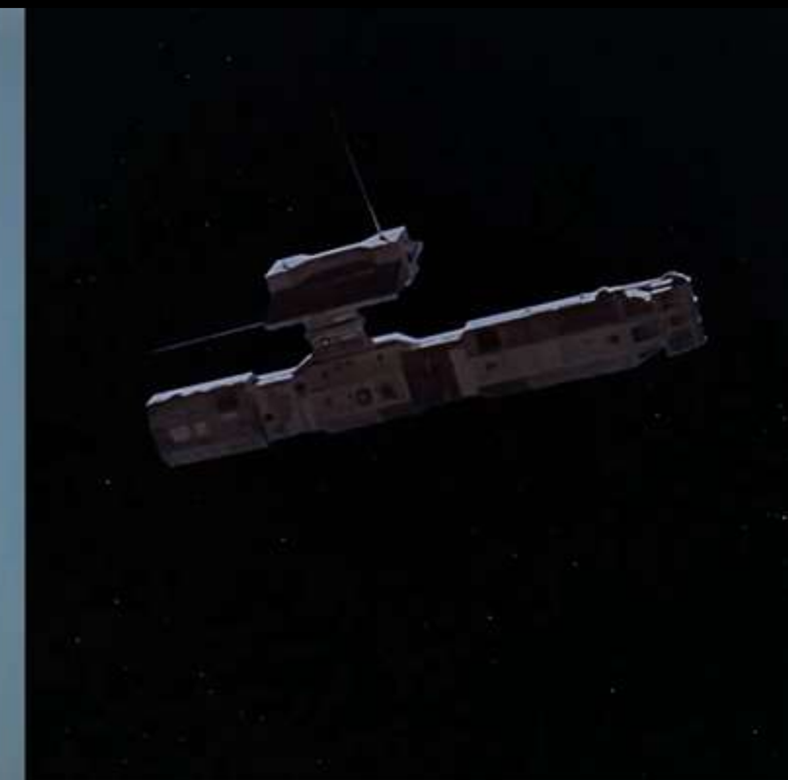
RESTING IN PEACE OR IN PIECES? TOMB I AND DEATH MANAGEMENT IN THE 3rd MILLENNIUM BC AT THE PERDIGÕES ENCLOSURE (REGUENGOS DE MONSARAZ, PORTUGAL).
Lucy Elizabeth Shaw Evangelista
Universidade De Coimbra



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Tese de Doutoramento em Antropologia, ramo de especialização em Antropologia Biológica, orientada pela Professora Doutora Ana Maria Gama da Silva e apresentada ao Departamento de Ciências da Vida da Faculdade de Ciências e Tecnologia da Universidade de Coimbra

Novembro 2017

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Universidade de Coimbra

FCTUC FACULDADE DE CIÊNCIAS E TECNOLOGIA UNIVERSIDADE DE COIMBRA

Departamento de Ciências da Vida

Faculdade de Ciências e Tecnologia

Universidade de Coimbra

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Lucy Elizabeth Shaw Evangelista

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Thesis presented to the Faculdade de Ciências e Tecnologia, Universidade de Coimbra in order to obtain the degree of Doctor In Biological Anthropology

November 2017

Cover image is a reference to Stanley Kubrick's 2001 Space Odyssey

For Miguel.

And through you, Bito, Tilly and Nessie, my suns.

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ABSTRACT AND KEYWORDS

For this study, the human bone sample recovered from Tomb I was analysed from a bioarchaeological perspective with the aim of contributing towards a better understanding of the Late Neolithic/Chalcolithic individuals that used the Perdigões prehistoric enclosures (Reguengos de Monsaraz, Portugal) as a burial site, and their attitudes towards death.

To achieve this, four main research objectives were defined:

(I) the analysis of the human remains exhumed from Tomb I, in order to characterize demographic, morphologic and pathological aspects of the population(II) based on physical anthropological analysis and the archaeological register, identification of funerary rules and attitudes, relating them to mental constructions towards death through a study of: the conception and form of deposition of human remains; the organization of the internal space of the tomb; evidence of ritualization; signs of management of the funerary space (III) to understand how the specific mortuary practices identified in Tomb I fit into the global funerary practices already known for the rest of the important archaeological site of Perdigões (IV) Tomb I was also understood within the context the history of the use of other *tholoi* type structures in the territory that is now referred to as South Portugal.

Tomb I is a tholos type structure from Perdigões Archaeological Complex, dated from the first half of the 3rd millennium BC and excavated between 1997 and 2001.The sample was in poor state of conservation and highly fragmented, and skeletonized elements were found completely disarticulated. Anthropic and natural taphonomic alterations were limiting factors of the study.

A two-fold approach was applied to the study of the skeletal sample from this funerary structure. First, it was studied according to the archaeological phases defined after field work, which sought to understand possible differentiated uses of the tomb through time. The skeletal sample was then studied as a whole, regardless of phases of use. The data obtained through this latter anthropological study were utilized for the paleodemographic reconstruction and for the identification of potential patterns in mortuary practices and for further comparison of this monument with other funerary structures inside and outside Perdigões Archaeological Complex. Both approaches mirror the same reality: the collective, commingled use of this tomb for deposition of human remains from both sexes and individuals of all ages.

A total of 61926 bone fragments and 1579 teeth were studied. The paleodemographic approach estimated an MNI of 103 individuals for this structure: 55 adults and 48 non-adults (below 15 years of age at death). Results showed both sexes were represented, while non-metric trait data, highly limited by the conditions of the sample, delivered few results.

Calculus was identified on 20,6% of the analysed teeth (289/1399) and linear enamel hypoplasia on 10,4% (143/1369) of the tooth sample, making them the most frequently represented dental pathologies for permanent teeth. Average tooth wear in this sample was low: 1,9 (n=1428) very close to the level of wear obtained for deciduous dentition: 1,8 (n=84). Cariogenic lesions were found on only 0,5% of the 1406 permanent teeth analysed and antemortem tooth loss was identified in 5,3% (n=29/539) of the observable alveoli. Skeletal pathological changes related mostly to joint disease, found mainly on upper and lower limb bones and the spine. The presence of enthesopathies were most commonly found on the lower limb and foot bones. Some evidence other diseases, such as infectious, congenital, metabolic and traumatic conditions, was found, but in low frequencies. However, the rarity of some of these pathologies for prehistoric contexts must be highlighted, as the probable case of *Hyperostosis Frontalis Interna* identified on an individual from Phase 2C.

The analysis of the use of the chamber for funerary depositions throughout the different phases revealed that different physical areas were used for the depositions of human remains and artefacts. In terms of Funerary Anthropology, Tomb I constitutes a burial site where an obvious and intense manipulation of the skeletal remains took place. No anatomical connections were identified and evidence suggests the secondary use of this funerary structure, although the possible presence of primary depositions at some point of its life cannot be overruled.

Comparison with other *tholos/tholoi* type structures made it possible to record differences in demographic, morphological and pathological features between coeval populations.

Keywords:

Biological Anthropology; Funerary Practices; Prehistory; Portuguese Copper Age populations; Perdigões Archaeological Complex; Collective burials.

RESUMO E PALAVRAS CHAVE

(Escrito de acordo com a Antiga Ortografia)

Neste trabalho, os ossos humanos recuperados do Sepulcro I, foram analisados numa perspectiva bio-arqueológica com o objectivo de contribuir para uma melhor compreensão dos indivíduos do Neolítico Final / Calcolítico, que usaram o Complexo Arqueológico dos Perdigões (Reguengos de Monsaraz, Portugal) como local de enterramento e suas atitudes em relação à morte.

Para atingir este objectivo, 4 linhas de investigação foram definidas: (I) a análise dos restos humanos exumados do Sepulcro I, a fim de caracterizar os aspectos demográficos, morfológicos e patológicos dos indivíduos exumados (II) com base nos dados de antropológica biológica e do registo arqueológico, identificar regras e atitudes funerárias através de um estudo da concepção e forma de deposição de restos humanos, da organização do espaço interno do túmulo, das evidências de ritualização e dos sinais de gestão do próprio espaço funerário (III) compreender de que forma as práticas mortuárias específicas identificadas no Sepulcro I se encaixam nas práticas funerárias conhecidas para o sítio arqueológico dos Perdigões (IV) e compreender como o Sepulcro I se enquadra no contexto da utilização de outros monumentos funerários tipo-*tholos* conhecidos para o sul de Portugal.

O Sepulcro I é uma estrutura funerário tipo-*tholos* do Complexo Arqueológico de Perdigões, datada da primeira metade do 3º milénio AC e escavada entre 1997 e 2001. A amostra encontrava-se em mau estado de conservação e muito fragmentada, e os elementos esqueléticos foram encontrados completamente desarticulados. Alterações tafonómicas de origem antrópica e natural foram factores limitantes do estudo.

Foi aplicada uma dupla abordagem ao estudo da amostra esquelética da Perdigões. Primeiro, o monumento foi estudado de acordo com as fases arqueológicas definidas após o trabalho de campo, que procuravam compreender possíveis usos diferenciados do túmulo ao longo do tempo. A amostra esquelética foi depois estudada como um todo, independentemente das fases de uso. Os dados obtidos através desta última abordagem foram utilizados para o estudo subsequente. Este incluiu a caracterização antropológica e a identificação de potenciais padrões nas práticas mortuárias da amostra esquelética e para posterior comparação do Sepulcro I com outras estruturas funerárias dentro e fora do Complexo Arqueológico dos Perdigões. Ambas as abordagens refletem a mesma realidade: o uso coletivo deste túmulo para a deposição de restos humanos de indivíduos de ambos os sexos e de todas as idades.

Um total de 61926 fragmentos de osso e 1579 dentes foram estudados para o Sepulcro I. A abordagem paleodemográfica estimou um NMI de 103 para esta estrutura: 55 adultos e 48 não adultos (menos de 15 anos de idade). Os resultados mostraram que ambos os sexos se encontravam representados. A análise dos dados paleomorfológicos, muito limitada pelas condições da amostra, apresentou poucos resultados.

As patologias orais mais frequentemente representadas para dentes permanentes são o tártaro, identificado em 20,6% dos dentes analisados (289/1399) e as hipoplasias do esmalte dentário, observadas em 10,4% (143/1369) da amostra dentária. O desgaste médio dos dentes era baixo: 1,9 (n=1428) muito próximo do nível de desgaste obtido para a dentição decidual: 1,8 (n = 84). As lesões cariogénicas foram identificadas em apenas em 0,5% dos 1406 dentes permanentes observados e a perda de dentes antemortem foi identificada em 5,3% (n = 29/539) dos alvéolos observáveis. Alterações patológicas do esqueleto estavam principalmente relacionadas com a doença articular, encontradas sobretudo nos ossos dos membros superiores e inferiores e na coluna vertebral. A presença de entesopatias foi mais comumente encontrada nos membros inferiores e nos ossos dos pés.

Foram identificadas algumas evidências de outras doenças infecciosas, congénitas, metabólicas e traumáticas, mas em baixas frequências. No entanto, a raridade de algumas destas patologias para contextos pré-históricos deve ser destacada, como o provável caso de *Hiperostosis Frontalis Interna* identificado num indivíduo da Fase 2C.

A análise do uso da câmara para deposições funerárias ao longo das diferentes fases revelou que diferentes áreas físicas foram usadas para deposições de restos humanos e artefactos. Em termos de Antropologia Funerária, o Sepulcro I constitui-se como um local de enterramento onde ocorreu uma intensa manipulação dos restos humanos. Não foram identificadas conexões anatómicas e as evidências sugerem o uso secundário desta estrutura funerária, embora a possível presença de deposições primárias, em alguma fase da sua utilização, não possa ser rejeitada.

A comparação com outras estruturas do tipo *tholos* permitiu registar diferenças demográficas, morfológicas e patológicas entre populações contemporâneas e esclarecer a presença potencial de rituais funerários diferenciados ocorrendo ao mesmo tempo em diferentes regiões.

Palavras-Chave:

Antropologia Biológica; Práticas Funerárias; Pré-História; Populações Calcolíticas Portuguesas; Complexo Arqueológico dos Perdigões; Sepulturas Colectivas.

LIST OF ABREVIATIONS

AD – Anno Domini

aDNA – ancient DNA

AMTL – Antemortem Tooth Loss

BC – Before Christ

Cal. – Calibrated

DMRT –Double/Multi-Rooted Tooth

EH – Enamel Hypoplasia

FDI - World Dental Federation

MC - Metacarpal

MNI - Minimum Number of Individuals

MSM - Musculoskeletal Stress Markers

MT – Metatarsal

NI – Non-Identified

NMI – Número Mínio de Indivíduos

OA - Osteoarthritis

SRT - Single-Rooted Tooth

SU – Stratigraphic unit

YRS - Years

ACKNOWLEDGEMENTS

My first word goes out to Professora Ana Maria Silva. One has to be a special, generous kind of person to agree to take in a near neophyte to the world of Biological Anthropology and without a wink (visible one, at least!) accept the challenge to supervise a thesis like this one. I am sure I could not have had a better luck. Thank you so much for your patience, good will and constant support. Through rough paths and easier rides, your good humour and acuteness turned this into a truly extraordinary experience.

The Department of Life Science in the University of Coimbra is full of wonderful people that crossed my path throughout this adventure. To my teachers, Eugénia Cunha, Ana Luísa Santos, Cláudia Umbelino, and Paulo Gama I thank for broadening my inner world. To my department colleagues, David Gonçalves, Teresa Ferreira and Vítor Matos, who were also my teachers, thank you for your generosity and for setting such good examples. I also thank Ricardo Godinho and Claúdia Cunha for their help. To Manolo, from the academic services, thank you for your readiness, whenever needed. To the sweet Donas Lina and Célia, thank you for your warmth and beautiful smiles. To Dona Lurdes, too.

Thank you also to the nice humans that made my days in the attic more luminous: Pedro Ferreira, Tânia Pereira, Daniel Fidalgo, Deborah Camotti, Hugo Aluai Sampaio and Inês Santos. To my house mates, Joana and later Tina, thank you for all the laughs.

Other three souls deserve a special mention. I met Mariana Guimarães on the very first day at Coimbra, on the 30th of November 2012, exactly 5 years ago. What started then will remain as long as there are existential matters to discuss and glasses of wine to drink. Edilson is the shiniest star in the whole of Coimbra. The most dedicated and sweetest of friends. I deeply cherish our friendship and this bond will last forever, whatever happens. Thank you. To Inês Leandro, and her infinite generosity, I say this: thank you for making life in Coimbra so much better. Thank you for all the help, roaring laughs, weird adventures around the department, private jokes, “empalhadas” at Tropical or for that São João in Figueira da Foz. You are one of kind, sweet Inês, and I will never forget our days together in Coimbra. Fly high!

Without the institution Era Arqueologia S.A., where I have proudly worked for the last 20 years of my life, none of this would have been possible. Thank you to Miguel, Henrique and Alberto for believing I could to this. Henrique also had the pleasure (and the patience) to format the whole of my thesis. You are the best! Thank you, Era, for all the support.

To Liliana Carvalho I thank for the photographs and the amazing drawings of the pathological bones in the thesis. To André Texugo I have to thank for digitalising the whole of the Tomb I photo archive. Marina Lourenço actually read my thesis and made, as she always does about everything, very valuable comments. Working with you is a true pleasure.

António Carlos Valera was also a strong force behind all this work. Thank you, as always, for all your help, comments and support and for your moving dedication to the Perdigões project. This would not be possible without it.

To Cidália Duarte, my mother-in-anthropology: I am only here because of you. Thank you for so many years of fun and learning. This thesis is also yours.

As with any endeavour, life the most complex of them, love is the only way. This is above all, a work of love, made possible by the love of those around me. Far or close, these humans saw me over high mountains, down dark holes, across vast oceans. They helped me with their light, love, music and words. To my Nuno, Mafalda, Tété, Álvaro and Paulo. To Salima, Nicholas, Ariadne, Teresa C, Ana S and João BR, Kikita, Tiago, Maria, Inês MS, Alexandre. Vasco. It is a privilege to have you all in my life. Thank you.

To Mummy and Paizinho, all of this is an emanation of what you gave me: unfailing love, strength and hope in a better tomorrow, always. I love you both back. Thank you for everything.

To my siblings (and surf buddies) Eduardo, Ema, Inês and Pedro (or makers-of-me) just the one word: love.

To Teresa and Alberto and all my sisters and brothers-in-law and my beautiful 10 nieces and nephews, it is so good to have you around. Sweet Magui, too.

Vóvó,

Tio.

Gil.

Forever my Holy Trinity. You live on in me.

To all the magic creatures on the planet, Fairies and Titans.

The dead who climb up to the sky
climb up steps
to the sky
up worn steps
all the dead who climb up to the sky
on worn steps
worn from the other side
worn from the inside
climb up to the sky

Three trios: Poems. JII. (Translated by Judith Hall).

1 Introduction

The Perdigões archaeological site is a 20-hectare ditched enclosure culturally identifiable as part of the Southwest Iberian Late Middle Neolithic/Chalcolithic (3500 – 2000 BC). Continuous archaeological interventions have been taking place at the site since 1997, unearthing several funerary structures with traces of a variety of mortuary practices. Death is an inevitable biological process with a clear social impact, to which each culture gives a particular response. In Perdigões it is very much present in the archaeological record and the study of the rituals surrounding death, as happens when dealing with other ancient cultures, allows us a glimpse into the world of the living. Indeed, each group of individuals approaches death in different manners, with different treatments given to the human body for different reasons: it can be handled, deposited or altered due to ritual practices, sanitary purposes or beliefs in the afterlife (Parker Pearson, 2000; Stutz and Tarlow, 2013).

Over the years Perdigões has become one of the most important investigation projects in the Iberian Peninsula for this period, and the Perdigões Global Research Programme (NIA-ERA-Arqueologia) coordinates various projects integrating specialists from very different scientific areas (Valera et al. 2007; Silva et al. 2010, Marquez Romero et al. 2011). Because of its extraordinary results it has become an essential source for the study of recent Pre-Historic populations and their attitudes towards death. Currently five different types of funerary repositories have been identified in Perdigões, which include at least three very distinct body treatments and cover a time span of about 1500 years: primary depositions in pits, collective commingled depositions in structured architectural megalithic tombs, deposition of commingled and collective human cremated remains in pits and open area and finally, depositions of loose human bones in ditches, exposed to fire or not.

The first funerary structures to be discovered were Tomb I and II set in the Eastern side of the site in the so-called necropolis area. Although normally referred to as "*tholoi*" these structures lack a corbelled dome and so, although they belong to the megalithic tradition of construction, they represent a new kind of architecture, which appears in the archaeological record in the transition between the 4th and the 3rd millennia BC, probably materializing changes in the way death and the treatment given to the deceased was regarded (Lago et al., 1998; Evangelista, 2004; Valera et al. 2000).

Excavations of Tombs I and II in the Perdigões archaeological complex were undertaken using state-of-the-art methods. The great investment in terms of field work, which continued in the laboratory, provided valuable clues for a better understanding of the burial practices of the local populations, which were much more complex and varied than was thought until recent years (Boaventura et al. 2014: Silva et al, 2014; Silva et al. 2015, Valera et al., 2014a).

The data arising from the study of Perdigões Tomb I raise questions concerning of the nature of deposition of the human remains. The bones and fragments were found completely commingled and reached us in a very poor state of conservation. The high number of human bones and fragments recovered from Tomb I is clear evidence of the complex use of the monument over an unknown period of time around the first half of the 3rd millennium. Other than this, it is difficult to state with any certainty or reach any firm conclusions regarding the particular rituals involved or which phase in the particular and generic rituals associated with death these remains relate to. This raises a number of questions regarding the apparently long process of manipulation of bodies, from the moment of death until the moment when they were unearthed in these structures.

Where did the original deposition occur? Inside the Tomb, elsewhere within the enclosures or somewhere completely different? Are these remains evidence of a crystallization of a sequence of moments and is it possible that the one represented in Tomb I was not intended to be a final moment? What is the significance of the prolongation of the ritual of death which implies a primary deposition of bodies with characteristics we know little about, followed by the repetition of acts, with the deposition of parts of bodies in other structures, which were specially built for this purpose? (Valera et al, 2000:101 and following.)

When looking at funerary practices in recent pre-history, complete understanding of the ritual aspect involved is impossible. Using the methods available, this thesis is an attempt to shed light on this process and reach a better understanding. Indeed, such continuous funerary practices, and their repetitive nature, are extremely detrimental to the analysis of osteological data from human remains; osteobiographies are difficult to reconstruct, the relationship between individuals and artefacts is almost impossible to establish, the construction of paleodemographic profiles becomes a difficult task. What is more the bone surface is severely damaged by post-depositional trampling and also by human transportation and manipulation, leading to erosion, crushing, and fracturing, limiting paleopathological diagnosis.

In spite of the evident limitations involved in the anthropological study of Tomb I it nonetheless proved a relevant exercise: not only did it provide important additional biological information on the people deposited at Perdigões but it also provided results, which when compared with those already obtained for the rest of the site helped elucidate the cultural and mental framework behind the perception of death and choices regarding death management strategies in these populations.

1.1 Research aims

Our intention with this doctoral thesis was, through the application of standard anthropological analysis of the human remains recovered from Tomb I in Perdigões, to contribute to the better understanding of the Late Neolithic/Chalcolithic populations that used the Perdigões enclosure as a burial site and their attitudes towards death. We intended to come forward in the comprehension of their death management strategies in the light of what is known about the mental framework of these populations, which can also be assessed through other archaeological evidence. Data obtained through this anthropological study were utilized for the paleodemographic reconstruction and for the identification of potential patterns in mortuary practices of the skeletal sample. The identification of thousands of human bone fragments suggested the presence of a large number of individuals in this collection and the degree of fragmentation and commingling suggested that Tomb I may have functioned as a location for the continued deposition of human bones with a specific role and possibly meaning in the scope of what is known for the rest of the funerary practices taking place in Perdigões. This adds relevant information for the understanding of Chalcolithic funerary behaviours and practices. The overall purpose was to try to understand the specific treatment given to the dead of Tomb I in Perdigões. The other types of burials identified in the site and the variation in funerary practices could respond to social status, diachronic changes in funerary practices revealing significant differences in the perception of social identity and treatment of the dead. Unfortunately, only a small part of the human remains exhumed in Perdigões are studied from a bioarcheological point of view and so comparisons had to be found outside the boundaries of Perdigões enclosures, in the other tholos/tholoi type structures known in the south of what is today Portuguese territory.

To fulfil this purpose the research aims were as follows:

1. At a more direct level of interpretation, analysis of the human remains exhumed from Tomb I, in order to characterize specific anthropological and demographic, morphologic and pathological aspects of the population;

2. Based on physical anthropological analysis and the archaeological register, identification of funerary rules and attitudes, relating them to mental constructions towards death through a study of: the conception and form of deposition of human remains; the organization of the internal space of the tomb; evidence of ritualization; signs of management of the funerary space.

3. Based on the information recovered from our laboratory study, an attempt was made to understand how the specific mortuary practices identified in Tomb I fit into the global funerary practices already known for the rest of this important archaeological site.

4. On a broader scale, Tomb I was also understood within the context of the history of the use of other *tholoi* type structures in the territory that is now referred to as South Portugal.

1.2 Structure of this thesis

This thesis is divided into eight chapters.

- Chapter 1 - The introductory chapter, the aims and objectives of this work are outlined and contextual information for the research is offered through a description of what is known about funerary practices in south Portugal during recent prehistory.

- Chapter 2 - Narrows the scope and presents a context for Tomb I, the basis of this work, through an introduction to the Perdigões Archaeological complex, where it is located and the known funerary structures in the site.

- Chapters 3 and 4 - Describe the sample and present the methods used for this study.

- Chapter 5 - The results of the analysis of the monument are presented, starting with the per-phase study results followed by the total-results obtained for Tomb I. The advantages of this twofold approach are also discussed.

- Chapter 6 - The results are discussed including a comparative analysis with all the available bioarchaeological information for the other funerary monuments, not only in Perdigões but also other south Portugal tholos/tholoi type monuments.

- Chapter 7 - The results are used to propose a model of what could be happening in the large enclosures of southwest Iberia.

- Chapter 8 - summarises the general conclusions of this study, identifying its limitations and proposes ideas for future research.

1.3 Background for funerary practices in Recent Prehistory in south Portugal

Indeed, it is possible to consider what is broadly know as Neolithic/Chalcolithic period in South Portugal and see it as a unity regarding basic social and cultural order and structure, prevailing belief systems and ideology that are the underlying factors and cultural determinants behind the choice of the mortuary practices of any given society or human group (Carr, 1995). In order to understand the past, the mortuary context in which individuals are buried must be considered and the funerary rituals associated with their passing, as the dead are often manipulated and disposed by the living (Osterholtz et al., 2014; Parker Pearson, 2000). The relationship between the living and the dead varies as some cultures do not perceive death as the inevitable end of life (Parker Pearson 2000; Stutz and Tarlow, 2013). Some may view death as a rite of passage where the individual transfers from one social state to another, while other cultures perceive death as a metaphoric symbol of regeneration that ties into human fertility and agriculture (Parker Pearson, 2000).

Furthermore, disposal of the dead is a special cultural process or series of processes that demonstrates a relationship between the living and the dead (Parker Pearson 2000; Sprague, 2005; Stutz and Tarlow, 2013). The dead are often interred in different places as a physical separation is required for a variety of reasons, including health and sanitation, the grieving process, and cultural preferences. These decisions on how and where to dispose of the deceased are influenced by perception of death and possibly the need to maintain physical or spatial connection to the dead via their remains.

Consequently, the attempt to discuss recent pre-historic funerary practices in the South of Portugal is a complex enterprise, at minimum. For the period between circa 3500 BC until the end of the 3rd millennium BC there are many funerary features scattered around a vast territory that assume such a variety of architectures, formations processes, depositional contexts, number of individuals, degree of preservation and mortuary rites that the effort to systemize all the available information is not an easy one. The empirical revolution, as António Carlos Valera (Valera et al. 2014b) called it, was made possible in the last 20 years by several major public works in the South of the country involving the construction of the Alqueva Dam and its many irrigation channels and several motorway sections that were planned to link the coast around Sines to the Spanish border. Others are still being undertaken and together have yielded an amazing amount of information for every prehistoric and historic period. With regard to the Middle Late Neolithic/Chalcolithic period, whole blank areas around the Beja district are now covered with new identified sites, many of them with funerary structures and anthropological remains that are adding ever more complexity to our understanding of the management and vision of death in prehistoric communities.

Until that moment, the data on funerary practices in the South of Portugal were based on the information available from the hundreds of archaeological excavations on dolmens densely concentrated in certain regions (Évora and Portalegre Districts) and considered one of the primary expressions of the pan European phenomenon of Megalithism, along with other non-funerary constructions involving large stones (isolated menhirs or grouped in stone circles or cromelechs). The concept has now broadened and Megalithism can be said to include other 4th/3rd millennium BC forms of collective burial such as natural caves, rock cut tombs, pits or tholoi type monuments that seem to occur under the same generic set of social and ideological prescriptions and rules that involve the collective and sequential use of funerary spaces.

This “unity” - the basic social-cultural order and structure, prevailing belief system and ideology (that are the underlying basic factors and cultural determinants behind the choice of the mortuary practices of any given society or human group) – are what we would like to access in order better understand the Neolithic Cosmology. The analysis of the already relatively large and complex corpus of information regarding the funerary world in this period shows a process full of advances and retreats, adoption of new architectures and burial practices and the survival of many earlier traditions.

For the South of Portugal, and from a diachronic point of view, one of the main things that stands out from relatively large collection of funerary data is that the new traditions are most obviously linked to older ones that were still in use. On the other hand, the path wass one towards diversification and complexification, a process that reaches its peak in the 3rd millennium BC, as can be seen in Figure 1 where a multiplicity of funerary practices and architectural solutions are evident for this period as diversity increases. The beginning of the 3rd millennium BC, for example, saw the construction of tholoi for the disposal of dead bodies at a time when megalithic monuments, caves, hypogea and pits for funerary practices were still in use (Valera, 2012a). In the Bronze Age this diversity remains, with the reuse of megalithic monuments, which continues some earlier traditions, but also some noticeable changes in the increase of individual burials (García Sanjuán 2006).

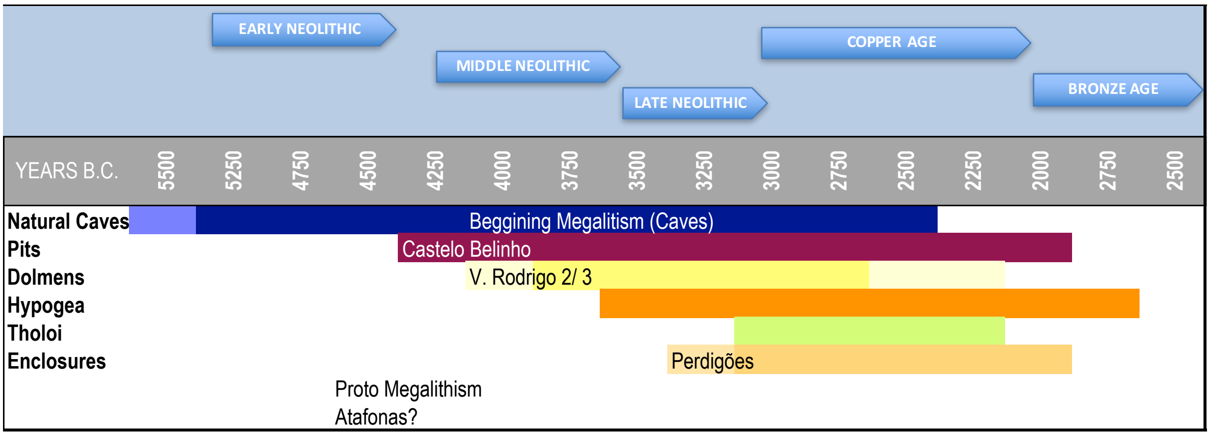


Figure 1 - Diachronic table of the various different types of funerary structures in use in the South of Portugal.

In this section of our work an attempt will be done to produce a descriptive review of the known funerary practices for the Centre/South of Portugal. The choice of limiting this investigation mostly to the Alentejo and Algarve creates an artificial area inside the wider Iberian Southwestern reality, in which the whole phenomenon that will be discussed in this chapter must necessarily be understood. It is assumed that the chosen geographical area addressed here can be regarded as a micro cosmos of that wider geographical reality.

In addition, it is not our aim to mention all the known Neolithic/Chalcolithic sites with remains of funerary practices involving human remains. This territory is rich in prehistoric burial sites, particularly those of the what is known as Middle and Late Neolithic/Chalcolithic periods (4th–3rd millennia BC). In the past 150 years, more than 3000 tombs, namely natural caves used as tombs, dolmens, rock cut tombs and tholoi have been identified and many of them explored (Silva, 2002; Boaventura et al., 2014). This overview will concentrate on some of them, giving particular attention to the ones with recent anthropological studies of the human remains.

Special attention is also given in this chapter to the review of mortuary practices in tholos/tholoi type structures in the south of Portugal, since it is these architectural funerary structures that can provide, amongst the other known funerary practices, a better understanding and comparison with the reality found in Tomb I. However, although the anthropological significance of the many human remains recovered in different structures in Perdigões is still not established, this chapter will also attempt to understand the phenomenon of enclosures in their known close relation with funerary practices. Narrowing the scale of approach, the archaeological context of Tomb I will also be described.

1.3.1 Natural Caves

This kind of structure is mostly found in central/southern Portugal (Beira Litoral, Alto Ribatejo, Estremadura, the Setúbal Peninsula and the Algarve). Because they are natural formations, there is not much to say about the architectural features. These natural hollow places, large enough for a human to enter, hold the oldest human funerary remains found in Portugal (Zilhão and Trinkaus, 2002). This is a tradition that spans Prehistory and there are several examples of natural caves with long stories of usage and re-visitation not just involving funerary practices.

With regard to funerary cave contexts in the Early Neolithic, such as Gruta do Caldeirão (Zilhão, 1992), they seem to be for the primary deposition of only a few individuals. As the Neolithic progressed there seems to have been a tendency towards collectivization of burial deposits with the increase the number of deposited/interred individuals (Silva, 2002; Boaventura et al., 2014) and the practice of bone rearrangements and secondary depositions.

At Gruta do Cadaval, near Tomar, two individual burials were separated from layers of collective burial. An anthropological study by Tomé et al. (2011) identified the remains of 31 individuals of both sexes, belonging to all age groups. This site is particularly important since it seems to hold the oldest megalithic burial in Central/South Portugal (Oosterbeek, 1985, 1994; Boaventura, 2009), belonging to one of the individualized burials of Layer D (ICEN 464 5160±50 BP).

For natural caves in Estremadura, such as Casa da Moura, in Óbidos, (Carvalho e Cardoso, 2010/2011) C14 dates now very clearly show that although they were continually used for hundreds of years, the different funerary phases are separated by time gaps sometimes of hundreds of years.

A thorough study of the important site of the Algar do Bom Santo (Alenquer), a Middle Neolithic cave necropolis near Lisbon, was recently published (Carvalho et al., 2012; Carvalho (ed.), 2014) Three field seasons had already taken place at Algar do Bom Santo since its discovery in late 1993 (Duarte, 1998a). Human remains were identified in the so-called Rooms A and B (although only the latter room was totally excavated). The anthropological analysis studied hundreds of commingled, disarticulated bones, deposited mostly on the cave floor. Although two primary depositions were identified, in most cases anatomical connections were almost never preserved. The cave was used for the deposition of male and female individuals of all ages. There seems to be some kind of funerary organization of the space since in Room A the number of males is residual. The use of red pigment and the presence of some long bones with cut marks were also registered.

The Lugar do Canto Cave in Alcanena (Leitão et al. 1987) showed similarities with what was found in Algar do Bom Santo: also a Middle Neolithic context, it was used for one period of time after which it was abandoned and closed. Its primary depositions are surrounded by apparent secondary depositions. Both sexes and ages were also identified (Silva et al, 2011). The use of caves continued through the second half of the fourth millennium with several types of body treatment. At the Late Neolithic Lapa do Fumo Cave, on the Setúbal Peninsula, (Serrão, 1978; Serrão and Marques, 1971; Boaventura, 2009) complex funerary rituals were detected related with the "red layer" context, where intense use of red pigment on the remains of 13 individuals seems to have been the final gesture after the deposition of bones with clear signs of cremation and several cut and bite marks.

Cova das Lapas (Gonçalves, 1999a) in Alcobaça, received primary and secondary depositions in the Late Neolithic/Chalcolithic. A cranium with 2 foot bones, "heel bones" (*sic*) leaning against it were found amongst primary inhumations.

The human osteological material from the 2nd and 3rd hollows of the Poço Velho (Cascais) caves was studied by Nathalie Antunes-Ferreira (2005). At least 115 subjects (93 adults and 23 non-adults) were identified with an even distribution of men and women in the adult group. The caves seem to have been used between the end of the 4th millennium to the 1st half of the 3rd millennium BC (Antunes-Ferreira, 2005), based on two C14 dates and artefact analysis.

For the Alentejo natural cave and rock shelter burials are rare. The exception is Gruta do Escoural, in Santiago do Escoural, Évora (Araújo and Lejeune, 1995), which has a very long and complex history of use since the Middle Paleolithic. The use of the cave as a necropolis began in the Early Neolithic period but was especially intense in the Late Neolithic period. The C14 dates show a pattern similar to the Bom Santo Cave, although later in time: a single continuous occupation of about 500 years, between *circa* 3500-3000 BC. Funerary practices involved primary depositions, as shown by the two flexed individuals found at the entrance of the cave. Secondary depositions and bone rearrangements were also identified with clusters of cranial and long bones (Araújo and Lejeune, 1995).

1.3.2 Dolmens

Dolmen architecture seems to show the same tendency towards collectivization. Megalithic tombs are above-ground burial chambers, built of large stone slabs (megaliths) laid on edge and covered with earth or other, smaller stones. They are a type of chamber tomb, and the term dolmen is used to describe the structures widely found across Atlantic Europe, the Mediterranean and neighbouring regions, mostly during the Neolithic period. This is not the place for the detailed description of this phenomenon and in this necessarily brief overview we will try to focus on what is known of the funerary practices in this specific kind of architecture in the South of Portugal. Although there are chronological regional variations regarding the beginning of Megalithism, for the South of Portugal the available data now suggest that the first dolmens were erected in the first quarter of the 4th millennium (Vale Rodrigo 2 and 3, for example) although the great majority of tombs from the Alentejo were erected between the 2nd and the 3rd quarter of that same millennium. It is likely that at the turn of the 3rd millennium BC some monuments were still being built and there was an intensification of their use as funerary structures (Boaventura, 2009; 2011).

Protomegalithism refers to small closed structures originally designed to apparently receive individual depositions. For some authors, these small chambers normally found under a small cairn, move away from funerary practices of the Early Neolithic, where the domestic and funerary spaces were spatially associated, following the Mesolithic tradition (Soares and Silva, 2000). These proto megalithic monuments preceded the major dolmenic structures mentioned above and if we exclude the few pit burials identified for this period (such as Castelo Belinho, cf. Pit subchapter), they are amongst the first burials found in places other than natural features of the landscape, although both burial traditions are identified as happening at the same time.

In southern Portugal, it appears that the protomegalithic sepulchral phenomenon appeared, in coastal and inland areas (Silva and Soares, 2000). Once again, information is quite scarce on these monuments. Not only did few survive, but bone survival is extremely rare, leaving us with very little to work on in terms of anthropological analysis of these populations, and funerary practices can only be understood through architectures and artefactual component.

Marco Branco, on the North Alentejo coast, is a small closed chamber partially excavated in the rock, which was limited by a number stone blocks placed on the surface, and small pillars less than one meter high. No osteological remains were recovered from the first moment of use of the monument. In the second phase, at least 3 inhumations took place with traces of the use of fire (Silva and Soares 1983; Soares and Silva, 2000).

Grave 2 from Cabeço do Torrão 2 (Elvas) shows striking affinities with the Marco Branco structure. The oval burial chamber was also partially excavated in the rock and limited by stone blocks standing directly on the base of the pit. At the base of the filling in the burial chamber, a human bone was found, with a geometric trapezoid microlith, an axe and an adze (Lago and Albergaria, 1995; 2001).

With the progressive development of the Neolithic, a gradual replacement of these small closed protomegalithic tombs, the re-use of which was difficult, started. Much bigger tombs, allowing the deposition of several individuals, appeared and their architecture became more diverse. Leonor Rocha (2005) speaks of an evolutionary polymorphism and it is clear that the passing from simple to complex architectures occurred over a wide geographical area. These architectures were systematically used and reused. This author also considers the possibility of the systematic practice of reburial of the human remains and artefacts from the oldest monuments to the new monuments were being built. It is likely that this practice has frequently been confused with the secondary burial from a temporary grave - where the bones are incomplete and disjointed. This would explain a phenomenon which affects a large number of monuments, especially the oldest: total absence or significantly low count of human remains (Rocha, 2005).

Thousands of megalithic monuments have been uncovered (and many destroyed since then) in South Portugal, especially in the Alto and Central Alentejo (Leisner and Leisner, 1959; Leisner, 1965; Oliveira, 1997; Rocha, 2005; Boaventura, 2009). Unfortunately, the number of human remains recovered from these structures is infinitesimal when compared with the number of known monuments. Other explanations for this could be fund in the nature of the geological substrates where most of these monuments are located (exceptions are the Estremadura, Algarve and the regions around Estremoz and Serpa (Boaventura and Mataloto, 2013), and in the poor archaeological record of some the excavations carried out on them since the 19th century.

For the purpose of this section and given the general paucity of the anthropological information available for dolmen type structures, the work carried out by Leonor Rocha and Cidália Duarte (2009) on the human remains recovered in the excavations led by Manuel Heleno on megalithic monuments from Central Alentejo in the mid 20th century, and deposited in the Portuguese National Archaeology Museum (MNA), yielded useful important information on the types of depositions and on sex and age distribution of the individuals exhumed.

Rocha and Duarte’s study focused on 20 monuments distributed around the Montemor-o-Novo area, in the Évora district. It comprises monuments built in different phases of the region’s megalithism: small tombs with no corridor and small chambers, such as Sepultura 4 from Zambujeiro or Sepultura 6 from Aldeia de Bertinandos, probably erected during the Early/Middle Neolithic, but also big monumental constructions with large chambers and long corridors (Anta de Nossa Senhora dos Olivais).

It is the date of death of the human individuals deposited in these monuments and not their construction which is dated by the several C14 dates obtained based on human bone samples. Some of these monuments were used in several different moments of time. A good example is the Early Neolithic Sepultura 4 of Zambujeiro reutilized during the Bronze Age with a second burial. Another good example, a Roman burial was performed in the chamber of the small Sepultura 6 of Aldeia de Bertiandos. Also in the Anta de Nossa Senhora dos Olivais a Bell Beaker burial of a male with a vase and a bowl in the corridor followed the deposition of cremated remains during the Late Neolithic in the chamber. Cremains were also found at Anta da Aldeinha. Although the lack of collagen did not allow the dating of these bones they seem to belong to an adult individual whose body was cremated shortly after death (Rocha and Duarte, 2009).

The authors related the data recorded in field notebooks by Manuel Heleno and the bones found deposited in the Museum. They agree on the possibility of primary deposition of bodies, although that is obviously difficult to ascertain based on the conditions in which these collections were unearthed, with poor field methodologies. The hypothesis is nonetheless considered for the Bell Beaker burial at Anta de Nossa Senhora dos Olivais and for Anta 2 da Lobeira de Cima. The presence of cremains (and no evidence of local cremation ritual) also suggests secondary use of some of these structures. At Anta da Aldeinha apparently only long bones and cranial fragments were recovered. Anta 1 do Deserto yielded a single foot bone. The authors are careful when discussing the collective or individual nature of burials in these monuments and present a number of explanations for the apparent presence of single human depositions in this kind of monument: bone destruction, cleaning actions and bone removal are some of the possibilities that must be considered. Although Minimal Number of Individuals (MNI) seems low it was possible to identify individuals of both sexes and all age groups in the collections studied (Rocha and Duarte, 2009).

Red pigment and fire rituals are also mentioned. A red layer was found covering the bottom of the Curral da Antinha tomb and in that of Vale de Covas. The presence of ashes and charcoal inside vases at Anta do Paço A and Anta do Chapelar suggest the use of fire in the funerary rituals.

Another comprehensive study of a dolmen was carried out in Anta de Santa Margarida 3 (STAM3), in Reguengos de Monsaraz, in the same geographical area as Tomb I and Perdigões. Not only does it represent a recent excavation conducted using appropriate methodologies of excavation and recovery of human remains, studied by Eugénia Cunha, Ana Maria Silva and Marta Miranda for a monograph published in 2003 (Gonçalves, 2003), but all significant radiocarbon dating was performed on bones related to specific funerary depositions.

For the known orthostatic megalithic monument contexts, it is very rare to be able to directly date a funeral deposition, since the human organic remains seldom survive. Generally, the available dates in dolmens are based on charcoal samples, which can be quite unreliable sources of information since they cannot always be directly connected with a specific burial or even to the monument itself. Rui Boaventura (2011) discusses the “old wood effect” in his works on the chronology of megalithic monuments in the Centre and South of Portugal (Boaventura, 2009; 2011).

STAM 3 seems to belong to the latest tradition of dolmenic monument building. The construction and the first phase of the monument’s funerary use dates between 2930-2500 cal. BC. The second phase, following an apparent reconstruction, was dated from the funerary depositions named Cm2, Cm3 and Cm4 (and an apparently associated dog burial), between 2280-2120 cal. BC. Two medieval violations and a modern one were also registered.

In the corridor, traces of three funerary depositions badly affected by post-depositional phenomena, were identified, and according to archaeological analysis they correspond to the first phase of use.

In this first phase at the beginning of the third millennium, Cm-7 funerary deposition consisted of jaw and skull fragments associated with hand phalanges. A large schist plaque was found in connection with these bones, leading the excavators to the belief that the plaque was around the individual’s neck.

In the last quarter of the third millennium, the funeral deposition Cm3 was uncovered in an exceptionally well-defined position: a woman of 40-45 years was deposited with a vase and three white quartz fragments (one of which was in her mouth). The remains of a young midsized dog, about 18 months old, were next to her, although a clear connection cannot be assumed.

Although identified in many other monuments of this type, the presence of rituals using fire cannot be proved for STAM-3, related to either of the two main phases of funerary depositions. The use of red pigment is also not definite.

Apart from these separately identifiable depositions, other unrelated sets of human bones and teeth were found in STAM-3, some reduced to bone stains, making any kind of identification impossible. Even so, they are all attributed to primary depositions. MNI was estimated around 28 (12 adults and 16 non-adult) of which only three can definitely be said to belong to the second phase of use. There seems to be no age selection in the funerary depositions and although sexual diagnosis in collections of this kind is difficult, several indicators point to the existence of adult bones of both sexes (Cunha et al. 2003).

This latter point is important and underlines one of the great features of ritual funerary depositions of the beginning of Late Neolithic/Chalcolithic in the West of Iberia - the commingled use of death spaces by individuals of all ages and both sexes.

Another recent study of the small osteological series from the dolmen of Sobreira 1 in Elvas (Alentejo) shows the same tendency for collectiveness (Boaventura et al., 2013). It consists of 128 fragments of small dimensions and several taphonomic alterations. The minimum number of individuals is six: three adults - one perhaps over the age of 40 and one female - and three non-adults with death ages between 4 and 9 years old. Due to the great fragmentation of the material, as well as to the poor preservation of the osseous surface, the characterization of these individuals at a paleodemographic, morphological and pathological level was greatly compromised.

Finally, the observation of the bones exhumed in Dolmen da Venda, also in Elvas, during the 1998 campaign (Duarte, 1999) suggests the presence of two distinct moments of occupation of the necropolis or, at least, of two distinct spaces. The first one, surrounding it, seems to have been used as a collective but not very numerous grave, and it was possible to identify only the presence of three individuals (adults and non-adults), very partially represented. The interior space, probably from a later period, seems to have been filled by a single funeral deposition. However, the analysis of the relative spatial distribution of the represented bones suggested that this was a secondary deposition In fact, only the bones of the lower limbs were recovered (Duarte, 1999).

1.3.3 Hypogea

Hypogea are artificial caves, cut into the rocky substrate. As with dolmens, they can frequently be found in groups or clusters and their geographical distribution seems to be limited to certain areas. The fact that they are mostly totally invisible underground, structures could explain this apparent difference in number of hypogea, when compared to orthostatic megalithic monuments. It is generally accepted that this kind of funerary architecture follows dolmenic building in time, placing the oldest known constructions around 3500 BC (Boaventura, 2009; Valera, 2013).

It was in the Algarve region that between 1991 and 1994 archaeological and anthropological intervention in Monte Canelas I hypogeum took place (Silva, 1996). This was one of the pioneering collaborative works between archaeologists and bioanthropologists and set the pace for other to come. The site was part of a cluster of at least four tombs and consisted of two burial chambers connected by a small hallway, where collective burials were carried out over a period of time around the end of the 4th millennium BC. The first deposition comprised the remains of 97 adults and 50 non-adults, covered in red pigment. Around 100 years later, 24 individuals (12 adults and 12 non-adults) were laid on the superior level. Primary and secondary depositions were identified, alongside episodes of bone rearrangement (Silva, 1996).

Sites such as Quinta do Anjo (Soares, 2003) in Palmela or São Pedro do Estoril (Silva 1993), in the Lisbon district belong to the large group of prehistoric hypogea located in Portuguese Estremadura. From all structures of this kind studied in this area it is São Paulo II hypogeum that yielded the highest MNI: 254 (Silva, 2002). The first phase of use of the site as a necropolis began in the late Neolithic and, according to the archaeological remains recovered, was in use up to the Early Bronze Age (Barros and Espírito Santo, 1997). Only one burial, that of an infant of about 7/8 years was recovered, in situ (Silva 1993). All the other bone remains were found commingled and no anatomical connections were identified. 50% of the sample bones belonged to non-adult individuals. Both sexes and all ages are represented.

Until 10 years ago, the finds were confined to the Estremadura region and the Algarve. Indeed, until 2006 there were no known Neolithic/Chalcolithic hypogea in the Alentejo. In 2014 António Valera (Valera, 2014b) suggested that the Portel Serra, which runs East-West across the inner Alentejo, South of Évora, was a sort of geographical border separating two different areas: the Évora plain and the Beja plain. Their geomorphological particularities and differences could help explain the choice of differentiated funerary solutions in each area: dolmens in the Évora region and the recently discovered negative structures of the Beja region, with rock-cut tombs and pits. These latter features will be considered part of the general megalithic funerary phenomenon. It is important to underline the way the "map" regarding subterranean funerary structures changed considerably over the last decade (Valera, 2012a) mainly due to long lasting contract archaeology projects undertaken especially in South Alentejo revealing pit graves and hypogea to be quite common funerary features in the Neolithic and Chalcolithic and inclusively in the Bronze Age, where the exclusivity of cist graves is now being replaced by a more diversified scenario with pits and hypogea maintaining an important presence as funerary architectures.

Work carried out at the Sobreira de Cima (Vidigueira) hypogea necropolis, located on the south side of the Serra de Portel was very quickly considered an exceptional context in this region (Valera, 2013). Indeed, as already mentioned, until then this kind of underground funerary structure was not known outside coastal regions. At Sobreira de Cima, 5 tombs were excavated (out of possibly 7 – the remaining two were considered as potential structures based on geophysical survey) after the site was severely damaged by major construction works. Only Tombs 1 and 5 were totally preserved. These tombs were mainly used for the collective, sequential, primary burial of adults of both sexes and non-adult individuals (although no under 3-year-olds were identified). The authors do not rule out the possibility of multiple burials nor of the secondary deposition of human bones. The bodies were laid directly on the floor of the chambers, normally in lateral decubitus and mostly with the heads facing the entrance of the tombs and sprinkled with red pigment. In some cases, the several depositions created accumulations of human bones with apparent specific organization (Tomb 5) leading the authors to talk about "internal secondary depositions" resulting from the deliberate internal organization of the funerary space and not from the bringing of bones from outside the tombs. What is more, the funerary ritual there seems to include the intentional association of sheep and goat phalanges to the human burials in Tombs 5. Here, 57 of these faunal remains were included in the big ossuary that covered the floor of the tomb (where an intentional organization of the human bones was identified) and in clear association with a concentrated area of human phalanges.

This pattern of disposal of the dead seems to be common in other recently discovered hypogea. In Serpa, Outeiro Alto 2 (Valera and Filipe 2010; Valera, 2012a; Fernandes, 2013; Silva et al., 2015) was discovered to be a large, complex archaeological area comprising several nuclei of negative structures built from the Late Neolithic through to the Bronze Age and including what is thought to be a small Chalcolithic ditched enclosure. Nucleus C yielded several pits and 3 Late Neolithic hypogea. Here, anatomical connections covered by an ossuary were identified in tombs H4/5 and H16/17. The collective nature of the depositions was attested in tomb H1. An MNI of 3 individuals was determined based on the primary deposition and ossuary found (Fernandes, 2013).

Vale Barrancas 1 is a vast hypogea necropolis (hypogea 1, 2, 3, 4, 5, 7 and 8) from the Late Neolithic, with a second phase of use in the Bronze Age. Bones were considerably altered by taphonomic phenomena making it difficult to reconstruct all the funerary rituals involved (Fernandes, 2013). In these graves the human bone spoils were recovered in a primary, collective context with the widespread use of red pigment over the human osteological remains, which included adults and non-adults. Among the latter, the age group most represented was that between 5-9 years old. The sexual diagnosis data suggest a similar proportion between individuals of both sexes.

Chalcolithic burials in hypogea sites seem to follow the same pattern. At Monte das Cortes 2 (Valera et al., 2014b), Structure 2 was a hypogeum with two phases of funerary use. Although the bones were found in a poor state of conservation, it was possible to determine the presence of an incomplete skeleton of a probable male adult, another incomplete and disrupted single deposition of an adult of undetermined sex. The remains of two non-adults (one of ± 4 years of age) were also recovered (Tomé et al., 2013). C14 dating places its use during the 2nd and the 3rd quarters of the 3rd millennium BC.

It is perhaps in Ferreira do Alentejo (Beja District) that the wave of new data of is most significant. Several funerary structures were uncovered associated to the large Porto Torrão ditched enclosure, and the physical limits of the site initially proposed by José Arnaud in the 80's are under revision due to these recent finds (Arnaud, 1982, 1993).

Monte do Carrascal 2 (Santos, 2010; Valera et al., 2014c) is one of these newly identified structures. Several very diverse contexts were excavated, including a partially excavated group of hypogea, distributed along a Chalcolithic ditch.

Work on the site was led by two different teams (Era Arqueologia and Dryas Arqueologia) and is not yet published. Nonetheless, preliminary results reveal that for Hypogeum 1 mostly primary depositions were taking place. There seems to also be intentional removal of specific body parts due to cleaning or rearrangement of the funerary space. Secondary depositions are also considered a hypothesis (Valera et al., 2014c).

1.3.4 Pits

These features are found across a wide time span in South Portugal and as would be expected their study reveals a great variety of funerary practices. In the area under study, the oldest examples recorded are at the Castelo Belinho site (Gomes, 2010; 2012) in western Algarve. In the 2nd half of the 5th millennium, a series of 14 pit graves of varying shapes were used for burials of adults of both sexes and non- adults. The site is considered a habitation area (some of the pits – 4 and 53 - could have been grain storage pits before their funerary use) and these burials probably took place under the floor of the houses. Pit 1 contained highly fragmented and scattered bone remains of an individual and was described by the authors as a fragmented body, resulting from the handling or dismemberment of human remains (Gomes, 2012, p.119).

In Castelo Belinho, primary depositions (Structures 38, 52 or 4) are present. Individuals are found normally in the flexed position, mostly lateral decubitus. There seems to be no specific orientation of the bodies. As expected with this period, the choice seems to be for invisibility of the funerary structures. The use of red pigment (probably ochre) was also recorded.

Sepultura 1 from the Atafonas site in Torre de Coelheiros, Évora district (Albergaria, 2007) seems to hold the same practice of commingled and rearranged bones in probably a slighter later period (Figure 1). According to author, this seems to constitute a rare case linking ancient Mesolithic funerary practices with the changes brought about by the Neolithic process. A large pit was uncovered within an Early Neolithic habitat. Under a layer sealed by stones, an ossuary containing the remains of at least 4 individuals was identified. Unfortunately, the biological information on the human remains is not clear, although the pit appears to contain adults and non-adults. Regarding possible age the author states "the majority of the individuals were probably not over 15 years ±36 months old and the rest were probably over 15 years old" (my translation). 22 teeth belonging to two overlapping maxilla (*sic*) belonged to an individual between 10 and 12 (± 36 months). No comment is made on possible sex diagnosis.

Pit burials have also been identified for the Late Neolithic. In Outeiro Alto 2 a young individual was found in primary position in a pit close to the Late Neolithic hypogea burials already mentioned (Valera and Filipe, 2012). The same is true of Ribeira de Pias 2 (Valera et al., 2014b) where one individual was found in primary, foetal position.

The burial at Mina das Azenhas 6 (Tomé et al, 2013; Valera et al., 2014b) is dated from the 3rd quarter of the 4th millennium (BETA 318380 – 4590±30 BP). The adult individual (sex diagnosis was not possible) was found in an uncommon position (ventral decubitus) and showed signs of possible perimortem disturbance (Tomé et al., 2013).

Two funerary pits from Torre Velha 3 (Alves et al., 2012; Coelho, 2015) were made up of a rectangular section and a flattened base, and contained individual burials. Skeleton [1998 = 2155] was found along one of the walls of the negative structure and in supine position; the [2015] skeleton of a male adult of between 30-50 years was lying on his right side in the centre of the pit. In both structures, stone rings were placed along the walls. Although the authors consider them Chalcolithic, the artefacts described for these negative structures (no plates, presence of carinated vases) could possibly place them in the Late Neolithic.

The great ditched enclosures of Perdigões and Porto Torrão also show the use of this pit burial practice for the Late Neolithic and Chalcolithic. Examples of mostly primary depositions can be found in Perdigões Pits 7 and 11, although some signs of body part manipulation were detected for the burial of individual 3 from Pit 11 (Valera et al. 2014a). Also, in sector Q, pit 16 and 40 were used for the deposition of hundreds of cremated human remains adding even more complexity to the already known funerary practices happening in this important site (Valera et al, 2014a). In Sector 1 in Porto Torrão (Santos et al., 2014) a pit burial (Pit 1250) of a young female was identified. Also in Sector 3 (West) in negative structure 29 a double burial of two females of around 65 years of age was identified. This burial was also considered Late Neolithic. Other pit burials in this area (Pits 3107 or 3168) held primary individual inhumations. Pit 3107 held the skeleton of a 30-50-year-old adult and Pit 3168 a non-adult between 8-15 years of age, with general masculine features. On top of this deposition a group of mixed bones was identified probably resulting from a secondary deposition. However, it must be stressed that these two pits have no chronological framework.

The remains from pit structures in four archaeological sites in the district of Beja were studied by Tânia Pereira (Pereira, 2014): Ribeira de S. Domingos 1 (Neolithic/Chalcolithic structures), Alto de Brinches 3 (Chalcolithic), Monte Vale do Ouro 2 (Chalcolithic/Bronze Age structures) and Misericórdia 1 (Bronze Age). The Bronze Age structures will not be taken into account here but are important to mention because they represent the subsistence of this form of burial through time.

The Late Neolithic/Chalcolithic structures contained multiple burials, although human remains were in a poor state. The position of inhumation varies from supine, lateral (right and left) and ventral decubitus and the orientations are diverse, without a pattern of reference. The MNI on the multiple burials is low, ranging from 4 (pit 97 and 102 at Monte do Vale do Ouro 2) and 6 (Ribeira de S. Domingos 1). At Monte do Vale do Ouro 2, traces of fire were found on two individuals exhumed from pit 97. This was confirmed by FTIR analysis. Regarding paleodemography data, there seems to be a slight predominance of females. Adults and non-adults were identified.

1.3.5 Tholoi Type Structures

A tholos tomb (plural tholoi) is a burial structure characterized by its false dome created by the superposition of successively smaller rings of mudbricks or, more often, stones and a last cover stone.

In formal terms, these tombs may be said to belong to the megalithic tradition of orthostatic funerary construction with a chamber and a corridor, (the atrium is only present in particular cases), but they nonetheless possess very specific architectural characteristics.

During the Chalcolithic, tholos type structures appeared as a very new architectural solution for receiving mortuary depositions. There appears not to have been a break with older forms of burial, which continue in dolmens, caves, rock shelters, pits, hypogea and in ditched enclosures (Garcia Sanjuán, 2006; Cardoso 2007). This type of construction also covers a shorter chronological period of use (Cardoso, 2007). Indeed, they only appear in the Portuguese archaeological record at the turn of the 3rd millennium, around 2900 BC.

Based on field work undertaken using modern methods, it is important to ascertain if there is any relationship between the new funerary structures represented by the “false dome monuments” and the social transformations occurring in the transition between the 4th and the 3rd millennium BC, which culminated in the new model of the Bronze Age. It is important to contextualize the variations in the burial ritual in fine detail, and also the reasons behind such different choices regarding treatment of the dead and of death, in contemporary ages.

The information referred to in this chapter was based on the initial survey conducted in 2000 (Valera et al., 2000) and mainly concerns the archaeological bibliography that accounted for the existence of about 60 monuments of this kind, distributed throughout the south of Portugal, with particular concentrations in the Lisbon Peninsula, Alentejo and Algarve hinterland. The funerary and anthropological data will be addressed in the discussion chapter, where comparisons are drawn between Tomb I and the other tholos/tholoi type monuments.

The last fifteen years has brought an avalanche of new archaeological data for Recent Prehistory, thanks to an exponential increase in contract archaeology mainly in the Alentejo areas, for where information for this period was extremely limited (Valera, 2012).

Some major public works related to the construction of the Alqueva dam (now completed) and the installation of a complex network of irrigation canals connecting the various parts of the Alentejo, have also brought new monuments to light. Before its interruption in 2012, the construction of the Baixo Alentejo highway network, also affected a part of the territory between Sines and Beja, passing through Ferreira do Alentejo and the Porto Torrão large ditched enclosure (Arnaud, 1982; 1993). Contract archaeological excavations performed in this area allowed the identification of very complex and important structures including the Monte Cardim 6 tholos (Figueiredo, 2011a; Valera et al., 2014c), Horta do João da Moura 1 and 2 (Pereiro, 2010; Corga et al., 2011), Monte do Pombal (Figueiredo 2011b) and Centirã 2 (Robles Henriques, 2013 a and b) performed with state-of-the art methodologies and techniques. In two cases, Horta do João da Moura 1 and 2, the job was carried out by two different teams, Era Arqueologia (Pereiro, 2010) and Dryas Arqueologia (Corga et al., 2011).

What is more, since that first approach in 2000 (Valera et al. 2000), several anthropological studies based on bones collected in tholoi and deposited in museum collections have been carried out. Although the specific archaeological context for these bones has been lost, these publications add valuable information for well-known tombs such as Pai Mogo I and Cabeço da Arruda II (Silva, 2002; 2012) and Praia das Maçãs (Silva and Ferreira, 2007), tombs for which the only available information in 2000 was the original publications with very little anthropological data. Moreover, in 2008 the archaeological and anthropological information on Monte da Velha 1 (Soares, 2008; Silva et al., 2008) was also made available, which is also true for the Cerro do Malhanito monument (Cardoso and Gradim, 2005).

As a result of this new mapping and complete literature review, a total of 97 possible tholos /tholoi type monuments were considered to exist in Portugal. To facilitate the systematization of the information collected, a form was created for each referenced monument, specifying the following:

- The location and / or geographical location;
- Type of architecture;
- Data on funeral rites;
- Paleodemographic elements;
- Available bibliography;

For the management of data an Excel, a database was created with a comprehensive listing of all the information collected at each site (Table 1).

The location of each monument was also mapped so the dispersal or spread of this type of monuments throughout the country could be easily perceived (Figure 2).

After closer analysis, 4 of these monuments were not considered to belonging to the tholos/tholos type category. Lousal 3 (Ferreira et al., 1955-57) and Monte Branco 2 (Ferreira et al., 1957) are both megalithic monument formed by a burial chamber of circular design and a short corridor facing east. Although repeatedly referred to as tholoi it is now thought that they are orthostatic dolmenic monuments, with no architectural indicators that suggest the presence of a false dome. The fact that Monte da Boiça 1 /Anta da Pata do Cavalo (Ferreira et al., 1957) also presented a circular layout led several authors to refer to this monument as tholos. However, an analysis of the configuration of the pillars and their arrangement rules out the possibility that it is a false dome grave. The Pia dos Mouros monument in the Minho region is identified as a tholos (Sarmento, 1970). It was, nonetheless, omitted from this category due to its unusual position, North of the Mondego valley and to the fact that there are no clues to its true architectural features. The monument of Chaparrinho was also excluded.

Some archaeological field surveys and preparation of regional archaeological charts have made it possible to relocate "lost" tholoi/tholoi type monuments or provide new dots on an ever-growing map.

The search for archaeological sites with information included and recorded as Tholoi in the DGPC (Endovélico) database (http://arqueologia.patrimoniocultural.pt) are Cerro do Moinho, Chabouco, Corte Cabreira 1, and Quinta da Lameira, for the Algarve region. Also, some entries are found in the same database with a few monuments set closer to the Alentejo coastline as is the case of Casa da Vinha Grande, Herdade das Antas and Monte do Paço. One new monument, Brejinho, is mentioned for the Ourique region, and one for the Estremadura, Pedreira do Campo. Although they are considered tholoi, for all these monuments the available information refers only to the identification of monuments with summary descriptions of architectures.

A further four monuments could only be registered as possible tholoi. They result from field surveys and were not excavated, making it extremely difficult to ascertain if they are in fact false domed structures. This is the case of the monuments of Corte de Baixo, Ronceiro, with very little information available on the Endovélico database. Monte do Branco 1, Perdigoa 1 and Ambrósio 6 were relocated by Manuel Calado in the Alandroal region (Calado 1993) although there is very little information about these Central Alentejo monuments. The same is the case for the Caladinho monument, in Redondo (Calado and Mataloto, 2001). As for the so-called tholos of Caparrosa, in Viseu, its localization and description make it difficult to define it as such.

Alcalar 14,15,16 and Poio 1 monuments belong to the great funerary context in Alcalar, Portimão in the Algarve (Móran and Parreira, 2004). These monuments are listed as tholoi but their identification results from geophysical survey and no more information is available regarding their specific architecture or funerary use. The Cabeça do Charrinho monument near Torres Vedras (Lucas, 2002) is also just a point on the map. For the monuments Torre dos Frades 1 and 2 there is very little information. Although Estácio da Veiga (1886/1889) describes them as tholoi, the text presents a number of inconsistencies that make it difficult to assign a specific architectural type to these structures. Folha das Barradas is included in the list of radiocarbon dates presented for prehistoric funerary structures from the Estremadura in Rui Boaventura's PhD thesis but it was considered an artificial cave (Boaventura, 2009, p. 217).

Finally, the case of the Samarra monument, in Sintra, Estremadura is not clear. The monument lacks stratigraphic context and the large number of human bones mixed up with bone, ivory and clay artefacts were interpreted as the result of the landslide of the monument to a secondary position, after its original location was disturbed (França and Ferreira, 1951). The nature of the archaeological finds, presence of stone masonry remains and the available C14 date led several investigators to consider it a tholos type monument (Boaventura, 2009; Sousa, 2016). An anthropological study was performed by Ana Maria Silva and colleagues (Silva et al., 2006), and although it only concerns part of the exhumed collection of bones it will be considered for this study.

Because of these doubts, the rest of this discussion will only consider the remaining 84 monuments and in this section, will center on the archaeological information, architectures, and chronologies. Indeed, without such information the understanding of the various funerary uses of these spaces and the individuals whose bones were deposited there cannot be understood. Information regarding what is known about the biology of these individuals and their mortuary practices will be discussed below (cf. Discussion chapter).

Work carried out on Tomb I and II the Perdigões, between 1997 and 2005 revealed the complete absence of evidence for any type of roofing structure and launched the debate on the true architectural morphology of these commonly designated tholoi or false-domed monuments.

It seemed that, when faced with certain funerary architectures rooted in the megalithic tradition (though less monumental and using lighter construction techniques), archaeologists assumed them to possess a vaulted dome, even though in many cases the archaeological record did not show any trace of this. Indeed, the detailed observations of the construction technique of Tombs I and II in Perdigões led to questioning as to whether this type of structure (tholoi) has been misidentified and generalized in the past. Contrasting with a previously accepted homogeneity regarding construction, the results obtained in Perdigões suggested that diversity should be considered in this type of funerary building and that, in many cases, "false dome monument" is not the exact description (Lago et al., 1998; Valera et al., 2000; Evangelista, 2004).

This comprehensive review of the available data on what has been considered a specific architectural type suggests that instead of assuming these monuments are tholoi, it is more correct to assume that they cover a range of architectural typologies and construction techniques, amongst which a false dome can sometimes be found. This is the case of Alcalar 7 (Veiga, 1889; Gonçalves, 1989; Parreira, 1996), Monge (although the rest of the architecture of this monument is quite unique) (Ribeiro, 1880; Zbyszewski et al., sd) and the dolmen at Vale Rodrigo 1 (Leisner, 1949). In many cases, such as S. Martinho 1 and 2 (Apollinario, 1896), Comenda 2 b, Farisoa 1 b, (Leisner and Leisner, 1951), Monte Velho (Viana et al., 1961), Malha Ferro (Viana et al., 1959; Viana et al., 1960) and Nora Velha (Viana, s.d.) considerable numbers of small stones were found inside the burial chambers and systematically interpreted as the result of the fall of possible domes. However, the lack of details, particularly reliable archaeological records, hampers interpretation as to their origin. In the absence of specific data on the constitution and stratigraphic position of these elements, it would be hasty, to relate them directly to false domes.

For some of the monuments there is not even any reference to the roofing system: Pai Mogo I (Gallay, 1973), Cabecinha Grande (Rocha, 1900), Folha das Barradas (Ribeiro, 1880), Agualva (Ferreira, 1953), Trigache 4 (Leisner e Ferreira, s.d.), Tituaria (Cardoso et al., 1996), Olival da Pega 2d e 2e, (Gonçalves, 1999b), Santiago do Escoural (Santos, 1967; Santos and Ferreira, 1969), Monte das Pereiras (Serralheiro, 1961), Monte do Outeiro (Viana and Ferreira, 1961a), Amendoeira Nova (Viana et al., 1959), Cerro do Gatão (Viana et al., 1961b), A–dos–Tassos (Viana et al., 1961b), Marcela (Veiga, 1886; Gonçalves, 1989), Arrifes (Veiga, 1886), Castro Marim (Zbyszewski and Ferreira, 1967), Eira dos Palheiros (Gonçalves, 1989), Alcalar 2, 3, 5, 6, (Veiga, 1889; Gonçalves, 1989; Parreira, 1997, Alcalar 8, 9, (Rocha, 1904; Gonçalves, 1989) e de Monte Velho 1, 2 and 3 (Rocha, 1911; Gonçalves, 1989).

In this work, therefore, any reference to tholos type monuments will concern a universe that includes classical false domed monuments but also others that possess similar features and can be considered part of the same architectural/construction technique, which is here denominated tholos type, even though for most of them it is hard to confirm the presence of any sort of vaulted roofing.

The primary function of these structures has also been a subject of discussion. Several investigators (Gallay et al, 1973, Soares, 2008) have questioned if these tholos type buildings served an initial purpose not related to practices involving the funerary deposition of human bones but with other activities also related to the ritual and symbolical world. In the case of the “pseudo-tholos” of Monte da Velha 1 (Soares, 2008) the issue is raised by the fact that no remains of a dome or a tumulus were identified on the site. Moreover, the total absence of any sort of human remains in the oldest layers of the monument, where only votive objects were recovered from the floor of the monument, pointed in the same direction. Human remains were, in fact, recovered from the top layers of the monument but correspond to a “Ferradeira” individual inhumation, dated from the end of the 3rd quarter of the 3rd millennium (Soares, 2008). Unfortunately, the Monte da Velha 1 monument is one of the few that has been excavated using modern excavation techniques excavation and so there are no other similar cases registered with which to compare it. Gallay et al. (1973) had made a similar suggestion for the Pai Mogo I monument, in Estremadura. Beingo one of the biggest tholos type monuments uncovered (definitely the one with the highest MNI), its architecture included in the chamber, what was interpreted by the archaeologists as an altar, used for the laying of offerings. The number of artefacts found in the monument is impressive but the interpretation of the site as a sanctuary previous to its funerary use must carefully looked at.

For Perdigões Tomb I, the question remains as to the purpose served by the internal compartment identified. The slab on the western side was found in situ and vestiges of another upright schist slab on the eastern side were identified. A possible third, which had been removed prior to the earlier depositions, was identified during excavation. Only the groove dug in the bedrock to support it was found. No human depositions were found inside this specific space and its original function remains unclear. It could have held the remains of a particular nature that may have not survived. There are no C14 dates for this oldest uncovered phase of use of the chamber in Tomb I. It is also difficult to relate the use of the atrium, which was used for the deposition of votive materials (12 arrow heads and stone vases) with the use of the chamber. The carbonized half-moon structure found next to these offerings points towards the use of this area of Tomb I for ritual practices which might or might not have been associated with the funerary use of the chamber.

There is one other monument, Herdade do Monte Velho, in Ourique, that shares the same feature (Viana et al., 1961c). It also comprises a totally orthostatic chamber and corridor with a compartment on the left side of the chamber built out of two schist slabs, forming right angles. The Marcela monument, in Vila Real de Santo António, is part of the group to which it is impossible to attribute a typology since it has been long destroyed and descriptions are contradictory (Veiga, 1886). Gonçalves (1989) suggested it may have been a tholos type construction to which a dolmen was attached, which being true would make it an absolute exception. The first descriptions do mention the existence of three internal compartments with slabs on the floor, like Herdade do Monte Velho.

The first publication on the funerary structures at Perdigões (Valera et al., 2000) questioned the idea, perpetuated in the archaeological discourse, which systematically included this type of funerary architecture in a specific constructive tradition, found in several cultures across the Mediterranean. This assumption probably has its roots in the Diffusionism concept that understood such architectures in the context of the arrival of metallurgist populations who built these “new” tombs (Valera et al, 2000; Evangelista, 2004; Sousa, 2016).

But the fact remains that when talking about tholos type monuments here we are referring to a constructing tradition that includes many variants that can be considered from different perspectives. In the present work, the proposition for tholos architecture (Gonçalves,1989) will be generically followed and listed monuments were divided into 5 main groups:

- Type 1 – Totally orthostatic structures. Semi subterranean structures partially excavated in the bedrock and entirely lined with flagstones.
- Type 2 - The chamber and passage are built in masonry. The chambers are built with layers of stone placed closer together as the vault tapers toward the top of the tomb.
- Type 3 – Mixed architecture. The chamber is built in masonry and the passage-way is orthostatic or vice versa.
- Type 4 – Monuments that cannot be included in any of the above categories. They possess a false dome but the architecture of the rest of the structure is different.
- Type 5 – Monuments that have been identified, but for which there is no information regarding architectural features.

Very close to the conclusion of this chapter (June 2016) a new architectural typology for tholoi was suggested by Ana Catarina Sousa (Sousa, 2016), in the tribute volume published for Victor S. Gonçalves, on the occasion of his retirement. It follows his 1989 categorization but adds some variations regarding the presence of segmented corridors and the presence of niches. Sousa also creates a second general category for composite monuments, found in association with pre-existing funerary structures that may be dolmens or hypogea. In Portugal, only the Reguengos de Monsaraz monuments (Olival da Pega 2b, Farisoa 1b and Comenda 2b fit the first category. For the latter there is one single example: Praia das Maçãs is the only Portuguese tholos type monument found attached to hypogea. It is not clear why this typological variation exists.

There is hence no doubt that the varied architectures of these monuments must be emphasized. The chambers may have internal compartments or side niches like Alcalar 3,4,7,9 (Veiga, 1886/1889); slabs may cover the floor of some chambers, as in Marcela (Veiga, 1886; Gonçalves, 1989), Monte do Pombal 5 (Figueiredo, 2011), Pai Mogo I (Gallay et al, 1973), São Martinho 1 and 2 (Apolinário, 1896) or only the passageway as in the case of Cabecinha Grande (Rocha, 1911) or Cerro do Malhanito (Cardoso and

Gradim, 2005). Passages or corridors may be long features, such as in Pai Mogo I or Alcalar 2, 3 and 4 (Veiga, 1889; Morán and Parreira, 2004), or short features such as the one described for Malha Ferro (Viana et al. 1959), Marcela and Castro Marim (Gomes et al., 1994). Around a quarter of these monuments also include an atrium (20/77). Examples are Perdigões Tombs I and II, Santiago do Escoural (Farinha dos Santos, 1967) annd the Tituaria monument (Cardoso et al, 1996).

Another interesting case regarding architectural variation in these structures is found in Monte do Outeiro (Viana, Ferreira, 1961a). In the publication, the archaeologists go to som lengths to analyse and describe the monuments architecture since it was found in pristine condition. In their opinion, the slabs found coating the walls of the chamber did not have a supporting function but worked only as a coating for the chamber. It was the whole negative structure cut into the bedrock for the chamber that served as a support for the dome.

There seem to be a geographical pattern in the distribution of these monuments across southern Portugal (Figure 2). Tomb I in Perdigões is geographically located in one of the several nuclei that can be found in the region, the only one where monuments attached to previous dolmens can be found. They share the same general architecture as the other monuments scattered around the Alentejo hinterland, basically Type 1. The other monuments around Central Alentejo are also built using the same technique and no masonry monuments are known east of the Beja district. It is in Central/Low Alentejo where there seems to be a contact zone between the above mentioned architectural tradition of orthostatic construction and the other, typical of the coastal lands of Estremadura and Algarve, where Type 2 monuments can be found. In fact, it is the Beja district where Type 3 mixed architectures can be seen: monuments with a masonry chamber and orthostatic corridor or vice versa, alongside exclusively Type 1 and Type 2 monuments (Centirã, Monte Pombal 5, Monte Cardim 6, Horta João da Moura).

Estremadura seems to have the biggest concentration of Type 2 monuments: the ones totally made up of masonry stone walls. But unlike the Alentejo hinterland, where up to now only one architectural type has been registered, in Estremadura and the Algarve the two typologies seem to exist together in the same geographical area.

The Algarve also seems to present two main groups. Alcalar and related monuments in the west and another, less well known group in the east.

The vast majority of known monuments are isolated in the landscape. Cases like the Alcalar or Monte Velho tombs located in Portimão, Algarve are grouped in necropolis and the same is the case for the tholos type monuments found associated to the great ditched enclosures, such as Perdigões and Porto Torrão. In Reguengos de Monsaraz, where Tomb I is located, tholos type monuments can be found attached to the corridors of previous orthostatic monuments, as observed for the Comenda 2b and Farisoa 1b monuments (Leisner and Leisner, 1959; Gonçalves, 1999) and in the Olival da Pega 2 complex (Gonçalves, 1999; Gonçalves, 2014).

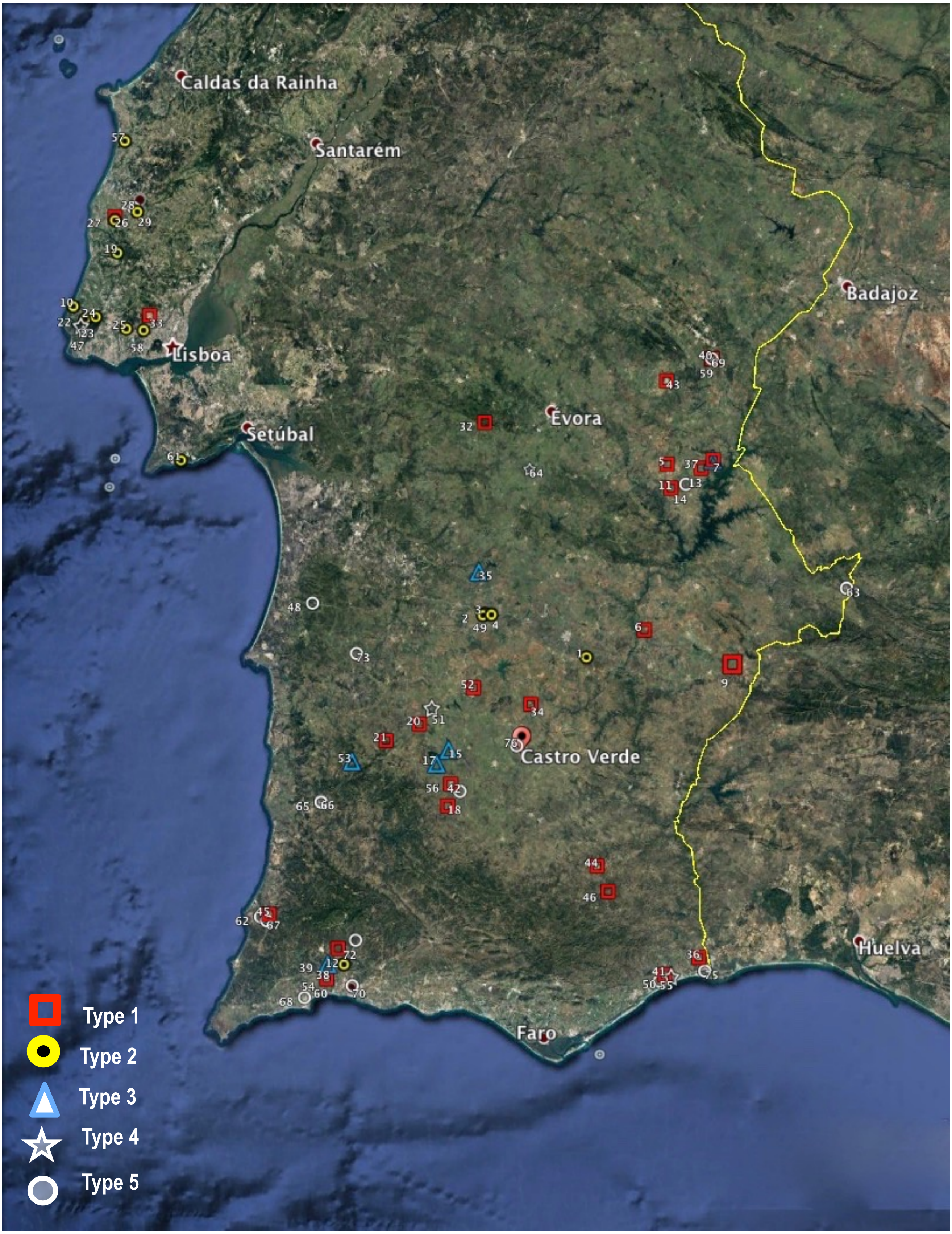


Figure 2 - Distribution of *tholoi* type monuments in southern of Portugal

Table 1 - List of identified *tholos* and *tholoi* type monuments from the south of Portugal

No	Monument	Location	Region	Type Arhitecture	Bibliography
17	A-dos-Tassos	Ourique	Baixo Alentejo	3	Viana et al., 1961b
25	Agualva	Sintra	Estremadura	2	Ferreira, 1953; Boaventura et al., 2016
12	Alcalar 2	Portimão	Algarve	1	Veiga, 1889; Leisner and Leisner, 1943; Morán and Parreira, 2004
12	Alcalar 3	Portimão	Algarve	1	
39	Alcalar 4	Portimão	Algarve	3	
39	Alcalar 5	Portimão	Algarve	2	
39	Alcalar 6	Portimão	Algarve	3	
38	Alcalar 7	Portimão	Algarve	3	
39	Alcalar 8	Portimão	Algarve	3	
38	Alcalar 9	Portimão	Algarve	2	Rocha, 1904; Gonçalves, 1989; Móran, 2014
12	Alcalar 10	Portimão	Algarve	? Corr 1	Veiga, 1889; Leisner and Leisner, 1943; Morán and Parreira, 2004
12	Alcalar 11	Portimão	Algarve	1	Rocha, 1911; Gonçalves, 1989; Morán and Parreira 2004
39	Alcalar 12	Portimão	Algarve	3	Rocha, 1911; Gonçalves, 1989;
39	Alcalar 13	Portimão	Algarve	3	Rocha, 1911; Gonçalves, 1989;
72	Alcalar 14	Portimão	Algarve	Geophysic survey	Morán and Parreira, 2004;
72	Alcalar 15	Portimão	Algarve	Geophysic survey	
72	Alcalar 16	Portimão	Algarve	Geophysic survey	
40	Ambrósios 6	Alandroal	Alentejo Central	Possible Tholos	Calado, 1993
No	Monument	Location	Region	Type Arhitecture	Bibliography
21	Amendoeira Nova	Odemira	Alentejo Litoral	1	Viana et al., 1959
41	Arrifes	VR Santo António	Algarve	1	Veiga, 1886
62	Barranco da Figueira	Aljezur	Algarve	5	http://arqueologia.igespar.pt/index.php?sid=sitios.resultados&subsid=52931&vt=152677
63	Barrancos	Barrancos	Baixo Alentejo	5	Zbyszewski and Veiga Ferreira, 1967
29	Barro	Torres Vedras	Estremadura	2	Pereira, 1946; Jalhay, 1946
22	Bela Vista	Sintra	Estremadura	3	Pereira de Melo et al., 1961
42	Brejinho	Ourique	Baixo Alentejo	5	http://arqueologia.igespar.pt/index.php?sid=sitios.resultados&subsid=2508625
31	Cabecinha Grande	Figueira da Foz	Litoral	1	Rocha, 1900
27	Cabeço da Arruda 2	Torres Vedras	Estremadura	2	Correia, 1914
43	Caladinho	Redondo	Alentejo Central	1	Calado and Mataloto, 2001
74	Caparrosa	Tondela	Centro	Possible Tholos	http://arqueologia.patrimoniocultural.pt/index.php?sid=sitios.resultados&subsid=2142153
65	Casa da Vinha Grande	Odemira	Alentejo Litoral	5	http://arqueologia.igespar.pt/index.php?sid=sitios.resultados&subsid=50619
36	Castro Marim	Castro Marim	Algarve	1	Zbyszewski and Veiga Ferreira, 1967

No	Monument	Location	Region	Type Arhitecture	Bibliography
14	Cebolinhos 2b	Reguengos de Monsaraz	Alentejo Central	5	Gonçalves, 2003; Gonçalves, 2014
6	Centirã 2	Serpa	Baixo Alentejo	1	Robles Henriques et al., 2013 a and b
15	Cerro do Gatão	Ourique	Baixo Alentejo	3	Viana et al., 1961b
44	Cerro do Malhanito	Alcoutim	Algarve	1	Cardoso and Gradim, 2005; 2007
68	Cerro do Moinho	Lagos	Algarve	5	http://arqueologia.igespar.pt/index.php?sid=sitios.resultados&subsid=48660
67	Chabouco 1	Aljezur	Algarve	5	http://arqueologia.igespar.pt/index.php?sid=trabalhos.resultados&subsid=119348&vp=2215610
30	Chaparrinho		Estremadura	Not a Tholos	
No	Monument	Location	Region	Type Arhitecture	Bibliography
13	Comenda 2b	Reguengos de Monsaraz	Alentejo Central	1	Leisner and Leisner, (1951) 1985; Gonçalves 1999; Gonçalves 2014;
45	Corte Cabreira 2	Aljezur	Algarve	1	http://arqueologia.igespar.pt/index.php?sid=trabalhos.resultados&subsid=118627&vs=52434
73	Corte de Baixo	Santiago do Cacém	Alentejo Litoral	Possible Tholos	http://www.atlas.cimal.pt/drupal/?q=pt-pt/node/263
46	Eira dos Palheiros	Alcoutim	Algarve	1	Gonçalves, 1989;
1	Estácio 6	Ferreira Alentejo	Baixo Alentejo	2	http://arqueologia.igespar.pt/index.php?sid=sitios.resultados&subsid=52419 Valera et al., 2014c;
11	Farisoa 1b	Reguengos de Monsaraz	Alentejo Central	1	Leisner and Leisner, (1951) 1985; Gonçalves 1999; Gonçalves 2014;
35	Folha da Amendoeira	Ferreira Alentejo	Baixo Alentejo	3	Viana, 1953
47	Folha das Barradas	Sintra	Estremadura	4?	Ribeiro, 1880
48	Herdade das Antas	Santiago do Cacém	Alentejo Litoral	5	http://arqueologia.igespar.pt/index.php?sid=sitios.resultados&subsid=50829
3	Horta João da Moura 1	Ferreira Alentejo	Baixo Alentejo	2	Pereiro, 2010; Corga et al., 2011; Valera et al., 2014c
49	Horta João da Moura 2	Ferreira Alentejo	Baixo Alentejo	2	Pereiro, 2010; Corga et al., 2011; Valera et al., 2014c
8	Lousal 3	Grândola	Alentejo Litoral	Not a Tholos	Ferreira and Cavaco, 1955-57
20	Malha Ferro	Ourique	Baixo Alentejo	1	Viana et al., 1960
50	Marcela	VR Santo António	Algarve	1	Veiga, 1886; Gonçalves, 1989
51	Messejana	Aljustrel	Baixo Alentejo	4	http://arqueologia.igespar.pt/index.php?sid=sitios.resultados&subsid=49774
23	Monge	Sintra	Estremadura	3	Ribeiro, 1880; Leisner, 1965
69	Monte Branco 1	Alandroal	Alentejo Central	Possible Tholos	Viana and Dias de Deus, 1957; Calado, 1993
47	Monte Branco 2	Grândola	Alentejo Litoral	Not a Tholos	http://arqueologia.igespar.pt/index.php?sid=sitios.resultados&subsid=52323
2	Monte Cardim 6	Ferreira Alentejo	Baixo Alentejo	2	Figueiredo, 2011a; Valera et al., 2014c
45	Monte da Boiça 1/Pata Cavalo	Grândola	Alentejo Litoral	Not a Tholos	Veiga Ferreira and Cavaco, 1955-57
No	Monument	Location	Region	Type Arhitecture	Bibliography
9	Monte da Velha 1	Serpa	Baixo Alentejo	1	Soares, 2008
34	Monte das Pereiras	Beja	Baixo Alentejo	1	Serralheiro and Andrade, 1961
52	Monte do Outeiro	Aljustrel	Baixo Alentejo	1	Viana et al., 1961a

No	Monument	Location	Region	Type Arhitecture	Bibliography
53	Monte do Paço	Odemira	Alentejo Litoral	3	http://arqueologia.igespar.pt/index.php?sid=sitios.resultados&subsid=54118
4	Monte do Pombal 5	Ferreira Alentejo	Baixo Alentejo	2?	Figueiredo, 2011b; Valera et al., 2014c
18	Monte Velho	Ourique	Baixo Alentejo	1	Viana et al., 1959
54	Monte Velho 1	Portimão	Algarve	1	Viana et al. 1953; Gonçalves 1989; Morán and Parreira, 2004
54	Monte Velho 2	Portimão	Algarve	1	
54	Monte Velho 3	Portimão	Algarve	1	
55	Nora	VR Santo António	Algarve	5	Veiga, 1891; Marques (1995).
56	Nora Velha 1	Ourique	Baixo Alentejo	1	Viana et al., 1959; Viana, s.d.
7	Olival da Pega 2b	Reguengos de Monsaraz	Alentejo Central	1	Gonçalves, 1999; Gonçalves, 2014
37	Olival da Pega 2d	Reguengos de Monsaraz	Alentejo Central	3	
7	Olival da Pega 2e	Reguengos de Monsaraz	Alentejo Central	1	
57	Pai Mogo I	Lourinhã	Estremadura	2	Gallay et al., 1973
58	Pedreira do Campo	Amadora	Estremadura	2?	http://arqueologia.igespar.pt/index.php?sid=sitios.resultados&subsid=50814
59	Perdigoa 1	Alandroal	Alentejo Central	Possible Tholos	Calado, 1993
5	Perdigões Tomb I	Reguengos de Monsaraz	Alentejo Central	1	Lago et al., 1998; Valera et al., 2000; Valera et al., 2014
5	Perdigões Tomb II	Reguengos de Monsaraz	Alentejo Central	1	
52	Pia dos Mouros	Póvoa do Lanhoso	Minho	Not a Tholos	Sarmento, 1970; http://arqueologia.patrimoniocultural.pt/index.php?sid=sitios.resultados&subsid=52193
No	Monument	Location	Region	Type Arhitecture	Bibliography
70	Poio 1	Portimão	Algarve	Geophysic survey	Morán and Parreira, 2004
10	Praia das Maçãs	Sintra	Estremadura	2	Leisner et al., 1969; Silva and Ferreira, 2007
60	Quinta da Lameira	Portimão	Algarve	5	http://arqueologia.igespar.pt/index.php?sid=sitios.resultados&subsid=52419
61	Roça do Casal do Meio	Sesimbra	Estremadura	2	Silva e Ferreira, 2007.
76	Ronceiro	Castro Verde	Baixo Alentejo	Possible Tholos	http://arqueologia.patrimoniocultural.pt/index.php?sid=sitios.resultados&subsid=178918
71	Samarra	Sintra	Estremadura	Possible Tholos	França and Ferreira, 1958; Silva et al., 2006
32	Santiago do Escoural	Montemor-o-Novo	Alentejo Central	1	Santos, 1967; Santos and Ferreira, 1969
24	São Martinho 1	Sintra	Estremadura	2?	Apolinário, 1896; Leisner, 1965
24	São Martinho 2	Sintra	Estremadura	2?	Apolinário, 1896; Leisner, 1965
28	Serra Da Vila/ Cabeça Charrino	Torres Vedras	Estremadura	Possible Tholos	Lucas, 2002
26	Serra das Mutelas	Torres Vedras	Estremadura	1?	Correia, 1914
19	Tituaria	Mafra	Estremadura	2	Cardoso et al., 1996
75	Torre dos Frades 1	VR Santo António	Algarve	5	Veiga, 1886;

No	Monument	Location	Region	Type Arhitecture	Bibliography
75	Torre dos Frades 2	VR Santo António	Algarve	5	
33	Trigache 4	Odivelas	Estremadura	1?	Leisner e Ferreira, 1961
64	Vale Rodrigo 1	Évora	Alentejo Central	4	Leisner, 1949
66	Vila Formosa 2	Odemira	Alentejo Litoral	5	Serra et al., 2014)

The general orientation for these monuments is more homogenous (Hoskin, 2001). Of the 84 monuments studied for this chapter, there was no information regarding orientation for 32 (38%) of them. Eastern orientation is described for 16, 6 % (14/84) and most of the remaining monuments are divided between a southeastern orientation (27,1% - 22/84) and a northeastern one (13,1% - 11/84). Two strange cases are Monte Velho 1 (Rocha, 1911; Gonçalves, 1989), in Portimão, and Trigache 4 (Leisner and Veiga Ferreira, 1961) in Odivelas, which seem to show a southwestern orientation of the corridors, and Serra das Mutelas (Correia, 1914), also in Estremadura, which presents a northwestern orientation.

