THE COPPER AGE IN SOUTH-WEST SPAIN: A BIOARCHAEOLOGICAL APPROACH TO PREHISTORIC SOCIAL ORGANISATION

DIAZ-ZORITA-BONILLA, MARTA

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Marta DÍAZ-ZORITA BONILLA BA MA

Submitted for the degree of Doctor of Philosophy

Department of Archaeology

Durham University

2013

To Javier

Marta Díaz-Zorita Bonilla

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Keywords

Bioarchaeology, Copper Age, mortality, morbidity, stable isotopes, diet, mobility, funerary context, La Pijotilla, Valencina-Castilleja, La Orden-El Seminario.

Abstract

This research uses a bioarchaeological approach to explore social structure and social differences during the 3rd millennium BC in south-west Spain. The study tests the overall hypothesis that social differences are present at different sites during the 3rd millennium BC in south-west Spain using the following research questions: (1) are there social differences manifested in mortality, morbidity, diet and mobility patterns, and (2) what was the relationship between Copper Age social differences and funerary patterns? Specifically, this research uses osteological, biochemical, and paleopathological analyses in combination with the funerary context to reconstruct mortality, morbidity, dietary and mobility patterns of two human skeletal populations from the Copper Age (c. 3300-2100 cal BC). The fragmented skeletal collections derive from the Extremadura and Western Andalusia, specifically Tomb 3 at La Pijotilla (Solana de los Barros, Badajoz) (283,329 human bone and teeth fragments, MNI= 178), and from different sectors at Valencina-Castilleja (Seville) (MNI= 36), respectively. Data from previously excavated human remains at La Orden-El Seminario (Huelva) were also included. In total, bioarchaeological data from 44 comparative Copper Age funerary sites were used to contextualize intra- and inter-site differences throughout the region at this time.

Results showed an equal distribution of adults by sex and by type of funerary structure (megalithic and non-megalithic), while non-metric trait data showed close biological relationships between both the sample populations and with the whole of south-west Spain during the Copper Age. Health status was mainly identified through the presence of joint disease. Calculus and linear enamel hypoplasia (LEH) were the most frequently represented dental pathologies, both diet-related and associated with megalithic structures; the individuals represented by the teeth were interpreted as higher status.

Analysis of the stable isotopes of carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) showed no significant differences between inland and coastal sites, however individuals buried in megalithic structures had significantly higher $\delta^{15}N$ values. Strontium ($^{87}Sr/^{86}Sr$) results revealed the presence of non-local individuals, suggesting a degree of human mobility, further supported by the presence of exotic raw materials with the burials. Inter-site comparison within south-west Iberia showed that the highest degree of mobility was found in large settlements, potentially reflecting a growing engagement with long distance contact and trade. Together the analyses support a scenario in which increased human interaction between these two settlements and other contemporary sites occurred because of their role as central places for meeting, exchange of goods and/or to perform rituals.

Overall, the results of this research 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 inequality and differentiation. In summary, the study demonstrates the Copper Age was a period of growing social differentiation, detected through variation in specific funerary structures, grave goods, health status and diet.

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ACKNOWLEDGEMENTS

This work was partially funded by the “Talentia Programme” from the Ministry of Science and Innovation from the Government of the Junta de Andalucía, Spain, to which I would like to express my gratitude for their support.

I would like to start giving my special thanks to my team of supervisors: to Professor Charlotte A. Roberts, for being such an excellent and practical supervisor, for her patience, motivational words, enormous help and great conversations about osteology (and especially for all her efforts to understand and edit my *spanglish*). To Dr Leonardo García Sanjuán (University of Seville, Spain), my mentor, and my friend, who trained me to run this long-distance academic race, for his good ideas, astute comments, great help and support. To Professor Chris Scarre for his help and discussions about European Prehistory, to Dr Mike P. Richards for his help and funding for the paleodietary analysis at the Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany (MPI-EVA) and to Dr Kelly J. Knudson, School of Human Evolution and Social Change, Arizona State University for her help with the strontium isotope analyses and data interpretation. All of this would not have been possible without the help and support of Dr Víctor Hurtado Pérez (University of Seville, Spain), and I am very grateful to him letting me use the osteological material from La Pijotilla and for all his help providing the facilities during the data collection process.

There are several institutions and people that have been very helpful over this past four years and to all of them I would like to express my sincere gratitude to

- my research group HUM-694 at the Department of Prehistory and Archaeology at the University of Seville for financial support for conducting biochemical analysis on the human remains to explore mobility and performing radiocarbon dating.

- the technicians at the Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany (MPI-EVA) for their help with the dietary stable isotope analysis, and specially to Dr Marcello Maninno and to Dr Domingo Carlos Salazar García.

- Dr Anna J. Waterman and Jonathan Thomas at the University of Iowa for financial support for biochemical analysis.

- the museums for giving me permission to study the skeletal collections and conduct destructive analyses: Manuel Alvarado (ex-director) and Guillermo Kurtz Schaeffer (director) of the Archaeological Museum of Badajoz, to Concha Sanmartí (director) and Antonio Pérez Paz (curator) of the Archaeological Museum of Seville, and to Juana Bedia (director) of the Archaeological Museum of Huelva

I am indebted to all the students from the University of Seville who helped with the cleaning and classification process of the human remains, and especially to Sonia Robles Carrasco, Milagros Sánchez Romero, Mercedes Herrera, María Gómez Martín, Pablo M. Santos Breval, María José Suárez Ramos and Luis Sevillano Perea; I am grateful for your dedicated work. I am also grateful to Diego González Batanero, Dr Juan Carlos Vera Rodríguez, José Antonio Linares Catela, Inmaculada López Flores and María José Armenteros Lojo for giving me permission to extract samples from the human remains from the site of La Orden-El Seminario (Huelva, Spain) and for all the archaeological and anthropological information provided about this site. The following archaeologists also all shared information about Valencina-Castilleja (Seville, Spain): Fernando Fernández Gómez, Juan Manuel Vargas Jiménez, Juan Carlos Pecero Espín, Juan Manuel Guijo Mauri, Florentino Pozo Blázquez, Álvaro Fernández Flores, José Peinado Cucarella, Ana Pajuelo Pando and Pedro López Aldana. Finally, thanks to Dr José Antonio Sánchez Sánchez for sending information about documented skeletal collections in Spain.

I owe my deepest gratitude to my colleague and friend Dr Manuel E. Costa Caramé for helping me in the design of the database, the statistical analysis and for his technical support with the images and maps for this thesis. My colleagues, Dr Eulalia Subirá de Galdácano, Prof. Hervé Bocherens and Dr. Andrew Millard read and gave comments on some of the chapters. My housemate and friend Dr Eva Alarcón García helped with the treatment of images, and my colleague Andrew Chapman and Dr Yuichi Naito helped me with statistics. My friend and colleague, Jennifer Sharman, is appreciated for her help, patience and dedicated work in the proofreading of the penultimate version of this thesis.

I would like also to thank my two examiners, Prof. Jane Buikstra and Dr Janet Montgomery, who substantially improved this thesis with their constructive comments and suggestions.

There is a very large list of friends that were always there for me, especially during these past four years when I was mostly absent, but I want to tell them that they were always with me in spirit: Jara, Pablo, Rubén, Nuria, Daniel, Blanca, Inmaculada, Julia, Luis, Andrea, Alejandro and Richard. Thanks to my colleagues at Durham University for their support.

My deepest gratitude goes to my family, for their encouragement and their supporting words, which included both emotional and financial help, and for their understanding during the days when I was always away busy writing this PhD; without all of them, this would have been an impossible task: to Paloma, Antonio, Estrella, Draku and Sara. This thesis is in memory of Quinita and Lalo, who left us early, but taught me to keep studying and were always very supportive.

Finally, my dearest thanks goes to my partner, Javier, who has constantly and patiently awaited my arrival from different countries, and who has flown with me to different continents in search of a better future; no matter the circumstances he has always waited for me. Thanks for always being there and sharing life with me, even when I was solely focused on this work.

To those that I may have forgotten, thank you for accompanying me during this journey.

LIST OF PUBLICATIONS AND PRESENTATIONS RELATED TO THIS THESIS

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Díaz-Zorita Bonilla, M., Waterman, A.J. and Peate, D. ***In press.*** La movilidad de las poblaciones de la Edad del Cobre en el Suroeste de España a través de los análisis de isótopos estables de $^{87}Sr/^{86}Sr$. *Actas del II Congreso de Prehistoria de Andalucía*. February 15th-17th, 2012, Antequera, Málaga, Spain.

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2012 Díaz-Zorita Bonilla, M. Bioarqueología del III milenio en el SW de España. Undergraduate seminar, Department of Prehistory and Archaeology, University of Seville. April 19th 2012.

2012 Díaz-Zorita Bonilla, M. and Robles Carrasco, S. April 12th 2012. La antropología del PP4-Montelirio, Valencina-Castilleja, Seville, Spain. 1ª Jornada de Participación Ciudadana. Castilleja de Guzmán, Seville, Spain.