The data are very scarce for architectural design and construction techniques and there are many questions still to be answered regarding the temporality of these false domed monuments.

The examples of the "attached" monuments of Farisoa 1b and Comenda 1b, in Reguengos de Monsaraz, illustrate the idea that their construction generically succeeds dolmens in time (Leisner, 1985). The available dates show that the use of these monuments for funerary depositions occurred throughout the 3rd millennium BC as can be seen in Table 2 and Figure 3. This list of dates only considers monuments with a definite architectural description, and sites like Folha das Barradas, although dated [Beta-234135 - 2790-2610 cal BC σ (Boaventura, 2009)] are left out.

The Castro Marim date must be looked at carefully. It results from a modern dating of an old excavation and it could be argued that the specific bone context is not accurately known.

In his Phd thesis, Rui Boaventura disregards the Cabeço da Arruda II date, essentially due to the real suspicion of possible mixing with bone remains from Cabeço da Arruda I monument during field work, or after their deposit in the Museum (Boaventura, 2009, p. 344).

Speaking of the Estremadura monuments, the same author pointed to the 3rd millennium BC as the period when tholos/tholoi type monuments arise. He summarizes the appearance and peak of use of this type of tomb in the first half of the 3rd millennium BC, although some seem to be in use until the second half of this millennium, though with an apparently lower number of depositions (Boaventura, 2009, p. 343).

The same seems to be the case with the Southern monuments. The Reguengos group (Tomb I and II from Perdigões and OP2b appear at the turn of the 3rd millennium and are in use until the middle of the millennium. Later uses of these funerary structures are known for Tomb II (Perdigões) in the third quarter of the 3rd millennium (when Tomb I and OP2b seem to no longer be in use) and that is also the date for the individual burial identified at Monte da Velha 1, considered by António Monge Soares (Soares, 2008) as a posterior use of a monument that would not possess an original funerary purpose. The Centirã monument has its first known funerary use around the middle of the 3rd millennium although the team led by F. Robles Carrasco considers the hypothesis of a much earlier construction around the turn of the 4th to the 3rd millennium BC (Robles Henriques, 2013b, p. 348).

Other dates show the possible reutilization of these monuments in the Late Bronze Age/Early Iron Age or even later, as happens with Centirã 2 when the tholos seems to have been used (in the last quarter of the 2nd millennium BC) for two secondary burials.

Although chronological data are still scarce, at this point in time, it seems clear that at least the construction of these monuments did not happen after the end of the third millennium, when the Neolithic belief system seems to have collapsed.

Table 2 - Radicarbon dates for tholoi type structures in Portugal

Site	Date Ref.	Date BP	Date cal 2 σ	Samples type	Bibliography
Castro Marim	OxA 5441	4525 ±60	3370-3030 2970-2930	Tibial remains from tomb	Gomes et al. ,1994
Centirã 2	Sac-2791	3940	2497-2204	Oss. 1 - SU 12	Robles et al. ,2013b
	Sac-2790	3900	2469-2205	Burial 2 - SU 13	
	Sac-2792	3790	2457-2077	Bones - SU 14	
	Sac-2782	3760	2404-2058	Burial 4 - SU 14	
	Sac- 2796	3710	--	Burial 1 - SU 12	
	Beta-331980	3680±30	--	Burial - SU 12	
	Sac-2788	3810±80	2179-1957	Red. 1- SU 7	
	Sac-2789	2950±80	1392-938	Red. 1 - SU 10	
Tituaria	Ox A 5446	3995±65	2850-2820; 2660-2640; 2620-2320	Human bone group H27	Medeiros, 1996
OP2b	ICEN 956	4180±80	2920-2500	1st Dep. Level Level 7 Chared bones/charcoal	Soares, 1999
	ICEN 955	4290±100	3290-2610	2nd Dep. Level Level 6 Chared bones/charcoal	
	ICEN 957	4130±60	2880-2490	3rd Dep. Level Level 5 Chared bones/charcoal	
Monte da Velha 1	Beta - 194027	3900±40	2479-2280 (0.97096)	Human Bone	Soares, 2008
Perdigões - Tomb I	Beta-327750	4030±40	2836-2467(95.4)	SU 173 Human bone	Valera et, al., 2014
	Beta-327748	4060±30	2840-2482 (95.4)	SU 93 Human bone	
	Beta-327747	4130±30	2872-2582 (95.3)	SU 84 Human bone	
	Beta - 311480	3990±30	2570 - 2460	SU 175 Human Bone	Personal Information Ana Maria Silva and António Valera
Perdigões - Tomb II	Beta-308789	3840±30	2459-2202 (95.4)	SU 232 Human bone	Valera et, al., 2014
	Beta-308791	4090±30	2860-2498 (95.4)	SU 458 Human bone	
	Beta-308792	3890±30	2469-2290 (95.4)	SU 429 Human bone	
	Beta-308793	3970±30	2575-2350 (95.3)	SU 231 Human bone	
Agualva	Beta-239754	4110±40	2880-2570 (94,3) 2520-2500 (1,1)	Human Femur unknown provenance	Boaventura, 2009 Silva, 2002 Silva, 2002
Pai Mogo 1	UBAR -539	4130±90	2900-2480	Human Bone	
	Sac 1556	4250±50	3100-2570	Human Bone	
	Sac-1782	4100±60	2880-2490	Human Bone	
Alcalar 9 - Alc 9 604	Beta - 316624	3730±30	2205-2032	Human Bone	Moran, 2014 (Sousa, 2016)
Cabeço da Arruda 2	UBAR 538	4230±100		3045 – 2555 cal BC 3090 - 3055 cal BC 2535 – 2495 cal BC	Silva, 2002

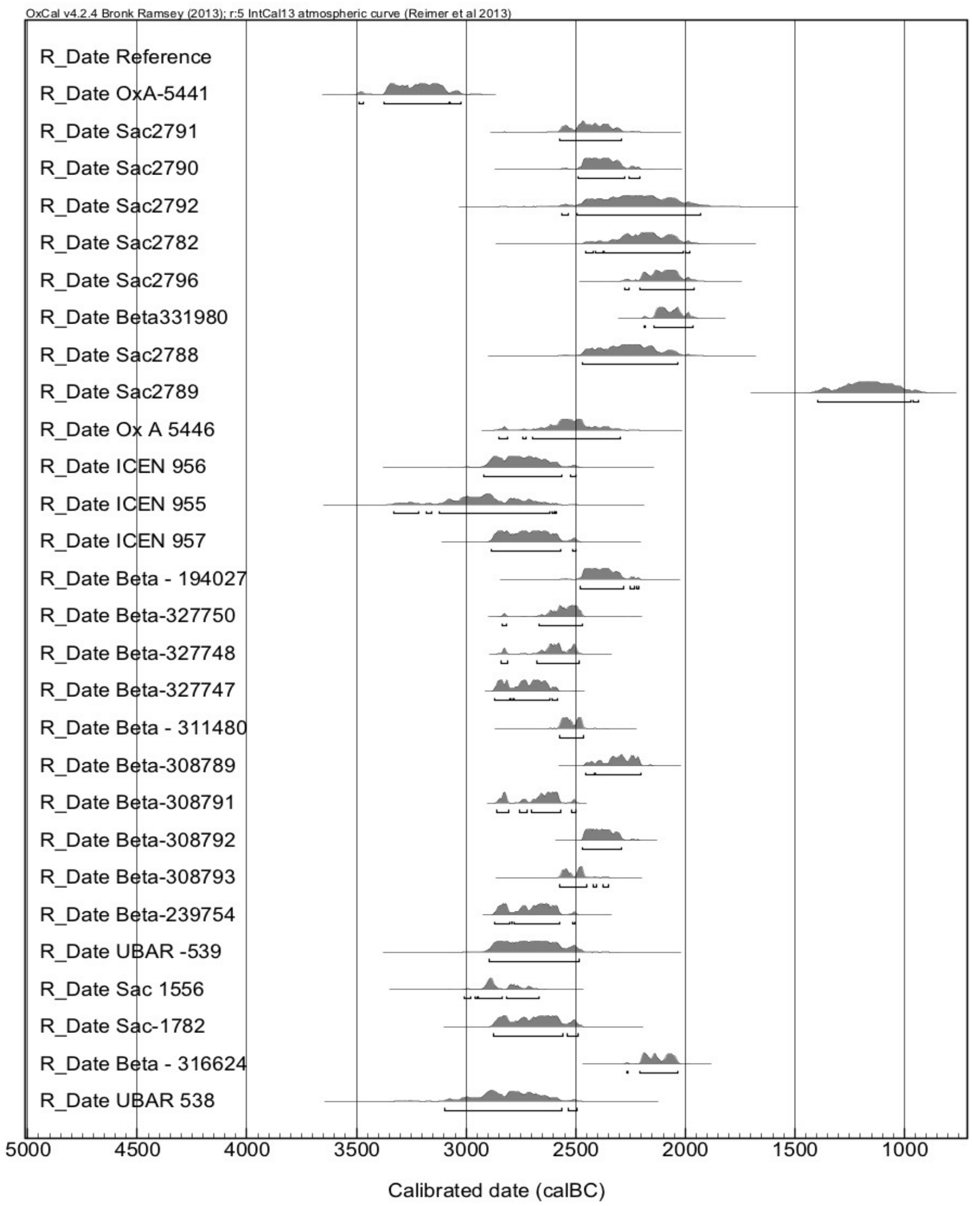


Figure 3 - Radiocarbon dates based on human bone for *tholos* type monuments in Portugal.

1.3.6 Ditched Enclosures

The emergence in the archaeological record of enclosing phenomenon began to be the subject of more thorough and systematic studies some thirty years ago (Burgess et al., 1988). This process was led by the Anglo-Saxon school in an attempt to understand what is understood as a pan-European manifestation, which spreads from Central Europe from the beginning of the 6th millennium BC on the Lower Danube and in the Carpathian Basin to the fringe of the Atlantic west coast of Europe (Darvill and Thomas, 2001). Ditched enclosures appeared in various parts of Europe at different times. The tradition continued through the last part of the Neolithic before the Bronze Age, which is called Late Neolithic in some contexts, and Copper Age or Chalcolithic in others. In the areas of Central-Western Europe where ditched enclosures were built their chronology extends from approximately 5500 BCE in Central Europe to the last few centuries of the 3rd millennium BCE in regions such as Iberia and Britain, that is between 7500 and 5000 years ago (Whittle 2014; Ard and Pillot, 2016)

The first major interpretative approaches to the enclosing phenomenon in Europe (Whittle, 1977) did not include sites in southern Europe (including the Iberian Peninsula) where the archaeological discourse was dominated by the study of the so-called "fortified settlements" that dominated peninsular archaeological research about the so-called Chalcolitization process, until ditched enclosures started to make their appearance about 20 years ago. Despite the differences between the two types of enclosures, discussed below, on a macro-scale they can be looked at as being part of the enclosure phenomenon (Jorge, 1994).

Prehistoric enclosures are sites that begin to manifest very clearly in the European landscape from the Early Neolithic period and are essentially characterized by the presence, in all cases, of delimiting mechanisms of circular or sub-circular shape, resorting to several architectural devices that can differentiate at least in their formal aspect, as ditches dug into the bedrock, banks, walls, or any other type of barrier. These various architectonic features can occur or be found together (Jorge, 2002; Márquez Romero, 2007; Márqez Romero and Jiménez-Jáimez, 2010; Valera, 2012b; Valera, 2013 a and b; Valera, 2016) although in the specific case of Portuguese realities, this kind of mixed architecture has only been registered in Monte da Ponte (Kalb and Hoch, 1997). The geophysical surveys carried out at Monte da Ponte confirm the presence of a solution where apparently six concentric stone wall lines of circular tendency are surrounded by two ditches. The problem with assuming a mixed architecture for this site comes from the fact that, without further work, there is no way of knowing if the different constructions are contemporaneous.

As a European phenomenon, enclosures present great variability in architectures, geographical and topographical implantation, base designs and dimensions and in chronology (Valera, 2013a). Indeed, although these structures share certain formal characteristics and can be read at a very general level as constructed spaces for communal use, they no doubt cover an overwhelming range of social uses within their local and regional contexts. For what is today the Portuguese reality, these differences also become substantial when a comparison is made between walled enclosures and ditched ones, the two types of enclosure found in the archaeological register.

Walled enclosures have a longer history in the story of Portuguese archaeology than ditched ones, although the latter are one of the most common architectures known for European Prehistory. In fact, their nature and function has been continuously discussed in the prehistory of Western Europe but only relatively recently has the theme of ditches entered the Iberian archaeological register and investigation (Márquez Romero, 2007; Valera, 2013a). Indeed, their known number has risen from a mere 5 (known in 1996) to an impressive 67, identified not only through fieldwork but also by aerial prospection and photography (Valera, 2013 a and b; Valera and Pereiro, 2013). The great majority of these are located in the interior of the Alentejo and only around 10% of the known sites of this kind have been identified outside of this area. Although this situation can probably be explained through the lack of wide scale archaeological investigation and prospection, the few exceptions were identified in the Estremadura, but with only a few very badly characterized examples, as is the case of the Gonçalvinhos site (Sousa 2010) or Santa Sofia (Pimenta et al., 2013). The remaining 4 identified ditched features are found scattered from the very south of the country, in Western Algarve as is the case of the exceptional site of Alcalar (Morán, 2010), to the North coast of Portugal where the Forca enclosure, Maia (Valera and Rebuge, 2008) was excavated. In Central Portugal two sites have been identified until now: Senhora da Alegria (Coimbra), where a small ditch was dated back to the Early Neolithic (Valera et al., 2013c) and Santa Bárbara in Sabugal (Perestrelo and Osório, 2005).

The story of investigation of walled enclosures, on the other hand, goes back to the end of the 19th century in the Estremadura region, where the largest concentration of walled enclosures is to be found (Gonçalves et al., 2013). Indeed, for the centre and South of Portugal walled enclosures are found sharing the same basic geographic areas as ditched ones but with considerable differences in local density. The Lisbon and Setúbal peninsulas are thus home to the majority of these realities: large sites like Vila Nova de São Pedro, Leceia or Castro do Zambujal but also other smaller features, as is the case of Olelas and Penedo do Lexim. Despite a long list of identified sites throughout the last century in this area, the great majority of them are badly characterized with an out-of-date and insufficient archaeological record.

Both walled and ditched enclosure types present what are considered to be circular shapes with one or more concentric lines. Typologies and sizes of these sites can be highly variable. Portuguese ditched enclosures can range from a relatively small size, like Cabeço do Torrão, in Elvas (Lago and Albergaria, 2001), with a 50m diameter, or Santa Vitória, in Campo Maior (Dias, 1996), the first of the sort to be identified in Portugal (Dias, 1996) to sites that cover several tens of hectares, like the Porto Torrão enclosure in Ferreira do Alentejo (Valera and Filipe, 2004). The analysis carried out would allow an estimate of its total area, which could range from 50 to 100ha (Arnaud, 1982 and 1993), approximately the size of its Spanish counterparts of La Pijotilla in Badajoz, about 1 km in diameter (Hurtado, 1995a: 62), or Marroquies Bajos, which by 2000 BC had a walled extension of about 340,000m² (Zafra de La Ponte et alli, 1999: 82). Valencina de La Concépcion, in Seville, whose total ground plan is unknown, presents a dispersion of material of more than 300ha (Ruiz Mata, 1983: 184; García Sanjuán, 2013). The Perdigões enclosures also fit into this last category (Lago et al. 1998; Marquez Romero et al., 2011). The dimensions and morphologies of the ditches also vary, not only in the comparative analysis between sites (the maximum width of ditch 3 from Marroquies Bajos is 22 m, while in Cabeço doTorrão it is not more than 1.5 m), but also in the analysis of each specific site. The aerial photography of Perdigões and the several structures intervened clearly demonstrates the differences of size between the several ditches that compose the enclosure. The section of these negative structures may vary between U and V shapes. Nonetheless, and in the light of the dynamics that we can already perceive for places like Perdigões, authors such as Valera (Valera et al.,2014d) point to the intermittence of the lives of many of these sites that were most probably subject to periods of abandonment and reconstruction. These dynamic processes can only be perceived if the final ground plan of these sites, available to us nowadays through geophysics and aerial photograph, is observed and may lead to evolutionary and linear occupational interpretations (Valera e, 2014d).

Their topographical setting is also highly variable. The big enclosures seem to be preferentially located in low zones, of water-abundant alluvial peneplains. In the cases of Porto Torrão (Arnaud, 1983 and 1993), Monte das Cabeceiras 2 and Salvada (Valera and Pereiro, 2015) in Portugal, and La Pijotilla in Spain (Hurtado,1995; 2008) the perimeter of the ditches even surrounds waterways. This situation contradicts a stereotyped view of the Chalcolithic settlement, which, for reasons of a predominantly defensive nature, presupposes the occupation of high places with a good command of the landscape. On the other hand, in smaller sites such as Cabeço do Torrão or Santa Vitória, they occupy slightly higher areas, set on small flattened heads.

Walled enclosures mostly occupy higher points in the landscape such as spurs or steep cliffs, organized in one or more lines of walls accessed through gates although several construction solutions are present. Some authors also suggest the existence of towers (Gonçalves et al. 2013; Soares, 2013). All these observations are nonetheless the result of very partial data since the great majority of the identified sites are not fully excavated or even excavated at all.

Regarding specific chronology studies, the first attempts to systematize information happened very recently (Valera, 2013a and b; Valera et al, 2014b) revealing that, very much what is known for the rest of Europe, Portuguese ditched enclosures have a long-lasting presence in the archaeological record at least since the Early Neolithic, as has been recorded for the Senhora da Alegria site, near Coimbra. This site was re-occupied around the Middle Neolithic. The oldest ditch from Perdigões is also dated to this period, the 2nd quarter/ middle 4th millennium BC (personal information from António Valera) and Valera (2013a) suggests the Gonçalvinhos enclosure from Estremadura could also belong to this period. Some ditched enclosures appear around the late Neolithic and do not survive after the turn of the 4th to the 3rd millennium, when the ditched enclosure phenomenon seems to become generalized, specially in the Alentejo. Sites like Perdigões, for example, continue throughout the whole of the 3rd millennium with ever-growing dimension and complexity. The 3rd millennium is the time for the construction of large ditches and large sites although many other cases show the making of other ditched enclosures with smaller designs, and variable sizes and shapes. Nonetheless, it seems clear at this point of the investigation on this theme that the ditched enclosure phenomenon has its major expression in the Late Neolithic and Chalcolithic becoming ever more complex reaching, regarding size, impressive dimensions, although they do not go beyond the end of the 3rd millennium. Walled enclosures, on the other hand, seem to be in use for a shorter period of time, appearing in the archaeological record in the first centuries of the 3rd millennium (2900-2800 AC) and living relatively short lives until their disappearance in the 3rd quarter of the 3rd millennium (Gonçalves et al., 2013; Valera, 2015).

Research into this theme is still recent and specific contextual information on most of the known sites is missing, thus leaving investigators with several research problems. Indeed, the need to understand the enclosing phenomenon based on the contextual uniqueness of each site, but at the same time integrating it into regional systems, leads to more general questions as to their purpose and meaning (Jorge, 2003). Also, as has been underlined by various authors from the very beginning of investigation into this theme, the fact that many of these enclosures, especially the ones with long periods of use, underwent numerous transformations and alterations throughout their life indicates also possible parallel changes in meaning and setting (Jorge, 2003; Valera, 2003). In the case of Perdigões, which is the basis for this work, the final global image that reached us in 1996 is the result of over 1500 years of use of those specific spaces, a palimpsest of actions materialized in architectures and specific plans.

Thus, the beginning of the 21st century brought about a huge transformation in the peninsular archaeological map, with an exponential increase in identified prehistoric sites (including ditched enclosures). This fact does not only translate into the accumulation of points on the map but also leads to a wider questioning of the enclosure phenomenon.

The first interpretations for ditched enclosures categorized them as fortified settlements, an explanation that was based on the traditional explanation for the walled enclosures, which still prevails in some academic mcontextseans. The first interpretation for Perdigões (Lago et al., 1998) saw it as a settlement surrounded by ditches (with possible defensive/draining functions) and integrating, within its limits, a specific necropolis area where Tomb I was set. The implantation of these sites in flat zones, without any kind of landscape obstacle, seems to substantially reduce their defensive capacities. However, the alternative explanation of the ditches as mere mechanisms of water conduction is also reductive and does not justify the degree of complexity that these enclosures reached.

The further important differences noticed between the two kind of features (walled and ditched) soon began to be noticed (Valera, 2012a; 2013a) and interpretations started moving away from this more functionalistic approach or even the materialistic one, where enclosures were understood as monumentalized settlement sites built by hierarchical communities, in which elite groups would be able to recruit enough manpower to implement such large scale work, although there is limited direct evidence of specific individuals possessing socially valuable items. The macro villages worked as centers of regional power and they would have access not only to local goods, but also to exotic materials. The smaller settlements identified in the same territory would be under the control of larger ones (Díaz-del-Río, 2004a; 2004b; Márquez-Romero, 2007; Díaz-del-Río, 2013). Places like La Pijotilla, located on the other side of the Guadiana river in Tierra de Los Barros, Badajoz, and presenting several formal similarities to Perdigões was considered to be the center of a politically conneced territory of about 60 by 30 km of area. The agricultural wealth of the region where the site is implanted, Tierra de los Barros, would make its defense necessary (Hurtado, 1995). A settlement network would then have been formed in which the fortified settlements would protect the western border of the territory (the most unprotected area), erecting the walls, not for the defense of each site but for the protection of a whole territory. In its interior zone, smaller settlements would be in use, occupying flat defenseless zones, and the central aea of the region, La Pijotilla, whose agglutinating character would probably stem from its religious aspect rather than its political or economic importance (Hurtado, 1995a: 61 - 68). The attribution of strategic importance to La Pijotilla as a possible religious center is based on the analysis of its ideotechnical component of a religious nature, which seems to be composed of characteristic elements seen throughout the south of the Iberian Peninsula, making up the largest known collection for any enclosure of this kind. This role is considered sufficiently valid as a mechanism to regulate social relations between communities in the region and, according to the author, would explain, the implantation of the site in a place without any strategic or defensive importance.

However, authors such as Díaz-del-Río (2004b) argued that the variations in size, chronology, topographic position and variations in other features of these sites cannot be explained simplistically and that interpretations should be processed on the basis of contextualized regional data. The concepts of "dwelling" and "building developed through the work of Tim Ingold (1996; 2000) inspired investigators such as Susana Oliveira Jorge (1994, 2003) and her innovative work for the understanding of the walled enclosure phenomenon. Ingold's ideas on how people organize the world around them through architecture, a concept involving the idea that architecture involves predesign and previous thought, was imported and used in archaeological studies of the prehistoric past and opened the way for new theoretical approaches regarding these sites as places of meeting, places with a strong identity character for the performance of a diverse set of meaningful social actions (Valera, 1997; 2007;2013a).

Today, an important debate is still going on between the more materlistic approach to these sites and alternative ones that focus on the important differences between enclosures surrounded by ditches and walls. The vast majority of ditched enclosures for which an integral ground plan is available show that they are built based on specific cosmological prescriptions following astronomical orientations. The pattern of orientation for the enclosure doors to the summer and winter solstices, for example, in sites like Perdigões, Santa Vitória or Xancra (Valera 2013a) reveal a strong symbolic and ritual tendency behind their design, which must be taken into account for their understanding. Unlike walled enclosures, most ditched enclosures show at least a few pits within the enclosed space or in the surrounding area. At certain sites the number of pits is very high, in the range of hundreds or even thousands (Perdigões, Porto Torrão). It is rare, nevertheless, to find exterior structures associated to ditches and pits as it is to find structures outside of the exterior limits of the enclosures. The nature of pit fillings is in many cases very similar to what is recovered from the filling of ditches: cultural and natural material remains, including ceramic sherds, flint tools and knapping waste, ash and other organic material like charcoal, faunal remains and human bones, which seem to result from deliberate and dynamic anthropic actions involving a symbolic meaning. So their formation does not result exclusively from random processes of sedimentation, but from intentional depositions regulated both by global social prescriptions with variable and autonomous meanings.

This brings us to one of the most interesting features of these large enclosures which can be considered an essential fact for understanding the meaning of these places: the recurrent existence of funerary structures within the limits defined by the ditches and the relation between Portuguese enclosures and specific mortuary rites. This is just one more piece of this wider mosaic of practices involving collective and sequential use of spaces for the deposition of human bones. The enclosure/enclosing phenomenon is yet another materialized aspect of this way of being-in-the world and the interaction between funerary behaviours and the practice of enclosing is still an area in which there is much to be discovered and many questions to be answered.

Although it is now clear that this interaction between enclosures and funerary practices starts much earlier, (sometime around the middle of the fourth millennium, at least in Perdigões), this correlation seems to increase significantly in the 3rd millennium BC, even in enclosures with an older origin.

Starting in the first quarter of the 3rd millennium, several funerary structures and bone depositions began around or inside the ditched enclosures of the southwest Peninsula as has been mentioned in the description of some of the funerary structures in the previous sub chapters. Although this work is centered mainly on what is presently today Portuguese territory, in the case of ditched enclosures, it is useful to resort to well-known examples from the other side of the border.

In the case of the already mentioned La Pijotilla site, two funerary chambers with respective access corridors (T 1 and T 3) are unified through a common corridor section that interconnects them, defining a double V-shaped structure (Hurtado, 1995, 1999). These are tholos type monuments, excavated in the local, soft rock that was also used for the construction of the false domes. A radiocarbon date was obtained for the main level of Tomb 3 which provided the date of 4130 ± 40BP-2865-2595 cal to 1σ (Beta-121143) (Hurtado, 1999: 56). A full anthropological study of the fragmented skeletal collections derive from Tomb 3 at La Pijotilla consisting of 283,329 human bone and tooth fragments, MNI= 178 was performed by Marta Díaz-Zorita Bonilla (2013). The author tried to understand the relationship between Copper Age social differences and funerary patterns. The results obtained showed an equal distribution of adults by sex and by type of funerary structure and means to support the hypothesis that social differences were present at different sites during the 3rd millennium BC in south-west Spain, demonstrating the complexity of funerary patterns in Copper Age communities and providing evidence for social differentiation.

In the case of the complex archaeological site of Marroquíes (Jaén, Spain) the composition of the population buried in rock-cut tombs was analysed, along with the different treatment given to the dead, integrated into multiple or collective burials where primary and secondary burials were identified including evidence for bones removal. Most of the individuals identified correspond to mature adults (113) with a certain balance between women and men, although the former seem to dominate. Fifty-one individuals below 21 years of age were identified (Camara Serrano et al, 2013: 64). The available dates point to these activities happening mostly in the second half of the 3rd millennium BC. Apart from structured tombs there are also indications that some skulls were identified inside ditches at La Pijotilla and Marroquíes Bajos (Zafra de la Torre et al., 1999, 2003).

Valencina de La Concépcion is one of the largest and most important sites in the Iberian Peninsula and includes significant sets of funerary structures, of which the tombs of La Pastora, Matarrubilla and Ontiveros are the most classical examples. Its importance resides as much in its size and diversity of contexts as in the remarkable number of archaeological excavations carried out during the last three decades. However, the lack of a coordinated archaeological rescue and action program motivated the dispersion of existing information about the site, intervened by several investigators under different conditions. The situation has started to change in the last few years, through the effort of several investigators (García Sanjuán et al, 2013;García Sanjuán, 2013) and regarding the funerary structures, a recent analysis was carried out, where the distribution of human remains and metal artifacts (scarce and considered as prestige items) were used in combination to test this functional hypothesis (Costa Caramé et al., 2010). When available, osteological information was included and results show that no spatial pattern was present, as had been suggested by other authors (Arteaga Matute and Cruz-Auñón Briones ,1999) and so the hypothesis of the existence of two functional areas (one habitational and one funerary) was not supported.

Several studies of funerary practices have been carried out at the site, (Díaz-Zorita Bonilla, 2013a and 2013b Robles Carrasco and Díaz-Zorita Bonilla, 2013). The contextual information available for Valencina de la Concepción makes it clear that this is a site where a wide diversity of funerary practices in variable structures (funerary deposits, non-megalithic chambers, megalithic chambers and megalithic chambers of exceptional size) can be found. Differences in architectures and sets of grave goods were observed although the presence of both sexes and all ages was determined amongst the recovered bones from several structures, in a total MNI of 30 (García Sanjuán and Diaz-Zorita Bonilla, 2013: 95). As for the exceptional megalithic structures that include constructions such as Matarrubilla, La Pastora and Montelirio, they are interpreted as being spaces whose utilization would go beyond strict funerary use. The ritual practices to which these buildings gave rise included an important funerary component, but their enormous complexity leads the investigators to consider that they were built for something more than to provide shelter for human remains.

In South Portugal, except for the case of Bela Vista 5 (Valera, 2014) enclosure, these practices and bone depositions seem to happen only in these very large enclosures although the process of becoming large and complex enclosures happens over a long period of time and result from different dynamics and many of the structures are not synchronic.

Several funerary practices and structures (tholos/tholoi type monuments, pits or hypogea) associated with ditched enclosures have been described in the previous sub-chapters.

However, in recent years, the great ditched enclosures have also started to yield human remains found outside strictly funerary structures. This practice appears to have been occurring earlier than in the 3rd millennium in Perdigões, where human remains can be found in different types of negative features, including pits and tombs. Human remains have also been identified integrated in the filling strata of some of the ditches (Valera et al., 2014a). Ditches 3 and 4 are both dated from the Chalcolithic and inside the former a radius was recovered as part of a structured deposition of stones. In a niche found half way up the ditch wall a cranial fragment was also recovered and dated from the 2nd quarter of the 3rd millennium. In ditch 4 hand phalanges were recovered on the bottom of the ditch and then in the more recent filling layers. These depositions were found mingled with fauna, ceramic shards, some stone and metal tools and seem to have been contemporaneous. Both depositions (or the bones deposited) were dated from the middle of the 3rd millennium BC.

Apart from the above mentioned funerary structures and depositions found around the great Porto Torrão, in Sector 3, East – a section of an internal ditch revealed funerary use in the first phases of filling (Santos et al, 2014; Rodrigues, 2014). Approximately 100 human remains were identified, some in anatomical connection around faunal remains. The bones of a further 6 individuals (2 adults, 3 non-adults and one of indeterminate age) were also uncovered. Sexing the adult individuals was not possible. Isolated finds are also mentioned: a cranial fragment and a cranium with a mandible.

For walled enclosures, all the known cases are from Portuguese Estremadura, where this sort of architecture seems to have survived for a longer period of time. In Olelas, Penedo do Lexim and Zambujal (Miranda, 2006; Kunst 2014) the sites were being used for the depositions of commingled human remains in the last centuries of the third millennium, in a phase when some of the dolmen and tholoi type structures were also being reutilized for funerary depositions but the walled enclosures of the Alentejo (that until now have not revealed human remains that can be directly related to their existence as enclosures) had already gone out of use.

In Leceia, Lisbon (Cardoso, 1994, 1997 and 2010). in Locus 3, a small natural cave on the esatren side of the settlement, a group of human bones (MNI:5) and dated from more or less the same period (ICEN 737: 2580 – 2150 cal BCE) was also identified (Kunst et al., 2014: p. 94).

The same sort of find was described for Penedo do Lexim site, in Mafra (Miranda 2006, Boaventura 2009). The deposition of teeth and some bones in Locus 3/3b and 6, rock shelters inside the walled area were dated from the 3rd quarter of the 3rd millennium, a time associated with the phase of decadence and abandonment of the site. Also from a moment when the Zambujal site, Torres Vedras, seems to be entering its final phase and being deserted and deactivated (Boaventura 2009), 83 bone fragments were found, along with some bell beaker shards in Bastion L (Kunst et al., 2014)

The case of Castelo Velho (Jorge, 1999a; Jorge et al., 1998/1999), Freixo de Numão, falls totally outside the geographical scope of this chapter but deserves mention. Located to the North of the Douro river this important Chalcolithic walled enclosure nonetheless yielded a singular example of bone manipulation and deposition that seems to be set within the same mental and symbolic boundaries as those mentioned for the South of the country. In Structure ER the remains of one partially articulated body was surrounded by bone fragments belonging to a further 8 to 11 adult individuals of both sexes and non-adults of different ages. Most of the heads were missing and some of the bones had signs of cutting, burning and gnawing.

1.4 Summary

This chapter briefly explored part of the empirical data related to funerary practices of the Middle/Late Neolithic and Chalcolithic in Central/South Portugal /2nd half of the 4th and 3rd millennia BC). There is still much to learn, even for the recently discovered sites and information are still very scarce and fragmentary specifically for anthropological data. Although many hundreds of funerary structures have been investigated, the quality of the information available for those varies considerably limited by research agendas, methodologies and techniques of excavation and different standards of reporting.

Nonetheless, as has already been stressed by other authors (Valera, 2012c; Boaventura et al, 2014) several ideas come across as transversal to the whole description, which constitute the first solid base for the discussion of funerary practices in late prehistory to grow on. The first idea is one of **diversification** of these practices as time moves towards the 3rd millennium. This phenomenon is happening with regard to architectures, that we know now largely go beyond the dolmenic traditon of caves, dolmens and even tholos/tholoi type structures to include other solutions like hypogea, pits and practices inside enclosures, walled or not. But diversification is also obvious in the mortuary practices and body treatments involved, which also seems to increase as the 4th millennia comes to an end, adding a second idea to this process: that of **complexification**. Primary burials are present in the archaeological register of Late Neolithic hypogea like Vale Barrancas, (Fernandes, 2013; Valera, ed., 2013) and pits as was observed in the contexts from Torre Velha 3 (Alves et al., 2012) but even in here, there is evidence of several forms of post-mortem disturbances. Although taphonomy is often used to explain these phenomena some of them are the result of deliberate actions through the rearrangement of bones inside funerary structures to increase space, as observed in the hypogea of Monte Canelas I (Silva 1996) and Sobreira de Cima hypogea (Valera ed., 2013), through the presence of ossuaries covering anatomical connections as seen in Pit 3168 in Porto Torrão (Santos et al, 2014) or through the removal of body parts from their original contexts. This process of body manipulation seems to have an older origin, back in the 5th millennium BC as Pit 1 from the site of Castelo Belinho (Gomes, 2010; 2012) seems to suggest.

The reutilization of monuments is also evident, as was described for dolmens (Rocha and Duarte, 2009) and tholoi type monuments. Cremations are also identified as a relevant form of body treatment mainly in the 3rd millennium. The complex context of the cremated bone depositions in Carrascal 2 (Santos, 2010; Valera et al, 2010, Valera et al, 2014c) or pits 16 (Silva et al, 2015) and 40 from Perdigões are good examples (Valera et al., 2014a). Although only briefly mentioned, the artefact assemblages found in different architectures are also variable, suggesting differentiated ritual prescriptions applied to coeval funerary structures (Valera, 2012c).

The third idea that comes through is connected to **collectiveness,** which seems to reach its greatest expression in the 3rd millennium. Indeed, most of the funerary structures analysed, correspond to deposits containing multiple burials, often the result of successive deposition over a period of time. The degree of commingling varies but no strong differences are found between individuals based on status, age or sex.

The interpretation of the significance of mortuary variability implies a broader understanding of how these mortuary rituals were articulated with the living social structure, ideology and even economic life. This is hardly a simple task, constricted as the investigation is by the level of incompleteness of the information available for the past.

The study of the articulation of many of these funerary practices with some of the great ditched enclosures started for the South of Portugal a few years ago (Valera 2012 a and b and 2016; Valera et al, 2014a, b and c) following a trend started in Europe decades before (Whittle, 1988; Burgess, et al (eds.), 1988; Evans, 1988a and b; Bradley, 2005) and reveals that these places could function as arenas for the various social practices that mirror the Neolithic cosmogony. Tomb I is set within one of these enclosures and its context will be explored in the following chapter.

Once there was a river, now there´s a stone.

Dire Straits, Water of Love

2 Archaeological context of the osteological sample: Perdigões Enclosures and Tomb I

The osteological sample dealt with in this work comes from a collective tomb (Tomb I) that is part of the Perdigões Archaeological Complex, located about 2 km northeast of the village of Reguengos de Monsaraz, the seat of the county with the same name (Figure 4).

It is a large archaeological site covering an area of 20 hectares composed of various enclosures encircled by wide ditches, associated to a cromelech with several surviving menhirs. The available chronological data (based on archaeological evidence and absolute chronology) indicate that the site was in use for a long period of time, beginning at the end of the Middle Neolithic (mid 4th millennium BC) and surviving until the transition between the Chalcolithic and the Bronze Age (last quarter of the 3rd millennium BC) (Valera, 2010; Valera and Silva, 2011; Dias et al., 2012; Valera et al., 2014e).

Several enclosures were defined at the site, comprising 12 roughly concentric, broadly circular ditches. Inside, several hundred circular pits were identified but only a few dozen of them have been excavated to date (Lago et al., 1998; Valera et al., 2007; Valera 2008a; Márquez et al., 2011)

It is likely that the site was of great importance for the communities occupying the region during the recent pre-history period and that it was a place used for the practice of rituals related to the cult of the dead and to ancestors.

The Perdigões site was first identified in 1983 by Mário Varela Gomes, following archaeological research on the megalithic cluster identified a few meters East of the site.

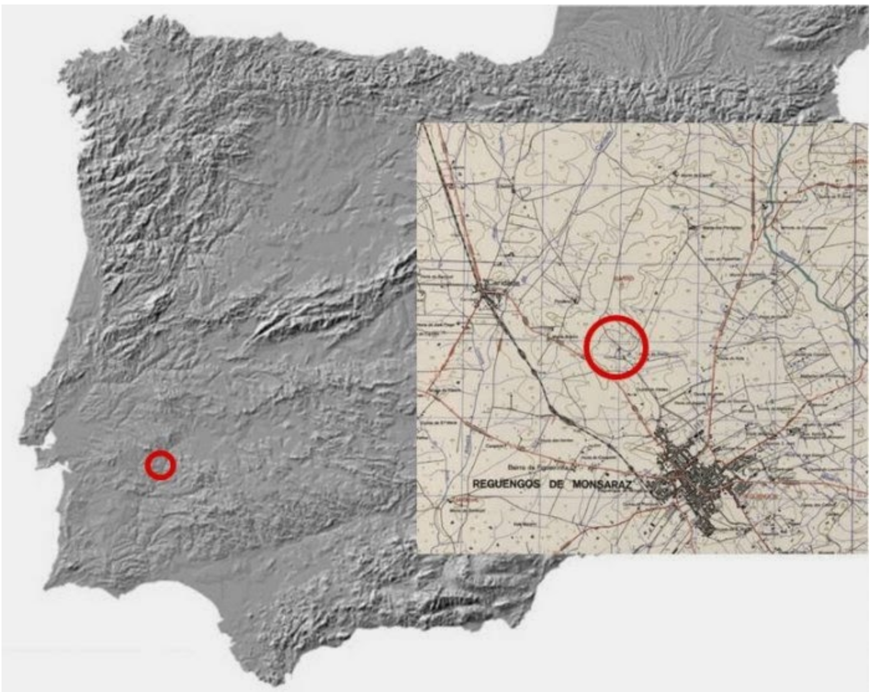


Figure 4 - Location of Perdigões Enclosure on the Iberian Peninsula map and in relation to the town of Reguengos de Monsaraz, Portugal. Adapted from: topographic map of Portugal, scale 1:25000, sheet 473 (Reguengos de Monsaraz) (IGEOE, 2008) and http://perdresearch.blogspot.pt/p/perdigoes-synopsis.html

The identification of the true dimensions of the prehistoric set of enclosures, dated from the Late Middle Neolithic and Chalcolithic, happened in 1996, after a substantial agricultural project for the plantation of grapevines appeared to have destroyed all archaeological evidence. It was then that ERA Arqueologia started a salvage archaeological intervention. Several archaeological surveys were performed throughout the enclosure in order to evaluate the degree of destruction resulting from the deep ploughing. These were performed in locations where the existence of negative structures such as ditches, pits or stone structures were identified. In the specific case of survey 4, carried out in the east section of the outer ditch, its implantation was based on the superficial presence of concentrations of human bones and fragments of slates of schist, raw material clearly exogenous to the natural environment of the area of the enclosure, and an indication of the possible existence of graves in the area of the necropolis. The excavation survey, in an area where the concentration of schist slabs was particularly intense confirmed the existence of a tomb structure (Tomb I), intervened between 1997 and 2001, and later, Tomb II and III (Lago et al, 1998; Valera et al., 2000; Evangelista and Silva, 2013; Valera et al., 2014a).

This emergency intervention, undertaken in 1997, brought to light the great importance of the Perdigões site and its remarkable state of conservation. The terrain in which Perdigões is implanted presents very singular and almost exclusive characteristics within the surrounding region of Reguengos de Monsaraz

(Lago et al. 1998). Indeed, in the middle of a peneplain zone marked by granitoids, this dioritic outcrop stands out topographically and did not go unnoticed by the prehistoric communities of that area. The soft nature of this extremely altered rock, was ideal for the installation of a site like this one, which includes so many different structures excavated into the bedrock. Faced with the best possible "subterranean" scenario, where these actions could be undertaken with least effort, it seems clear that the choice of this particular spot in the landscape for the building of these enclosures involved objective and prior knowledge of the geological reality.

Perdigões is situated within a vast segment of northeast/southwest oriented slopes and sits on a set of slight slopes open to a vast Eastern landscape. The enclosures face a common centre, situated on an elongated platform, also an integral element of the slopes. The spatial implantation evokes the image of a Greek theatre, since the site is arranged on a slope, rising from the base facing the valley, to a point very close to the flattened top. It faces towards the valley of the Ribeira do Álamo, where intense human occupation during recent prehistory has been documented, comprising more than a hundred megalithic monuments dating from the Neolithic and Chalcolithic (middle 4th and 3rd millennium BC).

The area is also extremely rich in underground water resources and several well-known water sources can still be found in the lower areas of the enclosures. The entire area of Perdigões is known in Reguengos de Monsaraz for its abundance of water. In addition, two large water holes had been opened shortly before our arrival and are still in operation, associated with irrigation systems. Ribeira do Álamo (Álamo brook) is about 1000 m away towards the Eastern landscape.

The quantity of water and the nature of the muddy and heavy soils positively influenced the potential for agricultural exploitation that is classified as good and sufficient in the surrounding areas. The transposition of this reality to periods as far back as the 3rd millennium BC raises problems since the soils are extremely sensitive realities that undergo very significant transformations over time, due to the effect of climate and human action. However, without much margin of error, it is possible to assume that in view of the hydric resources present, the area would be the most fertile in the Valley (Lago et al, 1998).

The site was initially interpreted as a large settlement, with a necropolis integrated wiyhin its limits. As work on the site progressed, the interpretation for this large complex evolved. The dichotomy between a funerary space and a probable domestic one was abandoned as this dualistic organization of space lost strength through the mere observation of the empirical evidence: no domestic context has so far been found in the site and the fact that funerary structures were found in different areas of the large enclosures radically changed the initial approach to the space (Valera and Godinho, 2010; Silva et al., 2010; Valera et al., 2014a).

What is more, in 2008 and 2009 a geophysical survey of the site was carried out covering most of its area (Márquez-Romero et al. 2011). A high-resolution image of underground structures contained in the site provided a more detailed plan of the complex when compared to that obtained in the first campaign in 1997. It also corroborated the existence of thousands of pit-like structures within the site and outside it to the east and the existence of one or more funerary structures just outside the limits of the necropolis in the Eastern part of the enclosure (Figure 5).

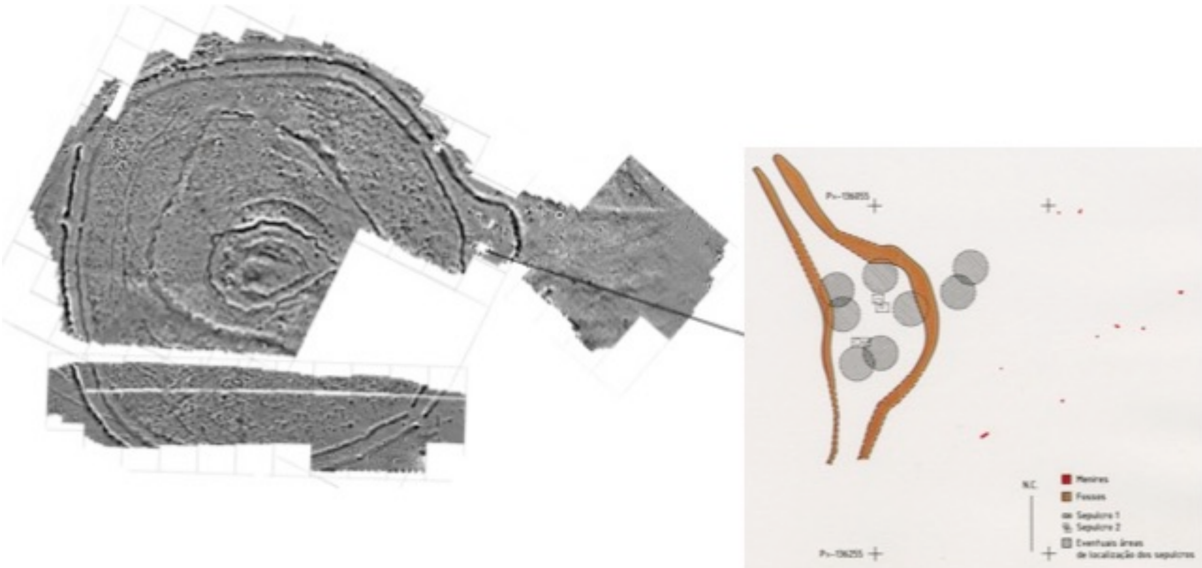


Figure 5 - Location of Tombs I and II in the Perdigões Archaeological Complex (Reguengos de Monsaraz, Évora). The darker circles represent other areas where the existence of funerary structures seems probable.

It also opened the possibility to the development of approaches based on the architectural connection of these places to cosmogonic dimensions, namely of an astronomical nature (Valera, 2008b; 2012a; 2012b) and Perdigões was re-analysed in the light of its orientation and that of its main known entrances. These would be intentionally built to face cosmological events such as the Summer and Winter solstices. This evident cosmogonic dimension is considered central to the interpretation of the location, design, and the landscape relations these sites present (Valera, 2013a, 2013b) and even to the understanding of the social practices that took place in them. They bring to mind Neolithic ideologies, as holistic expressions of the communities that built them (Valera, 2013a).

During the last almost twenty years, intensive work has continued both in the field and in the laboratory. The site has been widely publicized in scientific papers and at scientific meetings and a good deal of research has been based upon it. Currently, the Perdigões Global Research Programme coordinates the various projects, articulating them with various national and international institutions in particular the University of Coimbra, the University of Málaga and the Technological and Nuclear Institute (Lisbon) (Silva et al, 2010).

Prehistoric ditched enclosures have undoubtedly become one of the topics most discussed in south Iberia and as we have seen the last 15 years have seen the more traditional interpretations challenged (Márquez-Romero; 2006; Márquez-Romero and Jiménez-Jáimez 2010, 2013; Valera 2012a, 2013a and b; García Sanjuán and Murillo- Barroso 2013). The way in which these structures relate in space and time to prehistoric funerary contexts has been one the main themes of discussion

Indeed, death seems to be a central factor for our understanding of Perdigões. Since the initial works investigation has not stopped and has moved to other areas of the enclosure with very important results (Lago, 1998; Valera et al., 2000; Valera, 2008 a and b, 2010; Valera et al, 2007; Valera and Godinho, 2010; Valera and Silva, 2011; Marquez et al., 2008, 2011 b and c, 2013; Godinho, 2008; Silva et al, 2010; Valera et al., 2014a; Silva et al., 2014; Silva et al., 2015b). The last ten years of continuous work at the site have allowed the recognition of several different funerary practices spread out over the intervention area, using distinct mortuary structures where human bodies were given diverse treatments thus revealing a complex system of death management throughout more or less 1 500 years.

There are now 35 published radiocarbon dates for Perdigões making it into the best dated late Neolithic/Chalcolithic enclosure of the South of Portugal (Valera and Silva, 2011; Valera et al, 2014) The dates give a first clear idea of the temporality of this site and for the known funerary structures. They confirm the Late Neolithic primary burials in Pit 7 and 11 dating them respectively to the second half of the 4th / transition to the 3rd millennium BC and the transition 4th / 3rd millennium BC.

Tomb I and II were built and used for the first time around to the first half of the 3rd millennium BC (2900 – 2500). Then, between the middle/third quarter of the 3rd millennium BC, depositions started in the Tomb's II atrium at the same time that its chamber was reused for human depositions after being emptied. At the same time these events were occurring, the central area of the enclosures was being used to deposit cremated human remains in pits and open area. The human remains recovered from Ditch 3 dated from the 2nd quarter / middle 3rd millennium BC and the layer where the human bones were identified in Ditch 4 are from the middle / 3rd quarter of that same millennia (Valera et al, 2014a)

Most of these funerary contexts (except Tombs I and II) have been studied within the scope of the research project "Death Management in Recent Prehistory: funerary practices in Perdigões enclosure", financed by the FCT (Silva et al, 2010) and participated by several Institutions namely the FCTUC (University of Coimbra), Era-Arqueologia and Instituto Tecnológico e Nuclear.

In the previous section, where an overview of funerary practices was attempted, it became clear that several different mortuary rites, structures and body treatments seem to come together in some of these large ditched enclosures. Indeed, happening at the same time, normalised funerary practices (Marquez Romero, 2012; Márquez- Romero and Jiménez-Jáimez, 2014) can be observed, which involve the deposition of human remains in structured architectonical features, built and used for that specific purpose. But other of the human bones identified in these enclosures seem devoid of this strictly funerary dimension and have to be considered from a different point of view. In fact, the possibility of the use of parts of the human body in such a way that their intrinsic original value has been diluted and turned into some other category must be considered. This is no doubt also the case of Perdigões where almost since the beginning of the investigation human remains have been identified outside strictly funerary structures. Although these also occur in such a great variety of forms, the fact must be appreciated and interpreted.

In Perdigões, the funerary architectures, the involved treatment of the human remains and the associated votive material are all substantially different, as is their relative location in the site, raising interesting questions regarding the nature of these differences.

2.1 Formalized funerary structures in Perdigões:

2.1.1 Pit burials

For the Late Neolithic, examples of primary depositions can be found in Perdigões Pits 7 and 11 (Godinho, 2008), although some signs of body part movimentation were detected for the burial of individual 3 from Pit 11 (Valera et al. 2014a; Silva et al., 2015b).

These two pits were part of a sequence of four pits that intersected and cut them. **Pit 7** yielded some parts of lower limbs possibly belonging to an adult female (calcaneus and talus measurements) (Silva et al., 2015b), as well as non-adult phalanges, part of a partially articulated hand of a 1-3-year-old individual. The adult legs were found articulated but with different orientations and in two different SU's. The lack of a taphonomical explanation (through faunal action or weathering) led the author to consider the possibility of body manipulation and body part removal, in what must have been an open space burial (Godinho, 2008; Valera et al., 2014a).

Some other adult skull fragments were also identified that could result from soil movement that displaced them from their original position.The hypothesis is also raised that they might have belonged to another burial deposit present in Pit 7. These human remains were associated to faunal ones, namely a suidae paw.

Pit 11, although cut in a significant part of its area, contained the skeletal remains of three non-adult individuals. As with Pit 7 these partial articulations show no sign of taphonomic alteration revealing the same probable decomposition in open space in such a way that they could be easily accessed from the exterior, thus explaining the signs of manipulation. Individual from SU 78, for example, was found with his lower limbs folded towards the torso. Preliminary ancient DNA results indicate that these three non-adults were male and that they did not share any matrilineal relationship since they belong to three different haplogroups (Afonso et al., 2013). Dental age assessment was performed on the 3 individuals: SU76 was aged between 16-17, SU77 around 5 years old and SU78 was between 12-15 at the time of death (Silva et al., 2015b). At present, patrilineal relationships are being evaluated. The available results show that only the strontium 87Sr/86Sr ratio of individual SU78 falls within the local Perdigões range. The other two display values below the local range of 87Sr/86Sr suggesting that they are non-local (Silva et al, 2014). Among them a suidae paw and a cockle shell were also found (Moreno-Garcia and Cabaço, 2009).

These are until now the most complete primary depositions available in Perdigões. Considering that, based on preliminary analysis, a minimum number of individuals (MNI) for the whole site has loosely been assessed at around 500 Individuals (for all chronological periods), 3 or 4 primary depositions represent an extremely small percentages and. This helps to build the idea for Perdigões as for other enclosures, that the total collectivization and gathering together of human remains in death reached a peak from the beginning of the 3rd millennium onwards.

Later in the mid 3rd millennium BC (Table 3), precisely at the time when a significant diversification of practices can be perceived in the enclosures, revealing different body treatments and the use of different structures and spaces for the deposition of human remains, the central area of the enclosures (Sector Q) is being used to deposit cremated human remains in pits and open area (Godinho, 2008; Valera, 2008b; Valera e Godinho, 2010; Silva et al, 2010; Pereira, 2014; Silva et al., 2014; Silva et al. 2015b,; Valera et al. 2014a).

Pit 16, fully studied (Silva et al., 2015b), was a structure that included abundant charcoal fragments and ashes, containing human remains, animal bones (namely pig, sheep or goat, cattle, dog, deer and rabbit). All had been subjected to fire and later deposited in that pit, resulting in a secondary disposal of human and non-human bones. The stratigraphy showed the sedimentation of two thin layers at the bottom of the pit, followed by a "dumped" deposit with a conical shape of cremated remains. These had been subjected to temperatures of over 900º. The stratigraphy also showed evidence that the cremation took place elsewhere and that the remains were carefully collected, transported and deposited in the structure. The fragmented human bones recovered showed no selection of body parts, since all were represented and corresponded to a minimal number of 9 individuals: 6 adults and 3 sub-adults. No sex diagnosis was possible.

Near to pit 16, just 5 meters east, there is an area that revealed a sequence of structures and contexts with several deposits of human cremated remains. The sequence is composed of a pit (Pit 40), a cist integrated within a semicircular stone cairn and several episodes of depositions of cremated remains in the open air over the cairn structure.

Pit 40 is a 2.70m diameter structure excavated in deposits of previous chalcolithic occupations in the central area of the enclosures, beneath this unstructured context called Ambiente 1. A disturbed primary burial of an adult male individual with partial connections was uncovered together with other partial anatomical connections, most of which showed no signs of being thermally altered (Valera et al., 2014a). These depositions were surrounded and covered by deposits containing thousands of cremated human remains, mixed with ashes and faunal remains. The osteological and archaeological material is under study at the moment. Nonetheless, the results described for the annual field report for 2013 (Valera, 2014) for which 8 bags of 3 different squares were randomly selected for a complete analysis of the bones allowed some conclusions. Despite the fact that the laboratory study involved a small part of the exhumed bones, no bone selection was identified as all parts of the skeleton of adult (both sexes) and non-adult individuals were identified amongst the fragments analysed. The MNI for this sample, of approximately 11750 bone fragments, was of 11, 6 adults and 5 non-adults.

As with Pit 16, no evidence of fire was identified *in loco*. The careful recovery of all body parts from the original cremation place is attested by the presence of very many fragments of human bone like phalanges (including non-adult), teeth, or unfused epiphyses and artefacts.

Table 3 - Radiocarbon dates for funerary contexts in pits, Perdigões (Valera et al., 2014a)

Context	SU	Lab. Ref.	Date BP	Date cal 2 σ	Samples type
Pit burial 7	114	Beta-289265	4430±40	3331-2922	H. Bone
Pit burial 11	76	Beta-289263	4370±40	3096-2901	H. Bone
Pit burial 16	74	Beta-289262	3990±40	2621-2350	H. Bone

During the 2004 Perdigões archaeological campaign in the necropolis area located in the eastern area of the site, a small survey was opened a few meters away from Tomb II and revealed Tomb III. This small intervention confirmed the presence of yet another funerary structure of a different nature from Tomb I and II but holding remains of collective depositions of human bones. This funerary structure was described as most likely being a pit (Valera et al., 2007). The osteological sample recovered from the upper layers of Tomb 3 was rather small and very fragmented. MNI was 14, four of which are non-adults. Due to taphonomic constraints, no other demographic data are available (Evangelista and Silva, 2013) although evidence for the presence of both sexes is present. A rich group of artefacts was recovered including an impressive collection of blades, funerary ceramics similar to those excavated from Tomb I and an idol figurine made of a faunal phalange.

2.1.2 Tholoi Type Stuctures on the Eastern side of the Enclosures

Tomb I and II are located in the eastern side of the site (Figure 5) in a specifically defined space where the available excavation and survey data point to the possible existence of a further six or seven tombs in addition to the two already excavated. They represent other two examples of normalised funerary practices in Perdigões. Indeed, the confirmation of the existence of an unmistakably associated "necropolis" and included within the limits of the Perdigões enclosures was one of the first certainties obtained in 1997 and clearly one of the most important conclusions of these works, not only because of the enormous potential that this situation offered with respect to the understanding of a 4th and 3rd millennia communities, but also because it was, at the time, an absolutely unprecedented situation within the reality of ditched enclosures of the South of the Iberian Peninsula. In fact, although associations of this kind were known in places like La Pijotilla, Badajoz (Hurtado Peréz, 1986, 1995) Valencina de la Concepción, Seville (Ruiz Mata, 1975 a, 1975b and 1983; García Sanjuán et al.,2013), Los Marroquies, Jaén (Zafra de la Ponte et al., 1999) and Los Millares, Almeria (Arribas et al., 1985), this was the first time a clear demarcation within the enclosure in order to house a "necropolis" was identified. In other words, the extension of the outer ditch in the Perdigões Complex was carried out with the specific intention of including a well-structured functioning burial area (Evangelista, 2004; Valera et al., 2014e).

The meaning behind this eastward orientation of the "necropolis" had already been emphasized in the first publication on the site (Lago et al., 1998) given the importance of that cardinal point. The specific location of the "necropolis" established a relationship with the cromlech, also to the east, while also creating a secluded space related to the ancestors and an "entrance or passage" to the enclosures, very close to Gate 1.

The global organization of the specific complex area of the site where Tomb I is set, including the number and location of the different funerary structures, is still not known with precision, although the data obtained from surveying and excavating suggests the existence of 7 or 8 tombs, two of which (Tomb I and Tomb II) have been fully excavated (Lago et al, 1998: Valera et al. 2000; Silva at al, 2010; Valera et al., 2014a). The existence of other tombs outside this specific area has been confirmed by geophysical survey that has been since then carried out (Marquez et al., 2011).

2.1.2.1 Tomb I

Tomb I, the basis for this work, was identified in 1997, during the first archaeological campaign in Perdigões. It was excavated between 1997 and 2001 with the participation, in all phases, of the author of this thesis (Lago et al., 1998; Valera et al., 2000; Evangelista, 2004; Valera et al., 2014a). The concentrated presence of a significant number of broken schist slabs, normally used in the construction of Chalcolithic collective tombs, alongside the presence of scattered human bones over the same area, led to the opening of a survey in the Eastern area of the site. The deep ploughing had had a clear impact on the monument; still evident on the first preserved layers, where several plough marks were still visible. The first part of the campaign was dedicated to the definition of the amalgam of earth and revolved stones, but it did not take long to understand the presence of an important funerary structure, of the *tholoi* type (cf. Tholoi Type Structures chapter), built on the inside of the site's most exterior ditch.

The analysis of the architecture of the tomb clearly showed the existence of three different physical spaces. It was composed of a **chamber**, a small **corridor** and an **atrium**, all dug into the bedrock. The analysis of the spoils and distribution of human and animal bones demonstrated that these spaces had different uses (Figure 6).

Figure 6 – 3D virtual reconstruction of Tomb I (Perdigões) according to available data.

The **chamber** is a circular structure partly excavated in sediments and in the rock, about 3.5m in diameter and covered with thin schist slabs with a maximum height of approximately 1.60m and approximately 3cm in thickness. Its covering structure would have been of an unknown morphology, still to be identified, and it is clear that the hypothesis of a false dome is not supported by the archaeological record. Indeed, the overturn of stones identified in the chamber is not relatable to the collapse of a cover structure, and probably almost entirely resulted from the progressive slipping of the inner wall slabs of the chamber. It is extremely significant that in the archaeological record there are absolutely no indications attesting to the repair or "restoration" of the funerary structure, while it remained active. On the north side of the chamber, there was also a small compartment made of schist slabs (Lago et al., 1998; Valera et al., 2000).

The vast majority of depositions of human bones occurred in the chamber where votive artefacts were also found. It is impossible to determine with exactitude if these objects, which include mostly pots or fragments of pots, lithic artefacts, beads and a collection of idols of several types, have a particular connection with a particular individual or group of individuals, since they were found scattered and mixed with the human remains with no apparent organisation.

The small **corridor** of this funerary structure, slightly sub-rectangular, represented the connecting point of about 1.80m between the space occupied by the funerary chamber and the atrium. This segment of the tomb was strongly affected by the ploughing. Archaeological contexts inside the corridor were also significantly altered by the planting of an olive tree (cf. Extrinsic Factors chapter). The artefact collection was very scarce (two fragments of blade and an arrowhead), and their presence in the corridor must have resulted from displacements from the chamber.

The **atrium**, presumably the entrance to the monument, is a sub-circular structure about 2m in diameter, covered with small schist slabs. They are incomplete, but the small size of these slabs points to an original encircled area of a fairly reduced height. The absence of any sign of a possible covering structure must also de underlined. This context was greatly affected by the ploughing and was completely excavated in 1997. Nevertheless, it provided some important clues, since it is the only context outside the chamber where the presence ritual depositions was clearly attested. These depositions included small limestone vases, fragments of ceramic vases, some with symbolic decoration based on triangles filled with white paste, spherical vases, thin-walled bowls, arrowheads, blades, a dagger, fragments of schist plaques and valve of a *Pecten Maximus* shell. The relationship between this artefactual set and the scarce fragments of human bones identified is not clear because they are extremely fragmented and widely dispersed but they seem to be deliberately placed at the entrance of the tomb and appear to point to a ritual action linked to those interred in the chamber.

A badly preserved structure made of burnt clay was identified on the floor of the atrium pointing to the possible ritual use of fire in the first stages of the monument (Valera et al. 2000)

Finally, it should be noted that the orientation of the monument is of 89.5º, according to a measurement made in collaboration with Professor Michael Hoskin from the University of Cambridge (Hoskin, 1998), in the precise direction of the top of the Monsaraz elevation, at the opposite limit of the Ribeira do Álamo valley.

Tomb I is the basis of the work presented in this dissertation. As such, the phases of use identified for Tomb I are presented for a fuller understanding of the following chapters where the anthroplogical results are presented (Figure 7). The complete discussion of the phases of use of the monument can be found in Chapter 5. Only the funerary chamber is considered here since very few human bones related to the use of the Tomb were found in the atrium and corridor.

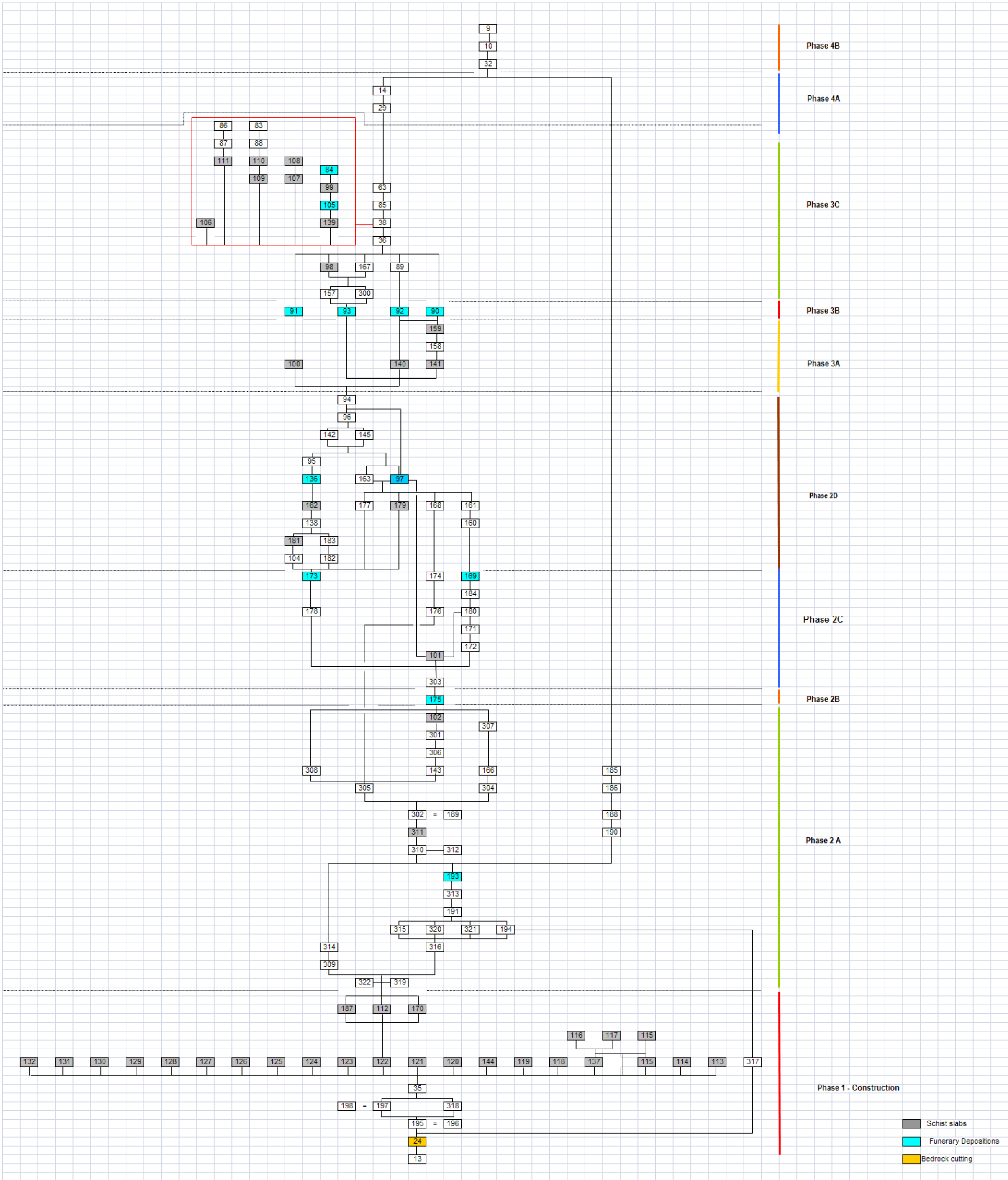


Figure 7 - Harris matrix for Tomb I (Perdigões) illustrating stratigraphic sequence and phases of use.

The construction phase (**Phase 1**), includes: the opening up and digging of the outline of the monument (atrium, corridor and funerary chamber) in soil and rocky substrate and lining it with schist slabs and the possible erection of two upright slabs which were probably torn out when an olive tree was planted.The compartment identified on the north side of the chamber also belongs to this stage of construction.

The funerary use of Tomb I at Perdigões was long and complex. **Phase 2** is subdivided according to the stratigraphic analysis (Figure 7) and corresponds to the most intense funerary use of the area, which is evident from the great scatter and fragmentation of the osteological remains and votive material. This may possibly be explained by occasional collapses of the slabs covering the walls of the monument.

It is clear that **Phase 2A** was a period of intensive use of the tomb in spite of the poor state of the human bone fragments collected. The collection of bones was made extremely difficult due to their extremely poor state of preservation. Four basic types of artifacts were frequently found: ceramic containers, arrow heads, blades and necklace beads.

Phase 2B corresponds to stratigraphic unit [175]. There were many deposits of a heterogeneous nature, including large numbers of human bones of varying concentrations spread over different areas. For the most part, they were in a very poor state of conservation, so much so that it was often impossible to define their shape or to collect them. Abundant slight traces of red pigment were found and a large number of votive objects.

Phase 2C is characterized by a set of depositions including human bones and large quantities of votive material which indicate intensive use of area of the chamber and manipulation of human remains. Some contexts would appear to have been formed by the accumulation of soil and material next to the wall of the structure, possibly pushed in that direction to free up space in the central areas of the chamber.

There was a period of intensive use of the chamber of the monument during **Phase 2D** and SU 97 covered a large part of the chamber. The great bone scatter and apparent absence of specific depositions would appear to indicate that the site was frequently visited and that this must have included its internal reorganization. It included abundant funerary objects associated to the human remains.

The beginning of the collapse of the monument with the destruction of the walls and possibly of the roof, from **Phase 3** onwards is evident in the stratigraphic study. The site was still, however, used for funerary practices, although there is no evidence of any attempt to repair the basic structure. Human remains were detected which had literally been crushed by the collapsed slabs.

Phase 3A saw the beginning of the collapse of the monument with no funerary deposits followed by **Phase 3B,** which corresponds to a more intensive use of the part of the chamber next to the top of the chamber.

Phase 3C includes moments of collapse interspaced with deposition of human remains and votive objects, and it is evident that the tomb was still in use even when the wall lining practically no longer existed. No data/information is available concerning the collapse of the roof/covering.

Available data indicate that that Tomb I was effectively abandoned in the Chalcolithic period. Evidence of action affecting the structure and associated contexts relate to our time and are a result of agricultural work. This was considered **Phase 4** and subdivided into:

Phase 4A considered because part of it is a result of surface disturbance from contexts included in sub-phase 3C, namely [38], although it cannot be considered that they were destroyed.

Phase 4B where the surface of the soil was strongly affected by the ploughing and harrowing that was carried out in preparation for planting of the vines.

The chamber depositions of Tomb I now have four radiocarbon dates available in Table 4 (Valera et al, 2014e).

Table 4 – List of Radiocarbon dates available for Tomb1 (Perdigões).

4030±40: 2830-2470 cal BC at 2 σ (Beta-327750): corresponds to an intermediate layer of the depositions before the first episodes of ruin of the lateral slabs; **SU 173. Phase 2C**.
3990±30: 2570-2460 cal BC at 2 σ (Beta-311480): corresponds to the final depositions of that previous moment; **SU 145. Phase 2D**
4060±30: 2830-2490 cal BC at 2 σ (Beta-327748): corresponds to a deposition that took place after the ruin of the monument had already started**. SU 93. Phase 3B**
4130±30: 2870-2580 cal BC at 2 σ (Beta-327747): corresponds to a deposition that took place when the process of ruin was fully in progress. **SU 84. Phase 3C.**

2.1.2.2 Tomb II

In 2000 the excavation of a second funerary structure was initiated, in another of the areas where a concentration of schist slabs and human bones was detected. Tomb II is located a few meters NE from Tomb I, and was excavated during 6 campaigns (2000-2005).

Its total design generally resembles that of the Tomb I and presents a structure semi-excavated in the bed rock divided into chamber, corridor and atrium. Here again, we are faced with the absence of tumulus and no vestiges of roofing structures were detected. The tomb set was affected by the action of the ploughing carried out in 1997, and although this action reached some depth (even perforating the bed rock base in several places) the preservation of the majority of the contexts was maintained.

Tomb 2 (Figure 8) is also constituted by a circular chamber of about 3m diameter partially excavated in the bedrock, with walls covered by schist slabs. It has a 1m orthostatic corridor an ellipsoidal atrium also excavated in the bed rock whose walls were also covered by schist slabs. It is orientated at 130º (Valera et al., 2000; Valera et al. 2014e).

Figure 8 - General view of Tomb II. Perdigões

Several funerary moments of use were defined for Tomb 2 (Valera and Godinho, 2010; Valera et al., 2014a; Valera et al., 2014b) (Table 2). The first phase was dated from the first half of the 3rd millennium BC (Beta-308791 - 4090±30: 2860-2500 cal. BC at 2 σ), showing that the construction and first use was contemporaneous with that of Tomb I. The first phase was probably restricted to the chamber, before it was emptied. Only a few contexts belonging to this first phase were preserved below some broken schist slabs that fell into the chamber. The artefacts associated with the first phase include some pots, arrow heads, some ivory and bone objects and beads.

After the emptying process, the chamber was reused and the door between the passage from the chamber to the atrium was sealed with schist a slab. This is also when the deposition of human bones increased in the atrium and continued even after the door fell towards the atrium and the deposition of human remains continue on the top of it. The date 3970±30: 2570-2460 cal. BC at 2 σ (Beta-308793) was obtained for the later depositions in the atrium, after the fall of the door slab. It thus seems contradictory that this date is older than the one obtained for the human depositions found under the door slab: 3840±30: 2460-2200 cal. BC at 2 σ (Beta-308789) (Valera et al. 2014a and e.). Explanations for this must be linked to the funerary use of these spaces where the deposition of human bones of different chronologies was happening at the same time (Valera et al. 2014a).

The later reutilization of the chamber included, in the southwest quadrant, an area delimited by a trapezoidal structure made of schist slabs and a small menhir containing human remains. The date obtained for this second phase of use of the chamber is 3890±30: 2470-2290 cal. BC at 2 σ (Beta-308792). Related to this phase, some artefacts culturally associated to Bell Beaker groups were identified: thin gold blades and ivory button. Also, ivory *lunulae* and zoomorphic figurines and idols, limestone idols and pots and arrowheads were recovered.

The anthropological study of the human remains from Tomb II is underway by Ana Maria Silva, Mariana Garcia and Tatiana Rodrigies from the University of Coimbra, but no primary depositions were recognized during the excavation in the chamber. The exception was recovered from the first layer in the center of the atrium: a foot in anatomical connection. Several ossuaries were identified in the chamber with signs of some bone selection (Valera et al., 2014a).

2.2 Non-Formalised Funerary Practices

Other depositions found in Perdigões can be considered non-formalised funerary practices, as human remains have also been identified outside formal architectural structures as part of open air deposits or integrated in the filling strata of some of the ditches (Valera and Godinho, 2010; Pereira, 2014; Valera et al. 2014a).

The first evidence of deposition of human remains in ditches now goes back to the end of the Middle Neolithic. In the 2016 campaign, in **Ditch 13** in a broader section of the ditch, an elongated central deposition with bones, ceramics and stones was defined. The archeological materials identified belong to the Middle Neolithic. Among the bones a human mandible was found fractured in the area of the *mentum*, forming two halves. The halves were deposited one on top of the other but facing different sides with each section facing opposite directions (Valera, 2016).

For the Chalcolithic, amongst the ditches already submitted to archaeological survey, **Ditches 2, 3, 4** and **7** documented the presence of human bones (Valera 2008a; Godinho, 2008; Valera and Godinho, 2009 and 2010; Marquez Romero et al., 2016).

Inside **Ditch 3** (Valera and Godinho, 2010) a radius was recovered as part of a non-structured deposition of stones, in SU 94. In a niche found half way up the ditched wall, a cranial fragment was recovered from what seemed like an intentional deposition and dated from the second quarter of the 3rd millennium (Table 5).

Indeed, in Ditch 3 it was possible to identify several moments of intentional depositions not involving human bones, such as the horizontal accumulation of stones and abundant faunal remains (Valera and Godinho, 2010, p.30).

During the anthropological study of Tomb I and while accessing some misplaced bones from the very first campaign in Perdigões in 1997 several bone shards were also identified as belonging to a negative structure (that we now know is Ditch 3) where they integrated the bottom deposits. The structure had clear statigraphic evidence of a complex history of cutting and refilling and the bones were found alongside depositions of ceramic shards and faunal remains.

In **Ditch 4** a hand phalange was recovered from SU 18 in the more recent filling layers of the ditch. In SU 90, one of the deeper deposits of this negative structure, fragment of a left radius; a fragment of skull, 3 metacarpals and 3 hand phalanges were recovered, although no anatomical connection was identified. The MNI for depositions in Ditch 4 is 1, and some of the hand bones were diagnosed as belonging to a probable female individual. Age estimation was hindered by the nature of these human bones although the authors (Valera and Godinho, 2010) suggest the individual (s) represented by the hand bones were over 16 years of age. These depositions were found mixed up with fauna, ceramic sherds, some stone and metal tools and seem to have happened generically at the same time. Both depositions (or the bones deposited) were dated from the middle of the 3rd millennium BC (Table 5).

The team from Malaga led by José Marquez Romero who have been working in Perdigões for several years now in the Eastern door area of the enclosures, along ditches 1 and 2, recovered a human humerus from the deposits in Chalcolithic Ditch 2. It belongs to an adult of undetermined sex (Marquez Romero et al., 2016; Valera, 2016).

Table 5 - Radiocarbon dates for non-formalised funerary practices. Perdigões (Valera et al, 2014e)

Context	SU	Lab. Ref.	Date BP	Date cal 2 σ	Samples type
Ambiente 1	109	Beta-308784	3900±30	2470-2296	H. bone
Ambiente 1	177	Beta-308785	3970±30	2575-2350	H. bone
Ambiente 1	128	Beta-313720	3850±30	2459-2206	H. bone
Ambiente 1	263	Beta-313721	4000±40	2831-2356	H. bone
Ditch 3	99	Beta-285098	4050±40	2851-2472	Sus sp.
Ditch 3	58	Beta-285096	4050±40	2851-2472	Bos taurus
Ditch 3	38	Beta-285095	3980±40	2618-2347	Fauna
Ditch 4	90	Beta-289264	3940±40	2568-2299	H. Bone
Ditch 4	90	Beta-285097	3980±40	2618-2347	Cervus elaphus
Ditch 4*	18	Beta-285099	4420±40	3328-2918	Sus sp.

*This date is consider a clear outlier by the authors

Daniela Pereira (2014) studied the sample of cremated human remains from **Ambiente 1**, an open-air context identified very close to Pit 16, which covered the area over Pit 40 and around a small cist. The estimation for MNI was 90 (72 adults and 18 non-adults) for Ambiente 1 and the area around and inside the cist yield a MNI of 8. Bones belonging to individuals from both sexes were identified. This funerary context lacked constructed limits (either positive or negative structures) (Valera 2012a; Valera et al., 2014a) and held cremated and very fragmented human remains, fauna and industry (ivory figurines, arrowheads, beads and ceramic fragments) along with ashes.

One interesting fact, however, is that the set of dates for Ambiente 1 (Table 5) is identical to that obtained for the last use of Tomb I and reutilization of Tomb II located in the eastern limits of the site. By radiocarbon standards they are contemporaneous, during the middle / third quarter of the 3rd millennium BC (Valera et al, 2014a and 2014e).

Accordingly, at Perdigões, in the middle and 3rd quarter of the 3rd millennium, human remains were being formally deposited inside ditches, cist graves were being built, secondary depositions of human remains were taking place in pits and in open surfaces and earlier tholoi type tombs were being emptied and reused). The full study of the anthropological remains from Tomb I are yet another contribution to shed light on the questions raised by these discoveries that have implications for our understanding of the functionality of these great enclosures and of the social practices that were being held there (Valera 2008a; Valera et al., 2014a and 2014e).

2.3 Summary

This chapter explored the archaeological site of Perdigões, a large Middle/ Late Neolithic and Chalcolithic ditched enclosure where the tholoi type structure Tomb I, the basis of this work is located. During the life span of this complex of enclosures, that lasted around 1500 years, funerary practices and body manipulation were always present, but revealing diversified procedures, in clear contradiction with the until recent perception of a certain homogeneity in prehistoric funerary practices induced by megalithism.

Indeed, in Perdigões, funerary practices show a considerable diversity not only in architectures (or lack of them) but also in the treatment given to the body (primary and secondary depositions are identified cremated or not) and even in the artefactual collections found alongside the depositions.

Detailed information on Tomb I was also provided in this chapter. The bones found in this structure were commingled and many elements were fragmentary, which complicated anthropological analysis.

Thus, in the following chapter, a review of how taphonomic processes that may have contributed to the commingling of the skeletal remains in this mortuary context and may have had an effect on their level of preservation and representativeness will be addressed.

3 Materials

3.1 The sample

The human remains in this study come from the collective Tomb I whose archaeological context was detailed in the previous chapter. Bones and teeth were highly fragmented. A total of 61926 bone fragments were studied for Tomb I, of which 2216 were considered as belonging to non-adults (3,57%). The total number of studied teeth was 1579, which included which were still in formation process (10,9%) and 83 (5,3%) deciduous ones.

Between finishing the excavation and beginning the thorough analysis and the writing up nearly 20 years passed. The conditions of storage and the processing protocols, which were started by two different teams prior to the present analysis affected the final assemblage available for study (Figure 9).

Figure 9 – Storage conditions of the bones from Tomb I at the department of Life Sciences. University of Coimbra.

Human bones from Tomb I were subjected to treatment at the laboratory facilities of the Portuguese Institute of Archaeology (CIPA), where cleaning, stabilization, labelling, marking and analysis of part of the anthropological collection was carried out by a team supervised by Cidália Duarte. What is more, a first attempt to study the human bones from Tomb I was also made in Coimbra within the framework of the project "Death Management in Recent Prehistory: funerary practices in Perdigões enclosure", financed by the FCT (Silva et al, 2010).

It is also important to refer to the important work carried out by Cláudia Cunha (2015). Cunha's research characterized the dental morphology of several prehistoric samples: Tombs I and II from the Perdigões

Archaeological Complex and from de Cerro de las Baterías tomb in La Abuera, in the Spanish Extremadura province, in order to gather information on possible biological affinities. Cunha used the Arizona State University Dental anthropology system (ASUDAS) to evaluate most of the discrete traits. That is why that task was not performed for this thesis.

3.2 From death to fossilization: the effect of taphonomy on the human remains from Tomb I.

Taphonomy examines the transformations that occur in the transition from the planet's world of living organisms (biosphere) to the Earth's mineral crust (biosphere) (Renfrew and Bahn, 2008). A lot has been written about taphonomy in recent years as it has developed enormously as a discipline, providing important tools for the understanding of postmortem changes (Micozzi,1991). It initially emerged as a concept defined by paleontologist I.A. Efremov in 1940, its meaning deriving from the Greek *taphos*, τάφος meaning "burial", and *nomos*, νόμος meaning "law" and refers to the field of study that analyses physical and chemical processes (generated by human, animal or natural agents) that transform an organism after its death as it incorporates into the geological deposits (Renfrew and Bahn, 2008). So as well as addressing natural transformations, taphonomic studies also explore cultural ones, allowing important insights into a factor that is central to the understanding of archaeological evidence: human action. Indeed, between the moment of death until the moment of recovery (and even afterwards) the human remains may go through several human cultural systems before they entered the archaeological record. As Micozzi eloquently put it "Taphonomy may be regarded as the study of entropic forces which disorder material remains, cause disturbance of the archaeological record and to some extent homogenize material features" (Micozzi, 1991, p. V).

The determination of the state of preservation of human bones is fundamental in any bioanthropological study and affects any understanding of the populations studied. Taphonomic factors are always present in skeletal assemblages and depending on their effect they interfere with the possibility of a complete study of skeletal collections and tamper with the recording of several parameters including sex, age at death, stature, pathologies and many other observations.

What is more, while smaller samples allow a more careful analysis, a large commingled context like the one from Tomb I presents several challenges and a long list of possible taphonomic factors that affected the bones through the millennia (Ubelaker, 2002). Factors that influence body decomposition (such as soil pH, soil type, water, corpse structure, and so on) will also affect bone preservation (Ferreira 2012).

The time of decomposition of a body may vary, depending on a set of factors, including its age at death (Mays 1998). However, what later becomes, archaeological record are the hard tissues, that is, the bones (Mays 1998).

The differential preservation of individuals occurs from the moment that the living choose to bury the bodies, protecting them from some taphonomic agents (Bello et al., 2006). The bones that are not on the surface are better preserved because they are protected from the fauna and environmental conditions (rain and water), differences in temperature and the sun (Ferreira 2012). However, the choice of burial structure and even of individuals to be buried, whether for social or biological reasons, leads to this differential preservation that largely influences the final result of the anthropological analysis of the population under study (Bello et al., 2006).

From the moment the skeleton becomes an archaeological record, it changes as a result of several processes that may be chemical, physical or biological (Baxter, 2004). Intrinsic taphonomic factors are related to the processes that occur in the bone matrix, such as age, sex, bone density, size, shape, chemical composition and pathologies (Baxter, 2004; Bello et al., 2006; Ferreira 2012; Manifold 2012). On the other hand, the extrinsic factors are found in the environment that surrounds the skeleton and depend on temperature, soil pH, soil type, water quantity, microorganisms, fauna and flora, type of burial, among others (Henderson 1987; Willey et al. 1997; Mays 1998; Baxter 2004; Ferreira 2012; Manifold 2012).The coloration of the bones can also be modified by several factors that affect them, such as bacteria, fungi, minerals and tissue pigments (Ferreira 2012).

In addition, as in the case of Tomb I, forty-five centuries of subterranean deposition and nearly twenty years of human handling since they were excavated necessarily had a tremendous effect on these organic remains and a number of altering deteriorative processes must be taken into account in order to correctly address the results of this study. Although it cannot explain everything, it is important to try to measure how taphonomic processes influenced the preservation of the osteological material.

Indeed, one of the most challenging factors in the interpretation of human remains is their often-differential preservation which is a result of a multiplicity of causes, from disposal patterns to all the myriad of post-depositional changes that can occur. Because there is no fixed pattern for taphonomic effects on bones, at a first stage we must contemplate the taphonomic effects related to chemical, physical and biological properties of human bone itself and then look at them together with all the other many and variable factors involved in the formation of every archaeological record that are capable of altering them in so many different ways (Henderson, 1987; Roberts, 2009).

3.2.1 Intrinsic Factors

Some of the factors contributing to bone degradation are intrinsic to the bone itself. The compositional base of the bone is twofold: 90% of the organic component is made out of collagen protein. The collagen molecules intertwine to form flexible fibres in the bone. In mature bones, this component is hardened by a hydroxyapatite filling that forms most of the inorganic mineral component of bone and it is this mixture of mineral and protein that give bone its properties as a resistant and elastic material (White and Folkens, 2005).

Hence it is easy to understand the correlation between mineral density and the level of preservation of bones and how these structural properties can determine different levels of bone preservation between different skeletal elements. Low density bones (with a great amount of trabecular bone) will tend to preserve less well than those in which the mineral component is higher.

Because the mineral content in bone fluctuates with age, that also explains the obvious differential preservation between age groups; shape, structure, chemical composition (Silva et al., 2009).

Pathology can also influence bone preservation and many pathological conditions may contribute to an alteration of the intrinsic and natural structure of bones. Prolonged immobilization can lead to bone demineralization and reabsorption. Conditions such as Vitamin D deficiency, for example, can highly alter size and shape of certain skeletal elements. Hematological conditions may contribute towards cortical bone alteration, and infectious processes of several aetiologies may produce a bone overgrowth and the modification of the bone structure and surface, weakening it.

3.2.2 Extrinsic Factors

The location of Tomb I within Perdigões and the type of geology had an obvious effect on bone preservation. Nonetheless, because the nature of the human bone deposition is not clear, in this case the taphonomic alterations found on the bone surface could result from the deposition in other different potential environments.

The marks of **chemical action** on the bones originate from chemical phenomena that occur within the sediments or deposits, mainly by hydrolysis (Costa, 2013). The sites topography and abundance in water might have acted as taphonomic agents on the human remains. Many of the bones and teeth observed display evidence of chemical alteration probably caused by acids, minerals and farming additives brought into the monuments by pluvial waters, naturally drained towards the eastern side of the site, towards the Álamo brook.

The collection studied was analysed for the identification of precipitation marks of manganese and iron oxides, which stain the surface of the bones with darkened spots. **Precipitation of manganese oxides** was visible on 59,6% of the individually registered bones (n=3723) covering their surface with stains and spots usually of very dark brownish colour (Costa, 2013).

Another phenomenon observed was **the presence of carbonate concretions** over bone surfaces forming layers that could not be eliminated and also frequently causing different bones to literally stick to each other, rendering their separation impossible without causing great damage to the bones (Figure 10). Concretions (n=490 cases) represent 13,2% of the individually registered bones (n=3723).

Figure 10 - Example of bones stuck together by carbonate concretions. Tomb I (Perdigões).

The forces of nature (soil type, influence of temperature and air, local flora and fauna) can all act on organic materials and objects after they are disposed of. The effects of **environmental factors** can at times be difficult to tell apart from anthropogenic ones, since their final impact on the bone surface may look very similar.

Weathering results from the action of the sun, wind, rain and temperature variations. On the individual registered human bones from Tomb I it was possible to account for 91 cases where bone surface was altered by this phenomenon, which represents 2,4% of the total.

The **roots** of some plants secrete acidic substances that may come into contact with skeletal remains as a way of obtaining nutrients. Roots can also be responsible for revolving the soil, in more severe cases leading to the displacement of bone and artefacts.

In the case of Tomb I, apart from uprooting of an old olive tree in the area of the corridor, where no human remains were identified, there is only one other case, amongst the human remains (n=3723), where root marks were identified on the diaphysis of a fragmented humerus (field nº 2115) recovered from SU63 (Phase 3C).

In Tomb I, each individualized human bone register was analysed for surface changes that could reveal the action of **carnivores and rodents** (Figure 11). Bone surface was in many cases altered rendering observations difficult. From the 3723 observed registers, only 5 showed signs of bite marks (0,13%).

Figure 11 – Fragment of right radius showing signs of bite marks. SU174.TombI (Perdigões)

Results are shown below in Table 6.

Table 6 - Bite marks identified in bones from Tomb I (Perdigões).

Field No. .	Bone	Side	SU	Phase
2898	Frag. Radius (Proximal Diaphysis)	Right	174	2C
3152	Frag. Ulna (Proximal Extremity)	Right	174	2C
3468	Frag. Tibia (Diaphysis)	-------	174	2C
2489	Frag. Femur (Diaphysis)	Left	97	2D
4316	Frag. Fibula (Diaphysis)	--------	63	3C

The study of **fragmentation** allows the distinction to be made between intentional fractures resulting from cultural action on bone or as part of the funerary ritual (Bunn, 1989) and recent fractures resulting from handling during and after the archaeological excavation. However, a thorough typological analysis of old fractures (staggered, dentate, irregular/transverse, regular/transverse, irregular/oblique, regular/oblique, regular/spiral, irregular/spiral, grooved etc.) was not performed on the collection of human remains from Tomb I. We assume that for this particular work, with its specific objectives, such an approach on a collection as fragmented as this one would derail the proposed chronogram, producing results that would most likely be inconclusive. The chapters concerning bone preservation and representativeness nonetheless shed some light on this subject and convey a clear idea of the high (almost total) level of fragmentation in the human bones from Tomb I (Figure 12).