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CHAPTER 1.- INTRODUCTION

1.1. Background

What would you do to find out information about the nature of people's lives represented by a commingled deposit of 283,329 prehistoric human bone fragments? The answer is easy: you would apply the most appropriate analytical methods to them. This, in combination with contextual data, then enables inferences to be made about the people to whom the bone fragments originally derive in order to explore, for example, the demographic profile for the time period and geographic region, the health status of the buried population, and activity-related bone changes, including data on normal variation, such as non-metric traits. Considering these data within a theoretical framework thus helps to test hypotheses regarding aspects of our human history.

Archaeological human remains contain much information about biology, and hence culture, and set within a chronological framework their study can contribute extensively to the interpretation of an archaeological site. It should be noted that to reconstruct prehistoric societies, human bone analysis is sometimes the only archaeological "materials" available and, although representing only one piece of the jigsaw puzzle, without this information a holistic interpretation is not possible.

The transition from the Neolithic to the Bronze Age (Copper Age) in the Iberian Peninsula is characterised by several changes that affected the social makeup and economic strategy of these groups, as well their settlement patterns. Furthermore, an increase in the number of sites and an increase in the size of the settlements and their populations during the 3rd millennium BC have been documented (García Sanjuán and Murillo Barroso, 2013; Amores Carredano, 1982; Nocete Calvo, 1989; Rodríguez Temiño, 1984 and Ruiz Delgado, 1985), with significant social differences starting to occur in south-west Spain in the second half of the 3rd millennium BC (García Sanjuán and Hurtado Pérez, 1997).

The focus of this research is this "Copper Age", which spans c.3300-2100 cal BC (Castro Martínez et al., 1996; García Sanjuán, 2006). Aspects of the Copper Age in southern Spain have been investigated since the end of the 19th century. The first investigations in the south-east were conducted within an hypothesis that explained the construction of Iberian megaliths by people from the a possible Aegean colonising the area (Siret and Siret, 1887; Blance, 1986), and this period is well known particularly from investigations of two areas: in the south-east, particularly at the archaeological site of Los Millares (Siret and Siret, 1890; Arribas and Molina, 1982; Almagro Basch and Arribas, 1963; Ferrer Palma, 1984), and in central Portugal, at sites such as Vila Nova de Sâo Pedro (VNSP) (Spindler, 1981; Paço and Sangmeister, 1956; Savory, 1970, 1972) and Zambujal (Sangmeister and Schubart, 1981).

At the end of the 1970s, a number of authors proposed a re-interpretation (Gilman, 1987; Gilman and Thornes 1985; Chapman, 1981). This second hypothesis was founded on the environmental land-management hypothesis and suggested in relation to social hierarchy, where stone-walled enclosures were interpreted as fortifications. The increased number/intensity of archaeological excavations throughout the 1990s and 2000s, and particularly the discovery of new sites such as ditched enclosure of Perdigôes (Valera, 2010; Valera and Godinho, 2010; Valera and Silva, 2011; Márquez Romero et al., 2011) provided new data for the interpretation of Copper Age settlement patterns, bringing different types of features, such as pits, to the forefront of the debate. The absence of fortified structures at enclosures such as Perdigôes and Valencina-Castilleja, makes the discussion of Copper Age settlement patterns far more complex (García Sanjuán and Murillo-Barroso, 2013). In this context, new interpretations challenging the nature of the fortified structures at sites like Los Millares have been proposed (Ramos Millán, 2004; 2007; 2013).

A wide variety of different funerary structures, such as megalithic monuments, *tholoi*, and artificial and natural caves have been documented for this period , and human remains have also been recovered from storage pits and ditches, but not all individuals from the same communities were buried in well-constructed funerary structures such as megaliths. Fundamental differences are also observed in relation to funerary architecture and the preparation of the funerary ritual: disposal and preparation of the “burial” space, deposition of individuals, placement of grave goods, and offerings, the quality and quantity of grave goods and the health and type of diet of the buried period.

One school of interpretation has proposed the formation of a Copper Age state in the Spanish south-west (Nocete Calvo, 2001, 2004; Nocete Calvo et al., 2008, 2011; Nocete and Peramo, 2011), as well as the south-east (Molina González and Cámara Serrano, 2005). This has been contested by several authors (Chapman, 2008; García Sanjuán and Murillo-Barroso, 2013; etc.). However, the debate about Copper Age social complexity continues, and to a great extent has been focused on the variability in settlement patterns. As has been recently claimed "[since] the very start of Iberian prehistoric research, the debate on this period has been intense, with special attention devoted to the processes, causes, and relations behind the growing social complexity" (García Sanjuán and Murillo-Barroso, 2013: 120).

Data from the archaeological record suggest that the social structure of Copper Age communities was to a large extent structured by kinship, and society was organised into clans, where relationships were based on the principles of solidarity and communalism, although competition for power and the institutionalisation of social hierarchy were elements also at work (García Sanjuán, 1999, 2000, 2005; García Sanjuán and Hurtado Pérez, 1997). A complex and hierarchical social organisation founded on unequal access to surpluses existed in these communities but, according to García Sanjuán (1999), this does not imply that development of an exploitative economic system occurred based on taxation, as would happen in a fully developed state system. This complexity in social structure was the result of technological changes that made the accumulation of a surplus possible and, in turn, led to a population increase. These changes led to the exploitation of other, secondary, products, which are understood to have been a "revolution" during this time period (Sherrat, 1983; Greenfield, 2010). The ability to exploit secondary products led to intensified farming and allowed a surplus to accumulate. Together, these factors resulted in a marked increase in population size, as evidenced by a twofold increase in sites identified as dating to the period following the Neolithic period (García Sanjuán and Murillo Barroso, 2013; Amores Carredano, 1982; Nocete Calvo, 1984; Rodríguez Temiño, 1984 and Ruiz Delgado, 1985). The accumulation of a surplus would have enabled a group or segment of the community to take charge of storage, management and redistribution of the produce, as appears to be evidenced in some settlements in the south of Spain, acting possibly as a catalyst for the development of a hierarchical social system. At these sites, several circular structures excavated into the ground have been interpreted as storage pits, as seen at the settlements of Valencina-Castilleja (Arteaga Matute and Cruz Auñón Briones, 1999b; Cruz-Auñón Briones and Arteaga Matute, 1996; Vargas Jiménez, 2004a, 2004b), Papauvas (Martín de la Cruz 1985, 1986a, 1986b) and La Pijotilla (Hurtado Pérez, 1991).

Most studies carried out in the area in question divide the funerary structures dating to the Copper Age period into megalithic and non-megalithic structures, with a few natural cave sites (Ferrer Palma, 1982; Cruz-Auñón Briones, 1983-1984; Cabrero García, 1985b; García Sanjuán, 1999; Lacalle Rodríguez, 2000; Hoskins, 2001). The megalithic monuments include chambered tombs, passage graves and *tholoi.* However, the majority of these studies disregard other, more commonplace, structures, which may have had a mortuary function. For example, there are other kinds of "burial" structures, whose function may not have originally been for the deposition of the dead, but rather for storage, or they may have purely functioned as ditches or huts. There has been much controversy with regard to the understanding and interpretation of these structures; were they places for storage, production, waste deposition or habitation. However, some studies such as by Márquez Romero (2001) have interpreted burials in such structures as ritual deposits. Many interpretations concerning the use of "pit features" are plausible due to the great variety of possible functions, but more research is needed to clarify these interpretations. There is some evidence for collective burials found at Valencina-Castilleja and at the sectors of La Gallega (Martín Espinosa and Ruiz Moreno, 1992), El Algarrobillo (Santana Falcón, 1993) and La Cima (Ruiz Moreno, 1991), in what pit features have been interpreted as domestic structures, despite the presence of human remains. Previous bioarchaeological research has been done on these three sites (Díaz-Zorita Bonilla 2004, 2007), so comparisons of the interred individuals buried in megalithic structures are included in this research.

The evidence presented above, where a variety of mortuary contexts have been identified within the southern Iberian peninsula (and within the Copper Age), presents a complex funerary world with different funerary patterns and burial treatment that can only begin to be clarified through bioarchaeological analysis. In relation to the study of social differences in health and wellbeing, an inherent part of being human both past and present, bioarchaeology is thus a powerful tool to explore social inequality in prehistoric societies (Brown, 1981; Sahlins, 1968; Carr, 2005a; Gillespie, 2001; 2002; Buikstra et al., 1995), in combination with contextual data.

1.2.- Aims and objective

The aims of this thesis are:

- To investigate social structure and social differences during the 3rd millennium BC
- To obtain new bioarchaeological data
- To consider evidence for variability in funerary practices
- To explore the impact of subsistence strategies in different environments on demography, health, diet and mobility (e.g. coastal vs. inland)
- To investigate the degree of mobility of Copper Age populations,

with the objective of understanding, via bioarchaeological and contextual data, the impact of changing social organisation and subsistence patterns on mortality, morbidity and health.

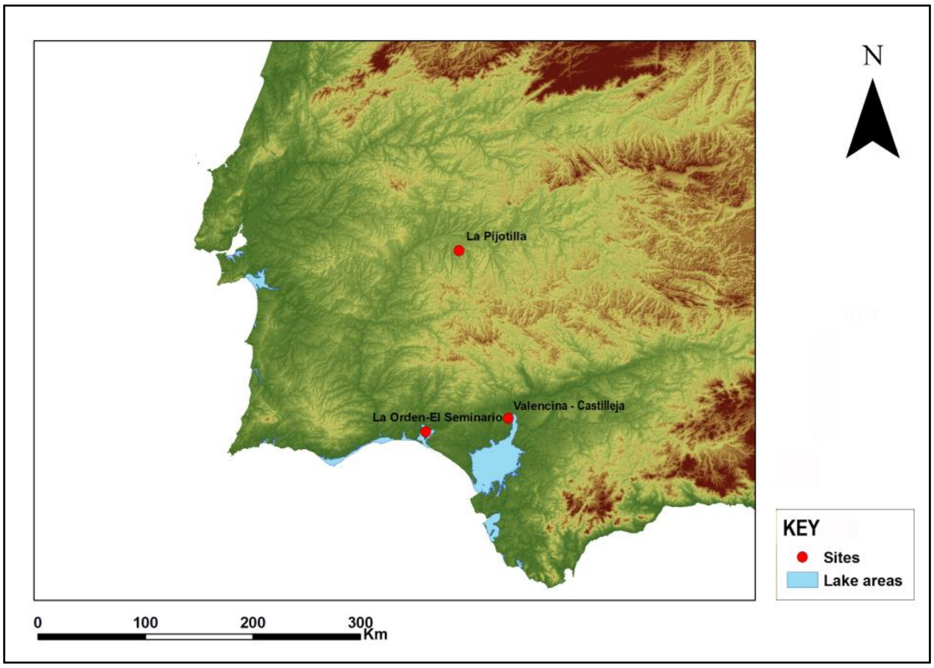


Figure 1.1. Map of the Iberian Peninsula with the location of the three sites

For this purpose, two of the key sites in Late Iberian prehistory were selected, La Pijotilla and Valencina-Castilleja, and for isotopic comparative analysis, a third site, La Orden-El Seminario was also incorporated to the analysis (Figure 1.1). Taking into account the constraints placed on such a study by the commingled nature of the human remains, the data are compared to other contemporary sites and the research overall offers a new interpretation of the Copper Age archaeological record

1.3.- Hypothesis to be tested and questions to be answer

By addressing the aims and objectives described above, and considering the discussion above, following hypothesis (Figure 1.2) will be tested:

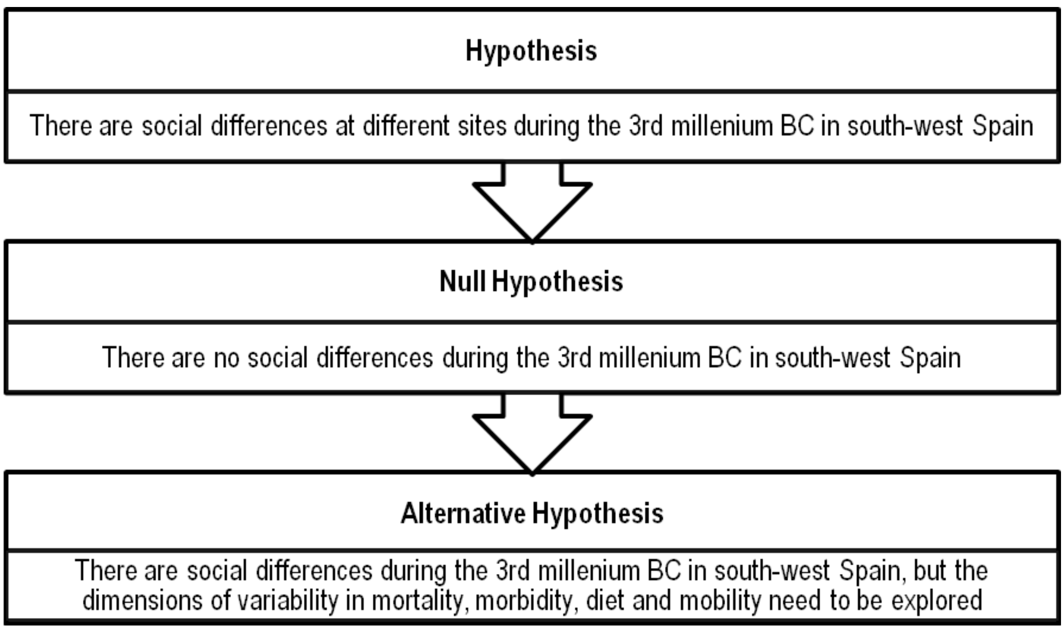


Figure 1.2.- Hypothesis to be tested in this research

If social differences are found via multiple lines of evidence (i.e. funerary architecture, health, mortality, type of diet, activity, origin of individuals and associated of grave goods), then the null hypothesis is rejected. Therefore analytical methods applied in this research focused on (1) individual sites, (2) variations within individual sites, (3) differences between sites within the south-west of Spain and (4) comparison within a European context for stable isotope to research mobility.

This study does not assume any particular stance regarding the debates about the scale and degree of complexity of Copper Age social organisation. Instead, it claims that the debates would benefit from the contribution of bioarchaeological data obtained from Copper Age skeletal samples. Starting from the assumption that social status and lifestyle can be reflected in features of normal and abnormal variation in skeletal remains, as shown by many authors (Agarwal and Glencross, 2011; Gowland and Knüsel, 2006; Díaz-Andreu and Lucy, 2005; Ambrose et al., 2003; Buikstra et al, 1995, among others), this study assumes that if inequalities in labour (activity patterns), access to foodstuffs, and health status in general existed in the Iberian Copper Age, they would be reflected in the study populations. It is widely agreed that Copper Age societies were more socially complex that their Neolithic counterparts (García Sanjuán and Murillo Barroso, 2013; García Sanjuán and Hurtado Pérez, 1997), but the question is to what degree.

Related to the hypothesis, the following questions will be addressed:

Given that the skeletal evidence used to analyse this problem is inherently linked with burial practices, this study also concerns itself with how burial rites were carried out in the Copper Age, how they reflected the existing social relationships and, in particular, how they conditioned the selection and preservation of skeletal remains buried.

With regard to the stated hypothesis, this research addresses the following questions:

- Are social differences manifested in mortality, morbidity, diet and mobility patterns in these samples?

- Is there a relationship between Copper Age social differences and funerary patterns?

1.4.- Significance of research

Scientific research carried out since the late 19th century has conclusively proven that southern Iberian Copper Age societies had complex forms of social organisation that entailed incipient forms of social inequality. The scale and extent of these inequalities is however a matter of controversy, to date, as reflected in the abundant published literature.

The Copper Age in south-west Spain has not been investigated through a bioarchaeological perspective until now, and this is the first attempt to undertake a comparative analysis of populations during the 3rd millennium BC in this area. This research seeks to contribute by approaching this debate by examining at the available bioarchaeological evidence.

1.5.- Structure of the thesis

This thesis is divided into seven chapters. Chapter 2 is a brief introduction to bioarchaeology, discussing how the discipline has developed, including the terminology used in each country, and the spread of the discipline around the world. A brief theoretical background in relation to mortuary analysis is also covered. This chapter also includes a specific section on bioarchaeology in Spain, where its origin, development, training opportunities and its current state are addressed. Chapter 3 offers contextual information for the research, with an overview of the 3rd millennium BC in south-west Spain. In this chapter, the main characteristics of the time period are highlighted, as well as settlement and funerary patterns. There are also details of the main sites, with a description of the study areas and an introduction to each of the three study sites. Chapter 4 describes the methods used, while Chapter 5 summarises the results of the analysis. Chapter 6 includes a comparative analysis of the results of this study, incorporating all of the available bioarchaeological information from south-west Spain to allow inter-site, statistical, comparisons. This chapter also includes intra- and inter-site comparisons of the data on paleodiet, mobility and funerary practices. The results are then used to inform the continuing debate on social differences during the 3rd millennium BC in south-west Spain. Chapter 7 summarises the general conclusions of this study, identifying its limitations and proposes ideas for future research.

CHAPTER 2.- BIOARCHAEOLOGY

2.1.- Introduction

This thesis is based on the empirical analysis of two human skeletal collections applying standard bioarchaeological methods. For this reason, a general overview of the discipline is provided. In this sense, this chapter presents a brief introduction to the discipline, the theoretical background, its origin, development and recent scientific advances. The aim is to summarise the impact of development, but unfortunately, bioarchaeology has not expanded equally worldwide, and for that reason only the main centres (countries) with older traditions will be described. In addition, a specific section on the development of bioarchaeology in Spain is also provided.