Figure 12 – Fragmentation of the bones collected on Tumb I (Perdigões)

Humans are taphonomic agents (Sorg and Haglund, 2002), and that is why past and present **human action** must be considered and evaluated when dealing with a monument like this one.

A thorough analysis of the formation processes of Tomb I could provide important insights into ritual, religion and the social organization of the people who deposited their dead there. Bones, like artefacts, go through the same general process of "use", deposition and decay and may even go through one or more secondary cycles of reclamation, recycle and reuse (Renfrew and Bahn, 2008). The clarification of those past processes and their effect on the material assemblages, when possible, allow more accurate conclusions to be drawn about past societies. But present behaviours and actions also have great impact on remains from the past. In densely packed prehistoric graves, several problems of stratigraphy and excavation method are bound to happen.

Before our arrival at the site, several actions had occurred that were responsible for a considerable level of destruction of the archaeological and anthropological remains from Tomb I, and Perdigões Archaeological Complex in general. Indeed, the very process that made the discovery of Perdigões possible was hugely damaging to the anthropic realities. The chaotic image visible at our very first arrival at the site in late 1996, showed a large recently formed surface layer, resulting from the work of cutting and burning of the ancient olive grove, followed by a deep ploughing and breaking up of the soil that reached depths of up to 1m. Suddenly, the archaeological contexts that had for long been stabilized, were violently revolved and dragged to superficial levels. Indeed, in case of Tomb I, the first days of excavation confirmed that the area had been strongly affected by agricultural work. Here, the stratigraphic layers were shallower and so the machines hit the bedrock easily, which when revolved and mixed with the earthen layers created an amalgam which was difficult to understand (SU 9). Concentrations of fragments of schist slates (SU 10) systematically appeared (Figure 13).

Figure 13 - General view of the superficial layers of Tomb I (Perdigões) as found on our first arrival at the site.

Another example of recent human intervention on the specific archaeological contexts of Tomb I is the destruction and partial emptying identified in the corridor area, due to the opening of an approximately 1x1m pit for the planting of an olive tree.

As detailed in the previous chapter describing Tomb I, from Phase 3 onwards the beginning of the collapse of the monument with the destruction of the walls and possibly of the roof is also evident in the stratigraphic study. The site was still, however, used for funerary practices, although there is no evidence of any attempt to repair the basic structure. Human remains were detected which had literally been crushed by the collapsed slabs.

Douglas Ubelaker (Ubelaker, 2002) draws attention to the way excavation and curation practices can further alter the preservation and representativeness of human remains. In the case of Tomb I, these elements are of crucial importance. In addition, although it can undoubtedly be said that Tomb I was excavated using all of the best available equipment at the time and by a specialized team, including archaeologists and physical anthropologists, throughout the great part of the intervention circumstances were very different from those today.

During field work, for example, the deposits containing human remains recovered from Tomb I were not sieved and a there is no doubt that the options regarding the method of recovery influenced the representation of individual bones, especially the small ones, easily lost amongst the debris. The amount of information lost through this process is impossible to measure, but deserves mention.

Another extrinsic taphonomic factor visible on the surface of the human bones from Tomb I is the use of **red pigments**, only evident in the chamber of the monument. In the atrium, it was only identified covering the inside of the small container. This fact seems to suggest a ritual use, and seems to exclude the possibility of a more pragmatic use, such as those related to prophylactic treatment of the bodies. The use of red pigments in funeral rituals of this period is present in innumerable sites and also identified in the chamber of Tomb I, sprinkled over several contexts containing artefacts, bones and earthen sediments (Figure 14). Its mixture with the sediments, sometimes in large quantities, particularly in the strata belonging to the oldest phases of use, indicates that the actions related to its application took place in that specific environment or in places where the bodies had previously been deposited. Amongst the diverse contexts of deposits integrating red pigments, SU 310 stands out. Scattered throughout the area of this vast deposit, it sometimes appeared in concentrations or even "*en bloc*" (Figure 20). Moreover, in addition to the use of red pigments, other cases were identified where sediments, bones and artefacts are associated with a more or less intense whitish colouring resulting from mixing with very small pieces of limestone, which may reveal a symbolic exploitation of its chromatic effects.

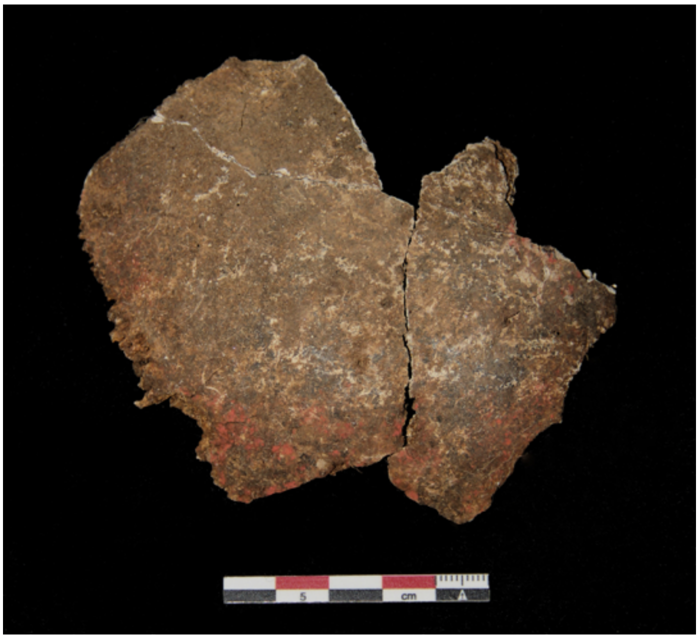


Figure 14 – Fragment of paretial bone showing traces of red pigment. SU97.TombI (Perdigões)

It is interesting to note that the atrium of Tomb II documented the almost exclusive presence of yellow pigments, clearly associated to the contexts with depositions of human bones, but it was absent from the spaces where these depositions were not made. Indeed, ochre, a naturally occurring substance in rocks and soils is primarily composed of iron oxides and may vary in colour, from purplish to yellow and also red or orange.

Within the scope of the debate surrounding the ritual use of pigments in funerary contexts several analyses were carried out on bones and teeth from several contexts in Perdigões, including Tomb I, revealing that part of the red pigments used for the funerary rites were, in fact, cinnabar (Emslie et al., 2015). Cinnabar is a naturally occurring soft red mercury sulphide and its use as pigment and in the composition of paints is well documented in archaeological and historical contexts (Eastaugh et al., 2004).

In the atrium, the **use of fire** is limited to the burnt clay structure used prior to the first deposition of votive artefacts. It is possible that in the case of this specific case we are dealing with a combustion structure related to foundation rituals of the Tomb, although that hypothesis is difficult to demonstrate (Figure 121).

A small box from Phase 2B, SU 175 was found amongst the human remains from Tomb I containing a few fragments of long bones altered by fire (Figure 15). They showed signs of fragmentation, shrinking, thumb marks and changes in colour, compatible with fire at different temperatures (cf. Phase 2B sub-chapter).

In her 2015 thesis, Cláudia Cunha mentions fragments of teeth altered by fire at different temperatures from SU175: with inventory numbers **152** (FDI 14), **156** (FDI 33) and **157** (FDI 46) (Cunha, 2015, p.112). Our analysis of the teeth confirmed these assumptions.

Figure 15 - Cremated human remains recovered from SU 175 in Tomb I (Perdigões).

Figure 16 - Cremated human teeth recovered from SU 175 in Tomb I (Perdigões). Top: FDI 14. Bottom: left FDI 33; right FDI 46

3.3 Summary

The potential effects of taphonomic elements was dealt with in this chapter. Again, since the human skeletal remains appeared commingled and disarticulated, methods for commingled, collective burials were applied to maximize the collection of paleobiological, paleomorphological and paleopathological data, which will be described in the next chapter.

4 Methods

4.1 Field Work

The 1997 campaign was carried out under specific circumstances that involved the accurate definition of the degree of destruction the whole site had been subject to as a result of the deep ploughing for the planting of vines. The identification of Tomb I came as a total surprise and the presence of human bones even more so. It was not mandatory at that time to have a specialist in physical anthropology as part of the field teams, although we were assisted by an orthopedist, Dr. João Moreira, who confirmed the human nature of the bones and helped with basic identification. Only a small area of the monument was intervened during this first year and the Stratigraphic Units (SU) containing human remains were carefully drawn using large plastic sheets, and were plotted.

From 1999 onwards fieldwork methodology was defined and followed by a physical anthropologist, Dra. Cidália Duarte, who worked with the archaeological team until 2001, when the excavation was completed. Fieldwork became concerned with the analysis of possible organizational evidence of the funeral space inside the chamber of the Tomb and the focus of this second stage of excavation was to identify possible anatomical connections and/or organized distribution of the bones in the chamber. The author of this thesis was present at every stage of this work.

Fieldwork at Tomb I took place during the years 1997, 1999, 2000, 2001. From 1999 onwards, tridimensional plotting was used on all archaeological evidence, including human remains with the use of a Total Station (Valera and Lago, 2004).

Registration was done for each bone with an indication of provenance of X, Y and Z in terms of absolute coordinates of latitude, longitude and altitude. The smallest or simply uncoordinated fragments were collected in "bone bags" with grid indication and SU. The grid used is shown in Table 7.

Table 7 – Grid numbers used in Tomb I for the 1999, 2000 and 2001 archaeological campaigns (Perdigões),

	468.00	**468.50**	**469,00**	**469,50**	**470,00**	**470,50**	**471,00**
	468.50	**469.00**	**469,50**	**470.00**	**470,50**	**471,00**	**471,50**
720.00 a 720.50	A1	A2	A3	A4	A5	A6	A7
720.50 a 721.00	B1	B2	B3	B4	B5	B6	B7
721.00 a 721.50	C1	C2	C3	C4	C5	C6	C7
721.50 a 722.00	D1	D2	D3	D4	D5	D6	D7
722.00 a 722.50	E1	E2	E3	E4	E5	E6	E7
722.50 a 723.00	F1	F2	F3	F4	F5	F6	F7
723.00 a 723.50	G1	G2	G3	G4	G5	G6	G7

The numbering of the collected bones and fragments followed a sequence given per square in 1999 and 2000 (A1.-1, A1-2, A1-3, etc.). However, in 2001, in order to make the use of the Total Station more expeditious, a continuous numbering system was adopted, from 1 to 2159. Thus, for 2001, the numbering is different and uncoordinated bags were not given a sequential number, but assigned to the square of provenance and to the SU they belonged to. This registration is more restrictive but made registration faster, since it could be done automatically with the Total Station, with data transfer directly to the computer.

During field work the Harris matrix was used as the descriptive and interpretive tool. Natural layers were considered, together with the definition of SU's and the construction of the matrix. In addition to creating a grid that divided the chamber, the creation of SU made it possible to characterize bone sets according to their specific attributes and special features. Thus, in addition to a spatial frame of distribution, it was possible to identify specific areas of deposition with potentially unique functions more or less different among themselves, which we tried to test in the laboratory work, with very little result.

In order to effectively control the distribution of bone elements apart from the SU, individual numbers were assigned to each bone (or bones together) excavated in each of the grids. Thus, the analysis on the bones undertaken in the laboratory included the provenance of each bone according to the square in which it was found.

Human bones uncovered in Tomb I were in an extremely poor state of conservation, with a high degree of fragmentation and very consistent texture. This fact led to the use of consolidating products on the bones to be exhumed during the excavation although some exceptions were made in bones that were reserved for radiocarbon dating. In such cases, the chemical integrity of specific bone elements was safeguarded, and the choice fell on either the best-preserved bones or their location throughout the monument.

The consolidating product applied was Primal E-822K, which can be effectively used with temperatures above 20 degrees. Its application showed good results. Because its consolidating effects are reversible through the use of water, its removal in the laboratory was easy since it does not require the use of solvents.

No sieve was used at the site, although the excavation was carried out with precision instruments. Wherever possible, the bones were excavated with the help of wood and plastic instruments, but the hardness of the surrounding sediments made it necessary to use metal tools in most cases. The inevitable signs of this practice are visible and cannot be mistaken for marks left by rodents or carnivores,

4.2 Laboratory work

The methods applied to this research were selected according to the specific nature of the archaeological context of Tomb I and its commingled human remains.

After cleaning, labelling, and separation by anatomical area, each bone was assigned a specific laboratory number. This procedure was used in order to overcome the problems generated with "bags of bones and fragments" that came from the field, where the same identification number was assigned to a more or less numerous set of bones. This detail became particularly important when it was necessary to attempt to glue together dispersed fragments of bones. The origin of portions of glued bones is indicative of the original organization of the funerary space and/or of changes occurring in the Tomb. Only in this way was it possible to evaluate the integrity of the context. Therefore, whenever possible, the bone or bone fragment were marked directly with China ink on transparent varnish.

Given the collective nature of the context, bone analysis had to focus on each identifiable fragment, rendering it impossible to use the more traditional and standardized techniques for skeletal recording from the skeletal set. The collection of data was initially focused on issues of conservation of the various identifiable portions, identification of carnivore, rodent or cut marks. These are the most important variables for understanding the context itself and its degree of preservation. Our initial intention, for the long bones, was to identify the visible fracture pattern in each bone fragment, so that the origin of the high fracturing index of the human remains could be evaluated in this context. Unfortunately, 20 years have passed since the bones were recovered and this exercise became useless since so much of the bone fragmentation resulted from the recovery, storage, transport and handling processes the collection went through since the end of the field work.

4.2.1 Cleaning and marking of the bone fragments

Laboratory work focused on cleaning, gluing and observing bones unearthed during the archaeological campaigns. Initially, the bones were all observed and identified, to correct any erroneous identification made in the field. Then began the long process of cleaning with the help of brushes to minimize damage to the surface. As mentioned above, two previous attempts to study the collection were undertaken and so a small part of the collection was already cleaned and marked when research for this PhD began.

4.2.2 Inventory of Bones and Teeth

An inventory was made of bone and tooth samples. Although a preliminary and general inventory was made during the fieldwork, all data was confirmed through observation of each of the bones and bone fragments. The bones were identified individually and the laboratory inventory number was attributed to each of them.

Each **bone** fragment was observed, after cleansing and labelling. The overwhelming number of human bone fragments recovered led to specific registration options that could render the analysis of the whole collection possible in the time available:

Individual registers were composed of bone (s) fragment(s) that could be clearly identified although not always lateralized, which could contribute towards the estimation of minimum number of individuals, provide any paleobiological information or that presented some recognizable surface change (taphonomic or pathological).

Cranial registers: these are cranial fragment(s) recovered during fieldwork, which after observation yielded none of the above information and were counted and separated into bags per SU but kept together according to information coming from the field.

Rib/Vertebral registers: these are rib fragment(s) recovered during fieldwork, which after observation yielded none of the above information and were counted and separated into bags per SU but kept together according to information coming from the field.

NI Long Bone registers were the groups of non-identifiable fragment (s) of long bone (s) recovered during fieldwork, which after observation yielded none of the above information and were counted and separated into bags per SU but kept together according to information coming from the field.

NI Bones registers: are the group of non-identifiable fragment(s) bone(s) recovered during fieldwork, which after observation yielded none of the above information which were counted and separated into bags per SU but kept together according to information coming from the field.

Individual registers were analysed for each of the sixteen variables, registered on an Excel database, specifically created for that purpose:

- General access number, given during laboratory work, a four digit sequential number in the collection- 0001, 0002, 0003 and so on.
- Square or Field number: 50 cm side unit, defined in 1999, dividing the internal and adjacent space of the grave into sub-areas. They were designated by the Cartesian coordinate system - A1, A2, A3, B1, B2, B3 followed by sequential number in the square (each square has a registration serial number), A1.1, A1.2, A1.3. From 2001 (inclusive) the square number ceased to exist and a general sequential number was assigned to each bone.
- Identification of the bone to which the fragment belongs. This may include anatomical position, where applicable. When dealing with phalanges, for example, the anatomical position determines whether it belongs to the hand or foot, if it is proximal, intermediate or distal phalanx and the bone portions represented (easily identifiable specific anatomical regions that can allow MNI quantification).
- Bone laterality.
- SU: the stratigraphic unit of origin is indicated. Some stratigraphic units were later corrected and altered, according to the instructions of the archaeologists, after review of the stratigraphic units.
- Date of recovery
- Bone surface alterations: erosion, scaling, perforation, grooves, gnawing, presence of chemical pigmentation, root marks.
- Osteobiographic data: age, sex, pathology, osteometric evaluation when possible.
- Cultural changes: presence of red pigment, signs of fire.
- Conservation data: cast, consolidated, photographed.

For **teeth**, a separate Excel database was created that contained the following fields:

- General access number, given during laboratory work by Cláudia Cunha (Cunha, 2015).
- Square or Field number: 50 cm side unit, defined in 1999, dividing the internal and adjacent space of the grave into sub-areas. They were designated by the Cartesian coordinate system - A1, A2, A3, B1, B2, B3 followed by sequential number in the square (each square has a

registration serial number), A1.1, A1.2, A1.3. From 2001 (inclusive) the square number ceased to exist and a general sequential number was assigned to each tooth.

- Tooth Identification: the FDI World Dental Federation notation was used to associate information to a specific tooth.
- SU: the stratigraphic unit of origin is indicated. Some stratigraphic units were later corrected and altered, according to the instructions of the archaeologists, after review of the stratigraphic units.
- When possible the degree of development and calcification was observed and recorded based on the tooth development.
- Based on the results obtained through the previous step, age was assigned to teeth when possible.
- Presence of tooth wear, enamel hypoplasia, caries and dental calculus were also registered and degree and location were also assigned.

4.2.3 Taphonomic analysis

The bones deposited in the Tomb were studied for analysis of potential taphonomic variables which may have affected them. This type of analysis is important to detect patterns observed in funerary contexts due to human activity and other factors (Knüsel et al., 1996; Bello and Andrews, 2006). The taphonomic variables which may affect the state of conservation of the bones include: geological context (Janaway,1996), the culture and type of funerary ritual practiced (Nawrocki, 1995), the depth at which the individuals were thought to have been deposed (Nawrocki, 1995; Janaway, 1996), and the action of the local flora and fauna (Micozzi, 1991).

4.2.4 Bone Representativeness

After the inventory was performed, the bones were assessed in terms of their representativeness. This step was crucial for the understanding of factors such as the disparity in preservation and the type of deposition of the individuals concerned (primary/secondary) (Ubelaker, 1974; Silva, 2002). This analysis was only performed for adult bones. Thus, for each archaeologically defined phase, the most highly represented bone or tooth (that which provided the MNI estimation) was considered as representing 100%. The expected percentage for the remaining bones was assessed and divided by intervals of preservation: less than 20%; between 20-39%; between 40-59% and equal to or higher than 60%. We followed Silva (2002) for this exercise since her study of prehistoric Portuguese human collections is the main base for comparison with the present results.

This approach should include the weighing of the bones, a method which has already been shown to be useful (Silva, 2002; Silva et al., 2009). An attempt was indeed made to weigh bones from Phase 2A and 2B (following Silva et al., 2009) but it was abandoned for the remaining phases. The bones were weighed by means of a high precision digital scale (model AND FX5000i d=0,01g). The reasons for not systematically weighing all the bone fragments

chapter, in Discussion) was related to the great level of mineralization most of the bone fragments presented, rendering them much heavier than an average dry bone with no such taphonomic effect. The concretions attached to many of the bones, impossible to remove without causing considerable damage to the tissues, also added difficulty to the task. The choice was however made to present the results of this exercise for Phase 2A and 2B it is because it nonetheless provided some interesting information.

4.2.5 Estimation of Minimum Number of Individuals (MNI)

The bone representativeness made it possible to estimate the minimum number of individuals (MNI). This is crucial for the funerary characterization of the Tomb and consequently for the archaeological site itself. In this specific case, for long bones, we follow Herrmann et al. (1990) adapted by Silva, (1993). Basically, bones are divided by general age group of adults and non-adults (children and young adults or adolescents). It may be difficult to differentiate between the bones of the latter and those of adults and so they are normally included in the oldest category. After this process all elements are then identified and sided. Each long bone is divided into anatomical smaller divisions, and using an already existing table with horizontal lines for left and right-side bones (as shown on Figure 17 for a femur) vertical lines are drawn to represent the existing anatomical portion of the bone. After every portion of both sides of every long bone is registered in this way, the vertical lines are added up and the highest number of lines of a specific bone region represents the MNI. The single most represented and non-repeatable bone element provides the Minimum Number of Individuals.

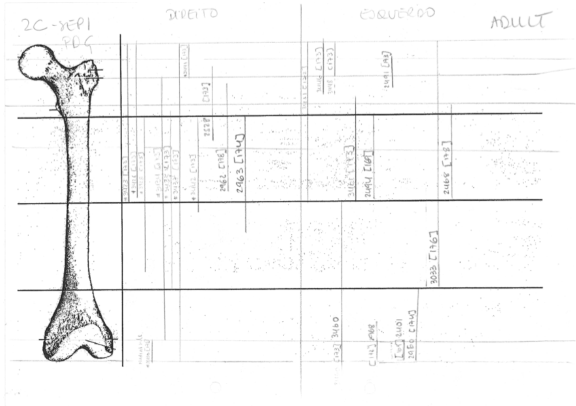


Figure 17 - Example of MNI table for femur. After Silva (1993).

This method also allows the estimation of the Maximum Number of Individuals, a value that considers the extreme case of every long bone fragment identified as belonging to different individuals.

Bones were also visually observed for potential pair matching. This process involved observations of similarities in morphology to match the left and right side, and taphonomic appearance such as color, staining, etc. Although osteometric pair sorting, which refers to the method in which the measurements and morphology of the bones are compared, was also attempted, the fact that it requires complete measurements from whole bones, which were not available for many bones in this collection, made the task almost impossible.

Bone maturation status was also taken into account in estimating the MNI of bone remains belonging to non-adults and following recommendations from Silva (1996; 2002).

Other parts of the skeleton also give an indication of the MNI estimate, due to their particular characteristics that allow them to be identified as being part of one individual (such as the atlas, the pars petrosa, for example).

For Tomb I, the analysis of teeth was also essential in the definition of this parameter. Teeth found *in situ*, loose dentition and antemortem lost dentition were considered as recommended by Silva (2002). Their identification followed White (2005) and Silva (classroom material) and then divided into three main groups: completely formed teeth (closed apex), teeth still in formation and deciduous teeth (Silva, 1996; 2002). The two latter categories made it possible to attribute specific age through the analysis of tooth development. For permanent dentition, completion is reached between the age of ± 8,5 years of age (for FDI 11 and 21) and the age of ± 23,5 (for third molars, upper and lower) (AlQahtani et al., 2010).

4.2.6 Age-at-death estimation and Sex determination

The estimation of age-at-death and determination of sex are two essential parameters for knowledge of past populations and are the basis of paleodemographic analysis. Knowledge of the latter has a clear impact on paleopathological and paleoepidemiological analysis (Milner et al., 2008; Pinhasi and Bourbou, 2008).

The estimation of the age at death is indispensable in the study of an osteological collection, namely in the paleodemographic analysis. This type of diagnosis is more accurate when the methods are applied to non-adults' osteological remains, becoming less reliable when applied to adults (Mays 1998; Silva 2012). However, despite indications of the morphology of epiphyses and their fusion rate to diaphyses (Scheuer and Black 2000) even non-adults may have discontinuities in their normal growth states. For age-at-death estimation for adults the following criteria were used (Table 8 and Table 9).

Table 8 - Methods for age-at-death estimation for adult individuals used for the anthropological study of Tomb I (Perdigões).

Methods	Author
Fusion Iliac Crest	Ferembach *et al.* (1980); Schaefer and Black (2009).
Clavicle Fusion Age (25/30 years)	McLaughlin *et al.* (1990)
Pubic Symphysis	Brooks and Suchey, 1990;
Auricular Surface	Lovejoy (1985); Buckberry and Chamberlain, 2002

For **age-at-death estimation for non-adults** the following criteria were used:

Table 9 – Methods for age-at-death estimation for non-adult individuals used for the anthropological study of Tomb I (Perdigões).

Methods	Author
Calcification and Dental Eruption*	Ubelaker, 1989; Smith, 1991; AlQahtani et al, 2010
Formation and fusion of the epiphyses	Scheuer and Black, 2000; Schaefer and Black (2009).
Length of long bones	Maresh, 1970 in Schaefer and Black (2009); Stloukal and Hanáková, 1978

*Since the great majority of teeth were found loose, we based our analysis for age at death estimation on Smith, 1991, AlQahtani et al, 2010);

The general categories used in assigning an overall age were the following (Table 10). The age groups considered correspond to those used by French-speaking authors (Bocquet and Masset, 1977; Bocquet-Appel and Miguel, 2000;) to allow, in future research, the elaboration and comparison of mortality curves between different populations.

Table 10 - Age categories used in the study of human remains from Tomb I (Perdigões).

Age Categories
Fetal/Birth
Birth-1 year
1 year - 4 years
5 years - 9 years
10 years-14 years
15 years - 19 years
>20 years

Sexual diagnosis is performed based on the assumption that when certain skeletal features are observed they show a degree of sexual dimorphism that allows distinction between the two sexes (Wasterlain 2000). The hip bone is considered the most morphologically dimorphic bone between both sexes, and therefore the most accurate when estimating the sexual diagnosis of individuals (95% reliability) (Bruzek 2002; Murail et al., 2005). However, other bones may be used in this observation, as is the case of the skull (Murail et al., 2005).

Although some sexual dimorphism is also present in non-adults, considerinfg the reliability of the applied methods, there are still reservations regarding the results (Scheuer and Black 2000). If in foetuses the differences between the sexes are slightly, after birth, only from the beginning of puberty do these differences begin to be really significant (Mays 1998, Scheuer and Black 2000). For this reason, sex diagnosis was only applied to adults in this study.

For **sex diagnosis** morphological methods were applied and the following sexually dimorphic features of the *os coxae* and cranium were scored based on the system proposed by Ferembach et al. (1980) and Buikstra and Ubelaker (1994), as can be seen in Table 11, below. The scored anatomical regions were chosen according to the specific nature of the bone sample from Tomb I and its level of preservation.

Table 11 – Methods used for the determination of sex in the anthropological study of Tomb (Perdigões).

Cranial Morphology *	
	Nuchal Crest
	Mastoid Process
	Supra-Orbital Margin
	Supra Orbital Ridge/Glabella
	Mental Proeminence
Os Coxae Morphology*	
Subpubic Region**	
	Ventral Arc
	Subpubic Cavity
	Ischiopubic ramus ridge
	Greater Sciatic Notch
	Preauricular Sulcus ***

* Cranial sexually dimorphic features and the greater sciatic notch of the *os coxae* are scored from 1 to 5, with the lowest degree being the most gracile and feminine and the highest being the most robust and masculine

** Attributes for the subpubic region are scored as follows:

Blank= unobservable

1=Female

2=Ambiguous

3= Male

*** The preauricular sulcus is scored from 0-5:

0 = absence of sulcus

1 = wide sulcus (exceeding 0,5 cm) and deep.

2 = wide sulcus (usually greater than 0,5 cm) but shallow.

3 = well defined sulcus mas but narrow (usually less than 0,5 cm).

4 = sulcus is narrow (less 0,5cm), shallow with smooth walls.

Metric methods were applied on long bones, the talus and the calcaneus as expressed in the following Table 12.

Table 12 - Osteometric Methods for Sex Diagnosis. Tomb I (Perdigões).

Bone	Measurement	Variable	Sectioning Point (mm)	Total Discriminant Rate
Femur*				
	Vertical head diameter*	FVHD	43,23	85,5%
	Transverse head diameter	FTHD	42,84	85,4%
Humerus*				
	Vertical head diameter	HVHD	42,36	90%
	Transverse head diameter	HTHD	39.38	90.2%
	Biepicondylar width	HBW	56,63	90,5%
Calcaneus**				
	Maximum Length	CM1	75,50	81%
Talus **				
	Maximum Length	TM1	52,50	84%

*Wasterlain, 2000; **Silva, 1995

Every bone fragment analysed was then classified into the following categories:

F = Female

M = Male

F? = Possible Female

M? = Possible Male

ND = Nondeterminable

SB= Non-Adult

4.2.7 Morphological analysis

The importance of the study of skeletal remains for the understanding the past lifestyles and behaviours of cultures, populations and individuals from the archaeological record extends from the direct biological evidence of the biology of past populations to insights into health, lifestyle and activity. The role played by the environment on the relation between biology and behaviour has been a central theme for investigators (Larsen, 2000). In particular, by focusing on human behaviour, as can be inferred from human skeletal material, authors such as Larsen (1997, 2000) highlight the very real and integral worth of the study of human osteology and bioarchaeology beyond local contexts and in the wider historical context.

The study of morphology has been an important part of bioarcheology and is based on the physical characterization of an individual or population, that is, the determination of the shape and size of individuals, making it possible to compare different individuals or population groups.

The informative potential of both cranial and postcranial measurements and the record of morphological variation of the human skeleton has been widely applied to the description and understanding of environmental adaptations of human populations, and for analyses of biological distance, i.e. the degree and interpretation of similarity or divergence between populations or subgroups based on cranial and dental character analysis (Ubelaker, 1994; Larsen, 1997; Silva, 2002). Various researchers have indicated that bone morphology is related with variables of the following types: genetic (Hauser and De Stefano, 1989; Buikstra and Ubelaker, 1994; Tyrrel, 2000; Ullinger et al., 2005; Stojanowski and Schillaci, 2006), nutritional (Saunders, 1989; Bogin, 1999; Cardoso, 2000) and occupational (Larsen, 1997; Capasso et al., 1998; Ruff, 2000; Holt, 2003; Ruff et al., 2006).

Morphological analysis for bones from Tomb I included metric and non-metric parameters although as expected, the contribution of the data from Tomb I to the discussion of this theme is poor with regard to skeletal metric and non-metric analysis. The high level of fragmentation of these bones did not allow us to perform most of the morphological studies normally applied in these situations, in order to better understand behavioural aspects of past communities (Silva, 2002).

Indeed, it is teeth, with their unique anatomy and physiology that are the skeletal elements which are the most resistant against environmental forces that act on the fossil record, and are not easily affected by external and biological factors (sex, age, among others) (Marado 2010; Silva 2012). Teeth are very variable in their morphology and structure. These specific non-metric traits are hereditary and their close evaluation allows inferences regarding biological affinities (Scott, 2008; Scott, 2013): through the presence and absence of these traits it is possible to perceive the structure of the populations of the past, their biological tendencies, aspects related to genetic flows, genetic drift and degrees of crossing (Silva 2012).Through them it is possible to contextualize an individual or a community of the past in a given space and time, to discriminate cultural relations, to differentiate biological and hereditary tendencies and to support inferences in relation to themes that are discussed in archaeology, such as migrations or diffusions, some of the problems that material culture alone cannot solve without this support of biological anthropology .

The study of discrete dental characters is of such importance, mainly because of their greater durability and preservation compared to cranial traits and their easy observation (Scott 2008; Marado, 2010; Silva 2012) that they have gained a prominent position in studies based on communities of the past (Hillson, 1996; Silva 2002).

For Tomb I, the odontological non-metric analysis of teeth identified was so relevant that it justified being part of the sample used for a PhD thesis defended in 2015, at the Department of Life Sciences in Coimbra by my collegue, Cláudia Cunha (Cunha, 2015) and are not, for this reason, included in this work.

Morphological analysis fof bones from Tomb I included metric and non-metric parameters. Robustness could not be assessed in any of the available long bones. Only platimery could be analysed (Martin and Saller,1957).

Stature was assessed using Santos (2002) since this specific approach does not require a prior knowledge of the individual's sex. The equations applied to the different bones used are shown in Table 13.

Table 13 - Stature estimation following Santos (2002) used in the anthropological analysis of Tomb I (Perdigões).

Length of Second Metatarsal
Y = 790,041 + 11,689 M2* ± 47,5
Length of First Metatarsal
Y = 816,157+13,007 M1** ± 53,5

* Maximum Length of Second Metatarsal; ** Maximum Length of First Metatarsal

Regarding non-metric trait scoring, the characteristics of the postcranial skeleton were studied using Saunders (1978) and Finnegan (1978). This author argues that discrete post-cranial traits may be more reliable to understand relationships between populations and that, moreover, they are also easier to apply to archaeological collections since the bones in which they are located are generally better preserved. The scored traits can be observed in Table 14 and were chosen according to the nature of the specific sample from Tomb I.

Table 14 - Post-cranial non-metric traits scored for the human bones recovered from Tomb I (Perdigões).

Presence of Trait	Bone
Allen's Fossa	Femur
Hypotrochanteric Fossa	Femur
Third Trochanter	Femur
Medial Tibial Squatting Facet	Tibia
Lateral Tibial Squatting Facet	Tibia
Supracondyloid Process	Humerus
Septal Aperture	Humerus
Acromial articular facet	Scapula
Vastus Notch	Patella
Vastus Fossa	Patella
Emarginate Patella	Patella
Medial Talar Facet Present	Talus
Inferior Talar Articular Surface	Talus
Anterior Calcaneal Facet Absent	Calcaneus

4.2.8 Paleopathology

The various bones were studied to look for indications of pathologies that could have affected the individuals found in the Tomb. Paleopathology makes it possible to study the evolution of diseases over time, and also the way in which the species analysed adapted to these diseases. Paleopathological evidence is the most direct and most primary, and probably the most trustworthy evidence in the study of how disease affected the populations observed. From a synchronic perspective, information may also be obtained on the diseases which affected the individuals studied and also the communities they belong to (Buikstra and Ubelaker, 1994; Aufderheide and Rodríguez-Martín, 1998). Diseases which affect individuals are conditioned by factors such as: migrations, climate, diet and economy, environment, occupation/profession, “therapies” (Roberts and Manchester, 2005).

The paleopathological study included examination of physiological stress indicators, oral pathology, degenerative, infectious, congenital and traumatic pathologies and any other condition recorded during the study.

4.2.8.1 Physiological Stress Indicators

Most metabolic diseases have a common root in nutritional issues: they result either from a surplus or deficit of a food component. They can also be caused by biological deficiency in the absorption of ingested nutrients (Ortner, 2003). The human skeleton may reflect past periods of shortages or disruption with the established balance with the environment (Cunha, 1994). Although they occur through different etiologies, these cases can be called metabolic or physiological stress indicators (Roberts and Manchester 2005). These indicators may be subdivided into: (i) general cumulative, (ii) general episodic and (iii) specific (Cunha, 1994).

The ***cribra orbitalia*** features similar lesions to those observed in porotic hyperostosis, but it is located on the superior part of the orbits. As **in porotic hyperostosis**, changes in bone tissue are predominantly bilateral. The former is regarded as a more serious stage when compared to *cribra orbitalia* (Wapler et al., 1998; Blom et al., 2005; Roberts and Manchester, 2005; Keenleyside and Panayotova, 2006). It is generally accepted that *cribra orbitalia* also results from anemia due to iron deficiency. But other causes are also suggested including scurvy, syphilis or the presence of toxins (Wapler et al., 2004; Blom et al., 2005; Sullivan, 2005).

Linear enamel hypoplasia is a non-specific stress indicator and consist of changes in the thickness of the enamel. These lesions provide a retrospective, longitudinal registration of growth disturbances during the formation of the enamel and may occur due to nutritional or other imbalances suffered during childhood (Neiburger, 1990). Dental enamel hypoplasia is a defect in the enamel structure caused by some kind of physiological stress of great magnitude, that was not fatal to the individual (Aufderheide and Rodriguéz-Martín 1998). These disorders are common and have varied causes, such as problems related to birth, infections and other diseases. Caries, tooth wear, fracture and the effects of taphonomy on human teeth may sometimes prevent the observation of hypoplasia (Waldron 2009).

The existence of several lines of dental enamel hypoplasia means different moments of physiological stress and for this work, the number of hypoplasia lines per tooth was also performed (Aufderheide and Rodriguéz-Martín 1998).

4.2.8.2 Oral Pathology

As the mouth is where food is first processed, teeth provide valuable information about the individual's diet, its composition and consistency (Lukacs, 1989; Freeth, 2000; Vodanovic et al., 2005). Moreover, it also provides important information regarding oral hygiene, stomatological practices and cultural practices (Freeth, 2000; Roberts and Manchester, 2005; Lieverse et al., 2007, Godinho, 2008). Because teeth are more resistant to taphonomic processes this feature, combined with the amount of information they can deliver, makes them a valuable source of information on past populations (Vodanovic et al., 2005; Wasterlain, 2006; Lieverse et al., 2007).

Although **tooth wear** is not considered a pathology, it is included in this section because food masticatory stress can increase the incidence of oral diseases (Roberts and Manchester 2005). It can be caused by friction, with well-defined wear facets produced by tooth-to-tooth contact (Hillson 2005; Wasterlain 2006). Another form of wear is abrasion, a more diffuse wear, occurring on the surface of teeth through contact with harder particles (Hillson 2005; Wasterlain 2006). This type of wear may also reveal the intentional or functional use of the teeth as a tool. Erosion consists of wear through the dissolution of enamel and dentin through oral bacteria extrinsic acids (Wasterlain 2006).

Occlusal wear (dental surface erosion through contact with opposite teeth) is the most widely studied by anthropologists in the study of skeletal remains, and wear patterns have been analysed as sources of information for inferring dietary habits and strategies by past populations (Smith, 1974; 1984). These attempts have sometimes been challenged by some authors, once again, due to absence of standardized scoring methods (Luckacs, 1989). The method developed by Smith (1984) for the analysis of wear patterns was developed through the analysis of *in situ* specimens but has applicability for the scoring of loose teeth since the score of wear is defined by tooth sector. Although it is originally an 8-level method, the lack of a level 0 (for no wear at all) was recognized by authors studying patterns of wear in prehistoric Portuguese collections based mainly on loose teeth (Duarte, 1993 and Silva 1996). The need to distinguish teeth crowns that were originally enclosed in the jaw but are found loose in these commingled collections led to a modified creation of Smith's first score method by Silva (1996) with the inclusion of the 0 level, for the total absence of wear.

Dental tooth wear was analysed based on the 8-scale table developed by Smith (1984), modified by Silva (1996) and applied mainly to loose teeth.

The presence of **Antemortem tooth loss** was also registered for this collection.

Calculus results form the mineralization of the bacterial plaque that accumulates on the tooth surface and adheres to the crown or root surface through poor oral hygiene or consumption of a high level of protein (Hillson, 1996). The lack of oral hygiene in the populations can lead to a higher prevalence of calculus, and its formation occurs mainly on the lingual surface of the anterior teeth (Waldron 2009). In theory, it is possible to say that this establishes some kind of caries prevention since, as a process of mineralization, it prevents the demineralization of the enamel (Waldron 2009).

For calculus, the scoring system developed by Martin and Saller (1957) was adopted.

Cariogenic lesions are characterized by a focal process of demineralization of enamel and dentin by organic acids produced by bacterial fermentation of carbohydrates, particularly sugars (Hillson, 2000). In most cases, there is a strong relationship between development of caries and age (Hillson 2005; Hillson 2008).

Because the number of cariogenic lesions in this collection and for prehistoric ones in Portugal in general is low, in order to describe them the Luckacs method was applied for the description of the extent of the lesions (Luckacs1989), and the suggestions of Moore and Coorbett (1971) were utilized to describe the anatomical site of the carie on the tooth. The choice of these methods is also related to the subsequent need to compare the results obtained with other coeval series.

4.2.8.3 Articular Degenerative Disease

This pathology is characterized by the destruction of articular cartilage, in most cases associated to bone remodelling and may affect one or more joints, according to a specific distribution pattern that makes it possible to infer causes (Roberts and Manchester, 2005). Osteoarthritis can be primary, resulting from the interaction between factors such as age, sex, mechanical stress and genetic predisposition, or secondary, due to some type of trauma or other injury (White, 2000).

The various phases of this pathology are well known and documented: formation of osteophytes at the margins of the joint (labiation), formation of new bone on the articular surface, changes in the contour of the joint (more open and flattened) and eburnation (Waldron 2009). Eburnation is pathognomonic of this pathology, that is, it allows the differential diagnosis of arthrosis when the ceramic glaze aspect is observed in the bone (Assis 2007).

In the framework of the methodology applied in this study, the criteria for recording of osteoarthritis followed Crubézy (1988).

4.2.8.4 Non-Articular Degenerative Disease

Musculoskeletal Stress Markers (MSM) are observable indicators of activity-induced stress on bone, often appearing as bony projections. They are present on the origin and insertion of muscle on bone, in the form of the ossification of the tendon and ligament attachments that help anchor the body of a muscle to the bone itself (Benjamin et al., 2001 and 2002; Weiss, 2003; Steen and Lane, 1998; Assis, 2007). Causes for this condition are normally related to mechanical, systemic or genetic factors but they are studied under the general group of degenerative bone diseases. Intense physical effort and excessive or repetitive muscular activity will cause micro-breaches in the tendon fibres followed by a process of repair. So, as they are often the product of repetitive movements or of a demanding physical lifestyle, when scored and recorded at a population level, they may be considered Markers of Occupational Stress (MOS). For Tomb I, the analysis was performed on the bones and anatomical regions presented in Table 15 and follows Crubézy (1988) for the scoring. Although a group of researchers in Coimbra have in recent years developed a method for scoring enthesophytes (Henderson and Cardoso, 2012) for this work Silva's (2002) approach was followed to render possible comparisons between the prehistoric collection studied in that PhD thesis and the collection presented here.

Table 15 - Bones and anatomical regions observed for enthesal changes in Tomb I (Perdigões).

Bone	**Region Observed**
Scapula	Coracoid Process
	Acromion
Clavicle	Sternal Extremity
	Deltoid Tuberosity
Humerus	Medial Epicondyle
	Lateral Epicondyle
	Trochlea
	Lateral Supracondylar Ridge
Radius	Bicipital Tuberosity
	Radial Styloid Process
Ulna	Proximal extremity
	Styloid Process
Ilium	Iliac Crest
	Ischiatic Tuberosity
Femur	Greater Trochanter
	Lesser Trochanter
	Linea Aspera
	Digital Fossa
Patella	Anterior Surface
Tibia	Soleal Fossa
	Anterior Tuberosity
	Distal
	Medial Malleolus
Fibula	Biceps Femoris
	Lateral Malleolus
	Tibiofibular Ligament
Calcaneus	Tuberosity
	Adductor Hallucis

4.2.8.5 Infectious pathology

The effect of pathogens on the human skeleton is an important source of information with regard to biological changes associated with the development of modern man (Ortner, 2008).

Lesions attributable to specific infections are those related to specific microorganisms. The non-specific infections, potentially caused by many different microorganisms, may include periostitis (infection of the periosteum), osteomyelitis (infection of the cortical bone) and osteitis (infection of the medullary cavity) (Roberts and Manchester 2005).

The intrinsic nature of this collection limited the diagnosis for infectious disease. Indeed, if these bone changes are, in some cases, difficult to assess and diagnose definitively in a complete skeleton, this is even more true for commingled remains, where the possible diagnosis of infectious disease was very limited. It was only possible to describe abnormal bone changes with an infectious origin, without suggesting a specific diagnosis.

4.2.8.6 Trauma

Any wound or lesion in the body can be classified as trauma, whether it affects only the soft tissues, or the skeleton also (Roberts, 2009). Those that affect the skeleton are only a fraction of the traumatic episodes that affect individuals. The bones directly affected are recognized through fractures and dislocations. These are discontinuities or breaks in the skeletal tissues and result from mechanical stimuli that exceed the plastic capacity of bones (Aufderheide and Rodriguéz-Martín, 1998). The different types of fractures reflect different kinds of mechanical stimuli associated with various causes (Lovell, 2000; Roberts and Manchester, 2005). Fractures can be characterized in relation with the mechanisms that caused the trauma, which may be: direct, indirect, result from stress or come as a secondary effect to other pathology (Lovell, 1997).

4.3 Funerary analysis of space

This was essential for a better understanding of the way death was managed during the period in which the tomb under study was in use. Indeed, funerary rites constitute evidence of ritual customs (Fogelin, 2007). These customs may be seen as symbols to which certain actions are associated, the latter becoming part of the cultural system they report to (Geertz, 1993). Thus, funerary rituals reflect the cultural contexts which they belong to and may be used as indicators of the culture which produced them and the religious systems which they are associated to (Fogelin, 2007), and are therefore a clear indication of the attitude of individuals from the respective cultures with regard to the dead (Crubezy, 2000). The "anthropologie de terrain", or "archaeothanatology" approach, developed in France since the 1970s (Duday, 1978, 2006, 2009; Duday et al., 1990) recognizes that after death, the body undergoes a complex series of changes. These changes form the basis of a mortuary analysis that can reconstruct both the original treatment of the body and those practices that were associated with the body: presence of multiple burials, original body or bodies position, the identification of primary vs. secondary burials, etc. It is dependent on meticulous recording of the relative position and levels of the various different bones of the skeleton (see Duday and Guillon, 2006 for detailed discussion of methodologies) and has applications in both archaeological and forensic contexts (Duday and Guillon, 2006).

Duday (2006, 2009) notes that identification of a true secondary burial is complex, since primary burials can decay in a manner that mimics secondary burial. Due to these problems and based on the methods available at the time, from 1999 onwards a total station was always used as a way of locating exhumed bone remains (cf. Field Work sub-chpater). The aim was to try to analyse the spatial distribution of human bones found scattered in the chamber or in small nuclei, under slabs and understand if there was an underlying logic to this distribution. By applying this "archaeo-anthropological" approach it could be possible to reconstruct mortuary practices and modes and rhythms of depositions from the data acquired in the field.

In his work on collective neolithic graves in France Phillipe Chambon (2003), considers that the questions posed differ according to the type of bone: if a concentration of skulls on the periphery of the sepulchral chamber usually does not correspond to a radiating deposition of the bodies but to arrangements after decomposition it is also important to look for possible zones reserved for a particular age group, or one of the two sexes or any other category of inhumation considered important. For this work the spatial analysis considered several level of analysis.

- A first general distribution of bones is considered based on the main categories of analysis in the laboratory work (cf. Inventory of Bones and Teeth sub-chapter): cranial fragments, teeth, identified adult and non-adult bones, foot and hand bones, ribs, vertebrae and non-identified long bones. The main aim of this exercise was to understand the global distribution of human bones in the chamber.

- A second level of analysis considers the possibility of an age or sex criteria in the distribution of human bones thoroughout the phases of use of Tomb 1. In this sense the distribution of adult/non-adult and male/female referenced bones was anlaysed.

- A third level of analysis considers the distribution of specific bone categories. It was important to understand if cranial fragments (including teeth) had a specific distribution in the chamber. and the same was true for the other categories of long bones (femur, tibia, fibula, humerus, ulna and radio). Also, the specific distribution of hand and foot bone was also analysed. According to Chambon, despite their small size, hand and feet bones are remains that do not move a lot inside funerary chambers: they escape the attention of the gravediggers and reflect fairly well the initial position of the corpses even when connections are absent (Chambon, 2003 p. 45). This informatin is important in commingled funerary sets to try to understand the origin of the gestures that led to the final position of the human bones in a funerary strucutre.

4.4 Comparative study

It should be noted that for the purpose of this thesis a twofold approach was adopted. On one hand, the study of human remains uncovered by archaeologically defined phases of use of the monument (cf. Phasing of Tomb I chapter). The aim was to detect possible differential uses of the Tomb throughout its use regarding mode and number of depositions, sex and age of individuals.

On the other hand, the collection was studied as a whole to allow comparison with other coeval collections. Once results were obtained, a comparative analysis was performed based on data available at the time for similar archaeological contexts. Information is already available for several tholoi type contexts studied (Silva, 1996, 2002, 2002; Silva and Ferreira, 2007; Silva et al., 2006 and 2008; Boaventura and al., 2014 and 2016; Robles Henriques et al., 2013 a and b) and it is expected that in the near future the anthropological data of more recently excavated monuments will become available.

This comparaison made it possible to record differences in demographic, morphological and pathological features between coeval populations and aimed to go further and shed light on the potential presence of differentiated funerary rituals occurring at the same time in different regions.

4.5 Summary

This chapter outlined the methods used in this study for sorting and counting the skeletal remains, determining the possible number of individuals. For paleodemographic, paleomorphologic and paleopathologic analysis and other data review an Excel sheet inventory of the human skeletal remains from TombI was set up using information from the original data collection.

The following chapter will present results from the data analyses for the phased analysis of Tomb I as well as the total results for the monument.

"Be strong, saith my heart; I am a soldier;
I have seen worse sights than this."

Homer, The Odyssey

5 Results

The results study starts, as already mentioned before, by a per-phase approach of the monument, following the archaeological phasing defined after the excavation of the monument was completed. Phases are only considered for the chamber of the monument.

5.1 Per-phase study of Tomb I (Chamber)

After it was constructed (Phase 1) Tomb I has 2 main phases of use that are divided by the moment when the schist slabs lining the chamber start collapsing. Both main phases are divided into sub-phases as described schematically in Figure 7. Results for each phase start with a description of the archaeological context followed by the paleobiological, paleomorphological and paleopathological analysis. The spatial analysis of bone distribution is the last item described.

5.1.1 Phase 1

The construction phase (Phase 1) includes the opening up and digging of the outline of the monument (atrium, corridor and funerary chamber) in soil and rocky substrate, its lining with schist slabs and the possible erection of two upright stone monoliths similar to those found in Tomb II, which were probably torn out when the olive tree was planted. The compartment identified on the North side of the chamber also belongs to this stage of construction.

5.1.2 Phase 2

The funerary use of Tomb I at Perdigões was long and complex. Phase 2 is subdivided according to the stratigraphic analysis and corresponds to the most intense funerary use of the area, which is evident from the great scatter and fragmentation of the osteological remains and votive material.

During this phase, the tomb's architectural structure remained stable, although there were sporadic landslides of two lining slabs from the wall of the chamber. It is possible that this stable environment explains the fact that the vast majority of deposits from this phase are composed of fine sediments, apparently without major intrusion of soil or grain of the rock disintegration in which the structure was implanted.

5.1.2.1 Phase 2A

When the monument began to be used in Phase 2, the internal chamber/compartment was no longer in use. Indeed, there is no indication of its original use, which raises questions as to its purpose. It is possible that nothing survived from the first utilizations of the monument or that this space was no longer used for its original purpose. The remains of the interior compartment, found empty and partially dismantled are the only evidence of this primitive use of the chamber (Figure 18). Given the available data, we can only speculate on the motivations for its presence. As considered for Monument 7 of Alcalar (Estácio da Veiga, 1896), could it be a specific space of deposition for the remains of a particular individual or group of people? That being the case, any vestiges would have been "cleaned out" and the space created could have ceased to make sense within the funerary organization of the chamber space. It should be noted that with the exception of the slabs on its west side, no traces of other *in situ* or overturned slabs, which might have formed the remaining walls were identified.

Figure 18 - General view of the chamber from the corridor. The internal compartment is visible. Tomb I (Perdigões).

It is clear that phase 2A was a period of intensive use of the tomb, in spite of the poor state of the bone fragments collected. The oldest deposition which revealed clear evidence of intentional deposition of votive material contained two sets of artefacts, one that included a ceramic pot and the other an arrow head. Therefore, SU 194 seems to be a moment of a ritualized use of the chamber that does not include the deposition of human bones. It could be seen as a foundational moment, with the deposition of objects of a kind that suggest a more sacred nature (Figure 19). Other tholos type monuments possess this kind of internal compartmentation as discussed in previous chapters (cf. Tholoi Type Structures sub-chapter).

Figure 19 - General view of SU 194. Tomb I (Perdigões).

Almost simultaneously we identified the first clearly funerary use of the monument. On the bedrock floor of the chamber, on its West side, towards the head end, a few depositions were identified that included mainly stains of red pigment (Figure 20), several artefacts of a sacred nature and a few human remains (SU 310).

Figure 20 - Detail of red pigment covering part of SU 310. Tomb I (Perdigões).

These oldest depositions are scattered at the head end of the monument. After this moment and for the rest of the use of the Tomb during Phase 2A, the depositions of human remains (SU 302, 304, 305, 193, 143) occur mainly in the East sector of the chamber on either side of the opening to the corridor, which functioned as an entry and exit point of the chamber. Collection of bones was made extremely difficult due to their extreme state of decomposition. Four basic types of artefacts were frequently found: ceramic containers, arrowheads, blades and necklace beads, among which can be seen the only decorated schist tablet/slab(?) collected from Tomb I.

Table 16 presents the results for the general bone count for Phase 2A of Tomb I. This count follows the inventory used in laboratory work. This is the oldest known phase for the use of the monument. Although there are no C14 dates available for it, the bone fragments recovered are considered, at least in stratigraphic terms, older than the others. Also, their position in the very bottom layers of the Tomb contributed to their very poor state of conservation. The number of adult bone fragments (n=706) is higher than non-adult bones (n=82) and although most of the fragments were identifiable (n=2440), 54,4 % could only be generically referred to as part of long bones. These are seconded by 870 cranium fragments (19,4% of the total) and then by general rib (n=197) and vertebrae (n=123). Only around 1, 3% (60 fragments) were non-identifiable.

Table 16 - Bone count for Phase 2A. Tomb I (Perdigões).

Type		**No. Registers**	**No. Fragments**
Identified bones			
	Adults	430	706
	Non-Adults	58	82
Others (adults)	Cranium	166	870
	Rib	90	197
	Vertebrae	61	123
Long Bones N.I.		158	2440
N.I. Bones		8	60
TOTAL		**971**	**4478**

In the case of teeth, Table 17 summarizes their total count. 209 permanent teeth were recovered and only 7 deciduous teeth were identified.

Table 17 - Tooth count for Phase 2A. Tomb I (Perdigões).

Type		**Number**
Permanent		
	Totally Formed	175
	In formation	34
Deciduous		7
TOTAL		**216**

The minimum number of individuals (MNI) estimated for this phase was of 28. For non-adults, an estimated number of 16 individuals (less than15 years of age) was estimated based mainly on loose tooth analysis (Table 23) except for one perinatal individual whose fibula was recovered and metric analysis provided an estimated age at death.

The MNI for adults is 12 based on the presence of that number of upper left third molars, FDI 28 (Table 19).

Bone analysis shown in Table 18 provided a minimal number of 6 adult individuals obtained by the presence of 6 fragments of right humerus and the same number of fragments belonging to right scapula.

Table 18- Adult MNI based on bones for phase 2A. Tomb I (Perdigões)

Bone	MinNi
Right Humerus	6
Left Scapula	6
Left Humerus	5
Left Ulna	5
Right Ulna	5
Left Femur	4
Right Tibia	4
Left Radius	3
Left Tibia	3
Right Femur	2
Right Radius	1
Left Fibula	1
Right Fibula	1

9,3% (n=40) of the 430 individual adult bone registers of Phase 2A were found complete. The kind of bone that survived fragmentation is presented in the following graph (Figure 21) and is exclusively composed of small carpal and tarsal bones.

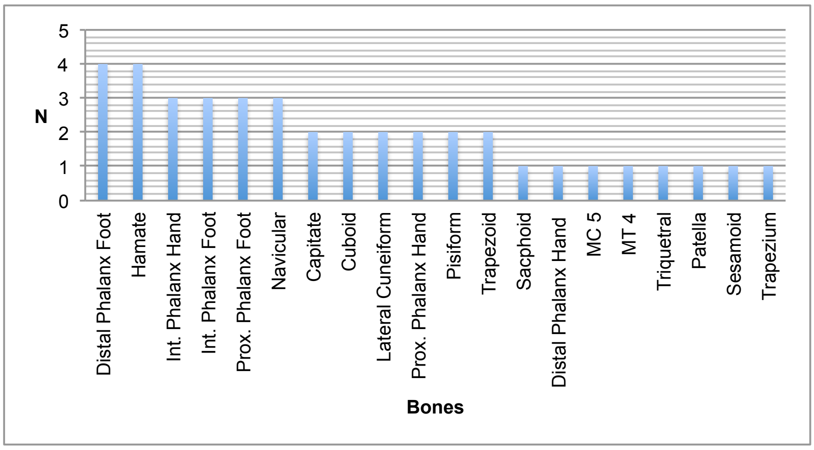


Figure 21 - Complete adult bones from Phase 2A. Tomb I (Perdigões).

As was found with adults, the only complete non-adult bone elements (7 / 59 individual registers, 11,8% of the total) are small foot and hand bones as can be seen in Figure 22.

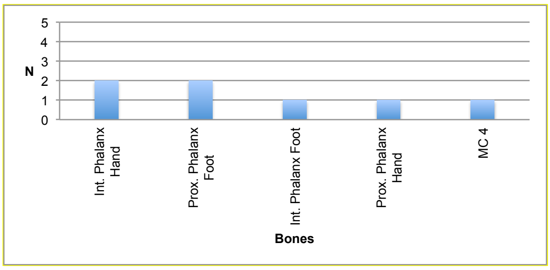


Figure 22 - Complete non-adult bones for Phase 2A. Tomb I (Perdigões).

If this data is analysed together with information from Table 19 it is evident that although all skeleton parts are present in Phase 2A most of the bones categories are poorly represented. This information is based exclusively on bones that could be assigned a secure laterality and probably does not reflect the real number of each bone present. For Phase 2A, bone based MNI is half the one defined through tooth analysis, which provided an MNI of 12. Although most skeletal parts seem to be present (although the pelvic girdle is badly represented) there is a low representativeness of resistant bones like the tibia, which has a 25% representativeness. On the other hand, the larger tarsal bones like the calcaneus and the navicular have a similar presence to the best represented bones with 41,6% representativeness.

The presence of 50% of the expected fragments of scapula seems to contradict the above shown information, but is secured by the conservation and lateralization of the area of the glenoid cavity, the most resistant area of that bone. Fragments of all long bones were preserved with some difference of representativeness between the upper and the lower limb, especially regarding the fibula that is only represented by one lateralized fragment.

What is more, the presence of small carpals and tarsals should be noted. As seen in the previous bone preservation section they represent most of the complete registers of the collection and the fact they "escaped" destruction can probably be explained precisely by their reduced size. Two fragments of hyoid bone were also recovered. Unlike other bones, the hyoid is only distantly articulated to other bones by muscles or ligaments and its presence in the funerary register of Phase 2A must be taken into account.

With such a low count of bones, however, it is hard to reach any sure conclusions on the specific nature of these depositions based exclusively on this parameter. The presence of two hyoid renders this analysis even more complicated. If this phase is not the reflection of a secondary use of the tomb then it must correspond to a deeply revolved and manipulated context with the possible removal of certain body parts to other contexts.

Table 19 - Bone representativeness for Phase 2A. Tomb I (Perdigões)

Bone	Obs. No.	Representativeness (%)
FDI 28	12	100
Right Humerus (Distal ½)	6	50,0
Left Scapula - Glenoid	6	50,0
Left Ulna (Proximal 1/3)	5	41,6
Left Calcaneus	5	41,6
Left Navicular	5	41,6
Left Temporal (*Pars Petrosa*)	4	33,3
Left Femur (Distal Extremity)	4	33,3
Left Zygomatic	4	33,3
Right Patella	4	33,3
Left Tibia (Middle 1/3)	3	25,0
Left Pisiform	3	25,0
Left Radius (Distal 1/3)	3	25,0
Right Capitate	3	25,0
Right Ilium	3	25,0
Right Hamate	3	25,0
Left Talus	2	13,6
Left Lunate	2	13,6
Hyoide	2	13,6
Left Frontal	2	13,6
Left Clavicle	2	13,6
Left Ischium	2	13,6
Left MC4	2	13,6
Left Mandible	2	13,6
Left Lateral Cuneiform	1	8,3
Left MC1	1	8,3
Left Fibula	1	8,3
Left Scaphoid	1	8,3
Right MC3	1	8,3
Right MT1	1	8,3
Right MC5	1	8,3
Right MT4	1	8,3
Right Trapezoid	1	8,3
Left Cuboide	1	8,3
Left Parietal	1	8,3
Left Trapezium	1	8,3
Mentum	1	8,3
Occipital	1	8,3

The information presented on Table 20 and Table 21 is indicative of tooth representativeness for phase 2A. In Table 20 the percentages obtained for upper teeth (single or double/multi-rooted), although slightly higher, seem to conform to the expected numbers. However, for lower teeth the percentages obtained are very far from what would be expected. In fact, for single-rooted teeth the values are 14% below what could be expected and double/multi-rooted teeth are 8,1% above.

This imbalance is also visible when the results shown in Table 21 are looked at more closely. Again, the proportion between upper and lower teeth does not fall within the expected values. Upper teeth show a better survival of double/multi-rooted teeth, which is understandable. The same seems to happen with lower teeth where the group of single rooted teeth, which should be naturally larger (for it includes all the anterior teeth and premolars), appears misrepresented when compared to double/multi-rooted teeth.

Table 20 - Percentages for single-rooted, double/multi-rooted teeth for Phase 2A. Tomb I (Perdigões).

	In situ	**Loose**	**Total**	**% Obtained**	**% Expected**
Upper SRT	7	48	55	26,3	25
Upper DMRT	12	50	62	29,6	25
Lower SRT	13	23	36	17,2	31,2
Lower DMRT	14	42	56	26,7	18,8

SRT (Single-Rooted Teeth); DMRT (Double/Multi-Rooted Teeth)

Table 21 - Proportion of upper and lower teeth for Phase 2A. Tomb I (Perdigões).

	SRT	**DMRT**	**Obtained**	**Expected**
Upper	55	62	0,89	1
Lower	36	56	0,64	1.7

Legend: SRT (Single-Rooted Teeth); DMRT (Double/Multi-Rooted Teeth)

Although only experimental, the results for bone weight (Table 22 and Figure 23), show some important information. In fact, the reason for not systematically weighing all the bone fragments (which has been explained in the Methods chapter) was related to the great level of mineralization most of the bone fragments presented, rendering them much heavier than an average dry bone with no such taphonomic effect. The concretions attached to many of the bones, impossible to remove without causing considerable damage to the tissues, also adds difficulty to the task. Thus, it would be expectable for all bone categories to be found in higher weight values. Strangely this was only true in the case of cranial fragments, where the fragments weighed 18,2% more than expected. For all the other bone groups (Long bones, Hand, Foot and Others) the values are below expected. Although for the first 3 of these categories differences are quite insignificant, the values for Others is considerably underrepresented (12,8% less than expected) and could indicate the actual lower presence of the body parts constituting this category (scapula, ribs, vertebrae, clavicle, etc.)

Table 22 - Results for bone weight for Phase 2A. Tomb I (Perdigões).

Bone	**Weight (g)**	**%Obtained**	**%Expected**
Cranium	3616,64	37,69	19,54
Long Bones	3959,78	41,27	42,12
Hand	169,77	1,77	2,53
Foot	318,96	3,32	5,69
Others	1529,29	15,93	28,77
Total	9594,44		

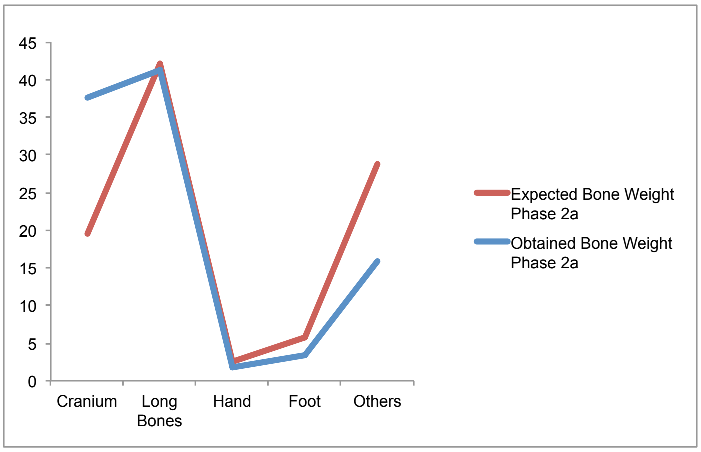


Figure 23 - Results for bone weight from Phase 2A. Tomb I (Perdigões).

Apart from the distinction between adult and non-adult bones, it was also possible to estimate the approximate age of some of the non-adult individuals present in the collection (Table 23). The youngest individual found in the series was an individual whose death occurred in the period around birth. When compared to the presence of adult individuals the proportion of non-adult individuals in this phase is higher: 57,1% of the total.

All age groups, except the 15 to19 age group, were detected as is revealed in Figure 24. Higher mortality seems to occur in the 5 to 9 age group, with 9 individuals. No specific age at death determination was possible for adult bones.

Table 23 – Age at death estimation for non-adult individuals from Phase 2A. Tomb I (Perdigões).

Age at death	Number	Tooth/Bone
Perinatal	1	Fibula
2,5	1	FDI 26
3,5	2	FDI 26
4,5/5,5	1	FDI 11
5,5	3	FDI 11
6,5	3	FDI 14, FDI12
7,5	1	FDI 15
8,5	1	FDI 15
10,5	1	FDI 23
13.5/14.5	2	FDI 48

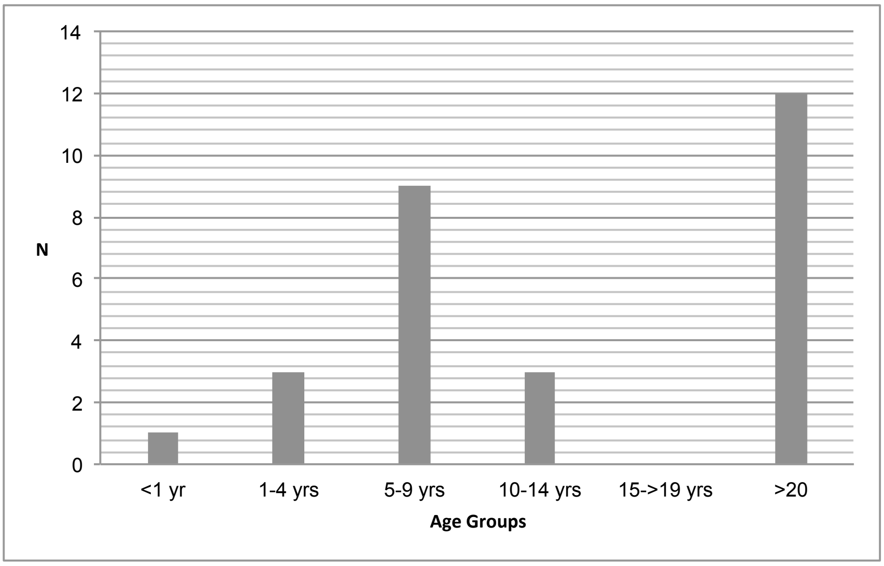


Figure 24 – Age at death profile for individuals from Phase 2A. Tomb I (Perdigões).

For sexual diagnosis, none of the reliable anatomical regions for the determination of this criterion were available in the elements recovered from Phase 2A. All the cranial elements were extremely fragmented and the 22 fragments identified of adult *os coxae* did not allow any positive conclusion. We can only point to a fragment of *os coxae* compatible with a male individual but that is only a suggestion based on proportion and this diagnosis may lack accuracy.

The possible presence of other less sexually dimorphic bones which, nonetheless are better preserved in similar archaeological contexts was also excluded, leaving no information on this particular parameter.

The high level of fragmentation of these bones only allowed very scarce morphological studies, which are normally applied in these situations in order to better understand behavioral aspects of past communities (Silva, 2002). The analysis of indices of robustness and flattening was precluded by the poor conservation state of the femurs and tibias recovered.

Only for one right femur (no. **3002**), from SU 143, was it possible to measure the platimetric index - 75,0. Indices lower than 85 normally mean the antero-posterior crushing of the superior third of the diaphysis (platimetry), normally linked to the strong development of the trochanter due to biomechanical stress.

With regard to the scoring of post-cranial non-metric traits, results can be observed in Table 24 showing that only one septal aperture was scored for Phase 2A, on a left humerus.

Table 24 – Post-cranial non-metric traits observed in bones from Phase 2A. Tomb I (Perdigões).

Trait	Left	Right
Allen's Fossa	0/0	0/1
Hypotrochanteric Fossa	0/0	0/0
Third Trochanter	0/0	0/0
Medial Tibial Squatting Facet	0/0	0/0
Lateral Tibial Squatting Facet	0/0	0/0
Supracondyloid Process	0/3	0/6
Septal Aperture	1/4	0/5
Acromial articular facet	0/0	0/2
Vastus Notch	0/0	0/1
Vastus Fossa	0/0	0/1
Emarginate Patella	0/0	0/1
Medial Talar Facet Present	0/2	0/0
Inferior Talar Articular Surface	0/1	0/0
Anterior Calcaneal Facet Absent	0/0	0/0

For permanent teeth analysed, 16,1 % of a total of 192 (31/192) presented enamel hypoplasia. They are recorded on Table 25. Unsurprisingly it is anterior dentition that presents a higher percentage of enamel hypoplasia registers, namely in the FDI 11 or FDI 43. But the same 50% percentage is also registered in FDI 16.

Table 25 – Enamel hypoplasia for teeth from Phase 2A. Tomb I (Perdigões).

Tooth	Upper		Lower	
	Left	Right	Left	Right
I1	2/5 (40%)	2/4 (50%)	0/1	0/3
I2	1/5 (20%)	0/5	0/2	0/2
C	1/9 (11,1%)	1/4 (25%)	0/3	1/2 (50%)
P1	3/7 (42,8%)	1/4 (25%)	0/3	1/6 (16,6%)
P2	1/10 (10%)	2/11 (18,1%)	3/7 (42,8%)	0/3
M1	0/10	3/6 (50%)	2/11 (18,1%)	0/10
M2	0/7	0/1	4/11 (36,3%)	1/8 (12,5%)
M3	0/12	1/8 (12,5%)	0/8	1/6 (16,6%)

Figure 25 - FDI 11 from SU 304 presenting 3 visible enamel hypoplasic lines. Tomb I (Perdigões).

From the 31 teeth that present enamel hypoplasia, 8 have two or more visible lines as described in Table 26. The tooth presenting 3 enamel hypoplasia is an FDI 11 (Figure 25), from SU 304 (no. **1203**). Two visible lines were identified on 7 teeth and 1 single line on a total of 24 teeth, including on an FDI 85.

Table 26 - Distribution of number of enamel hypoplasia per tooth for Phase 2A. Tomb I (Perdigões).

No Hypoplasia	FDI	No.	Field No.
1	14	1	1133
	15	2	642; 1185
	16	2	438; 1225
	18	1	1181
	21	1	628
	22	1	1245
	23	1	2113b
	24	3	782; 783; 1158
	25	1	1257
	35	3	271; 1183; 469a
	36	1	786
	37	3	656; 434a; 953e
	43	1	668
	44	1	569
	48	1	299
	85	1	333b
2	11	1	1130
	13	1	428
	16	1	503
	21	1	1439a
	36	1	2113c
	37	1	960
	47	1	300
3	11		1203

Regarding deciduous dentition, 14,2% presented enamel hypoplasia (1/7) registered on FDI 85 as shown in Figure 26.

Figure 26 - FDI 85 presenting enamel hypoplasia on lingual surface. Tomb I (Perdigões).

Of the 209 permanent teeth identified in Phase 2A, we were able to analyse 201 for tooth wear and results are presented in Table 27 and Table 28. Average tooth wear is medium low, 1,88% (n=201), with no significant difference between maxillary and mandibular teeth. Anterior mandibular dentition seems to have a slightly higher level of tooth wear as is illustrated by the values presented in Table 28, where lower first and second incisors (FDI 31,32,41 and 42) present a moderately high level of attrition.

Table 27 – Average Tooth Wear for Phase 2A. Tomb I (Perdigões).

	Anterior Dentition	Posterior Dentition	Total
Maxillary	1,5 (n=32)	1,8 (n=82)	1,7 (n=114)
Mandibular	3,9 (n=14)	1,7 (n=73)	2,1 (n=87)

Table 28 – Tooth wear per tooth for Phase 2A. Tomb I (Perdigões).

Tooth	Upper	Lower
I1	0,89 (n=9)	4,8 (n=6)
I2	2 (n=10)	4,2 (n=5)
C	1,5 (n=13)	2,8 (n=5)
P1	2,2 (n=2)	1,2 (n=9)
P2	1,8 (n=21)	1,6 (n=10)
M1	2 (n=18)	2,1 (n=21)
M2	2,4 (n=11)	2,1 (n=19)
M3	1,3 (n=21)	1,1 (n=14)

Although not normally performed, tooth wear was also measured for deciduous teeth since some of them presented quite a considerable level of attrition, as observable in Table 29. In this case, it is a FDI 75 that shows the highest level of wear (a level of 4).

Table 29 – Tooth wear for deciduous teeth from Phase 2A. Tomb I (Perdigões).

Tooth FDI)	Tooth Wear
52	3
55	1
64	3
65	2
75	4
84	0
85	0

No cariogenic lesions were registered in permanent (n=0/193) or deciduous teeth (n=0/7) from phase 2A. Calculus was identified in 17% of the permanent teeth analysed (n=33/193). For superior dentition 14,5% presented calculus deposits (N= 16 /110) and for inferior dentition the percentage of calculus deposits found was of 20,5%(n=17/83).

Table 30 expresses antemortem tooth loss in Phase 2A, only observed in 2 lower teeth. For a defined MNI of 12 adult individuals it would be expected to find something like 384 alveoli available. The presence of only 90 observable ones (just 23%) once again, gives us an idea, of the poor state of conservation of the human bones in the collection.

Table 30 - Antemortem tooth loss for Phase 2A. Tomb I (Perdigões).

Maxillary	Mandibular
0/36 alveoli	2/54 alveoli

Table 31 illustrates on osteoarthrithis lesions recorded for Phase 2A. As can be observed there is very little to report. Only a proximal extremity of a humerus showed signs of degree 1. When possible to score, the remaining bones showed no traces of the pathology.

Table 31 - Osteoarthritis observed in bones from Phase 2A. Tomb I (Perdigões).

		Degree Left		**Degree Right**	
		0	1	0	1
Humerus	Proximal	0	0	0	1
	Distal	2	0	3	0
Radius	Proximal	0	0	0	0
	Distal	1	0	1	0
Ulna	Proximal	1	0	0	0
	Distal	0	0	3	0
Femur	Proximal	0	0	2	0
	Distal	3	0	1	0
Tibia	Proximal	0	0	0	0
	Distal	0	0	0	0
Fibula	Proximal	0	0	0	0
	Distal	1	0	0	0

Regarding enthesal changes Phase 2A is quite poor in results (Table 32). For many bones, most of the anatomical regions we intended to analyse were fragmented or so altered it was not possible to score them. The bones we did observe yielded almost no results. The best observable anatomical area was the Lateral Supracondylar Ridge where 5 humerus (2 left and 3 right) showed signs of some alteration (Degree 1). Apart from these, only the *Linea Aspera* of several femurs was observable but with no record for this parameter.

Table 32 - Enthesal changes observed in bones from Phase 2A. Tomb I (Perdigões).

		Degree Left		Degree Right	
		0	1	0	1
Scapula	Coracoid Process	2	0	4	0
	Acromion	2	0	4	0
Clavicle	Sternal Extremity	2	0	0	0
	Deltoid Tuberosity	0	0	0	0
Humerus	Medial Epicondyle	1	0	1	0
	Lateral Epicondyle	1	0	1	0
	Trochlea	1	0	1	0
	Lateral Supracondylar	3	2	4	3
Radius	Bicipital Tuberosity	0	0	0	0
	Radial Styloid Process	0	0	1	0
Ulna	Proximal extremity	1	0	1	0
	Styloid Process	0	0	0	0
Ilium	Iliac Crest	0	0	0	0
	Ischiatic Tuberosity	0	0	0	0
Femur	Greater Trochanter	0	0	0	0
	Lesser Trochanter	0	0	1	0
	Linea Aspera	2	0	4	0
	Digital Fossa	0	0	0	0
Patella	Anterior Surface	0	0	0	0
Tibia	Soleal Fossa	0	0	0	0
	Anterior Tuberosity	0	0	0	0
	Distal	0	0	0	0
	Medial Malleolus	0	0	0	0
Fibula	Biceps Femoris	0	0	0	0
	Lateral Malleolus	0	0	0	0
	Tibiofibular Ligament	0	0	0	0
Calcaneus	Tuberosity	5	0	2	0
	Adductor Hallucis	5	0	2	0

Other Pathlogies > Infectious Pathology

Register 2969, from SU 302, is a 58-mm long portion of the distal end (probably lateral side) of an adult fibula with no assigned laterality. The bone surface shows sign of periostitis. The size of the alteration is not perceptible as only half the section of the preserved bone is present. This condition seems to have been active at the time of death with deposition of woven bone on the original surface of the fibula.

Figure 27 - Fragment of adult fibula with signs of active infection from SU 302. Tomb I (Perdigões).

> Traumatic Pathologies

Register 819 is a 46mm adult metatarsal fragment belonging to SU 191. Because only the distal half is preserved, complete identification could not be assigned. The global morphology of the bone shows it probably does not belong to a first metatarsal but to the group between the second and the fourth metatarsal.

A bone callus is present on the right side of the diaphysis (it cannot be said if this represents the medial or the lateral side, since we have no general laterality for the bone) probably as a result of the total remodelling of the tissues after an oblique fracture (Figure 28).

Figure 28 - Remodelled fracture on an unknown MT from SU 191. Tomb I (Perdigões). Left Photo: Dorsal view. Right Photo: Side view (laterality not assigned)

- -

Spatial analysis of the funerary use of this phase 2A reveals that, although they are not abundant, all skeletal parts seem to be proportionally represented as can be seen in the Figure 29, below. The dispersion of human bones points to an eminently peripheral use of the funerary chamber, as the bones can be found accumulated close to the schist slabs that close the eastern side of the chamber, with a higher concentration along the north wall. Indeed, very few human remains were identified in the central area of the chamber during this phase.

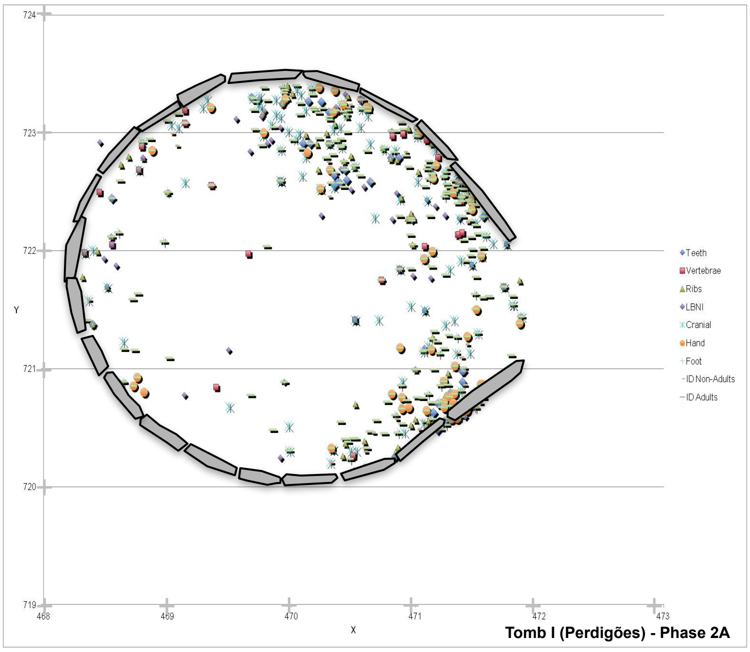


Figure 29 – Human bone distribution for Phase 2A. Tomb I (Perdigões).

Unlike bones, artefacts from phase 2A, are found spread evenly over the surface of the chamber with the deposition of several categories happening in spaces where no human remains were recovered. In the case of ceramic pots, for example, and if the concentration found on the right side of the entrance is excluded, all the other pots seem to be placed in areas with no human bones (Figure 30).

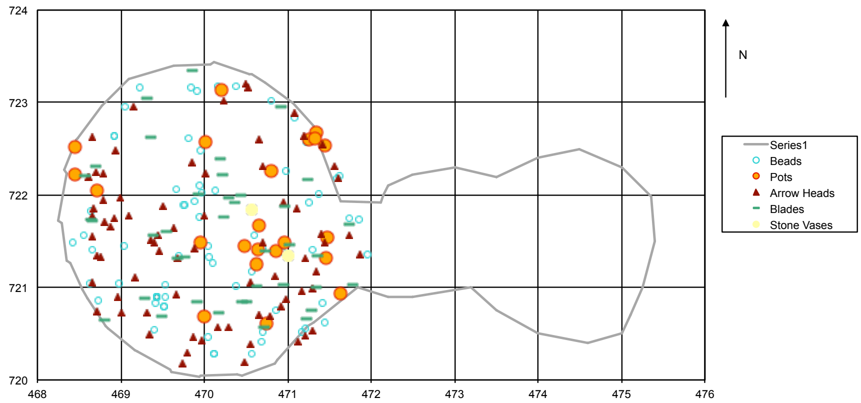


Figure 30 – Distribution of artefacts for Phase 2A. Tomb I (Perdigões).

Figure 31 illustrates that with regard to age groups there appears to be no intentional choice for the spatial deposition of adult/non-adult remains, although a slightly higher concentration of the latter seems to be observable to the left of the entrance.

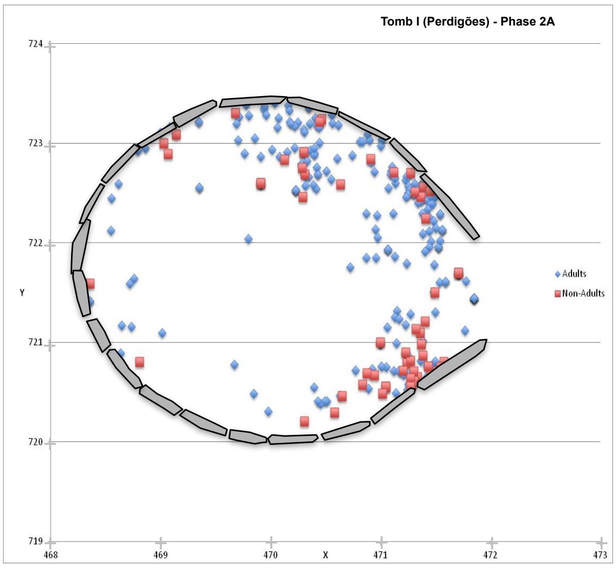


Figure 31 - Adult/non-Adult bone distribution for Phase 2A. Tomb I (Perdigões).

In terms of space distribution of the specific bone groups this would appear to confirm the general idea expressed above. Cranial fragments, including teeth follow the pattern mostly around the north half of the chamber, with some elements also on the left side of the entrance (Figure 32). The same happens for the distribution of long bones (Figure 33) and hand and foot remains (Figure 34)

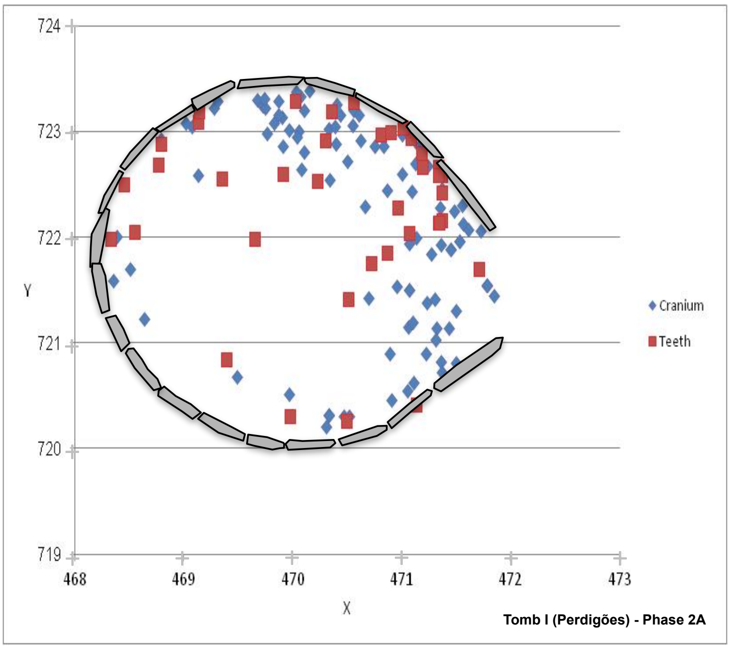


Figure 32 - Cranial fragments and tooth distribution for Phase 2A. Tomb I (Perdigões).

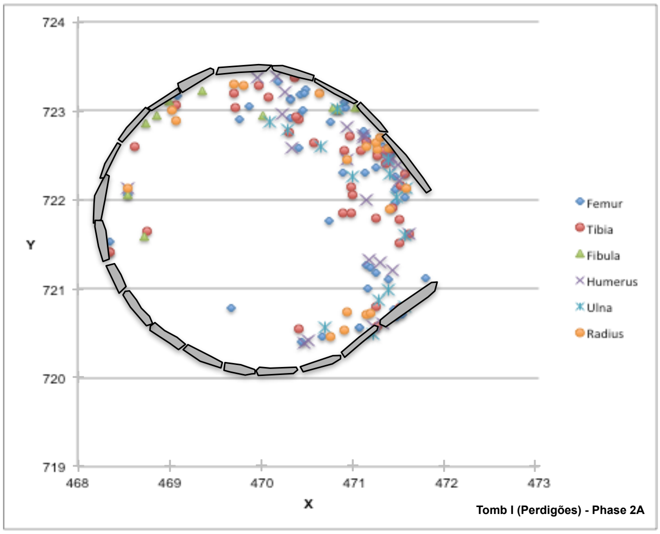


Figure 33 - Long bone distribution for Phase 2A. Tomb I (Perdigões).

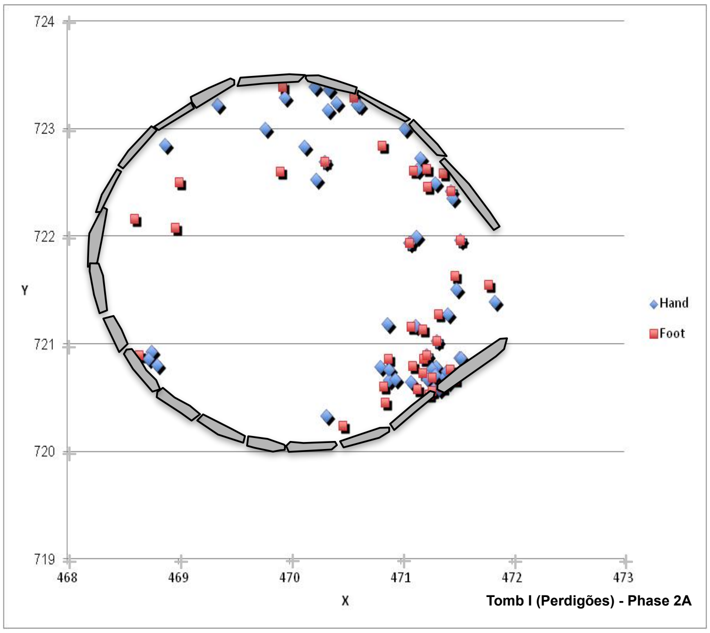


Figure 34- Hand and foot bone distribution for Phase 2A. Tomb I (Perdigões).

5.1.2.2 Phase 2B

This sub-phase corresponds to SU 175. There were many deposits of a heterogeneous nature, including large numbers of human bones of varying concentrations, spread over different areas. For the most part, they were in a very poor state of conservation, so much so that it was often impossible to define their shape or to collect them (Figure 35). Traces of red pigment were found and a large number of votive objects alongside human depositions.

Figure 35 - Detail of SU 175 with human bones and artefacts. Tomb I (Perdigões).

Phase 2B is the smallest of the four sub-phases defined for the first known funerary use of Tomb I, with a total of 2160 fragments recovered. Bones were found in a poor state of conservation and this may explain why non-identified fragments comprise 46,1% (n=998) of the total identified fragments, followed by 405 non-identified long bones fragments (18,8% of the total). General cranial fragments comprise 15,6% (n=337) of the total count followed by rib fragments (n=108) and vertebrae (n=69).

Table 33 also shows that although adult and non-adult bones were recovered, the latter only represent 1,3% of the total fragments identified.

Table 33 – Bone count for Phase 2B. Tomb I (Perdigões).

Type		No. Registers	No. Fragments
Individual bones			
	Adults	139	215
	Non-Adults	26	28
Others (Adults)	Cranium	63	337
	Rib	33	108
	Vertebrae	36	69
Long Bones N.I.		51	405
N.I. Bones		45	998
TOTAL		**393**	**2160**

Amongst the total number of identified teeth, the great majority of which were found loose (Table 34), 184 were permanent, and deciduous dentition was represented by a total of 10 teeth.

Table 34 – Tooth count Phase 2B. Tomb I (Perdigões).

Type		Number
Permanent		
	Formation Complete	159
	Formation Incomplete	25
Deciduous		10
TOTAL		**194**

For non-adults, an estimated minimum number of 12 individuals (less than 15 years of age) was established based on analysis of loose teeth, and 1 individual between 0-6 months of age was identified based on the morphological observation of a hand distal phalanx.

The estimation of a minimum number of adult individuals is 9, based on the presence of the count of FDI 35 as can be seen in Table 36. Bone analysis, shown in Table 35, provided a minimal number of 3 adult individuals, obtained by the presence of fragments of left femur.

Table 35 - MNI based on long bone analysis for Phase 2B. Tomb I (Perdigões).

Long Bone	MinNi
Left Femur	3
Right Humerus	1
Left Humerus	1
Left Radius	1
Right Tibia	1

For phase 2B, for adult bones, the only complete bone elements are carpals and tarsals as can be seen in Figure 36, below. Indeed, only 14 bones were found complete amongst the 139 individual registers (10,1% of the total).

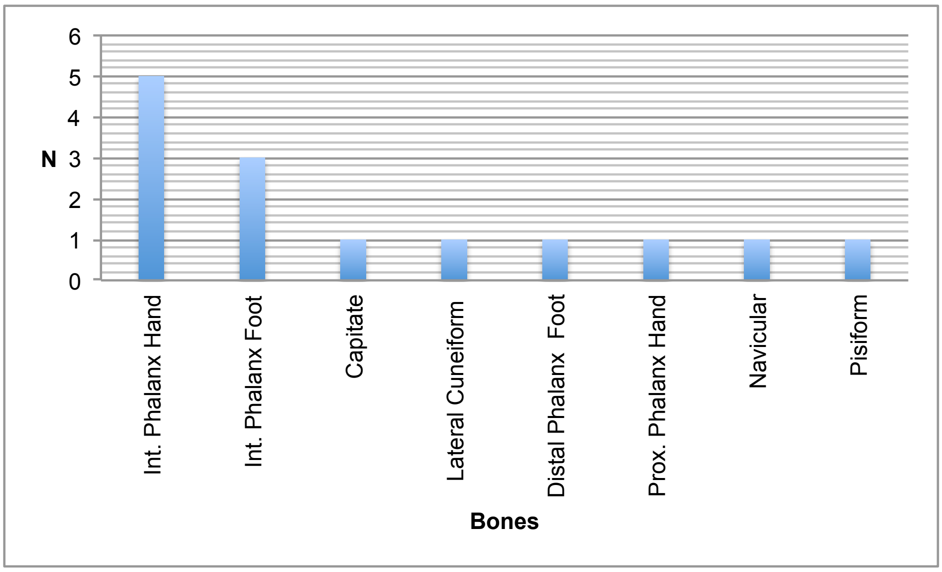


Figure 36 – Complete adult bones from Phase 2B. Tomb I (Perdigões).

This pattern continues when non-adult bones from this phase are analyzed. Once again only 1 proximal hand phalanx and 1 pisiform (7,7% of the total) were found complete amongst the 26 individual bone records.

Bone representativeness is irregular as shown in Table 36 with a modest presence of all post-cranial parts of the skeleton, although foot and hand elements are also present. The presence of a pisiform should be highlighted. Cranial features are the most numerous elements, reflecting the idea gained during fieldwork, of the abundance of this bone. Regarding long bones, the absence of observable fibula and ulna must be noted. Although with low representativeness when compared to the MNI value, femur, humerus, tibia and radius are present in similar proportions.

Table 36 – Bone representativeness Phase 2B. Tomb I (Perdigões).

Bone	Obs. No.	Representativeness (%)
FDI 35	9	100
Right Temporal (*Pars Petrosa*)	4	44,4
Occipital	4	44,4
Left Clavicle	3	33,3
Left Femur	3 (Distal Extremity)	33,3
Right Patella	2	22,2
Right MT3	2	22,2
Left Lat. Cuneiform	2	22,2
Right Tibia	1 (Proximal	11,1
Right Humerus	1 (Distal 1/3)	11,1
Left Radius	1 (Middle 1/3)	11,1
Right Mandible	1	11,1
Right Scapula - Glenoid	1	11,1
Right MC4	1	11,1
Right Navicular	1	11,1
Right Pisiforme	1	11,1
Left Zygomatic	1	11,1
Left MT5	1	11,1
Left Lunate	1	11,1

In contrast with bones, upper teeth are observed in the expected percentage regarding their single-rooted or double/multi-rooted nature, as can be seen in Table 37 and fitting almost exactly into the expected parameters. Lower teeth show a difference when comparing the proportion in single-rooted and double/multi-rooted, although lower than in Phase 2A.

Table 37 - Percentages for single-rooted double/multi-rooted teeth for Phase 2B. Tomb I (Perdigões)

	In situ	**Loose**	**Total**	**% Obtained**	**% Expected**
Upper SRT	1	45	46	25	25
Upper DMRT	2	46	48	26	25
Lower SRT	11	34	45	24,4	31,2
Lower DMRT	11	34	45	24,4	18,8

Legend: SRT (Single-Rooted Teeth); DMRT (Double/Multi-Rooted Teeth)

Proportion between upper and lower teeth from Phase 2B (Table 38) shows the former were very close to the expected value. Lower teeth show a deviation from the expected results.

Table 38 - Proportion of upper and lower teeth from Phase 2B. Tomb I (Perdigões).

	SRT	DMRT	Obtained	Expected
Upper	46	48	0.96	1
Lower	36	43	0.84	1.7

Legend: SRT (Single-Rooted Teeth); DMRT (Double/Multi-Rooted Teeth)

Table 39 and Figure 37 show how weight values reinforce the idea that for Phase 2B there was a slight underrepresentation of most body parts, except the cranium, which is once again 12,4% above the expected value.

Table 39 - Bone weight results for Phase 2B. Tomb I (Perdigões).

Bone	Weight (gm.)	% Obtained	% Expected	Dif
Cranium	935,52	31,94	19,54	>12.4%
Long Bones	1138,53	38,9	42,12	<3.22%
Hand	31,49	1,07	2,53	<1,46%
Foot	60,78	2,1	5,69	<3,6%
Others	762,73	26	28,77	<2,77%
Total	2929,05			

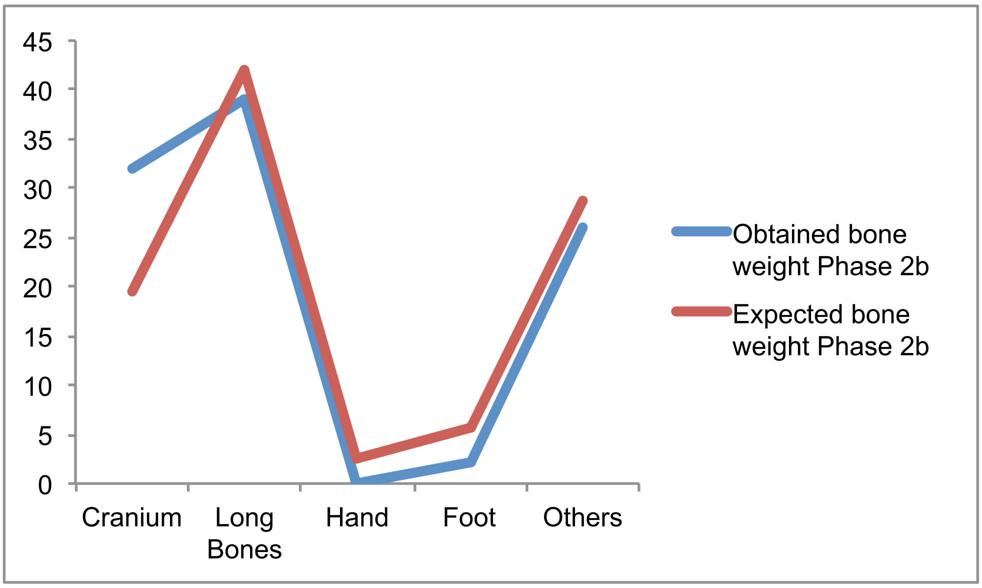


Figure 37 - Results for bone weight from Phase 2B. Tomb I (Perdigões).

The distribution by age of death can be observed in Table 40 and in Figure 38. As had happened in Phase 2A, the presence of a very young individual (between 0-6 months) must be highlighted. Of the established age groups, no individuals belonging to the 15-19-year-old group were identified. As in the previous phase, the number of adults is lower than non-adult bones, which comprise 59% of the total number. The great fragmentation of the bones did not allow the assessment of more precise age-at-death estimation for adults.

Table 40 – Age at death estimation for individuals from Phase 2B. Tomb I (Perdigões).

Age at death	Number	Tooth/Bone
0-6 months	1	Hand Phalanx
3,5	3	FDI 16
5,5	2	FDI 23
6,5	2	FDI13; FDI 24
7,5	1	FDI 14
8,5	1	FDI 25
10,5	1	FDI 22
14	2	FDI 18; FDI 28

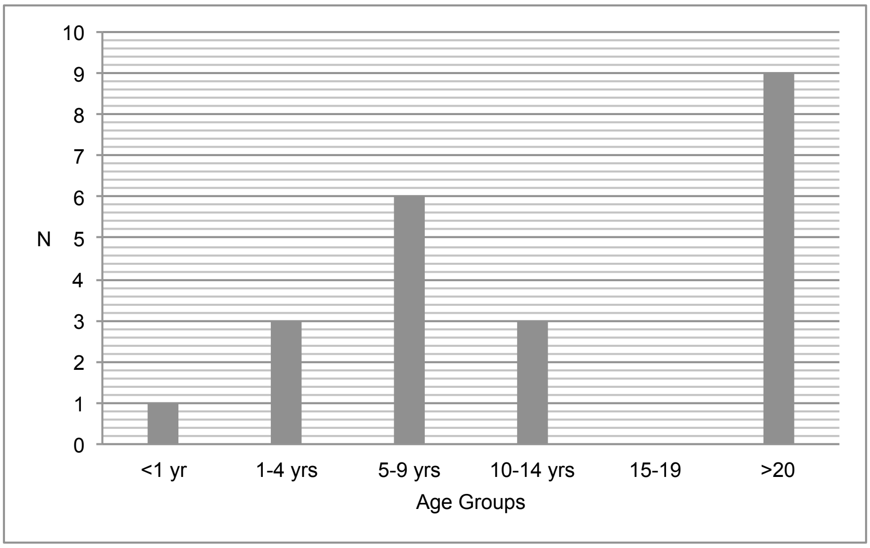


Figure 38- Age at death profile for individuals from Phase 2B. Tomb I (Perdigões).

Phase 2B yielded no information regarding sexual diagnosis. Once again, the high level of fragmentation of bones together with the scarceness of reliable anatomical regions prevents any conclusion on this point.

There was no available data for morphological metric analysis.

For post-cranial non-metric traits observable in Table 41 there are no results to describe.

Table 41 - Post-cranial non-metric traits observed in bones from Phase 2B. Tomb I (Perdigões).

	Degree Left	Degree Right
Allen's Fossa	0/0	0/0
Hypotrochanteric Fossa	0/0	0/0
Third Trochanter	0/0	0/0
Medial Tibial Squatting Facet	0/0	0/0
Lateral Tibial Squatting Facet	0/0	0/0
Supracondyloid Process	0/0	0/1
Septal Aperture	0/0	0/0
Acromial articular facet	0/0	0/1
Vastus Notch	0/1	0/2
Vastus Fossa	0/1	0/2
Emarginate Patella	0/1	0/2
Medial Talar Facet Present	0/0	0/0
Inferior Talar Articular Surface	0/0	0/0
Anterior Calcaneal Facet Double	0/0	0/0
Anterior Calcaneal Facet Absent	0/0	0/0

Table 42 shows that 19,7 % of a total of 177 (35/177) permanent teeth analyzed presented enamel hypoplasia. FDI 11, FDI 43 and FDI 17 show the highest frequency of this condition.

Table 42 – Enamel hypoplasia for teeth from Phase 2B. Tomb I (Perdigões).

Tooth	Upper		Lower	
	Left	Right	Left	Right
I1	1/2 (50%)	2/4 (50%)	0/4	0/2
I2	2/7 (28,5%)	1/3 (33,3%)	0/2	0/1
C	2/6 (33,3%)	1/9 (11,1%)	2/5 (40%)	2/4 (50%)
P1	0/4	2/9 (22,2%)	1/5 (20%)	0/5
P2	1/8 (12,5%)	0/5	4/9 (44,4%)	0/6
M1	1/6 (16,6%)	0/7	2/11 (18,1%)	1/7 (14,2%)
M2	0/3	2/4 (50%)	1/5 (20%)	2/8 (25%9
M3	2/9 (22,2%)	0/3	1/7 (14,2%)	2/7 (28,5%)

From the 35 permanent teeth that present enamel hypoplasia, 9 have two or more visible lines. This distribution is visible on Table 43. Although most teeth present 1 line, the case of tooth no. **562**, an FDI 33, where 6 enamel hypoplasia were counted, must be highlighted.

Figure 39 - FDI 33 from SU 175 presenting 6 visible enamel hypoplasic lines. Tomb I (Perdigões).

Two other teeth present 3 enamel hypoplasia and on the remaining six teeth 2 lines were observed.

Table 43 - Distribution of number of enamel hypoplasia per tooth for Phase 2B. Tomb I (Perdigões).

No. Hypoplasia	FDI	Number	Field No.
1			
	11	1	733
	12	1	699
	14	1	753
	17	2	137; 755
	22	2	1100; 1237
	23	1	702
	25	1	135
	26	1	136
	28	2	140; 894
	34	1	400a
	35	4	729; 1280; 399a;
	36	2	636; 400c
	37	1	400d
	38	1	356
	46	1	405a
	47	2	1283; 405b
	48	2	306; 405c
2	11	1	1231
	13	1	1149
	14	1	477
	23	1	313
	33	1	1448f
	43	1	1448k
3	21	1	132
	43	1	734
6	33	1	562

In the case of deciduous dentition, 10% presented enamel hypoplasia (1/10) an FDI 75.

Regarding oral pathology, the following tables reveal the level of tooth wear for this phase. General wear determined for a total of 184 teeth is medium to low: 1,8%.

Mandibular bones show an average wear that is slightly higher than wear recorded for maxillary teeth (Table 44). This is also clear in the analysis of wear level per tooth (Table 45), where mandibular teeth show higher wear, especially posterior teeth, although the highest level of attrition is found in the lower second incisors.

Table 44 - Average tooth wear for Phase 2B. Tomb I (Perdigões).

	Anterior Dentition	**Posterior Dentition**	**Total**
Maxillary	1,8 (n=33)	1,6 (n=61)	1,7 (n=94)
Mandibular	1,9 (n=18)	1,9 (n=72)	1,9 (n=90)

Table 45 – Tooth wear per tooth for Phase 2B. Tomb I (Perdigões).

Tooth	**Upper**	**Lower**
I1	1,9 (n=7)	2 (n=6)
I2	1,6 (n=11)	2,3 (n=3)
C	2 (n=15)	1,8 (n=9)
P1	1,3 (n=13)	2 (n=10)
P2	1,5 (n=13)	1,6 (n=15)
M1	1,6 (n=16)	2,2 (n=17)
M2	1,7 (n=7)	2,2 (n=13)
M3	1,6 (n=12)	1,7 (n=17)

Although not normally performed, tooth wear was also measured for deciduous teeth since some of them presented quite a considerable level of attrition (Table 46). This can be illustrated by the case of a FDI 65 with an attrition level of 5.

Table 46 – Tooth wear for deciduous teeth from Phase 2B. Tomb I (Perdigões).

Tooth (FDI)	Tooth Wear
55	1
62	2
64	0
64	1
65	1
65	5
65	0
65	0
75	0
84	4

No cariogenic lesions were registered in permanent (n=0/178) or deciduous teeth (n=0/10) from Phase 2B.

Calculus was identified in 25,5% of the permanent teeth analyzed (n=45/178). For superior dentition, 21,9% presented calculus deposits (N= 20 /91) and for inferior dentition the percentage of calculus deposits found was of 28,7% (n=25/87). What is more, 10% (n=1/10) of the deciduous dentition identified showed signs of calculus deposits.

There is no antemortem tooth loss registered for Phase 2B (Table 47). Once again, it is important to highlight that only 13,9% of the possible total of 288 adult alveoli were observed.

Table 47 - Antemortem tooth loss for Phase 2B. Tomb I (Perdigões).

Maxillary	Mandibular
0/9 alveoli	0/31 alveoli

For long bones (Table 48) no osteoarthritis was scored. The other case of osteoarthritis identified in phase 2B is register no. **3283** from SU 175 is a very small fragment (18 x 0,9 mm) of a cervical vertebral body with degree 2 osteoarthritis alteration.

Table 48 - Osteoarthritis observed in bones from Phase 2B. Tomb I (Perdigões).

		Degree Left		**Degree Right**	
		0	1	0	1
Humerus	Proximal	0	0	0	0
	Distal	0	0	0	0
Radius	Proximal	0	0	0	0
	Distal	0	0	0	0
Ulna	Proximal	0	0	0	0
	Distal	0	0	0	0
Femur	Proximal	0	0	0	0
	Distal	1	0	0	0
Tibia	Proximal	0	0	0	0
	Distal	0	0	0	0
Fibula	Proximal	0	0	0	0
	Distal	0	0	0	0

The results expressed on Table 49 are a good example of the paucity of data on this specific parameter for Tomb I. Indeed, enthesal changes were extremely difficult to score throughout the whole collection since in most cases the condition was non-observable due to the very bad state of conservation of the majority most of these bones. No enthesal changes were therefore observed in the bones from this phase.

Table 49 - Enthesal changes observed in bones from Phase 2B. Tomb I (Perdigões).

		Degree Left		**Degree Right**	
		0	1	0	1
Scapula	Coracoid Process	0	0	2	0
	Acromion	0	0	0	0
Clavicle	Sternal Extremity	2	0	0	0
	Deltoid Tuberosity	0	0	0	0
Humerus	Medial Epicondyle	0	0	0	0
	Lateral Epicondyle	0	0	0	0
	Trochlea	0	0	0	0
	Lateral Supracondylar Ridge	0	0	1	0
Radius	Bicipital Tuberosity	0	0	0	0
	Radial Styloid Process	0	0	0	0
Ulna	Proximal extremity	0	0	0	0
	Styloid Process	0	0	0	0
Ilium	Iliac Crest	2	0	0	0
	Ischiatic Tuberosity	1	0	0	0
Femur	Greater Trochanter	0	0	0	0
	Lesser Trochanter	0	0	0	0
	Linea Aspera	1	0	0	0
	Digital Fossa	0	0	0	0
Patella	Anterior Surface	0	0	0	0
Tibia	Soleal Fossa	0	0	0	0
	Anterior Tuberosity	0	0	0	0
	Distal	0	0	0	0
	Medial Malleolus	0	0	0	0
Fibula	Biceps Femoris	0	0	0	0
	Lateral Malleolus	0	0	0	0
	Tibiofibular Ligament	0	0	0	0
Calcaneus	Tuberosity	0	0	0	0
	Adductor Hallucis	0	0	0	0

In this phase the use of the space of the chamber continued through the deposition of human remains in the available space, mostly in the center of the chamber and in the western half, towards the headstone. In fact, the middle of the floor of the chamber was mostly occupied, since the use of space during the previous phase was mostly on the eastern side and around the edges of the chamber (Figure 40). The pattern described for human bones would appear to be similar to artefacts, as can be seen from Figure

41 although their high number is surprising. The dispersal pattern for artefacts would seem to cover and extend beyond that of human remains, which is surprising. Beads and arrowheads are predominant.

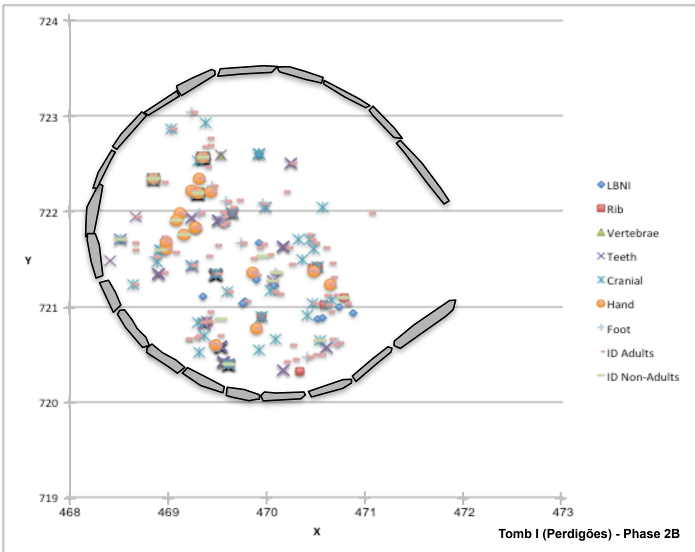


Figure 40 – Human bone distribution for Phase 2B. Tomb I (Perdigões).

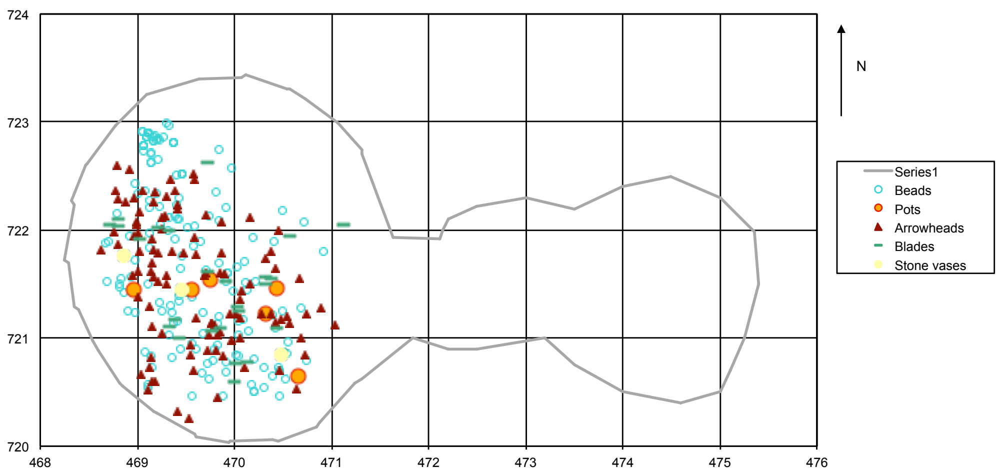


Figure 41 – Distribution of artefacts for Phase 2B. Tomb I (Perdigões).

A detail must be highlighted that explains the absence of human and artefact depositions to the left of the entrance: the collapse of a great schist slab over that area (SU 102: Figure 42) covering the human remains identified in Phase 2A.

Figure 42 - Detail of schist slab (SU 102) fallen over the deposits from Phase 2B. Tomb I (Perdigões).

Once again, as had been observed for the previous phase, the dispersion of adult and non-adult remains shows that there seems to be no spatial segregation, as the available data points to a commingled mode of deposition (Figure 43).

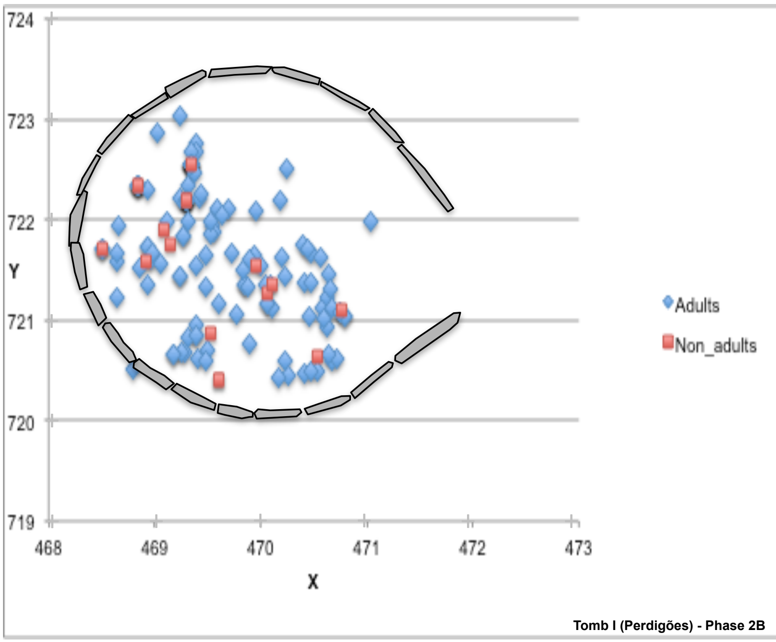


Figure 43 - Adult/non-adult bone distribution for Phase 2B. Tomb I (Perdigões).

The following figures show the dispersion of other bone groups and once again convey the idea of a a lack of formal logic in the final display of the skeletal elements. Cranial and tooth fragments were the most frequently found and were scattered across the base of the chamber (Figure 44) corresponding to Phase 2B. Analysis of Figure 45 for long bones leads to the conclusion that there is also no particular pattern in their disposition or direct association between contiguous bone elements. The dispersion of foot and hand bones follows the same dispersion pattern (Figure 46).

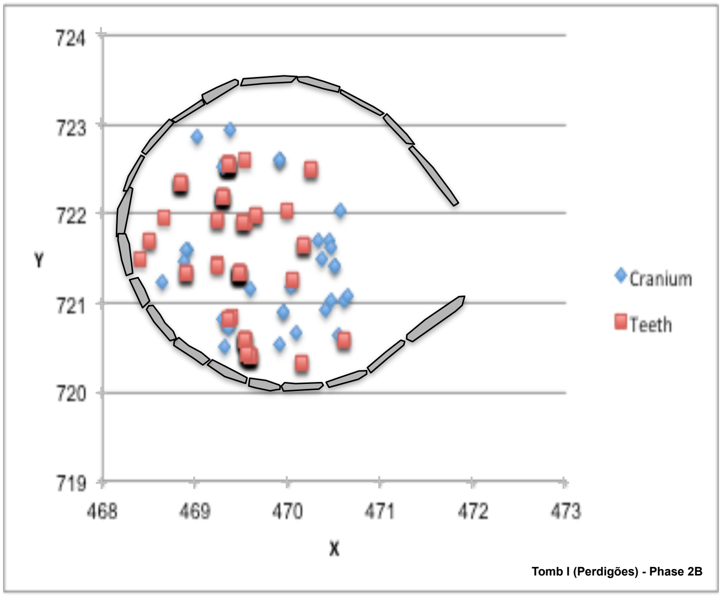


Figure 44 - Cranial fragments and tooth distribution for Phase 2B. Tomb I (Perdigões).

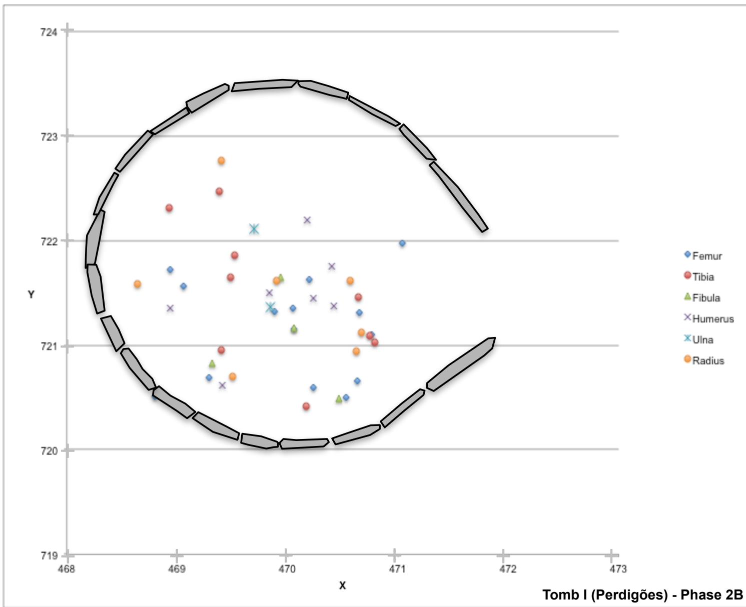


Figure 45 - Long bone distribution for Phase 2B. Tomb I (Perdigões).

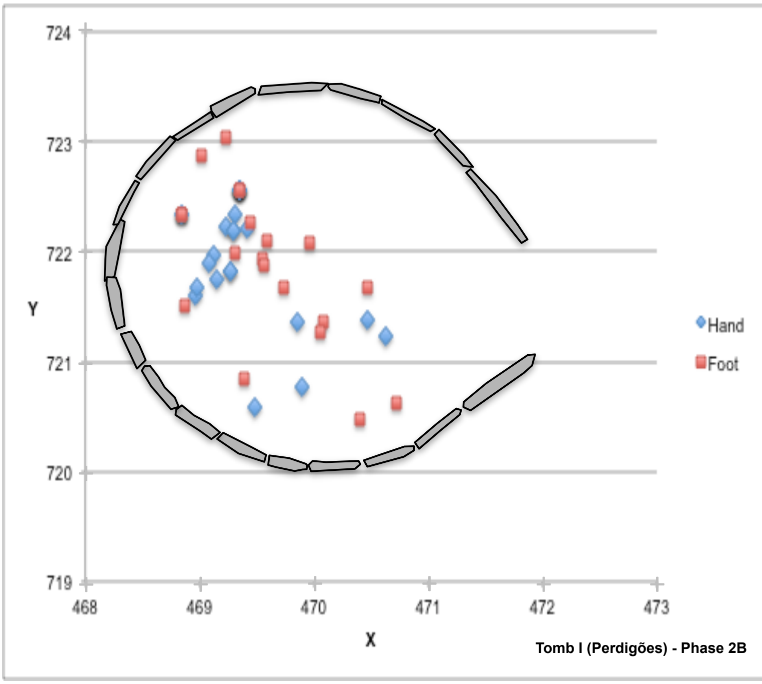


Figure 46 - Hand and foot bone distribution for Phase 2B. Tomb I (Perdigões).

5.1.2.3 Phase 2C

This sub-phase is characterized by a set of depositions including abundant human bones and large quantities of votive material that indicate intensive use of area of the chamber and manipulation of human remains. Some archaeological contexts would appear to have been formed by the accumulation of soil and other material next to the wall of the structure, possibly pushed in that direction to free up space in the central areas of the chamber.

Phase 2C yielded a total of 9704 bone fragments (Table 50), of which 374 (13,2%) definitely belonged to non-adult individuals. 9.4% (n=915) of the total fragments attributed to this phase were considered unidentifiable and 24.6% (n=2390) could only be identified as fragments of long bones with no definite designation. Nearly 28% (2693) of the generic records are cranium fragments, followed by rib (278 fragments) and vertebrae (231 fragments).

Table 50 – Bone count for Phase 2C. Tomb I (Perdigões).

Type		No. Registers	No. Fragments
Identified bones			
	Adults	619	2823
	Non-Adults	108	374
Others (Adults)	Cranium	199	2693
	Rib	100	278
	Vertebrae	128	231
Long Bones N.I.		194	2390
N.I. Bones		35	915
TOTAL		**1383**	**9704**

A total of 387 teeth were recovered in Phase 2C (Table 51). Among them 11 were deciduous, although 21 were not completely formed.

Table 51 – Tooth count for Phase 2C. Tomb I (Perdigões).

Type		Number
Permanent		
	Totally Formed	355
	Forming	21
Deciduous		11
TOTAL		**387**

For non-adults, an estimated minimum number of 10 non-adult individuals, under 15 years of age was determined based on analysis of loose teeth. In Table 56 the presence of another ±11-month-old individual can be observed, whose age was obtained through the measurement of the *pars basilaris* (maximum width – 24mm; maximum height – 22mm; sagittal width – 1,5mm). The estimated MNI of adults is 24 based on the presence of the count of FDI 37, as can be observed in Table 53.

Bone analysis for this parameter, available in Table 52 provided a minimal number of 13 adult individuals (left temporal bone count).

Figure 47 - *Pars basilaris* from an ±11-month-old individual from SU173. Tomb I (Perdigões).

Table 52 - MNI based on long bones for phase 2C. Tomb I (Perdigões).

Long Bone	**MinNi**
Left Temporal	13
Right Femur	10
Left Ulna	8
Left Tibia	8
Left Radius	7
Left Humerus	6
Left Femur	6
Right Tibia	6
Left Fibula	6
Right Humerus	5
Right Ulna	5
Right Radius	3
Right Fibula	2

In Phase 2C, 619 individual adult bones were recorded, an increase when compared to the older phases. Nonetheless, the proportion of complete bones is maintained (9,2%). Again, it is the smaller bones (Figure 48) that seem to survive better, although for this phase two long bones (a tibia and a femur) were recovered complete.

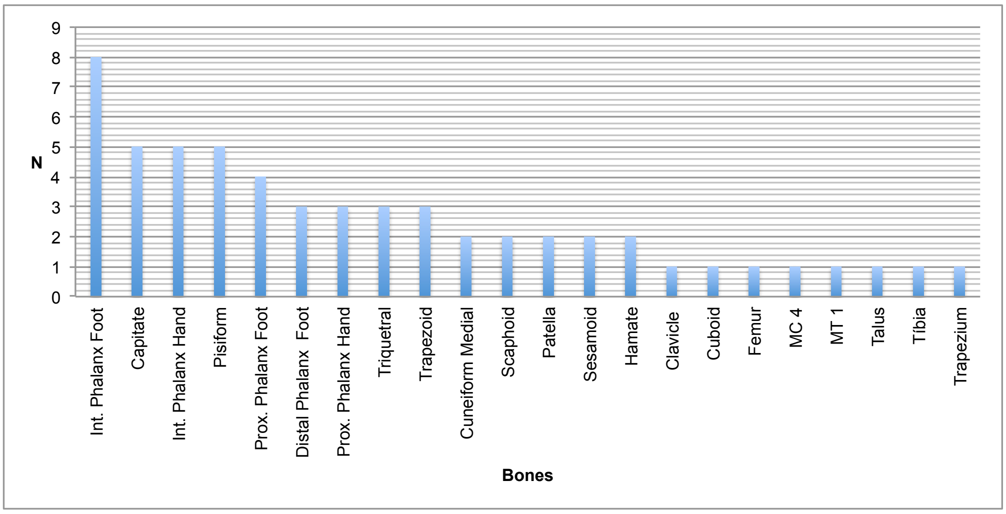


Figure 48 – Complete adult bones from Phase 2C. Tomb I (Perdigões).

In this phase, 6,5% of the non-adult bone registers, were complete (7 /108) as can be observed in Figure 49.

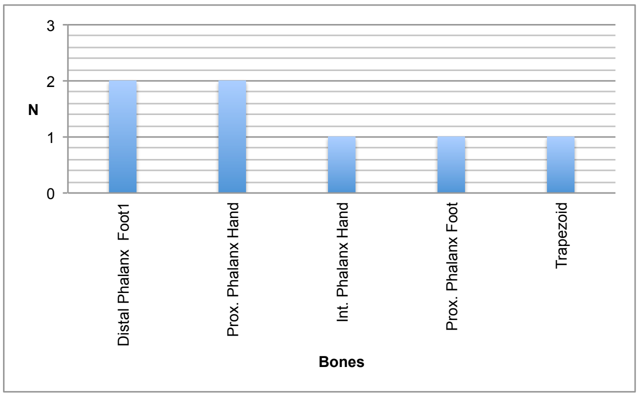


Figure 49 – Complete non-adult bones from Phase 2C. Tomb I (Perdigões).

Table 53, with bone representativeness for Phase 2C, again shows how cranial fragments are well represented although their values are well below the MNI, given by the count of 24 teeth, FDI 37. Once again, the scapula (namely the glenoid cavity) is robustly present. The presence of small bones is not as obvious here as it was for the previous phases, although 4 right trapezoids, 3 left lunates and 2 left scaphoids were recovered. Tarsal bones are not as numerous, although present. Once again there is a regularity in the representativeness of long bones, which are identified in similar proportions.

Table 53 - Bone representativeness for Phase 2C. Tomb I (Perdigões).

Bone	Obs. No.	Representativeness (%)
FDI 37	24	100
Right Temporal (Pars Petrosa)	13	54,1
Right Femur (Prox. Diaphysis)	10	41,6
Left Glenoid Cavity	10	41,6
Left Ulna (Prox. Extremity)	8	33,3
Left Tibia (Middle Diaphysis)	8	33,3
Left Radius (Middle 1/3)	7	29,1
Left Humerus (Distal Diaphysis)	6	25,0
Left Fibula (Distal Extremity)	6	25,0
Atlas	6	25,0
Right MT3	4	16,6
Right Coracoid Process	4	16,6
Axis	4	16,6
Right Talus	4	16,6
Right Trapezoid	4	16,6
Left Capitate	3	12,5
Left Lateral Cuneiform	3	12,5
Right Patella	3	12,5
Left Lunate	3	12,5
Left Cuboid	2	8.3
Left Medial Cuneiform	2	8.3
Left Scaphoid	2	8.3
Right Navicular	2	8.3
Left Frontal	2	8.3
Left Zygomatic	2	8.3
Right MC4	2	8.3
Left Pubis	2	8.3
Left MT2	2	8.3
Right MT4	2	8.3
Left MT5	2	8.3
Left Hamate	2	8.3
Right Clavicle	1	4,2
Right Prox. Phalanx Hand 1	1	4,2
Right MC2	1	4,2

Table 54 displays the percentages of single-rooted, double/multi-rooted teeth from Phase 2C. Only for upper double/multi-rooted teeth are values close to the expected 25%, although the value of 28,7% obtained is 3,7% above that number. The result of 14,2% of upper single-rooted teeth is clearly below the expected 25%. The same happens with lower dentition, where significant discrepancies are registered. Lower single-rooted teeth are 7.6% below the expected value of 31,2%. However, lower double/multi-rooted teeth are 15,5% above the expected value of 18%.

Table 54 - Percentages for single-rooted, double/multi-rooted teeth for Phase 2C. Tomb I (Perdigões).

	In situ	Loose	Total	% Obtained	% Expected
Upper SRT	7	46	53	14,2	25
Upper DMRT	21	86	107	28,7	25
Lower SRT	18	70	88	23,6	31,2
Lower DMRT	51	74	125	33,5	18

Legend: SRT (Single-Rooted Teeth); DMRT (Double/Multi-Rooted Teeth)

These irregularities in Phase 2C continue as we observe the proportion between upper and lower teeth exhibited in Table 55. For upper teeth, the disproportion is obvious between single-rooted teeth and double/multi-rooted teeth. Present in equal proportions in the maxilla, their presence in the archaeological record should be similar but that is not what seems to be the case in Phase 2C, where only 53 (of an expected 107) were recovered. For lower teeth, this imbalance continues as single-rooted teeth should present a much higher value than double/multi-rooted teeth simply because they are in higher number in the mandible (10 single-rooted teeth versus 6 double/multi-rooted teeth). In this case, the opposite is observable, with a proportion of 0,7 between the different teeth when the expected value would be 1,7.

Table 55 - Proportion of upper and lower teeth for Phase 2C. Tomb I (Perdigões).

	SRT	DMRT	Obtained	Expected
Upper	53	107	0,49	1
Lower	88	125	0,7	1,7

Legend: SRT (Single-Rooted Teeth); DMRT (Double/Multi-Rooted Teeth)

Table 56 and Figure 50 illustrate age-at-death distribution for this phase. The youngest individual from this phase would be around 1 year old at time of death. For non-adults, it is the group between 10-14 years of age that presents the highest mortality rate although individuals belonging to all age groups were identified. The percentage of non-adults in general is of 31% when compared to adult individuals.

For adults, no anatomical bone sections were available for an estimation of a more specific age at death. However, the level of dental calcification of an FDI 18, from SU 173, revealed the presence of a 15,5-16,5-year-old individual.

Table 56 - Age at death estimation for non-adult individuals from Phase 2C. Tomb I (Perdigões).

Age at death	Number	Tooth/Bone
± 11months	1	Pars Basilaris
3,5	2	FDI 16; FDI 26
4.5	1	FDI 21
5.5	1	FDI 13
6.5	1	FDI 14
8.5	1	FDI 25
11,5	1	FDI 47
12.5	1	FDI 18
13.5/14.5	2	FDI 38

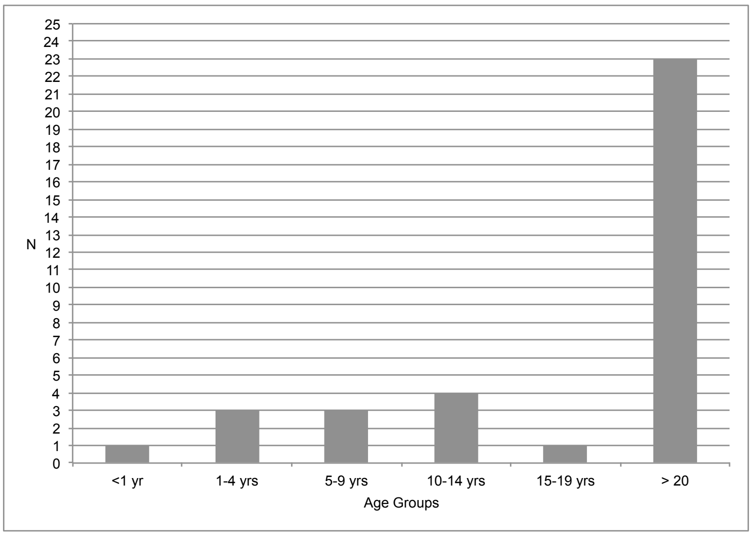


Figure 50 - Age at death profile for individuals from Phase 2C. Tomb I (Perdigões).

Phase 2C was the first to yield consistent results regarding sexual diagnosis. Table 57 demonstrates the probable presence of male and female remains amongst the funerary depositions in Phase 2C. The morphological analysis and scoring of ilium no. **2842** pointed to male. The other scored bone structures are listed below and present female characteristics. Metric analysis also points towards the presence of bone structures with female features.

Table 57 - Sexual diagnosis based on bone fragments from Phase 2C. Tomb I (Perdigões).

Morphological Analysis					
Bone	**No.**	**SU**	**Sex**	**Side**	**Scored Structures**
Frag. Ilium	2842	172	♂	NO	Gt. Sciatic Notch 4
Frag. Ilium	2891	178	♀	NO	Gt. Sciatic Notch 2
Frag. Temporal	3120	172	♀	Left	Mastoid Process 1
Frag. Frontal	3123	172	♀?	NO	Glabella 2/3
Frag. Mandible	3312	173	♀?	Left	Mental Eminece 2
Metric Analysis					
Bone	**No.**	**SU**	**Sex**	**Side**	**Variable Measurement**
Distal Ext. Humerus	2906	173	♀?	Right	HBW - 56 mm
Talus	886	173	♀	Right	TM1 - 46,7 mm

The only morphological metric analysis possible for this phase was through the measuring of a left MT1 from SU 172 (no. **872**), for estimation of stature, following Cordeiro (2002) since this methodology does not require the determination of the sex of the individual. The measurement yielded an estimated height of 1538,05 mm ±53,5.

Table 58 shows the results for the observation of skeletal non-metric traits, which were only obtained for a right and a left humerus in which the septal aperture was present. No metric morphological analysis was possible for bones from this phase.

Table 58 – Post-cranial non-metric traits observed in bones from Phase 2C. Tomb I (Perdigões).

Trait	Left	Right
Allen's Fossa	0/0	0/0
Hypotrochanteric Fossa	1/3	0/3
Third Trochanter	0/0	0/1
Medial Tibial Squatting Facet	0/2	0/0
Lateral Tibial Squatting Facet	0/1	0/0
Supracondyloid Process	0/5	0/4
Septal Aperture	1/2	1/2
Acromial articular facet	0/1	0/2
Vastus Notch	0/1	0/2
Vastus Fossa	0/1	0/2
Emarginate Patella	0/1	0/2
Medial Talar Facet Present	0/2	0/3
Inferior Talar Articular Surface	0/2	0/3
Anterior Calcaneal Facet Absent	0/4	0/5

Out of a total of 192 permanent teeth analysed 16,1 % (31/192) presented enamel hypoplasia. They are recorded on Table 59 and the highest frequency is observable on FDI 43.

Table 59 - Enamel hypoplasia for teeth from Phase 2C. Tomb I (Perdigões).

Tooth	Upper		Lower	
	Left	Right	Left	Right
I1	1/8 (12,5%)	0/3	0/1	0/3
I2	0/5	0/1	0/5	0/5
C	4/14 (28,5%)	0/5	1/8 (12,5%)	3/6 (50%)
P1	2/15 (13,3%)	0/7	0/5	2/17 (11,8%)
P2	0/9	0/8	0/16	1/15 (6,7%)
M1	3/16 (18,8%)	2/15 (13,3%)	0/19	0/19
M2	0/12	1/11 (9,1%)	1/21 (4,8%)	0/21
M3	0/12	0/17	0/15	0/14

From the 21 teeth that present enamel hypoplasia, 3 presented two visible lines, as can be confirmed in Table 60. On an FDI 21, 3 enamel hypoplasia were counted. Regarding deciduous dentition none presented enamel hypoplasia (0/11).

Table 60 - Distribution of number of enamel hypoplasia per tooth for Phase 2C. Tomb I (Perdigões).

No. Hypoplasia	FDI	Number	Field No.
1			
	16	2	1088; 910
	17	1	M3912
	23	3	1127; 1122; 884
	24	2	1451; 1052
	26	2	1126; 1105
	33	1	243
	37	1	1141g
	43	2	M3915a; M3950c
	44	2	M3915b; M3950d
	45	1	M3950e
2	23	1	681
	26	1	670
	43	1	90a
3	21	1	451

Tooth wear was scored for teeth from Phase 2C. The results for average wear are visible in Table 61 and per tooth type in Table 62. General results show medium to low level of wear: 1,78 (n=365).

Tooth wear is higher in mandibular teeth, especially the posterior ones. The level of attrition scored for FDI 31 and 41, is probably exaggerated due the small size of the sample (only 3 teeth scored).

Tooth wear was also measured for deciduous teeth since some of them presented quite a considerable level of wear. Results can be seen in Table 63.

Table 61 - Average tooth wear for Phase 2C. Tomb I (Perdigões).

	Anterior Dentition	**Posterior Dentition**	**Total**
Maxillary	1,5 (n=37)	1,5 (n=124)	1,5 (n=161)
Mandibular	2,3 (n=27)	2 (n=177)	2 (n=204)

Table 62 - Tooth wear per tooth for Phase 2C. Tomb I (Perdigões).

Tooth	**Upper**	**Lower**
I1	1,4 (n=11)	2,7 (n=3)
I2	1 (n=6)	2,3 (n=10)
C	1,8 (n=20)	2,1 (n=14)
P1	1,4 (n=22)	2,1 (n=22)
P2	1,4 (n=17)	1,9 (n=35)
M1	1,5 (n=32)	2,4 (n=42)
M2	2,1 (n=23)	2,1 (n=47)
M3	0,9 (n=29)	1,3 (n=29)

Table 63 - Tooth wear for deciduous teeth from Phase 2C. Tomb I (Perdigões).

Tooth (FDI)	**Tooth Wear**
51	1
55	1
64	1
65	1
65	1
74	1
74	1
75	2
84	1
84	1
85	3

One (n=367) of the permanent teeth analyzed presented cariogenic lesions (0,3%). In this case, it was an FDI 36 with a level 2 interproximal distal lesion. No cariogenic lesions were identified on deciduous teeth (0/11).

Calculus was identified in 21,9% of the permanent teeth analyzed (n=79/360). For superior dentition, 11,8% presented calculus deposits (n=19 /161) and for inferior dentition the percentage of calculus deposits found was of 30,1%(n=60/199). None of the deciduous teeth identified showed signs of calculus deposits (0/11).

Antemortem tooth loss for this phase was only observed in inferior teeth (Table 64). Signs of this condition were observable in 7 out of the 89 countable alveoli (7,8%). As only 151 alveoli of the minimum expected of 768 (19,6%) could be found, this number is hardly indicative of the likely rate of this condition for the individuals deposited in this phase.

Table 64 - Antemortem tooth loss for Phase 2C. Tomb I (Perdigões).

Maxillary	**Mandibular**
0/62 alveoli	7/89 alveoli

A slight case of osteoarthritis was identified on the proximal extremity of a left femur, scored with degree 1. This is the only register for this condition available in the observable long bones from Phase 2C (Table 65). Apart from what is described in this table, a small number of other cases of osteoarthritis were identified amongst the bones from this phase.

A degree 1 osteoarthritis lesion was identified on the first distal foot phalanx no. **657**, from SU 173 and a left cuboid (no.**998**) showed signs of degree 1 alteration on every articular surface.

A thoracic vertebrae no. **3419** showed signs of osteoarthritis (degree 1) on the inferior annular apophysis. The superior surface of the vertebral body was destroyed.

Table 65 - Osteoarthritis observed in bones from Phase 2C. Tomb I (Perdigões).

		Degree Left		**Degree Right**	
		0	1	0	1
Humerus	Proximal	1	0	2	0
	Distal	0	0	1	0
Radius	Proximal	2	0	0	0
	Distal	5	0	1	0
Ulna	Proximal	6	0	4	0
	Distal	0	0	1	0
Femur	Proximal	0	1	0	0
	Distal	0	0	1	0
Tibia	Proximal	0	0	1	0
	Distal	0	0	1	0
Fibula	Proximal	3	0	0	0
	Distal	0	0	0	0

The table registering the observable enthesal changes for bones from Phase 2C (Table 66) shows very slight alteration on a right and a left humerus. The proximal extremity (bicipital tuberosity) of one left radius presented a degree 1 alteration. The same degree was found on the anterior surface of a left patella and on the *linea aspera* of a right femur fragment. A degree 2 alteration was scored in the same observed area of a left femur. No further alterations were registered.

Table 66 - Enthesal changes observed in bones from Phase 2C. Tomb I (Perdigões).

		Degree Left			Degree Right	
		0	1	2	0	1
Scapula	Coracoid Process	1	0	0	4	0
	Acromion	0	0	0	1	0
Clavicle	Sternal Extremity	1	0	0	0	0
	Deltoid Tuberosity	1	0	0	1	0
Humerus	Medial Epicondyle	0	0	0	1	0
	Lateral Epicondyle	0	1	0	2	0
	Trochlea	0	0	0	1	0
	Lateral Supracondylar	3	0	0	1	1
Radius	Bicipital Tuberosity	4	1	0	0	0
	Radial Styloid Process	4	0	0	1	0
Ulna	Proximal extremity	6	0	0	4	0
	Styloid Process	0	0	0	1	0
Ilium	Iliac Crest	3	0	0	5	0
	Ischiatic Tuberosity	0	0	0	1	0
Femur	Greater Trochanter	3	0	0	0	0
	Lesser Trochanter	0	0	0	0	0
	Linea Aspera	5	0	1	3	1
	Digital Fossa	1	0	0	0	0
Patella	Anterior Surface	0	1	0	3	0
Tibia	Soleal Fossa	0	0	0	1	0
	Anterior Tuberosity	0	0	0	0	0
	Distal	1	0	0	0	0
	Medial Malleolus	0	0	0	0	0
Fibula	Biceps Femoris	0	0	0	0	0
	Lateral Malleolus	4	0	0	0	0
	Tibiofibular Ligament	1	0	0	0	0
Calcaneus	Tuberosity	5	0	0	4	0
	Adductor Hallucis	3	0	0	2	0

Other Pathologies > Infectious Pathologies:

Register no. **2468.** SU 178: fragment of a left adult femur diaphysis, 137 mm long. This is part of the proximal half of the femur corresponding to the area below the lesser trochanter and around the trochanteric fossa. There are signs of active infection with alteration of the periosteal surface, with mild porosity on the lateral-posterior side of the bone (Figure 51).

Figure 51 - Fragment of an adult femur from SU178 with signs of active infection. Tomb I (Perdigões).

Register no. **3300**. SU 174: fragment of an adult frontal bone. 42 mm of the frontal crest is preserved starting at the *foramen cecum*, which is visible. From here 53 mm of the bone is preserved on the left side including the left supraciliary arch and the supraorbital margin, all the way to the zygomatic process. Only 2mm of the right portion of the frontal crest is preserved but fragmented around the right frontal sinus.

A band with a maximum width of 14 mm and a minimum of 9mm is visible over the left supraciliary arch showing alteration of the bone surface in the form of “serpentine” shape (Figure 52). This alteration does not extend to the interior of the orbit. Similar lesions have been reported related to a condition called *Serpens Endocrania Symmetrica* (SES), which can also affect the frontal bone but only the endocranial region (Hershkovitz, 2002).

This specific lesion, whose taphonomic origin cannot be totally ruled out, could be a response of this specific area of the frontal-orbital bone to some exterior aggression (infectious or traumatic) that caused disruption of the exocranial surface, lending it a maze-like appearance.

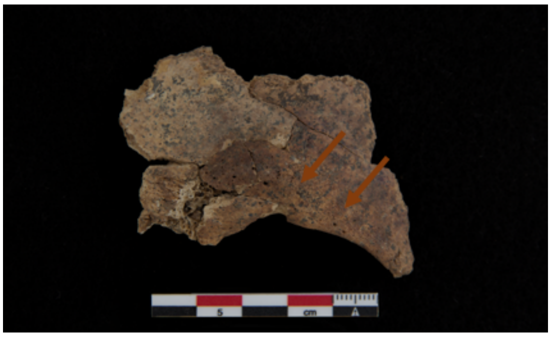


Figure 52 - Adult frontal bone fragment with “serpentine” alteration of the surface. SU174. Tomb I (Perdigões).

> Congenital Pathologies:

Register no. **3398**. SU 172. The bodies of two undetermined adult cervical vertebrae (from C3-C7) are found fused. The fragment, which is in a very poor state of conservation, has a maximum height of 26 mm and a maximum width of 24 mm. The only observable preserved surfaces of the fused bodies are the anterior ones, where no sign of the fusing line is visible (Figure 53). Although this last point suggests a congenital or long-term condition, common in the vertebral column (Erdin, 2003) it would be important to try to differentiate between a congenitally-fused cervical vertebra or an acquired condition, following trauma, for example (Yin et al., 1989) which unfortunately is not possible in this case.

Figure 53 – Two fused adult cervical vertebrae (from C3-C7) from SU172. Tomb I (Perdigões).

Register no. **3397**. SU 174. This is a fragment of an adult thoracic vertebral body (probably a T11 or T12). It is fragmented around the area where the right pedicle attaches to the body. On the sagittal line (centre/right) of the inferior surface of the vertebral body a large orifice can be observed, close to the anterior limit. Its outline is grossly circular (11mm x 12 mm) with totally remodeled edges (Figure 54). This line limits an orifice with an irregular base (9mm maximum depth). This vertebra represents an isolated fragment and it is not possible to compare it with any other spinal elements with which it would be in contact.

Ethne Barnes (2012) describes a condition called Notochord Defect: Sagittal Cleft Vertebra resulting "from the failure of a portion of the notochord to recede and disappear from the developing embryonic vertebral segment, disrupting the formation of the centrum in a variety of expressions, depending on the location of the renegade tissue" (Barnes, 2012, p. 75). In this case, the retained notochord tissue turned fibrous, persisting as a tissue pocket on the inferior end plate. It appears deviated away from the midsection of the vertebral body as a large, rounded indentation penetrating half way through the vertebral body.

Although this congenital condition can be considered as a probable cause for this feature, other hypotheses must be considered, such as this indentation being the result of an acute Schmorl nodule in which there was a protrusion of the nucleus pulposus of the intervertebral disc through the vertebral body endplate and into this adjacent vertebra. Also, some unusual type of Schmorl nodes are reported appearing as giant cyst like lesions of the vertebral bodies. The extension of the effect of a Schmorl nodule is usually limited because trabecular sclerosis occurs in the surrounding bone (Hauger et al., 2001). However, in some rare cases, intravertebral disk herniation can lead to giant cystic lesions as a possible result of trabecular hemorrhage occurring after this herniation, which prevents chondrification and thus leads to cystic degeneration (Hauger et al., 2001). Typical Schmorl's nodes are most commonly found in the lower thoracic and upper lumbar spine and usually involve the inferior endplate and are more common in men than in women (Hilton et al., 1976). The condition described for this thoracic vertebral body from Tomb I is compatible with this kind of lesion and so the possibility must be considered that this case is the result of a giant cystic Schmorl's node.

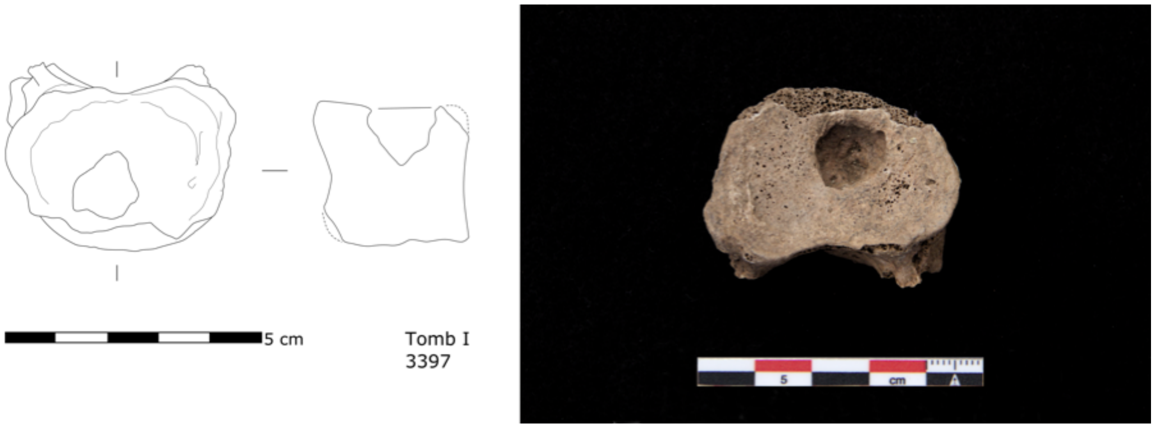


Figure 54 - Vertebrae n.3397 showing a large orifice on the sagittal line.

Spatial analysis for Phase 2C reveals that human remains occur over almost the whole surface of the chamber (SU 172, 173, 174, 180, 182) although there seems to be greater use of the northern half. The presence of fallen schist slabs used for the lining of the chamber walls explains the absence of human bones to the left of the entrance (because of the already mentioned SU 101 but also SU 102) and close to the head stone (slabs SU 177 and SU 138) but does not fully justify the absence of human bones in the southeast quadrant of the chamber nor in its very northern limit. Figure 55 portrays bone spread across the chamber, detailed in Figure 57 and Figure 58. The former shows the southern limit of the chamber. The slab is SU 101 and to the left of the bones there seems to be a patch with no depositions, which corresponds to a more central area. The latter gives an idea of the human remains found in between fallen slabs and large stones placed inside the chamber.

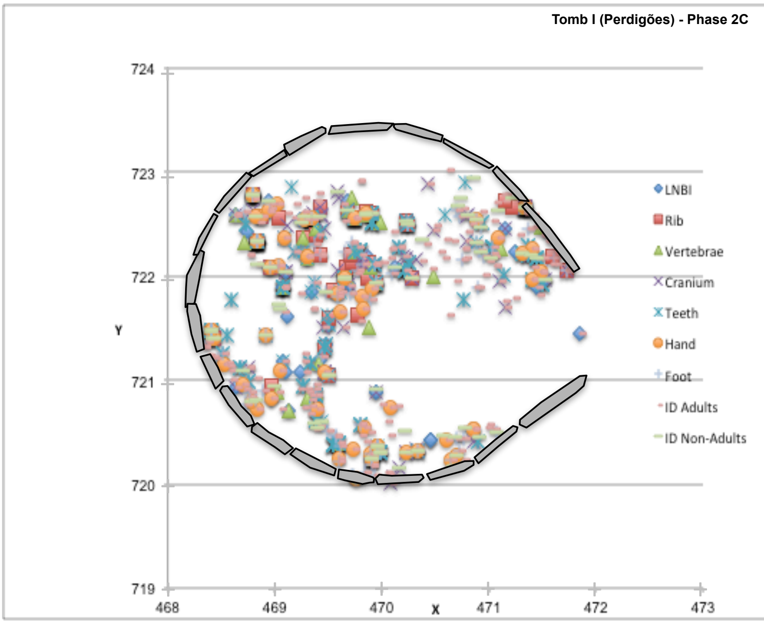


Figure 55 – Human bone distribution for Phase 2C. Tomb I (Perdigões).

A considerably higher number of pots was found in this phase compared to the previous one although the overall number of artefacts was lower. They appear to be scattered over the same area as human remains (Figure 56).

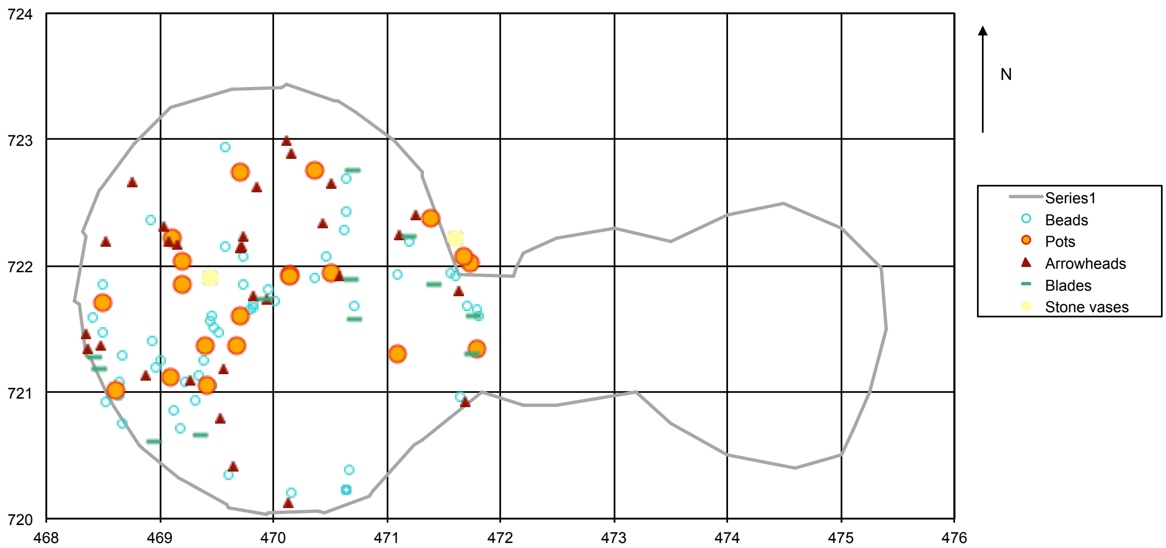


Figure 56 – Distribution of artefact for Phase 2C. Tomb I (Perdigões).

Figure 57 - Detail of Phase 2C with bones from SU 174. Tomb I (Perdigões).

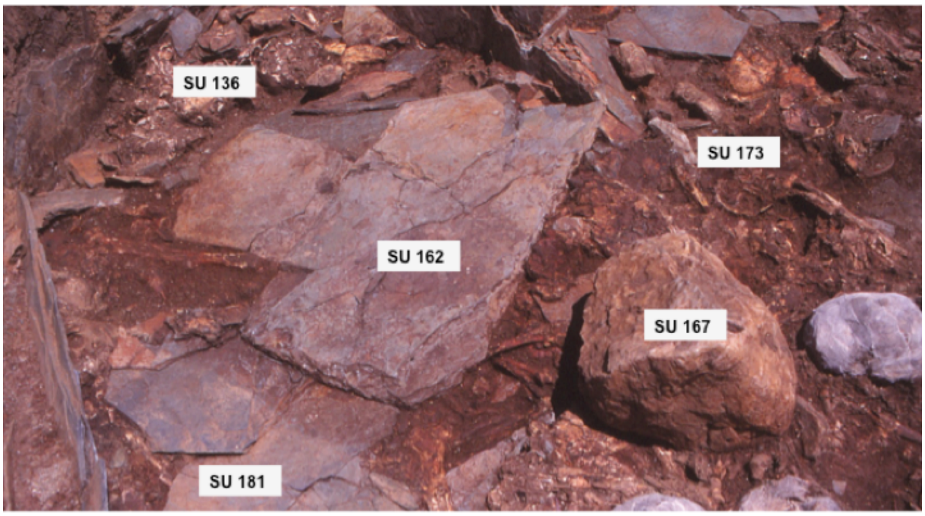


Figure 58 – Detail of Phase 2C with bones from SU 136 and 173. Some slabs can be seen collapsed on to the human remains. Tomb I (Perdigões).

Once again, as seen for the previous sub-phases, the available data reveals that the use of the space in the chamber does not seem to follow a pattern based on age groups or sex. There is very little information on this latter parameter for Phase 2C so conclusions must be drawn with caution (Figure 60). There appears to be no separation by age group, as Figure 59 shows the total mixture of human remains from different age categories.

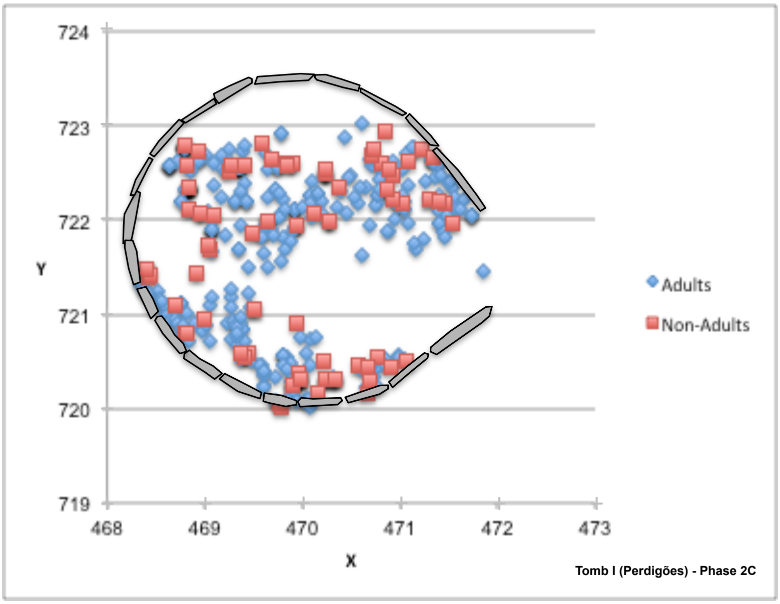


Figure 59 - Adult/non-Adult bone distribution for Phase 2C. Tomb I (Perdigões).

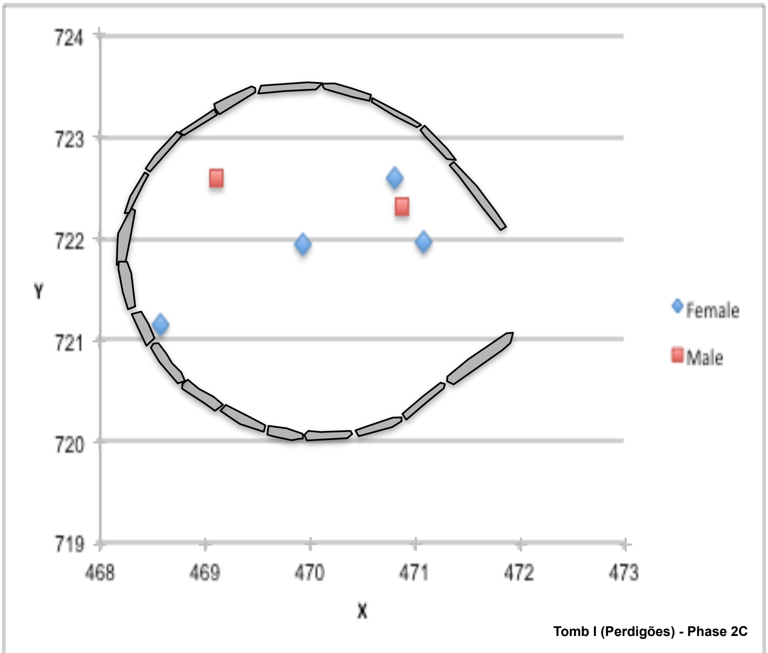


Figure 60 - Male/female bone distribution for Phase 2C. Tomb I (Perdigões).

Cranial fragments are evenly distributed across the area occupied by Phase 2C (Figure 61). The same pattern seems to apply to foot and hand bones (Figure 63). Although arm and leg bones appear scattered on both sides of the chamber, there is clearly a higher deposition of these specific elements on the northern side of the chamber (Figure 62). A concentration of bones can be observed to right of the chamber entrance.

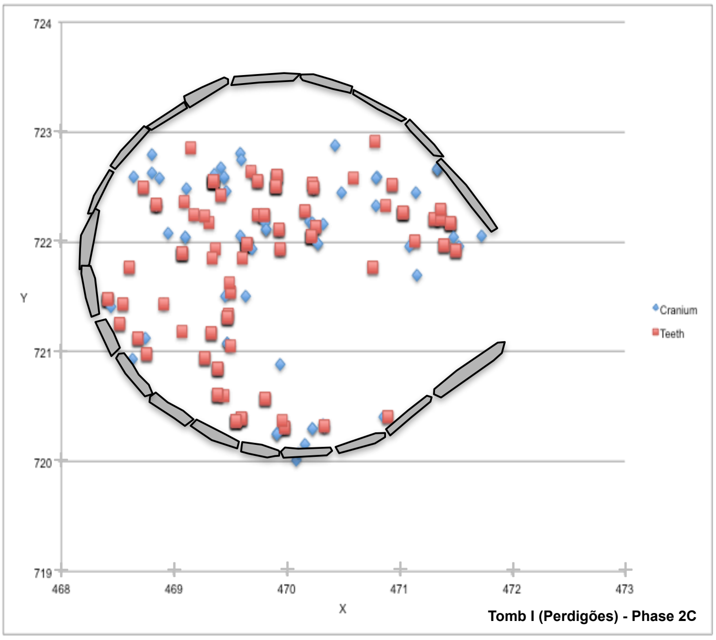


Figure 61 - Cranial fragment and tooth distribution for Phase 2C. Tomb I (Perdigões).

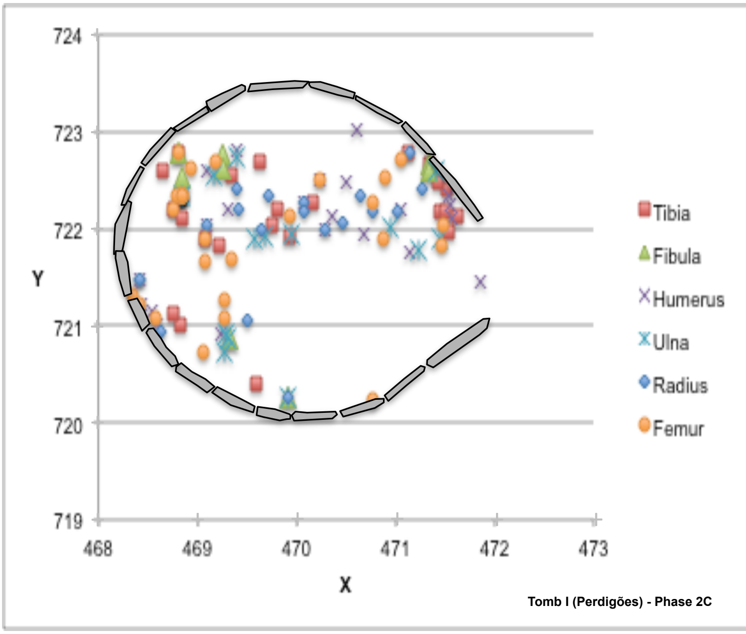


Figure 62 - Long bone distribution for Phase 2C. Tomb I (Perdigões).

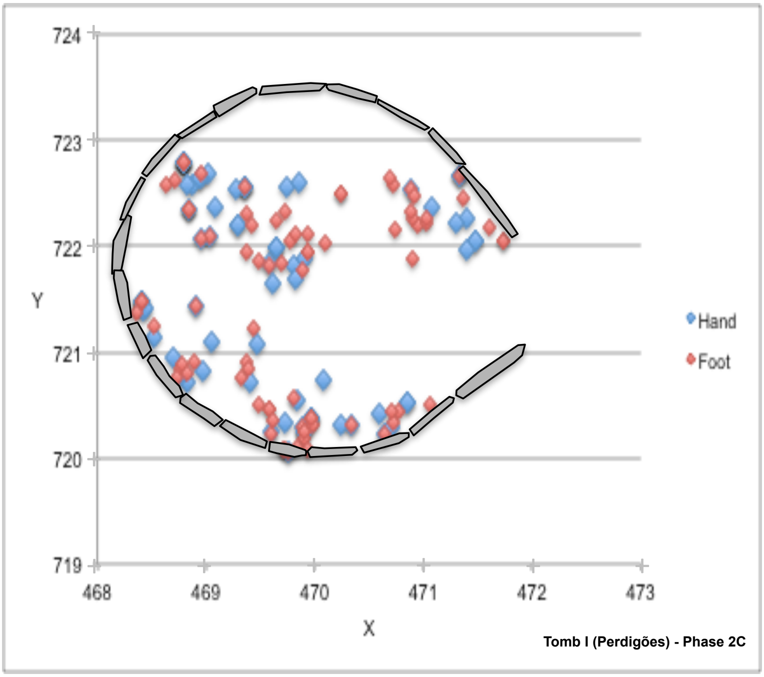


Figure 63 - Foot and hand bone distribution for Phase 2C. Tomb I (Perdigões).

5.1.2.4 Phase 2D

Covering a large part of the chamber, SU 97 is the most representative for this sub-phase layer and corresponds to the period of the most intensive use of the chamber of the monument. The great bone scatter and apparent absence of specific depositions would appear to indicate that the site was frequently visited and that this must have included its internal reorganization. It should be noted that the context, SU 97, was largely covered by a relatively thin layer of a greyish to off-white sediment (less than 0.5 cm), SU 96 (Figure 64). Due to its specificity and because it is unique within the contexts identified, this "powdering" would appear to be an action related to funeral practices that included the application of white pigment on human remains, which could involve some possible symbolic association with the colour white. Indeed, the presence of white quartz blocks in association with human remains is recurrent in the tomb.

Figure 64 - Detail of SU 96. The bones of this layer are covered in a thin layer of white sediment. Tomb I (Perdigões).

Phase 2D is by far the most complex funerary phase identified in Tomb I (Table 67). A total of 26739 bone fragments were recovered, of which 3,25% (n= 870) belonged to non-adult individuals. A total of 13114 bone fragments belonged to the 954 individual adult bone registers. The general registers comprised 2384 cranial fragments (8,9% of the total) followed by rib fragments (n=618) and vertebrae (n=527).

A considerable number of fragments (n=9226) could not be included in specific bone types: 2759 (10,3%) could only be identified as undifferentiated long bones fragments and 6467 (24,8%) were considered non-identifiable bone fragments.

Table 67 - Bone count for Phase 2D. Tomb I (Perdigões).

Type		No. Registers	No. Fragments
Identified bones			
	Adult	954	13114
	Non-Adult	207	870
Others (Adults)	Cranium	238	2384
	Rib	203	618
	Vertebrae	203	527
Long Bones N.I.		171	2759
N.I. Bones		158	6467
TOTAL		**2134**	**26739**

Phase 2D is also the phase from which the largest number of teeth were recovered, a total of 501 (Table 68). Of these, 38 were deciduous teeth and for 53 it was possible to determine that formation was still in progress.

Table 68 - Tooth count for Phase 2D. Tomb I (Perdigões).

TYPE		Number
Permanent		
	Formation Complete	410
	Formation Incomplete	53
Deciduous		38
TOTAL		**501**

For non-adults, a minimum estimated number of 20 individuals was estimated: 18 individuals, less than 15 years of age were obtained based on analysis of loose teeth and the age at death for 2 individuals was estimated through bone measurement (Figure 65).

Figure 65 - Left ischium of a non-adult individual (between 7-18 months old) from SU 97. Tomb I (Perdigões). Maximum length: 46 mm

The estimated minimum number of 25 adult individuals is shown in Table 70 and was obtained based on the count of FDI 18 and the same number of left temporal bones (*pars petrosa*). This information can also be confirmed in Table 69, where MNI is based uniquely on bone analysis.

Table 69 - Adult MNI for Phase 2D based on bone analysis. Tomb I (Perdigões).

Long Bone	**MinNi**	**MaxNI**
Left Temporals (*Pars Petrosa*)	25	
Right Femur	17	33
Right Humerus	15	25
Left Ulna	10	12
Right Tibia	10	23
Left Femur	9	19
Left Tibia	9	20
Left Humerus	8	16
Right Ulna	6	10
Right Fibula	6	9
Left Radius	4	9
Left Fibula	4	9
Right Radius	2	3

Although this was the most intense phase of use in Tomb I, it yielded proportionately similar results to the those obtained for the previous phases. The percentage of complete adult bones (100/954), 10,5%, follows the pattern observed until now. As for the types of complete bone, they are represented in Figure 66. Apart from the small hand and foot bones, one humerus, one tibia and one clavicle were recovered intact.

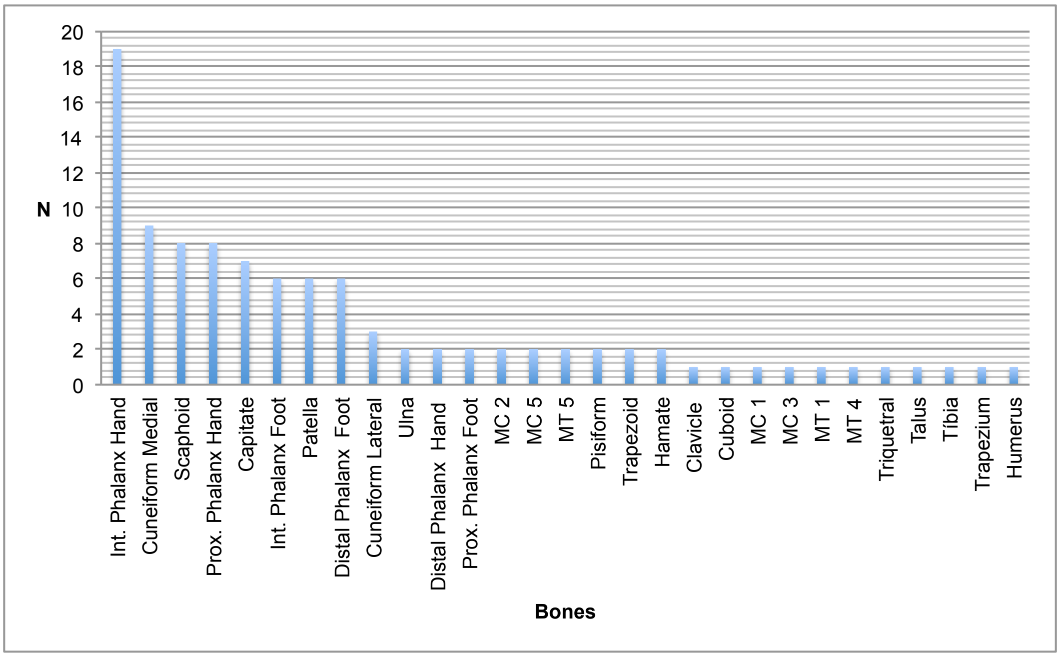


Figure 66 - Complete adult bones from Phase 2D. Tomb I (Perdigões).

There are 207 individual non-adult bone registers for Phase 2D, of which 18 (8,7%) were found intact (Figure 67). Yet again, it is for small foot and hand bones that the rate of completeness is higher, although in this particular group of bones one femur and one clavicle were also found intact.

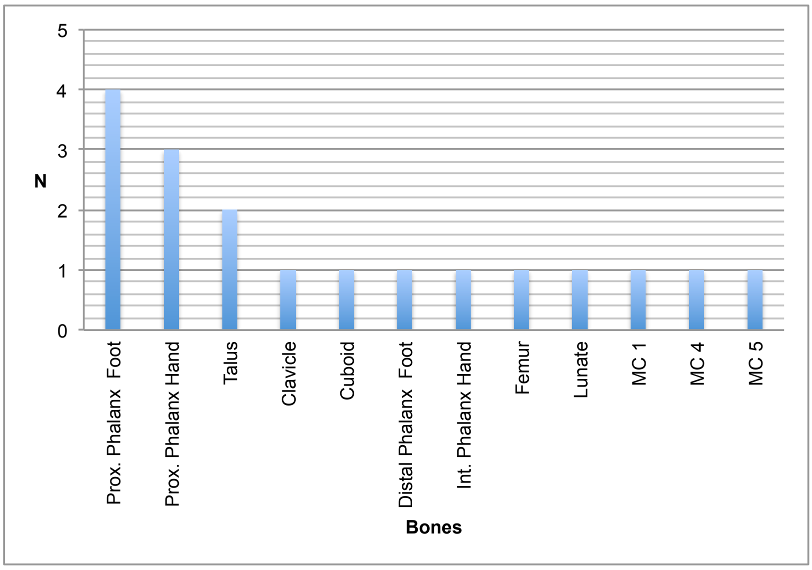


Figure 67 – Complete non-adult bones from Phase 2D. Tomb I (Perdigões).

All skeletal parts seem to be represented in Phase 2D although in unequal percentages. It was worthy of note that although Phase 2D is the phase where most fragments of human bone were recovered the percentage of cranial fragments comprised less than 10% of the total sample, unlike the previous phases analysed. This can possibly be explained by a higher completeness of cranial fragments excavated. Indeed, several cranial vaults were recovered from this phase almost complete and the strong presence of left temporal bones (*pars petrosa*) observed in Table 70 (almost in equal number to the estimated MNI of 28 given by FDI 18) helps to consolidate this idea. The same table demonstrates that long bones are unequally represented: the right femur shows a 61% representativeness but the representativeness for the left radius is only 14,3%. Scapula (through 8 left glenoid cavities) has a representativeness of 28,6% while the presence of ilium is demonstrated by 6 identified fragments of ischium (21,6% of representativeness) and 2 fragments of pubis (right side, only 7,1% representation). Foot and hand fragments are also present although underrepresented when compared to the higher figures. 6 right capitates (21,4% of representativeness) are the carpal element most represented. As for foot bones, 5 MT2 and 5 MT5 are those most represented (17,9%). The identification of 3 left scaphoid bones (10,7% representativeness) and 1 right trapezium (3.6% of total) should be highlighted.

Table 70 - Bone representativeness for Phase 2D. Tomb I (Perdigões).

Bone	Obs. No.	Representativeness (%)
FDI 18	28	100
Left Temporal (Pars Petrosa)	25	89,3
Right Femur (Prox. Diaphysis)	17	61
Right Humerus (Distal 1/3))	15	53,5
Left Ulna (Prox. Extremity)	10	35,7
Right Tibia (Prox. 1/3)	10	35,7
Left Glenoid Cavity	8	28,6
Right Fibula (Middle 1/3)	6	21,4
Right Capitate	6	21,4
Left Ischium	6	21,4
Left Lateral Cuneiform	5	17,9
Right MC 2	5	17,9
Left MT 5	5	17,9
Left MT 2	5	17,9
Atlas	3	10,7
Right Patella	5	17,9
Left Radius (Prox. 1/3)	4	14,3
Right Navicular	4	14,3
Right Calcaneus	4	14,3
Left Talus	4	14,3
Right Clavicle	3	10,7
Left Scaphoid	3	10,7
Right MC 4	3	10,7
Left MC 5	3	10,7
Right MT 5	3	10,7
Left Medial Cuneiform	2	7,1
Right Pubis	2	7,1
Left MC 3	2	7,1
Right MT 3	2	7,1
Right Hamate	2	7,1
Right Trapezoid	2	7,1
Right Cuboid	1	3,6
Left First Rib	1	3,6
Left MT 4	1	3,6
Left MC 1	1	3,6
Right Trapezium	1	3,6

Table 71 displays an overview of tooth representativeness through the values for single-rooted and double/multi-rooted teeth from Phase 2D. None of the obtained percentages fit those expected. Indeed, both for upper and lower single-rooted teeth the values are below those established, respectively 9,1%

and 9,6%. The opposite occurs with upper and lower double/multi-rooted teeth. The former were recorded 11,5% above the expected percentage and the latter also appear 7,9% over the established value.

Table 71 - Percentages for single-rooted, double/multi-rooted teeth for Phase 2D. Tomb I (Perdigões).

	In situ	**Loose**	**Total**	**% Obtained**	**% Expected**
Upper SRT	15	59	74	15,9	25
Upper DMRT	42	127	169	36,5	25
Lower SRT	15	85	100	21,6	31,2
Lower DMRT	36	84	120	25,9	18

Legend: SRT (Single-Rooted Teeth); DMRT (Double/Multi-Rooted Teeth)

The discrepancies observed in Table 71 are maintained when the proportion between upper and lower teeth displayed in Table 72 is analysed. Once again, for upper teeth, single-rooted teeth are clearly below the value expected when compared with double/multi-rooted teeth. This difference is even more obvious for lower teeth, where the number of single-rooted teeth should exceed the number of double/multi-rooted teeth when, in fact, the opposite is observed.

Table 72 - Proportion of upper and lower teeth from Phase 2D. Tomb I (Perdigões).

	SRT	**DMRT**	**Obtained**	**Expected**
Upper	74	169	0,44	1
Lower	100	120	0,83	1,7

Legend: SRT (Single-Rooted Teeth); DMRT (Double/Multi-Rooted Teeth)

Table 73, Table 74 and Figure 68 illustrate age-at-death distribution for Phase 2D. All age groups are present, although the youngest individual identified can only tentatively be included in the first group of less than 1 year of age. The age group between 5-9 years old again shows the highest rate of child mortality, very close to the previous one between 1-4 years of age. Non-adult individuals are again very well represented in the total count and make up 44,5% of the total sample.

Table 73 - Age at death estimation for non-adult individuals from Phase 2D. Tomb I (Perdigões).

Age at death	Quantity	Tooth/Bone
7- 18 months	1	Left Ischium (max length:46
±1,5/2	1	Right Femur (156mm)
2,5/3.5	2	FDI 36; FDI 36
3.5	2	FDI 31; FDI 36
4.5	2	FDI 23; FDI 32
5.5	2	FDI 22; FDI 41
6.5	2	FDI 24; FDI 33
6.5/7.5	1	FDI 16
7.5	3	FDI 46; FDI 14; FDI37
8,5	1	FDI 37
10,5	1	FDI 12
11,5	1	FDI 45
13,5	1	FDI 18

Table 74 – Age at death estimation for adult Individuals from Phase 2D. Tomb I (Perdigões).

Age	Bone/FDI	Ner.	E.U.	Lat.	Sex	Method/Score System
18,5/19.5	28	195b	97	Left	------	Dental
20,5	38	1112	97	Left	------	Dental
22,5	28	1286	97	Left	------	Dental
30-40	Auricular	2404	179	Left	♀	Phase
45-55	Auricular	2461	97	Left	NO	Phase
± 55	Auricular	2543	97	Left	NO	Phase

* Lovejoy et all (1985); **Buckberry and Chamberlain (2002)

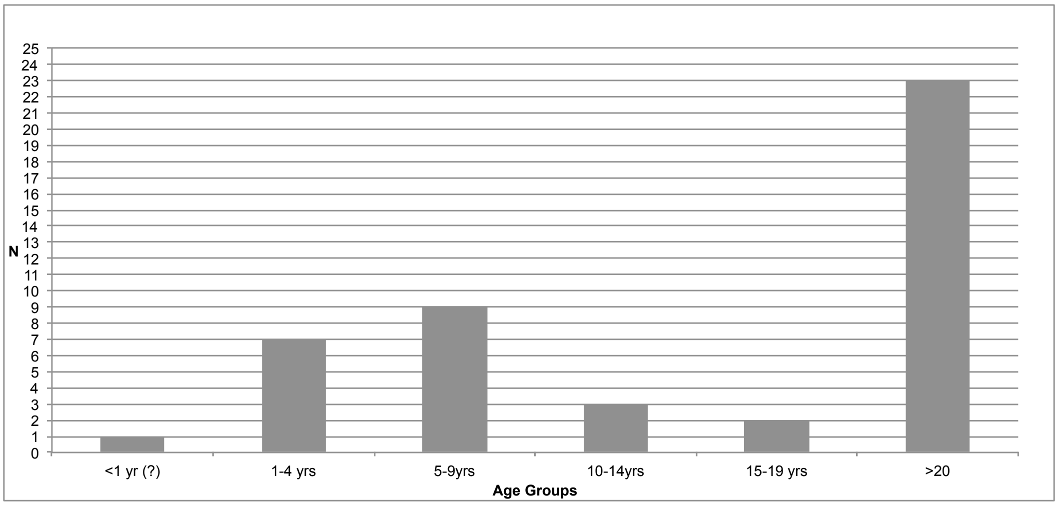


Figure 68 - Age at death profile recovered for individuals from Phase 2D. Tomb I (Perdigões).

Table 75 displays the results for sexual diagnosis for the bones recovered from Phase 2D. The application of both morphological and metric methods allows us to assume the presence of male and female individuals in this phase of use of Tomb I.

Table 75 - Sexual diagnosis based on bone fragments from Phase 2D. Tomb I (Perdigões).

Morphological Analysis					
Bone	**No.**	**SU**	**Sex**	**Side**	**Scored Structures**
Frag. Ilium	2404	97	♀	Left	GSN*: 2; PS**: 2
Frag. Ilium	3635	97	♀	Right	GSN*: 2; PS: 3
Frag. Ilium	2077	97	♀?	Right	GSN*: 3
Frag. Ilium	2435	97	♀?	Left	GSN*: 3
Frag. Ilium	2270	97	♂	Right	GSN: 5
Mandible	3723	97	♂?		Mental Eminence: 4
Frag. Mandible	3714	97	♂?		Mental Eminence: 4
Frag. Mandible	3724	97	♀?		Mental Eminence: 1
Frag. Temporal	3999	97	♂?	Left	Mastoid Process: 4
Frag. Occipital	3990	97	♂?		Nuchal Crest: 4
Metric Analysis					
Bone	**No.**	**SU**	**Sex**	**Side**	**Variable Measurement**
Frag. Distal Humerus	220	97	♀	Right	HBW: 54 mm
Frag. Distal Humerus	221	97	♀	Right	HBW: 47 mm
Frag. Distal Humerus	205	97	♀	Left	HBW: 50 mm
Frag. Distal Humerus	204	97	♀	Right	HBW: 54 mm
Frag. Distal Humerus	207	97	♀	Right	HBW: 54,5 mm
Frag. Distal Humerus	206	97	♀?	Right	HBW: 56,5 mm
Frag. Distal Humerus	114	97	♂?	Left	HBW: 57 mm
Frag. Distal Humerus	218	136	♂	Left	HBW: 60 mm
Frag. Prox. Humerus	211	97	♂	Left	HVHD: 45,5 mm
Talus	962	97	♂	Left	TM1: 53mm
Talus	3914	97	♀	Left	TM1: 52 mm
Frag. Calcaneus	898	97	♂	Left	CM1: 78mm
Frag. Prox. Femur	4091	94	♀	Right	FVHD: 36 mm
Frag. Prox. Femur	4124	97	♀	Right	FVHD: 36 mm
Frag. Prox. Femur	4167	97	♂	Right	FVHD: 46mm
Frag. Prox. Femur	4103	136	♂	Left	FVHD: 44 mm
Frag. Prox. Femur	4112	97	♂	Left	FVHD: 45 mm

*Great Sciatic Notch **Preauricular Sulcus

It is the metric results that are most useful in the determination of minimum numbers of male and female individuals in the bones analysed. The measuring of the biepicondylar width (HBW) of 5 right humerus (nos. **204, 206, 207, 220** and **221**) with results below the established sectioning point of 56,63 mm point (Wasterlain and Cunha, 2000) suggest the presence of that number of female individuals although bone no. **206** was very close to that value and raises some doubts. As for male individuals, their number is suggested through the metric results on femur vertical head diameter (FVHD). Left femurs no. **4103** and no. **4112** yielded measurements above the sectioning point of 42,23 mm and probably belonged to male individuals. A third right femur (no**. 4167**) could possibly belong to a third male individual.

Once again, the only morphological metric analysis possible for this phase was through the measuring of a right MT1 from SU 97 (no. **772**), for estimation of stature. The measuring yielded the following result: 1555,10 mm±53,5

Regarding post-cranial non-metric traits observed in bones from Phase 2D, which can be found in Table 76, there is only one occurrence to mention: the presence of a hypotrochanteric fossa on a right femur.

A specific case (because it is the only one registered in Tomb I) concerns the observation of a possible accessory hip facet. It occurs on bone no. **2270** from SU 97. It is a right ilium, with masculine features (cf. Table 75). In this case an articular facet can be observed on the ilium, posterior to the auricular surface, on its superior border, in the area of the iliac tuberosity (for the sacroiliac ligament) (Finnegan, 1978; Saunders, 1978).

Table 76 – Post-cranial non-metric traits observed in bones from Phase 2D. Tomb I (Perdigões).

Trait	Left	Right
Allen's Fossa	0/1	0/3
Hypotrochanteric Fossa	0/0	1/3
Third Trochanter	0/3	0/5
Medial Tibial Squatting Facet	0/3	0/2
Lateral Tibial Squatting Facet	0/3	0/2
Supracondyloid Process	0/4	0/10
Septal Aperture	0/3	0/6
Acromial articular facet	0/2	0/3
Vastus Notch	0/4	0/3
Vastus Fossa	0/4	0/3
Emarginate Patella	0/4	0/3
Medial Talar Facet Present	0/4	0/0
Inferior Talar Articular Surface	0/4	0/0
Anterior Calcaneal Facet Absent	0/1	0/5

Table 77 shows that 8,2 % of a total of 461 (53/461) permanent teeth analysed for Phase 2D presented enamel hypoplasia. Once again, it is in canines that a higher frequency of hypoplasia is found, namely on lower right canines (37,5%).

Table 77 - Enamel hypoplasia observed in teeth from Phase 2D. Tomb I (Perdigões).

Tooth	Upper		Lower	
	Left	**Right**	**Left**	**Right**
I1	0/2	4/8 (50%)	0/10	1/5 (20%)
I2	0/3	0/5	0/5	0/9
C	2/11(18,2%)	5/16 (31,2%)	3/11 (27,2%)	3/8 (37,5%)
P1	2/16 (12,5%)	1/8 (12,5%)	1/10 (10%)	0/5
P2	1/9 (11,1%)	0/17	0/9	0/13
M1	4/29 (13,7%)	1/23 (4,3%)	1/27 (3,27%)	1/20 (5%)
M2	0/17	0/12	0/18	1/17 (5,9%)
M3	2/24 (8,3%)	3/26 (11,5%)	1/16 (6,25%)	0/12

From the 38 teeth that present enamel hypoplasia, 6 have two or more visible lines and their distribution can be confirmed in Table 78. Regarding deciduous dentition none presented enamel hypoplasia (0/38).