2.2.- The concept of bioarchaeology

The term "bioarchaeology" can be defined in the American sense as the study of human remains from archaeological sites and the integration of biological data from those remains with information about the context from which the remains derived. Other terms for this discipline that have been (and continue to be) used include physical anthropology, biological anthropology and osteoarchaeology. One key event in the development of bioarchaeology was the 11th Annual Meeting of the Southern Anthropological Society, where some authors, such as Robert Blakely (1977), began to talk about the importance of multidisciplinary teams where physical anthropologists and archaeologists would work together in the same direction. It was at this meeting that Jane Buikstra (1977:69) proposed the new term "bioarchaeology", based on the use of bioarchaeological teams as a work strategy that was already being applied to research on skeletal remains from the Woodland period of the Hopewell community in southern Illinois, in the United States. However, in the United Kingdom, the first reference to bioarchaeology was by Clark (1972), although it was in regard to the study of the faunal remains from the Mesolithic site of Star Carr, Yorkshire (Roberts 2006: 448).

The model suggested by Buikstra (1977:72) included influences from the New Archaeology and the work done by Binford on funerary practices (Binford 1962, 1971), which considered the following approaches in the study of cemeteries:

- The type of burial and social organisation (analysis of funerary structure, orientation and position of the individual)
- The daily activities and division of labour based on the analysis of grave goods and paleopathological analysis of the individual
- The study of paleodemography
- The use of biochemistry to research human mobility, diet, paleopathology and genetic analyses (aDNA) to characterise human groups

Another definition of bioarchaeology is that of Larsen (1997, 2002, 2006b), based on human adaptation to the environment and the analysis of three variables: the quality of life, lifestyle and biological distance (Larsen, 2006: 361). Bioarchaeology thus has different meanings around the world (Buikstra and Beck 2006:348) and there now exist several "bioarchaeologies" based on who first described the concept; nevertheless, over the past few years, professionals have been developing the discipline to incorporate lines of evidence from other disciplines. A holistic approach incorporates the study of human, animal and plant remains from archaeological contexts. However, in some countries, such as the United States, bioarchaeology usually refers only to the study of human remains (Buikstra and Beck, 2006), while in the UK it refers to any biological remains from an archaeological site (Roberts 2006: 418). Both biological anthropology and osteoarchaeology were used as terms in 1998 when the British Association of Biological Anthropology and Osteoarchaeology was founded and named. However, whatever name is used, the main objective of the discipline is the reconstruction of past human behaviour through the analysis of human remains and their funerary context using a combination of methods.

In the case of Spain, the terms "physical anthropology" or "biological anthropology" were replaced by "bioarchaeology", taken to mean the discipline that considers archaeological biological remains in context.

Figure 2.1. Different terminology for bioarchaeology

2.3.- Mortuary analysis and the implications for bioarchaeology: brief summary of the theoretical background

The study of human remains in archaeological contexts is of vital importance in order to understand the dynamics of past societies. We should consider that what we excavate is unique and represents a single moment in history, or as the case here, prehistory. However, the interpretation of archaeological data is not straightforward and many factors should be taken into account. For instance, the analysis of mortuary ritual can be used as an approach to investigate social structure, assuming that funerary practices are a reflection of how the living community "deals" with their dead. The use of ethnographic[1] data (Binford, 1971; Saxe, 1970; Bartel, 1982) provides another avenue to investigate the past (Parker Pearson, 1999:21). However, ethnographic data can be problematic, since environment, climate and social systems are not static and will have changed through time, and therefore cannot be assumed to reflect the past in a simple and direct way; these communities are distanced in time and space from archaeological populations. Some aspects of the environment (e.g. paleoecology) need further investigation to determine whether ethnographic data can be used as a valid interpretive tool. Comparative analyses of different archaeological sites (Renfrew, 1973; Chapman, 1977; Parker Pearson, 1982) along with ethnography have demonstrated that strong links can exist between mortuary practices and the social structure of a community, and in fact do exist more often than not (Parker Pearson, 1982). However, other aspects of social structure, such as religious belief, symbolism and ideology need further exploration. Nevertheless, our task as archaeologists is to investigate whether those practices are a real reflection of the past community and are not simply subjective interpretations. We must strive to discriminate between representative patterns, and what may look like exceptions and this is not always well understood from the archaeological record.

Some of the first anthropological studies in the 1960s based their research on ethnographic data as a way to understand mortuary practices in the archaeological record (Ucko, 1969), and studies by French sociologists, who were not ethnographers, for example Durkheim (1965), Hertz (1960) and Van Gennep (1909), considered mortuary ritual as a process where death represents the beginning of the three-stage "rites de

[1] Ethnography= "descriptive study of a particular human society or the process of making such a study" (source: Encyclopaedia Britannica).

passage" (Van Gennep, 1909), from which social structure could be reconstructed. This approach influenced later scholars who formulated functionalist explanations and refocused attention on society as a whole instead of on individual cases. Some anthropologists such as Malinowski (1948), Radcliffe-Brown (1952) and Evans-Pritchard (1948), among others, provide detailed interpretations of ethnographic societies and their approach has also been applied to archaeological material.

During the 1970s a new approach to the investigation of past societies was formulated with the birth of a new school of thought known as the New Archaeology. From a paleoecological and processual perspective, this novel approach had a positive influence on bioarchaeology, giving special attention to the study of human remains in archaeological contexts and the integration of these data into broader models. *Middle range theory* was formulated (Merton, 1968) as a way to investigate and to compare past societies, the objective being to extract holistic interpretations and assumptions. The most prominent exponent of this School was the American anthropologist Lewis Binford. His theories are based on his own experience with ethnographical analysis and the application of *middle range theory*, relating funerary practices to social complexity. Within the New Archaeology, however, some theories only focused only on the use of mortuary analysis to understand and reconstruct social differences (Binford 1971; Saxe 1970, 1971; Brown 1971; Peebles, 1971; Carr, 1995). For example, Tainter's (1978) *Energy Expenditure* theory asserts that social differentiation can be distinguished by the type of burial structure and the amount of effort invested. The work of Binford (1971) and Saxe (1970, 1971), also known as the Binford-Saxe hypotheses, points to mortuary ritual and grave goods as empirical indicators capable of addressing social complexity. Nevertheless, several authors (e.g. Randsborg 1980; Okely, 1979), criticized their work, arguing that using archaeological, rank could not be correlated with social differences as represented by mortuary practices.

Two other influential cultural anthropologists, but not from the New Archaeology school of thought, are Service, Fried and Sahlins. Their perspective offered a different approach, classifying past societies according to categories of "social evolution". According to Service (1975) there are four different forms of political organizations: bands, tribes, chiefdoms and states. Many anthropologists, including Leach (1979), argued against this hypothesis, harshly criticizing the inapplicability of these categories to human societies. In Europe this approach had much influence, especially among British scholars like Clarke, Shennan and Gamble, and above all Renfrew, known for his systematic application of scientific methods to archaeology, such as the use of radiocarbon dating (Renfrew, 1973) and for his extensive work in European archaeology (Renfrew, 1976, 1979, 1986).

Within the same period (1960-1970), Structuralism became very important as a critical reflection of functionalism. Structuralism emphasises the ideology of societies and the interpretation of symbolic concepts rather than material aspects. The pioneer of this theory and one of the most influent anthropologists of the 20th century was Levi-Strauss. He believed that cultures are structured according to binary opposites, a concept which he called "dualism". He argued that we must re-discover what it is behind material culture in order to make inferences about past societies, making this essentially a cognitive approach (Lévi-Strauss, 1963). Another author from this same school is Leroi-Gourhan, famous for his interpretation of Paleolithic rock art. He established his methodology on the extrapolation of symbols and language as a way to understand past societies, avoiding a reliance on ethnographic parallels (Leroi-Gourhan, 1968).

A further theoretical school that developed in the mid-20th century was Marxist archaeology, which has been associated with historical materialism. Marxist approaches interpret past societies based on the economic relationships among human groups and modes of production. The most influential author from this school is Gordon Childe, but there are more recent proponents such as Gilman, Lull and McGuire. The most important body of work by Childe is his synthesis of European prehistory (Childe 1925, 1962), which still remains the first holistic interpretation of societies at this time. In addition, he coined the term "Neolithic revolution" to explain the change in subsistence strategy from hunter-gatherers to the first agriculturalist societies in Europe. Gilman's research focused on the interpretation of the collective efforts made by powerful individuals and elites to control resources (Gilman and Thornes, 1985). More recently, Lull and his team have made significant contributions to the interpretation of the development of state societies in south-east Spain (Lull and Micó, 2007).

The impact of processualist New Archaeology was challenged in the 1980s by the development of post-processual theory. For post-processualists, the main criticism of the New Archaeology was that social differences cannot directly be addressed and that mortuary practices might not actually reflect the living community (Braun 1981; Hodder

1982; Parker Pearson 1982; Shanks and Tilley, 1987). For some archaeologists this became a very radical approach, questioning key aspects of processualism such as the objectivity of research and the very feasibility of interpreting past societies. Instead of understanding what people did in the past, the most important question became why those things were done (Parker Pearson 1999:32). Another influential post-processualist author, Hodder, criticised some of the key assumptions made by the New Archaeology, namely the extensive use of cross-cultural approaches and what he viewed as their inapplicability to prehistoric societies. According to Hodder and Hutson (2003), each culture must be analysed in its own context. Furthermore, he emphasised the importance of interpreting objects or symbols individually in the archaeological record in order to search for their meaning (Hodder, 1991).