Table 78 - Distribution of number of enamel hypoplasia per tooth for Phase 2D. Tomb I (Perdigões).

No. Hypoplasia	FDI	Quantity	Field No.
1	11	2	445; 1405
	13	5	288; 463; 745;1032;1078
	16	1	932
	18	2	927; 934
	23	1	M3923a
	24	2	771; M3990a
	25	1	1242
	26	4	504; 1350; 1022b;M4003
	28	2	525; 1008
	33	2	674; 929a
	34	1	1397b
	36	1	590
	38	1	430a
	41	1	233
	43	2	943; 858a
	46	1	M3663
	47	1	873
2	11	2	843; 925
	14	1	481
	33	1	92a
	43	1	762
3	13	1	945
	23	1	1419

Results for general tooth wear (n=440) show an average of medium to low level of 2,1 wear for this phase Table 79 and

Table 80 detail this information showing a very slightly higher value in maxillary anterior dentition, with canines presenting an average of attrition of 2,4. Posterior mandibular dentition presents similar values.

Table 79 - Average tooth wear for Phase 2D. Tomb I (Perdigões).

	Anterior Dentition	**Posterior Dentition**	**Total**
Maxillary	2,2 (n=44)	2,1 (n=192)	2,1 (n=236)
Mandibular	2 (n=49)	2,1 (n=155)	2,1 (n=204)

Table 80 - Tooth wear per tooth for Phase 2D. Tomb I (Perdigões).

Tooth	Upper	Lower
I1	2 (n=10)	2,1 (n=16)
I2	1,9 (n=9)	1,9 (n=14)
C	2,4 (n=26)	1,9 (n=20)
P1	2 (n=27)	1,4 (n=17)
P2	2,4 (n=27)	1,9 (n=25)
M1	2,2 (n=56)	2,2 (n=47)
M2	2,3 (n=29)	2,4 (n=36)
M3	1,7 (n=52)	2,4 (n=29)

Tooth wear measured for deciduous teeth since showed that some of them presented a quite considerable level of wear. The average is 1,8 (n=38) and can be seen on Table 81.

Table 81 - Tooth Wear for deciduous teeth from Phase 2D. Tomb I (Perdigões).

	Dental Tooth Wear (average)
Maxillary	1,8 (n=15)
Mandibular	1,8 (n=23)

Three of the permanent teeth (n=434) from Phase 2D presented cariogenic lesions (0,7%) and are described in Table 82. In the case of the teeth FDI 17 and 18, they are in bad state of preservation but found together during excavation, although not *in situ* (Figure 69). The cariogenic lesions they present and their morphological compability make it possible that they were contiguous teeth belonging to the same individual. The cariogenic lesion found on an FDI 46 is illustrated in Figure 103.

No cariogenic lesions were identified on the deciduous dentition (0/38).

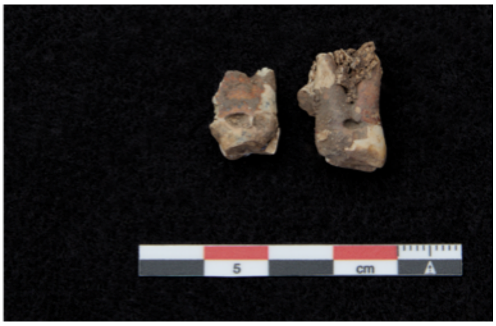


Figure 69 - FDI 17 and FDI 18 presenting contiguous interproximal cariogenic lesions from SU97. Tomb I (Perdigões). Left: occlusal view; Right: FDI 17 (distal interproximal facet); FDI 18 (medial interproximal facet).

Table 82 - Cariogenic lesions observed in the teeth from Phase 2D. Tomb I (Perdigões).

Tooth No.	S.U.	FDI	Extent Lesion	Anatomical Site
281a	97	17	1	2/3
M281b	97	18	1	2/3
588	97	46	1/2	4

Figure 70 - FDI 46 presenting a cariogenic lesion on the lingual surface. SU97. Tomb I (Perdigões).

Calculus was identified in 24% of the permanent teeth analysed (105/434). For superior dentition 18,6% presented calculus deposits (N= 44 /236) and for inferior dentition the percentage of calculus deposits found was of 30,8%(n=61/198). None of the deciduous teeth identified (n=0/38) showed signs of calculus deposits.

Table 83 illustrates the number of observable episodes of antemortem tooth loss for individuals from Phase 2D. Only 18,5% of the expected alveoli (148/800) were found and counted, and show only one case occurring in superior dentition (only 1,4%). Eleven cases were registered amongst the 77 available alveoli (14,2%).

Table 83 - Antemortem tooth loss for Phase 2D. Tomb I (Perdigões).

Maxillary	Mandibular
1/71alveoli	11/77alveoli

Only the distal extremity of a small number of femurs from Phase 2D yielded results regarding the presence of osteoarthritis (Table 84). Two left femurs and one right femur showed degree 1 lesions in this area.

Table 84 - Osteoarthritis observed in bones from Phase 2D. Tomb I (Perdigões).

		Degree Left		Degree Right	
		0	1	0	1
Humerus	Proximal	1	0	3	0
	Distal	4	0	6	0
Radius	Proximal	1	0	0	0
	Distal	2	0	1	0
Ulna	Proximal	8	0	3	0
	Distal	2	0	1	0
Femur	Proximal	2	0	4	0
	Distal	2	1	4	2
Tibia	Proximal	2	0	1	0
	Distal	4	0	1	0
Fibula	Proximal	0	0	0	0
	Distal	1	0	1	0

Not registered in Table 84 there are other isolated cases of bones revealing osteoarthritis lesions:

Register no**. 3654**. SU 97. A small, 50mm fragment of vertebral body shows a degree 2 (osteophytosis) alteration around the observable area of the rim (Figure 71).

Figure 71 - Vertebral body with signs of OA alteration around the rim from SU97. Tomb I (Perdigões).

Register no. **2702**. SU 97. Fragment of a body of a thoracic vertebra. None of the posterior processes are present and the body presents several post depositional alterations (fragmentation, concretion). On the left side of the inferior surface of the vertebra an osteophyte (9 mm x 14 mm) can be observed growing from the surface of the body and not from the rim.

Figure 72 -Thoracic vertebra with OA alteration on the inferior surface. SU97. Tomb I (Perdigões).

Register no. **3651**. SU 96. An almost complete body of a lumbar vertebra. None of the posterior processes are present. A downward circular protrusion (7mm wide) is visible on the centre/left of the superior vertebral surface, compatible with a lesion caused by a Schmorl nodule (Figure 73).

Figure 73 - Lumbar vertebra with a visible Schmorl nodule from SU96. Tomb I (Perdigões).

What can be highlighted in Table 85, which describes enthesal changes scored for bones from Phase 2D is again the scarcity of results, although some alterations were registered. The most visible ones are evident on lower limbs. This is the case of 3 right femurs where on the *linea aspera,* one bone showed a degree 2 alteration and two bones presented a degree 1 alteration. Three femurs were also scored with degree 1 enthesal change on the great trochanter. Three right fibulae were also classified as having degree 1 alteration of the tibiofibular ligament. The anterior surface of two right patella showed degree 1 enthesal change and the same degree was observed in one right patella. For tibia only a single degree 1 alteration was registered on the soleal fossa of a left bone. Two calcaneus (one left and one right) showed degree 1 alteration in the calcaneal tuberosity.

Upper limbs only presented alteration in two supracondylar ridges (degree 1) of two left humeri, and the same degree was described on the bicipital tuberosity of a right radius.

For other bones, a right clavicle showed sign of alteration (degree 1) on its sternal extremity.

Table 85 - Enthesal changes observed in bones from Phase 2D. Tomb I (Perdigões).

		Degree Left			Degree Right		
		0	1	2	0	1	2
Scapula	Coracoid Process	0	0	0	2	0	0
	Acromion	1	0	0	1	0	0
Clavicle	Sternal Extremity	3	0	0	1	1	0
	Deltoid Tuberosity	2	0	0	1	0	0
Humerus	Medial Epicondyle	1	0	0	7	0	0
	Lateral Epicondyle	1	0	0	8	0	0
	Trochlea	3	0	0	8	0	0
	Lateral Supracondylar Ridge	3	0	0	7	2	0
Radius	Bicipital Tuberosity	2	1	0	0	0	0
	Radial Styloid Process	2	0	0	1	0	0
Ulna	Proximal extremity	8	0	0	3	0	0
	Styloid Process	2	0	0	1	0	0
Ilium	Iliac Crest	5	0	0	5	0	0
	Ischiatic Tuberosity	4	0	0	1	0	0
Femur	Greater Trochanter	0	0	0	3	3	0
	Lesser Trochanter	1	0	0	3	0	0
	Linea Aspera	4	0	0	5	2	1
	Digital Fossa	1	0	0	3	0	0
Patella	Anterior Surface	2	1	0	1	2	0
Tibia	Soleal Fossa	1	1	0	0	0	0
	Anterior Tuberosity	0	0	0	0	0	0
	Distal	4	0	0	0	0	0
	Medial Malleolus	5	0	0	2	0	0
Fibula	Biceps Femoris	0	0	0	0	0	0
	Lateral Malleolus	3	0	0	1	0	0
	Tibiofibular Ligament	1	0	0	0	3	0
Calcaneus	Tuberosity	1	1	0	7	1	0
	Adductor Hallucis	0	0	0	4	0	0

Other Pathologies > Infectious Pathologies

Register no. **2936**. SU 97: an almost complete distal half of an adult right fibula preserved in 154 mm of its extension. The distal end of the distal extremity is absent. On the area around the tibiofibular ligament insertion there are signs of remodelled infection with alteration of the periosteal surface, with mild porosity on the lateral-posterior side of the bone.

Register no. **2937.** SU 182: a fragment of an adult right fibula diaphysis preserved in 73 mm of its extension. This is part of the distal end of the fibular diaphysis corresponding to the area around the tibiofibular ligament insertion. On this area, there are signs of remodeled infection with alteration of the periosteal surface with mild porosity on the lateral-posterior side of the bone (Figure 74).

Figure 74 – Distal fragment of an adult right fibula with signs of remodeled infection. SU182. Tomb I (Perdigões).

Register no. **4110**. SU 97: 101 fragments of an adult right femur diaphysis. Although highly fragmented this represents the part of the shaft around the *linea aspera.* There are signs of alteration of the periosteal surface with mild porosity on many of these fragments compatible with an active infectious process.

Register no. **4048**. SU 97: 25 fragments of an adult left tibia proximal extremity and diaphysis. One of the fragments (46 mm long), probably belonging to the mid diaphysis, shows signs of alteration of the bone surface through the presence of thin longitudinal grooves. This is the only fragment where these alterations are visible. They seem to be the result of an inactive infectious process of unknown and unknowable origin, which affected the periosteum at some point in the life of the bone.

Register no. **3688**. SU 96. A fragment of an adult occipital bone (54 mmx 39mm. A small section (34 mm) of the lambdoidal suture is visible. On the endocranial surface an undetermined section of the cruciform eminence is also visible. The ectocranial surface of the entire fragment is altered by the presence of micro porosity probably resulting from an active infectious process (Figure 75).

Figure 75 - Fragment of adult occipital bone displaying widespread microprorsity probably resulting from an active infectious process. Tomb I (Perdigões).

Register no. **3689**. SU 97. A fragment of an adult occipital bone (47 mmx 36mm). The internal occipital protuberance is completely preserved and visible on the endocranial surface, where one of the visible cerebellar fossae (probably top right one) seems much deeper than the opposite one (top left). On the ectocranial surface, around the nuchal plane and the external occipital crest there are signs of an active infectious process manifested through the presence of micro and medium porosity (Figure 76).

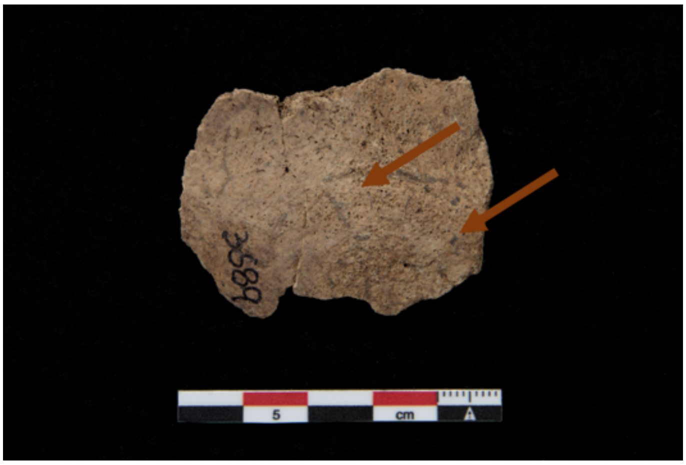


Figure 76 - Fragment of an adult occipital bone with signs of infection on the endocranial surface. SU)/. Tomb I (Perdigões).

> Congenital Pathologies

Register no. **3965**. SU 97. In this almost complete mandible FDI 31, 33, 34 and 35 can be found *in situ* but fragmented *post-mortem* above the cementoenamel line in the cervix area. As for the remaining teeth FDI 32, 36 and 37 are found *in situ* and intact except for the FDI 32 where a small portion of enamel and dentine are missing, postmortem, around the distal side of the root/cervix area. This tooth also presents a vertical fracture on the enamel from top to bottom, across the buccal surface of the crown. A slight postmortem fracture line can also be seen on the buccal surface of the crown belonging to FDI 37. These teeth present a considerable level of wear: FDI 32 and FDI 27 present a degree 5 wear and FDI 36 shows a degree 4 wear level. No enamel hypoplasia or cariogenic lesions were identified on these teeth.

As for FDI 38, it was also originally found *in situ* but removed by Maria Hillier for isotopic analysis on 22.6.2006. The left mandibular ramus (condylar and coronoid processes) were also taken for sampling on the same occasion.

For the right side of the mandible FDI 42, 44, 45, 46 and 47 are found *in situ* and almost intact. FDI 42 presents an enamel fracture from top to bottom on the buccal facet of the crown. Part of the distal-occlusal part of FDI 37's crown is also absent, resulting from a postmortem fracture. The alveolus for FDI 41 is visible but nothing remains of the tooth. The absence of post-traumatic wear and the presence of encrusted sediments in the alveolus suggest its peri or postmortem occurrence and its antiquity. As for the remaining FDI 43 and 48 they are visible in the alveoli but fragmented *postmortem* above the cementoenamel line in the cervix area.

The mandible also presents several old postmortem fractures on its body. On its anterior portion, above the *mentum* a fracture line can be seen crossing the whole arch, just below the tooth line. It also presents a top to bottom fracture to the right side of the right mental foramen (starting between FDI 45 and 46) and was glued during laboratory work.

Examination of this mandible revealed a deviation in the mandibular dental midline in relation to the chin midline showing mandibular asymmetry characterized by a probable elongated right mandibular branch. The absence of the corresponding maxilla did not allow the evaluation of the possible degree of malocclusion for this individual.

Mandibular asymmetry was characterized by comparing each one side of the mandible with its mirror image. The degree of displacement between corresponding structures on the right and left sides can be seen (Figure 77) resulting in a *mentum* that is deviated from the mandibular midline towards the left. The absence of the left mandibular ramus (sampled for isotopic analysis) precluded the results on this respect as it is not possible to understand how displaced the left ramus is when compared with its right-side counterpart. Nonetheless, if the position of both right and left first and second lower molars is compared it is clear that their relative position on opposite sides of the dividing line or median plane lacks symmetry.

The etiology for asymmetric mandibular growth is believed to be related to congenital, developmental, or acquired factors. In some developmental cases, asymmetry may be secondary to condylar hyperplasia or hypoplasia, anchylosis, or hemifacial microsomia (Vasconcelos et al., 2012; Solem et al., 2016). When the causes are pathological they may result from tumours and cysts, infection or condylar resorption. Condylar fractures of a traumatic origin can also be responsible for this condition.

In this case, no evidence of trauma or pathological conditions was identified and a developmental cause seems the most probable for this asymmetry. Because no unilateral three-dimensional enlargement of the mandible was visible nor was there increased alveolar bone height (typical of a developmental deformity called hemimandibular hyperplasia) the most probable reason for this case is another developmental deformity, of unknown aetiology, known as hemimandibular elongation (Chia et al., 2008). In this case it affected the right side of the mandible increasing the transverse displacement of the chin point towards the left.

Figure 77 - Mandible from SU 97 showing hemimandibular elongation of the right side. Tomb I (Perdigões).

The most striking particularity of Phase 2D is in fact its abundance in human remains and the intense funerary use of the chamber. Spatially, they are found spread over almost all the surface and even covering part of the fallen schist slabs that have already been mentioned and that were found on the left side of the entrance (SU 101 and SU 102). Figure 78 and Figure 79 illustrate the absolute collective and commingled nature of the depositions, in line with observations for the previous phases. The area to the right of the entrance and the southern section, between the two collapsed slabs, show the highest concentration of remains.

Figure 78 - General view of human bone deposition for Phase 2D. Tomb I (Perdigões).

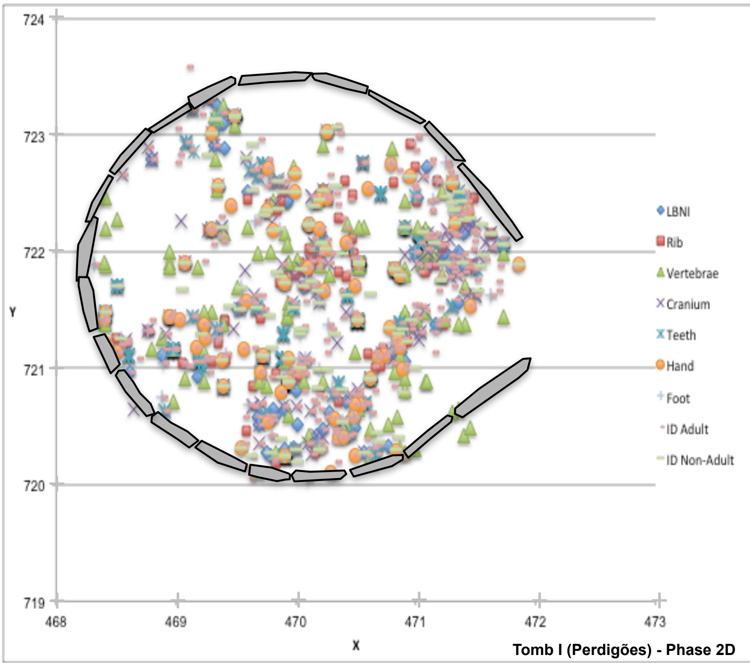


Figure 79 - Human bone distribution for Phase 2D. Tomb I (Perdigões).

Some archaeological materials were recovered from Phase 2D. Considering the high number of human remains it could be expectable that the number of artefacts would correspond. This does not seem to be the case, as illustrated in Figure 80. The only remarkable feature regarding artefact dispersal is the group of closely deposited vases coinciding with the human bone concentration identified to the right of the entrance.

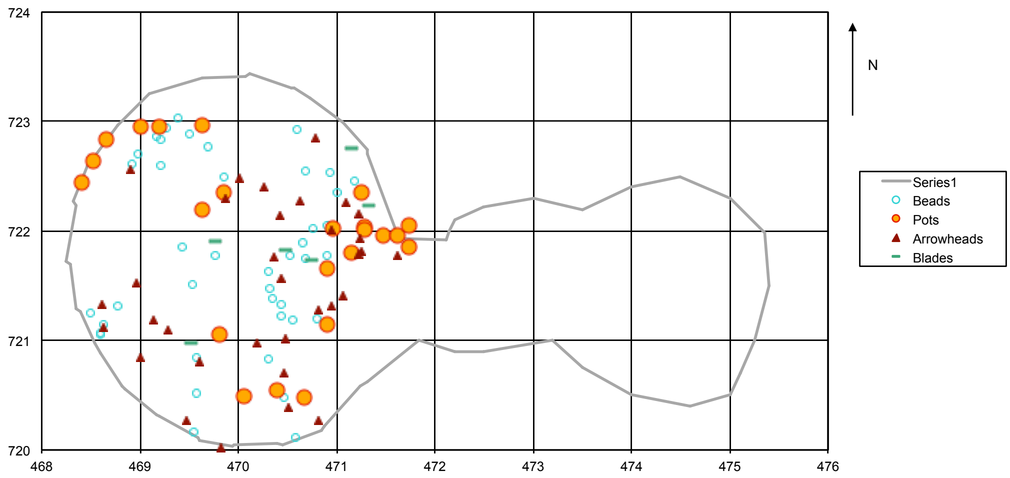


Figure 80 - Distribution of artefacts for Phase 2D. Tomb I (Perdigões).

Adult and non-adult bones are found together and overlapping as can be seen in Figure 81. As for the location of bones according to sex, Figure 82 suggests a preferential deposition of bones with male characteristics towards the western side of the chamber and female bones closer to the eastern side. Nonetheless, although there is more information regarding sex diagnosis for this phase when compared to others, this information could be biased by the enormous limitations imposed by the fragmented and poor state of the human bones in Tomb I.

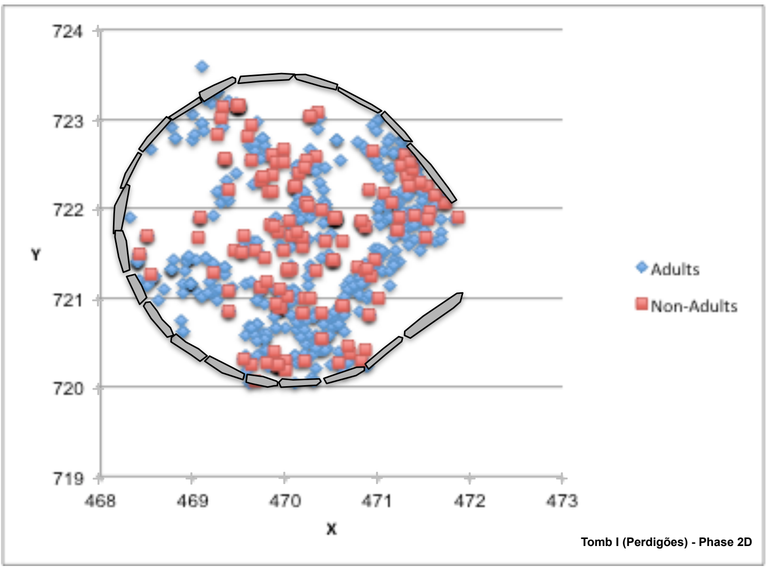


Figure 81 - Adult/non-adult bone distribution for Phase 2D. Tomb I (Perdigões).

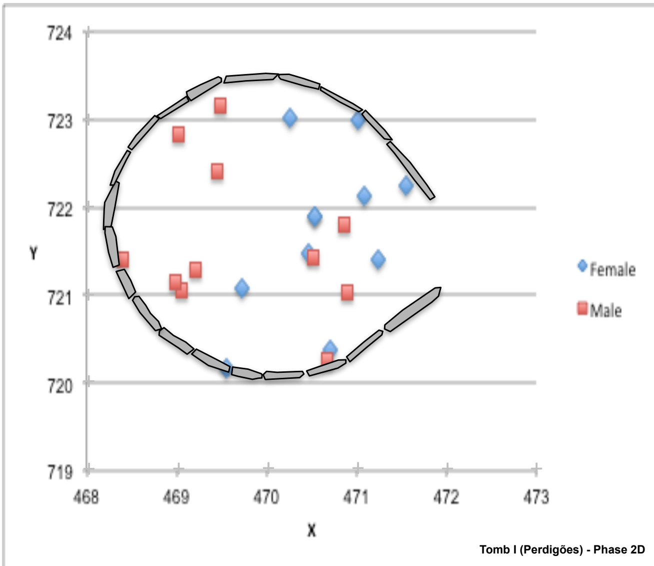


Figure 82 - Male /female bone distribution for Phase 2D. Tomb I (Perdigões).

In terms of bone concentrations, there seems to be a more intensive use of the area around the right side of the entrance to the chamber, which continues diagonally with a northeast/southwest pattern. That is where the highest number of cranial and long bone fragments (particularly tibias) can be found (Figure 83 and Figure 84). This concentration also includes foot and hand bones, although they can be found spread around the whole area covered by phase 2D (Figure 85).

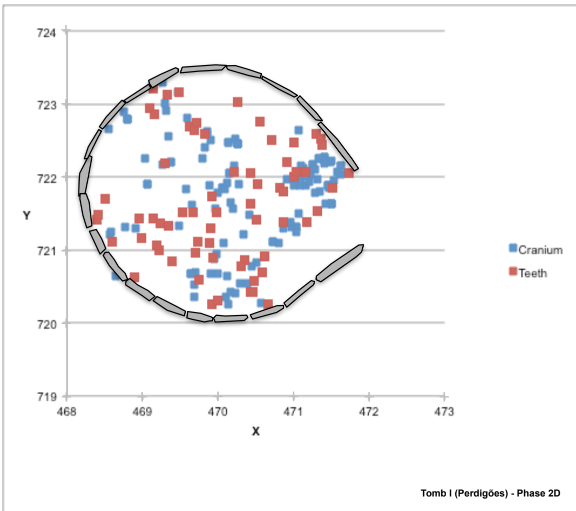


Figure 83 - Cranial fragments and tooth distribution for Phase 2D. Tomb I (Perdigões).

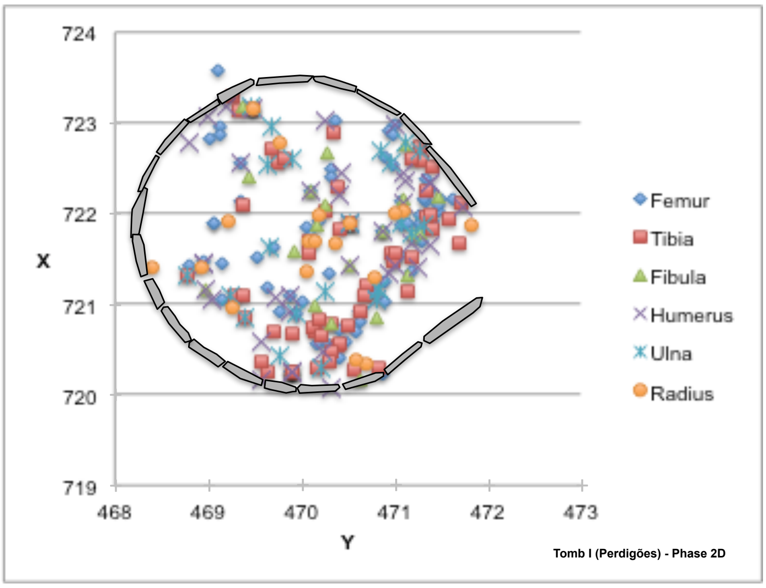


Figure 84 - Long bone distribution for Phase 2D. Tomb I (Perdigões).

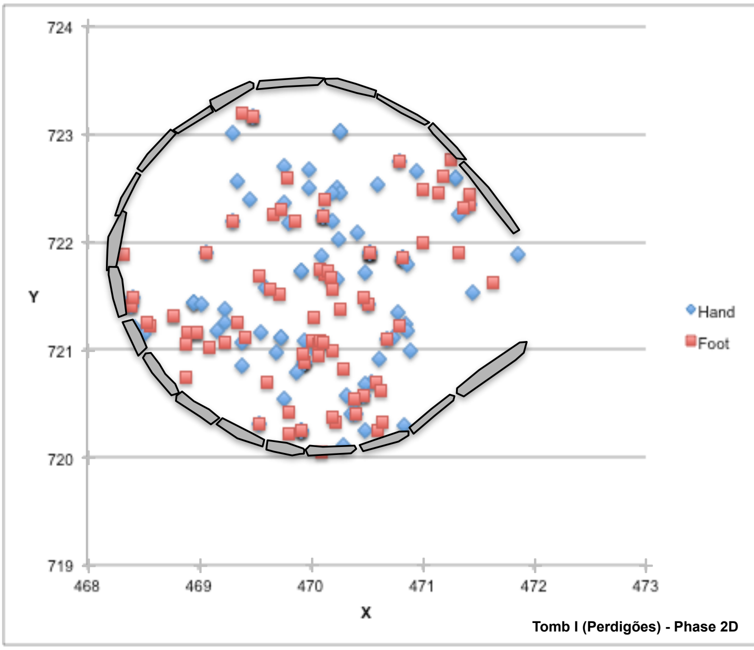


Figure 85 – Hand and foot bone distribution for Phase 2D. Tomb I (Perdigões).

5.1.3 Phase 3

From a certain moment, which in the archaeological and stratigraphic interpretation corresponds to the beginning of Phase 3, the architectural structure of the chamber of Tomb I entered a process of degradation, culminating in the collapse of its walls. At the same time, it regular funerary use continued, sometimes through intense deposition of human remains and votive paraphernalia. These are the two essential characteristics of this phase. But no less significant is the total absence of evidence indicating possible repair or remodeling of the structure, possibly never even considered, precisely because evidence suggests the Tomb was in permanent use.

The beginning of the collapse of the monument with the destruction of the walls (evidence is lacking regarding any potential covering) from Phase 3 onwards is evident in the stratigraphic matrix (Figure 7). Human remains were detected which had literally been crushed by the collapsed slabs.

5.1.3.1 Phase 3A

Following a prolonged use and some evidence of the degradation of the tomb through the collapse of two wall lining schist slabs during Phase 2, from a certain point on this phenomenon seems to have accelerated, starting from this sub-phase onwards. It may, indeed, correspond to a set of relatively contemporary occurrences. In addition to three large fragments of fallen slabs on pre-existing deposits, a large schist slab, SU 100, was found next to the head of the chamber, lying horizontally on the same level (Figure 86). Because of its large dimension, it is unlikely that this was a wall lining slab, except possibly one of the slabs that defined the entrance to the Tomb. If that was the case, then the stone was moved to this new location for specific purposes.

Although no human depositions are attributed to Phase 3A a small number of artefacts was collected from the south side of the tomb as can be seen from Figure 87.

Figure 86 - General view of Phase 3A. Slab SU100 is visible in the foreground. Tomb I (Perdigões).

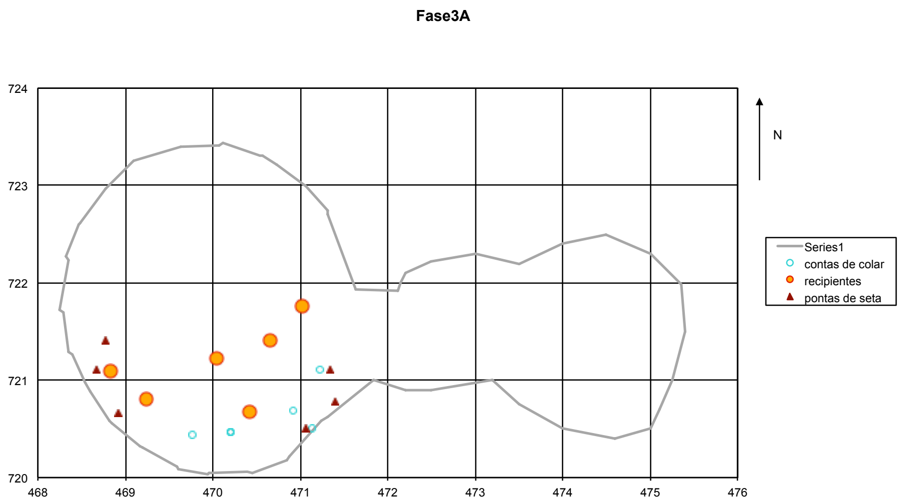


Figure 87 – Distribution of Artefact for Phase 3A. Tomb I (Perdigões).

5.1.3.2 Phase 3B

This sub-phase corresponds to a more intensive use of the western part of the chamber close to the head of the chamber. Bone deposition is scarcer when compared to the intensity of the two last sub-phases of Phase 2. However, the deposition of three human skulls (Figure 88), placed on the slab SU 100, was identified. The possibility exists that the latter was placed there with this purpose.

Figure 88 - Deposition of crania (SU 91) on the surface of slab SU 100. Phase 3B. Tomb I (Perdigões).

Phase 3B is the first phase of use of the monument after the schist slates of the walls started to collapse into the chamber. It is not surprising that the level of fragmentation was considerable, making the classification of the bones a difficult (Table 86). Nonetheless, we were able to individualize 268 registers for adult bones, comprising 4017 bone fragments (50,2% of the total). Of these fragments,13,3% (n=266) were attributed to non-adult individuals. General cranial fragments represent 17% of the sample (n=1358), once again followed by rib (n=137) and vertebral (n=119) fragments. A considerable number of pieces of bone,1478 (18,4%) were unidentifiable and for 7,7% (n=616) it was only possible to attribute them to the generic category of long bones. The total number of bones fragments for this phase is 7991.

Table 86 - Bone count for Phase 3B. Tomb I (Perdigões).

TYPE		No. FRAGMENTS	No. REGISTERS
Identified bones			
	Adults	4017	268
	Non-Adults	266	46
Others (Adults)	Cranium	1358	56
	Rib	137	47
	Vertebrae	119	49
Long Bones N.I.		616	27
N.I. Bones		1478	23
TOTAL		**7991**	**516**

As can be seen in Table 87, 71 teeth were recovered from Phase 3B, of which 54 were completely formed, 11 were still in formation and 6 were classified as part of the deciduous dentition.

Table 87 - Tooth count for Phase 3B. Tomb I (Perdigões).

TYPE		Number
Permanent		
	Formation Complete	54
	Formation Incomplete	11
Deciduous		6
TOTAL		**71**

Phase 3B provided an estimated minimum number of 5 non-adult individuals, less than 15 years of age. This number was estimated based on loose teeth and a maxilla (Table 92). The MNI for adult individuals is 10, based on the presence of that number of left temporal bones (*pars petrosa*), as can be observed in Table 88, and Table 89. In the case of Phase 3B, the proportion of non-adult individuals seems to decrease when compared to the previous phases, as in this case they make up one third of the total sample (33,3%).

Table 88 - MNI estimated for phase 3B based on bone observation. Tomb I. (Perdigões).

Long Bone	MinNi
Left Temporal (*pars petrosa*)	10
Right Femur	9
Right Tibia	6
Left Humerus	5
Left Femur	5
Left Tibia	4
Left Radius	3
Right Radius	2
Right Ulna	2
Left Fibula	2
Right Fibula	2
Right Humerus	1
Left Ulna	1

Figure 89 displays the number of complete adult bones identified in Phase 3B. They represent 11,6% of the total of 268 individual bone records registered and comprise mainly carpals and foot bones. Three whole tibias were also recovered in this phase, the highest number for a long bone in any of the previous phases.

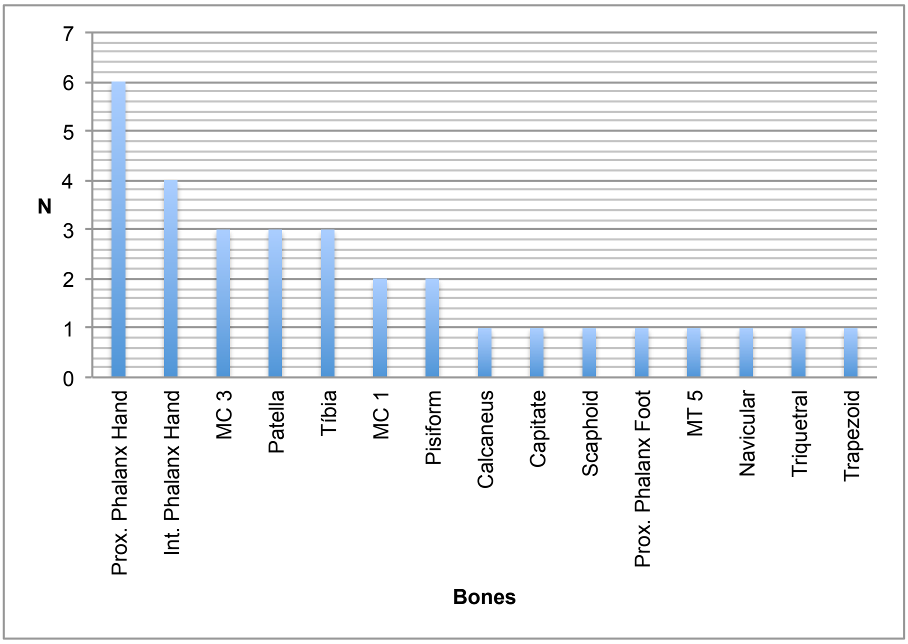


Figure 89 - Complete adult bones from Phase 3B. Tomb I (Perdigões).

Only 1 intermediate hand phalanx, 1 tibia and 1 patella (6,5% of the total) were found complete amongst the 113 individual bone records for non-adults.

Unsurprisingly, Table 89 confirms the strong presence of cranial fragments in Tomb I. In this case the 10 left temporal fragments identified provided the MNI for Phase 3B. Long bones are consistently represented by right femur, with 9 registers (90% of representativeness) although the count for ulna and fibula is low, with records for only 2 right ulnae and 2 left fibulae (only 20% representativeness). Unlike what was observed for the other phases, the scapula is very poorly represented with only 1 right glenoid cavity identified (10% representativeness). The representativeness of the ilium is of 50%, with 5 ischium fragments, unlike the tendency observed in the previous analysis. The remaining skeletal elements represented are mainly below 30% of representativeness. Small bones are represented by 2 right capitates (20% representativeness) and by, for example, 1 left lunate, 1 left pisiform or 1 right trapezoid (10% of representativeness).

Table 89 – Bone representativeness Phase 3B. Tomb I (Perdigões).

Bone	Obs. No.	Representativeness (%)
Left Temporal	10	100
Right Femur (Distal Extremity)	9	90,0
FDI 18	7	70,0
Right Tibia (Distal 1/3)	6	60,0
Left Humerus (Distal 1/3)	5	50,0
Left Ischium	5	50,0
Left Radius (Prox. 1/3)	3	30,0
Left MT5	3	30,0
Left Patella	3	30,0
Right Ulna (Distal Diaphysis)	2	20,0
Left Fibula (Distal Diaphysis)	2	20,0
Right Capitate	2	20,0
Left Mandibular Condyle	2	20,0
Left Coracoid Process	2	20,0
Right Talus	2	20,0
Right MC3	2	20,0
Left Calcaneus	1	10,0
Right Scaphoid	1	10,0
Right MT 2	1	10,0
Right MT3	1	10,0
Left Clavicle	1	10,0
Right Int. Cuneiform	1	10,0
Left Medial Cuneiform	1	10,0
Right Mandible	1	10,0
Left Maxilla	1	10,0
Right MC2	1	10,0
Left MT1	1	10,0
Right Glenoid Cavity	1	10,0
Right MC1	1	10,0
Left MC3	1	10,0
Right Navicular	1	10,0
Left Pisiform	1	10,0
Left Lunate	1	10,0
Right Trapezoid	1	10,0
Axis	1	10,0

Tooth representativeness for phase 3B is displayed in Table 90 and Table 91. Close analysis reveals the great disparity of values between upper and lower teeth. Because of this imbalance the percentages obtained for single-rooted and double/multi-rooted teeth are very far from the expected values. But although this fact explains a difference of 24% between obtained and expected percentages for lower single-rooted teeth and a difference of 13,4% for the upper ones, it does not help resolve the percentage obtained of 58,5% for upper double/multi-rooted teeth, when a value around 25% was expected. What is more, upper single-rooted teeth present a slightly higher number than expected.

Table 90 - Percentages for single-rooted, double/multi-rooted teeth Phase 3B. Tomb I (Perdigões).

	In situ	**Loose**	**Total**	**% Obtained**	**% Expected**
Upper SRT	6	14	20	30,7	25
Upper DMRT	16	22	38	58,5	25
Lower SRT	0	4	4	6,2	31,2
Lower DMRT	0	3	3	4,6	18

Legend: SRT (Single-Rooted Teeth); DMRT (Double/Multi-Rooted Teeth)

It is not unexpected that proportions between upper and lower teeth from Phase 3B presented in Table 91 maintain the differences detected in the previous table. Once again, upper single-rooted teeth are present in lower numbers than expected when compared to double/multi-rooted teeth. Because so few lower teeth were identified, the value obtained is only an indication.

Table 91 - Proportion of upper and lower teeth for Phase 3B. Tomb I (Perdigões).

	SRT	**DMRT**	**Obtained**	**Expected**
Upper	20	38	0,53	1
Lower	4	3	1,3	1,7

Legend: SRT (Single-Rooted Teeth); DMRT (Double/Multi-Rooted Teeth)

For the estimation of age-at-death data for this phase, Table 92, Table 93 and Figure 90 show that no bones belonging to individuals under 1 year of age were identified. The same is true for the group between 15 and 19 years of age, although this absence may be masked by the fact that it was temporal bones (*pars petrosa*) and not teeth that defined the MNI for adult individuals. This number must be analysed with caution. Indeed, at 2 years of age this portion of the temporal bone has reached about 50% of its adult size and it is natural that the *pars petrosa* of juveniles and adolescents can be confused with that of adults. The group between 5 and 9 years of age is the best represented for non-adults.

Table 92 - Age at death for non-adult individuals from Phase 3B. Tomb I (Perdigões).

Age at death	**Number**	**Tooth/Bone**
2,5/3,5	1	FDI 65
6,5	1	FDI 15
7,5	1	FDI 47
±8	1	Whole Maxilla
14.5	1	FDI 13;

Table 93 - Age at death for adult individuals from Phase 3B. Tomb I (Perdigões).

Age	Bone/FDI	No.	S.U.	Lat.	Sex	Score System
21/22,5	18	67h	91	Right	----	Dental calcification
±18,5/19,5	Pubic Symphysis	4213	93	Left	----	Phase 1*

* Brooks and Suchey (1990)

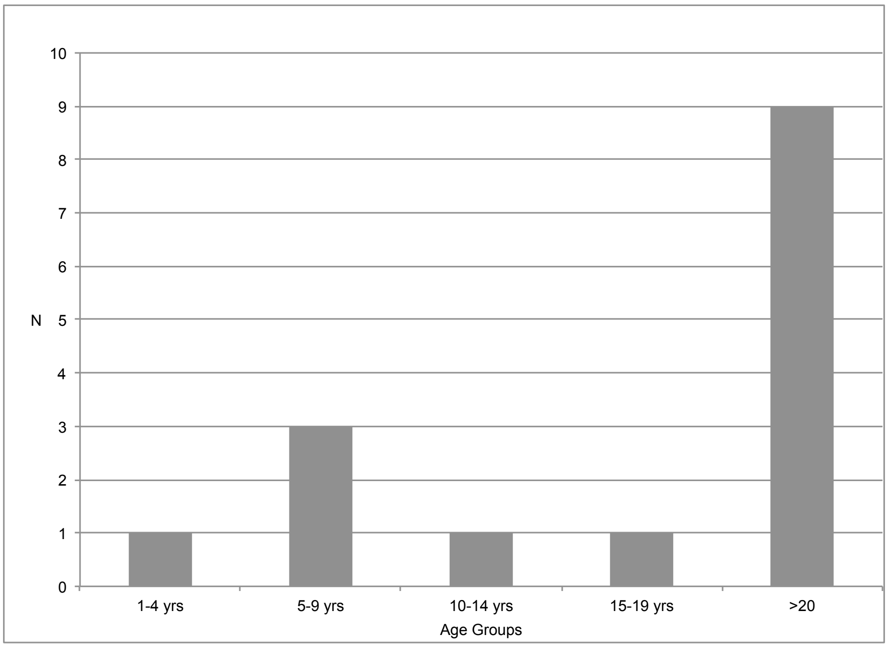


Figure 90 - Age at death profile for Phase 3B. Tomb I (Perdigões).

The main conclusion that may be drawn from the observation of Table 94 is the absence of identifiable bones or parts of bones presenting female characteristics. Morphological analysis does indeed point to the possible deposition, in Phase 3B, of the remains of at least 3 male individuals, that were accounted for through the presence of 3 occipital bones with typically male features.

Table 94 - Sex diagnosis based on bone fragments from Phase 3B. Tomb I (Perdigões).

Morphological Analysis					
Bone	**No.**	**SU**	**Sex**	**Side**	**Scored Structures**
Frag. Occipital	2440	92	♂		Nuchal Crest: 4
Frag. Occipital	4293	93	♂		Nuchal Crest: 5
Frag. Occipital	4294	91	♂		Nuchal Crest: 4
Frag. Temporal	4304	93	♂	Right	Mastoid Process: 4
Metric Analysis					
Bone	**No.**	**SU**	**Sex**	**Side**	**Variable Measurement**
Calcaneus	3594	93	♂	Right	CM1: 77 mm
Calcaneus	886	93	♂	Left	CM1: 84 mm

No metric morphology was performed on bones from Phase 3B. Although bones from Phase 3B were observed for the possible presence of post-cranial non-metric traits, none were identified as can be seen in the following Table 95.

Table 95 – Post-cranial non-metric traits observed for Phase 3B. Tomb I (Perdigões).

		Left	**Right**
1	Allen's Fossa	0/0	0/0
4	Hypotrochanteric Fossa	0/1	0/0
6	Third Trochanter	0/0	0/0
7	Medial Tibial Squatting Facet	0/1	0/1
8	Lateral Tibial Squatting Facet	0/1	0/1
9	Supracondyloid Process	0/3	0/1
10	Septal Aperture	0/1	0/0
14	Acromial articular facet	0/0	0/0
17	Vastus Notch	0/2	0/2
18	Vastus Fossa	0/2	0/2
19	Emarginate Patella	0/2	0/2
21	Medial Talar Facet Present	0/0	0/2
23	Inferior Talar Articular Surface	0/0	0/2
25	Anterior Calcaneal Facet Absent	0/1	0/0

Of a total of 461 (6/56) permanent teeth analysed, 10,7 % presented enamel hypoplasia. They are recorded on Table 96 and seem to show a higher frequency in upper dentition. For lower dentition, only one hypoplasia was identified, on a right canine.

Table 96 - Enamel hypoplasia observed in teeth from Phase 3B. Tomb I (Perdigões).

Tooth	Upper		Lower	
	Left	Right	Left	Right
I1	0/1	0/2	0/0	0/1
I2	0/0	0/1	0/0	0/0
C	1/5 (20%)	0/2	0/0	1/1 (100%)
P1	1/4 (25%)	1/3 (33,3%)	0/0	0/2
P2	1/4 (25%)	0/5	0/0	0/0
M1	0/4	1/6 (16,6%)	0/0	0/1
M2	0/1	0/5	0/0	0/0
M3	0/3	0/7 (11,5%)	0/0	0/1

From the 6 teeth that present enamel hypoplasia, 2 have more than one visible line, as can be seen in Table 97. Regarding deciduous teeth none presented enamel hypoplasia (0/6).

Table 97 - Distribution of number of enamel hypoplasia per tooth for Phase 3B. Tomb I (Perdigões).

No. Hypoplasia	FDI	Quantity	Field No.
1	14	1	482
	16	1	411
	23	1	70
	43	1	1215
2	24	1	71
	25	1	72

Table 98 details the degree of tooth wear analysed for Phase 3B. Maxillary teeth (anterior and posterior) were considerably more abundant and present the same level of attrition: 1,7 (N=52). The remaining 7 teeth show a slightly higher average due to values of wear in anterior mandibular dentition (

Table 99). General tooth wear is medium to low: 1,7 (n=59).

Table 98 - Average tooth wear for Phase 3B. Tomb I (Perdigões).

	Anterior Dentition	Posterior Dentition	Total
Maxillary	1,7 (n=10)	1,7 (n=42)	1,7 (n=52)
Mandibular	3,5 (n=2)	1,2 (n=5)	1.9 (n=7)

Table 99 - Tooth wear per tooth for Phase 3B. Tomb I (Perdigões).

Tooth	Upper	Lower
I1	2,3 (n=3)	4 (n=1)
I2	1 (n=1)	0 (n=0)
C	1,5(n=6)	3 (n=2)
P1	2,1 (n=7)	2 (n=2)
P2	2,2 (n=9)	0 (n=0)
M1	1,7 (n=11)	1 (n=1)
M2	1,6 (n=5)	0 (n=0)
M3	1 (n=10)	1 (n=1)

The average level of wear for deciduous dentition is 2,8 (n=6), higher than for permanent dentition (Table 100).

Table 100 - Tooth wear for deciduous teeth from Phase 3B. Tomb I (Perdigões).

Tooth	Tooth Wear
53	4
55	3
64	1
64	4
65	1
65	4

Two of the permanent teeth (n=57) from phase 3B that presented caries (3,5%) are described in following Table 101 and Figure 91. None of the 6 deciduous teeth had cariogenic lesions (0/6).

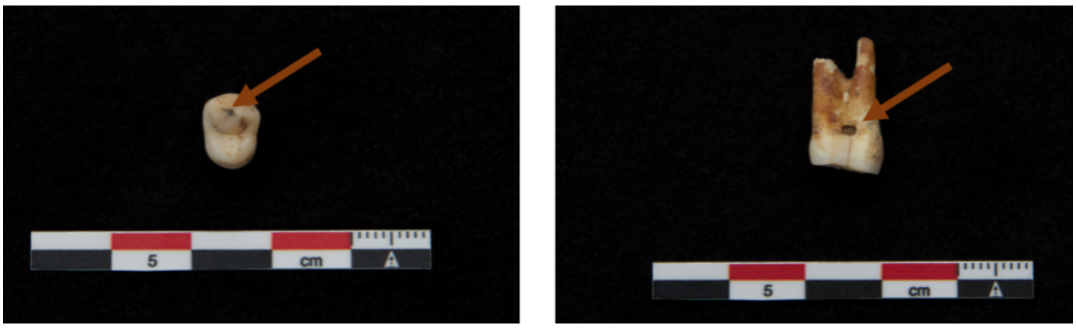


Figure 91 – Left: FDI 14 (SU93) showing a degree 1 cariogenic lesion on the occlusal surface. Right: FDI 24 (SU92) with a cariogenic lesion with origin in the root. Tomb I (Perdigões).

Table 101 - Cariogenic lesions observed in teeth from Phase 3B. Tomb I (Perdigões).

Tooth No.	FDI	S.U.	No. of Caries	Extent Lesion	Anatomical Site
482	14	93	1	1	1
441 b	24	92	1	1	5

Calculus was identified in 12% of the permanent teeth analysed (n=7/58). For superior dentition 11,7% presented calculus deposits (N= 6 /51) and for inferior dentition the percentage of calculus deposits found was of 14,2% (n=1/7). None of the deciduous teeth identified (0/6) showed signs of calculus deposits.

Only 11. 8% of the expected number of 320 alveoli fragments from Phase 3B, were preserved (n=38). From these it was possible to observe the antemortem tooth loss of 3 upper teeth (9,8%) but no register was made for lower teeth where only 7 alveoli were counted (Table 102).

Table 102 - Antemortem tooth loss for Phase 3B. Tomb I (Perdigões).

Maxillary	Mandibular
3/31 alveoli	0/7 alveoli

For osteoarthritic alterations for this phase, most observable areas presented no lesions (Table 103). Only on the proximal extremity of a right and a left ulna was it possible to score a degree 1 alteration. Four distal extremities of right femurs also showed the lowest level of alteration (degree 1).

Other osteoarthritic lesions detected on the bones from this Phase 3B and not presented in the Table are as follows:

Register no. **2538**. SU 93. Body of a cervical vertebra (between vertebra C3-C7) with degree 2 osteoarthritis. The whole of the inferior vertebral rim seems to show slight degenerative alteration but on the left side of the inferior surface of the vertebra, an osteophyte (4 mmx 15 mm) can be observed growing from the surface of the body and not from the rim.

Register no. **4310**. SU 92. Body of a cervical vertebra (between vertebra C3-C7) with degree 2 osteoarthritis. The whole of the inferior vertebral rim seems to show slight degenerative alteration but on the right side of the inferior surface of the vertebra an osteophyte (3 mmx 12 mm) can be observed growing from the surface of the body and not from the rim.

Register no. **2549**. SU 93. Body of a thoracic vertebra. Its size points to the possibility of it probably belonging to the lower thoracic region. A degree 2 osteoarthritic lesion is observable on the inferior left side of the inferior surface of the vertebra where an osteophyte (10 mm x 16 mm) can be observed growing from the rim.

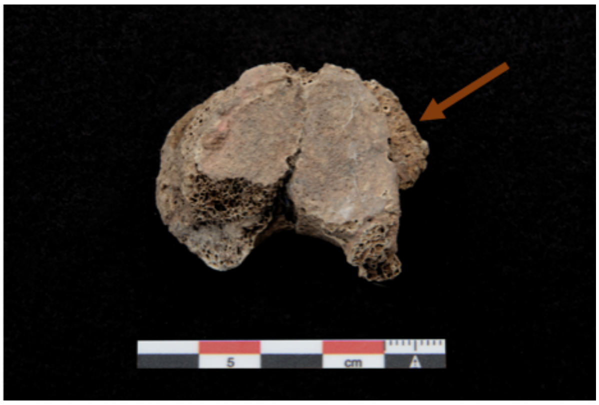



Figure 92 - Body of thoracic vertebra with degree 2 OA lesion from SU93. Tomb I (Perdigões).

Table 103 - Osteoarthritis observed in bones from Phase 3B. Tomb I (Perdigões).

		Degree Left		Degree Right	
		0	1	0	1
Humerus	Proximal	0	0	0	0
	Distal	2	0	1	0
Radius	Proximal	3	0	1	0
	Distal	0	0	2	0
Ulna	Proximal	0	1	0	1
	Distal	0	0	0	0
Femur	Proximal	1	0	3	0
	Distal	0	0	1	4
Tibia	Proximal	2	0	1	0
	Distal	6	0	7	0
Fibula	Proximal	1	0	1	0
	Distal	1	0	1	0

Little information is available regarding enthesal changes for Phase 3B. The existing information is shown on Table 104: degree 1 alterations were identified on the lateral supracondylar ridge of a right and a left humerus and also on the iliac crest of a left and a right ilium. The only two other cases are on the anterior facet of a right patella (degree 1) and on the anterior tuberosity of a left tibia.

Table 104 - Enthesal changes observed in bones from Phase 3B. Tomb I (Perdigões).

		Degree Left		Degree Right	
		0	1	0	1
Scapula	Coracoid Process	2	0	0	0
	Acromion	1	0	0	0
Clavicle	Sternal Extremity	1	0	0	0
	Deltoid Tuberosity	0	0	0	0
Humerus	Medial Epicondyle	3	0	2	0
	Lateral Epicondyle	1	0	2	0
	Trochlea	3	0	2	0
	Lateral Supracondylar Ridge	2	1	1	1
Radius	Bicipital Tuberosity	0	0	0	0
	Radial Styloid Process	0	0	0	0
Ulna	Proximal extremity	1	0	1	0
	Styloid Process	0	0	0	0
Ilium	Iliac Crest	4	1	3	1
	Ischiatic Tuberosity	2	0	3	0
Femur	Greater Trochanter	1	0	0	0
	Lesser Trochanter	1	0	1	0
	Linea Aspera	3	0	3	0
	Digital Fossa	0	0	0	0
Patella	Anterior Surface	0	0	1	1
Tibia	Soleal Fossa	1	0	1	0
	Anterior Tuberosity	1	1	2	0
	Distal	3	0	1	0
	Medial Malleolus	2	0	3	0
Fibula	Biceps Femoris	0	0	0	0
	Lateral Malleolus	1	0	1	0
	Tibiofibular Ligament	0	0	0	0
Calcaneus	Tuberosity	2	0	2	0
	Adductor Hallucis	0	0	0	0

The following figures show, for Phase 3B, a dispersion of commingled bones over and around the areas where fallen slabs covered considerable expanses of the surface (Figure 93). No information is available on sex diagnosis for this phase and there seems to be no choice in the placing of bones according to age group or bone type (Figure 95, Figure 96, Figure 97 and Figure 98). The only exception is apparently related to the deposition of foot and hand bones since none seem to be present on the eastern side of the chamber (Figure 98).

Figure 94, below, illustrates the deposition of mainly pots as part of the funerary procedure. Only a few beads and arrow heads were identified. The decrease in number of artefacts is noticeable as the use of the Tomb progresses.

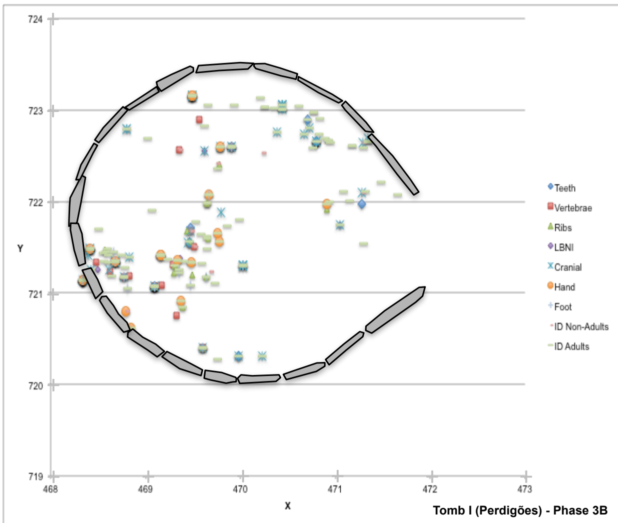


Figure 93 - Human bone distribution for Phase 3B. Tomb I (Perdigões).

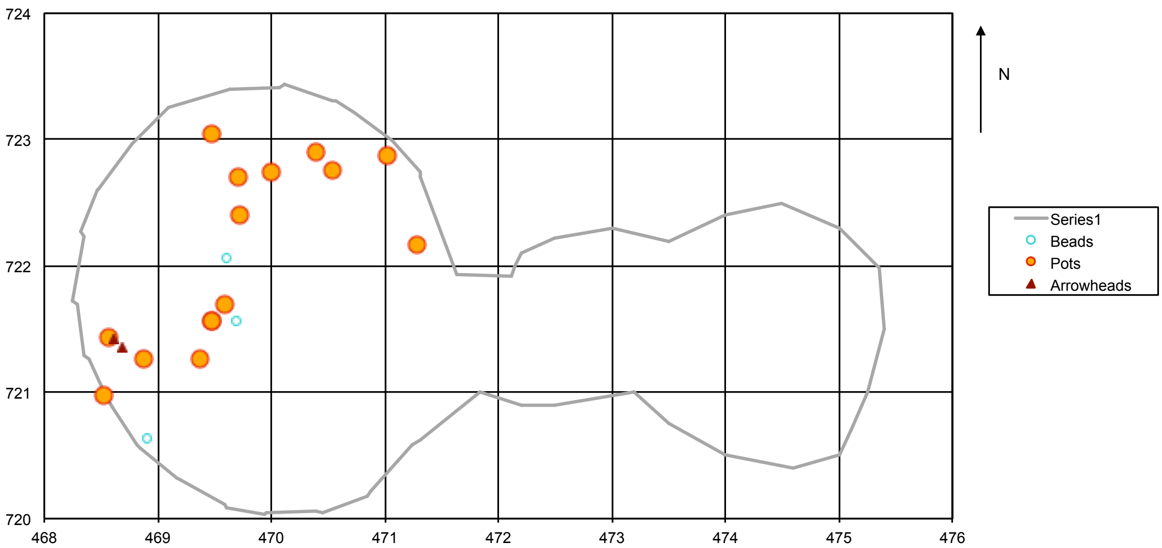


Figure 94 – Distribution of artefact for Phase 3B. Tomb I (Perdigões).

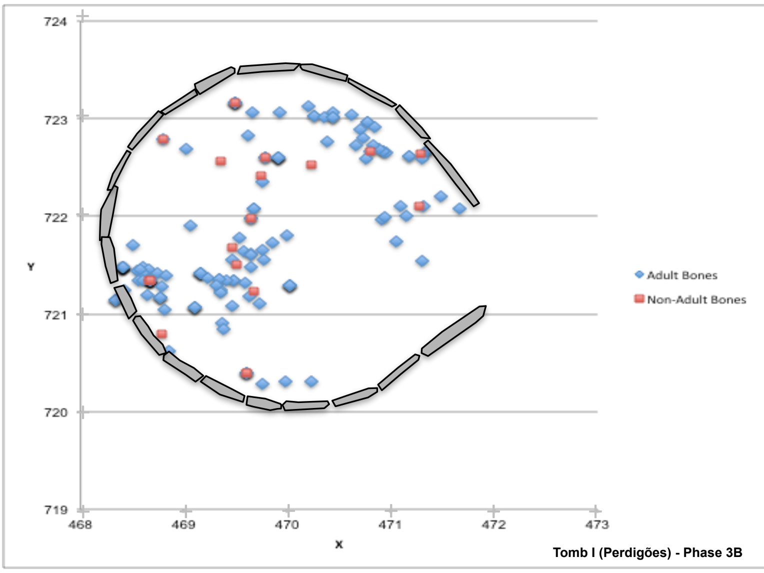


Figure 95 - Adult/non-Adult bone distribution for Phase 3B. Tomb I (Perdigões).

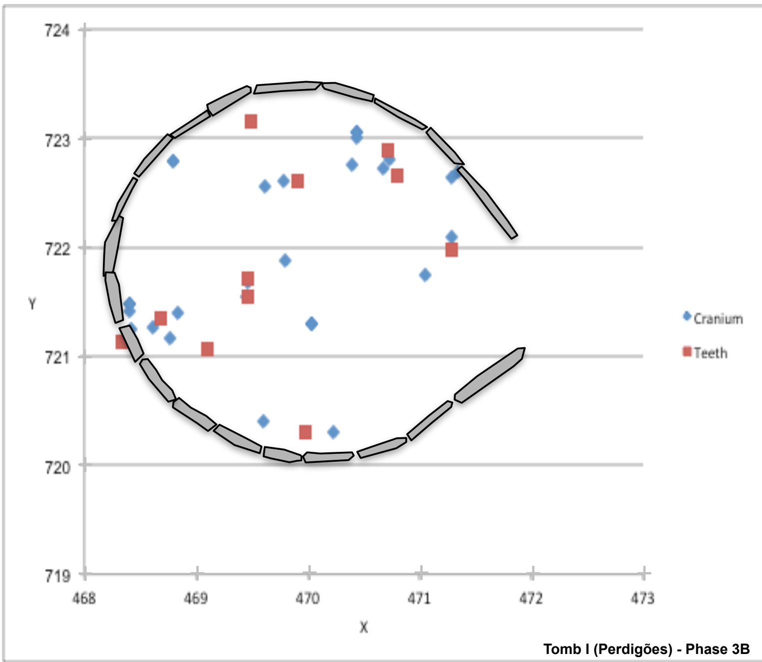


Figure 96 - Cranial fragments and tooth distribution for Phase 3B. Tomb I (Perdigões).

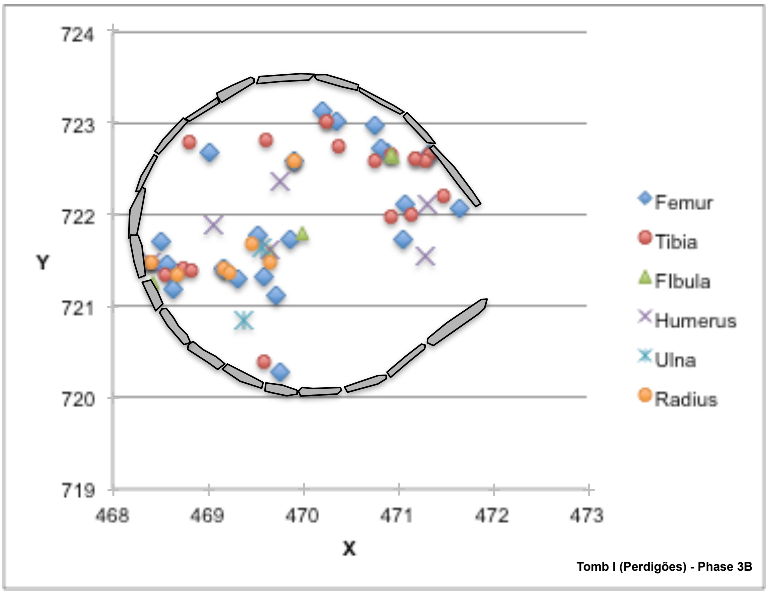


Figure 97 - Long bone distribution for Phase 3B. Tomb I (Perdigões).

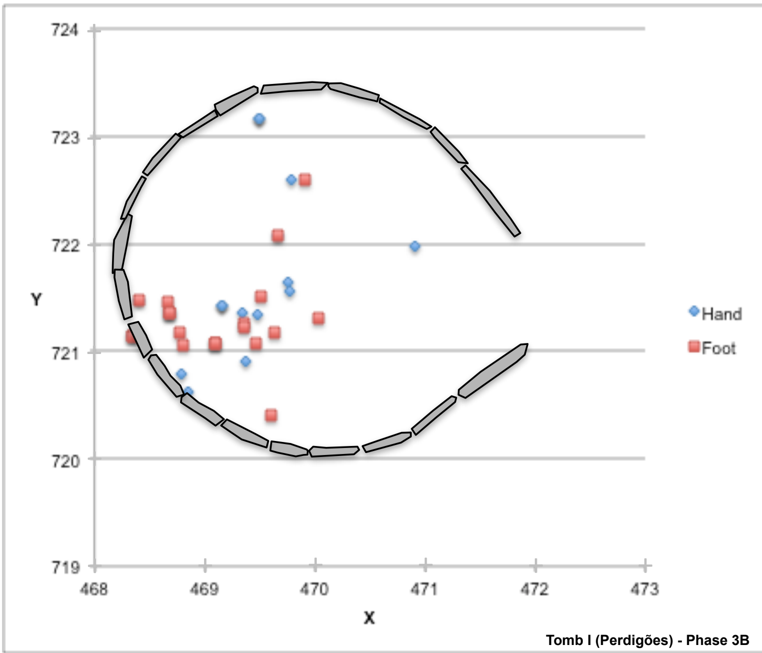


Figure 98 - Hand and foot bone distribution for Phase 3B. Tomb I (Perdigões).

5.1.3.3 Phase 3C

Phase 3C corresponds to a succession of occurrences that intersperse funerary use and moments of ruin of the structure of the chamber. This final moment corresponds to SU 38 (Figure 118) and is interpreted as a final moment of disarray, the causes of which are not fully understood. Indeed, after intense soil overturning of different origins, the tomb would have been ruined and almost surely without funerary use.

Throughout this sub-phase moments of collapse were interspaced with deposition of human remains and votive objects (SU 63 and SU 84) and it is evident that the tomb was still in use even when the wall lining practically no longer existed. No data/information is available concerning the collapse of the roof/covering.

SU 84 is a longitudinal deposit of comingled human bones, extending southwest from the right of the chamber entrance occupying most of the free space between fallen slabs of several sizes (Figure 99). SU 63, where a considerable number of human remains were also identified, corresponds to the deposits that occupy the southern and western (near the head) limit of the chamber, close to the ruined walls.

Figure 99 - Overview of SU 84. Phase 3C. Tomb I (Perdigões).

Together with Phase 2D this phase is one of the largest in Tomb I. Of the 8310 bone fragments observed for Phase 3C (Table 105), 1559 (18,8%) were classified as non-identifiable fragments, which reveals the degree of fragmentation and poor preservation of these bones. In addition, 1427 (17,2%) were only identifiable as part of long bones. A total of 2967 (35,7%) fragments belonged to the 544 individualized registers of adult bones and 561 fragments (6,8%) were classified as non-adult remains. General cranial count consists of 1238 fragments (14,9%) followed by vertebrae (283 fragments) and ribs (275 fragments).

Table 105 - Bone count for Phase 3C. Tomb I (Perdigões).

Type		No. Fragments	No. Registers
Identified bones			
	Adults	2967	544
	Non-Adults	561	113
Others (Adults)	Cranium	1238	132
	Rib	275	71
	Vertebrae	283	102
Long Bones N.I.		1427	87
N.I. Bones		1559	79
TOTAL		**8310**	**1128**

Of the 146 teeth recovered from Phase 3C (Table 106), an unerupted supernumerary tooth from SU 84 must be highlighted. For the remainder, 9 were deciduous teeth and 28 teeth were described as being still in formation. The remaining 108 teeth were completely formed.

Table 106 - Tooth count for Phase 3C. Tomb I (Perdigões)

Type		Number
Permanent		
	Formation Complete	108
	Formation Incomplete	28
	Supernumerary	1
Deciduous		9
TOTAL		**146**

FDI 27 was the base for the estimation of a minimum number of adult individuals of 8, as explained in Table 108. Bone analysis for this parameter, available in Table 107, provided a minimal number of 7 adult individuals through the identification of that number of left ulnas.

The number of non-adult individuals was totally determined based on loose tooth count (Table 111) and provided an estimation of a minimum of 9 individuals. In the case of Phase 3C, the proportion of non-adult individuals is superior to that of adults and makes up 53% of the total sample analysed.

Table 107 - MNI for Phase 3C based on bone observation. Tomb I (Perdigões).

Long Bone	MinNi	MaxNI
Left Ulna	7	9
Right Ulna	6	10
Left Fibula	6	9
Right Radius	5	11
Right Femur	5	11
Left Tibia	5	8
Right Humerus	4	8
Left Femur	4	6
Right Tibia	4	5
Right Fibula	3	3
Left Humerus	2	4
Left Radius	2	2

As can be seen in Figure 100, the surviving complete adult bones are similar to those found in previous phases. The percentage of complete bones, 12, 1% (66 of 544 complete bones) is slightly higher which can possibly be explained by the better preservation of the more superficial contexts inside Tomb I.

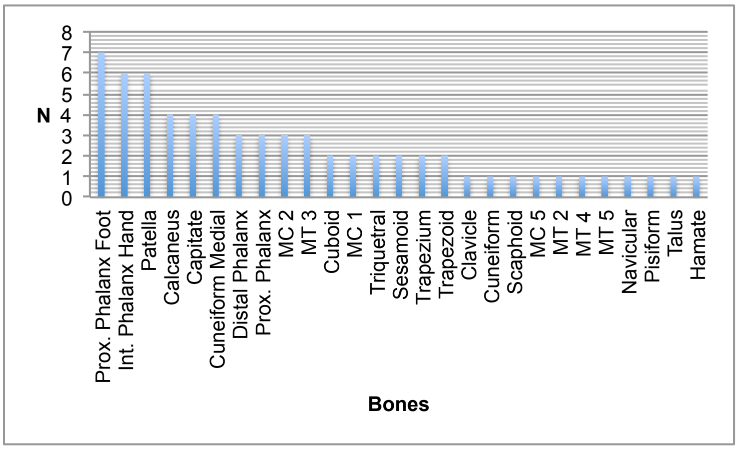


Figure 100 – Complete adult bones from Phase 3C. Tomb I (Perdigões).

Another complete femur from a non-adult was recovered in this phase alongside the usual small hand and foot bones (Figure 101). The total number of complete bones represents 8,8% of the total non-adult individualized registers (n=113).

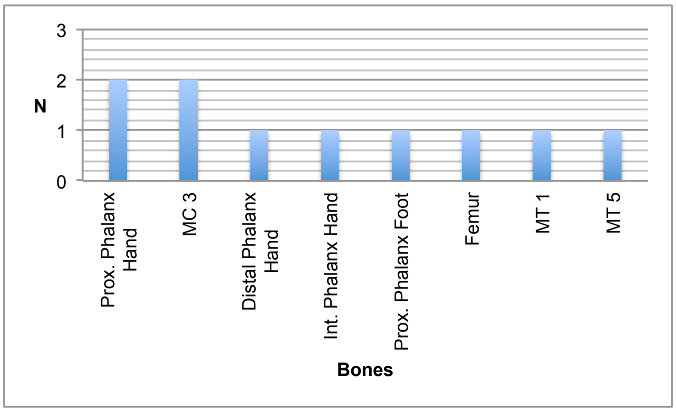


Figure 101 – Complete non-adult bones from Phase 3C. Tomb I (Perdigões).

Right ulna and temporal bone, with 7 entries each, are the best-represented skeletal parts for Phase 3C with an 87,5% representativeness (Table 108). The other long bones are also very well represented in similar percentages, all above 50%. For the rest of the skeletal parts, the absence of ilia should be highlighted as should be the presence of hand and foot bones including, for example, small bones such as right triquetral and a right scaphoid, although in low percentages (12,5% of representativeness).

Table 108 - Bone representativeness Phase 3C. Tomb I (Perdigões).

Bone	Obs. No.	Representativeness (%)
FDI 27	8	100
Left Ulna (Prox. Extremity)	7	87,5
Right Temporal (*Pars Petrosa*)	7	87,5
Left Fibula (Distal Diaphysis)	6	75,0
Right Radius (Prox. 1/3)	5	62,5
Right Femur (Prox. Extremity)	5	62,5
Left Tibia (Prox. 1/3)	5	62,5
Left Ischium	5	62,5
Right Humerus (Distal 1/3)	4	50,0
Left Calcaneus	4	50,0
Right MT 3	4	50,0
Left Mandible	4	50,0
Right Patella	4	50,0
Right Capitate	3	37,5
Right Medial Cuneiform	3	37,5
Left Glenoid Cavity	3	37,5
Right MC 2	3	37,5
Right MC 3	3	37,5
Right Clavicle	2	25,0
Right Cuboid	2	25,0
Right MT 4	2	25,0
Left Navicular	2	25,0
Right MC 5	2	25,0
Left Lunate	2	25,0
Right Scaphoid	1	12,5
Left MT 1	1	12,5
Left MT 2	1	12,5
Left Prox. Foot Phalanx 1	1	12,5
Left Distal Foot Phalanx 1	1	12,5
Left Lat. Cuneiform	1	12,5
Left MT 5	1	12,5
Left Talus	1	12,5
Left MC 1	1	12,5
Right Triquetral	1	12,5
Left Trapezium	1	12,5
Right Trapezoid	1	12,5
Left Hamate	1	12,5

The percentages for single-rooted and double/multi-rooted teeth on Table 109 show that for upper teeth the values obtained for single-rooted teeth are very close to expected although values for the double/multi-rooted teeth ones are 22,8% above the established percentage, which obviously disrupts all the remaining results: for lower teeth, results are obviously below expectations and the difference is particularly obvious for single-rooted teeth, where the 14% obtained is far from the expected 31,2%.

Table 109 - Percentages for single-rooted, double/multi-rooted teeth Phase 3C. Tomb I (Perdigões).

	In situ	**Loose**	**Total**	**% Obtained**	**% Expected**
Upper SRT	4	32	36	26,5	25
Upper DMRT	22	43	65	47,8	25
Lower SRT	0	19	19	14	31,2
Lower DMRT	1	15	16	12	18

Legend: SRT (Single-Rooted Teeth); DMRT (Double/Multi-Rooted Teeth)

Table 110 explores the proportion between upper and lower teeth and once again, the ratio between the obtained and expected numbers is evident and below what would be predictable.

Table 110 - Proportion of upper and lower teeth for Phase 3C. Tomb I (Perdigões).

	SRT	**DMRT**	**Obtained**	**Expected**
Upper	36	65	0,55	1
Lower	19	16	1,18	1,7

Legend: SRT (Single-Rooted Teeth); DMRT (Double/Multi-Rooted Teeth)

Analysis of age groups present in Phase 3C, shown in Table 111 and on Figure 102, once again reveals that no individuals below one year of age were identified. The most abundant age group is 5-9 with remains of at least 4 individuals, followed by the 10-14 age group, with 3. The age group between 1-4 is represented by the remains of 2 individuals. As for the group between 15-19, it must be underlined that the lack of remains attributed to that age group does not imply the absence of individuals of those ages: it was simply not possible to attribute them directly to that age group and indeed some may be contained in the following group of older than 20. Indeed, for adult individuals we could only assess age for one individual from SU 63, whose death must have occurred sometime around the twentieth year of age. This conclusion is based on the analysis of an FDI 38.

Table 111 - Age at death estimation for non-adult individuals from Phase 3C. Tomb I (Perdigões).

Age at death	Number	Tooth/Bone
4,5	2	FDI 21
5,5	1	FDI 13
6,5	1	FDI 14
7,5	1	FDI 26
7±2	1	Maxilla
9,5	1	FDI 33
10/11	1	FDI 34
11,5	1	FDI 16

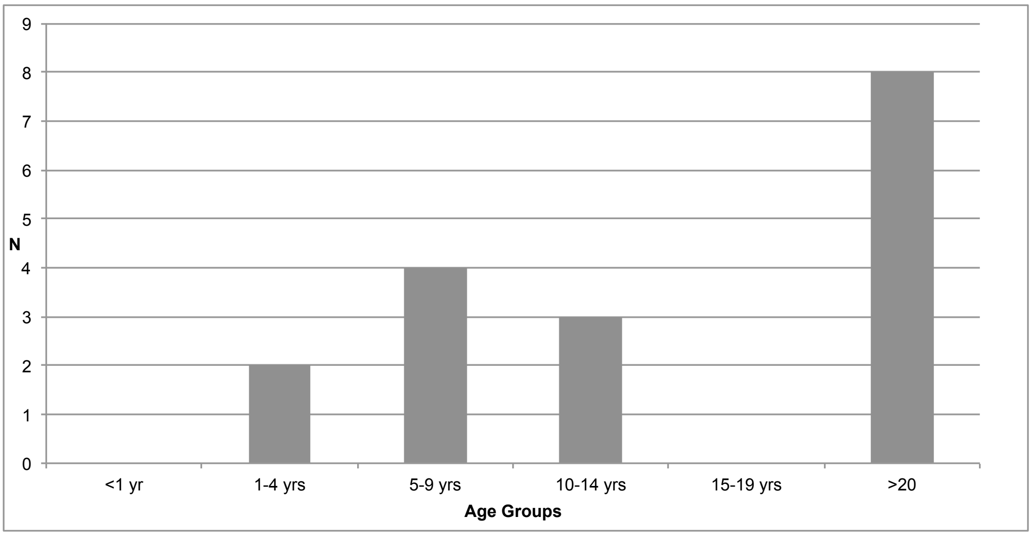


Figure 102 - Age groups profiles from Phase 3C. Tomb I (Perdigões).

For Phase 3C, four right ilium fragments were scored with male characteristics, as can be observed in Table 112. Other bone fragments presented male features but could potentially belong to the latter. The number of bone fragments with female characteristics is considerably lower. Only the possible deposition of the remains of one female individual could be considered, as 1 talus provided a metric measurement that is below the established sectioning point of 52,50 mm.

Table 112 - Sexual diagnosis based on bone fragments from Phase 3C. Tomb I (Perdigões)

Morphological Analysis					
Bone	**No.**	**SU**	**Sex**	**Side**	**Scored Structures**
Frag. Ilium	2043	84	♀?	NO	PS: 3
Frag. Ilium	4456	63	♂	Right	GSN: 2; PS:0
Frag. Ilium	4457	84	♂	Right	GSN: 2; PS:0
Frag. Ilium	4458	84	♂	Right	GSN: 1; PS:0
Frag. Ilium	4459	63	♂	Left	GSN: 2; PS:0
Frag. Ilium	4460	84	♂	Right	GSN: 1; PS:0
Frag. Temporal	2179	63	♂?	Right	Mastoid Process: 4
Frag. Temporal	1051	84	♂?	Right	Mastoid Process: 4
Frag. Temporal	2053	84	♂?	Left	Mastoid Process: 4
Metric Analysis					
Bone	**No.**	**SU**	**Sex**	**Side**	**Variable Measurement**
Frag. Distal Humerus	2373	63	♂	Right	HEB: 59 mm
Calcaneus	2037	63	♂	Left	CM1: 82 mm
Calcaneus	3600	84	♂	Left	CM1: 76 mm
Talus	2628	63	♀	Right	TM1: 48,5 mm

Morphological metric analysis was performed through the measuring of a right MT2 from SU 63 (no. **875**), for estimation of stature. The measuring yielded the following result: 1719,31mm±47,5.

The information contained on Table 113, regarding the register of post-cranial non-metric traits reveals that the observable bones yielded no results for this parameter.

Table 113 – Post-cranial non-metric traits observed in bones from Phase 3C. Tomb I (Perdigões).

		Left	Right
1	Allen's Fossa	0/0	0/2
4	Hypotrochanteric Fossa	0/0	0/0
6	Third Trochanter	0/1	0/2
7	Medial Tibial Squatting	0/0	0/0
8	Lateral Tibial Squatting	0/0	0/0
9	Supracondyloid Process	0/1	0/2
10	Septal Aperture	0/2	0/1
14	Acromial articular facet	0/0	0/2
17	Vastus Notch	0/2	0/2
18	Vastus Fossa	0/2	0/2
19	Emarginate Patella	0/2	0/2
21	Medial Talar Facet	0/1	0/1
23	Inferior Talar Articular	0/1	0/1
25	Anterior Calcaneal Facet	0/4	0/1

Of a total of 111 permanent teeth analysed, 5,4 % (6/111) presented enamel hypoplasia. Recorded on Table 114, they are overall scarce, showing a higher frequency the anterior dentition, namely on FDI 11 and FDI 21.

Table 114 - Enamel hypoplasia observed in teeth from Phase 3C. Tomb I (Perdigões).

Tooth	Upper		Lower	
	Left	Right	Left	Right
I1	2/5 (40%)	0/1	0/3	0/0
I2	1/3 (33,3%)	0/3	0/2	0/0
C	0/6	0/4	0/5	0/2
P1	0/8	1/7 (14,2%)	0/2	0/2
P2	0/1	0/7	0/2	1/2 (50%)
M1	0/12	1/7 (14,2%)	0/4	0/1
M2	0/4	0/4	0/4	0/1
M3	0/4	0/5	0/2	0/0

From the 6 teeth that presented enamel hypoplasia, 2 had more than one visible line as expressed in Table 115. Regarding deciduous dentition, none presented this condition (0/7).

Table 115 - Distribution of number of hypoplasia in teeth from Phase 3C. Tomb I (Perdigões).

No. Hypoplasia	FDI	Number	Field No .
1	16	1	1365
	21	1	1162
	22	1	1373
	45	1	1094
2	14	1	1093
	21	1	454

General tooth wear for Phase 3C is similar to previous phases. It shows an overall medium-low value of 1,6 after the 124 teeth were analysed, as can be seen in Table 116. The lower first incisors (FDI 31 and 41), are seen to present higher levels of attrition (3.3) followed by posterior dentition namely lower first molars, (FDI 36 and 46) with an average of 2.6 (Table 117). The remainder of the teeth analysed show levels of attrition below 2.

Table 116 - Average tooth wear for Phase 3C. Tomb I (Perdigões).

	Anterior Dentition	Posterior Dentition	Total
Maxillary	1,5 (n=25)	1,6 (n=67)	1,6 (n=92)
Mandibular	2 (n=9)	1,5 (n=23)	1,7 (n=32)

Table 117 - Tooth wear per tooth for Phase 3C. Tomb I (Perdigões).

Tooth	Upper	Lower
I1	1,7 (n=7)	3,3 (n=3)
I2	1,1 (n=7)	2 (n=2)
C	1,5 (n=11)	1,3 (n=6)
P1	1,3 (n=16)	0,5 (n=4)
P2	1,3 (n=11)	1,3 (n=5)
M1	1,8 (n=19)	2,7 (n=6)
M2	2,5 (n=10)	1 (n=5)
M3	1,2 (n=10)	1,5 (n=2)

Tooth wear was once again measured for deciduous teeth and revealed an average of 2,8 (n=6), again generally higher than in permanent teeth even if we consider their low count (Table 118).

Table 118 - Tooth wear for deciduous teeth from Phase 3C. Tomb I (Perdigões).

Tooth	Wear
54	1
55	3
55	1
62	1
64	3
65	1
65	1
75	4
84	1

Cariogenic lesions were present in 1 (n=115) of the permanent teeth analysed (0,9%). This is the case of an FDI 18 (no.**207b**), from SU63 with a level 1 interproximal lesion on the medial surface (Figure 103). None of the observed deciduous teeth (0/7) showed any sign of cariogenic lesion.

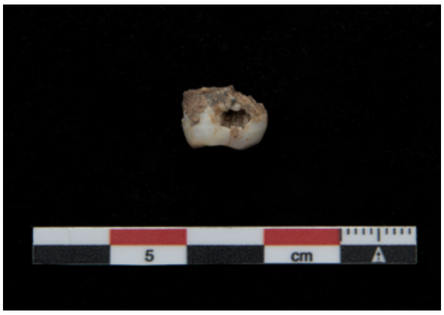


Figure 103 - FDI 18 showing an interproximal cariogenic lesion on the medial surface from SU63. Tomb I (Perdigões).

Calculus was identified in 8,8% of the permanent teeth analysed (n=10/113). For superior dentition 8,3% presented calculus deposits (n= 7/84) and for inferior dentition the percentage of calculus deposits found was of 10,3% (n=3/29). None of the deciduous teeth identified showed signs of calculus deposits.

Four cases of antemortem tooth loss were identified in Phase 3C (Table 119). One is a maxillary case observed amongst the 35 countable superior alveoli (2,8% of the total) another 3 (17,6% of the total 17 observable alveoli) were identified in mandibular teeth. When considered together, only 20,3% (n=52) of the expected 256 alveoli was present in this phase.

Table 119 - Antemortem tooth loss for Phase 3C. Tomb I (Perdigões).

Maxillary	**Mandibular**
1/35 alveoli	3/17alveoli

The great majority of the bones observed for osteoarthritis showed no alterations. The exceptions, shown on Table 120, are two degree 1 lesions on the proximal extremity of a right humerus and on the distal extremity of a left femur. Apart from these cases, one more is described below:

Register no**. 2180**. SU 63. A fragment of a cervical vertebra (from vertebra C3-C7) body. The spinous process is not present. On the right superior articular facet, a degree 2 osteoarthritis lesion was observed.

Table 120 - Osteoarthritis observed in bones from Phase 3C. Tomb I (Perdigões).

		Degree Left		**Degree Right**	
		0	1	0	1
Humerus	Proximal	1	0	0	1
	Distal	1	0	0	0
Radius	Proximal	0	0	4	0
	Distal	2	0	2	0
Ulna	Proximal	2	0	2	0
	Distal	1	0	1	0
Femur	Proximal	1	0	2	0
	Distal	0	1	3	0
Tibia	Proximal	1	0	0	0
	Distal	1	0	0	0
Fibula	Proximal	1	0	1	0
	Distal	3	0	0	0

Enthesal changes observed in bones from Phase 3C are summarized in Table 121. The most severe alteration (degree 2) was found on the *linea aspera* of a right femur. Two other degree 1 alterations were identified on a lesser trochanter of a right femur and on the digital fossa of a left one. For lower limbs, degree 1 lesions were also found on the anterior surface of a right patella and on the tuberosity of a left calcaneus. For upper limbs, only one left humerus yielded a degree 1 alteration on the lateral supracondylar ridge. Apart from these occurrences, only a degree 1 alteration was described on the deltoid tuberosity of a right clavicle. A further two cases, not presented in the Table below, are described here:

Register no. **2365**. SU 63**.** A right first metacarpal was identified with a degree 2 alteration on the lateral side of the head, in the insertion area for the *abductor pollicis brevis* muscle insertion (Figure 104).

Figure 104 - Right MC1 from SU63 showing signs of degree 2 OA alteration on the lateral side of the head. Tomb I (Perdigões).

Register no. **2067.** SU 63. A right first proximal hand phalanx presents a degree 2 enthesal change observable on the lateral side of the proximal (basal) articular facet for the first metacarpal head, where the *flexor pollicis brevis* muscle inserts (Figure 105).

Figure 105 – Right proximal first-hand phalange with degree 2 OA alteration on the lateral side the base. SU63. Tomb I (Perdigões).

Table 121 - Enthesal changes observed in bones from Phase 3C. Tomb I (Perdigões).

		Degree Left			**Degree Right**		
		0	1	2	0	1	2
Scapula	Coracoid Process	1	0	0	0	0	0
	Acromion	0	0	0	2	0	0
Clavicle	Sternal Extremity	1	0	0	2	0	0
	Deltoid Tuberosity	1	0	0	3	1	0
Humerus	Medial Epicondyle	1	0	0	2	0	0
	Lateral Epicondyle	1	0	0	1	0	0
	Trochlea	2	0	0	2	0	0
	Lateral Supracondylar Ridge	0	1	0	1	0	0
Radius	Bicipital Tuberosity	0	0	0	4	0	0
	Radial Styloid Process	1	0	0	2	0	0
Ulna	Proximal Extremity	2	0	0	2	0	0
	Styloid Process	1	0	0	1	0	0
Ilium	Iliac Crest	3	0	0	4	0	0
	Ischiatic Tuberosity	5	0	0	4	0	0
Femur	Greater Trochanter	1	0	0	0	0	0
	Lesser Trochanter	1	0	0	1	1	0
	Linea Aspera	2	0	0	1	0	1
	Digital Fossa	0	1	0	3	0	0
Patella	Anterior Surface	2	0	0	2	1	0
Tibia	Soleal Fossa	0	0	0	0	0	0
	Anterior Tuberosity	0	0	0	0	0	0
	Distal	1	0	0	0	0	0
	Medial Malleolus	1	0	0	0	0	0
Fibula	Biceps Femoris	0	0	0	0	0	0
	Lateral Malleolus	3	0	0	1	0	0
	Tibiofibular Ligament	2	0	0	1	0	0
Calcaneus	Tuberosity	3	1	0	2	0	0
	Adductor Hallucis	1	0	0	0	0	0

Other Pathologies > Infectious Pathology

Register no. **2081**. SU 84. A fragment of frontalis fragmented into 43 pieces. The three most intact elements fragments (Figure 106) belong to the posterior horizontal area of the bone, beginning on the posterior end of the sagittal sulcus, towards the coronal suture that is not identifiable in any of the surviving fragments. The ectocranial surface shows signs of an active infectious process manifested through the presence of micro and medium porosity. There is also a possible thickening of the diploe although it must be taken into account that there are studies that point to a statistically significant difference in diploeic thickness between males and females, in the frontal region only (Lynnerup et al., 2005).

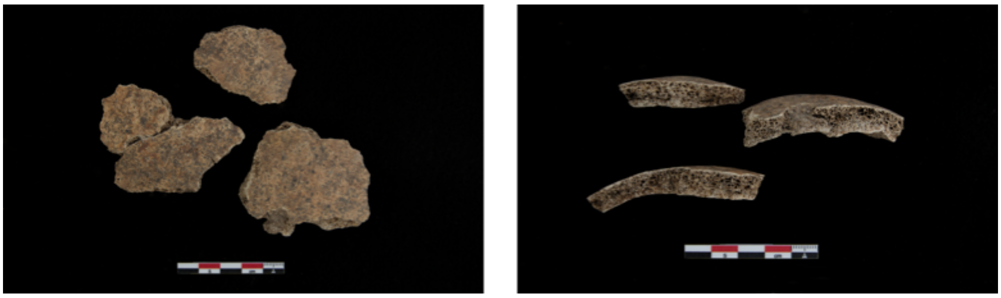


Figure 106 - Fragments of parietal bone with signs of active infection. Left: aspect of ectocranial surface. Right: aspect of the diploe, with possible thickening.

Register no. **2115**. SU 63. This is a fragment of a right non-adult humerus diaphysis, preserved in 69 mm of its extension. It is part of the distal end of the diaphysis below the nutrient foramen. On the posterior area, there are signs of active infection, with alteration of the periosteal surface showing mild porosity (Figure 107).

Figure 107 - Fragment of a non-adult right humerus with signs of active infection on the diaphysis. SU63. Tomb I (Perdigões).

> Congenital/Degenerative Pathologies

Register no. **2180.** SU63**.** Fragment of a cervical vertebrae (C3-C7). The whole body is present as are the superior and inferior articular facets. The posterior part of the vertebra is absent (right and left laminas and the spinous process) as are the intertubercular laminas, on both sides (Figure 108). This vertebral element is generically asymmetrical as is macroscopically perceptible if both pedicles are compared. Indeed, the right pedicle is thicker (7,5mm) when compared to the left one (6mm).

On the right superior articular facet it is possible to observe a small circular shallow depression that seems to have worn out the facet's surface down to the trabecular bone that is visible on the bottom. The walls of this small depression are regular. Due to fragmentation of the bone and the collection, this vertebra represents an isolated fragment and it is not possible to compare it with any other spinal elements with which it would be in contact.

Facet joints are synovial joints between the vertebrae of the spine. There are two facet joints (left and right) in each spinal motion segment. Biomechanically, the function of each pair of facet joints is to guide and limit movement of that spinal motion segment. Facet joints are lined with cartilage which not only helps ensure smooth movement between bones but also serves as shock absorbers for the daily weight and pressure that is naturally put on the spine. Facet syndrome (also commonly known as facet joint disease, facet osteoarthritis, facet hypertrophy or facet arthritis) is a syndrome in which the facet joints (synovial diarthroses, from C2 to S1) degenerate to the point of causing painful symptoms (Kalichman et al., 2008;Suri et al. 2012). In the case of cartilage degeneration conjoined vertebrae can begin to rub together, which can cause inflammation, swelling and other painful symptoms. Additionally, if the bones rub together for long enough, the body will naturally begin to address the instability within the spine by creating bone spurs, thickened ligaments or even cysts. The natural asymmetry of this vertebral element could have been responsible for an instability in this area, creating the conditions to an earlier degeneration of this facet. A congenital condition could have resulted in a degenerative one. The small depression described could then possibly form with the presence of a synovial cyst on the facet joint of this vertebra probably caused by biomechanical impact on the joint, which eventually could have led to the formation of the cyst. In modern medicine, synovial cysts in the spine are relatively rare and cervical cysts are particularly rare. Diagnoses of synovial cysts have increased with increased use of magnetic resonance imaging (Machino et al. 2012). According to the same authors, although these cysts occur over a wide age range (8–86 years), they are more commonly encountered in older persons (mean age 67.3 years).

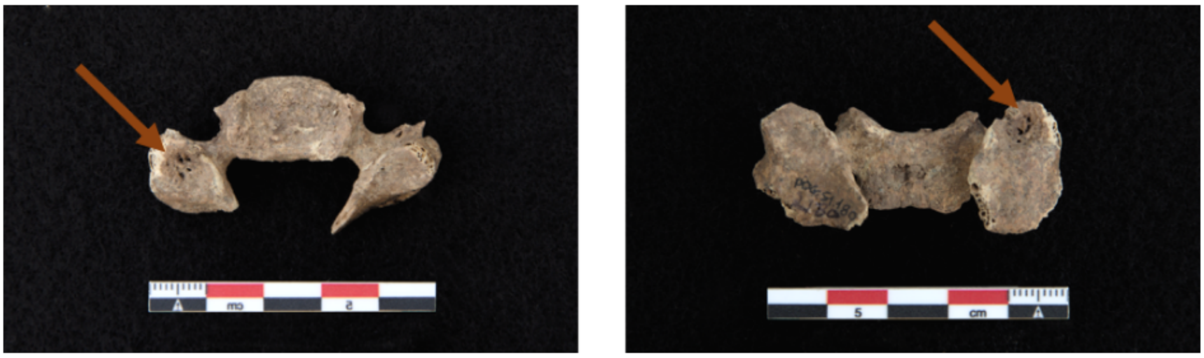


Figure 108 - Cervical vertebra (C3-C7). Left: Superior view. Posterior is down. Right: Posterior view.

> Traumatic Pathologies

Register **4312**. SU 63 is an 85mm adult right fibula fragment from the middle of the diaphysis. It has its natural shape altered by a bone callus probably as a result of the total remodeling of the tissues after an oblique fracture (Figure 109).

Figure 109 - Right adult fibula from SU63 displaying remodeled fracture. Tomb I (Perdigões).

> Metabolic Pathology

Register no. **2021**. SU 84. Six fragments of a frontal bone were glued together (Figure 110). The vertical frontal squama is absent and only the horizontal portion of the frontal bone is present, which does not reach the coronal suture in any of the extension present. The posterior end of the frontal crest is visible on the endocranial plate and new formation of bone tissue is visible protruding in patches on the internal surface of the cranial bones to both sides of this crest. This alteration is compatible with *Hyperostosis frontalis interna* (HFI) or Morgagni's syndrome, which corresponds to a thickening of the internal surface of the frontal bone may be related to endocrine disorders and is more common in females (Aufderheide and Rodríguez-Martín, 1998).

This condition has been reported in high frequency among post-menopausal elderly women (She and *Szakacs, 2004)*. According to these authors HFI should be recognized as a benign entity and distinguished from other disorders that involve the frontal skull bone, such as Paget's disease, acromegaly, and malignancy. The etiology of HFI is unknown, but current hypotheses implicate hormonal stimulation.

Figure 110 - Fragment of frontal bone with thickening of the endocranial surface. SU84. Tomb I (Perdigões).

As mentioned at the beginning of this chapter, SU 84 extends southwest from the right of the chamber entrance occupying most of the free space between fallen slabs of several sizes. SU 63, occupies the southern and western (near the head) limit of the chamber, close to the ruined walls.

A close look at the distribution of bones and artefacts for this phase shown in the following figures, reveals that most of the human remains are registered around these segments (Figure 111 and Figure 112) alongside pots and a small number of lithic artefacts. No beads are registered for this phase.

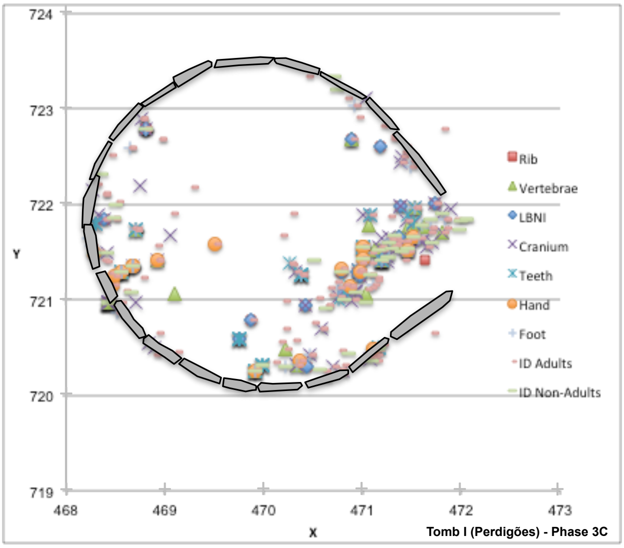


Figure 111 - Human bone distribution for Phase 3C. Tomb I (Perdigões).

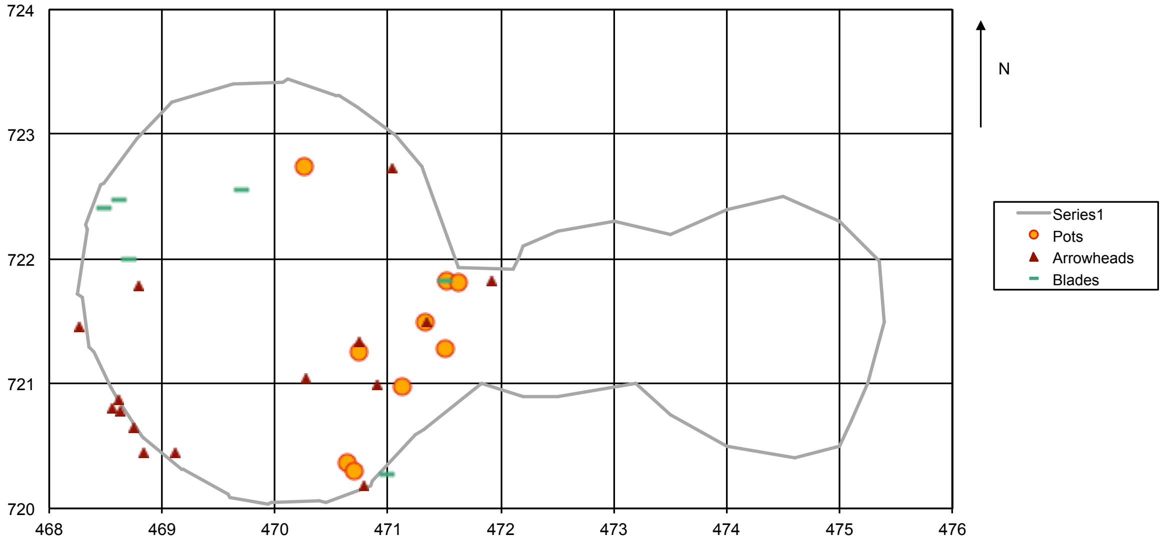


Figure 112 – Distribution of artefact for Phase 3C. Tomb I (Perdigões).

As already registered for the previous phases, the comingled nature of the depositions continues throughout Phase 3C as adult and non-adult remains are found together and mixed with no obvious pattern of discrimination, at least based on age (Figure 113).

The observation of any sort of distribution based on sex is rendered difficult by the scarcity of the data. Only two bones with female characteristics could be positioned within the tomb, based on coordinates. They are found on opposite sides of the chamber, close to the northern and southern wall and set quite apart from the few male bones that seem to mostly occupy the south side of the chamber (Figure 114).

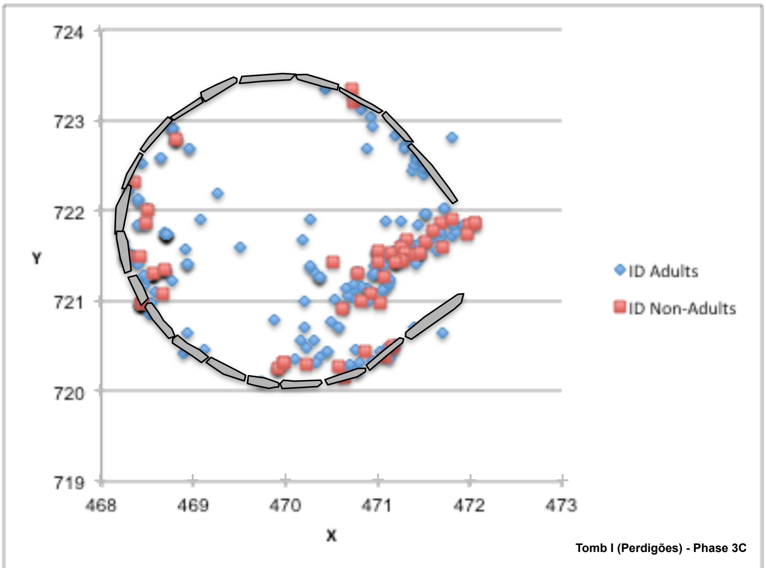


Figure 113 - Adult/non-adult bone distribution for Phase 3C. Tomb I (Perdigões).

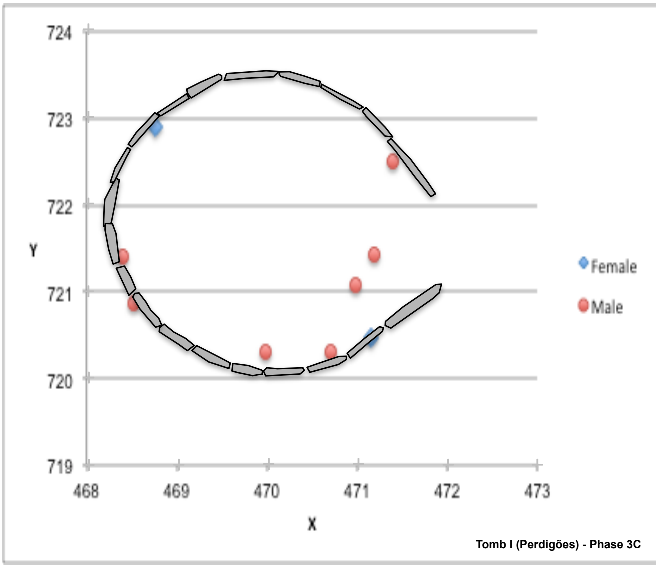


Figure 114 - Male/ female bone distribution for Phase 3C. Tomb I (Perdigões).

Cranial fragments are present in both SU 63 and 84, as can be seen in Figure 115. Long bone distribution shows a predominance of femurs in SU 84 and a concentration of humerus close to the western extremity of the chamber. Spatial positioning of tibia yielded very little information for this specific analysis (Figure 116). A higher number of foot bones was available for this analysis and they can be found together with hand bones in the main deposits of Phase 3C (Figure 117).

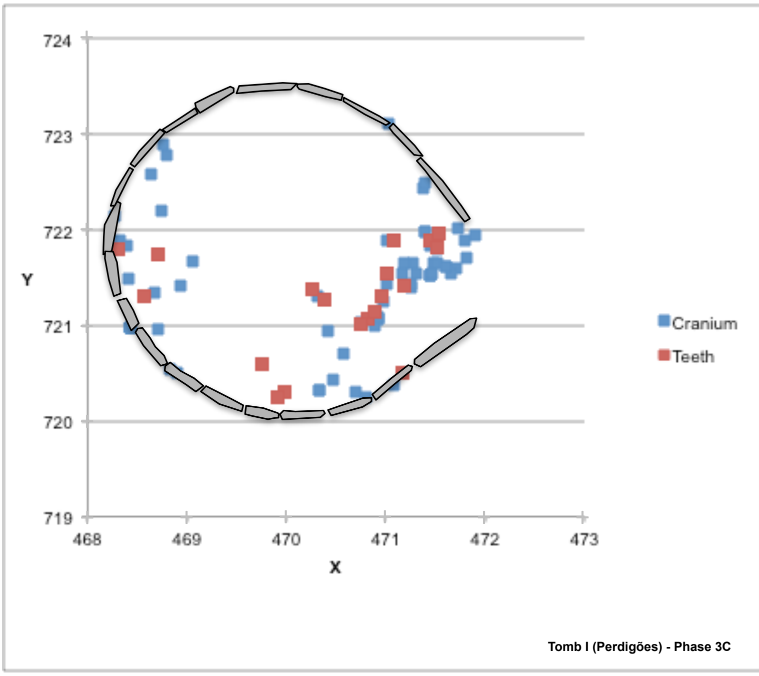


Figure 115 - Cranial fragments and tooth distribution for Phase 3C. Tomb I (Perdigões).

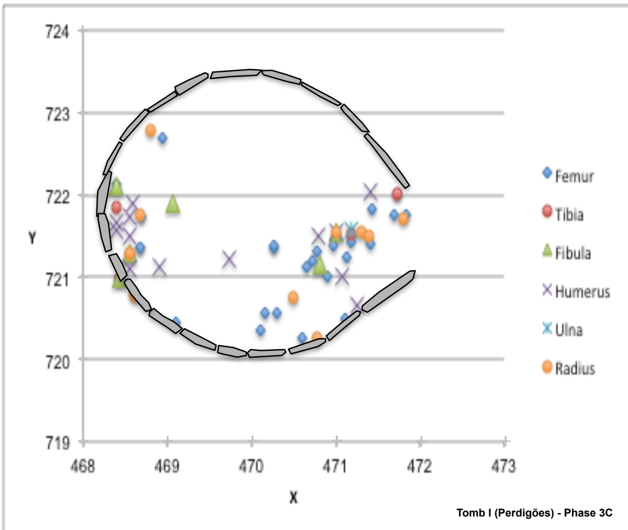


Figure 116 - Long bone distribution for Phase 3C. Tomb I (Perdigões).

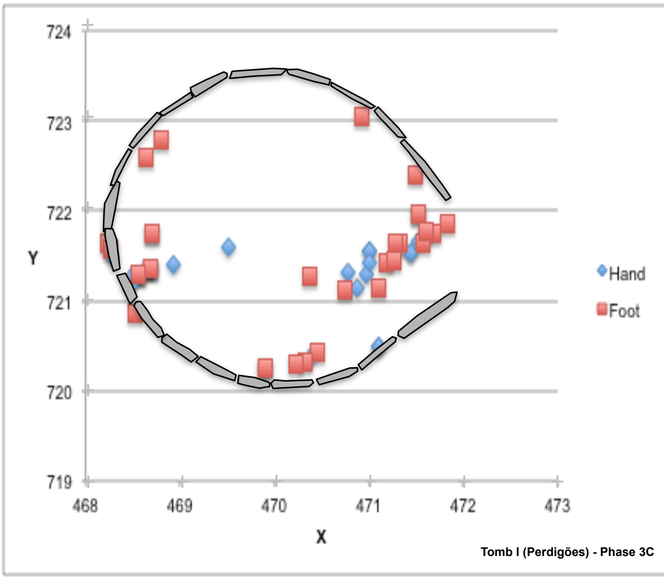


Figure 117 - Hand and foot distribution for Phase 3C. Tomb I (Perdigões).

5.1.4 Phase 4

Available data indicate that Tomb I was effectively abandoned in the Chalcolithic period. Evidence of action affecting the structure and associated contexts relate to our time and are a result of agricultural work and other disturbances (cf. Extrinsic Factors sub-chapter)

5.1.4.1 Phase 4A

This was considered a sub-phase because some contexts were a result of surface disturbance of deposits included in sub-phase 3C, namely SU 38, mentioned above, although it cannot be considered that they were destroyed (Figure 118).

Figure 118 - General view of Phase 4. Tomb I (Perdigões).

Table 122 conveys the paucity of human remains for Phase 4A. Few bones were recovered from this phase which results from the mixing of the superior layers of Phase 3C with the sediments that covered the monument.

Only 112 bone fragments were recovered and they include 29 adults (25,9%) and non-adult (4,5%) fragments. The largest group (n=33) belongs to non-identified bones (29,5%) and 10,7% (n=12) were included in the generic long bone category. In generic bones, 20 fragments (17,9%) were cranial and a small number of ribs and vertebral fragments were also identified. Table 124 shows how the small number of identified and lateralized remains are represented.

Table 122 - Bone count for Phase 4A. Tomb I (Perdigões).

Type		No. Registers	No. Fragments
ID bones			
	Adults	23	29
	Non-Adults	5	5
Others	Cranium	1	20
	Rib	1	6
	Vertebrae	1	7
Long		2	12
N.I.		2	33
TOTAL		**35**	**112**

As with bones, Table 123 confirms the scarcity of teeth for Phase 4A: only 6 totally formed teeth were registered. Table 125 and Table 126 below, display the percentages and proportion for single-rooted, double/multi-rooted, upper and lower teeth.

Table 123 – Tooth count for Phase 4A. Tomb I (Perdigões).

Type		Quantity
Permanent		
	Formation Complete	6
	Formation Incomplete	0
Deciduous		0
TOTAL		**6**

Adult MNI estimation for Phase 4 A was based on the presence of **2** left pubic symphyses (Table 124 and Table 128). A left and a right patella were also identified. Although from opposite sides, the differences in size and proportion between them make it very unlikely that they can belong to the same individual.

For non-adults, the presence of a *pars basilaris* of a more or less 2-year-old individual (based on the measurement of maximum width) is not compatible in age with the measurement of a right MT3, thus also yielding a minimum number of non-adult individuals of 2. This information is described on Table 127.

Amongst the small number of bones recovered in Phase 4A, no complete bones were identified for either major age group. A talus was preserved in its maximum length but presented taphonomic fractures on its medial and lateral sides.

Table 124 – Bone Representativeness for Phase 4A. Tomb I (Perdigões).

Bone	Obs. No.	Representativeness (%)
Right Pubis	2	100
Right Capitate	1	50
Right MT 1	1	50
Right Talus	1	50
Left Ulna	1	50
Right MT 2	1	50
Right MT 3	1	50
Left Clavicle	1	50
Right Mandible	1	50
Left Maxilla	1	50
Left Patella	1	50

Table 125 - Percentages for single-rooted, double/multi-rooted teeth from Phase 4A. Tomb I (Perdigões).

	In situ	Loose	Total	% Obtained	% Expected
Upper SRT	1	0	1	20%	25
Upper DMRT	1	0	1	20%	25
Lower SRT	1	0	0	20%	31,2
Lower DMRT	2	0	0	40%	18

Legend: SRT (Single-Rooted Teeth); DMRT (Double/Multi-Rooted Teeth)

Table 126 - Proportion of Upper and Lower Teeth for Phase 4A. Tomb I (Perdigões).

	SRT	DMRT	Obtained	Expected
Upper	1	1	1	1
Lower	1	2	0,5	1,7

Legend: SRT (Single-Rooted Teeth); DMRT (Double/Multi-Rooted Teeth)

Analysis of age groups present in Phase 3C, reveals the presence of an individual of around 2 years of age, already described, and one for whom the only age estimation possible was to consider him under the age of 16 based on the maximum length of an MT3 (Table 127). For adult individuals, the morphological analysis of the 2 pubic symphyses used for the definition of adult MNI also provided indication of age as can be seen on Table 128.

Table 127 – Age-at-death for non-adult individuals from Phase 4A. Tomb I (Perdigões).

Age-at-death	Number	Tooth/Bone
±2	1	Pars Basilaris (MWB*: 25mm)
<16	1	Right MT3 (ML**: 53,5 mm)

* Maximum Breadth Basilaris (Schaefer et al., 2009). **Maximum Length

Table 128 - Age at death and for adult individuals from Phase 4A. Tomb I (Perdigões).

Age	Bone/FDI	No.	S.U.	Lat.	Sex	Score System
19-40 (±25)	Pubic Symphyses	4504	29	Right	♀	Phase 2*
26-70 (±38.2)	Pubic Symphyses	4580	14	Right	----	Phase 4*

* Brooks and Suchey (1990)

The measurement of one talus provided the maximum length of 50mm (TM1) giving us the indication of the possible presence of a female individual. It was also possible to perform morphological analysis on a right pubis that was also scored as having female characteristics (Table 129).

Table 129 - Sexual diagnosis for bone fragments from Phase 4A. Tomb I (Perdigões).

Morphological Analysis					
Bone	**No.**	**SU**	**Sex**	**Side**	**Scored Structures**
Pubis	4504	29	♀	Right	VA*, IRR**: FEMALE
Metric Analysis					
Bone	**Ner**	**SU**	**Sex**	**Side**	**Variable Measurement**
Talus	2375	29	♀	Right	TM1: 50mm

* Ventral Arc; **Ischiopubic Ramus Ridge.

It was not possible to perform any metric or non-metric morphological analysis on bones from Phase 4A.

No enamel hypoplasia were identified in teeth (n=6) from Phase 4A.

The average of tooth wear for Phase 4A (3,4 n=5) is based on a very low number of teeth and so must be analysed cautiously. The general and individual results for this parameter can be confirmed on Table 130 and Table 131.

Table 130 - Average tooth wear for Phase 4A. Tomb I (Perdigões).

	Anterior Dentition	Posterior Dentition	Total
Maxillary	5 (n=1)	5 (n=1)	5 (n=2)
Mandibular	0 (n=0)	2,3 (n=3)	2,3 (n=3)

Table 131 - Tooth wear per tooth for Phase 4A. Tomb I (Perdigões).

Tooth	Upper	Lower
I1	0 (n=0)	0 (n=0)
I2	0 (n=0)	0 (n=0)
C	5 (n=1)	0 (n=0)
P1	5 (n=1)	0 (n=0)
P2	0 (n=0)	0 (n=0)
M1	0 (n=0)	2 (n=1)
M2	0 (n=0)	3 (n=1)
M3	0 (n=0)	2 (n=1)

None of the identified teeth presented any sign of cariogenic lesion or calculus deposits 0 (n=3)

Only one case of antemortem tooth loss was identified in this phase (1/10 – 33,3%) in a superior tooth, an FDI 25. Although the number of countable alveoli is low, the 13 found represent 20,3% of the total 64 expected (Table 132).

Table 132 - Antemortem Tooth loss for Phase 4A. Tomb I (Perdigões).

Maxillary	**Mandibular**
Alveoli 1/10	Alveoli 0/3

No pathologies were recorded in the bones from Phase 4A, except a slight enthesal change on the distal extremity of a distal foot phalanx (degree 1).

5.1.4.2 Phase 4B

The surface of the soil was strongly affected by the ploughing and harrowing that was carried out in preparation for planting vines. Bones from SU 10 were identified in this phase and are the result of the soil being overturned by the heavy action of the ploughs used in 1996 to rip out the many olive trees that covered the area where Perdigões Archaeological Complex is located (Figure 119).

Figure 119 - General view of the first deposits belonging to Tomb I. The slabs were broken through the intense plough work in 1996, which brought several human remains to the surface. Tomb I (Perdigões).

The few bones from to SU 10 belong to adult individual(s), and come from the upturned upper deposits resulting from the deep ploughing that originally uncovered the enclosure.

A total of 44 bone fragments and 4 teeth were recovered. Fifteen bone shards belonged to bones that we were able to identify individually. No non-adult remains were identified and so the MNI for adults estimated for Phase 4B is 1. For adults, 3 complete bones were recovered out of the 15 individual records (20%): they were a proximal hand phalanx, an MC2 and a talus. No non-adult bones were recovered complete.

Sexual diagnosis was only attempted by the measuring of one talus (44,4 mm) assignable to a female individual. After observation, the possibility could not be discarded that this bone belongs to an adolescent.

It was not possible to perform any morphological analysis due to the high fragmentation of the bone elements.

Teeth were all found *in situ* in a portion of a left mandible (FDI 35,36,37 and 38). None presented enamel hypoplasia. The observable teeth yielded an average wear of 3,33 % (n=3) and tooth FDI 37 and 38 showed signs of slight calculus deposits on their buccal surface (Table 133). No cariogenic lesions or signs of antemortem tooth loss were observed.

Table 133 - Combined description for teeth from Phase 4B. Tomb I (Perdigões).

SU	Tooth	Age	EH	Wear	Caries	Calculus
10	35	adult	NO	NO	NO	NO
10	36	adult	0	4	0	0
10	37	adult	0	4	0	1
10	38	adult	0	2	0	1
Average				3,3 (n=3)		2/3 (66,6%)

No pathologies were recorded in the bones from Phase 4B, except a slight enthesal change on the diaphysis of a proximal hand phalanx.

5.1.5 Non-Referenced Bones

A considerable number of bone fragments reached this study phase with no indication of their original provenance. Undoubtedly belonging to Tomb I, their handling over the years also had an effect on field identification labels. Some faded, others disappeared. Likewise, some of the original bone wrappings disintegrated and so a group of 2246 bone fragments and 53 teeth had to be considered as non-referenced, that is, they could not be assigned to any of the archaeologically defined phases of use for Tomb I. But because they represent an important collection of osteological material and their analysis provided important information for several parameters evaluated, influencing the final results, they were addressed as a separate group. Results regarding representativeness are only indicative as they are exclusively used to establish presence or absence of the different bone and teeth categories.

As for the previous archaeologically defined phases, non-referenced bones were counted and the results are displayed in Table 134. This distribution includes 31,1% of non-identifiable bones (n=699 fragments) and 11,3% of generically considered long bone fragments (n=253). The 831 adult bone fragments comprise 37% of the total and represent the largest group. Non-adult bones (30 fragments representing 1,3% of the total) are also present as are generic cranial fragments with 359 counts (16%), rib (0,9%) and vertebrae (2,4%).

Table 134 – Bone count for non-referenced bones. Tomb I (Perdigões).

Type		No. Registers	No. Fragments
Identified bones			
	Adults	84	831
	Non-Adults	18	30
Others	Cranium	30	359
	Rib	7	21
	Vertebrae	18	53
Long Bones N.I.		24	253
N.I. Bones		24	699
TOTAL		205	2246

All the three tooth categories defined for the previous phases were also discernible for the group of non-referenced teeth, a total of 53, divided in Table 135.

Table 135 – Tooth count for non-referenced teeth. Tomb I (Perdigões).

Type		Number
Permanent		
	Formation Complete	49
	Formation Incomplete	2
Deciduous		2
TOTAL		**53**

For non-adults, an estimated number of 2 non-adult individuals, less than 15 years of age, was determined based on analysis of loose teeth, as described in Table 138. The estimated minimum number of adult individuals was 4, based on the presence of the count of FDI 37 (Table 137). Bone analysis provided a minimal number of 2 adult individuals obtained by the presence of 2 right and left temporal (*pars petrosa*) and 2 fragments of right humerus (Table 136). Non-adult individuals make up 33,3% of the total non-referenced elements.

Table 136 - MNI based on non-referenced bones. Tomb I (Perdigões).

Bone/Teeth (FDI)	MinNi	MaxNI
Left Temporal	2	2
Right Temporal	2	2
Right Humerus	2	2

For bone preservation, only three records reveal complete adult bones, in this case a foot proximal phalanx, a distal one and a first metatarsal. This represents only 3,7% of the 84 individual bone records. No non-adult bones were recovered complete.

As mentioned above, the list of bones represented shown in Table 137 is merely an indication of the bones present and the incongruities found within are obviously a distortion resulting from the mixed and varied origin of these bones and so any explanation would be irrelevant. It is, however, interesting to note that to some extent they mirror the reality observed for the previous phases. This underlines the idea gained of the collective and all-inclusive nature of the human remains from Tomb I: any given and large enough group of human remains will invariably include bone fragments belonging to adults (probably from both sexes although this is the most challenging parameter) and non-adults and the main skeletal groups will also be observable. Table 137 provides a good example, with the assessed presence of cranial, long bones, ilium and scapula, hand and foot bones.

Table 137 - Bone representativeness for non-referenced Bones. Tomb I (Perdigões).

Bone	Obs. No.	Representativeness(%)
FDI 37	4	100,0
Left Temporal (*Pars Petrosa*)	2	50,0
Right Humerus	2	50,0
Left Tibia	2	50,0
Right Clavicle	1	25,0
Right Cuneiform	1	25,0
Left Calcaneus	1	25,0
Right Acromial	1	25,0
Left Ilium	1	25,0
Left MT2	1	25,0
Right Patella	1	25,0
Left Talus	1	25,0
Left MT 1	1	25,0
Right Trapezoid	1	25,0
Right Fibula	1	25,0
Right Radius	1	25,0
Left Femur	1	25,0

Regarding age-at-death estimation, it was only possible for non-adults as can be seen in Table 138 and replicated in Figure 120, where the less than 1-year-old age, the 10-14 and 15-19 age groups have no individuals.

Table 138 – Age-at -death estimation for non-adult individuals based on non-referenced bones. Tomb I (Perdigões).

Age-at-death	Number	Tooth/Bone
3,5	1	FDI 33
5,5	1	FDI 22

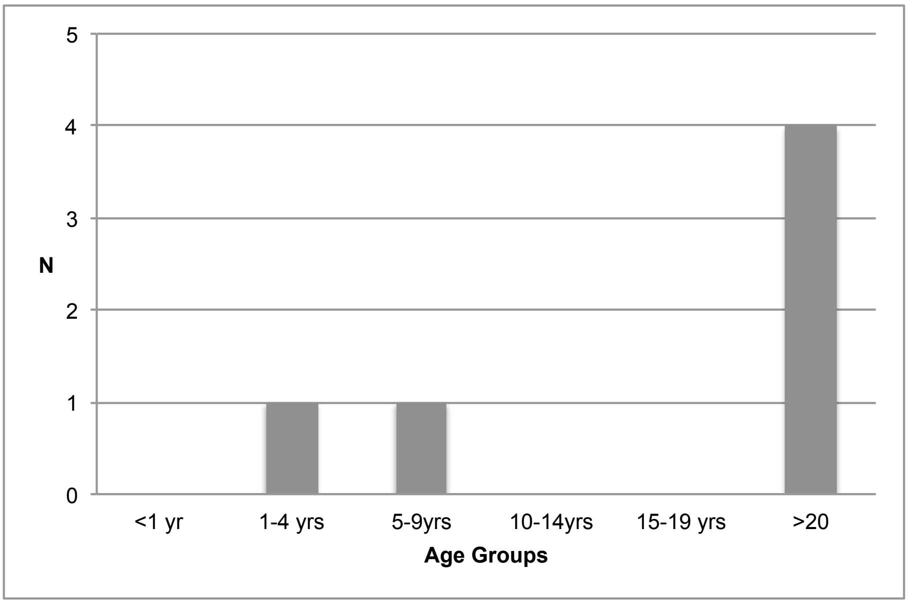


Figure 120 - Age group profile observed for non-referenced bones. Tomb I (Perdigões).

Regarding sexual diagnosis, no information was obtained for this criterion. Once again, the high level of fragmentation of bones together with the scarceness of reliable anatomical regions prevents any conclusion on this point.

No results were obtained through this observation for metric or non-metric morphological analysis, as can be seen for the latter on Table 139.

Table 139 – Post-cranial non-metric traits observed in non-referenced bones. Tomb I (Perdigões).

	Left	Right
Allen's Fossa	0/0	0/0
Hypotrochanteric Fossa	0/0	0/0
Third Trochanter	0/0	0/0
Medial Tibial Squatting Facet	0/0	0/0
Lateral Tibial Squatting Facet	0/0	0/0
Supracondyloid Process	0/0	0/0
Septal Aperture	0/0	0/0
Acromial articular facet	0/1	0/1
Vastus Notch	0/0	0/0
Vastus Fossa	0/0	0/0
Emarginate Patella	0/0	0/0
Medial Talar Facet Present	0/1	0/0
Inferior Talar Articular Surface	0/1	0/0
Anterior Calcaneal Facet Absent	0/1	0/0

Of a total of 177 permanent teeth analysed, 10,2 % (5/49) presented enamel hypoplasia. They are recorded on Table 140, where it is evident, that the frequency of enamel hypoplasia, is equally distributed between anterior and posterior dentition.

Table 140 – Enamel hypoplasia observed in non-referenced teeth. Tomb I (Perdigões).

Tooth	Upper		Lower	
	Left	Right	Left	Right
I1	0/1	2/2 (100%)	0/0	0/0
I2	0/2	0/0	0/2	0/0
C	0/0	0/3	1/2 (50%)	0/1
P1	0/1	0/2	0/1	1/1 (100%)
P2	0/2	0/2	0/3	0/1
M1	0/1	0/4	0/2	1/2
M2	0/1	0/2	1/4 (25%)	0/1
M3	0/2	0/1	0/3	0/00

From the 5 permanent teeth that presented enamel hypoplasia, only one (FDI 33) presented more than one visible line. No enamel hypoplasia was observed in deciduous dentition (0/2).

Tooth wear for this group of teeth is on average of 2,1% (n=49). Posterior maxillary dentition seems to show the highest level of attrition, with M1, M2 and M3 presenting a degree of around 3 (Table 141 and Table 142)

Table 141 - Average tooth wear for non-referenced teeth. Tomb I (Perdigões).

	Anterior Dentition	Posterior Dentition	Total
Maxillary	2 (n=8)	2, 5 (n=19)	2,4 (n=27)
Mandibular	1,5 (n=4)	1,7 (n=18)	1,7 (n=22)

Table 142 – Tooth wear per non-referenced tooth. Tomb I (Perdigões).

Tooth	Upper	Lower
I1	2 (n=3)	0 (n=0)
I2	1 (n=2)	1 (n=2)
C	2,7 (n=3)	2 (n=2)
P1	1,7 (n=3)	1 (n=2)
P2	2,3 (n=4)	1,8 (n=4)
M1	3,2 (n=6)	1 (n=2)
M2	3 (n=3)	2,6 (n=5)
M3	3 (n=3)	1,7 (n=3)

The two deciduous teeth presented the degree of wear shown on Table 143.

Table 143 – Tooth wear for deciduous non-referenced teeth. Tomb I (Perdigões).

Tooth	Tooth Wear
55	1
65	2

No cariogenic lesions were registered in permanent (n=0/50) or deciduous teeth (n=0/2) among the non-referenced teeth.

Calculus was identified in 8% of the permanent teeth analysed (n=4/50). For superior dentition 3,7% presented calculus deposits (n= 1 /27) and for inferior dentition the percentage of calculus deposits found was of 13%(n=3/23). None of the deciduous dentition identified showed signs of calculus deposits.

No antemortem tooth loss was registered for mandibles and maxillas, as may be observed in Table 144. Only 7 alveoli (5,4%) were counted out of the 128 expected.

Table 144 - Antemortem tooth loss for non-referenced teeth. Tomb I (Perdigões).

Maxillary	**Mandibular**
0/7 alveoli	0/0alveoli

Table 145 and Table 146 summarize observations regarding osteoarthritis and enthesal changes observable in the group of non-referenced bones. No results were obtained through this observation.

Table 145 - Osteoarthritis observed in non-referenced bones. Tomb I (Perdigões).

		Degree Left		**Degree Right**	
		0	1	0	1
Humerus	Proximal	0	0	0	0
	Distal	0	0	1	0
Radius	Proximal	0	0	0	0
	Distal	0	0	0	0
Ulna	Proximal	0	0	0	0
	Distal	0	0	0	0
Femur	Proximal	0	0	0	0
	Distal	0	0	0	0
Tibia	Proximal	1	0	0	0
	Distal	0	0	0	0
Fibula	Proximal	0	0	0	0
	Distal	0	0	0	0

Table 146 - Enthesal changes observed in non-referenced bones. Tomb I (Perdigões).

		Degree Left		Degree Right	
		0	1	0	1
Scapula	Coracoid Process	0	0	0	0
	Acromion	0	0	1	0
Clavicle	Sternal Extremity	0	0	1	0
	Deltoid Tuberosity	0	0	1	0
Humerus	Medial Epicondyle	0	0	0	0
	Lateral Epicondyle	0	0	1	0
	Trochlea	0	0	1	0
	Lateral Supracondylar	0	0	0	0
Radius	Bicipital Tuberosity	0	0	0	0
	Radial Styloid Process	0	0	0	0
Ulna	Proximal Extremity	0	0	0	0
	Styloid Process	0	0	0	0
Ilium	Iliac Crest	1	0	0	0
	Ischiatic Tuberosity	0	0	0	0
Femur	Greater Trochanter	0	0	0	0
	Lesser Trochanter	0	0	0	0
	Linea Aspera	0	0	1	0
	Digital Fossa	0	0	0	0
Patella	Anterior Surface	0	0	0	0
Tibia	Soleal Fossa	0	0	0	0
	Anterior Tuberosity	1	0	0	0
	Distal	0	0	0	0
	Medial Malleolus	0	0	0	0
Fibula	Biceps Femoris	0	0	0	0
	Lateral Malleolus	0	0	0	0
	Tibiofibular Ligament	0	0	0	0
Calcaneus	Tuberosity	2	0	2	0
	Adductor Hallucis	0	0	0	0

5.1.6 Atrium

Following the construction of the tomb in Phase 1, a half-moon shaped ceramic structure in the central space of the atrium was built. Although truncated, it is possible to consider that its specific shape around an empty space was meant to create a particular environment (Figure 121). The evidence suggests ritual practices including the handling of the fire. This phase might have occurred at very early stages of the use of Tomb I, since both the structure and the deposits around it cut into the bedrock. Could the actions that took place there be related to the early stages of life of the burial chamber?

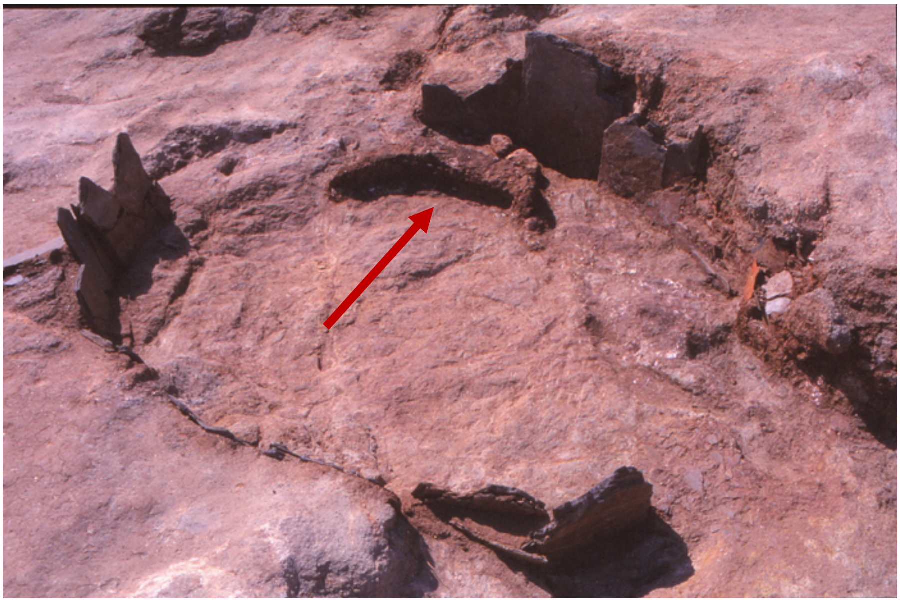


Figure 121 - General view of the Atrium and part of the corridor. The burnt half-moon shaped structure can be seen at the left of the entrance. Tomb I (Perdigões),

An intermediate stage of abandonment of this functional area seems to have followed and the deposits identified seem to be of natural formation (Phase 3). This phase may be contemporary with moments of use of the burial chamber.

Phase 4 comes after a phase in which the atrium was possibly just a mere area to access the main chamber a succession of depositions of artefacts took place close to the atrium entrance. The atrium SU 19 yielded only a very fragmented and scattered collection of long bones and cranial fragments and these were recovered amongst a very rich collection of artefacts comprising 7 stone vases, a *Pecten maximus* shell, a group of 8 schist arrow heads, several shards (some decorated) and a collection of lithic artefacts including a flint dagger. This was probably an area for the deposition of offerings related with the funerary practices taking place there.

Part of the corridor was destroyed in Phase 5 by the digging of a hole used for the planting of an olive tree. In SU 22 (corridor) a small number of bones were recovered alongside an arrow head and a flint blade. Because this feature is in direct contact with the burial chamber, these bones could have slid down from there.

The atrium area seems to have lost any particular use after the occurrences referred to in Phase 4, after which its use was abandoned and subsequently affected by agricultural works, particularly those that occurred in 1996.

A total of 127 bone fragments and 6 teeth were recovered in the atrium. We were able to identify 11 individual bones that were broken into 64 bone shards. The atrium contained no complete preserved bones amongst the 11 individualized adult bone registers.

The few bones recovered from SU 22 were mostly long bones and a number cranial fragments. Although found in the atrium area, they were identified in revolved sediments and so their provenance is unsure. Although a burned half-moon structure was detected, none of the bones showed signs of burning. Red pigment was observed on a foot bone fragment. Most of the bones were covered in concretions and manganese oxide precipitates.

No non-adult remains were identified and the estimated MNI for adult individuals, for the atrium is 1.

The bone representativeness in the atrium as seen in Table 147 can be explained by the very residual presence of human bones rendering this exercise hardly worthwhile.

Table 147 - Bone Representativeness for the Atrium. Tomb I (Perdigões).

Bone	Obs. No.	Representativeness (%)
Right Mandible	1	100
Occipital	1	100
FDI 21	1	100
FDI 36	1	100
FDI 37	1	100
FDI 47	1	100
FDI 48	1	100

No kind of sexual diagnosis was possible since none of the anatomical parts used to estimate these criteria were available. It was also not possible to perform any morphological analysis due to the high fragmentation of the bone elements. No pathologies were recorded in the bones from the Atrium, except a slight enthesal change on the distal extremity of a distal foot phalanx.

The results for tooth wear and calculus are combined in Table 148.

Table 148 - Teeth recovered from the Atrium of Tomb I (Perdigões).

SU	Tooth	Age	EH	Wear	Caries	Calculus
19	21	Adult	0	4	0	0
19	36	>Crc*	0	1	0	0
19	37	Adult	0	3	0	1
19	47	Adult	0	3	0	1
19	48	Adult	0	3	0	1
19	?	Adult	NO	7	NO	1
Average				3,5 (n=6)		4/6

*Crc: crown complete

5.2 Tomb I Total Results

Although there was no doubt from the very beginning of the importance of a phased study of the monument, it was also clear from the outset that any comparison with other monuments inside the Perdigões enclosures and also other tholoi/tholos type would be impossible if this work did not also include a global approach to the monument, with no reference to archaeological phases of use. Only then would it be possible to make any useful comparison with results from other monuments of this type studied in the past in the south of Portugal, which must be highlighted, were in the vast majority, studied as single units. Thus, it is precisely because the per-phase study does not have the usual approach to this type of monument that it was important to look at it also in a global and integrated way. Otherwise, all comparisons of the different biological, morphological or paleopathological parameters, for example, with any other monuments would not be possible.

Nonetheless, the total results of Tomb I, for many parameters, do not result from a simple summing up of the totals of previous phases. Instead, all the data available from the per phase groups must be cross-checked and linked to provide global results. Indeed, MNI, for example, represents an estimate of the minimum number of individuals possible within a specific mortuary sample based on the count of a distinctive portion, fragment, or landmark on a single skeletal element (Silva, 1006; 2002; Adams and Konisberg, 2004; 2008; Boz and Hager, 2014; Varas and Leiva, 2012). The landmark ensures that fragments of the skeletal element are not counted as more than one individual and in samples where the remains are highly fragmented and poorly preserved it is the most appropriate method. In the case of Tomb I, it is very hard, with the available methodologies, to assess the exact number of individuals whose bones were deposited in that specific funerary structure throughout its use. Tooth analysis proved to be essential for the determination of this parameter in Tomb I, both in the per phase study as in the global one. Indeed, for Tomb I and except for the adult MNI estimation for Phase 3B (based on the count for left *pars petrosa*) and for both adults (based on the presence of 2 pubic symphysis) and non-adults (metric analysis of a *pars basilaris* and an MT3) from Phase 4A it was systematically teeth that allowed the definition of this parameter.

Although mostly based on tooth analysis, it was always different skeletal elements that provided the base for the definition of this criteria in each phase and in the global study.

In this chapter the overall results for the anthropological study of Tomb I will be presented. This will happen based on the parameters that can be compared with other funerary contexts inside the Perdigões enclosures but also with the other tholos or tholoi type monuments in the south of Portugal. Other informations, regarding quantification and level of fragmentation that are perceptible in the results presented in the per-phase study will be left out, to avoid unnecessary repetitions.

This work is the result of the study of a total of 61926 bone fragments that make over 6800 individual registers or bags (Table 149). Non-adult represent only 3,6% of the whole bone collection (n=2216), although in terms of separate registers they make up 7,4% (n=501) of the total. With regard to adult bones, it was possible to determine 3125 individualized registers (45,9% of the total 6805), which correspond to 24842 bone fragments (40,1% of the total). The total number of non-identified bone fragments was 12219 (19,7% of the total count) and an significant group of 10318 bone fragments (16,7%) could only be assigned as belonging to long bones. Thus, non-identified bones make up 22537 fragments, representing 36,3% of the whole collection. The remaining fragments are divided between 9273 general cranium entries totalizing 14,9% of the fragments counted, making cranial remains clearly the most represented single anatomical region of the collection. Ribs, with 1646 fragments (2,7%), and vertebrae, with 1412 (2,3%) complete the bone count for Tomb I.

Table 149 - Total bone count for Tomb I (Perdigões).

Type		**No. Registers/Bags**	**No. Fragments**
Identified bones			
	Adults	3125	24842
	Non-Adults	501	2216
Others	Cranium	886	9273
	Rib	553	1646
	Vertebrae	598	1412
Long Bones N.I.		767	10318
N.I. Bones		375	12219
TOTAL		**6805**	**61926**

A total of 1579 teeth were observed in total for Tomb I. Deciduous dentition is represented by 83 elements. Amongst the permanent dentition it was possible to account for 172 that were still in formation and for 1 supernumerary element. These results can be observed in Table 150.

Table 150 - Total tooth count for Tomb I (Perdigões).

Type		**Quantity**
Permanent		
	Formation Complete	1323
	Formation Incomplete	172
Deciduous		83
Supernumerary		1
Total		**1579**

Altogether, the Minimum Number of Individuals estimated for Tomb I is 103: 55 adults and 48 non-adults, less than 15 years old (Table 152 and Table 155).

For non-adults, an estimated number of 48 individuals under 15 years of age was determined, based mainly analysis of loose teeth and through bone measurement for two individuals (Table 155): one individual, whose fibula was recovered and for whom metric analysis suggested time of death to be around birth. Another older individual was shown to be around 11 months old at time of death, through measurement of the *pars basilaris*, which was recovered intact

The MNI of adults is 55, based on the presence of that number of FDI 18 (Table 152). Bone analysis for the observation of this parameter provided a minimum number of 51 adult individuals, based on right temporal count. The long bone most represented is the femur with 38 counts (Table 151).

Table 151 - Estimated adult MNI for Tomb I based on bone analysis (Perdigões).

Long Bone	MNI
Right Temporal	51
Left Temporal	42
Right Femur	38
Right Humerus	30
Left Ulna	28
Right Tibia	24
Left Femur	26
Left Tibia	29
Left Humerus	25
Right Ulna	17
Right Fibula	9
Left Radius	14
Left Fibula	16
Right Radius	10

As expected for a funerary context of this nature, the level of fragmentation of the bones was extremely high. Although it was possible to identify (even if generically) the majority of the bones from Tomb I, a small percentage was considered undetermined. Siding of a considerable number of the bones composing this sample was also not possible due to the same reason. In addition to fragmentation, many of the bones showed signs of shape deformation and severe alteration of the bone surface. For teeth, general and poor state of conservation rendered complete identification of every tooth impossible.

Altogether, the image of adult bone representativeness for the total collection from Tomb I replicates the general picture obtained in the analysis by phase (Table 152). The main skeletal areas are all represented but in a disproportionate way. Cranial fragments are well represented through the right *pars petrosa* (n=51) and are not far from the total MNI identified through the count of 55 FDI 18. The count for occipital bones is nonetheless very far from this number, reaching only 16 (29%).

Long bones are unequally represented: almost 70% of representativeness for femurs (n=38) is followed by 50% for humeri (n=30), tibias (n=29) and ulnas (n=28). However, the analysis of the presence of fibula (n=16) and radii (n=14) reveal a much lower percentage of representativeness. These differences may be interpreted in different ways (cf. discussion) and do not occur only with long bones. The example of the metatarsal, indicates that they their representativeness also varies significantly: the highest value is for MT 3 with 19 counts, almost 65% below the expected value followed by MT 5 with 17. The number drops to 10 for MT 2 and then to 6 for MT 4 and finally to 4 with MT1, a number very far from the expected 55 elements.

Carpal bones vary between 17 counts (capitate) and 1 (triquetral) respectively 30,9% and 1,8% representativeness, For the foot bones, calcaneus and lateral cuneiform show the highest count with 12 each (almost 80% below expected), although intermediate cuneiform is only represented by 2 elements (3,6% of the expected value).

The shoulder girdle is represented by the presence of 27 glenoid cavities (almost 50%) although only 2 coracoid processes could be accounted for (3,6%). Clavicles show a representativeness of 16,3% with 9 counts. Eighteen ischia (32,7%) is the highest count for pelvic bones and the vertebral column is represented by 13 axis (23,6%) and 10 atlas (18,1%).

Table 152 - Adult bone representativeness for Tomb I (Perdigões).

Bone (MNI)	Obs. No.	Representativeness (%)
FDI 18	55	100
Right Temporal (Pars Petrosa)	51	92,7
Right Femur	38	69
Right Humerus	30	54,5
Left Tibia	29	52,7
Left Ulna	28	50,9
Left Glenoid Cavity	27	49
Right Patella	21	38,2
Right MT 3	19	34,5
Left Ischium	18	32,7
Occipital	16	29
Left MT 5	17	30,9
Right Capitate	17	30,9
Left Fibula	16	29
Left Radius	14	24,4
Axis	13	23,6
Left Calcaneus	12	21,8
Left Lateral Cuneiform	12	21,8
Atlas	10	18,1
Left Talus	10	18,1
Right MC 2	10	18,1
Left MT 2	10	18,1
Right Trapezoid	10	18,1
Left Clavicle	9	16,3
Left Lunate	9	16,3
Left Navicular	9	16,3
Right Medial Cuneiform	9	16,3
Left Mandible	7	12,7
Right MC 3	7	12,7
Left MC 4	6	10,9
Left Scaphoid	6	10,9
Left Zygomatic	6	10,9
Right MC 5	6	10,9
Right MT 4	6	10,9
Right Pubis	6	10,9
Left Frontal	4	7,3
Left Pisiform	4	7,3
Right Cuboid	4	7,3
Right MT 1	4	7,3
Left MC 1	3	5,4
Right Hamate	3	5,4
Right Ilium	3	5,4
Right Unciform	3	5,4
Left Coracoid Process	2	3,6
Left Hamate	2	3,6
Left Mandibular Co	2	3,6
Left Maxilla	2	3,6
Left Trapezium	2	3,6
Right Int. Cuneiform	2	3,6
Left First Rib	1	1,8
Right Piramidal	1	1,8
Right Prox. Phalanx Hand 1	1	1,8

The percentages for single-rooted and double/multi-rooted teeth shown in Table 153 reveals that the values obtained for single-rooted upper teeth are 5% below the expected value, although the value for double/multi-rooted teeth is 8,8% above the established percentage. Lower teeth results do not meet expectations either: single-rooted teeth are 6,2% below, whereas double/multi-rooted teeth appear 7,6% above the 18% expected.

Table 153 - Percentages for single-rooted, double/multi-rooted teeth for Tomb I (Perdigões).

	In situ	**Loose**	**Total**	**% Obtained**	**% Expected**
Upper SRT	39	260	299	20	25
Upper DMRT	118	387	505	33,8	25
Lower SRT	59	248	307	20,5	31,2
Lower DMRT	118	265	383	25,6	18

Legend: SRT (Single-Rooted Teeth); DMRT (Double/Multi-Rooted Teeth)

Table 154 explores the proportion between upper and lower teeth showing that the ratio between obtained and expected numbers is divergent and below what would be predictable. This difference is more obvious in mandibular teeth, where the higher count of double/multi-rooted teeth (n=383) compared to that of single-rooted teeth (n=307) explains the difference of 0,9 below the expected proportion of 1,7. For upper teeth, the count for double/multi-rooted teeth (n= 505), which should be much closer to that of single-rooted teeth (only n= 299), is responsible for the visible disproportion.

Table 154 - Proportion of upper and lower teeth for Tomb I (Perdigões).

	SRT	**DMRT**	**Obtained**	**Expected**
Upper	299	505	0,59	1
Lower	307	383	0,80	1,7

Legend: SRT (Single-Rooted Teeth); DMRT (Double/Multi-Rooted Teeth)

Tomb I yielded human remains of individuals whose ages range from birth to mature age around 55 years of age. No prenatal skeletal elements were identified and the same is true for individuals at the other extreme of the age range, after the mid-fifties. Table 155 together with Figure 122 clearly convey this idea.

The fact that non-adult individuals accounted for 46,6% of the total count for Tomb I is a clear indicator of the collective nature of the depositions in this funerary structure, where age does not seem to be a defining factor.

Based on the observations possible, as has already been reported for most of the different phases of use of the chamber of Tomb I, higher mortality in non-adult individuals seems to have occurred between the ages of 5 and 9, with 21 registers, followed by the previous age group of ages between 1 and 4 (14 counts). At least 17 individuals died in the second decade of their life, 11 between the ages of 11 and 14, and 6 between the ages of 15 and 19 (Figure 122).

Table 155 - Age at death estimation for individuals from Tomb I (Perdigões)

Age	No	FDI/Bone	Lat.	Method/Score System
Perinatal	1	Fibula		Metric
±11 months	1	Pars Basilaris		Metric
1,5/2,5	1	FDI 52		Dental Eruption/ Calcification
2,5	1	FDI 26		Dental Eruption/ Calcification
2,5/3,5	2	FDI 36;		Dental Eruption/ Calcification
3,5	5	FDI 16;		Dental Eruption/ Calcification
3,5/4,5	2	FDI 16;		Dental Eruption/ Calcification
4,5	3	FDI 21;		Dental Eruption/ Calcification
4,5/5,5	2	FDI 11; FDI 21		Dental Eruption/ Calcification
5,5	4	FDI 11; FDI 13		Dental Eruption/ Calcification
6,5	6	FDI 12; FDI 14		Dental Eruption/ Calcification
6,5/7,5	1	FDI 22;		Dental Eruption/ Calcification
7,5	3	FDI 14: FDI 26		Dental Eruption/ Calcification
7,5/8,5	1	FDI 17;		Dental Eruption/ Calcification
8,5	3	FDI 14; FDI 25; FDI		Dental Eruption/ Calcification
9,5	1	FDI 33;		Dental Eruption/ Calcification
9,5/10.5	1	FDI 65;		Dental Eruption/ Calcification
10,5	1	FDI 12		Dental Eruption/ Calcification
10,5/11,5	1	FDI 31		Dental Eruption/ Calcification
11,5	2	FDI 16; FDI 37		Dental Eruption/ Calcification
12,5	1	FDI 18		Dental Eruption/ Calcification
13,5	1	FDI 24		Dental Eruption/ Calcification
13,5/14,5	4	FDI 18		Dental Eruption/ Calcification
14,5/15,5	1	FDI 23		Dental Eruption/ Calcification
15,5/16,5	1	FDI 37		Dental Eruption/ Calcification
16,5	1	FDI 18		Dental Eruption/ Calcification
17,5	2	FDI 38		Dental Eruption/ Calcification
18,5/19,5	1	FDI 28		Dental Eruption/ Calcification
20,5	2	FDI 38		Dental Eruption/ Calcification
21,5/22,5	1	FDI 14		Dental Eruption/ Calcification
22,5	1	FDI 28		Dental Eruption/ Calcification
30-40	1	Auricular Surface (♀)	Left	Phase 3*/Phase 3**
45-55	1	Auricular Surface	Left	Phase 6*/Phase 4**
± 55	1	Auricular Surface	Left	Phase 7*/Phase 5**

Lovejoy et all (1985); **Buckberry and Chamberlain (2002)

Apart from teeth, no skeletal element prevailed as the base for the information regarding this criteria as can be seen listed in the following Table 156.

Table 156 - Age-at-death estimation obtained through bone analysis in Tomb I (Perdigões).

Phase	**Age at death**	**Bone**
2A	Perinatal	Fibula
2B	0-6 months	Distal Hand Phalanx
2C	±11 months	Pars Basilaris
2D	±12 months	Left Ischium
4A	± 2 years	Pars Basilaris
4A	<16 years	Right MT3

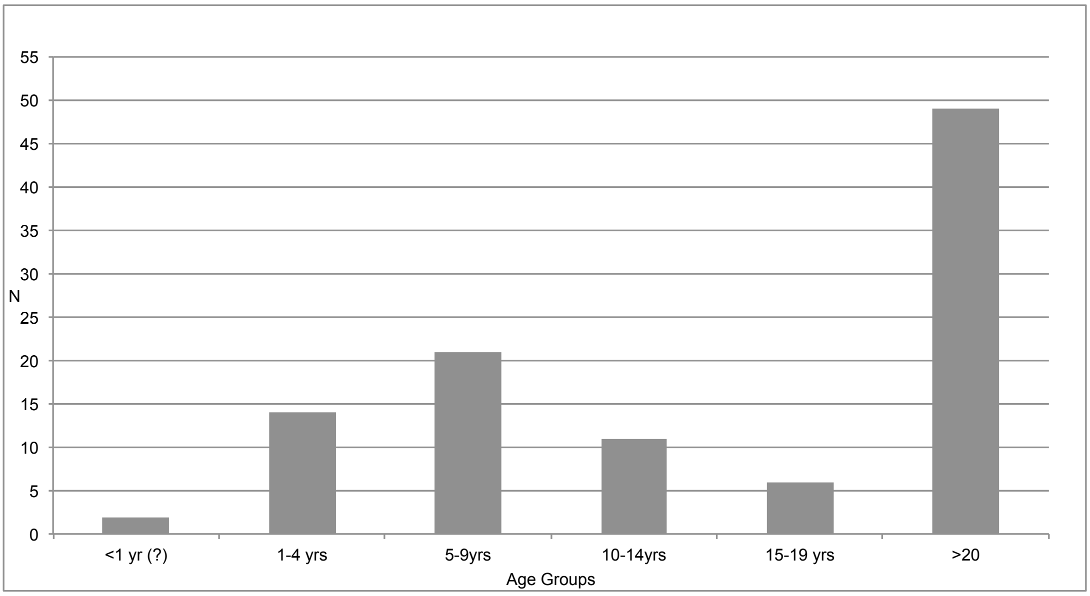


Figure 122 - Age at death profile for individuals from Tomb I (Perdigões).

Table 157 displays the total results for sexual diagnosis amongst the bones recovered from Tomb I. This is the parameter with poorest results for Tomb I, although both morphological and metric approaches point to the presence of bones with male and female characteristics.

It is the metric results of the bones analysed that give us a clearer indication of possible minimum numbers of male and females individuals. The measurement of the biepicondylar width (HBW) of 5 right humeri (nos. 204, 206, 207, 220 and 221) all identified in Phase 2C, with results below the established sectioning point of 56,63 mm indicate the presence of that number of female individuals, although bone no. 206 was very close to that value and raises some doubts.

The number of male individuals is revealed through the metric results on the calcaneus (CM1). Register numbered 886, 898, 2037 and 3600 provided measurements above the sectioning point of 75,5 mm and probably belong to 4 different male individuals, although five ilia presented male characteristics. Although these results are merely indications they convey the idea of a balanced presence of both sexes amongst the remains recovered from Tomb I.

Table 157 - Morphological and metric sex diagnosis for bones from Tomb I (Perdigões).

Morphological Analysis					
Bone	**No.**	**SU**	**Sex**	**Side**	**Scored Structures**
Frag. Ilium	2404	97	♀	Left	GSN*: 2; PS**: 2
Frag. Ilium	2435	97	♀?	Left	GSN*: 3
Frag. Ilium	3635	97	♀	Right	GSN*: 2; PS: 3
Frag. Ilium	2077	97	♀?	Right	GSN*: 3
Frag. Ilium	2270	97	♂	Right	GSN: 5
Frag. Ilium	4456	63	♂	Right	GSN: 2; PS:0
Frag. Ilium	4457	84	♂	Right	GSN: 2; PS:0
Frag. Ilium	4458	84	♂	Right	GSN: 1; PS:0
Frag. Ilium	4460	84	♂	Right	GSN: 1; PS:0
Frag. Ilium	4459	63	♂	Left	GSN: 2; PS:0
Frag. Ilium	2891	178	♀	NO	GSN:2
Frag. Ilium	2043	84	♀?	NO	PS: 3
Frag. Ilium	2842	172	♂	NO	GSN: 4
Frag. Mandible	3312	173	♀?	Left	Mental Eminece: 2
Frag. Mandible	3724	97	♀?		Mental Eminence: 1
Mandible	3723	97	♂?		Mental Eminence: 4
Frag. Mandible	3714	97	♂?		Mental Eminence: 4
Frag. Temporal	3120	172	♀	Left	Mastoid Process 1
Frag. Temporal	2053	84	♂?	Left	Mastoid Process: 4
Frag. Temporal	3999	97	♂?	Left	Mastoid Process: 4
Frag. Temporal	2179	63	♂?	Right	Mastoid Process: 4
Frag. Temporal	1051	84	♂?	Right	Mastoid Process: 4
Frag. Temporal	4304	93	♂	Right	Mastoid Process: 4
Frag. Occipital	3990	97	♂?		Nuchal Crest: 4
Frag. Occipital	2440	92	♂		Nuchal Crest: 4
Frag. Occipital	4293	93	♂		Nuchal Crest: 5
Frag. Occipital	4294	91	♂		Nuchal Crest: 4
Frag. Frontal	3123	172	♀?	NO	Glabella 2/3

Metric Analysis					
Bone	**No.**	**SU**	**Sex**	**Side**	**Variable Measurement**
Frag. Distal Humerus	205	97	♀	Left	HBW: 50 mm
Frag. Distal Humerus	220	97	♀	Right	HBW: 54 mm
Frag. Distal Humerus	221	97	♀	Right	HBW: 47 mm
Frag. Distal Humerus	204	97	♀	Right	HBW: 54 mm
Frag. Distal Humerus	207	97	♀	Right	HBW: 54,5 mm
Frag. Distal Humerus	206	97	♀?	Right	HBW: 56,5 mm
Frag. Distal Humerus	114	97	♂?	Left	HBW: 57 mm
Frag. Distal Humerus	218	136	♂	Left	HBW: 60 mm
Frag. Distal Humerus	2373	63	♂	Right	HEB: 59 mm
Frag. Prox. Humerus	211	97	♂	Left	HVHD: 45,5 mm
Talus	962	97	♂	Left	TM1: 53mm
Talus	3914	97	♀	Left	TM1: 52 mm
Talus	886	173	♀	Right	TM1: 46,7 mm
Talus	2628	63	♀	Right	TM1: 48,5 mm
Frag. Prox. Femur	4091	94	♀	Right	FVHD: 36 mm
Frag. Prox. Femur	4124	97	♀	Right	FVHD: 36 mm
Frag. Prox. Femur	4103	136	♂	Left	FVHD: 44 mm
Frag. Prox. Femur	4112	97	♂	Left	FVHD: 45 mm
Frag. Prox. Femur	4167	97	♂	Right	FVHD: 46mm
Frag. Calcaneus	898	97	♂	Left	CM1: 78mm
Calcaneus	886	93	♂	Left	CM1: 84 mm
Calcaneus	2037	63	♂	Left	CM1: 82 mm
Calcaneus	3600	84	♂	Left	CM1: 76 mm

The information contained in Table 158 regarding the register of post-cranial non-metric traits from Tomb I shows that the bones, possible to analyze, yielded few results for this parameter. The presence of a hypotrochanteric fossa was registered on one right and one left femur. Other than that, only the humerus provided more information on non-metric traits, with the identification of two septal apertures on left humeri and one on a right one.

Table 158 - Postcranial non-metric traits observed in bones from Tomb I (Perdigões).

Trait	Left	Right
Allen's Fossa	0/1	0/6
Hypotrochanteric Fossa	1/4	1/6
Third Trochanter	0/4	0/7
Medial Tibial Squatting Facet	0/6	0/3
Lateral Tibial Squatting Facet	0/5	0/3
Supracondyloid Process	0/16	0/24
Septal Aperture	2/12	1/14
Acromial articular facet	0/4	0/11
Vastus Notch	0/9	0/12
Vastus Fossa	0/10	0/12
Emarginate Patella	0/10	0/12
Medial Talar Facet Present	0/10	0/6
Inferior Talar Articular Surface	0/9	0/6
Anterior Calcaneal Facet Absent	0/11	0/11

From a total of 1369 permanent teeth analysed, 10,4 % (143/1369) presented enamel hypoplasia. They are recorded on Table 159. In absolute terms, canines are the teeth with the highest presence of this phenomenon: 41,7% of FDI 43 (10/24) followed by FDI 33, with 7 registers in a total of 34 teeth (20,6%).

FDI 11 is the most affected amongst incisors (10/24), although none were observed for FDI 31. The count of enamel hypoplasia for premolars is generally lower than or incisors and canines.

With regard to posterior dentition, except for FDI 27, enamel hypoplasia was registered in all quadrants with higher frequency on FDI 16 (11,8%).

Table 159 - Enamel hypoplasia observed in permanent teeth from for Tomb I (Perdigões).

Tooth	Upper		Lower	
	Left	Right	Left	Right
I1	6/25 (24%)	10/24 (41,6%)	0/19	1/14 (7,1%)
I2	5/28 (17,9%)	1/20 (5%)	0/14	0/15
C	10/51 (19,6%)	7/43 (16,2%)	7/34 (20,6%)	10/24 (41,7%)
P1	8/55 (14,5%)	6/40 (15%)	2/26 (7,7%)	4/38 (10,5%)
P2	4/43 (9,3%)	2/55 (3,6%)	7/46 (15,2%)	2/40 (5%)
M1	8/78 (10,3%)	8/68 (11,8%)	5/74 (6,8%)	3/61 (4,9%)
M2	0/45	3/39 (7,7%)	7/65 (10,8%)	4/58 (6,9%)
M3	4/66 (6,1%)	4/67 (6%)	2/52 (3,8%)	3/42 (7,1%)

2,5% of the total deciduous teeth observed for Tomb 1 presented enamel hypoplasia (2/81). The two cases were found on lower second molars: from Phase 2A there is one case identified on an FDI 85 and for Phase 2B on an FDI 75.

From the 1495 permanent teeth identified from Tomb I, it was possible to observe 95,5% of them (n=1428) for tooth wear. The results are shown in Table 160 and reveal a general tooth wear of 1,9.

Unsurprisingly, it is mandibular teeth that show the highest levels of attrition, with an average of 2,1 (n=651). It is in the anterior section of the mandible where this phenomenon is more marked, with an average level of 2,2 (n=126). No difference in average wear between anterior (n=180) and posterior dentition (n=587) is shown in maxillary teeth.

Table 160 - Average permanent tooth wear for Tomb I (Perdigões).

	Anterior Dentition	**Posterior Dentition**	**Total**
Maxillary	1,8 (n=190)	1,8 (n=587)	1,8 (n=777)
Mandibular	2,2 (n=126)	2 (n=525)	2,1 (n=651)

It should be noted that on both the mandibular and maxillary arch, the count for posterior dentition is always considerably higher than for anterior dentition (Table 161). Of all the teeth analysed it is the FDI 31 and 41 (n=33) that present the highest wear level, on average 2,6, although they are also the least represented type of tooth of the whole collection. On the other hand, although in comparison posterior dentition shows a lower rate of attrition of around 2 (M1, M2 and M3), these teeth are present in much more higher numbers.

Table 161 – Mean tooth wear per tooth for Tomb I (Perdigões).

Tooth	**Upper**	**Lower**
I1	1,6 (n=49)	2,6 (n=33)
I2	1,6 (n=46)	2,3 (n=36)
C	2 (n=95)	2 (n=57)
P1	1,7 (n=101)	1,6 (n=66)
P2	1,8 (n=102)	1,8 (n=94)
M1	1,9 (n=158)	2,2 (n=141)
M2	2,2 (n=88)	2,2 (n=128)
M3	1,4 (n=138)	1,7 (n=95)

As already performed for the different phases of use of Tomb I, tooth wear was also measured for deciduous teeth since some of them presented quite a considerable level of attrition (Table 162) The total number of teeth analysed was 84, and they presented an average wear of 1,8, a value that is extremely close to the one obtained for permanent dentition.

Table 162 - Tooth wear for deciduous teeth from Tomb I (Perdigões).

	Dental Tooth Wear (average)
Maxillary	1,7 (n=47)
Mandibular	1,8 (n=36)

Cariogenic lesions, which were not identified on any of the deciduous teeth observed (0/81), were present in 0,5 % of permanent teeth recovered from Tomb I (7/1406) as can be seen on Table 163

Table 163 - Summary of cariogenic lesions identified in Tomb I (Perdigões).

FDI	Nº.	SU/Phase	Wear	Location	Degree
36	395a	173/2C	2	2	2
17	281a	97/2D	5	2	1
18	M281b	97/2D	3	2	1
46	588	97/2D	4	4 (lingual)	2
24	441b	92/3B	6	5	1
14	482	93/3B	3	3	1
18	207	63/3C	2	2	2

Calculus was identified in 20,6% of the permanent teeth analysed (n=289/1399). For superior dentition 14,8% presented calculus deposits (N= 113 /761) and for inferior dentition the percentage of calculus deposits found was of 27,5% (n=176/638). For the deciduous dentition observed 1,2% (n=1/81) showed signs of calculus deposits.

The first thing that stands out when analysing the results for ante mortem tooth loss from Tomb I (Table 164) is the scarcity of observable alveoli. Indeed, if the MNI for adults is considered to be 55, it would be expectable for there to be have approximately 1760 alveoli. Instead, only 539 (30,6% of the possible total) could be quantified. Amongst those counted, 29 cases (5,3%) of tooth loss during life were registered. The phenomenon is more frequent in upper dentition, where 23 cases were registered (8,3%). For mandibular teeth 6 episodes were identified (2,3% of the total).

Table 164 - Ante mortem tooth loss for teeth from Tomb I (Perdigões).

Maxillary	Mandibular
23/ 278 alveoli	6/261 alveoli

Apart from the several isolated cases of osteoarthritis described throughout the analysis by phase, which will not be repeated here, Table 165 summarizes the effect of this condition on the extremities of long bones analysed in Tomb I, which yielded observable results for this parameter. Once again, results are quite poor and no alterations were scored above degree 1. For upper limbs, two alterations were scored on the proximal extremity of right humeri. No alterations whatsoever were found on the radius. The proximal extremities of a right and a left ulna showed a slight alteration.

It was possible to observe the distal extremities of 24 femurs, of which two left and six right showed degree 1 lesions in this area. As for the proximal extremity of this bone, only one case of osteoarthritis was identified, on a left bone.

Table 165 - Osteoarthritis observed in bones from Tomb I (Perdigões).

		Degree Left		Degree Right	
		0	1	0	1
Humerus	Proximal	3	0	5	2
	Distal	9	0	12	0
Radius	Proximal	6	0	5	0
	Distal	10	0	7	0
Ulna	Proximal	17	1	9	1
	Distal	3	0	6	0
Femur	Proximal	2	1	11	0
	Distal	6	2	10	6
Tibia	Proximal	6	0	3	0
	Distal	11	0	9	0
Fibula	Proximal	5	0	2	0
	Distal	6	0	2	0

In general terms, what can be highlighted regarding the results observable in Table 166, that describes enthesal changes scored for bones from Tomb I and summarizes the realities registered during the study by phase is the scarcity of results, although some alterations were registered. No alteration was classified above degree 2. The only bones scored with degree 2 were femurs. Of the 18 observable left femurs one had a degree 2 alteration on the *linea aspera* and two out of the 22 right femurs observed presented the same condition. The degree 1 enthesal alteration on the femur are all on the right side and affect the great trochanter in three cases and the lesser trochanter in one. For left femurs, only a slight degree 1 alteration was registered in a digital fossa.

The anterior surface of four right patellae (n=11) showed degree 1 enthesal change and the same degree was observed in two right ones (n=6). For tibia, only one degree 1 alteration was registered on the soleal fossa of a left bone and another on the anterior tuberosity of a bone from the same side. Three right fibulas were also classified as having degree 1 alteration of the tibiofibular ligament.

Three calcanei (two left and one right one) showed degree 1 alteration in the calcaneal tuberosity.

Upper limbs presented alterations. The humerus is the bone most affected: in four left supracondylar ridges and seven right ones, degree 1 alterations were observed and also on one left lateral epicondyle. The same degree was described on the bicipital tuberosity of two right radii.

For other bones, a right clavicle showed signs of alteration (degree 1) on its sternal extremity and another on the area of the deltoid tuberosity. It was also possible to observe several fragments of ilia for enthesal changes resulting in the identification of degree 1 alteration on a right and a left iliac crest.

Table 166 - Enthesal changes observed in bones from Tomb I (Perdigões).

		Degree Left			Degree Right		
		0	1	2	0	1	2
Scapula	Coracoid Process	6	0	0	12	0	0
	Acromion	4	0	0	9	0	0
Clavicle	Sternal extremity	9	0	0	4	1	0
	Deltoid Tuberosity	4	0	0	6	1	0
Humerus	Medial Epicondyle	6	0	0	13	0	0
	Lateral Epicondyle	4	1	0	15	0	0
	Trochlea	9	0	0	15	0	0
	Lateral Supracondylar Ridge	11	4	0	15	7	0
Radius	Bicipital Tuberosity	6	2	0	4	0	0
	Radial Styloid Process	7	0	0	5	0	0
Ulna	Proximal extremity	18	0	0	10	0	0
	Styloid Process	3	0	0	3	0	0
Ilium	Iliac Crest	18	1	0	17	1	0
	Ischiatic Tuberosity	12	0	0	9	0	0
Femur	Greater Trochanter	5	0	0	3	3	0
	Lesser Trochanter	3	0	0	6	1	0
	Linea Aspera	17	0	1	17	3	2
	Digital Fossa	2	1	0	6	0	0
Patella	Anterior Surface	4	2	0	7	4	0
Tibia	Soleal Fossa	2	1	0	2	0	0
	Anterior Tuberosity	2	1	0	2	0	0
	Distal	9	0	0	1	0	0
	Medial Malleolus	8	0	0	5	0	0
Fibula	Biceps Femoris	0	0	0	0	0	0
	Lateral Malleolus	11	0	0	3	0	0
	Tibiofibular Ligament	4	0	0	1	3	0
Calcaneus	Tuberosity	18	2	0	19	1	0
	Adductor Hallucis	9	0	0	8	0	0

5.3 Afterword: One Tomb, two different approaches.

Two different approaches to the life of Tomb I were attempted during this work. Together with the per-phase study of Tomb I, made possible by a careful archaeological excavation of this feature, a complete study of the human bones was also carried out, providing an integrated and complete perspective of the use of the tomb for funeral purposes, regardless of the archaeologically defined phases.

The per phase approach adopted in this study is not the usual one in this type of monument in the south of Portugal and in the specific case of Tomb I our aim was to paint a picture of the potential different uses of the monument in detail and make it possible to characterize, in a much more detailed and fine mode, the different moments of deposition of human remains in this great collective monument, and to identify possible differences in terms of number of individuals deposited, their age, sex or other important aspects involved in the funerary use of the monument. An historical perspective applied to the anthropological study of this monument unquestionably allowed for greater functionality and interpretative scope.

The work involved in the per-phase study of this kind of monumental funerary structure is obviously enormous and extremely time consuming. In the case of Tomb I, it could be said that the results for each phase mirror the same reality: the collective, commingled use of this tomb for deposition of human remains from both sexes and individuals of all ages. The differences identified deserve, nonetheless, to be underlined as the per-phase study results proved it to be a fruitful exercise for more than one reason. Primarily because it provided very solid means for the understanding of the complex use of the monument throughout its different phases, which would not be possible had the effort not been made. This is in fact an anthropological thesis based on and framed by the archaeological work carried out in Tomb I throughout the several campaigns in which the author of this work participated. The anthropological per phase study was an important tool for the confirmation of the proposed archaeological phases to which it responds and complements. These were created based on archaeological and stratigraphic observations that combined defined phases of use of Tomb I and the extremely complex and intense use of this Tomb as a funerary structure for the deposition of the remains of hundreds of individuals.

The global analysis of Tomb I led to the definition of a total **MNI** of 103 individuals of which 48 were considered non-adults (≤ 15 years old). However, the analysis of the per-phase information regarding MNI shown in Figure 123 makes that number look quite conservative. Indeed, the simple exercise of adding up the MNI estimations for each phase would make that global number rise considerably, to 90 adults and 76 non-adults, a total of 166, not counting the collection of non-referenced bones and the ones with no sure provenance, which would raise the numbers to 98 adults and 80 non-adults, a total of 178 individuals.

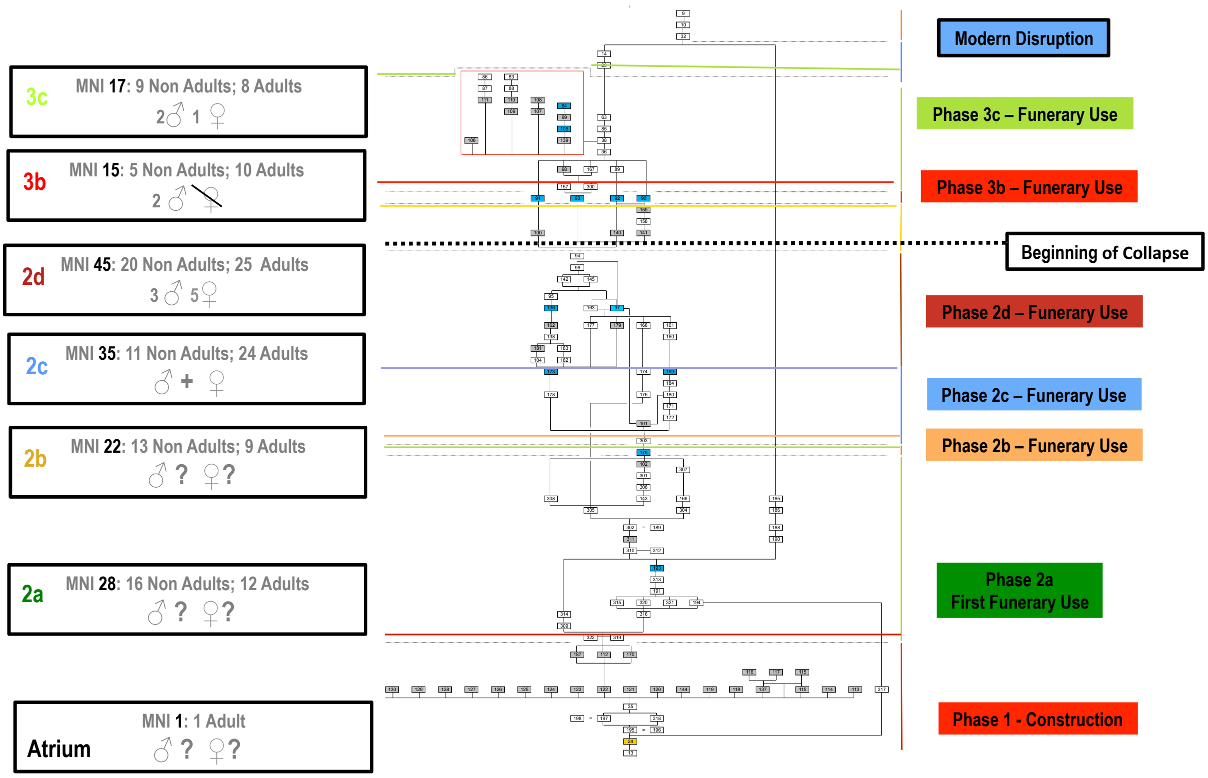


Figure 123 - Schematic synthesis for the use of Tomb I (Perdigões) per phase.

In the case of Tomb I, for minimum number of individuals, the real number will probably be somewhere in between the one obtained through the per-phase study and the one revealed by the global approach. But there seems to be no doubt this is a monument that received the remains of a considerable number of individuals, strengthening the idea of the collective nature of the depositions.

Regarding paleodemography, in the **estimation of age-at-death** for non-adults in Tomb I it was possible to identify human remains of individuals whose ages range from birth to early adulthood, and once again, the differences between the per-phase study and the global one are not relevant and it can be said that there are no significant differences between the existing age groups throughout the use of Tomb I as can be observed in Table 167 for non-adult individuals. There is also no great difference between what is observed in the per-phase study and the global one regarding this criterion for adult individuals.

Table 167 - Age-at-death synthesis for the several phases of use of Tomb I (Perdigões).

	<1	**1 - 4**	**5 - 9**	**10 - 14**	**15 - 19**
2A	1	3	9	3	0
2B	1	3	6	3	0
2C	1	3	3	4	1
2D	1 (?)	7	9	3	2
3B	0	1	3	1	0
3C	0	2	4	3	0
N Ref	0	1	1	0	0
TOMB I	2?	12	22	12	6

The low rate of **sexual diagnosis** makes the comparison between these total results for Tomb I and the observed for the per-phase study difficult (Table 168)

As had already been observed, sexual diagnosis was not possible for Phase 2A and 2B, due to poor bone preservation although the proportion of adults defined through MNI estimation was in both phases around 40%. Phase 2C demonstrated the probable presence of both male and female individuals based on morphological analysis of single attributes of the *os coxae* and the cranium, and metric analysis was only possible on one talus, with results below the sectioning point and indicating it belonged to a feminine individual. The number obtained for minimum number of female individuals for Phase 2D, based on humerus measurement was in fact the same that yielded the final female number in the global study. These are also the only two occasions where female proportion is higher than the male one. Phase 3B and 3C also allowed the determination of sex for male and female individuals although no reliable female remains were identified in Phase 3B. The scarcity of these results does not allow many more conclusions.

Table 168 - Sex diagnosis per-phase for Tomb I (Perdigões).

	Male	**Female**	**Proportion %**
2A	no	no	0/0
2B	no	no	0/0
2C	1? (4,2%)	1? (4,2%)	50/50
2D	3[1] (12%)	5[2] (20,8%)	37,5/62,5
3B	2[3](20%)	no	100/0
3C	2[3](50%)	1[4] (12,5%)	66,6/33,3
N Ref	no	no	0/0
TOMB I	4[1](16%)	5[2] (20,8%)	44,4/55,6

[1] FVHD [2]HBW [3]CM1 [4]TM1

Moreover, as is illustrated in Figure 124, this per-phase study has proved useful for the understanding of the dynamics of intensity of use of the chamber for the deposition of human remains and different sets of artefacts, which again, would be impossible through a simple, global approach. Although specific bone representativeness will be addressed later in this discussion, to illustrate this specific purpose and to facilitate analysis of human remains, the tens of thousands of fragments the excavation of Tomb I yielded, were divided into 10 generic groups of bones: cranial fragments, teeth, fragments belonging to pelvis and shoulder girdle, arm, leg, foot and hand fragments and finally ribs and vertebral elements. The graph (Figure 124) conveys the differences in intensity of use throughout the archaeologically defined phases. It is clear that Phase 2 received many more depositions than Phase 3. It is also clear that in the former there is a gradual increase in human bone depositions starting in Phase 2A, which after a slight decrease in Phase 2B reaches its peak during Phases 2C and D. The monument then starts to collapse and after a slight decrease in the use of the chamber during Phase 3B a new increase in human depositions is visible in the last known contextualized phase for this Tomb, in Phase 3C. It is also interesting to note that the relative proportion of the main 10 groups of bones defined is mostly maintained throughout the use of the monument, regardless of the number of bones per phase.

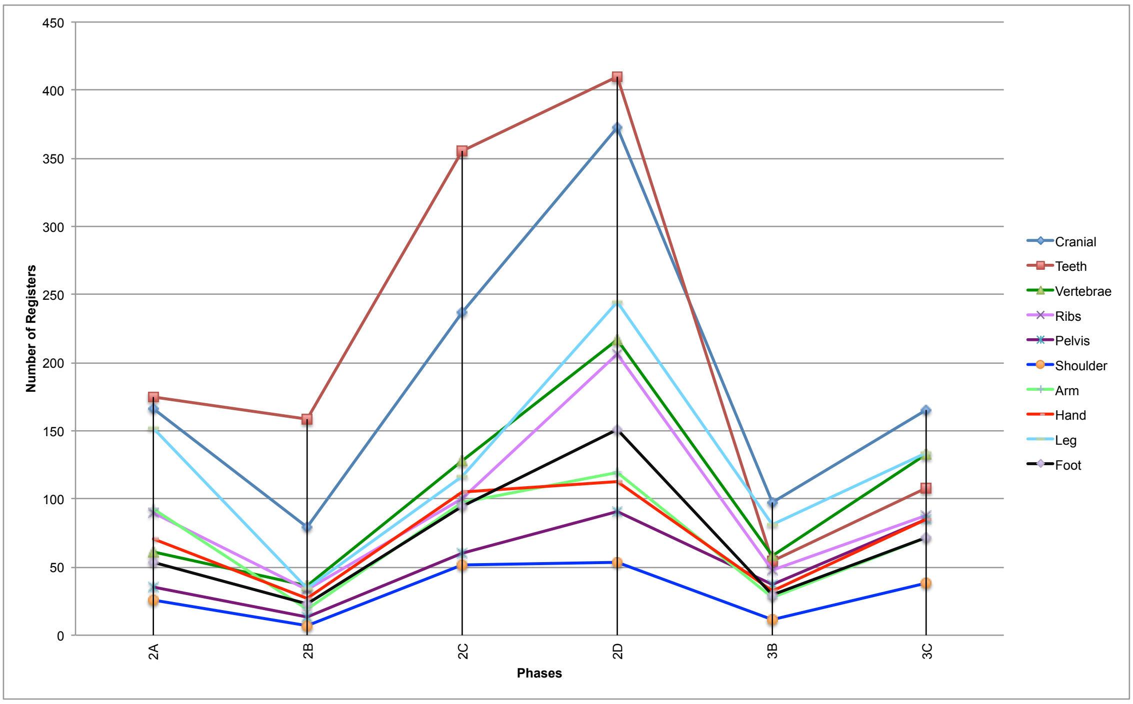
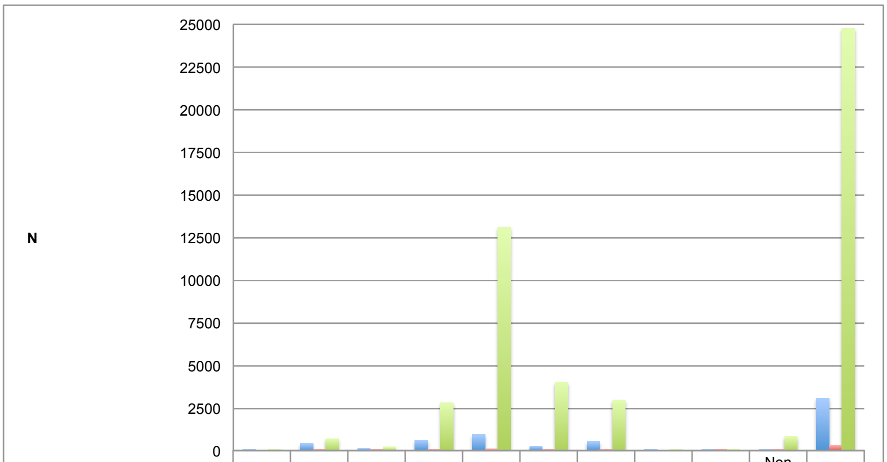


Figure 124 - Funerary use of Tomb I (Perdigões) throughout the different defined archaeological phases.

This idea is useful only as a schematic quantitative way of conveying the use of Tomb I in absolute terms.

Indeed, the **quantification** of the collection of human bones recovered from Tomb I is not an easy task. This is because the absolute number of 61926 bone and 1579 tooth fragments recovered, particularly in the case of bones, the result of a great level of fragmentation. Every attempt was made to try to find compatibilities and glue different fragments from the same type of bone, although these attempts were fruitless.

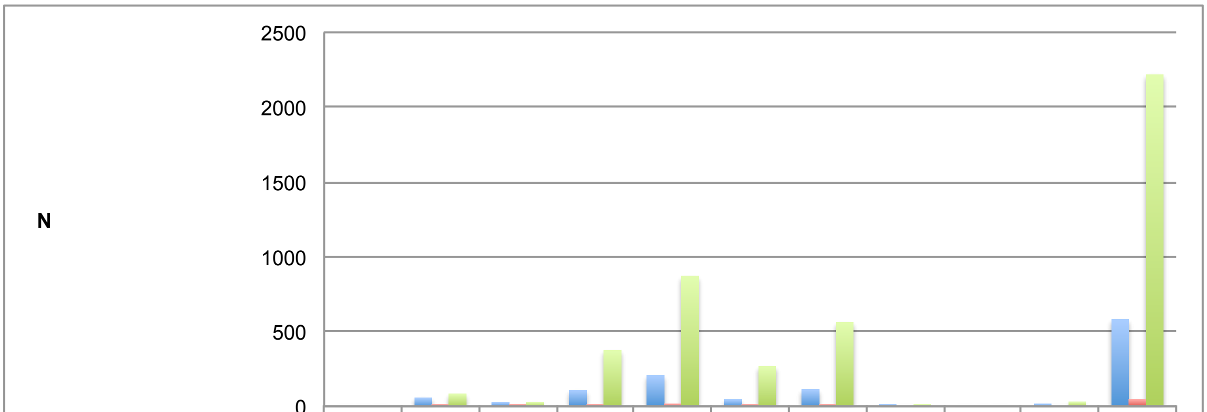
In order to further convey the idea of the very high level of **fragmentation** of the bones from Tomb I, Figure 125 (for adult bones) and Figure 126 (for non-adult bones) summarize a comparison between the number of individualized records for bones, the total number of fragments they include and the number of bones that among them are not fragmented. As is clear from both graphs, the level of fragmentation is very high when compared to the number of individual registers in every phase for adult and non-adult bones. In addition, the number of complete bones amongst the count of individualized bones is extremely low. The proportion between the three categories is very similar, regardless of the number of bones per phase.