In parallel with post-processualism, feminist theory reached archaeology In the 1980s and 1990s and this helped to develop other previously unexplored concepts of identity, such as gender, childhood, ethnicity and disability. Conkey and Spector (1984) were among the first to address gender in an archaeological context, followed in subsequent decades by many others, notably Gero and Conkey (1991), Butler (1999), Gilchrist (1999), Donald and Hurcombe (2000), Sorensen (2000), Arnold and Wickers (2001), Knüsel (2002) and Insoll (2007) and specifically related to paleopathology (Grauer and Stuart-Macadam, 1998; Pollard et al., 1999). The study and concept of childhood has been explored by a number of authors (Sofaer Derevensky, 1997, 2000, 2007; Kamp, 2001; Perry, 2005; Baxter, 2005a, 2005b; Lewis, 2007). Disability in the archaeological record is still largely unexplored but has been addressed by a few notable publications (e.g. Hawkey, 1998; Finlay, 1999; Roberts, 1999; Molleson, 1999; Knüsel, 1999; Hubert, 2000; Fay, 2006; Cross, 1999, 2007; Anderson and Carden-Coyne, 2007; Roca et al., 2012).

Scholars also began to emphasize the study of individual identity, focusing on aspects such as the body and its links to gender, social status, and ethnicity (Díaz-Andreu and Lucy, 2005; Buikstra and Scott, 2009). The “archaeology of the body” has also been developed (Joyce, 2005; Weiss-Krejci, 2005a; Beck, 2005; Malville, 2005; Stodder, 2005). Teams of experts involved in the investigation of past human populations, or at a community/individual level (e.g. Knudson and Stojanowski, 2008) have recently applied and enhanced these identity approaches from a multidisciplinary perspective, ultimately strengthening our interpretations of the past.

In relation to the theoretical approach of this thesis, two points need to be borne in mind: first, that social differences have always existed, in different degrees, and that they evolved over time throughout prehistory, and in some cases became more complex; and second, that those social differences materialised in various forms in the archaeological record. It is hard to believe that truly egalitarian societies existed and it is also quite challenging to understand the development of the socio-political organisation of Iberian Copper Age communities by comparison to ethnographical models (Bartelheim, 2012). As was pointed out in the previous chapter, the social structure of Copper Age communities appears initially to have been based on inter-group solidarity and communalism (García Sanjuán, 1999, 2000, 2005; García Sanjuán and Hurtado Pérez, 1997) until, towards the end of the 3rd millennium BC, social differences began to increase and more hierarchical societies can be identified (García Sanjuán, 2006).

This thesis seeks to understand the social structure of Copper Age communities in south-west Spain. It adopts a holistic approach to the recognition of social differences from archaeological sites, which involves the study of the human remains and their context in order to reconstruct the funerary ritual (if any) and the deposit of human remains. While the main goal of this thesis is to understand the social dynamics of these populations during this period, there is also attention to understanding how those individuals behaved individually. The characteristics of relationships, and the networking among individuals, are assumed to be reflected collectively in mortuary ritual, and this can therefore provide information about social structure in this region and time period.

The contribution of this thesis to the archaeology of the Iberian Peninsula is merely one element within a larger research design which will be achieved in the future. In addition, multiple lines of evidence, i.e. the analysis of material culture, funerary architecture, bioarchaeology (including stable isotopes for dietary and mobility evidence) are employed. The theoretical principles outlined above are applied to individuals sites, and within sites , but also between sites in an attempt to compare south-west Iberia with other available archaeological and bioarchaeological data. In summary, this study presents three levels of analysis (1) individual sites, (2) variations within individual sites and (3) between sites within south-west Spain.

2.4.- The history and global development of bioarchaeology

It is essential to understand the development of bioarchaeology, the succeeding advances in the field and achievements. For that reason, a general overview of the development of the discipline and the work of pioneering bioarchaeologists will be explained briefly in this section.

The history of bioarchaeology will be described from the 1970s to date, but the pioneers of the first studies in the early 19th and 20th centuries that focused solely on the skull and its classification into "racial groups" should not be forgotten (Morton 1839, 1844). The first analyses were often carried out by physicians and anatomists from different areas of the world. From that first medical perspective, the observation and classification of skulls developed into broader studies of archaeological human remains from different chronologies. In that sense, a pioneering bioarchaeological study was carried out by the American anthropologist Earnest Hooton on the Pecos Pueblo skeletal material (Hooton, 1930 in Buikstra and Beck 2006:83). Hooton´s work, including that on paleoepidemiology, demography, and changing patterns through time influenced later studies. At this time period there was also research done by Washburn (1951, 1953a, 1953b). His work is quite important for representing a change of the "New Physical Anthropology" where the intention was to integrate other disciplines, such as primatology and human evolution, and genetics. It was also a shift in mentality in comparison with previous periods. For this reason but also for his professional trajectory, Washburn is considered a key figure in anthropology (Stini, 2010). There is now a change from a very descriptive approach to a more scientific approach, with the formulation of hypotheses and questions, wand biological data from human remains is used to test those hypotheses and answer those questions.

Since then, there have been extensive developments that have combined anthropological, medical, ethnological, historical and biological data from multidisciplinary teams. During the 1990s, bioarchaeology enjoyed favourable circumstances, also influenced by a better world economic situation as well as a change in legislation in the United States (Smith, 1991). New projects incorporating paleodemography, health and disease, and interpretations of social organisation were developed across the United States; for example, a study in the midcontinent, which focused on the area around the Mississippi River (Buikstra, 1991) and another in Stillwater Marsh in the Great Basin of Nevada

(Larsen and Kelly, 1995), used data from human skeletal remains to answer questions about health, disease, and population change. A similar situation also occurred in Europe. In the United Kingdom, for example, according to Roberts (2009:221), improvements in the quality of work on human remains, and increased opportunities for the funding of such work were seen from this time onwards.

Bioarchaeology is a very prolific field with a plethora of publications on a variety of subjects. As a consequence, many general reference manuals in bioarchaeology have been published (e.g. Buikstra and Beck, 2006; Larsen, 2000, 2010; Cox and Mays, 2000; Weiss, 2008, Mays 2010; Roberts, 2009), with some focused on the study of children (Lewis, 2007), and paleopathology (e.g. Buikstra and Roberts, 2012; Grauer, 2012; Ortner and Aufderheide, 1991; Waldron, 1994, 2009; Ortner, 2003; Roberts and Buikstra, 2003; Pinhasi and Mays, 2008; Roberts and Manchester, 2007; Aufderheide and Rodríguez-Martín, 1998; Mann and Murphy, 1990), including some specific volumes on metabolic disease (Brickley and Ives, 2008), bioarchaeological perspectives on the origins of the agriculture (Cohen, 1977; Turner, 1979; Cohen and Armelagos, 1984; Buikstra et al., 1986; Larsen, 1995, 2006a; Harris, 1996; White, 1999; Smith et al., 2000; Lambert, 2000; Steckel and Rose, 2002; Pinhasi et al., 2005; Kennett and Winterhalder, 2006; Cohen and Crane-Kramer, 2007; Temple, 2007; Denham et al., 2007; Cohen, 2009; Shea and Lieberman, 2009; Pinhasi and Stock, 2011;) and human evolution (Kimbell et al., 2010; Tattersall, 1998; Johanson et al., 1994; Ullrich, 1999). In relation to paleopathology too, a world-wide project named “A global history health project”[2] has been carried out for the past few years in the form of an online database of paleopathology which will be accessible for researches. Other topics, such as the impact of colonisation in the human populations of the Americas, have also been investigated through bioarchaeology (Hutchinson, 2006; Larsen and Milner, 1994).

Bioarchaeology has explored social perspectives of past populations (e.g. Agarwal and Glencross, 2011; Gowland and Knüsel, 2006; Sofaer Derevensky, 2006), social embodiment (Bonogofsky, 2011) and the concept of identity (Gowland and Thompson, 2013; Knudson and Stojanowski, 2008 among others, for a complete review see section 2.3). On the other hand, it has also produced reconstructions of past lives over deep time

[2] www.global.sbs.ohio-state.edu/ (10/01/2013)

in different continents, for example in Croatia (Slaus, 2002), where the author examined skeletons dating from prehistory to the 18th century, and Southeast Asia, where hominins through to modern humans have been the focus of research (Oxeham and Tayles, 2006).