	Atrium	2A	2B	2C	2D	3B	3C	4A	4B	Non Ref	TOTAL
Individualized Registers	11	430	139	619	954	268	544	23	15	84	3087
Non Fragmented Bones	0	40	14	57	101	31	66	0	3	3	315
Total Number of Fragments	64	706	215	2823	13114	4017	2967	28	15	831	24780

Figure 125 - Bone preservation for adult individualized bones per phase for Tomb I. (Perdigões).

Non-adult bones seem to present a similar pattern of preservation as adult bones. Figure 126 presents the ratio between the numbers of complete bones found amongst individualized registers, which are then compared with the total number of fragments they comprise. Once again, the complete bones represent a small percentage of the count (8,3% of the total registers) and the proportion between the three groups is constant throughout the use of the monument, regardless of the total number of bones involved.



	Atrium	2A	2B	2C	2D	3B	3C	4A	4B	Non Ref	TOTAL
Individualized Registers	0	58	26	108	207	46	113	5	0	18	581
Non Fragmented Bones	0	7	3	7	18	3	10	0	0	0	48
Total Number of Fragments	0	82	28	374	870	266	561	5	0	30	2216

Figure 126 - Bone preservation for non-adult bones per phase for Tomb I (Perdigões).

This situation was closely related to the state of **preservation** of the bones and it is clear when analysing the results of Table 169 that the degree of conservation of these bones is proportional to the number of identifiable bones per phase, as would be expected. Indeed, as the phases succeed one another in time, the number of non-identifiable bones, which were divided into adult and non-adult registers decreases as the number of identifiable fragments increases. As has been seen throughout this work, the presence of non-adult remains is uniformly strong, regardless of the phase analysed. Once again, high fragmentation may have led to the misidentification of bone fragments belonging to non-adults (especially teenagers), which may have been inadvertently mixed up with adult remains. Indeed, it is not difficult to imagine this happening in a large, collective funerary structure of this kind, where long bone extremities are very often missing. In the presence of mostly diaphysis, bones belonging to adolescents can be easily misplaced (Silva 1996, 2002).

Table 169 - Percentages of each bone register observed for Tomb I (Perdigões)

%	ID*Adult	ID* N-	Cranium	Rib	Vertebra	NILB**	NI***	Total Frag.
2A	15,7	1,8	19,4	4,4	2,7	54,5	1,3	4478
2B	9,9	1,3	15,6	5	3,2	18,8	46,2	2160
2C	29,1	3,9	27,8	2,9	2,4	24,6	9,4	9704
2D	49	3,3	8,9	2,3	1,8	10,3	24,2	26739
3B	50	3,3	17	1,7	1,5	7,7	18,5	7991
3C	35,7	6,8	14,9	3,3	3,4	17,2	18,8	8310
N Ref	36,9	13,3	16	0,9	2,4	11,3	31,1	2246
TOMB I	40	3,6	15	2,7	2,9	16,7	19,7	61926

ID: Individual Registers; NILB: Non-identified long bones; NI: Non-identified bones.

For the cranial skeleton, in all the phases, the most preserved region is the mastoid (temporal bone). This is a dense, relatively heavy bone with good resistance to the process of destruction (Waldron, 1988; Silva 2002; Silva et al., 2015). It is even the most well represented part of the skeleton in Phase 3B (Table 89) and for the remaining phases, except for Phase 2A (Table 19) and Phase 4A (Table 124) it is the second most represented skeletal part. Small fragments of frontal, parietal and occipital bones are present in every phase but in most cases, do not allow a direct quantification, since it cannot be determined how many complete skulls they correspond to. The values for cranial fragments must be analysed with caution. First because unlike any other skeletal element, cranial fragments are very easily distinguished from others and so it is possible to say, with some certainty that only a small percentage of fragments from the cranium were included in the non-identified category. This, in itself, helps explain the high percentage of cranium fragments throughout the collection. What is more, and taking into consideration the undeniable level of fragmentation, the analysis of the number of cranial fragments must take into account the fact that, because of its morphology, the human cranium can break into almost infinite pieces and the number described in the table below are based on fragment count. However, and even if these two important factors are taken into consideration, there is little doubt that cranium is very well represented in Tomb I.

Figure 127 shows how lateralized long bones are distributed per phase of use. Once again, in general terms, the presence of the main long bones is constant in throughout the use of the Tomb I. The femur was the most well represented long bone in Phases 2B, 2C, 2D and 3B, followed by the humerus. These two bone types may have preserved better than other skeletal elements because they are larger than the other bones, especially in adults (Byrd and Adams, 2003) and more easily identified when compared to the fibula or radius, for example. The radius and the fibula are the least found. Except for Phase 2B (the smallest of all the phases), where there are no lateralized fragments of fibula or ulna identified, all the other phases present example of all other long bones.

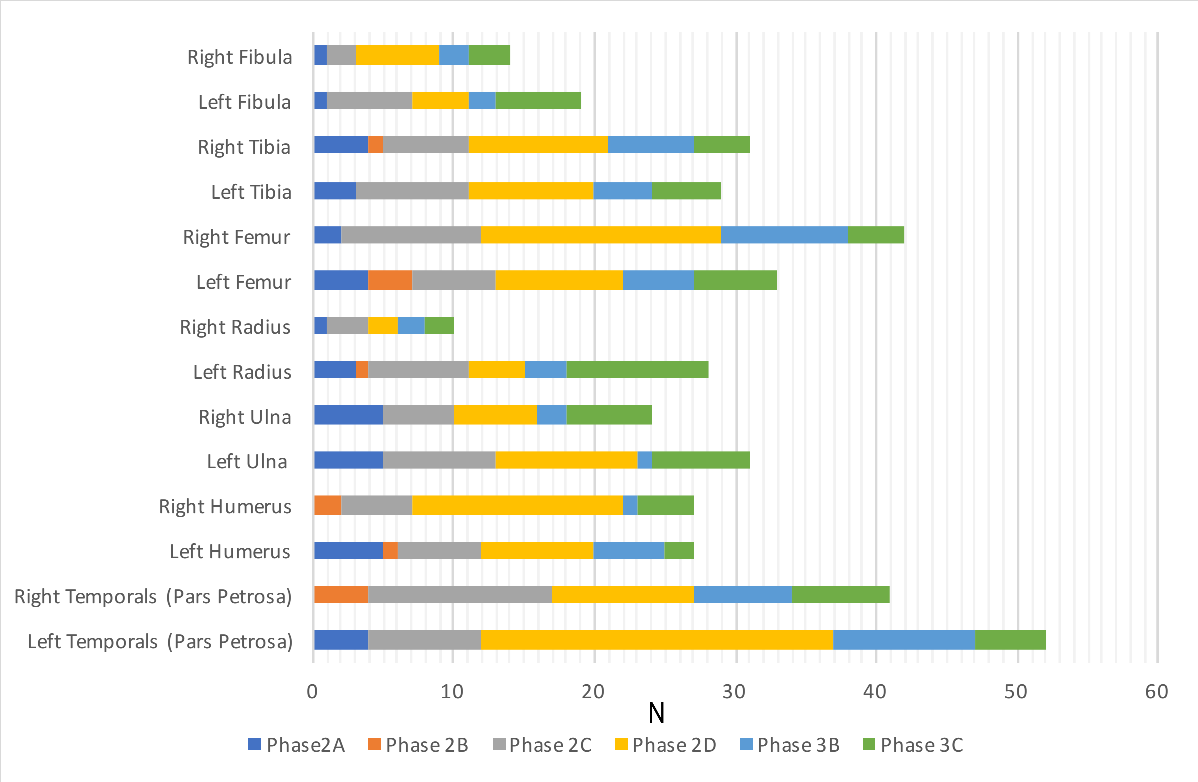


Figure 127 - Quantitative distribution of cranial and long bone fragments throughout the phases of use of Tomb I (Perdigões).

It is generally the regions of the diaphysis that show better preservation in long bones. In the case of this work the tables created based on the method proposed by Herrmann et al. (1990, adapted by Silva,1993), in addition to MNI of adult individuals based on bones allowed us to ascertain, which regions of the several long bones were best preserved as can be seen in Table 170 (the bold areas are the most frequently preserved regions of the bones). In Ana Maria Silva's work on Portuguese prehistoric populations, results for bone preservation are very similar to the ones obtained for Tomb I. With very few exceptions, the best-preserved bone regions are always the same ones for each long bone analysed (Silva, 2002, p.70).

Table 170 – Best preserved bone regions for the different phases of use for Tomb I (Perdigões).

	Humerus	**Radius**	**Ulna**	**Femur**	**Tibia**	**Fibula**
2A	Distal 1/2	Distal 1/3	Proximal 1/3	**Distal**	Middle 1/3	**Diaphysis**
2B	**Distal 1/3**	Middle 1/3	n.o.	**Distal**	**Proximal 1/3**	n.o.
2C	Distal Diaphysis	Middle 1/3	**Proximal**	Proximal	Middle 1/3	**Diaphysis**
2D	**Distal 1/3**	**Proximal 1/3**	**Proximal**	Proximal	**Proximal 1/3**	**Diaphysis**
3B	**Distal 1/3**	**Proximal 1/3**	Distal Diaphysis	**Distal Extremity**	Distal 1/3	Distal Diaphysis
3C	**Distal 1/3**	**Proximal 1/3**	**Proximal**	Proximal	**Proximal 1/3**	Distal Diaphysis

In the post-skeletal skeleton, the bones that are generally worse preserved are the shoulder blade, the ribs, the hip bone and the sacrum due to their irregular shape and because they are mainly composed of trabecular tissue (Nawrocki, 1995). In the case of Tomb I, preservation of the scapula is secured by the conservation and lateralization of the area of the glenoid cavity, the most resistant area of that bone (Silva 2002). For the ilium it is also present due to the survival of the area of the ischium. The sacrum and the sternum are in fact very poorly preserved.

For the registers of rib and vertebral fragments (cf. methodology chapter) their proportion is very much the same throughout the phases, regardless of the number of bone fragments present. The global analysis of the tomb is not the result of the average obtained of the pre-phase values (and only the contextualized phases were considered) but takes into account the whole bone collection observed. Nevertheless, it reflects the main characteristics expressed in the previous analysis.

Unlike bones, it was possible to identify the great majority of teeth. Found mostly loose, although some were preserved in situ (Table 150), more than 95% of the recovered teeth were given an identification. The ones that were not possible to identify correspond to cases of very high wear or broken fragments of roots that were counted and included in the cranial counts. Most of them correspond to permanent teeth with deciduous dentition occupying an average of around 5% throughout the phases. The importance of the distinction in loose teeth between totally formed or in formation is that the latter provide the best base for the estimation of age-at-death and are responsible for the assessment of the proportion of adults and non-adults throughout the phases of use. Once again, the total results for Tomb I include the teeth attributed to Phase 4 and the atrium, which have not a sure provenance.

Table 171 - Percentages of teeth observed for Tomb I (Perdigões)

	Permanent Teeth				
%	**Totally Formed**	**In Formation**	**Deciduous**	**Supernumerary**	**Total**
2A	81	15,7	3,2	0	216
2B	81,9	12,9	5,1	0	194
2C	91,7	5,4	2,8	0	387
2D	81,8	10,6	7,6	0	501
3B	76	15,5	8,5	0	71
3C	74	19,2	6,2	0,7	146
N Ref	92,4	3,8	3,8	0	53
TOMB I	83,8	10,9	5,3	0,1	1579

However, **representativeness** of the different types of bones of the skeleton is a slightly more complex parameter to analyse in Tomb I, although essential for the understanding of the funerary gestures that took place in this tomb, especially with regard to the possible selection of types of bones along the different phases of use. The first obstacle to the full understanding of this parameter, specially in the older phases, is the low MNI count based on most bones.

This is a result of the high level of fragmentation of bones, which, in many cases was so high as to make it impossible to identify many bones properly and provide them with laterality. This circumstance is obviously reflected in the bone-based MNI values, and what is more, results in a sub-representativity, especially for the more fragile bones. To overcome this problem, some investigators, have used the weight of different parts of the skeleton to evaluate and quantify any missing bones (Malinowski and Porawski, 1969; Herrmann, 1976. McKinley, 1993 Crubézy, 1988, Duday et al., 2000; Silva, 2002; Silva et al., 2009; Gonçalves, 2012; Gonçalves et al., 2013; Gonçalves et al., 2015). The application of this method has proved to be more effective and easier to apply than representatativeness of the bone pieces as it allows the inclusion of all the recovered bone fragments, since their weight is maintained regardless of any fragmenting taphonomic effect. It is nonetheless an approach full of limitations and problems that hindered its application on the bones from Tomb I.

Besides the dangers arising from poor anatomical identification, such as the possibility of non-human remains being included in the weighed sample, or the intrinsic factors that have a direct interference in bone weight (like age, sex, or body mass differences) and prevent a direct comparison with references obtained from modern cremations (Malinowski and Porawski, 1969; McKinley, 1993, Gonçalves, 2012; Gonçalves et al., 2013; Gonçalves et al., 2015) it was the impossibility of a proper cleansing of the bones that rendered the application of this specific approach unfeasible. Indeed, for Tomb I, and although the long process of cleansing was performed for the tens of thousands of fragments recovered, it was impossible, for many long bones, for example, to remove the dirt that often fills the most inner sections. In addition, in other cases, the complete removal of dirt would result in the complete fragmentation of the bone structures kept together through the presence of dirt. What is more, heavy concretions were identified on the surface of many bone samples (cf. Extrinsic Factors chapter) and in most cases the choice was to leave it rather than to remove it.

Thus, for this work only the analysis of bone representativeness was fully performed and the weighing of the various bone categories was only experimented for the first two phases of use. The analysis for Phase 2A and Phase 2B, followed Silva et al. (2009) according to which anatomically indeterminate bones are excluded from the count. This approach revealed itself to be insufficient and impaired weight analysis and subsequent comparisons because the ratio of each anatomical group to the bones identified could not represent an objective value.

Thus, left with only bone representativeness to shed light on any potential preferential presence or absence of specific skeletal parts during the use of Tomb I, and taking into account the state of fragmentation of the bones, clarification of this theme can only be partial.

On the whole, all skeletal parts seem to be represented. The questions arise when the proportion between the different bones is analysed. If the individuals from Tomb I were buried as complete skeletons, then there would be a similar MNI for the different sized bones, including cranial remains, consistent with a primary mortuary context. This is not the case for any of the phases studied in Tomb I. The hypothesis that parts of possible pre-existing primary depositions where removed from Tomb I cannot be ruled out as will be discussed below.

The pattern for most phases is characterized as having high frequencies of preserved cranial fragments. For almost every phase, except Phase 3B, it is the teeth that provide MNI. They correspond mostly to lose dentition but their presence necessarily implies the presence of at least some parts of the original bone structure they were inserted into. Even taking into account the ability of dental enamel to survive much longer than bone tissue, their high presence must be valued. This presence is seconded by the strong presence of temporal bones also in all phases.

Cranial fragments (including teeth) are followed by long bones. Femur and humerus were the most well represented bones in all phases. It is true that these two bone types may have preserved better than other skeletal parts because they are larger than the other bones, especially in adults (Byrd and Adams, 2003). Following the remaining long bones, come the scapula (represented by the glenoid cavity), the large tarsals, specially calcaneus, navicular and talus and then, clavicles and bones with frequencies generally lower than 20%. Some carpal bones are absent in certain phases. Even so, 2 hyoid bones were recovered from Phase 2A.

The comparison between the obtained and theoretical proportions of the upper and lower monoradicular and pluri-radicular teeth (Crubézy et al., 1998a; Silva, 2002) was also performed as it represents yet another type of analysis that may contribute towards the recognition of the type of burial present in collective graves. Throughout the phases of use of Tomb I, the proportions obtained between upper and lower monoradicular and pluriradicular teeth are systematically different to those theoretically expected, with greater deviation in the monoradicular lower which, as it happens, constitute the group of the most fragile teeth.

Another important conclusion resulting from the per-phase anthropological study of the human remains was that it made it clear that **different physical areas** of the chamber were used for the depositions of human remains and artefacts at different phases. As yet, there is no explanation for the fact that in Phase 2A, the peripheral area was used, to be followed in Phase 2B by the occupation of the central area of the chamber, where no remains of the previous phase were found. As the phases progress into Phase 2C, there is a widespread of the use of the available areas of the tomb, except in the areas where schist slabs had fallen onto the ground. By Phase 2D, the maximum funerary intensity had been reached in terms of space and number of depositions. In Phase 3B depositions occurred mainly on fallen slabs and during Phase 3C, when the monument was already severely structurally damaged, depositions are to occupy every free space in between the many collapsed structural elements. Whether these were deliberate actions cannot be determined with any certainty, although it would appear that knowledge of the pre-existing remains and artefacts were taken into account at each subsequent phase, especially during the whole of Phase 2.

This per-phase study also allowed the identification and recognition of an important nuance in relation to the use of Tomb I throughout its various phases. An overall count of the **main artefacts categories** found alongside the human depositions shows a different dynamic of deposition from that of human remains. The spatial analysis of the use of Tomb I had already pointed in this direction but the systematization of the data in Figure 128 confirms the idea.

Overall, the funerary artefact set consists of dozens of ceramic vases, some limestone vases, hundreds of arrowheads, blades and beads (mostly green stone). In smaller numbers, diverse artefacts also appear including knapped flint, several bone/ivory artifacts (pins, idols, phalange idols, bone cups, zoomorphic figures in ivory and other fragments of decorated or polished bone). Also worth mentioning is a small ivory staff in polished and decorated bone, with features unparalleled in our country.

The analysis of Figure 128 shows that not only does there not seem to be the same constancy in proportion between the different categories of objects that varies quite significantly across the phases of use, but it also demonstrates that it is in the phase with fewer human depositions (Phase 2B) that the higher number of artefacts was recovered. In the same way, Phase 2D, where the highest numbers of human remains were recovered yielded the smallest group of artefacts. It is difficult to ascertain why this occurred but it can be thought to show that these objects are most likely not deposited to accompany specific individuals but are rather votive artefacts presented to the "general" dead deposited in the tomb. It is almost impossible to establish spatial associations defined between objects and individuals. It is even quite plausible that such personalization was originally not necessarily very important within the funerary ideology prevailing among the societies of the 4th and 3rd millennium of the south of the Iberian Peninsula, where the notions of collectivity and communality seem to dominate over those of individuality in the definition of space and funeral rite. On the one hand, this is due, to the succession of episodes of use and re-use that many of these funerary structures experience throughout their useful life, resulting in an intense mixture of human remains and objects. As has been noticed for other funerary contents of this period, the possible movement of human remains from one part of the funerary chambers to the other, and the entry and exit of objects from the funerary chambers, could also be responsible for the loss of any original personalization of the objects making this relation to become invisible in the archaeological record (García Sanjuán and Díaz-Zorrita, 2013).

Some aspects of the stratigraphy reveal particularisms that can be emphasized. The predominance of blades in the oldest depositions should be mentioned. It would soon cease to occur. It is also in older contexts that the only schist-plaque was identified (in very late contexts another was collected resulting from the reuse of a fragment of a pre-existing plaque).

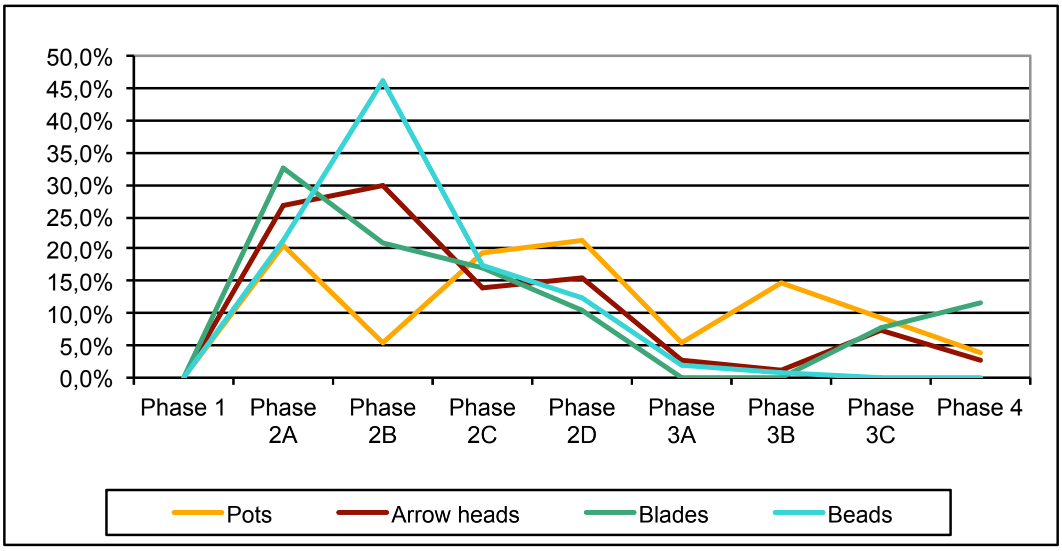


Figure 128 - Artefact Distribution through the different phases of use of Tomb I (Perdigões).

5.4 Summary

Two different approaches to the life of Tomb I were attempted during this work. Together with the per-phase study of Tomb I, a complete study of the human bones was also carried out, providing an integrated and complete perspective of the use of the tomb for funeral purposes, regardless of the archaeologically defined phases.

As will be seen, the results for the global approach for Tomb I, to a large extent mirror the results obtained in the per-phase approach regarding the main parameters analysed. This global approach to Tomb I will be the basis of the discussion in the following section where the total results obtained for Tomb I will be incorporated into the discussion and compared to what is known for other tholos/tholoi type monuments in Portugal and to the known anthropological reality of Perdigões Archaeological Enclosures.

someone will remember us
I say
even in another time

Sappho, If Not, Winter: Fragments of Sappho

6 Discussing Tomb I

This section of the work will discuss data obtained through the anthropological study, the paleodemographic reconstruction and the identification of potential patterns in mortuary practices of the global skeletal sample from Tomb I. The identification of thousands of human bone fragments suggested the presence of a large number of individuals in this collection and the degree of fragmentation and commingling suggested that Tomb I may have functioned as a structure for the deposition of human remains with a specific role, and possibly meaning, in the scope of what is known for the rest of the funerary practices taking place in Perdigões, adding relevant information to the understanding of Chalcolithic funerary behaviours and practices. Unfortunately, only a part of the human remains exhumed in Perdigões are studied from a bioarcheological point of view and so comparisons will also be found outside the boundaries of Perdigões enclosures, in the other tholos/tholoi type structures known in the south of what is today Portuguese territory.

It is in Perdigões, where Tomb I is located, that the first contextualization and comparisons should be sought. The verification of different hypotheses concerning the treatment given to the dead in Tomb I, the demonstration of the complex funerary world in Perdigões and how this specific structure fits into the variability of mortuary practices known in Perdigões would necessarily require an integrated study based on appropriate methodologies to try to understand the osteological sets and votive materials associated to each different funerary context in Perdigões. As is clear, this holistic approach to the funerary phenomenon in Perdigões is still not possible at the moment and is further precluded by the limitations of our own frame of reference. Indeed, we are dealing here with fragmentary realities of a wider “whole” which is unknown to us, concerning the social structures and the cultural meaning associated with these ancient mortuary practices.

The full bioarchaeological study of human remains from Perdigões is restricted to the Late Neolithic depositions of Pits 7 and 11, the Chalcolithic cremated remains from Pit 16 and the open area levels of cremations in Sector Q (Godinho, 2008; Valera, 2008a; Valera e Godinho, 2009; Pereira, 2014; Valera et al, 2014; Silva et al, 2015;). The numerous cremated depositions from Pit 40 are under study at the moment as are the human remains identified in the only other structure typologically similar to Tomb I, which isTomb II. Another probably large collective burial was identified close to Tomb II but this denominated Tomb III was only superficially delimited, although the human remains found were studied (Evangelista and Silva, 2013). The many times isolated depositions of human remains, in several of the ditches on the site, which started happening in the Middle Neolithic, right up to the Chalcolithic, will also be integrated in a study underway.

Tombs I and II belong a type of funerary architecture that appear in the archaeological record at the turn of the 4th to the 3rd millennium BC. Although the close association of tholos/tholoi type monuments to large ditched enclosures is not a novelty, they can also be found scattered isolated or in small nuclei around the landscape (confirm Tholoi Type Structures sub-chapter)

Based on these premises, and within the above-mentioned limitations, the choice throughout this discussion will be to take the global anthropological results obtained for Tomb I and compare them over several scales of analysis: first comparing them with other tholos/tholoi type structures from the south of Portugal. Afterwards, narrowing the scope, and supported by the conclusions, to try to understand the role of Tomb I in the wider funerary practices known for Perdigões.

The first level of analysis must necessarily only consider the global results for Tomb I. This is because, although a considerable number of tholoi type monuments have been identified and excavated in southern Portugal, there is a relative lack of anthropological data on them (Silva, 2012; Boaventura et al., 2014). Most were excavated in the “classical” period of Portuguese archaeology in the mid 20th century and their investigators privileged architectural and artefactual information over human remains. What is known about the biology and funerary practices of the populations that placed the remains of their dead in these monuments is scattered in archaeological short reports and articles.

As is the case of south-western Spain (Camara Serrano, 2001; Díaz-Zorita Bonilla, 2013), Neolithic/Chalcolithic mortuary practices in Southwest Portugal have not been investigated in detail, although some attempts have been made to systematize some of the known information (Inocêncio, 2013; Tomé 2011).

With the exception of a few cases, such as Perdigões Tombs I and II (Lago et al, 1998; Valera et al, 2014), Monte da Velha 1 (Soares, 2008; Silva et al, 2008) and Olival da Pega 2b (only the cremated human remains: Silva et al. 2007/2008) and more recently the monuments excavated in the context of major public works in the south of Portugal (Pereiro, 2010, Figueiredo, 2011a and b; Corga et al., 2011;

Valera et al., 2014, b and c; Dryas, 2011, 2012; Henriques et al. 2013 a and b), the majority of studies concerning anthropological collections recovered from tholoi type structures have been carried out using museum collections (Silva, 2012), which are necessarily totally detached from their original archaeological context. The final information on the some of the recently excavated structures is not yet available and awaits publication but the results will bring valuable information concerning mortuary practices in the same period as Tomb I at Perdigões was being used, and could become the basis for very interesting and enlightening comparisons.

Nonetheless, the corpus of disperse biological and funerary data from these structures deserves to be synthetized and analysed. The analysis was limited to the tholos/tholoi type structures identified in what is today Portuguese territory. This is done for practical reasons although it is recognized that this kind of geographical boundary has no relation with the recent Prehistoric reality. Indeed, archaeology is proving more and more that in the 3rd millennium BC, Southwest Iberia functioned as a cultural unity where there was wide scale mobility of people, animals, objects and ideas between the coast and the Alentejo hinterland, different parts of South Iberia and beyond (Valera, in press).

Fifteen years after the 2000 survey published in the second volume of Era Arqueologia magazine “Ambientes Funerários no Complexo Aqueológico dos Perdigões, - uma análise preliminar no contexto das práticas funerárias Calcolíticas no Alentejo” (Valera et al., 2000), which summarized the information available at the time, much has changed regarding the existing information for sites, their funerary use, rituals involved and the perception of death of the people who built and used these monuments. If these topics were not addressed then, it was due to the paucity of anthropological data. The fact that it is possible update information on some of these monuments, whose human bone collections have since studied exhaustively, is mainly to the work of Ana Maria Silva and collaborators (Silva, 1993, 1996, 2002, 2004, 2005; Silva et al., 2006; Silva and Ferreira, 2007; Silva et al, 2008; Silva et al., 2010; Silva et al., 2012; Silva et al., 2014; Silva et al., 2015c; Evangelista and Silva, 2013; Boaventura et al., 2014; Boaventura et al., 2016a; Valera et al., 2014a).

6.1 Fragmentation

The Figure below (Figure 129) synthetizes the data collected for number of bone and tooth fragments recovered from other tholoi/tholos type structure from the south of Portugal. Results are, as expected, very few and poor, with the number of fragments recovered from Tomb I clearly surpassing every other monument for which this information is available, supporting at least the idea of the great level of fragmentation that bone from Tomb I were subjected to. It must be noted that in the case of Paimogo I and Cabeço da Arruda II (Silva, 2002), Samarra (Silva et al., 2006), Praia das Maçãs (Silva et al., 2007) and Agualva (Boaventura et al., 2016) the anthropological studies are based on collections that result from old excavations with incomplete field information and partial or incomplete collection of human bone material, which was found in museums, many times placed in boxes with no contextual information. The fact that there is no way of knowing if the number of bone and tooth fragments described in the articles corresponds to the total number identified or if they represent partial numbers is noted by the several authors. For Paimogo I, for example, a box containing human bones with the reference “Ditch” was initially considered as not belonging to the original monument. However, as laboratory work progressed, several bones from this box were found to be compatible or could be glued to bones belonging to the main monument and hence considered for the final study despite the uncertain origin of a part of them (Silva, 2002, p. 104). On the other hand, some investigators have different counting methods for bone fragments. If in the case of Tomb I every bone fragment was counted, some investigators, as Ana Maria Silva (personal information), count one fragmented bone as one element, irrespectively of the number of fragaments the bone broke into. This fact also helps explain the lower number of bones in Pai Mogo I, for example.

For Horta João da Moura 1 and 2, the number of fragments is only available for the bones recovered from the Styx, Antropologia (Dryas Arqueologia) team (Corga et al., 2011). These numbers are also interesting when analysed together with the information for minimum number of individuals, as will be seen in the next sub-chapter.

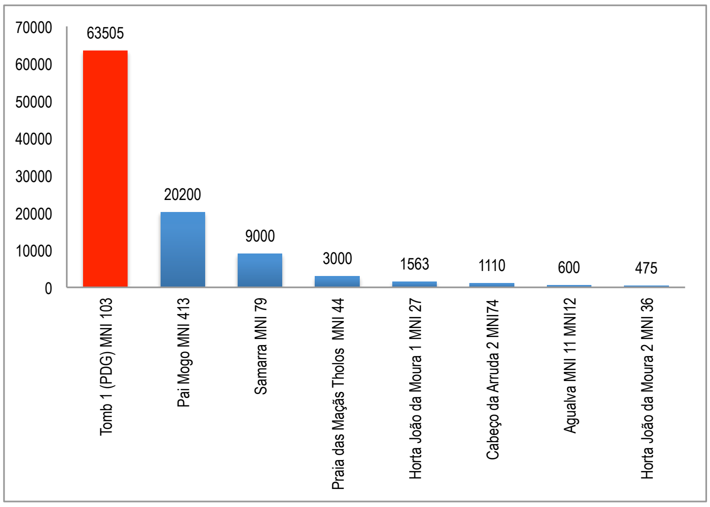


Figure 129 - Number of bone and tooth fragments identified in other tholos/tholoi type structures in the South of Portugal.

Comparisons with other collective or multiple funerary structures in Perdigões is limited by the known data. Pits 7 and 11, were probably used several centuries before Tomb I was in use (Beta – 289263; 4370 ± 40 BP; cal BC 3020-2910 - 2 - Valera e Silva, 2011). The pits also contain primary depositions although a certain level of disturbance of the corpses seems to have happened and the possibility of the handling of the human bones has not been overruled (Godinho, 2008; Valera and Godinho, 2009; Silva et al., 2015). For this context, there are no absolute numbers of bones although their high level of fragmentation is constantly remarked on (ibidem). Tomb I is more evidently compared, in terms of fragmentation to Tomb II, although this information is only based on observations made throughout the several archaeological field campaigns, in all of which the author of this work participated. Thousands of bone fragments were recovered from this structure. Although under study at the moment, it must be said they on the whole present a better level of preservation. The small sample recovered from Tomb III comprised 1525 bone fragments (Evangelista and Silva, 2014a). It cannot be said what percentage of the whole collection this represents, although the level of fragmentation was considered high. The undoubtedly secondary depositions in the central area of the enclosures present levels of fragmentation similar to those observed for Tomb I. It must be taken into consideration when considering this parameter for these structures that they result from the cremation of bones, an action that has obvious effects on the level of their completeness. As already mentioned, only Pit 16 and the open-air depositions were subject to anthropological studies (Silva et al.,2014). Approximately 2500 burnt human remains were recovered from the first structure and around 24264 fragments were recovered from Ambiente 1 and 969 remains from the Cist (Pereira, 2014).

6.2 Minimum Number of Individuals

The definition of the MNI for a large collective burial space like Tomb I is always a complex task. It implies the careful separation of bones and teeth by age and their classification based on type and laterality. Since any of these skeletal elements can prove to be the most represented in a collection, and provide the estimation for MNI, this study must be as thorough as possible (Crubézy, 2000; Silva, 1996). Although MNI is a commonly used method to analyse commingled remains, it can significantly underestimate the population size of the mortuary sample (Adams and Konisberg, 2004; 2008) because it only estimates the recovered assemblage and not the original number of deceased individuals in the mortuary sample. The global analysis of Tomb I led to the definition of a total MNI of 103 individuals of which 48 were considered non-adults (less than 15 years old).

Figure 130 helps contextualize the reality of Tomb I amongst other tholos/tholoi type monuments. Nowadays, it appears quite extraordinary that for only 57,1% of the 84 identified monuments in the south of Portugal is there any mention to the presence of human bones and for only 21% (18/84) is there an actual MNI definition.

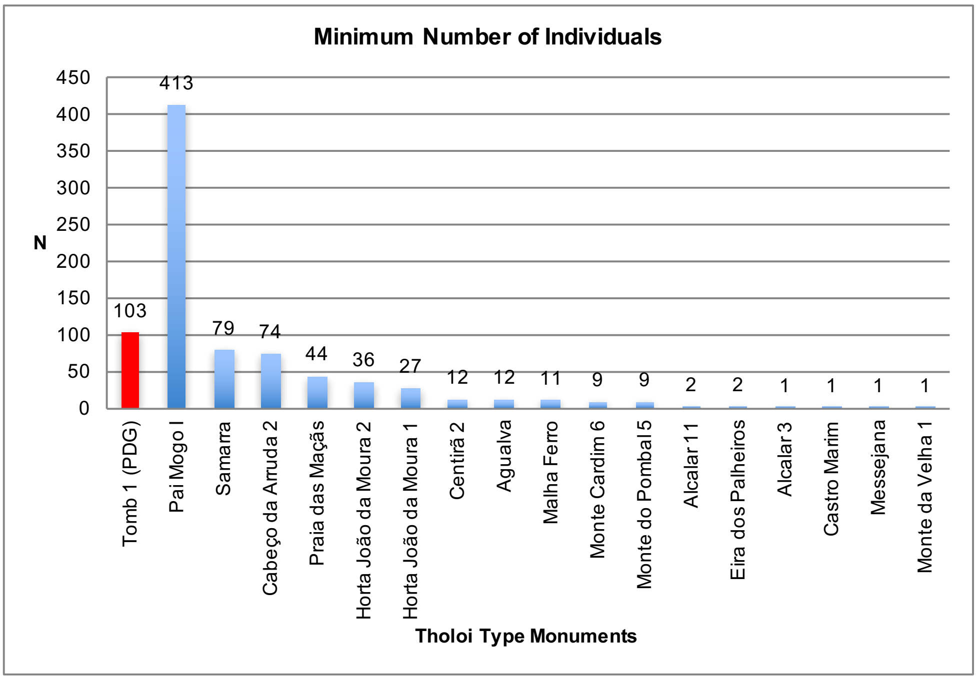


Figure 130 - MNI for Tholos Type Structures in Portugal

Indeed, in most publications where this parameter is mentioned the kind of unspecific expressions used are “Lots” or “Several” individuals as a way of underlining the obviously collective nature of these monuments.

Perdigões Tomb I seems to have higher MNI than other monuments in the Alentejo although this comparison could be a total fallacy considering that in its specific regional group it is the only one where this criterion has been accurately evaluated. Indeed, for most of the monuments the data is partial. For Olival da Pega 2b, the only *tholos* type monument in the Reguengos region intervened in recent years, only the cremated layer of bones has been studied with a defined MNI of 16 (Silva et al., 2007). In her doctoral thesis in 2002, Ana Maria Silva mentions a project on-going at the time concerning the laboratory study of the bones from the small tholos attached to the Olival da Pega 2 dolmen with a defined number of 118 individuals (Silva, 2002, p.118). These values would set the use of this monument very close to what has been defined for Tomb I. Nonetheless, to our knowledge, these results have not been published and so only the 2007 results for the study of the cremated remains by Francisca Cortesão Silva will be considered here (Silva et al., 2014). For the rest of the Alentejo, the monuments around Porto Torrão yielded numbers from 9 (Monte do Pombal and Monte Cardim) to several dozen in the Horta João da Moura monuments. It must be noted that regarding this site, the archaeological intervention was suspended, by decision of EDIA (Development and Infrastructure Company of Alqueva, S.A.), amidst the excavation of collective funeral structures. It is therefore not possible to make a description and subsequent complete diachronic analysis of the funerary use of any of the structures. The data presented here result from the analysis of two different technical reports (Pereiro, 2010 and Corga et al., 2011) and the data are merely indicative. The funerary use of space in these structures is still badly known, although there is reference to secondary depositions in Horta João da Moura 1 and Monte Pombal 1 and of both primary and secondary in Monte Cardim 6 and Horta João da Moura 2. Thus, the relation between MNI and mode of deposition does not seem to be a direct one as is also visible in Centirã, which also holds both types of deposition and a relatively low MNI of 12.

These conclusions must nonetheless take into account the problem regarding taphonomic phenomena and their effect on bone preservation. This could explain the low values identified for the Alcalar 3 and 11 monuments in the Algarve but also for Castro Marim and Messejana. Estremadura is the region where the minimum numbers for inhumed individuals seems to be more balanced although the case of Pai Mogo I surpasses by far any of the other monuments. It must also be noted that for Praia das Maçãs only the tholos structure is considered and for Samarra, numbers are also partial. At the present state of investigation, there seems to be no relation between chronology, geographical distribution, architecture and MNI in these structures. In fact, if the data observed in Figure 130 is crossed with the information available in Table 4 or the map in Figure 2 it becomes clear that, at the present moment, there is no ground for the definition of the differentiated use of the monuments based on this criterion.

Non-adult remains are in the vast majority of cases present in the anthropological record for these monuments. The cases of Alcalar 3 and Monte da Velha are exceptions: the former is a badly known context and the latter only housed a single primary deposition, probably the result of a later use of the monument (Soares, 2008; Silva et al; 2008).

In comparison to other known monuments, the adult/non-adult proportion in Perdigões Tomb I is slightly higher. Once again, it is the partial value of 43,8% presence of non-adult remains known for Olival da Pega 2, which is closer to the 46,6% in Perdigões, although, once again this proportion is poorly known considering the total universe of *tholos* type monument (Figure 131). In fact, only for 22,6% (19/84) of the registered ones is there any reference to the criterion age of the present individuals, although concrete, specific information only exists for 13% (11/84). For monuments such as Monte do Cardim 6 (Figueiredo, 2011) and Cabecinha Grande (Rocha, 1900), the expression used is “All ages” which implies the presence of all age groups but does not provide a summarized account.

The presence of non-adults is normally around 30 % of the total count of individuals. Centirã seems to be the exception with only one non-adult counted for (1/12).

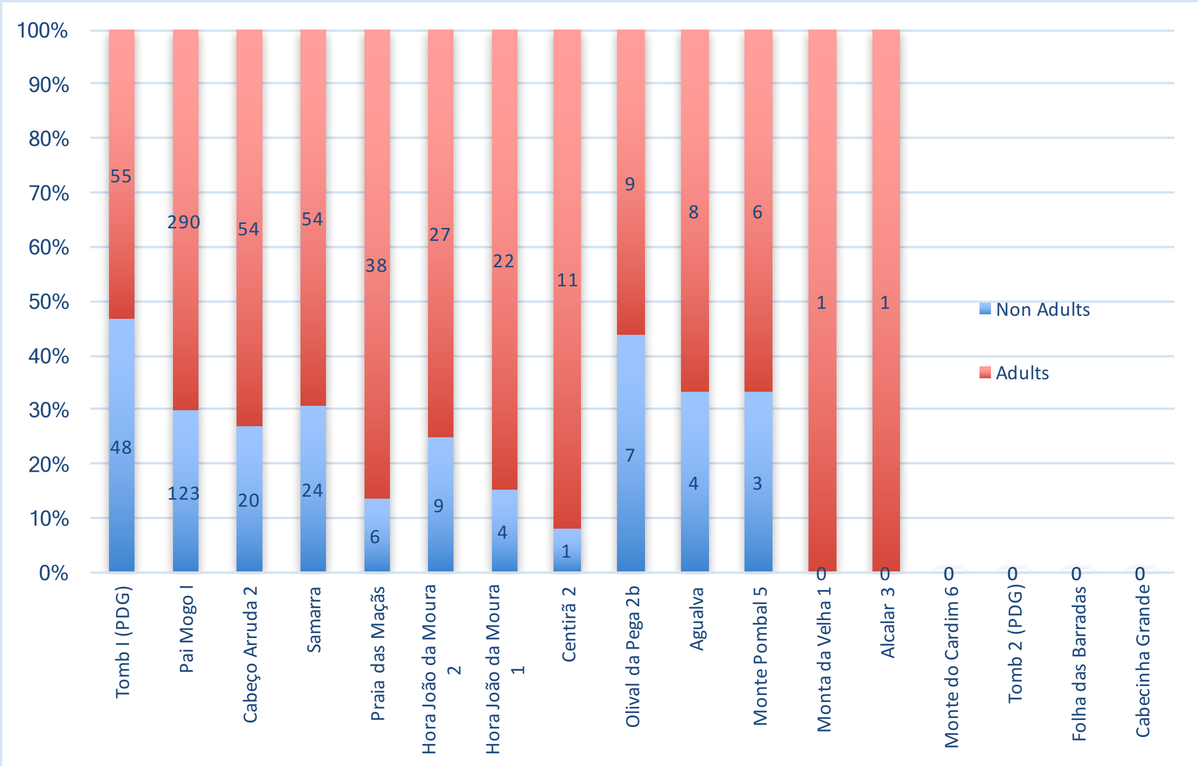


Figure 131 - Age Distribution for Tholos Type Structures in Portugal

The fact that non-adult individuals accounted for 46,6% of the total count for Tomb I is also a clear indicator of the collective nature of the depositions in this funerary structure, where age does not seem to be a defining factor. Indeed, if we consider the fact that due to differential preservation (Bello et al., 2006) non-adult remains normally preserve poorly since they are generally smaller and more fragile than adult bones, the non-existence of significant difference between the number of adults and non-adults throughout the different phases is even more relevant.

The analysis of the MNI parameter in Perdigões, expressed on Table 172, allows some interesting conclusions. The first one, which has already been mentioned in several public presentations by António Valera and myself is the fact that altogether, the known MNI for Perdigões, regardless of structure or chronology is of 244. This number is obviously very conservative since it cannot include the number for the funerary structures that are still under study, namely Pit 40 and Tomb II, which based on what has been observed up to now will certainly yield high MNI's. If we consider the fact that only about 2% of the whole site has been excavated, it is not difficult to imagine the number of human remains that are still to be discovered in this 16 ha site and how this MNI's will rise exponentially even if it must be distributed over approximately 1500 years of use of the site for the practice of the deposition of human remains, among others. Once more, and even for the isolated depositions of human bones in ditches (Ditch 7), non-adult remains are always present in these contexts, in medium to high proportion. Pit 7 and 11 represent mostly primary depositions from the Late Neolithic and must be interpreted accordingly. The defined MNI for these specific structures could be higher since they were considerably disturbed, as already mentioned. But for the 3rd millennium contexts, cremated or not, their collective nature is obvious as is the presence of individuals from all ages.

Table 172 - Minimum Number of Individuals estimated for several contexts in Perdigões. The highlighted structures are isolated depositions in ditches.

Structure	Total MNI	Adults	Non-Adults
Pit 7	2	1 (50%)	1 (50%)
Pit 11	3	0 (0%)	3 /100%)
Pit 16*	9	6 (66,6%)	3 (33,3%)
Pit 40*#	11	6 (54,5%)	5 (45,5%)
Ambient 1* (open air)	90	72 (80%)	18 (20%)
Cist*	8	5 (62,5%)	3 (37,5%)
Tomb I	103	55 (53,4%)	48 (46,6%)
Tomb II	?	?	?
Tomb III #	14	10 (71,4%)	4 (28,6%)
Ditch 2	1	1	0
Ditch 3 #	1	1	0
Ditch 4	1	1	0
Ditch 7	1	0	1

* Cremated remains #Partial numbers

6.3 Paleodemography

Paleodemography refers to the reconstruction of demographic parameters and categories (such as age and sex) for past populations, based on a skeletal morphology (Roksandic and Armstrong, 2011).

The intrinsic nature and state of preservation of the majority of the known Portuguese pre-historic collections make paleodemographic analysis into a challenging activity. Nonetheless, accurate age-at-death estimation and sex diagnosis are essential for the understanding of past populations. Apart from the important biological information drawn from the results, essential information is obtained for the reconstruction of past populations' sizes, dynamics and changes, and help us to come closer to lifespan and health patterns in prehistoric populations. Paleodemographic reconstruction is capable of revealing patterns in a mortuary sample because by estimating the sex and age of the skeletal remains, it may be possible to determine who may have been deposited in a given assemblage.

In the case of Tomb I, estimation of age-at-death and sex diagnosis was applied according to the state of conservation of the osteological remains, and those methods which were best suited to the state of conservation of the remains under study were adopted. Although the evaluation of these parameters should ideally follow a multi-factorial approach, this was not possible in Tomb I due to the collective and complex use of the monument over time. Indeed, the very poor state of conservation of most of the human remains recovered, are the result of multiple taphonomic actions that altered bone surfaces and extremities. Thus, the total absence or high fragmentation of the elements normally utilized for the definition of these parameters including teeth, bone epiphysis, *os coxae*, ribs, clavicles and even the cranium detracted from the paleodemographic analysis for Tomb I. Nonetheless an effort was to understand potential age and sex based differences in the use of Tomb I throughout its differences phases in order to be able to distinguish potential patterns of use or specific mortuary practices. Furthermore, it was important to analyse age structure and mortality rates not only of the human remains of Tomb I *per se* but also in comparison with other coeval available collections.

Teeth are an important part of the anthropological collection from Tomb I (n=1579 total) and allowed estimation of MNI and age-at-death in many cases. However, the intrinsic characteristics of this specific tooth sample limited paleodemographic assessments since there were limitations of the information that could be obtained through a sample composed of mostly loose teeth (n=1154 for permanent dentition). No direct correlation between specific individuals and sex and age was possible due to the lack of association with postcranial remains. Many times, even when the teeth were found *in situ* (n=334) the remains were too fragmented to establish any diagnosis of sex or age estimation. Nonetheless, this is the reality for many collective burials from Recent Prehistory in Central South Portugal and so it was important to recover all the possible information on teeth and allow future comparisons

The accurate and precise approach to these paleodemographic parameters goes beyond the strict limits of this work: it is the basis for the application of very important new methodologies for field of bioarcheology in recent years (Díaz-Zorita Bonilla, 2013). Indeed, the human remains from the various funerary contexts from Perdigões have recently integrated several studies based on stable isotope analysis and ancient DNA that have provided new insights into the understanding of the site but also for the interpretation of the recent pre-history period in Portugal, focusing on aspects such as mobility or geographic origin, subsistence strategies and environmental reconstruction. This is the case of the project “Mobility and interaction in South Portugal Recent Prehistory: the role of aggregation centres” funded by the Portuguese Science Foundation (PTDC/EPH-ARQ/0798/2014).

Regarding **age**, for Tomb I, the non-adult category was assumed to be for individuals less than 15 years of age. The certain age that marks the transition from being a child to being an adult is variable in different societies, as is the the nature of the factors that bring about the change. In modern western societies, and although many ceremonies are retained to celebrate the moment, coming of age is mostly a legal convention, which stipulates a point in late adolescence or early adulthood (most commonly 18-21 years of age) where individuals are no longer considered minors and are granted full rights and responsibilities as adults. But in the past, as in some societies today, such a change was mostly associated with the age of sexual maturity (early adolescence), and the menarche or spermarche and part of a spiritual and ritual event or associated with an age of religious responsibility.

Historically and cross-culturally, adulthood has been determined primarily by the start of puberty and the appearance of secondary sex characteristics, such as menstruation in women and ejaculation in men, and an individual usually moved from the status of child directly to the status of adult often with this shift being marked by some type of coming-of-age-test or ceremony. Although it is hard to establish a definition for the expression “biological adult”, especially for societies we know so little about as is the case of pre-historic ones, for this work it is broadly considered as the stage of life after which reproductive capacity has been attained by the individual (International Dictionary of Medicine and Biology, 1986). This is not to say that adulthood does not obviously encompass a psychological development that can render definitions of its state inconsistent and contradictory. This fact, alongside the evident differential beginning of puberty from person to person led us to the definition of the age of 15 as a “safe” indicator for adulthood.

Therefore, for **non-adult individuals** in Tomb I age at death was mostly determined based on dental development assessment but also, when possible, this information was also completed with information obtained through the ossification and fusion of specific skeletal elements and metric analysis of bones. Dental development is universally considered the best indicator for physiologic maturity, due to the fact that teeth are influenced by extrinsic and intrinsic factors like nutrition, hormones or environmental effects (Saunders, 2000). What is more it is an aging system that can be continuously applied from pre-birth phases all the way until the end of adolescence/early adulthood. Teeth also show the least inter-population variation (Hillson, 1996; Smith, 1991; Silva, 2002). This explains the fact that their growth and development pattern is independent of the rest of the skeleton and their stage of development is closer to the chronological age of the individual. In an ideal situation, however, the several age indicators in the same skeleton should be compared. This was not possible for Tomb I and so it is assumed that the results for estimation of age refer to an approximation of skeletal or biological age-at-death based on the primary assumption that skeletal age is closely associated with chronological age.

The youngest individual found in this collection is a perinatal individual identified in Phase 2A and the other remains estimated as belonging to under 1 year of age were all recovered from layers from Phase 2. The youngest individual from Phase 3 must have been around 2,5-3,5 years old at time of death. No prenatal skeletal elements were recovered from the several phases studied. The age group that systematically yielded more individuals was that of 5-9 one, equally followed by the 1-4 and the 10-14 age groups. As is observed in the table below, this is consonant for the little that is known for other funerary structures of this type. The 15-19 group raises other problems. In the first place, mortality could be lower in this interval. Nonetheless, the low numbers of individuals attributed to this age group could also be masked by the nature of the sample, whose very high level of fragmentation hindered the analysis of bone extremities where the level of fusion of the epiphysis could provide important information on this matter. Tooth analysis for inclusion in this specific group was based on the development of second and third molars when the roots and apex were preserved.Second molars reach apical closure around 16,5 years (AlQahtani et al, 2010), very close to the bottom limit of this age group. Third molars present high variability in their formation and reach that same stage between 21,5 and 25 years of age, so unless the apex still shows signs of some aperture, they are normally included in the over 20-year-old category.

As can be understood by the analysis of Table 173, specific information on age groups was only possible in a very restrict number of tholos or tholoi type monuments. Ana Maria Silva (2002) had already drawn attention to this fact in her thesis and opted to compare her results with collective burials of other nature such as natural caves or hypogea. In the present work, we will limit ourselves to the other tholos/tholoi type monuments known for the South of Portugal. Table 173 includes monuments for which there is an indication for the presence of non-adults but in which the age groups were not described. The reality observed for Tomb I is mirrored proportionately in the other known monuments. The remains of individuals between the ages of 1 and 9 are the most frequently found. Tomb I stands out regarding the number of non-adult remains of individuals less than 1 year of age found

Table 173 - Age group distribution in tholos type structures from Portugal.

	<1	1 - 4	5 - 9	10 - 14	15 - 19
Centirã 2	?	?	?	?	?
Horta João da Moura 1	?	?	?	?	?
Horta João da Moura 2	0	1	3	4	1
Monte Cardim 6	?	?	?	?	?
Monte da Velha 1	0	0	0	0	0
Monte do Pombal 5	1	2	0	0	0
Olival da Pega 2b	0	3	2	2	0
Alcalar 3	0	0	0	0	0
Cabeço da Arruda 2	4	4	8	3	1
Pai Mogo	7	41	42	33	0
Praia das Maçãs	0	3	2	1	0
Samarra	1	7	9	4	3
Cabecinha Grande	?	?	?	?	?
Agualva	0	0	1	2	0
Tomb I (Present Study)	2	14	21	11	6

Table 174 presents the distribution of age groups for the funerary contexts uncovered and studied until now in Perdigões. Results are scarce, although the general idea of the presence of individuals from all age groups in the contexts where a more collective nature is evident. Observations of the level of the epiphyseal union on the hand bones recovered from Ditch 4 suggests ages at death happening later than 13,5 – 16,5 years of age, meaning they could be included in the 10-15 age group in the Table below (Valera and Godinho, 2010). The sex of the individual (s) these bones belonged to is unknown and so the option was to place them in the 16-19 age group. The final results expected for Pit 40 and Tomb II will certainly shed some light on this subject and provide more information to work on.

Table 174 - Age group distribution for funerary contexts in Perdigões.

Structure	<1	1 - 4	5 - 9	10 - 15	16 - 19
Pit 7	?	'?	?	?	?
Pit 11	---	---	1	1	1
Pit 16*	---	---	1	2	---
Pit 40*#	1	1	2	1	---
Ambient 1* (open air)	2	4	6	1	0
Cist*	1	0	1	1	0
Tomb I	2	14	21	11	6
Tomb II	?	?	?	?	?
Tomb III #	1	1	2	---	---
Ditch 3	---	---	---	---	---
Ditch 4	0	0	0	0	1
Ditch 7	---	---	---	---	---

* Cremated remains #Partial numbers

For **adult** remains the estimation of some age-at-death intervals was possible even though the reliability of the age indicators after the age of 30 diminishes considerably. What is more, the degree of fragmentation of this specific collection makes the task even more challenging. This fact explains why this parameter could not evaluated for the two oldest phases, 2A and 2B.

For the rest of the collection, dental calcification was very useful for the group of individuals above 15 years of age and up to around the age of 22,5 years, the time when third molars reach apex closure state, ending the process of tooth development that started *in utero*.

Several other commonly used techniques are recognized as useful for age estimation in adults. They record alteration in age-related structures of the pubic symphyses (Suchey-Brooks, 1990) or the auricular surface of the ilium (Lovejoy et al., 1985) and link the biological age observed through the evaluation of the maturation stages of these structures to chronological age. Although the latter structure tends to preserve better in archaeological contexts, results are more reliable on the former (Buikstra and Ubelaker, 1989). Additional methods are available but inappropriate in a collection of this nature: this is the case of the morphological analysis in the sternal extremity of the 4th rib (Íscan and Loth, 1993) a specific anatomical area with a low degree of survival in a commingled collection like this one, or the evaluation of level of cranial suture closure that could not be applied due to the degree of fragmentation of cranial structures. The analysis of the sternal extremity of the clavicle would have been useful for the determination of individuals under 30 years of age but their degree of preservation was very low. As with the estimation of age in non-adults or sex diagnosis, a multivariate approach would be ideal and the known information should be complemented with radiographic or histological analysis.

On the whole, there are few indicators of elderly individuals in this collection. This is a result of the intrinsic difficulties in the definition of this parameter, although other indirect indicators of aging were also scarce. If we consider the incidence of degenerative joint disease in this collection, for example, as an indirect indicator of the average age of the individuals deposited in Tomb I some inferences can be drawn. Osteoarthritis is a condition for which aging is generally seen as the largest risk factor. As we age, the cartilage that coats our joints dries out and becomes brittle, and more vulnerable to deterioration. As observed throughout this work, incidence for degenerative joint disease was low in Tomb I (Table 165) giving strength to the idea that the population buried in Tomb I was probably mainly young. Another indicator, tooth wear, is also on average, quite low for this collection (Table 160) further reinforcing this idea.

In Tomb I, remains from adults of every age were identified for the interval between the minimum age considered, 15, up to 22/23 years of age. These conclusions were based on the analysis of dental calcification. Thus, there is an age interval to which no individuals could be attributed, after which individuals from the age of around 30 up to mature age, around 55 years of age area are identified, based on the morphological analysis of changes in the auricular surface of the ilium.

The comparison either with other coeval collections found in tholoi type structures or even for what is known in Perdigões, where the number of adults is well known and has already been discussed, will not be performed. It is difficult to assess life expectancy, given the lack of appropriate tables for the Portuguese Neolithic/Chalcolithic populations. As we have seen above, this difficulty arises precisely from the scattered, secondary nature of the funerary process adopted by these communities. Regardless of the exact paleodemographic profiles, it seems that a significant number of individuals died young.

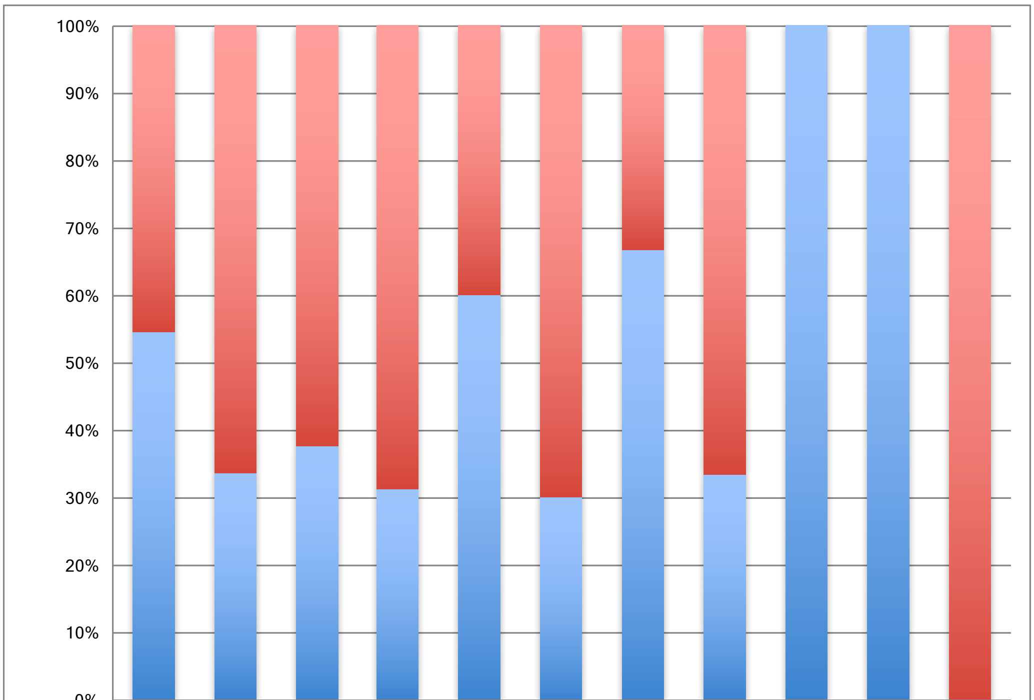
Sex diagnosis is clearly one of the most difficult parameters to define in collections resulting from collective intensive burials due to the great fragmentation and overall bad bone preservation. The approach used in this work was to try to identify and analyse, both morphologically and metrically, the available observable fragments of the most sexually dimorphic bones, the ilium, the cranium, specific long bones (humerus and femur) and the foot bones (calcaneus and talus). The dimorphic skeletal features used to sex elements in Tomb I were poorly preserved rendering this analysis complicated. Although the *os coxae* and the cranium are the best sexual indicators (Ferembach et al, 1980; Ubelaker, 1989), in Tomb it was never possible to use complete structures of any of these bones to reach conclusions regarding this parameter. Scoring was, thus, always performed on single attributes. What is more, certain bone structures could be scored for sexual diagnosis but not lateralized. Consequently, the results obtained through the morphologic analysis of these specific bones only provided an indication of one of the possible diagnoses, male or female, and a mere confirmation of the absence or presence of both sexes in the different phases of the monuments. The nature of these depositions shows that unless the observation is of the same portion of the same side of different bones, the possibility that these bones could belong to the same individual could not be ruled out.

Faced with the unreliability of the results for the more dimorphic bones of the *os coxae* and the cranium, other post-cranial skeleton elements had to be sought for the application of metric methods based on sectioning point could be used. Table 12 displays the total discriminant rate for these methods that were chosen based on the fact that they were developed on Portuguese collections (Wasterlain, 2000; Silva

1995) in an attempt to bridge the problem of inter and intra population variability in the patterns of sexual dimorphism (Ubelaker, 1989).

The distal extremity of the humerus and the proximal extremity of the femur are amongst the best-preserved bone regions for long bones (Silva, 2002) and therefore, the biepicondylar width for the humerus and the vertical head diameter for the femur were used to diagnose sex, when possible (Wasterlain, 2000). The methodology developed by Silva (Silva, 1995) for sex determination through the measurement of talus and calcaneus was also useful, since these skeletal elements seem to preserve well in such funerary monuments. In the global analysis of Tomb I it was the application of these latter methods that allowed the determination of the presence of remains belonging to 5 female individuals and 4 male ones (Table 157). As it is, sex diagnosis was possible for 16,3% of the MNI of adult individuals estimated for this sample (9/55), suggesting a similar proportion between both sexes. The table also shows that this balance between the presence of both sexes is visible in the diagnosis performed on the several bones where female and male traits were observable.

For Tomb I the final proportion of 44,4% male individuals and 55,6% of female reveals a higher balance between the presence of both sexes when compared with the information retrievable from other tholos type monuments (Figure 132).



	Tomb 1 (PDG)	Pai Mogo I	Samarra	Cabeço da Arruda 2	Agualva	Praia das Maçãs	Centirã 2	Olival da Pega 2b	Alcalar 3	Monte da Velha 1	Horta João da Moura 2
Female	5	69	23	22	2	7	1	4	0	0	2
Male	6	35	14	10	3	3	2	2	1	1	0

Figure 132 - Sex Distribution for Individuals from Tholos Type Structures in Portugal

Information is scarce but it is fairly safe to state that both sexes are present in the tholos/tholos type collections for which data is available. The fact that female individuals seem to have a slight predominance over male ones was mentioned by Ana Maria Silva in her thesis, since her results pointed in the same direction (Silva, 2002, p. 206). Explanations for this, although cautious, can be found in the light of problems raised by the preservation of bone material, and specifically the more dimorphic bones with low rate of survival, in the appropriateness of the methodologies used, which having been developed based on modern populations, could hinder the results for more ancient collections. The fact could also be simply related to human sex ratio and the effective greater presence of female individuals in these communities. The possibility that this could also be related to funerary practices carried out under specific prescriptions cannot be ruled out, although at this point of the investigation there is not enough data to sustain that hypothesis.

Table 175 - Proportion between male and female individuals from the different structures with human remains from Perdigões.

Structure	Male	Female	Adult MNI
Pit 7	0	1	1
Pit 11	3**	0	0
Pit 16*	no	no	6
Pit 40*#	1	1	6
Ambient 1* (open air)	1	1	72
Cist*	no	no	5
Tomb I	4	5	55
Tomb II	?	?	?
Tomb III #	no	no	10
Ditch 2	0	1	1
Ditch 3	---	---	1
Ditch 4	---	1?	1
Ditch 7	---	---	2
			0

*Cremated remains #Partial numbers**They are considered non-adults. Sex diagnosis is based on DNA analysis.

The quality of the data for sex diagnosis in Perdigões (Table 175) clearly does not allow for the creation of great explanatory models. In every one of these collections there was a relatively small number of complete ilium bones that were sexed in the original inventories. Many physical features used to sex elements were poorly preserved, which complicated analysis. For Ditch 4, the osteometric data was compared with the discriminant functions proposed by Barrio and colleagues (Barrio et al., 2006), and suggested that the metacarpal diagnosed belonged to a woman (Valera and Godinho, 2010). However, as these authors point out, the application of osteometric methods to populations chronologically and/or biologically distant from the reference populations, as well as the consequent need to adapt the sectioning points to the series under analysis (Bass, 1987; Murail et al., 1999; Wasterlain, 2000) is an obvious limitation. What is more, the case of Perdigões we are looking at human bone depositions that happened along a very considerable period of time and include several forms of body treatment, primary, secondary and also the practice of cremation. The human bones deposition in ditches is yet another form of disposal of parts of the human body. What can be said is that there seems to be no significant difference between male and females, since both were found in the different structures.

Concluding this paleodemographic analysis it can be said that, based on what could be perceived for Tomb I, the reality of other tholos/tholoi type monuments and for the other known contexts in Perdigões that there seems to be no cultural preferences for individuals of certain age groups or sex to be deposited in these funerary monuments: they contain a mixed assemblage of non-adults and adults, females and males with a slight preference for adult females.

6.4 Paleomorphology

6.4.1 Metric Analysis

One of the parameters used in the paleomorphological evaluation of a population is the indices of flattening and robustness. It is believed that the degree of flattening of bones, particularly the tibia and femur, is related to mechanical forces and changes detected in these bones may be indicators of biomechanical effort and can serve as an element for inference of the physical activities of a population or group (Lovejoy et al., 1976; Larsen 2000). The analysis of biomechanical trends in the long term is one of the means to understand the behaviour patterns of past communities, and how these are different from or similar to contemporary communities. It is possible that in agricultural and more sedentary populations the diaphysis of the femur would tend to be rounded. In the tibia, the cnemic index is generally lower in populations with greater mechanical stress. Thus, the morphological changes detected in these bones may reflect the transition from a mobile life to a sedentary life.

The analysis of indices of robustness and flattening for bones from Tomb I was precluded by the almost total absence of complete femurs and the non-existence of tibias in which this analysis could be performed. With regard to indices of robustness they could only be evaluated macroscopically and it is possible to say that some of the observed bones were clearly robust although measurements were not possible.

Only for one right femur (no. **3002**), from SU 143, was it possible to measure the platimeric index. The result of 75,0 classified this femur as platimeric, as indices lower than 85 normally mean the antero-posterior crushing of the superior third of the diaphysis (platimetry), normally linked to the strong development of the trochanter due to biomechanical stress. A platimeric index of 75,0 reveals a level of flatness of the femur diaphysis that is compatible with a certain level of biomechanical effort. The pilastric index could not be observed for any of the femurs in this collection.

Comparison with coeval collection is a difficult task. In many collections due to the great fragmentation of the material, the morphological analysis is severely limited, making it impossible to estimate the indices of robustness and flatness or estimations regarding height.

Nonetheless, comparison was sought with the available data from samples from populations of the Late Neolithic/Chalcolithic identified in tholos type monuments. For Cabeço da Arruda 2 (average platimeric index: 76,3) and Pai Mogo I (average platimeric index: 79,42) monuments (Silva, 2002), the value obtained were also predominantly platimeric. The same seems to be the case for Praia da Samarra monument, where the platimeric index was determined for 17 femurs, 12 left and 5 right with a combined average of 73,885 (Silva et al., 2006). The ten fragments of femurs that allowed for the measuring of the platimeric index in the Praia das Maçãs tholos (Silva and Ferreira, 2007) all presented antero-posterior flattening around the upper third of the diaphysis (average = 75.49).

Data is very scarce and no conclusions are possible although it seems reasonable to argue that communities of the Central Portugal and Alentejo region would be subject to a considerable degree of biomechanical stress throughout the recent Prehistory during the Late Neolithic and Chalcolithic Resorting to another coeval collection, not belonging to a tholos type structure, as the sample studied by Tânia Pereira (2014) it is possible to observe that the obtained platimeric index through the femurs of 2 individuals from the Chalcolithic site of Brinches Alto 3, which were both platimeric (indexes 73.3 and 74.19). It was also possible to calculate the platimeric index of the femurs recovered from the sites of Monte de Cortes 2, Monte das Covas 3, Cadavais, Monte do Gato de Cima 3, which revealed that they also tended to be flattened (Tomé et al., 2013). The tendency seems to keep in the Bronze Age. Anthropological study of the human remains from the Bronze Age hypogea in Torre Velha 3 (Fidalgo, 2014; 2016) revealed that the estimated mean values of the morphometric indexes indicate the presence of flattening and robustness of the lower limbs for individuals of both sexes. In Pereira (2014), who also studied samples from the Bronze Age, two flatness indices of the femur were registered, both in Misericórdia 1, one of which was platimeric (69.4) although the other one was euromeric (96.3). This may mean that during their daily lives both men and women would be subject to constant biomechanical efforts, possibly related to tasks requiring considerable and frequent mobility.

For Perdigões, there is no other information on this specific parameter.

Regarding stature for Tomb I, it was only possible to estimate this parameter on a right and a left MT2 and on a right MT1, as summarized in Table 176. The inexistence of intact long bones also invalidated any attempt to estimate stature from any of these bones present in the collection (Mendonça, 2000).

Table 176 – Summary of stature estimations for Tomb I (Perdigões).

SU	No.	Bone	Measurement
172	872	Left MT1	1538,05 mm±53,5
97	772	Right MT1	1555,10 mm±53,5
63	875	Right MT2	1719,31mm±47,5

From the human osteological material from Perdigões enclosure already excavated, there are still very few results for comparison in these terms. The value obtained by Daniela Pereira (2014) for Ambiente 1 is based on cremated bone and although it applies the regression equation developed by Cordeiro and collaborators (2009), there is no indication of sex. On the other hand, the likely female individual from Pit 7 (Silva et al., 2015) uses Santos (2002) for the estimation of stature. Despite the different approaches, both obtained values are very close to the two first estimations obtained for Tomb I (Table 177). The other estimation obtained for the Tomb I is quite above average although there is no indication if this belongs to a male or a female individual.

Table 177 - Summary of stature estimations for other funerary structures from Perdigões.

Structure	Bone	Measurement	Methods
Pit 7	Right MT2	157.3 cm ± 4.75	Santos, 2002
Pit 11	no	no	no
Pit 16*	no	no	no
Pit 40*#	?	?	?
Ambient 1* (open air)	Right MT1	1586,55mm±55,2	Cordeiro et al., 2009
Cist*	no	no	no
Tomb II	?	?	?
Tomb III #	no	no	no

However, the obtained estimated height values are close to the values obtained by Cardoso and Gomes (2008), for the populations of the Late Neolithic – Chalcolithic.

In Praia da Samarra, stature was obtained for 11 individuals based on MT1 measurement (following Cordeiro et al., 2009) and the combined average obtained for both sexes was 162, 8 cm with values varying from 154,2 cm and 174,6 cm (Silva et al., 2006).

The stature of the probably male individuals from burial 1 and 4 in Centirã tholos (Henriques et al, 2013 a and b) was estimated based on femur maximum length (following Mendonça, 2000). The estimated height for the former was 162.5 ± 6.96 and the latter 163.8 cm ± 6.96. For the male individual from burial

3, stature was estimated through the maximum length of the talus (following Holland, 1995). The estimated height obtained was 166.1 cm ± 5.89.

6.4.2 Non-Metric Analysis

Given the genetic importance attributed to non-metric morphological characters, it is important to systematize them in an attempt to reconstruct and study phylogenetic relationships and then compare them to other prehistoric populations.

Among the discrete traits, the cranial ones the most frequently used for the analysis of the kinship. More than 200 non-metric cranial characters were identified in Man (Hauser and De Stefano, 1989) divided into four basic types: sutural ossicles; hyperostosis (involving bone proliferation); conditions involving bone deficiencies and variations of foramina. Although the genetic basis of many has been questioned in recent years, for the first two types there appears to be clear evidence of a high genetic determinism (Crubézy et al., 1998).

Unfortunately, this was mostly not possible in the present study for **cranial discrete traits** since the state of the osteological material did not allow us to draw any conclusion about them. In fact, the crania are mostly reduced to small fragments in Tomb I but also in the other Portuguese coeval series, making it almost impossible to attempt any morphological study. This is the reason why this analysis is normally excluded from the investigation centered on this type of collective grave. The exception in Tomb I is the identification of supernumerary ossicles (or wormian bones) amongst a highly fragmented left side of a cranial vault (242 fragments) identified in Phase 3B (SU 91). These were irregular isolated bones that appeared in addition to the usual centers of ossification of the cranium. They occurred in the course of the lambdoid suture, which is more tortuous than other sutures. The ossicles at lambda and lambdoid ossicles may have very different embryonological origin or occur post-natally and be subject to mechanical influences (Lahr, 1996).

This case in Tomb I is an isolated one and allows little comparison or further problematization. Another case of a cranial vault with two wormian ossicles is reported for the Praia das Maçãs tholos (Silva and Ferreira, 2007). In the study of the cremated bones from Olival da Pega 2b tholos (Silva et al., 2007/2008) two cases (18.18%, 2/11) of supraorbital notch were observed and one case (25%,1/4) of metopic and/or supranasal suture was identified.

Postcranial bone elements were also considered for the present study but yielded poor results, related again to the poor condition of the bones.

In Tomb I, the presence of a hypotrochanteric fossa was registered on one right and one left femur. Other than that, only the humerus provided more information on non-metric traits, with the identification of 2 septal apertures on left humeri and one on a right one. In the case of the hypotrocantheric fossa, this morphological trait is the one most commonly found in samples from the Late / Chalcolithic Neolithic period of the Portuguese territory (Silva, 2002).

This specific trait is strongly related to the presence of a third trochanter (Finnegan, 1978), but this specific trait was not recorded in any of the 10 femurs analysed (4 left and 6 right ones) in Tomb I. It should be noted that in all other cases in which the hypotrochanteric fossa was recorded, the state of preservation of the femur was poor, thus making it impossible to observe the region of the third trochanter.

Septal aperture is the absence of a septum in the coronoid-olecranon fossae of the distal humerus. It is a relatively common anatomic variant in human distal humeri thought to occur early in childhood. The aetiology of septal aperture remains an unsolved problem although the influence of genes, joint laxity, bone robusticity, osteoarthritis, and osteoporosis has been discussed (Myszka, 2014).

These are frequent characters in Portuguese prehistoric populations (Silva 2002), following the trend described by Jackes et al. (1997). At the monument of Praia da Samarra (Silva et al., 2006) septal aperture was present in 5 of the 12 humeri analysed (right and left). In Praia das Maçãs, 14 femurs were observed for the presence of the hypotrochanteric fossa (seven on each side), and this trait was observed in 2 left femurs and 1 right one (Silva and Ferreira, 2007).

These results are not sufficient to establish any relation of population affinity. In the Chalcolithic structures studied by Tânia Pereira (2014), two post-cranial characters were identified: the hypotrochanteric fossa (in a right femur of Monte do Vale do Ouro 2) and a septal opening in a humerus recovered from Brinches 3). In the Chalcolithic structures from Torre Velha (Coelho, 2014), two septal apertures were registered.

The few identified discrete traits identified in Tomb I have no echo in the remaining structures from Perdigões for which the anthropological study is available. No information was observable on this matter for the Late Neolithic burials from Pits 7 and 11 nor for the isolated depositions in ditches (Valera and Godinho, 2010). There is also no information for Tomb III on this matter. Concerning the morphological analysis of cremated remains in Pit 16, two non-metric characters were registered: a complete supraclavicular perforation in a right clavicle diaphysis and the presence of supranasal suture in a small frontal bone fragment (Silva et al. 2014). In Ambiente 1 a left patella was recovered where a discrete trait, a *vastus* notch, could be identified (Pereira, 2014).

The study of **discrete dental traits** is of such importance, mainly because of their greater durability and preservation compared to cranial characters and their easy observation (Scott 2008; Marado 2010; Silva 2012) that they have gained a prominent position in studies based on communities of the past (Hillson, 1996; Silva 2002, Cardoso 2001). For Tomb I and as has been mentioned, the odontological non-metric analysis of teeth identified were so relevant that they justified being part of the sample used for a PhD thesis defended in 2015, at the Department of Life Sciences in Coimbra by Cláudia Cunha (Cunha, 2015) and are obviously not included in this work. Apart from the teeth from Tomb I, 2 other Chalcolithic samples from the Middle Guadiana Valley were analysed: Tomb II from Perdigões and Cerro de las Baterías, in Extremadura, Spain. Cunha concluded that there was a stronger biologic correlation between the results obtained from Tomb I and II than between either of them and the Cerro de las Baterias results, suggesting that the Perdigões samples were drawn from the same population or from biologically closely related ones. The populations sampled in the Guadiana display North African influences in the distribution of some non-metric traits. These influences possibly result from genetic exchanges with North Africa in prehistoric times. Another important result from this work was the identification, during the process of the study, of a recently described variation for human dentition, namely Hypotrophic Roots of the Upper Central Incisors. This morphological variation is characterized by the occurrence of UI1 roots that are equal in length to, or shorter than, their respective crowns (Cunha, 2015).

6.5 Paleopathology

The scarcity of information for skeletal pathologies and injuries, available from prehistoric collections, has been noticed by several investigators (Silva, 2002; Boaventura et al., 2014). The nature of these collections, the effect that funerary practices and taphonomic agents have on the preservation and completeness of the human bones have discouraged their study. The already mentioned outdated excavation strategies, with little concern for the detailed recording of the human remains, poor storage conditions, also contributed to commingling skeletal samples and to the production of some bone damage (Silva, in print). Nonetheless, in recent years, several efforts have been made to revisit some of these old collections and the analysis demonstrates the potential of the examination of poorly preserved and mixed human bone assemblages and the valuable information that can be obtained, including for the study of paleopathology (Boaventura et al. 2013; 2014; 2016; Silva and Marques, 2009; Silva, 1993; 1996; 1999;

2003; 2004; 2005; 2008; Silva and Ferreira, 2008 and b; Silva and Wasterlain, 2010; Silva et al. 2006; 2008; 2014)

The following information should be considered with due reservation as it comes from a context that mixes bone remains of several individuals, where fragmentation and reduced preservation prevail. Low survival of bones has an inevitable effect on the identification and classification of pathological changes that might not be appropriate. The possibility of underestimating the frequency of each disease may also hinder comparisons with other collection (Waldron, 1987). In pathological conditions affecting the joints, for example, the possibility of establishing their distribution in the skeleton is essential. It is important to know which joints are affected or not in order to correctly classify the changes. This is not possible in a context such as the one studied here, which results from the intense commingling of human remains, with no anatomical connection. The differential preservation of bones, the low representativeness of small ones, the impossibility of sex diagnosis and age estimation have also important repercussions for the diagnosis of pathological conditions.

Despite the many obstacles inherent in the study of collective prehistoric osteological remains, the diagnosis of pathologies remains, although the necessary conditions for a differential diagnosis are not always met.

6.5.1 Oral Pathology

Given their high information potential, diseases and injuries of the teeth and jaws are among the most frequently described in skeletal populations. These studies provide information on the occurrence and prevalence of various aspects of dental health and oral hygiene, type of subsistence and diet, among others (Hillson, 2000; Mays, 1998). The most frequently observed dental pathologies in archaeological populations are caries, calculus, periodontal disease, abscesses, antemortem loss tooth loss and enamel hypoplasia. Dental paleopathology is the study of the origin, nature and course of dental and jaw diseases in skeletal samples (Lukacs, 1989).

Although limited, the general characterization of dental health and attrition could be assessed for the remains deposited in Tomb I providing information to be applied for comparison with other commingled contexts from Portuguese prehistory.

Comparisons were sought with the information available from other tholos/tholoi type structures (Table 179). Occasionally, and when necessary, other funerary features with thorough anthropological studies were also used for comparison. The data available on oral pathology from other Perdigões structures with human remains was also summarized (Table 180).

Dental wear reflects the effects of processes of attrition and abrasion on tooth surfaces, diminishing dental tissue through functional contact with other teeth alongside the action of food or foreign particles inside the mouth (Smith, 1984; Duarte, 1993). Although tooth wear is not a pathological process, but rather a mechanical one, it is often studied in conjunction with the various dental pathologies whose prevalence it may affect (Freeth, 2000).

Of the 1495 permanent teeth identified I Tomb I, it was possible to observe 95,5% of them (n=1428) for tooth wear. The results reveal a mean tooth wear of 1,9. Mandibular teeth showed higher levels of attrition, with an average of 2,1 (n=651). It was in the anterior section of the mandible where this phenomenon was more marked, with an average level of 2,2 (n=126). No difference in average wear between anterior (n=180) and posterior dentition (n=587) is shown in maxillary teeth.

These values are lower than the averages between 3.10 and 4.00 obtained by Silva (2002), for prehistoric coeval populations. Overall, the occlusal wear observed in the teeth analysed is mild and the number of teeth with severe attrition of the occlusal surface is insignificant.

Table 179 summarizes the results available for other tholos/tholoi type monuments. Information ranges from non-existent to classification with no attributed level. The monuments studied by Silva and colleagues in Portuguese Extremadura have more complete information. The sample from Tomb I is distinguished by having a lower average wear than the above-mentioned monuments, only close to the value obtained for Praia das Maçãs.

None of the other contexts with human remains from Perdigões present average wear levels below degree 2, as Tomb I does, and the existing results comply with expected values for similar contexts (Table 180).

Tooth wear was also measured for deciduous teeth since some of them presented quite a considerable level of attrition. The total number of teeth analysed was 84, and they presented an average wear of 1,8, a value that is extremely close to that obtained for permanent dentition.

Inferences on how these results can yield information on both mechanisms of food break down and composition of diet are not linear. The abrasive nature of the diet of both hunter-gatherers and agricultural prehistoric population was emphasized by Smith (1984). At present, the analysis of trace elements of some of these teeth and stable isotope analysis of carbon and nitrogen in human bone collagen analysis is underway, which will certainly contribute to the reconstruction of the diet of these prehistoric populations and to make nutritional inferences.

Nonetheless, the low levels of attrition in permanent dentition suggest that the individuals deposited in Tomb I either did not consume a diet that was sufficiently abrasive to produce higher levels of attrition or suffered high mortality rates in the early stages of life. Considering that deciduous teeth are retained until a maximum age of 10 years (± 30 months), in the case of the last deciduous teeth remaining in occlusion - the second maxillary and mandibular molars (Ubelaker, 1989: 64) the second hypothesis becomes more viable. In fact, data seem to demonstrate a substantial level of abrasiveness in their diet, which could have started in the early stages of life, affecting deciduous dentition, but which did not have time to reflect on the permanent dentition possibly due to an early death.

Evaluation of wear levels at the most abundant tooth (LM1) suggests that a significant number of individuals died young at Perdigões: from 148 lower first molars present at Tomb I, 8,7% exhibited no wear and 38,5% were scored with wear level of 1, suggesting that individuals did not live a long life (Table 178).

Table 178 - Summary for global level of tooth wear per permanent tooth from Tomb **I** (Perdigões).

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**no**
11	4	10	3	5	0	1	1	0	0	0
12	2	7	6	2	2	0	0	0	0	0
13	5	15	10	5	7	3	0	0	0	2
14	8	21	7	4	2	2	1	0	0	0
15	5	26	14	5	2	3	1	0	0	0
16	**6**	**37**	10	13	4	1	1	2	0	1
17	2	11	11	8	4	1	1	2	0	1
18	12	32	15	10	2	0	0	0	0	0
21	7	10	1	5	2	0	0	0	0	0
22	2	16	3	4	1	0	0	0	0	1
23	7	17	12	9	4	2	0	0	0	1
24	10	19	9	13	2	2	1	0	0	0
25	3	15	15	9	2	2	0	0	0	0
26	**10**	**33**	13	13	8	2	2	2	0	3
27	2	19	7	16	2	2	0	0	0	2
28	8	37	15	4	2	1	0	0	0	0
31	3	3	3	3	3	4	0	0	0	1
32	2	6	1	5	2	2	1	0	0	0
33	9	8	6	5	5	0	0	0	0	1
34	5	10	7	4	1	0	0	0	0	0
35	8	15	13	11	4	0	0	0	0	2
36	**10**	**28**	5	17	13	3	1	1	0	1
37	7	22	13	8	13	4	1	0	0	0
38	4	25	11	9	3	0	1	0	0	1
41	0	5	3	2	2	0	2	0	0	1
42	1	7	3	3	1	2	0	0	0	0
43	1	6	6	6	4	0	1	0	0	1
44	4	15	10	7	3	0	0	0	0	0
45	1	20	12	5	5	0	0	0	0	0
46	**3**	**29**	6	10	7	3	5	0	0	1
47	5	23	15	3	10	2	1	0	1	2
48	9	15	7	8	3	0	0	0	0	0
Total	**165**	**562**	**272**	**231**	**125**	**42**	**21**	**7**	**1**	**22**

This information coincides with the absence of data for individuals with old age, previously mentioned in the paleodemography chapter and is further reinforced by information obtained for other analysed data, as follows.

Enamel hypoplasias are one of the several skeletal indicators available to assess the type of life led by the populations of the past. They are amongst the most informative ones, together with porotic hyperostosis (including *cribra orbitalia*) and infections (Larsen,2000). Enamel hypoplasia are deficiencies of dental enamel resulting from the cessation or interruption of enamel deposition during secretion or formation of the amelogenesis matrix. These defects which appear in the form of bands, grooves or small perforations (these latter 2 being very rare conditions) may result from local trauma, hereditary conditions or physiological stress (Goodman et all, 1985). Unlike most biological tissues, enamel does not have the ability to remodel and thus enamel hypoplasia become a permanent and precious record of the stress episodes suffered by individuals as they are growing up, unless they are removed through trauma or high tooth wear. Because they occur during crown formation it is also possible to estimate the age at which each episode of stress happened.

A review of enamel hypoplasia in Neolithic/Chalcolithic funerary collections, seems to suggest that the prevalence of dental enamel hypoplasia is generally low, with an average frequency of 2-3% (Silva, 2002) and, consequently, that these prehistoric populations were not subject to very severe physiological stress periods. It is precisely the thorough and systematic work by Ana Maria Silva (1996, 2002; Silva et al, 2007,2008, 2014,1015) on several prehistoric human bone samples that has allowed the first comparisons to be made between prehistoric collections of this period in Portugal as an attempt to bridge methodological problems that are still a major obstacle to the effectiveness of comparative studies.

In terms of total value, the percentage of 10,4% of permanent teeth from Tomb I presenting enamel hypoplasia does not follow the usual pattern. As mentioned already, the prevalence of this indicator of physiological stress is predominantly low (<10%), as registered in several prehistoric funerary samples such as the ones from Cabeço da Arruda II (2/38 – 5,3%), Cova da Moura (5/361 -1,4%) (Silva, 2002) and the São Paulo II hypogeum (0/49) (Silva, 1993) amongst others.

In order to facilitate the comparison between the different series belonging other tholos or tholoi type structures and the contexts from Perdigões and to avoid recording duplication (following Silva, 2002) the same type of tooth and one of the most prone to hypoplasia was used to compare the skeletal series with each other. Since teeth that most often manifest these defects are the upper central incisor teeth and the lower canines (Aufderheide and Rodriguéz-Martín 1998) the latter was selected for comparisons. Regarding this aspect, the teeth from Tomb I do follow the pattern. A total of 143 (n=1369) permanent teeth analysed presented enamel hypoplasia. In absolute terms, canines are in fact the teeth with the highest presence of this phenomenon, namely right lower canines, which present the highest values: 41,7% of FDI 43 (10/24), followed by FDI 33 with 7 registers in a total of 34 teeth (20,6%).

However, the most striking information regarding this condition is the distribution of enamel hypoplasia per tooth described throughout the per phase analysis of teeth, in previous chapters. Indeed, the high number of teeth with more than one hypoplasia shows that not only were the individuals whose remains where deposited in Tomb I subject to stress episodes during their lifetime but that they could occur frequently with some individuals, as the heavily hyoplastic banding of some of the described teeth shows. Further analysis of dental hypoplasias in teeth from Tomb I can help shed light on the periodicity and intensity of these stress episodes with closer indication on the age of insult and hence give further insight into patterns of dietary and disease stress in prehistoric communities.

Other coeval collections studied from tholos or tholoi type monument can be observed in Table 179. They show very few results, with most authors not mentioning this parameter in their publications. Cases like Horta João da Moura 2 (Styx Antropologia) mention the presence of enamel hypoplasia but no specification regarding type of teeth affected. Results obtained for Tomb I for the lower canine (FDI 43) are clearly superior to any of the other collections analysed and only surpassed by the results from the Praia das Maçãs tholos (Silva and Ferreira, 2007).

The unusually high number of enamel hypoplasia identified in Tomb I do, however, find echo in other prehistoric funerary contexts. The case of São Pedro do Estoril I and II hypogea is also a surprising exception, where 59.2% of the loose lower canines studied presented enamel hypoplasia (Araújo, 1996). However, this result includes teeth from both sides, so that some periods of stress may be duplicated (Silva, 2002). Further two cases have high values for lower canines, in this case left ones: at the artificial Neolithic/Chalcolithic caves of Tojal de Vila Chã, Duarte (1993) detected 16.6% (28/169) of hypoplasia on lower left canines. At the Monte Canelas I hypogeum, 13.5% of the lower left canines (5/37) also presented this condition (Silva, 1996c). Lower left canines in Tomb I present a degree of 20, 6%.

For Perdigões, the results are also limited. The individuals buried in the Late Neolithic pit all showed enamel hypoplasia on their lower canines. The frequency of 100% is explained by the fact that in this specific case these are results for primary depositions. The frequency obtained for Tomb III, although partial, fits with the average known for other prehistoric contexts.

Deficient nutrition can be looked at as one of the causes of death in these populations. The bad state of preservation of the skeletal remains from Tomb I did not allow for the observation of any indicators of nutritional stress. Enamel hypoplasia, seemingly the best indicator for nutritional deficiencies during growth (Goodman and Armelagos, 1980; Hillson, 1996: 165-166; Hutchinson and Larsen, 1990; Niven et al., 2004), has a low frequency for this time period in Portuguese samples. Tomb I, nonetheless, is an exception. Final results, after all the human remains were quantified, show a presence of enamel defects during tooth development (i.e., during early childhood). The fact that the individuals seemed to have survived these nutritional stress episodes might indicate that higher mortality coincided with later phases of childhood.

Of the total deciduous teeth observed for Tomb I, 2,5% presented enamel hypoplasia (2/81). The two cases were found on lower second molars: from Phase 2A there is one case identified on an FDI 85 and for Phase 2B on an FDI 75.

Dental enamel hypoplasia in the deciduous teeth of the several samples used for comparison are absent, except for one case in Paimogo I where the affected tooth is also a lower second molar (FDI 85) (Silva, 2002). This data suggests the absence of maternal stress in these populations (Ubelaker, 1992). Nevertheless, this conclusion should be viewed with caution in most cases since it refers to collections with low number of deciduous dentition.

Dental caries are caused by localized destruction of tooth enamel, as a result of acids produced by bacteria feeding upon and fermenting carbohydrates in the mouth (Danforth, 1999). Subsistence based upon agriculture is strongly associated with a higher rate of caries than subsistence based upon foraging, because of the higher levels of carbohydrates in diets based upon agriculture (Temple and Larsen, 2007).

According to Silva (2002), who studied several coeval samples, the frequency of caries in these prehistoric populations is usually low. Caries frequencies are between 2.5% and 8.2%, compatible with that expected for a mixed or agricultural subsistence.

For Tomb I, cariogenic lesions were present in 0,5 % of the permanent teeth recovered (7/1406).