Furthermore, there have been important developments in the standards used for recording human remains in archaeology (Buikstra and Ubelaker, 1994; Brickley and McKinley, 2004), the correct way to excavate (Roberts, 2009; Ubelaker, 1989), the post-excavation treatment of human remains (McKinley and Roberts, 1993; Mays, 2010; Brothwell, 1981; the Church of England and English Heritage, 2005; Williams, 2001), including their storage in museums (Cassman et al., 2006). It is also important to point out that ethical and legal issues in bioarchaeology have also been addressed in the published literature as well (Bray, 2011; Fforde et al., 2002; Márquez Grant and Fibiger, 2010; Sayer, 2010; Kakaliouras, 2008; Turner, 2005; Garrat-Frost, 1992). Finally, extensive developments have further been seen in the application of biomolecular analytical techniques, for example the use of ancient DNA (Wilbur and Stone, 2012; Stone et al., 2009; Brown and Brown, 2011; Brown, 2006; Jones, 2001), and stable isotopes to explore past disease, familial relationships, mobility and diet (Barnard and Wendrich, 2007; Tafuri, 2005; Saunders and Katzenberg, 1992; Price, 1989); further discussion of the last two topics will be made in Chapter 4.

All of these advances would not have been possible without the university-level efforts made in improving bioarchaeology training. For example, in the United Kingdom, masters level (MA or MSc) courses are taught in at least 12 universities now. A wide range of seminars, workshops, lectures, and conferences are also provided throughout different educational institutions. Thus, today bioarchaeology is a well-studied field.

Some professional international associations consistently work at improving standards in bioarchaeology (e.g. American Association of Physical Anthropology[3], the British Association of Biological Anthropology and Osteoarchaeology[4] and the Canadian Association of Physical Anthropology[5], and, specifically for paleopathology, there is the

[3] www.physanth.org/ (12/01/2012)

[4] www.babao.org.uk/ (12/01/2012)

[5] www.capa.fenali.net/ (12/01/2012)

Paleopathology Association[6]). However, while most efforts have been focused on the recording of human remains, there are still improvements that must be made to methods for the estimation of sex and age-at-death of skeletons (Roberts, 2009). Considering the enormous improvements in excavation and post-excavation treatment of human remains and ethical issues in bioarchaeology, the necessary strategies toward an international legislation to seek protection for human remains has not been developed properly, but a good start is the compilation made by Márquez-Grant and Fibiger (2011).

2.5.- Bioarchaeology in Spain

2.5.1.- Introduction

In this field, Spain seems to be an unknown country in the eyes of an outsider and this is due to the small impact that Spain makes outside its borders. This means that not much Spanish bioarchaeological research is well-known outside of Spain, but also that there are insufficiant publications in English or in mainstream journals. The Spanish contribution to international conferences (in the organisation, but also in attendance), and presence on editorial boards and committees is also insignificant. This is partially the result of the language barrier, which is a major issue, but there is also a mixture of lack of interest and a lack of funding in research. Of course, this is not the case for many researchers and universities, as there are some that are projecting their high-standard research outside Spain, such as the Autonomous University of Barcelona, the Society of Sciences Aranzadi and the University of Granada.

2.5.2.- Its beginnings and relevant institutions

The first third of the 19th century saw the beginnings of anthropology in Spain. Two events marked this beginning: the first was the 1833 creation of the Anthropology and Ethnology section in the Natural Science Museum in Madrid (Museo de Ciencias Naturales) by Manuel Antón y Ferrándiz (Porras Gallo, 2003-2005). This section had a laboratory that enabled the pioneers of anthropology to start their first studies in anthropology. The second event was the creation of the Spanish Anthropological Society (Sociedad Española de Antropología) in 1865 by Pedro González de Velasco (Porras Gallo, 2003-2005), which, in

[6] www.paleopathology.org/ (12/01/2012)

1873, led to the Journal of Anthropology (Revista de Antropología). The beginning of the 20th century started with the conversion of this society into the Spanish Society of Anthropology, Ethnography and Prehistory (Sociedad Española de Antropología, Etnología y Prehistoria).

At the end of the 19th century, the first studies in anthropology in Spain were published by Aranzadi (1889, 1894) and Eguren (1914), mostly focused on prehistoric Basque populations. Subsequent work was done by this team in relation to the study of the skull (Barandiarán, 1947; Aranzadi and Barandiarán, 1948).

One of the key researchers of the 20th century was Juan Comas, who published the book *Manual de Antropología Física* (Comas, 1959) and its subsequent English version (Comas, 1960). The birth of biological anthropology in Spain was due to the creation of the Biological Anthropology research group (Grupo de Antropología Biológica) in the Spanish Society of Natural History, several essential key meetings and conferences (Márquez-Grant et al., 2010), and the beginning of the Society of Sciences Aranzadi, the Spanish Society of Biological Anthropology and the Spanish Society of Paleopathology.

In 1947, the Society of Sciences Aranzadi (Sociedad de Ciencias Aranzadi) was established, a scientific institution with a department of Social Sciences that incorporated physical anthropology. In 1949, it created the journal "Munibe[7]", which publishes four issues per year. In 1978, the Spanish Society for Biological Anthropology (Sociedad Española de Antropología Biológica or SEAB) was founded with the intention of holding biannual conferences and publishing the results in conference proceedings, as well as in its journal (*Boletín de la Sociedad Española de Antropología Biológica).* In 2006, this Society changed its name to the Spanish Society of Physical Anthropology. In 2000, the Spanish Journal of Physical Anthropology, or "*Revista Española de Antropología Física"*, was founded, with an annual publication. The international renown of Spanish paleopathology was established for the first time as a result of the organisation of the 6th European Meeting of the Paleopathology Association in Madrid by the School of Legal Medicine of the Complutense University of Madrid. Following this, in 1987, the Spanish Paleopathology Association (Sociedad Española de Paleopatología or AEP) was born, having biannual conferences, conference proceedings, and an electronic journal called

[7]www.aranzadi-zientziak.org/fileadmin/webs/Munibe/Html/MunibeAA/ultimonumero-eng.html (13/12/2011).

"Paleopatología"[8] since 2003 (two issues per year). The 2nd international meeting celebrated in Spain was the 9th European Meeting of the Paleopathology Association, held in 1992 in Barcelona, organised by the Archaeological Museum of Catalonia and coordinated by Domingo Campillo (Pérez-Pérez, 1995).

The phrase "physical anthropology" was first used in Spain by José M. Reverte Coma and Domingo Campillo Valero, both considered pioneers of the discipline. This concept is clearly defined in Reverte Coma's book *Medical Anthropology I* (*Antropología Médica I*) (Reverte Coma, 1981) as the study of the physical and anatomical characteristics of humans and variations in modern humans (Reverte Coma 1981:1). José M. Reverte Coma was the creator of the Laboratory of Forensic Anthropology and Paleopathology and the Museum of Medical Anthropology and Paleopathology at the School of Legal Medicine of the Complutense University of Madrid. During this time in the Basque Country, the tradition of studies in anthropology, started by Telesforo Aranzadi at the end of the 19th century, is represented by the work of Basabe (1966, 1967, 1969) and Fusté (1955, 1960, 1965, 1966) on prehistoric populations.

The key pioneer of modern Spanish paleopathology is the neurosurgeon Domenéch Campillo Valero, professor of the History of Medicine at the University of Barcelona (UB), who is now developing his research at the Paleoanthropology Laboratory at the Museum of Catalonia in Barcelona. Most of his work involves paleopathology (Campillo Valero, 1976, 1977, 1993, 1994, 2001, 2009) including some research on the history of paleopathology in Spain (Campillo Valero, 1989), but he has also written manuals on physical anthropology (Campillo Valero and Subirá de Galdácano, 2004), case studies (Campillo Valero, 2002) and a recent book about trephination in prehistory (Campillo Valero, 2007). However, another publication on the history of paleopathology in Spain is that by Pérez and Carretero (1989).

2.5.3.- Education in bioarchaeology in Spain

In Spain, bioarchaeology has been an academic discipline since 1984, and included as a science module in degrees in Biology, Medicine, Odontology and Anatomy. Based on data

[8] www.ucm.es/info/aep/contenido.htm (13/12/ 2011).

from the Spanish Association of Physical Anthropology (Calderón, 2003), it is taught in 16 universities in Spain within bachelor of science degrees (BScs) in Biology, and was recognised by law as an area of knowledge by the Academic Commission of the University Board on the 3rd of April of 2000[9] (code 028).

1-Complutense University of Madrid, 2-Autonomous University of Madrid, 3-University of Alcalá de Henares, 4-University of Barcelona, 5-Autonomous University of Barcelona, 6-Pompeu Fabra University, 7-University of Santiago, 8-University of Vigo, 9-University of Oviedo, 10-País Vasco University , 11-University of León, 12-University of Salamanca, 13-University of Murcia, 14-University of Valencia, 15-University of Granada, 16-University of Zaragoza

Figure 2.2. Universities in where bioarchaeology is being taught in Spain (after Calderón, 2003)

Today the subject is incorporated into other diplomas or in masters' courses in Biological Sciences, but still remains without institutional support and there is an absence of legislation to control the excavation and retrieval of human and faunal skeletal remains by bioarchaeologists. Only a few of these programmes (figure 2.2) include bioarchaeology and paleopathology.

[9] BOE núm. 151 de 2 junio de 2000. (02/06/2000)

In 1999, the Catalonian-Balearic Association of Paleopathology[10] was created, another organisation promoting the study of paleopathology in Spain. Great efforts have been made towards the development of the discipline in Spain, but mainly from a clinical or biological perspective, and less so from an archaeological perspective. Nevertheless, there are several university departments, other research institutions, and research groups that work on bioarchaeology, as follows:

In the Basque Country (northern Spain), there are two main centres, the Aranzadi Society of Sciences and the Department of Legal and Forensic Sciences at the País Vasco University. One of the most active researchers in the Department of Physical Anthropology of this Society is the forensic scientist and medical doctor Francisco Etxeberría Gabilondo, who is also Professor at the University of El País Vasco. His career has been very productive and mainly focused on forensic cases, but he has published in paleopathology (Etxeberría Gabilondo, 1989, 1990, 1999; De la Rúa et al., 1995), including a brief summary of paleopathology in Spain (Etxeberría Gabilondo, 2007), and in archaeology (Arias et al., 2008; Etxeberría Gabilondo and Herrasti, 1989; 2001; Vegas et al., 1999; Herrasti and Etxeberría Gabilondo, 2007). Since 2000, he has been involved in the excavation of the mass graves from the Spanish Civil war (Etxeberría Gabilondo, 2004a, 2004b, 2008, 2009; Etxeberría Gabilondo et al., 2010; Prada and Etxeberría Gabilondo, 2005; Penedo et al., 2009).

Another main centre is Catalonia, which is represented by the Autonomous University of Barcelona (UAB), the University of Barcelona (UB) and the Museum of Catalunya. At the Autonomous University of Barcelona, in the Department of Animal Biology, Vegetal and Ecology, there are three main researchers, Assumpció Malgosa Morera, and Albert Isidro Llorens (also a medical doctor at the Hospital Universitari Sagrat Cor, Barcelona, Spain, and both from the GROB research group[11] where there are other researchers) and Eulália Subirá de Galdácano. This department has been working mainly on paleopathology (Isidro Llorens and Malgosa Morera, 2003) for over a decade, but part of their work is also on biochemistry, such as ancient DNA (Solórzano et al., 2007; Montiel et al., 2007; Smerling et al., 2007; Solórzano et al., 2006; Malgosa Morera et al., 2005; Montiel and Malgosa,

[10] www.academia.cat/paleopatologia (15/01/2012)

[11] www.grupsderecerca.uab.cat/grob/en (18/06/2012)

2003), trace elements (Safont et al., 1998; Malgosa Morera and Subirá de Galdácano, 1997) archaeological studies (Ruiz Ventura and Subirá de Galdácano, 2010) and stable isotope analyses (Fontanalls-Coll et al., 2010, 2011, 2012; Subirá de Galdácano, 2008; García Guixé et al., 2006a, 2006b). At this University, but in the Department of Prehistory and Archaeology, research in bioarchaeology is carried out mainly by Cristina Rihuete Herrada. She is also the former director of the Archaeological Museum of Son Fornés (Montuïri, Mallorca) and focuses her research in prehistoric remains (Rihuete Herrada, 2000, 2003; Castro Martínez et al., 2002; Castro Martínez et al., 1999).

The University of Barcelona, or UB, is represented by Daniel Turbón Borrega from the Department of Animal Biology (in the area of Anthropology in the School of Biology), and Carme Rissech and Alejandro Pérez-Pérez, whose work is mainly on human evolution (Turbón Borrega, 2008; Arenas Solá and Turbón Borrega, 1998) bioarchaeology (Rissech and Steadman, 2011; Fernández Domínguez et al., 2005) and paleopathology (Pérez-Pérez, 1995; Rissech et al, 2004; Rissech et al., 2007; Rissech and Black, 2007), respectively.

In Madrid, there are two main centres. The Complutense University has a School of Legal Medicine, represented by the forensic anthropologist José Luis Sánchez Sánchez, who has made substantial contributions to forensic investigations (Sánchez Sánchez and Villalaín, 1988) paleopathology (Kanaan et al., 2002) and the use of new technologies in the investigation of human skeletal remains (Sánchez Sánchez, 2003, 2005; Gómez et al., 2006). He has also been working on the creation and development of the Reverte Museum[12] (in honour of the famous forensic anthropology pioneer, José M. Reverte Coma) where there is an area dedicated to Paleopathology and Human Evolution. The other research centre relevant to bioarchaeology in this University is the Biology Department, where Dolores Garralda, Gonzalo Trancho and Beatriz Robledo Sanz are the main researchers. They have also been very prolific in the publication of a variety of studies, but mainly on prehistory (Maurille et al., 2009-2010; Garralda et al., 2005; Garralda, 2005; Robledo Sanz and Trancho Gallo, 2002; Trancho Gallo and Robledo Sanz, 2007b) and especially on the use of biochemical analysis to investigate paleodiet (Trancho Gallo et al., 1996; Trancho Gallo and Robledo Sanz, 1999, 2004, 2007a; Jimeno Martínez et al., 1993-

[12] www.museorevertecoma.org/v2/ (23/01/2012)

1994). At the Autonomous University of Madrid, the Department of Biology conducts research in bioarchaeology; for example, research by Armando González Martín, who specialises in subadult remains (González-Martín, 2000, 2008; González Martín and Etxeberría Gabilondo, 2006), Jesús Herrerín López (Herrerín López, 2000) and the medical doctor Manuel Campo Martín who specialises in the paleopathology of the vertebral column (Campo Martín, 2001, 2003).

In Valencia, the forensic doctor Delfín Villalaín Blanco, President of the Spanish Society of Paleopathology and Professor of the Department of Medicine at the University of Valencia, has focused his work on forensic anthropology (Villalaín Blanco, 1976, 1981; Sánchez Sánchez and Villalaín Blanco, 1988), but also on paleopathology (Villalaín Blanco and Puchalt Fortea, 1992). He recently published a paper on the history of paleopathology in Spain (Villalaín Blanco, 2007).

Another centre for bioarchaeology is the Laboratory of Anthropology in the School of Medicine at the University of Granada, founded by Manuel García Sánchez and coordinated by Miguel Botella López; other researchers include Inmaculada Alemán, Silvia Jiménez Brobeil and Rosa Maroto. This team has produced numerous fieldwork reports, and have been working mainly on south-east prehistoric Spanish populations (Botella et al., 1986; Jiménez-Brobeil, et al., 2001; Jiménez-Brobeil and García Sánchez, 1989-1990) and Mexico (Botella López et al., 2002; García García et al., 2002), most specifically in paleopathology (Botella López et al., 2000; Botella López et al., 1995; Jiménez-Brobeil et al., 1995).

The last, but not least, centre for bioarchaeology in Spain is on the Canary Islands, where the main researcher is Conrado Rodríguez-Martín, who states that studies in paleopathology did not start in the Canary Islands until 1970 (Rodríguez-Martín, 2012). His work has been mostly on paleopathology (Rodríguez-Martín and Casariego-Ramírez, 1991; Rodríguez-Martín, 1990).

In relation to contributions to the development of bioarchaeology, the first project to be carried out in Spain must be highlighted. This pioneering project began in the late 1980s and was called *The Gatas Project: Society and Economy in the Southeast of Spain c. 2500-800 ANE* (Chapman et al., 1987). This project covered the archaeological survey, excavation and post excavation analysis of the Argaric Bronze Age site of Gatas (Turre, Almería). The excavation started in 1985 and continued until 1991 (Chapman et al., 1986; Castro Martínez et al., 1987, 1989, 1991). This new research project included research by Buikstra (Buikstra et al., 1995; Buikstra and Hoshower, 1995; Buikstra et al., 1991; Buikstra et al., 1989) and would produce the first doctoral thesis on bioarchaeology in Spain entitled *Bioarchaeology of the Funerary practices from Cova des Cárritx (Citadella, Menorca)* (Rihuete Herrada, 2003).

2.5.4.- Training and research in bioarchaeology in Spain

The courses in Spain are focused in Human Biology, and are taught in Faculties of Biology; four official master's programmes exist, and are described below.

At the University of Barcelona (UB) and the Autonomous University of Barcelona (UAB), the Master of Human Biology is coordinated by Alejandro Pérez-Pérez (UB) and by Asunción Malgosa (UAB). The core modules[13] are *Fundamentals of Human Populations Morphological Diversity* and *Fundamentals of Human Molecular Diversity* with optional modules in *Human Evolution and Primatology, Forensic Anthropology, Genes, Environment and Disease and Cancer* and also *Tools, Techniques and Communication and Genetics, Evolution and Biodiversity.* The Autonomous University of Barcelona, jointly with the University of Barcelona, is also offering a PhD programme in Biodiversity[14], which is the first in this discipline in Spain, and has been adapted to the regulations of the new European Area of Higher Education (EAHE); the coordinator is Dr Alejandro Pérez-Pérez.