As can be observed in Table 163 the highest caries frequency can be found in upper teeth. Regarding the severity of caries, degree 2 lesions are the most severe and were identified on an FDI 36, an FDI 46 and an FDI 18. On the remaining teeth, lesions of a minimal degree predominate. Regarding localization, there is a predominance of interproximal caries. The most affected teeth are molars, distributed between upper and lower dentition following the tendency that these teeth, especially mandibular ones, are more prone to the development of cariogenic lesions (Turner at al., 1985). In living populations, premolars follow molars in the frequency of this condition (Loesche, 1982: 233). In the case of Tomb I, they are all associated to medium to severe levels of attrition, which might have had an influence on the presence of this pathology. The results from Tomb I show a low frequency of cariogenic lesions and suggest reasonable dental health conditions for these individuals from the Chalcolithic. A diet including fermentable carbohydrates is a prerequisite for the formation of dental caries and so these results for Tomb I suggest that the available foods were mostly non-cariogenic.

No cariogenic lesions were observed for the deciduous teeth observed in Tomb I (0/81).

This frequency for Tomb I is below the average obtained for other coeval collections (Table 179) where once more, values fluctuate between low (Praia das Maçãs) to average (Pai Mogo I and Samarra). The Agualva study (Boaventura et al, 2016) is based on a small collection of teeth so the high result for this parameter may be masked.

In the remaining Perdigões structures, one cariogenic lesion was registered on a tooth (FDI26) with a very high degree of attrition (6), recovered from Ambiente 1 (Pereira, 2014).

Calculus, or mineralized plaque, its main constituent being calcium phosphate (Hillson 2005; Waldron 2009) can have an influence on the frequency of caries. The lack of oral hygiene in the populations can lead to a higher prevalence of tartar, and its formation occurs mainly on the lingual surface of the anterior teeth (Waldron 2009). In theory, it is possible to say that this establishes some type of caries prevention since, because it is a process of mineralization, it prevents the demineralization of the enamel (Waldron 2009). However, other authors argue that carious lesions also have a direct relation with the presence of dental plaque and they can begin anywhere where the plaque accumulates, most often in the fissures of the crown and in interproximal areas, as seems to be case in Tomb I where most lesions were observed in this area.

Calculus deposits can be easily removed during both the excavation and restoration phases, and some caution is needed when trying to discuss the data from this parameter.

It was identified in 20,6% of the permanent teeth analysed (n=289/1399). For superior dentition 14,8% presented calculus deposits (N= 113 /761) and for inferior dentition the percentage of calculus deposits found was of 27,5% (n=176/638). There is little information for other coeval tholos/tholoi type structures and the values obtained for Tomb I are above the ones from the Samarra monument but below what was defined for the Agualva tholos although, once again, the fact that this study only includes 20 teeth most be taken into account. For Perdigões, Tomb I is for now the first structure with funerary use to show signs of this condition. For the deciduous dentition observed 1,2% (n=1/81) showed signs of calculus deposits.

The study of microfossils preserved within dental calculus from teeth from Tomb I and other funerary structures from Perdigões is planned for the near future and will help to draw other dietary inferences for these communities.

Antemortem tooth loss (AMTL) analysis was precluded by the scarcity of observable alveoli in preserved mandibles and maxillas. Amongst the 539 alveoli counted (30,6% of the possible total), 29 cases (5,3%) of tooth loss during life were registered.

Valuable insights can be derived from the careful study of antemortem tooth loss pattern (Lukacs, 2007) but for the collection from Tomb I, differential diagnosis of the aetiology explaining the condition that could yield important insights regarding patterns of behaviour for these prehistoric peoples was not possible. Although issues related to consistency of food and to food preparation methods can, for these populations, be a primary factor in AMTL, dental wear and caries also function as a significant precipitating factor (Lukacs, 2007). However, other possibilities must be considered: is the frequency of this condition the result of deficiency diseases, traumatic injury or does it exist for ritual /aesthetic reasons where dental ablation played a part?

There is also little information regarding this parameter for other tholos/tholoi type structures in South of Portugal (Table 179). The observation was made for the collections studied by Ana Maria Silva and colleagues. Pai Mogo I presents an exceptionally low number of AMTL with only 0,4% (Silva, 2002). The results for Tomb I are lower than the 14,6% obtained for Agualva (Boaventura et al., 2016) and Praia das Maçãs, with 33,7% of AMTL, which is the highest frequency for this condition amongst the studied monuments (Silva and Ferreira, 2007).

For Perdigões, only Ambiente 1 (Pereira, 2014) has available information on this this parameter (Table 180).

Table 179 - Summary of oral pathology (permanent dentition) for individuals from tholos/tholoi type monuments from south Portugal

	En. Hypoplasia	**Wear**	**Caries**	**Calculus**	**AMTL**	**References**
Centirã 2	ND*	ND*	1 (n=?)	Present (N=?)	ND*	
Horta João da Moura 1						
Era Arqueologia	ND*	ND*	ND*	ND*	ND*	Pereiro, 2010
Styx Antropologia	ND*	ND*	ND*	ND*	ND*	Corga et al. 2011
Horta João da Moura 2						
Era Arqueologia	ND*	ND*	ND*	ND*	ND*	Pereiro, 2010
Styx Antropologia	2 teeth (n=?)	Moderate to severe **	2 (n=?) **	2 teeth (n=?) **	ND*	Corga et al. 2011
Monte Cardim 6	ND*	ND*	ND*	ND*	ND*	Figueiredo, 2011
Monte da Velha 1	0/1	5 (n=1)	0/1	ND*	ND*	
Monte do Pombal 5	ND*	Moderate to severe		ND*	ND*	Dias and Figueiredo, 2011
Olival da Pega 2b	ND*	ND*	ND*	ND*	ND*	Silva et al. 2007/2008
Cabeço da Arruda 2	0/0	ND*	ND*	ND*	ND*	Silva 2002
Pai Mogo I	5,2% (11/213)	3,51 ± 1,67 (n=1094)	6,75 (72/1073)	ND*	0,4% (15/4221)	Silva 2002
Praia das Maçãs	13,3% (2/15)	2,64 (n=120)	1,7% (2/119)	ND*	33,7% (42/101)	Silva and Ferreira, 2007
Samarra	ND*	3,15 (n=726)	3,8% (28/717)	13,2% (n=726)	ND*	
Agualva	0/20	3,77 (n=22)	30% (6/20)	40% (8/20)	14,6 % (7/48)	Boaventura et al., 2016
Tomb I (present Study)	10,4% (143/1369)	1,9 (n=1428)	0,5% (7/1406)	20,6% (289/1399)	5,3% (29/539 alveoli)	

*Not described. **Only anatomical connections observed

Table 180 -Summary of oral pathology for structures with human remains from Perdigões.

Structure	En. Hypoplasia	Wear	Caries	Calculus	AMTL	References
Pit 7	NO	NO	NO	NO	NO	Silva et al., 2015
Pit 11						
Skeleton SU76	100% (n=1)	ND	0 (n=32)	0 (n=32)	0 (n=32)	Silva et al., 2015
Skeleton SU77	100% (n=1)	ND	0 (n=6)	0 (n=6)	0 (n=6)	Silva et al., 2015
Skeleton SU78	100% (n=1**)	ND	0 (n=32)	0 (n=32)	0 (n=32)	Silva et al., 2015
Pit 16*	NO	NO	NO	NO	2 (n=?)	Silva et al. 2014
Pit 40*	?	?	?	?	?	
Ambient 1 (open air)	ND	3,2 (n= 48)	1 (n=?)	ND	16,7% (20/114)	Pereira, 2014
Cist*	ND	3 (n=1)	0 (n=6)	0 (n=6)	0 (n=?)	Pereira, 2014
Tomb II	?	?	?	?	?	
Tomb III *	3,3% (n=91)	2,58 (n=105)	8 (n=105)	0 (n=105)	NO	Evangelista and Silva, 2014
Tomb I (present Study)	10,4% (143/1369)	1,9 (n=1428)	0,5% (7/1406)	20,6% (289/1399)	5,3% (29/539 alveoli)	

*Partial numbers **Lower Central Incisor

In general, results for oral pathology show low levels of tooth wear in permanent dentition, which could result from death at a young age. This idea is reinforced by a similar level of wear in deciduous dentition revealing some level of abrasiveness in the foods consumed by these populations that did not have time to affect permanent dentition in general. This can also help explain the residual frequency of caries, below 1% (by total number of teeth) although a diet low in cariogenic foods could also be responsible for this. However, since teeth lost during individuals' lifetime are normally the most cariogenic (Hillson, 2001), the frequency of caries obtained may be underestimated. The antemortem loss of teeth is low, although this was a difficult parameter to observe and numbers could be misrepresented.

At present, trace elements and isotope analysis are underway, which will certainly contribute to the reconstruction of the diet of these prehistoric populations.

Dental health status analysis showed that calculus and enamel hypoplasia are the most frequently represented pathologies; both are diet-related, but there are other causative factors.

Overall a considerable number of enamel hypoplasia was observed with several teeth showing more than one episode of stress during childhood. Future work on the tooth sample from Tomb I will include a deeper understanding of the periodicity and intensity of these episodes that could result from nutritional stress, although other indicators of physiological stress such as *cribra orbitalia* or porotic hyperostosis were not registered suggesting iron deficiency anemia was not a problem in this prehistoric community.

6.5.2 Articular Degenerative Pathology

The characterization of OA in the present series represented one of the most difficult aspects to materialize, since the regions to be observed were incomplete, fragmented or even absent. The information was nonetheless documented making it possible to draw a small number of conclusions since the analysis of these elements allows some insight into potential biomechanical activities of individuals, as well as postural and locomotor anomalies (Mariotiet al., 2007).

Degenerative changes were investigated in the joints of the appendicular skeleton as well as in the vertebral column. The vertebrae were among the worst preserved bone material, so it was only possible to divide them into the main vertebral categories. For each of these segments the body and joint surfaces were considered. The alterations observed in 8 vertebral bodies were distributed amongst cervical vertebrae (between C3-C7) and thoracic vertebrae, all with degree 2 alterations except for one of the latter that presented a degree 1 lesion. Identification was not possible for the other vertebral body observed. In addition to these, one case of vertebral fusion was detected, consisting of two cervical vertebrae belonging to the group between C3 and C7.

There was only one alteration identified on lumbar vertebrae. This was the case of the Schmorl nodule identified in Phase 2D (ner.3651). Considered by some authors as of unknown etiology (Saluja et al., 1986 in Roberts and Manchester, 1995) or as a growth problem due to mechanical pressures leading to the formation of hernias in the intervertebral disc (Cunha, 1994), the most frequent localization occurs in the lower and lumbar thoracic vertebrae (Saluja et al., 1986 in Roberts and Manchester, 1995), which is also true for Tomb I. Schmorl nodules were also identified in some thoracic vertebrae from Praia da Samarra (Silva et al., 2006) and on a lumbar vertebra form Olival da Pega 2b (Silva et al., 2007/2008).

Although very scarce, this information does not follow the worldwide trend of a higher prevalence of OA in the lumbar region (Bridges, 1992; Silva 2002). However, some human populations have a different pattern, namely a higher incidence in the cervical region. This pattern is related to the type of activity, namely the loading of weights on the head, as is typical in traditional agricultural populations (Molleson, 1994; Silva 2002). It should be noted that, even if they have not been preserved, other joints could be damaged.

Apart from the vertebrae, the other articulation generally more susceptible to the development of OA are the hands, the hip, the knee, the acromio-clavicular joint and the 1st metatarsophalangeal joint (Aufderheide e Rodríguez- Martín, 1998: 95; Rogers, 2000; Ortner, 2003). None of these anatomical regions seem to be particularly affected in the collection studies for Tomb I. Indeed, except for vertebral bodies, no alterations were scored above degree 1. For upper limbs, two alterations were scored on the proximal extremity of right humeri. The proximal extremities of a right and a left ulna showed a slight alteration. It was possible to observe the distal extremities of 24 femurs, of which two left and six right showed degree 1 lesions in this area. As for the proximal extremity of this bone, only one case of osteoarthritis was identified, on a left bone. One distal foot phalanx and one cuboid showed signs of degree 1 alteration.

Also, and because it is not possible to know the age and sex of the individuals affected by osteoarthritis it is not possible to understand possible differences between male and female individuals or understand patterns of possible sexual dimorphism in osteoarthritis prevalence.

Because of the functional differences in regions of the spine and the number and variety of joint surfaces of a vertebra (body, facets), a comparison of vertebral osteoarthritis was not possible. However, the lesions found on vertebrae may indicate the frequent transport on foot of heavy loads (perhaps water or food, firewood or even children) a scenario that is not hard to accept based on ethnographic accounts (White, 2012: 518).

The frequencies reported in Table 165 reflect only slight expressions of degenerative osteoarthritis in both in upper and lower limbs, changes probably associated with the normal wear and tear of living, visible around the edges of these articular joint surfaces with the loss of the normally smooth articular surface.

The signs of arthrosis in Portuguese Neolithic / Late Chalcolithic populations are few and the results of the present investigation follow this tendency. In Cabeço da Arruda II there was practically no osteoarthritis detected (Silva, 2002). For Paimogo I (Silva, 2002) although the number of observable joints was significant, osteoarthritis was rare. Nonetheless, it did provide information on a significant number of vertebrae, revealing that the degenerative lesions in the spine were, as in the case of Tomb I, higher in the region of cervical vertebral bodies, suggesting the transportation of heavy loads on the head, a frequent practice in agricultural populations (Molleson, 1994, Silva, 2002).

The signs of articular degenerative pathology are very scarce in the Praia das Maçãs monument (Silva et al., 2007). Of note is a cervical vertebral body with medium degree OA. For Horta da João da Moura 1 tholos (Corga et al., 2011) signs of degenerative pathology were identified on the ilium belonging to an adult female individual. For Horta João da Moura 2, on a skeleton belonging to a possible adult of undetermined sex, the presence of slight OA on a femur head was detected (Pereiro, 2010).

In total, 34 bone elements with evidence of OA (82.35%) were identified in the Olival da Pega 2b tholos (Silva, 2007/2008), most of which were assigned degree 1, according to the classification of Crubézy (1988), with the most affected bone elements being the ulna (N = 5) and the vertebrae (n = 12). The remaining cases are distributed amongst hand bones (n = 8), foot bones (n = 4), the patella (n = 3), the radius (n = 1) and the fibula (n = 1).

In the Agualva tholos (Boaventura et al., 2016), small ante-mortem lesions were observed in the areas of muscle insertions and some bone growth in the borders of the articular surfaces scored with degree 1. However, the authors note that most articular surfaces were not represented, so arthrosis in this monument could be under-represented.

When comparing the results from Tomb I to the other structures studied at Perdigões degenerative diseases in the form of osteoarthritis were observed in a lumbar vertebra and in a proximal foot phalanx from Pit 16 (Silva et al., 2014). Five bone elements with evidence of arthrosis were also found amongst the bones recovered from Ambient 1 (Pereira 2014). Two of them, a fragment of metacarpal and a distal half of an MT1, showed degree 1 changes, according to the classification of Assis (2007). The remaining 3 elements correspond to fragments of vertebral bodies, although it was not possible to fully identify them. Nevertheless, all of them revealed the presence of lipping and porosity (degree 4 alteration). This was the same case for another vertebral body recovered from the cist (Pereira, 2014).

6.5.3 Enthesopathies

The study of this type of pathology in archaeological collections can provide information on the way of life of past populations, especially in relation to levels of physical activity of the individuals (Mariotti et al., 2004). Most of them are of degenerative origin, resulting from micro-ruptures of tendinous fibers submitted to repetitive mechanical overloads, followed by a repair process (Crubézy et al., 1998a).

Enthesopathies do not seem to result from intense physical activity but rather develop as a result of excessive, prolonged and repetitive muscular activity (Cunha and Umbelino, 1995; Silva, 2002; Assis, 2007). Factors such as age at death and sex should also be taken into account when studying this type of injury (Mariotti et al., 2004). However, as already noted by some authors (Waldron, 1994; White, 2012) care is needed regarding inferences about the correlation of these skeletal traits to a specific type of activity undertaken in ancient individuals specially when based on small amount of weak evidence (Jurmain, 1999).

For Tomb I, although there is some information regarding musculoskeletal stress markers, the great degree of fragmentation and bad preservation of the bones highly limited inferences about this pathology in the sample studied because distribution patterns of enthesophytes could not be observed.

Additionally, although some sexual diagnoses and estimates of age at death were feasible, these parameters were never possible to relate to specific individuals. What is more, although some enthesopaties can be related to specific pathologies, the lack of any anatomical connections in the sample recovered from Tomb I did not allow their identification.

Enthesal changes scored for bones from Tomb I summarized in Table 166 show that the only area where lesions above degree 2 were registered was on the *linea aspera* of the femur.

The two Achilles tendons related enthesophytes on calcaneii may be the result of physical activity, as the heel is an important element in the mechanics of the foot, by providing support and propulsion. The lesions located on the patella may also have been the result of extended use of the patellar tendon and the quadriceps femoris tendon during physical activity. The most frequent lesions in Tomb I were found on the lateral supracondylar ridge of the humerus. Constant movements of extension and/or flexion of the elbow could result in micro traumatisms in this area.

In the few existing studies on the prevalence of enthesopathies in the Portuguese populations of this prehistoric period (Silva, 1993, 1996), minimum degree alteration is observed in bone elements described for Praia da Samarra monument (Silva et al., 2006). At Monte do Pombal 5, a case of non-articular degenerative pathology was also identified on the *linea aspera* of an adult left femur (Dias and Figueiredo, 2011).

Silva and colleagues (2007/2008), report 44 cases of enthesal changes in the tholos from Olival da Pega 2b, which include 13 types of lesions. The most frequent lesions are located in the *biceps brachii*, in the patellar ligament and in the flexor ligament of the proximal phalanges. Almost all lesions are degree 1 cases. Degree 2 cases mainly affect the ligaments of the phalanges while the only grade 3 condition involves a visible enthesopathic lesion on a patella (Silva et al., 2007-2008).

A radius fragment with enthesal changes in the area of the insertion of the biceps brachii muscle (degree 1) and a left patella with degree 2 alteration of the patellar ligament and quadrilateral ligament are reported for the Praia das Maçãs tholos (Silva and Ferreira, 2007). For this monument a few degree 1 alterations in the insertion of the Achilles tendon in the calcaneus were also registered: one on a left calcaneus (n = 6) and two on right ones (n = 7).

The research into enthesopathies in Silva (2002) for Paimogo I and Cabeço da Arruda II only delivered results or three regions, the patella, the Achilles tendon and the vertebrae (thoracic and lumbar). This choice was based not only on the fact that these specific regions present best preservation, but also because they are the most likely areas for enthesopathies to occur. Either way, the enthesopathic lesions are practically absent in the remaining parts of the skeleton (Silva, 2002).

In Perdigões, cases of degree 1 and 2 enthesal changes were reported in 64 cases from Ambiente 1 (scale following Mariotti et al., 2004; 2007). The most frequent lesions in this context (61 cases) occur mainly in the flexor ligaments of the proximal and intermediate phalanges of the hands and feet (Pereira, 2014). The same situation was observed by the same author for 4 hand phalanges recovered from the cist.

The general picture thus suggests that most of the pathological changes observed relate to joint disease, evenly distributed amongst the upper and lower limb bones and the spine. This is supported by the presence of enthesopythes, which were most commonly found on the lower limb and foot bones. However, more data are needed to make interpretations about possible causes.

6.5.4 Other Pathologies

Evidence for other diseases such as congenital, infectious and metabolic conditions as well as for trauma was found, but in low frequencies These other lesions observed are isolated cases with no significance at the population level.

Congenital conditions identified in the bone collection from Tomb I involve a case of total fusion between two cervical vertebrae in Phase 2C (no. **3398**) and abnormalities in a thoracic vertebra where a possible case of Notochord Defect (Sagittal Cleft Vertebra) or the result of giant cystic Schmorl's node was identified (no. **3397**). A case of mandible asymmetry was also described for Phase 2D (no. **3695**) with a considerable deviation in the mandibular dental midline towards the right. A congenitally asymmetrical cervical vertebra was identified in Phase 3C, a condition that could have been responsible for the formation of a synovial cyst (no. **2180**).

Similar congenital fusion of two vertebrae was reported for the natural Cave of Lugar do Canto (cervical), Tholos of Paimogo I (thoracic). A C2-C3 block vertebrae were described for a non-adult individual exhumed from the prehistoric tomb of Praia da Samarra (Sintra, Portugal; Silva and Ferreira, 2008b) associated with a possible case of dens axis hypoplasia. The absence of fusion of the posterior arch of the atlas and atlas bipartite were observed in Hipogeu de São Paulo II (Almada; 3.3%; n=30) and Tholos de Paimogo I samples (Torres Vedras, 4.35%; n=23) respectively

There are traces of **infectious pathology** in Tomb I were all observed on lower limbs: in 3 fragments of fibula, 2 fragments of femur and 1 fragment of tibia. All these bones belonged to adult individuals. Both active infections at the time of death and healed lesions were identified, suggesting chronic occurrence and affecting lower limb shafts, in particular fibulas. Due to the commingled nature of the sample it is impossible to know if these bones belong to the same individual or how many individuals they represent. Two frontal bone fragments and 2 occipital bone presented signs of porosity probably resulting from infectious pathology. For non-adult individuals, the only active infection on an upper limb was identified on a right humerus from Phase 3C.

However, the monotonous nature of the periosteal reaction alongside the intrinsic characteristics of the sample only allow a broad interpretation of these lesions as a sign of nonspecific etiology. Periostitis is one of the most commonly reported pathological lesions in archaeological human skeletal remains (Weston, 2012). It can affect any bone in the skeleton, but is most often seen on the long bones. In response to pathological stimuli, the osteogenic periosteum first creates woven bone, which remodels over time into lamellar bone. Despite their high reported frequency, periosteal reactions have not often been the primary focus of research and are often mentioned in passing, simply as a sign of a disease or pathological condition. In the bioarchaeological literature, periosteal reactions are commonly interpreted as a sign of “nonspecific infection,” despite a wealth of clinical literature pointing to multiple etiologies (e.g. Resnick 1995; Weston, 2012).

For other known contexts, Paimogo I and Cabeço da Arruda II are exceptions. In the former, around 20% of the tibias exhibited signs of periostitis but again, the majority were healed lesions. Cabeço da Arruda II stands out because it revealed a left ilium belonging to a non-adult with an age estimation of 1.5 – 2.5

years old displaying an extensive layer of new bone formation. With this exception, the frequency of periostitis is generally low in non-adult bones (Cunha et al. 2007; Silva, 2002; 2003).

In Praia da Samarra (Silva et al., 2006) signs of periostitis were observed on adult bones namely tibial diaphysis, ilium and a small rib fragment. In the individual [247] from Horta João da Moura 2, the presence of possible periostitis in the distal half of the left tibia was identified, belonging to a possible adult probably female (Pereiro, 2010). Several fragments of tibial diaphysis showed signs of small inflammatory reactions that occurred in the periosteum, in the bones recovered from the Agualva tholos (Boaventura et al., 2016). In the bones analysed from Praia das Maçãs, 3 fragments were identified with active signs of periosteal infection: a fragment of ulna, one of ischium and one of tibia. In the case of the latter there was also deposition of woven bone (Silva and Ferreira, 2007).

In the other contexts from Perdigões containing human remains, signs of periostosis were observed in 6 fragments of long bones from Pit 16 (Silva et al., 2014), and on a fragment of a fibular diaphysis, in Ambiente 1 (Pereira, 2014).

As for **traumatic pathology** it was also described in Tomb I on a fragment of a MT from the oldest phase in the tomb, Phase 2A and for a fibula from Phase3C. Once again, it is the lower limbs that are more affected.

This situation complies with what is known for other similar contexts where post-crania fractures are rare. They have been scored in upper limbs (ulna and radium), metacarpal but mostly metatarsal bones (Silva, 2002). Although it exceeds the scope of this work, the most documented trauma are, in fact, depressed cranial fractures (Silva et al. 2012) resulting probably from falls although interpersonal violence is not excluded.

Evidence of old fractures were seen on the lateral surface of a fragment of left tibial diaphysis and near the distal end of a right fibula in Samarra monument (Silva et al., 2006). In both bone pieces a bone callus was observed, representative of one of the phases of remodeling of this type of trauma.

Another situation registered is related with a possible to fracture to a left third metacarpal in Olival da Pega 2b tholos (Silva et al., 2007/2008). According to the author, a bone callus is macroscopically visible in the middle of the diaphysis and its traumatic origin is confirmed by X-ray and suggests that it results from a transverse fracture

In the Centirã tholos (Hoenriques et al., 2013a and b), a well-remodelled fracture was identified on the distal end of an ulna (fragmented shaft, unknown laterality).

The intracapsular fracture of an adult female femur identified in the Paimogo I tholos represents an exceptional find (Silva and Ferreira, 2007Curate et al. 2011).

For the studies on the Perdigões contexts the most striking case is a healed cranial fracture identified in Pit 16 (Silva et al., 2014) on an adult occipital bone fragment. The lesion, a circular remodelled depressed cranial fracture, was localised near the lambdoid suture. The authors do not rule out the possibility of this depression representing an incomplete trepanation

Amongst the cremated remains, in Ambiente 1 (Pereira, 2014), a longitudinal fracture line was also observed along the distal shaft of a tibia from the U.E.1, although doubts exist concerning the nature of the lesion. What is more, 4 phalanges, two proximal (U.E. 177 and 159) and two intermediate (U.E. 159), showed signs of trauma. The presence of bone callus was notable in three of them. Some lesions were also noted in cranial fragments. From the U.E. 160 an exocranial lesion was observed. At the time of death this was already being remodeled, although not totally recovered. The reduced size of the piece and the changes of color and fragmentation made it impossible to understand the original size of the lesion. Several factors may be at its origin, such as an accidental fall. However, no data was available for a differential diagnosis (Pereira, 2014, p. 85).

A probable case of frontal bone hyperostosis from Phase 3C was observed. This metabolic condition has been reported in high frequency among post-menopausal elderly women (She and Szakacs, 2004) and helps reinforce the idea of the presence of a few older individuals (in an apparently mostly young population) amongst the individuals whose remains were deposited in Tomb I. According to Ana Maria Silva (personal information) this is the only known case for this condition in Portuguese prehistory.

6.6 Bone representativeness and Funerary Practices

The analysis of patterns of organization inside funerary spaces is one of the main approaches in the study of necropolis as a way of inferring potential depositional strategies.

What is known about Iberian South Western recent prehistoric populations, their perceptions of bodyhood in life and how it was treated after death is increasing with work done in the last decade, although the overwhelming majority of funerary monuments from the Neolithic or Chalcolithic of this area are built in geological areas that do not allow bone preservation (Boaventura, 2009; Diaz-Zorrita Bonilla, 2013). There are exceptions, of course, but even these monuments were either dug at a time where the methodologies applied nowadays appear as nothing short of totally inappropriate and/ or remain unpublished. Only in the late nineties did it become compulsory to include the presence of experts in biological anthropology during fieldwork or report writing. Although Portuguese megalithism has been well known in archaeological bibliography for decades mainly due to its monumentality, the Neolithic/Chalcolithic necropolis has not been, in most cases, investigated under the combined techniques of Archaeology and Human osteology. In Portugal, this divorce was even been more pronounced and led to the loss of essential information regarding funerary rites practiced by the Neolithic populations. Until very recently, excavation of necropolis had been limited to the collection of bones, the inventory of artefacts and the classification of architectural structures.

However, especially in contexts that are exclusively collective and possibly secondary, Human osteology is an essential tool in the field, given that we are dealing with an historical period for which the ways of processing dead bodies and handling bones remain poorly known. The discussion is nonetheless an old one in other European countries and in the international literature on Neolithic-Chalcolithic collective burials. The secondary nature of the European megalithism necropolis was advanced by several researchers more than 20 years ago (Castro, 1995; Crubézy and Sellier, 1990: 310) At a more detailed level, some researchers even came forward with an even more elaborate hypothesis, according to which the use of British megalithic funerary monuments of the 3rd millennium BC, for example, involved the transportation of body parts between different tombs, and even between communities (Chapman, 1994).

Types of funerary repositories range from individual burials to multiple burials with more than two individuals interred, and collective commingled burials (Parker Pearson, 2000). The latter normally describes deposits found containing disarticulated and often fragmented human remains belonging to several individuals (Knüsel and Robb, 2016). They may be mixed with artifacts and faunal remains.

The variation in mortuary practices is further divided into primary burials and secondary burials as a way to characterize the burial ritual, normally based on calculation of skeletal parts representation. This is based on the premise that in undisturbed primary depositions individuals are found in the original place of deposition of the corpse, normally as articulated skeletons with all bone elements present, which may vary according to level of *in situ* bone destruction (Osterholtz et al., 2014; Fox and Marklein, 2014; Robb, 2016; Knüsel and Robb 2016). Secondary depositions correspond to a subsequent deposition of human remains that have already undergone a previous treatment elsewhere (Robb, 2016; Knüsel and Robb, 2016). In this case, skeletal remains are totally or partially disarticulated and there is typically an underrepresentation of smaller and more fragile bones. While these processes may be ritualistic and symbolic, they are inherently destructive to the preservation of the remains and challenging to the reconstruction of sample demographics. In cases where there is a cultural selection of bones, for example, funerary contexts can derive from primary or secondary depositions but because specific elements are intentionally collected or protected, particular bone elements can be over-represented (Robb, 2016). An ossuary is one type of secondary deposition where disarticulated human remains have been deposited in a structure with defined boundaries (Ubelaker, 1974). Ossuaries are significant to mortuary studies because individual identities are lost during the commingling process, which complicates bioarchaeological analysis of the remains (O'Shea and Bridges, 1989; Ubelaker, 1974).

The ritualization of death is difficult to understand in collective burial contexts, given the challenge of interpreting the burial and the several steps involved in the treatment of the body. Such questions can possibly be answered if the Human osteology methodologies are strictly applied.

Commingling involves the process of mixing partial and disarticulated skeletal elements from two or more individuals in a single assemblage (Byrd and Adams, 2003; Nikita and Lahr, 2011; Varas and Leiva, 2012). Natural taphonomic processes include disarticulation and fragmentation of the remains by processes of decomposition and animal scavenging, which lead to scattering/dispersal of the remains (Adams and Konisberg, 2008; Baustian et al., 2014). Intentional taphonomic processes by human action may involve transporting certain skeletal elements from a primary burial to a secondary burial or mixing the remains in some original location (Baustian et al., 2014; Shaefer and Black, 2007; Ubelaker and Rife, 2008).

Faced with the commingled reality found by archaeologists in Tomb I it was crucial to interpret the sample and try to understand if it resulted from the original funerary gestures taking place in Prehistory or if, on the other hand, it was the result of intense post-depositional transformations. And if indeed it was an original context, what phases and processes had the bones been through until they arrived at this final resting place. The assumption was made that taphonomic processes have an inevitable effect on the original depositions and that the assemblage identified and recovered by the archaeological team that excavated Tomb I is necessarily altered by them. It was also assumed that the effects of the passing of time and recurrent disturbance episodes that affected this bone assemblage are impossible to understand in full, since skeletal assemblages form by a combination of processes that affect different skeletal elements differently.

The information recovered during field work, after the cleansing, classification and labelling of bones and fragments, all bone fragments which could be glued and / or associated with their antimere were marked with China ink. The aim was to find possible anatomical associations that could indicate the origin of the various fragments and to evaluate the degree of dispersion of the bones. However, this association was not possible, partly because of the poor degree of preservation of the bone fragments.

The analysis of bone and tooth representativeness in Tomb I only included adult bones and revealed and pattern that is compatible with what was observed for the per-phase approach. Although bone representativeness analysis was not performed for non-adult bones, all the main skeletal parts were identified during this study.

There are several indicators of the presence of a large number of **cranial** elements in Tomb I. This is in accordance to the field observations where the general image of the chamber was dominated by apparently large numbers of deposited cranial vaults, which did not seem to have correspondence with many of the other generic bone groups, except for long bones. The biggest problem for the confirmation of this assertion is the fact that although found intact, many of these craniums did not survive field work and the many years of post-excavation storing and manipulation, as their physical integrity is hard to maintain. We are left with thousands of cranial fragments that cannot be put together. The weight values for the two first phases, of use of Tomb I, although experimental, show an extremely high presence of cranium even if we consider their high mineralization and number of concretions that obviously magnified the intrinsic weight value of the bones.

Although the degree of **tooth** fragmentation is high, the analysis of the dental remains showed an intense use of Tomb I, but their numbers contrasted with the number of individuals identified through bone count. The numbers for permanent teeth point, in reality, to a much higher MNI than the osteological data. A universe of 55 adult individuals through the count of FDI 18. This number is incompatible with data from osteology, which suggests a much smaller number of individuals (n=38, through right femur count). This apparent inconsistency may indicate that the tomb was "cleaned" several times, with individual teeth remaining, which then blended into the sedimentary fill. The opposite may also have happened - individual teeth were imported, mixed with human remains brought from other graves, although this case is less likely. The analysis of the bone representativeness was completed with the study of proportion and percentage of the different types of teeth suggesting, as mentioned, that Tomb I constitutes a burial site where intense manipulation of the skeletal remains took place (Table 153 and Table 154). It must also be taken into account that in bone collections such as the one recovered from Tomb I, success in tooth identification is very superior to that of fragmented long bones and this results could possible reflect this reality.

The quantification of the various anatomical elements of the **upper limb** seems to suggest that it is a more or less well-preserved set, where at least the remains of 30 individuals were deposited, based on the number of right humerus identified. The apparent discrepancy in the number of individuals indicated for each category of upper limb bone may be due to a heterogeneous conservation of different parts of the skeleton. For example, the maximum MNI, obtained from the left ulna (n = 28), contrasts with the values obtained for the shoulder blade (n=27), which is much more fragile and more likely to undergo more significant taphonomic changes, although it is based on the count of the glenoid cavity. Likewise, the minimum number of individuals obtained for the radius (n=14) contrasts with the double values obtained for the ulna (n=28), which seems incongruous, given the anatomical proximity of the two bones and the apparent formal similarity. However, if the origin of this data is analysed, it can be observed that the value is obtained from a portion of the ulna that is extremely resistant (the trochlea/humerus joint) but also easily identifiable. In the radius, the most frequent portion corresponds to the central part of the diaphysis which, however easy to identify, is difficult to lateralize. Thus, the numbers that seem to show a lesser representation of the radio must be looked at with caution.

The carpal bones are unequally represented, with right capitate indicating NMIs of 17 (30,9% of representativeness), but most of them showing a representation below 20%, which is noticeably low.

Regarding the **lower limb,** the femur (n=38) is the best-represented bone followed by the tibia (n=29) although with a lower representativeness. The remaining bone types show a frequency of less than 40% (patella, MT3, MT5 and fibula), and all the other tarsal bones show a presence below 20%. Amongst long bones, the identification of femoral and tibial fragments is more sucesseceful than that of the fibula, for example and these results could reflect this reality.

Noticing this already in 2001, as the available field data was systematized for the final archaeological report, Cidália Duarte (2001) came forward with 4 possibilities to explain the low presence of most small bones.

A: deficient collection of small bones, due to the lack of sieve during field work;

B: these bones were discarded as part of the funerary practices taking place in Tomb I

C: deficient conservation of these bones;

D: the bone set was affected by the action of carnivores and rodents.

Although these propositions were based on the observation of only part of the osteological remains from Tomb I, the discussion and exclusion of each one remains a valid exercise.

Indeed, the excavation of the tomb was performed with minute criteria of exhumation and registration and attested by the constant presence of an anthropologist, who would have identified anatomical associations even if only partial ones. Also, despite the non-use of a sieve, the explanation for the low representation of bones being based on deficient excavation techniques is excluded, as there are quite a number of portions of the skeleton present (the small fragments of dental enamel recovered are a good example), which would otherwise also not be identified during fieldwork. Hypothesis A was, hence, discarded. Likewise, hypothesis C was also excluded by Duarte, on the basis of the high conservation and resistance of carpal and tarsal bones in funerary contexts (Darwent and Lyman, 2002). Before discussing the proposition of deficient presence of carpal bones as a choice resulting from specific funerary practices, Duarte (2001) passes these bones through what she calls a "taphonomic filter", and analyses the possible effect of bioturbation factors on the bones, which could potentially be responsible for the preferential preservation of specific parts of the skeleton. The results of this analysis, which scored the surface alterations denouncing the action of carnivores and rodents, still stand. As was seen in the taphonomy chapter, only a very small percentage of bones show evidence of carnivorous marks. Therefore, by a process of elimination, the explanation for the low presence of carpal and tarsal bones in Tomb I was sought in the idea that the funerary use of the structure resulted from a sequence of intense manipulation that may have assumed several forms.

The complete testing of these hypotheses could only be performed after the complete analysis of all bone and bone fragments and the analysis of other funerary contexts, based on ethnographic and archaeological data. At the time of the first interpretations, the first hypothesis for the explanation of the funerary gestures that could lead to the production of these osteological contexts were beginning to be put forward (Trinkaus, 1995). Some very heterogeneous scenarios were described as possible for collective or multiple burials involving the emptying and cleaning of some of these structures (Chambon, 2003).

The heterogeneity in bone representativeness was also noticed in other early attempts to explain the funerary practices in Tomb I. Indeed, based on the relative frequency of bones Lago et al. (1998) and Valera et al. (2000) came forward with the proposition that the human remains buried in Tomb I were the result of the secondary use of the context. Once again, it is important to notice that the excavation and study of the tomb was not finished at the time these hypotheses were put forward and they were based on partial analysis of bone samples studied for the annual reports.

Despite this fact, the hypotheses put forward by these authors for the formation of the deposits in Tomb I maintain their validity after the conclusion of this anthropological study. They proposed that Tomb I was either the result of the transport of bones from another place (or places) from inside or outside the Perdigões enclosure or, rather, a set resulting from the partial transference of part of its human remains to another unknown location or locations (Lago et al., 1998; Valera et al., 2000; Duarte, 2001). On the whole, the human bones analysed from Tomb I showed that it was used for the probable secondary deposition of human bones without recognizable complete or partial anatomically connected skeletons. The alternative possibility put forward (Valera et al., 2000) that both primary and secondary depositions could have taken place within Tomb I and bones would be re-arranged after decomposition of soft tissues cannot be ruled out after this study, although not supported by the empirical evidence.

As it is, we remain with a strong indication that these first explanatory models for the funerary ritual in Tomb I maintain their validity although other hypothesis cannot be completely excluded. What is clear is that this is a context subject to high levels of manipulation and reorganization in a context that probably involved high levels of tomb re-visitation and internal re-organization in the light of the complex funerary practices that took place in the Perdigões enclosures, from which Tomb I cannot, in any way, be separated.

Almost twenty years later, there are many examples for the complex use of this kind of funerary structure and vast evidence for varied and differentiated funerary practices. Archaeological and anthropological field data indicate that in different kinds of funerary contexts the Chalcolithic communities seem to have used different funerary formulas in the treatment of the dead that involved tomb re-visiting and high levels of manipulation of the human remains at different stages of decomposition (Silva, 1996a; 2002; Godinho, 2008b; Miguel and Godinho, 2009; Tomé, 2011; Valera and Godinho, 2012; Valera 2012a; Cunha, 2015).

The variety in funerary practices in Perdigões has already been discussed and are the result of publications where the secondary nature of the human depositions in Tomb I is maintained (Valera and Godinho, 2009 and 2010; Silva et al., 2010; Valera et al., 2014). But amongst the other known tholos type structures this complexity and differentiated use of the tombs is also a reality although, once again, information is only available for a small percentage of the known sites.

As mentioned before, two different teams carried out the work in the Horta da João da Moura site. Only the analysis of the information gathered in both interventions and the integrated analysis of stratification will allow a clearer understanding of the complexity of the practices that took place in both funerary spaces, the reconstitution of the funeral gestures and the represented population. The radiometric confirmation of the chronology and diachrony of the different moments of construction, use and abandonment of the structures is fundamental for its integration in the wider knowledge of the funeral practices of the III millennium in the southwest of the Iberian Peninsula. Nonetheless, the technical reports from both teams shed a first light on the differences between the uses of these two contiguous monuments, found in the periphery of the great ditched enclosure of Porto Torrão (Valera, 2010; Pereiro, 2010; Corga et al., 2011). For Tholos 1, only one articular continuity was identified between the proximal section of a right femur and the ilium belonging to an adult female individual (Corga et al., 2011). Apart from this single anatomical connection, several groups of fragmented human bones were identified as part of different levels of funerary use of the monument (Pereiro, 2010; Corga et al., 2011). The data that were collected during our fieldwork are suggestive of a secondary deposition site with great bone fragmentation and disarticulation although further work is needed on this collection as these results are preliminary.

Horta João da Moura's Tholos 2, on the other hand, presents 28 cases of articular continuity represented in 10 cases, exclusively by the connection of the cranium with the mandible. For the rest of the 18 individuals, remains of anatomically connected upper and lower limbs are found. It was possible to perceive 2 individuals in right lateral decubitus, 2 in left lateral decubitus and also 1 in dorsal decubitus. Some of the limbs were found flexed and there seems to be a tendency towards the north-south orientation of the bodies in 2 of the identified individuals. One other was in a west-east position. Apart from these elements, groups of bones with no anatomical connection were identified, although the authors state that it is not possible to know if they are loose elements or part of the anatomical connections. The whole interior space of the tomb was intensely occupied, which is emphasized by the fact that some individuals were deposited or pushed, still as corpses, towards the wall of the chambers (Corga et al., 2011).

Monte do Cardim 6, also on the periphery of the Porto Torrão ditched enclosure shows evidence of several phases of use, abandonment and violation and so the anthropological data, still not thoroughly studied, must be analysed with caution. For this monument, there seems to be signs of primary deposition, represented by a non-adult deposited alongside a carinated bowl and several levels of ossuaries with mixed and fragmented human remains (Figueiredo, 2011).

In Monte Pombal 5, two distinct patterns in the organization of space were identified by the archaeological team (Dias and Figueiredo, 2011) A first on the north side corresponding to the largest osteological nuclei, which invariably is found pushed towards what remains of the stone structure which constituted the wall of the chamber. A second pattern of osteological remains was identified isolated and scattered throughout the area of the chamber. Within the first mentioned pattern, a frequent association between cranial remains and long bones was identified.

The study of the Olival da Pega 2b tholos by Silva (2005) contemplates only part of the bone material recovered in the whole monument. The author suggests that the "osteological profile" obtained gives credence to the hypothesis that the observed cremated bones are the result of a primary deposition of human bodies in the Tomb. This conviction is supported, on the one hand, by the homogeneity detected in the frequencies of MNI amongst different bones and, on the other hand, by the high numbers of small bones, such as carpal and tarsal, as well as metatarsal and metacarpal found relative to the maximum frequency of MNI of this sample.

For Agualva, the tholos in Estremadura with the apparent lowest MNI, there was the perception shared with the Leisner couple that the explanation for the position the bodies were found in was the fact that they were buried crouched, against the wall of the funerary monument (Ferreira, 1953, p148). Although skeletons are mentioned in the publication of Veiga Ferreira (1953: 150) the recent studied anthropological collection consisted of a set of disjointed bones (Boaventura et al., 2016) so nothing can be said with certainty about the original type(s) of deposition.

Bone weight was applied to the partial collection of human bones studied by Silva and Ferreira (2007) for the Praia das Maçãs tholos. The results revealed some deviations from the theoretical values. Skull bones (including the jaw) and the limb bones were overrepresented, but the opposite is true for hand bones and especially for the "remaining bones" category (torso and thorax). The authors state that this tendency is usually observed in places of collective burial. While the bones of the hands are easily lost because they are small, the "remaining bones" include very fragile bones, which are therefore greatly affected by the rummaging of the tombs and consequently present a lower preservation rate. In the opinion of the authors, the small size of the sample could disguise the true nature of the depositions and so conclude that the results of this approach do not rule out the possibility of the tholos being used as a primary place of burial (Silva and Ferreira, 2007).

Four primary and five secondary burials (reductions and ossuary) were identified in the recently excavated Centirã tholos, with the presence of numerous scattered bones (Henriques et al., 2013a and

2013b). The archaeologists discerned two different funerary moments of use in the chamber of this tomb – a first one before the collapse of the false dome represented by the primary burials 1 to 4 and by ossuary 1, and a second moment, after this collapse, represented by secondary 1 and 2. These second depositions are the result of the reutilization of this funerary structure late in the 3rd millennium BC as seen above in Table 4, which lists the radiocarbon dates available for tholoi or tholos type monuments in the south of Portugal. The presence of bone "reductions" in the chamber is explained through the need to incorporate new depositions in the tumulus that would sometimes imply the destruction of older burials, with the consequent dispersion of the disarticulated bones in the areas adjacent to the original position of the body and favouring the accumulation of bones in these 'reductions'. Two of the burials (# 1 and # 4) were deposited in a foetal position. The burial position of the other two primary burials (# 2 and # 3) was not determined due to the incomplete nature of the skeletal remains.

The analysis of the bone representativeness, the proportion and percentage of the different types of teeth and the weighing of different bone categories was also performed by Ana Maria Silva for Pai Mogo I tholos and Cabeço da Arruda 2 (Silva, 2002). For Paimogo I, the results point to a primary burial site: a comparison between the percentage of *in situ* and loose mono-radicular teeth with the pluri-radicular suggests not only that the decomposition of the bodies occurred inside the tomb but also that the bones showed strong signs of handling, which is also indicated by the results obtained in the analysis of the remaining bones of the skeleton. Cabeço da Arruda 2 on the other hand, revealed substantial irregularities in all of the methodologies used showing results which are incompatible with those expected in primary burials. But due to the lack of knowledge regarding the amount of bone loss occurred since its discovery, it would be very difficult to reach a definitive conclusion as to the type of burial of this tomb (Silva, 2002; p. 124).

When the investigation finally brings us to the point of trying to answer the question central to this thesis and attempting to ascertain to some extent what kind of ritual or rituals are involved in the use of Tomb I as a funerary structure, a two-fold issue rises. On the one hand, there is the complexity of the questionnaire that this approach involves, which derives partly from the intrinsic nature of these funerary contexts that do not exclusively result from a random process of sedimentation, but from intentional acts of deposition regulated by social prescriptions unknown to us, with varying and probably autonomous meanings. On the other, the requirements needed to respond to this questionnaire are confronted with the limitations of the existing archaeological and anthropological record.

The first problem refers to the theoretical debate concerning what can be inferred through the funerary record and the possibilities and limitations of knowledge in archaeology. The second, with the frailty of the material traces of past funerary practices, which rarely meet the demands of the questions that surround them.

The considerations on the nature of the anthropological sample exhumed from Tomb I result from the study of the osteological and dental remains analysed in the field and in the laboratory and led to the following conclusions regarding the funerary use of the space:

- The excavation of the tomb obeyed minute criteria of exhumation and registration, attested by the constant presence of an anthropologist who could identify anatomical associations, even if partial.
- Tomb I is a collective funerary context for the deposition of human bones and votive artefacts.
- The number of individuals represented here indicates the presence of remains from a minimum of 103 individuals, 48 of whom are less than 15 years of age.
- Possible secondary anatomical associations that could indicate the origin of the various fragments and to evaluate the degree of dispersion of the bones where sought in the laboratory. However, this association was not possible.
- The human bones analyzed point towards a probable secondary place of deposition or at least one where intense manipulation of the human bones took place. It is not clear whether the ensemble results from the partial removal of the skeletons from the local site to another tomb, or whether, on the contrary, it represents the importation of human remains from another site into this structure.
- the osteological set under analysis passed the taphonomic test, demonstrating that it is an intact set resulting from anthropic actions that took place in the Chalcolithic.
- In addition, the ruin of the slabs from the walls of this funerary structure would tend to preserve not only older possible primary depositions from Phase 2, but also the ones found “crushed” in between slabs, as identified in Phase 3B. The latter corresponded to the deposition of isolated bones with no anatomical connections. The bones identified in Phase 2 shared the same circumstance.

Disarticulation and disorganization of the bones in a funerary space under such conditions does not necessarily imply a secondary funerary context (Duday, 2006), particularly when tombs are used over a long period of time. It must also be recognized that other southwestern Iberian collective prehistoric tombs containing large numbers of individuals are usually characterized by an apparent disorganization of bones (Silva, 1996; 2002; 2012) and sometimes misinterpreted as places used for secondary deposition of human remains, although paleobiological studies (Silva, 1996a; 2002; 2012; Tomé, 2011; Diaz-Zorita et al., 2012) and recent field work have proven that many of them were also used for primary burials.

But this does not seem to be the case for Tomb I, where the first field based interpretations of the site as a secondary burial place (Lago et al., 1998; Valera et al, 2000) were strengthened through the posterior laboratory analysis. None of the available anthropological methodologies applied for the definition of the type of funerary practice present in Tomb I pointed towards the primary use of the tomb. Even the presence of some small human bones in the anthropological record (many of them intact) cannot be used as an argument. As already described, Pits 16 and 40, in the central area, which contain the unequivival secondary deposition of hundreds of cremated human remains included a large number of small bones and bone fragment, revealing that bone recovery from the previous location of deposition or body processing was extremely careful and detailed and included even the smallest elements of the skeleton (including non-adult small remains).

The archaeological data provides evidence that points in the same direction. If the available chronology of Tomb I is observed, a common difficulty arises - the prolonged duration of occupation of these tombs. In the case of Tomb I, its occupation is well defined culturally, given the homogeneity of the votive artefacts identified. Despite the difficulty in obtaining dates by radiocarbon, given the poor preservation of the collagen, the chronological spectrum the artefactual set identified in Tomb I indicates it was used in the first half of the 3rd millennium BC in a homogeneous way, regarding the specific funeral practices. Thus, it is more probable that the osteological set found in Tomb I results from the same cultural tradition and can be interpreted as a "process", with successive stages of treatment of the corpse.

If on one hand the use of the Tomb seems to have happened under the same “cultural prescriptions” and perhaps during a relatively short period of time, this does not necessarily have to reflect in the date set available for Tomb I, where data are suggesting bone transportation that could mingle different individuals that died in significantly different times (Valera et al. 2014). The dates from Phase 3, which corresponds to the use of the tomb after the walls of the chamber begin to collapse (Beta-327747 and Beta-327748) are similar to the older date from Phase 2 and actually older than the date from the end of that first phase (Valera et al., 2014). Two hypotheses have been suggested for this fact, one being that the great bone manipulation that took place in the tomb could have changed the stratigraphic position of bones in the chamber and push them up to the more recent layers, or that Tomb I was used for secondary depositions and older bones were brought to the tomb in later moments or at the same time as more recent ones, suggesting that bone transportation could mix different individuals that died in significantly different times (Valera et al., 2014, p. 40).

Concerning the ritual management of the funerary space, some considerations can also be advanced. First of all, in Tomb I there was a clear differentiation in the way the chamber, the corridor and atrium were used. This last space was probably not related to funerary depositions of human remains, as only artefact depositions were contextually identified here. These depositions are of an eminently votive character. The materials are almost entirely related to the sacred, and are common in funerary contexts of this period. On the other hand, the chamber was an area of intensive funerary use, with systematic and successive secondary depositions of human remains with greater use of the sides of the main entrance (Figure 133). Regarding possible specific organizations in the deposition of human remains, the evidence is unclear, as was demonstrated by the study of the spatial use of the chamber space in the various phases of use.

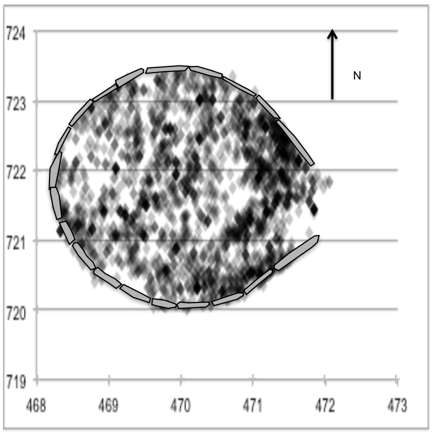


Figure 133 - Total use of Tomb I (Perdigões) based on the coordinated human remains from all phases.

The spatial distribution of human bones, in small nuclei, under collapsed slabs, demonstrates the successive and interrupted use of the grave by its users. In the case of Tomb I, we must add that detailed observation of the relationship between architectural structures and human remains even clearly demonstrated that at a certain point in time, the walls of the chamber started to collapse. Recovery of human remains on top and underneath the fallen flagstones show that the tomb was used, and maintained its function, even after its visible integrity was destroyed.

It seems consensual, based on the analysis of human bones recovered from Tomb I, that there is little distinction in age and sex of the individuals that were deposited there (Figure 134 and Figure 135). The percentage of non-adults is noticeably high.

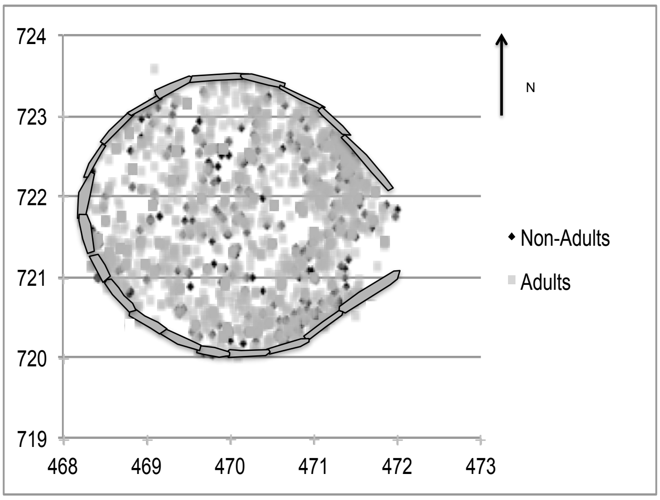


Figure 134 - Total distribution of adult/non-adult bones based on coordinated bones from all phases of use of Tomb I (Perdigões).

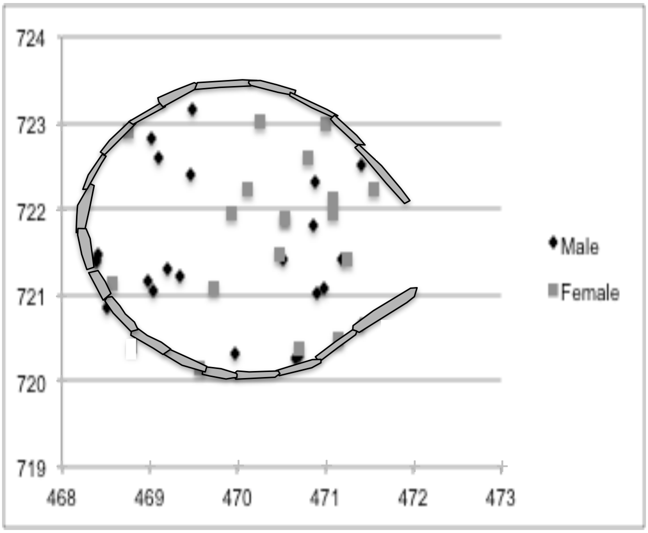


Figure 135 - Total distribution of bones with male/female characteristics based on coordinated bones from all phases of use of Tomb I (Perdigões).

Considering the information available for other tholos/tholoi type monument in the South of Portugal the funerary practices identified in Tomb I are not unusual, although no primary inhumations were uncovered. In what is the known universe of funerary practices in Perdigões, Tomb I is closer to the mortuary practices recorded in Tombs II and III than to the primary depositions of 3 individuals in sector I or the cremations identified in the central area.

6.7 Summary

In the previous chapter, the global approach to Tomb I was the base for disccussing the obtained results that were compared to what is known for other tholos/tholoi type monuments in Portugal and to the known anthropological reality of Perdigões Archaeological Enclosures.In the following chapter, a model is proposed for what could be happening, regarding funerary practices, in the large ditched enclosures of southwest Iberia.

(…) The grave is dug outside the town, very large and deep, capable of containing all the bones, furniture, and skins offered for the dead. A high scaffolding is erected along the edge, to which all the bags containing bones are carried; then the grave is draped throughout, both the bottom and the sides, with new beaver skins and robes; then they lay in it a bed of tomahawks, next kettles, beads, necklaces, and bracelets of wampum, and other things given by the relations and friends.

Description of Huron ossuary burial. The journals of Father Gabriel Sagard (1623-1624). In: Ubelaker, 1974: p. 8

7 Resting in peace or in pieces? What is happening in enclosures?

The original location of bones in a context like Tomb I is difficult to assess due to the intense manipulation of the funerary space, which could be the result of the re-use of the chamber, and also the post-depositional disturbance of the remains since Neolithic times. In the case of collective assemblages like this one, intentional assemblages of specific bones may have taken place after skeletal disarticulation (Duday 2006) so a dispersion analysis was performed in an attempt to detect such practices,

No anatomical connections were identified during fieldwork at Tomb I. No articulations, even the mostpersistent, were present at the site, and virtually all uncovered bones seemed to be in total disarray. Although this is not enough information to infer the nature of the depositions, the analysis indicates that they were probably mainly secondary ones. The presence of some small bones, such distal phalanx, carpals and tarsals cannot be interpreted as an unquestionable indicator for primary depositions. In fact, in another area of Perdigões (Pit 40) where the remains of hundreds of cremated human bones were identified in what is unmistakably a secondary deposit, a large number of small bones was recovered (Silva et al, 2010) revealing a great care in the collection and placing of bones between the previous and their final resting place. In the case of Tomb I, we must add that detailed observation of the relationship between architectural structures and human remains even clearly demonstrated that at a certain point in time, the walls of the chamber started to collapse. Recovery of human remains on top and underneath the fallen flagstones show that the tomb was used, and maintained its function, even after its visible integrity was affected.

In the only other structure with similar features in Perdigões, Tomb II, although the anthropological study of the human remains is still underway, no primary depositions were recognized in the excavation and only a foot was recovered in anatomical connection, deposited in the first layer in the centre of the atrium.

A more extensive and in-depth analysis of the inventoried remains could possibly have identified complete individuals from this sample, but no secondary connections were identified and the remains emerge as incomplete, disarticulated skeletal elements and not representative of complete human bodies. The results support the alternative hypothesis, which suggests that Tomb I was an ossuary of secondarily commingled remains.

The relative frequency of the dominant bones in this set is not what would be expected in a "natural" process of decomposition and post-mortem dismemberment of the bodies, especially given the presence of a large number of cranial elements. The available data point to the selection of specific elements in the final burial site - the secondary moment of the funerary process. If complete individualized skeletons existed in the chamber of Tomb I, they should have been preserved (at least partially) between the slabs that so singularly preserved groups of bones between the various moments of the wall collapse. However, no such evidence was recorded.

The suggestion of the secondary use of this structure advanced throughout the years by several investigators (Lago et al, 1998; Valera et al., 2000; Evangelista, 2003; Valera et al., 2014) is strengthened by this anthropological study and the several hypotheses regarding the process of funeral treatment maintain their validity.

- The first phase of the mortuary process was carried out in adjacent graves with a different organization of their osteological assemblages potentially characterized by a smaller number of bones as a whole, and a greater representativity of bone elements missing in Tomb I.
- The first stage of the mortuary process was carried out on perishable structures located inside the Perdigões complex, but not inside any structured grave. In this case, there would have been no traces of these structures, except for the presence of human bones in places where they would not be predictable, that is, in places not marked by any permanent structure.
- The first stage of the mortuary process would have been outside the Perdigões complex and would, consequently, have been virtually impossible to detect. These tombs would assume a symbolic role, as an integral part of the collective memory, revisited and reused for a long time. In the context of this hypothesis, Perdigões would be associated with the funerary deposition of individuals coming from more or less distant places in the territory.
- The hypothesis that Tomb I could have been the receptacle for primary depositions in an very early phase of its use cannot be ruled out. The constant posterior revisitation of the tomb and manipulation of the human remains could be responsible for there being virtually no trace of this use.

The existence of two body processing sites - the primary and secondary - involves the prolongation of a ritual, the permanence of life through death, the lingering and permanent contact with the ancestors, memory. The spatial distribution of the various human bones in Tomb I indicates the inexistence of a special treatment of certain individuals. From the field data, we can say that these nuclei are composed by several, diversified bone elements, which do not follow any organization based on age or sex distribution. This indiscriminate management of human remains suggests that the treatment of death is viewed as a collective act or memory, rather than individual. This interpretation is reinforced by the continuous deposition (and possible removal) of human bones and offerings throughout the process of ruin of the monument, a practice attested to by the contexts of funerary deposition interspersed by slabs fallen from the sepulcher wall. Approaching some understanding of the Neolithic/Chalcolithic funerary world is a complex and vast quest. The enclosure/enclosing phenomenon is yet another materialized aspect of this way of being-in-the world and the interaction between funerary behaviours and the practice of enclosing is still a theme replete with blank spaces and doubts. The results from the investigation of the last 20 years in Perdigões prehistoric enclosures allow research to advance and the opening up of other perspectives on how to try to understand these practices in the light of what is known about prehistoric ontology, where an apparent fluidity between different categories defies our modern concepts and views of the world.

As seen previously, for enclosures, their known number has risen from a mere number of 5 (in 1996) to an impressive 67, identified not only through fieldwork but also by aerial prospections and photography. The relation between Portuguese enclosures (ditched or walled) and specific mortuary rites, of which Tomb I is part, is just one more piece of this wider mosaic of practices involving collective and sequential use of spaces for the deposition of human bones.

We might know about typologies and sizes of sites, understand their broad chronology based on surface finds and architectures but investigation is at the beginning, contextual specific information is missing leaving us with several research problems.

Comparing the anthropological results from of Tomb I with what is known for Perdigões comes up against badly known temporalities, a great variety of mortuary practices and body treatments happening in different architectures with different artefactual sets. However, what is also very clear is that for some reason, these different funerary practices, formalized and non-formalized, all come together reunited in the same physical space, built and rebuilt throughout approximately 1500 years and that each of these realities must have played a part in the construction of meaning and the embodiment of beliefs for the communities that used that space for the deposition of human remains.

In the case of the Late Neolithic pits, in addition to the fact that they are chronologically disparate from Tomb I, they also represent a form of body treatment exclusive until now in the whole of the known anthropological record of the site (Silva et al., 2015) These two pits were part of a sequence of four pits that intersected and cut them. Pit 7 yielded some elements of lower limbs belonging to an adult female, as well as non-adult phalanges and skull fragments that could result from soil movement that altered their original position displacing them. The hypothesis is also raised that they might have belonged to another burial deposit present in Pit 7. Pit 11 contained the skeletal remains of three non-adult individuals. Preliminary results of ancient DNA analysis indicated that they were all male individuals with no matrilineal relationship between them.

Although articulated, these skeletons are incomplete and show signs of body manipulation as has been described (Cf. Pit burials). It has been suggested by Godinho and Valera (Godinho, 2008; Valera, 2008a) that the absent body parts may have been removed in a deliberate manner as part of the underlying and prevailing funerary ideology practiced by these communities. The primary, open space depositions inside the pits would be the initial stage of a complex process of body part circulation that would be subject to differentiated body treatments in different scenarios, involving different practices and spaces (Valera, 2012c).

As it is, for Perdigões, only Tomb I has been totally excavated and the anthropological study of Tomb II is expected to be available at the end of 2017. The data available, nonetheless, point to a different use of Tomb II as there is clear evidence of the chamber being completely emptied sometime around the middle of the 3rd millennium BC and reutilized in the 2nd half of the 3rd millennium (Valera et al., 2014). As for the atrium, it was heavily used as a funerary space for the deposition of a great number of human remains, unlike what happened in Tomb I. These depositions most probably belong to the first phase of use of Tomb II, before the emptying of the chamber, and included the only anatomical connection identified for both tombs, a probable female right foot.

So far, archaeological evidence published for deposition of human bones in ditches points to secondary deposition of unarticulated human bones, some of which might have been unintentionally carried along with other materials filling the ditches. However, at least the skull from Ditch 3 presents solid evidence of intentional deposition. The same seems to be the case for the group of bones found at the bottom of Ditch 4 (Valera and Godinho 2010).

At the same time as these events were occurring, the central area of the enclosures was being used to deposit cremated human remains in pits and open area.

In Pit 16 stratigraphy showed the sedimentation of two thin layers in the bottom of the pit, followed by a "dumped" deposit with a conical shape of cremated remains that includes abundant charcoal fragments and ashes, human bones, fauna. The stratigraphic evidence shows that the cremation took place elsewhere and that the remains were carefully collected, transported and deposited in the pit.

Nearby pit 16, just 5 meters east, there is an area that revealed a sequence of structures and contexts with several deposits of human cremated remains. The sequence is composed of a pit (Pit 40), a cist integrated in a semi-circular stone cairn and several episodes of depositions of cremated remains in open air over the cairn structure.

In Pit 40 a partial human primary deposition and other partial connections with no signs of exposition to fire were identified. These depositions were surrounded and covered by deposits of human cremated remains, mixed with ashes and faunal remains and archaeological material which was also burned. Those deposits filled the pit, spilling over in some areas. In this open area, the MNI has already surpassed 150, with a high number of bones belonging to non-adults. Once again, colour changes suggest bones submitted to high temperatures. Also, the presence of many small skeleton bones suggested great care in the collection of the human bones, which includes distal phalanges of hands and feet, sesamoid bones among other small skeletal elements that were not burned there.

One interesting fact, though, is that this set of dates is identical to the one obtained for the last use of Tomb I and reutilization of Tomb II located in the eastern limits of the site. By radiocarbon standards they are contemporaneous, during the middle / third quarter of the 3rd millennium BC. But the architectures, the involved treatment of the human remains and the associated votive material are substantially different, as it is their relative location in the site, raising interesting questions regarding the nature of these differences.

In any society, between the moment of death and the moment of final deposition of the body or what is rest of it, (a period that can take hours, days, months or years…), many variables and forms of body treatment can occur. The archaeological mortuary record can be built based on any of these moments and when identifying a funerary context or a deposition containing human bones it is difficult to tell which part of the "funerary cycle" we are accessing, what part of the process is being revealed to us (Weiss-Krejci, 2005; 2011a and 2011b).

Additionally, and specially with tegard to prehistoric societies, the rules, prescriptions or mental framework involved in the handling of death are very far from being understood. These are closed and necessarily inaccessible codes. But if it is accepted that the range of possibilities following the biological death of individuals are much broader than our westernized vision of reality, a different level of interpretation can be reached.

The use of human bones in these contexts cannot be linearly and exclusively associated with the traditional vision of funerary practices, normally linked with a set of ritual actions that ensure the transition from the world of the living to the world of the dead and which involve several and normalised phases of corpse treatment until the moment of final deposition, normally in identifiable containers usually accompanied by grave goods.

In fact, all possibilities must be considered. When facing a context containing human bones it is not clear, in many cases, at which phase of the funerary cycle they are. They may be at any phase of their funeral cycle or been through several actions during this "transition period" towards final deposition. This transition period can involve various forms of body treatment to accelerate, or avoid putrefaction including cremation, excarnation, mummification, defleshing, drying in the sun, to name a few. They may be subject to temporary depositions on scaffolds, trees, under house floors. All the variables are possible and can have simultaneous or different effect on the bones (Parker Pearson, 2000; Weiss-Krejci, 2005; 2011a). So that when bones are deposited in their final resting place they may be completely articulated, partially articulated or disarticulated and fragmented on purpose or not. The final deposition places can vary too: above or underground, in the ocean or rivers, under trees, for example.

We must also consider the possibility for post funeral processes occurring in the form of manipulation, tomb revisiting, reburial and exhumation. All these processes are actions that may or may not be ritualized or respond to particular cycles or festivities, to specific historical periods of warfare or many other social and political practices. That is why the borders between funeral and non-funeral practices are not always clear.

Bearing these premises in mind when analysing the interaction between recent prehistoric enclosures and depositions or use of human bones, some of the practices identified in Tomb I can more be easily identified and have some insight into what the Neolithic reality regarding death was.

The recent empirical revolution has put many points of the map of prehistoric landscapes of the Alentejo inland. The change in the archaeological record shows a diversification of the known funerary structures and practices but also a considerable increase in the number of known enclosures (Valera and Pereiro, 2013; Valera, 2013 a and 2013b). These may or may not be the stage for performing practices related to the use of human remains and the concentration of monuments associated with ditched enclosures seem to be happening in the great enclosures of the Évora and Beja district. As far as the recent investigations show, not all enclosures hold funerary practices and indeed many funerary contexts with rich assemblages and a variety of practices are being identified outside of the enclosures in tholoi type monuments, pits or hypogea) scattered in isolated locations or grouped in necropolis.

Nonetheless, it also appears that some of these practices (formalized or not) are being brought into these large prehistoric enclosures. **Tholoi type** structures have been identified inside the Perdigões enclosures and on the periphery of Porto Torrão (Pereiro, 2010; Corga et al.,2o11, Valera et al.2013; Valera, 2014c) or Alcalar (Veiga, 1889, Rocha 1911; Leisner, 1943; Gonçalves, 1989; Móran e Parreira, 2004,). As for **hypogea**, and although none have been identified in Perdigões until today, in Porto Torrão in the peripheral Carrascal 2 area, ditched structures were identified serving as vestibules to access several hypogea chambers full of human remains (Valera et al., 2013). **Pits** occur in all known great enclosures: in Alcalar they have been identified, although the excavated area is limited (Móran, 2007 and 2010). As mentioned in previous chapters for Porto Torrão, several pit burials in the internal area of the enclosure have been published. As for Perdigões Late Neolithic primary burial and small and large pits holding cremated remains have been identified.

As for **dolmens**, in the complex groups of enclosures of Valencina de La Concepcion, near Seville, a very great variety of situations appear including the presence of depositions in dolmens (García Sanjuán et al, 2013 (eds.); García Sanjuán, 2013; García Sanjuan and Zorrita-Bonilla, 2013). The case of Alcalar is still not clear but in the great tholoi necropolis associated with the enclosure some dolmen type monuments have been observed (Veiga, 1889, Rocha 1911; Leisner, 1943; Gonçalves, 1989; Móran e Parreira, 2004; Móran 2007).

These formalised funerary actions are happening alongside the practice of depositions of body parts in the filling of ditches. Porto Torrão (Ferreira do Alentejo), is the most striking example (Santos et al., 2014; Rodrigues, 2014) and the case of Perdigões has been amply described throughout this work.

The same is being observed in the great site of Valencina de la Concepción near Sevilla where 40% of the human remains were deposited outside megalithic contexts (García Sanjuán, 2013).

These discoveries are also being followed by new perspectives in recent investigation on this period in Southwest Iberia that is gradually but steadily moving away from the more traditional perspectives that approach these large sites as “macro-villages” or urban/pre-urban settlements with associated and clearly defined necropolis areas. These functionalist and materialist approaches in the context of the development of social complexity are gradually being questioned (Díaz-del-Rio 2004b; Gilman 2013, García Sanjuán, Murrillo-Barroso 2013 (eds.) and the existence of clear social stratification and centralized political organizations in Iberian Recent Prehistory is being replaced by nonlinear historical trajectories accepting local diversity and different rhythms of change although it is clear that between the end of the 4th millennium and during almost the whole of the 3rd millennium BC there is evidence of a generalized increment of social complexity that reached higher levels in some Iberian regions (Valera, in press).

Interpretation for these sites now puts them closer to places where a range of very different practices occurred under a set of ideological and cosmological rules that can be considered part of the Neolithic ontology and materialize in many other arenas (Valera, 2008b; 2012a; 2013b).

Although they must have served different purposes and had different roles and meanings, these large enclosures can be looked at as stages for social practices that replicate and give sequence to everyday life. A place like Perdigões could have functioned as a local or regional centre for the funerary treatment of the dead, amongst other things. The recognition of this centrality can be seen in the recent increase of Iberian research on human mobility through isotopic analysis, of archaeometric studies of provenance of raw materials and objects and of exchange networks (Dias et al., 2001; Valera, in press). Perdigões is no exception and any attempt to understand the funerary practices taking place there must necessarily take into consideration what archaeological data of this kind has to say.

The study of the items deposited along with the human remains might help understand the origin of the people inhumated in the site. The set of ceramic pottery artefacts identified in Tomb I included all the morphologies typical of the Late Neolithic and Chalcolithic of the South West of the Iberian Peninsula. An analysis carried out on the composition, technology and functional features of the chalcolithic pottery from Tomb I at Perdigões (Dias et al., 2001) indicated there were clear differences between the funerary and the domestic recipients. Twenty samples were selected from non-funerary contexts identified in the area where Tomb I is located. Another fifty-five of them were analysed from the funerary contexts. The main objective was the establishment of “geochemical” profiles of the samples, enabling, or not, the identification, or not, of possible artefact production specificities in funerary ritual pottery, when compared with domestic function ceramic.

Preliminary results pointed to the use of varied raw materials in the case of funerary ceramics, when compared with domestic ones, which presented a more homogeneous chemical composition. The heterogeneity of ceramics related to funerary rituals could reflect different technological procedures in their making suggesting the possibility that the Perdigões tombs were being used by local people as well as people from smaller and peripheral areas. This chemical heterogeneity could then reflect this possible different provenance of burial remains (Dias et al, ibidem).

Although this does not represent direct evidence for the provenance of the dead buried in Tombs I and II, it is a clear indicator that goods were circulating locally in a system of regional trade. Indeed, this is not limited to ceramic and trade of exotic goods from even further regions is registered almost exclusively in the funerary archaeological record of Perdigões (Valera, in press).

The evidence for circulation of exogenous material starts in the Late Neolithic phase (3400 – 2900 BC), although with only a few examples limited to the some rare flint blades and some estuarine (*Cerastoderma edule*) and sea (*Pecten maximus* and *Trivia monacha*) shells. The 3rd millennium changes this picture considerably and the volume and diversity of exogenous items increases (Valera, in press).

Identified almost exclusively in funerary contexts (Tombs I, II and II and Pits 16 and 40 with the depositions of cremated remains) they include sea and estuarine products, marble and limestone items, pottery, beads, cinnabar, flint, ivory and other materials. Indeed, it is stressed that many raw materials present at Perdigões, namely the ones used in the beads and other lithic assemblages, have not been identified yet (Valera, in press). These objects and raw materials, show connections with the littoral, with Portuguese Estremadura and the coast of Alentejo, with more northern areas of the inland Alentejo, with the Spanish Extremadura and more central areas of Iberia, with central Andalucía and with North Africa, placing Perdigões as a possible intermediary link in an inter-regional exchange network or as a place of consumption for exotic goods (Valera, in press).

Ivory, for example is found in both Tomb I and II and in other funerary contexts of the site (Valera et al., 2015; Valera, in press). All ivory pieces examined from Tombs I and have proved to come from Loxodonta africana (African savannah elephant) possibly from Atlantic North Africa (Schuhmacher et al., 2009; Schuhmacher and Banerjee, 2012).

Another example is the variscite beads excavated from Tomb I and II of PDG (Odriozola et al., 2010). The results obtained from the study of these artefact beads established the Pico Centeno outcrops in Sierra Morena (Encinasola, Huelva), about 70 km southeast of Perdigões, as the source of this raw material.

What is more, evidence for a considerable degree of mobility for these populations gives credence to the perspective of these enclosures as meeting points. The year 2016 was the start year for the beginning of a new project centred on Perdigões called "Mobility and interaction in South Portugal Recent Prehistory: the role of aggregation centres, funded by the Portuguese Science Foundation (PTDC/EPH-ARQ/0798/2014). The first results are expected in the second half of 2017 (António Valera's personal information) although in 2010, a few samples were collected on human remains from the site giving a first indication of the non-local provenance of individuals deposited in Perdigões (Hillier et al., 2010).

Strotium isotopic analysis ($^{87}Sr/^{86}Sr$) showed a significant mobility pattern with the source distant from the final site deposition of the bones. In this specific study, only 2 individuals showed values compatible with the local range known for Perdigões. Most are below this value and closer to the Portuguese Estremadura values (Figure 136).

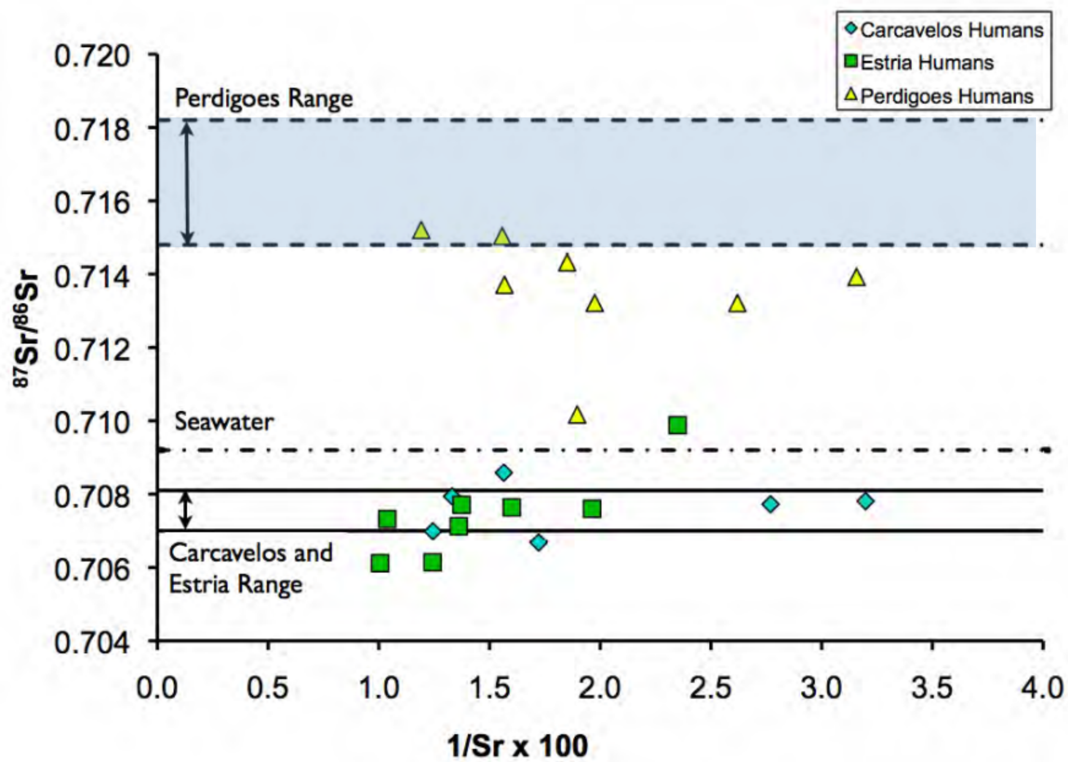


Figure 136 - Results from strontium analysis of individuals from Perdigões. Hilier et al. (2010)

Likewise, the information shown on the diversity of treatment given to human remains after death defies our modern view of things and show complex processes of body manipulation. The dead are brought to participate in whatever social practices are taking place in these sites as entities that have only gone through a biological death but are socially still very much capable of being part of the arena. This seems to reveal, once again, a mental framework where boundaries between worlds and existential categories are very much set apart from our dichotomized and religiously constricted view of the world.

Human remains are given different treatments and destinies and have different forms of participating in these processes. If on one hand the normalised funerary practices dispose of human remains in formal, easily revisitable and identifiable structures (like pits, tholoi or hypogea) so that they remain open to post funeral processes of manipulation, tomb revisitation or circulation, we could argue that the ones found in the bottom of the ditches singly deposed alongside animal bones and pottery shards (a practice that seems exclusive of these ditched enclosures), have less chance of being recovered and are more easily forgotten and when finally deposed or enclosed they become socially dead.

The development of the Neolithic may be seen as a transition period, where relevant traces of more fluid cosmologies can be found, generating permeable categories and a more relational connection between things and beings and between wholes and parts, and existential states. What these funerary practices might mean or how the dead were socially active depends a great deal, how Man saw himself and how he perceived the relations between worlds.

A black star appears, a point of darkness in the night sky's clarity. Point of darkness and gateway to repose. Reach out, pierce the fine fabric of the sheltering sky, take repose.

The Sheltering Sky, Paul Bowles

8 Conclusion

8.1 Summary of this study

The aim of this study was to contribute to a better understanding of the Late Neolithic/Chalcolithic populations that used the Perdigões enclosure (Reguengos de Monsaraz, Portugal) as a burial site, and their attitudes towards death.

To achieve this, the human bone sample recovered from Tomb I (almost exclusively in the chamber), a tholos type structure from Perdigões, excavated between 1997 and 2001, was analysed from a bioarchaeological perspective. The sample was in poor state of conservation and highly fragmented.

A two-fold approach was applied to the study of the skeletal sample from Perdigões. First, the monument was studied according to the archaeological phases defined after field work, which divided the use of the Tomb into 4 main phases, subdivided in smaller sub-phases. After this approach, which sought to understand possible differentiated uses of the tomb through time, the skeletal sample was studied as a whole, regardless of phases of use. The data obtained through this latter anthropological study were utilized for the paleodemographic reconstruction and for the identification of potential patterns in mortuary practices of the skeletal sample and for further comparison of this monument with other funerary structures: those identified in Perdigões enclosures throughout the last 20 years of continuous investigation, and with other tholos/tholoi type structures known for the south of Portugal.

8.2 Summary of results

8.2.1 Paleodemographic profile

A total of 61926 bone fragments were studied for Tomb I, of which 2216 were considered as belonging to non-adults (3,57%). The total number of studied teeth was 1579, which included 172 still in formation process (10,9%) and 83 (5,3%) deciduous ones.

The total MNI estimate indicated 103 individuals for this structure: 55 adults and 48 non-adults. Despite the highly fragmented nature of the remains recovered from Tomb I, the application of standard bioanthropological methods generated useful data.

Through the bones and teeth analysed it was possible to define the following distribution of ages at death for Tomb I:

- <1-year category= 1,94% (*n* = 2)
- 1-4-year category= 13,6% (*n* =14)
- 5-9-year category: 20,4% (*n* =21)
- 10-14-year category: 10,7% (*n* =11)
- 15-19-year category: 5,8% (*n* =6)
- >20-year category: 47,5 (*n* =49)

The results showed that at Tomb I from Perdigões, both sexes were represented with a slight predominance of female fragments over male. Sex diagnosis was possible for 16,3% of the MNI of adult individuals estimated for this sample (9/55), suggesting a balance between the presence of both sexes in the diagnosis performed on the several bones where female and male traits were observable.

For Tomb I the final proportion of 44,4% male individuals (4/9) and 55,6% (5/9) of female reveals a higher balance between the presence of both sexes when compared with the information retrievable from other tholos type monuments.

8.2.2 Paleomorphology

In total, stature was estimated based on 3 bones for which it was not possible to arrive to a sex diagnosis. Results showed that stature for these indiv iduals is in line for what is known for similar prehistoric collections.

Post-cranial non-metrical trait data showed few results and that the most common traits are the septal aperture (*2/12*) and the hypotronchateric fossa (*1/6*). The non-metrical dental trait analysis of Tomb I, alongside the samples from Tomb II and Cerro de Las Baterías, was previously performed by Cláudia Cunha (Cunha, 2015) who investigated the possible biological distance and heterogeneity within these populations. The results of this study can be used in combination with the ongoing mobility studies, through 87Sr/86Sr analysis.

8.2.3 Paleopathology

Dental health status analysis showed that calculus was the most frequently represented pathology. Indeed, 20,6% of the 1399 teeth observed (n=289) showed signs of calculus deposits.

Considering the total number of 1369 teeth, 10,4% (n=143) presented enamel hypoplasia and in a considerable number of cases more than one hypoplasic lesion was identified per tooth.

The degree of tooth wear was on average low: 1,9 if the whole observable tooth collection is considered (n=1428). This degree of wear is very similar to that identified in deciduous dentition (n=84) where the average degree was 1,8.

Cariogenic lesions were residual with only 7 cases identified in a total of 1406 observable teeth.

Antemortem tooth loss was precluded by the fact that only 30,6% of the possible observable alveoli were present (539 out of possible 1760). Amongst these 29 cases of antemortem tooth loss were identified (5,3%).

Skeletal pathological changes related mostly to joint disease, found mainly on upper and lower limb bones and the spine. The presence of enthesopathies were most commonly found on the lower limb and foot bones.

Some evidence for other diseases, such as infectious, congenital, metabolic conditions and trauma, was found, but in low frequencies.

8.2.4 Funerary use of space

The analysis of the use of the space of the chamber for funerary depositions throughout the different phases revealed that different physical areas of the chamber were used for the depositions of human remains and artefacts at different phases. However, no patterns of deposition based on age, sex or bone type were identified and all phases reflected the collective, commingled use of this tomb for deposition of human remains from both sexes and for individuals of all ages.

On the whole, the human bones analysed from Tomb I showed that it was used for the probable secondary deposition of human bones without recognizable complete or partial anatomically connected skeletons. The alternative possibility put forward (Valera et al., 2000) that both primary and secondary depositions could have taken place within Tomb I and bones would be re-arranged after decomposition of soft tissues cannot be ruled out after this study, although it is not supported by empirical evidence: only one anatomical connection for the whole universe of both collective tholoi type tombs was detected, and it was in Tomb II.

8.2.5 Comparison with coeval structures.

The results from this site were compared not only with the available results available for other funerary structures at Perdigões but also with bioarchaeological data from a further 84 tholos/tholoi type structures. These structures provide some bioarchaeological data (i.e. sex, age, metrical, non-metrical and paleopathological data) used for a comparative analysis, and are mostly located in the south of Portugal.

When compared to other funerary structures in Perdigões, Tomb I is closer to what is known for Tomb II and III and shares this same commingled and collective nature of the cremation pits of the central area, although variations exist with the latter regarding the artefactual components. However, more data and final bioanthropological studies are needed to make interpretations about possible causes for the differences in funerary practices and body treatments.

This comparison with other tholos/tholoi type structures made it possible to record differences in demographic, morphological and pathological features between coeval populations and aimed to go further and shed light on the potential presence of differentiated funerary rituals occurring at the same time in different regions.

8.3 Addressing the aims and objectives

The aims of this thesis were as follows:

> At a more direct level of interpretation, analysis of the human remains exhumed from Tomb I, in order to characterize specific anthropological and demographic, morphologic and pathological aspects of the population;
>
> Based on physical anthropological analysis and the archaeological register, identification of funerary rules and attitudes, relating them to mental constructions towards death through a study of: the conception and form of deposition of human remains; the organization of the internal space of the tomb; evidence of ritualization; signs of management of the funerary space.
>
> Based on the information recovered from our laboratory study, an attempt was made to understand how the specific mortuary practices identified in Tomb I fit into the global funerary practices already known for the rest of this important archaeological site.

On a broader scale, Tomb I was also understood within the context the history of the use of other *tholoi* type structures in the territory that is now referred to as South Portugal.

The results of this thesis showed that the aims and objectives of the study have all been addressed and achieved.

The attempt to understand the funerary universe at Perdigões was led by detailed interpretation of the funerary procedures detected during the archaeological intervention. Firstly, it was necessary to identify the nature of deposition; i.e., whether it was secondary or primary deposition. Indeed, the study of the anthropological collections of Tomb I points to the first hypothesis, suggesting that the first phase of the burial could have happened elsewhere.

This idea was tested through the intensive laboratory study of bones from all archaeological excavations (1997, 1999, 2000 and 2001). For more intensive laboratory study we refer to the marking of each bone, followed by attempts to identify possible compatibility between different fragments, particularly those from different sections inside the monument. Only in this way was it possible to identify the levels of bone dispersion and to assess the degree of post-depositional disturbance, possibly responsible for the absence of bones corresponding to particular anatomical regions.

After this first evaluation, which also included the analysis of taphonomic effects, it was possible to start the process of interpretation of the funerary contexts, based on the analysis of the distribution of bones in the monument.

Only after the detailed analysis could we move to a more complete interpretation of the relationship between the various funeral sub-spaces in terms of interpretation of possible social differences detectable by funeral deposition. However, in the case of collective burial contexts the identification of differential treatment of the individual bodies is difficult, if not impossible. Indeed, the amalgam of bones that may be found in monuments of this type prevents the association of artefacts to specific individuals, even when the individual skeletons can be identified. Thus, even the linear relationship between individual and artefact becomes impossible to ascertain.

Nonetheless, although the funerary anthropological analysis of this type of monuments may be challenging, a number of observations were carried out to help build the most complete picture possible. Observation of bone distribution within the monument enabled identification of potential differential treatment of human remains by age group and sometimes by sex. As seen, in the case of Tomb I this type of information could only be obtained through observation of secondary sexual characteristics of the remains. In the same way, the determination of different age groups of the remains interred in each of each funerary phase was only possible in many cases in a generic way.

The osteological series under analysis passed the taphonomic test, demonstrating that we are dealing with an intact series which results from a succession of anthropic gestures which occurred in the Chalcolithic.

The human bones analysed point to the probable secondary use of Tomb I, where no remains in primary connection or any vestige of burials of complete skeletons or part of skeletons were identified.

It is not yet clear whether the ensemble results from the partial removal of the skeletons from the local site to another grave, or whether, on the contrary, it represents the importation of human remains from another site into this structure.

Recent interpretation for large enclosures sites such as Perdigões puts them closer to places where a range of very different practices occurred under a set of ideological and cosmological rules that can be considered part of the Neolithic ontology and materialize in many other arenas (Valera, 2008b; 2012a; 2013b).

Although they must have served different purposes and had different roles and meanings, these large enclosures can be looked at as stages for social practices that replicate and give sequence to everyday life. A place like Perdigões could have functioned as a local or regional centre for the funerary treatment of the dead, amongst other things. The recognition of this centrality can be seen in the recent increase in Iberian research on human mobility through isotopic analysis, of archaeometric studies of provenance of raw materials and objects and of exchange networks (Dias et al., 2001; Valera, in press).

Tomb I is yet another piece in the large puzzle of the Neolithic/Chalcolithic funerary world. A world full of diverse funerary practices and objects, ways of dealing with the human body and fluidity between worlds.

8.4 Limitations

The main limitation in this work was the nature of the sample studied. As a result of a collective, commingled and probably secondary site of deposition, the bones recovered from Tomb I represented a true challenge. Fragmentation was extremely high (the MNI of 103 individuals was represented by 61926 bone fragments) requiring more time for identification. Although it was possible to provide 80,3% of the bone fragments with an identification (even if only to a general bone type) the remaining 19,7% remained unidentified. This disarticulated nature of the human remains and the the poor preservation of the anatomical areas used to estimate sex and age at death made this task impossible for many of the bones, which could also never be associated with individual skeletons. This condition also affected the paleopathological and paleomorphological analysis and hindered inferences on health status for these populations.

Although I had the personal advantage of having participated in the excavation of Tomb I throughout the several campaigns of field work and thus being familiarized with the general aspects of the burial depositions, this work was limited by the lack, in most cases, of quality publications, including results of human bone analysis for the other funerary structures of the tholoi/tholos type. This lack of information on archaeological sites represents an obstacle in the attempt to investigate and compare demographic profiles and funerary practices between different monuments.

The low survival of collagen in the bones from Tomb I also represented an obstacle for the finer chronological interpretation of the use of this funerary structure through time and for the understanding of its occupation dynamics. It would also have been useful for a full understanding of the type of funerary deposition taking place in this monument since there are indications, based on the few dates available for Tomb I, of the probable deposition of bones belonging to individuals that probably died decades or centuries apart in the same structure. On can only hope that future research will complement this lack of information.

8.5 Future work

The results of this work have provided a contribution for the understanding of past funerary patterns in the Chalcolithic communities, not only for people that frequented the great Perdigões complex of enclosures but also for those that deposited the remains of their dead in the tholos/tholoi type structures from south Portugal. This approach, based on standard macroscopic bioanthropological methods was crossed with data resulting from a modern archaeological excavation and offers a new perspective for answering questions relating to funerary practices and for the understanding the operating funerary dynamics of these communities.

There is still a lot of work to be done and the completion of the anthropological study for the other known funerary structures in Perdigões will no doubt help complete this complex picture. What is more, the identification of other possible monuments in the site, and their study and understanding through the osteological sets and votive materials in combination with biochemical analysis and radiocarbon dating will undoubtedly provide a positive contribution to research in this area. More data should be collected as the first step to further understand Chalcolithic populations and shed light on their way of being-in-the-world.

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