The Autonomous University of Madrid, the Complutense University of Madrid and the University of Alcalá de Henares run the inter-university programme *Physical Anthropology: Evolution and Human Biodiversity.* This programme is coordinated by Margarita Carmenate and the core modules are *Basic Principles in Physical Anthropology* and *Basic Principles in Human Population Genetics.* The basic and compulsory module offers courses in human variability, ecology, health and disease and genetics. There are also

[13] www.ub.edu/masteroficial/biohumana/index.php?option=com_content&task=view&id=18&Itemid=35 (25/05/2012)

[14] www.uab.cat/servlet/Satellite/postgraduate/phd-s/experimental-sciences/general-information/biodiversity-1221807698479.html?param1=2012&param2=1096478607699 (25/05/2012)

three optional modules, in *Human Evolutionary Biology, Human Biology* and *Skeletal Biology and Forensic Anthropology.*

The master's programme at the University of Granada is entitled Physical and Forensic Anthropology. The core units are *Introduction to Physical Anthropology*, *Human Evolution*, *Anthropology of Human Populations* and *Forensic Anthropology*. This programme is coordinated by Miguel C. Botella from the Laboratory of Physical Anthropology in the School of Medicine, and there is another opportunity to receive training in physical anthropology in the master's programme in Archaeology. This additional training is via a module entitled *Methods in the Study of Physical Anthropology Applied to Archaeology*, coordinated by Trinidad Nájera Colino and Sylvia Jiménez Brobeil. In addition to this master´s programme, for first time in 2013-2014 there will be an itinerary of bioarchaeology within the new and specific Bachelor's degree in Archaeology[15] at this University.

The fourth master´s programme is at the University of Alicante (Masters in *Biotechnology and Biomedicine*). The programme runs over two years and in the second year, the student has to choose between *Biology of Reproduction and Development, Clinical Laboratory and Pathological and Inmunology* and *Biological Anthropology and Health.* All the master's programmes described above require a dissertation to be written at the end of the learning process.

However, while there are official routes for training in bioarchaeology, there are other opportunities in the form of seminars, workshops, conferences or short courses. The institutions that often offer this training are the Society of Sciences Aranzadi, the Department of Animal Biology, Plant and Ecology at the Autonomous University of Barcelona (UAB), the School of Legal Medicine at the Complutense University of Madrid and the Laboratory of Physical Anthropology at the University of Granada. The Canarian Institute for Bioanthropology, which was created in 1993, also offers the opportunity for research in bioarchaeology. The Spanish Society of Paleopathology, Spanish Society of Physical Anthropology and the Catalonian-Balearic Association of Paleopathology also offer different courses over the year. As Etxeberría has pointed out (Etxeberría Gabilondo 2007: 151), during the 20th century the degree of specialisation in paleopathology was so

[15] http://grados.ugr.es/arqueologia/pages/infoacademica/estudios (14/07/2013)

high that only research groups with the relevant facilities and resources could continue to contribute to developing the discipline in Spain.

Another institution in Madrid is the Institute for Scientific Studies of Mummies (*Instituto de estudios científicos en momias* (IECIM). It was created in 1997, as a non-profit organisation that aims to undertake systematic studies of mummified remains, applying the latest techniques, and it is directed by Mercedes González.

In more recent years (2012), the Professional Association of Bioarchaeology[16] (*Asociación Profesional de Bioarqueología*) was founded by Inmaculada López Flores, Marta Díaz-Zorita Bonilla and Javier Escudero Carrillo. The main goal of the association is to protect the bioarchaeological heritage and to promote bioarchaeological projects in Spain.

2.5.5.- Documented and archaeological skeletal collections in Spain

Spain has a very rich and well-preserved archaeological heritage. In relation to the human skeletal collections, it must be said that there are hundreds of assemblages in archaeological museums. They are of such magnitude that there is not sufficient space to store them. In addition, there is the issue of an absence of qualified staff to curate the remains. For this reason, it is not currently possible to calculate the quantity of human remains that are stored in museums waiting for a better future. Taking a positive view, it must be said that these unstudied collections have enormous research potential, since the collections date from the prehistory up to the 19th century AD. The fact that there is such a huge amount of skeletal material is a challenge for future generations. However, there are, as always, some exceptions and some documented collections have been processed and used for comparative study.

Over the past 20 years, there has been a remarkable increase in the study of bioarchaeology in Spain; more funding opportunities at universities, but also funding from, and employment in, contract archaeology, due to the extensive urban development that Spain has seen. However, contract work has been of such magnitude that there have been

[16] www.bioarqueologia.es (24/10/2012)

many cases where cemetery excavations have not been supervised by bioarchaeologists. Most of the excavated remains have been curated at museums, are in urgent needed of re-packing, and are not housed in optimal environmental conditions. With respect to documented skeletal collections in Spain, according to Márquez-Grant et al (2011), there are at least six documented collections that are used for physical anthropological work.

The Olóriz Collection was created by the Medical doctor Federico Olóriz Aguilera and comprises 2,250 skulls, and an archive of 15,000 medical observations on living individuals and 1,000 on corpses. This collection is represented by an online database[17]. Another collection, at the Anatomical Museum of the University of Valladolid, comprises around 100 individuals of known age and sex. The University of Granada also has a collection of 483 complete documented skeletons (Márquez-Grant et al, 2011:425), and the Autonomous University of Barcelona has 35 complete adult skeletons from Granollers (Catalonia) from the 20th century, of known sex, age and origin (Rissech and Steadman, 2010). At the Legal Medical School at the Complutense University of Madrid there are two documented collections. The first collection is EML 1, belonging to a Spanish late 20th century population and composed of 122 individuals who died between 1975-1985 with ages between 20 and 91 years old (Río Muñoz, 2000). The second collection is EML 2[18], which also belongs to a Spanish late 20th century population, and is composed of 88 skeletons of individuals born between 1941 and 1975 and who died between 20 and 55 years old.

With respect to archaeological collections of human remains, there are many collections stored at museums. Some examples of large assemblages are located in Valladolid, Madrid, Murcia and Écija (Seville). At the University of León, the archaeological skeletal collection consists of around 2,000 skeletons from 40 populations from Castilla y León (Márquez-Grant, 2011: 425). The collection from the Reverte Museum at the Complutense University of Madrid (Reverte Coma, 1981) consists of a collection of approximately 2,000 skulls dating from the 5th to the 20th century and from different geographic locations, including some South American and Egyptian mummies, among other pathological remains. From this collection, 646 skulls are dated to the 18th and 19th centuries and were

[17] www.ucm.es/info/museoana/Colecciones/Craneos/index.htm (02/03/2012)

[18] Personal communication Dr José Antonio Sánchez Sánchez (Head of the Legal Medical School, Complutense University of Madrid) (February, 2012)

studied by Fernández García (2001). The archaeological museum of Murcia holds the medieval human skeletal collection from San Nicolás, of around 1,000 individuals (Navarro Palazón, 1986), which are actually being curated at the Autonomous University of Madrid by Professor Armando Martín, and the Municipal Museum of Écija (Seville) holds a human skeletal collection of around 5,000 medieval skeletons from the excavation at Plaza del Salón, which date from the 5th to the 14th century AD (Romo Salas et al., 2001).

2.5.6.- New directions for bioarchaeology in Spain

In summary, bioarchaeology in Spain is still underrepresented in the world and it is in the process of developing, compared to other European countries (such as the United Kingdom, France, Portugal or Germany), the United States or Canada. Despite the old tradition of physicians working on skeletal remains and the great advances in Spain, It is believed that bioarchaeology has not yet fully developed as an independent discipline; there is still much to do, including encouraging the incorporation of multiple techniques of analysis in each studies. It is fundamental that bioarchaeology should become incorporated into social science departments, like Archaeology, to ensure holistic studies, using as many lines of evidence as possible.

However, there are still many limitations, including the lack of funding. This issue, which is now common worldwide, could be changed if resources were shared. For instance, to contribute to research progression, different departments and universities need to bring together projects and programmes, by finding a link in any given project that runs through different disciplines, like Geological Sciences, Biology, Chemistry, Archaeology or Medicine, in order to contribute to truly multidisciplinary research. Sharing resources and knowledge between and among those disciplines will certainly help to develop bioarchaeology appropriately, as has been seen in other countries, like the United States or the United Kingdom.

In Spain, it is still necessary to have specialists with the right academic training to curate collections in universities and museums, in order to build skeletal collections that are accessible for research. Despite the many attempts to implement standards, like standard recording forms for human skeletal remains, through several meetings of the Spanish

Society of Paleopathology (a specific workshop was held at the 9th conference), this has so far been unsuccessful. Until the standardisation of methods is realised, the professionalisation of bioarchaeology in Spain will not happen. It is moving in the right direction, but insufficient efforts have yet been made to date.

CHAPTER 3 - THE 3RD MILLENNIUM BC IN SOUTH-WEST SPAIN

3.1.- The context: the 3rd millennium BC in south-west Spain (Copper Age period)

3.1.1.-Introduction

The purpose of this chapter is to summarise the relevant contextual information regarding the 3rd millennium BC in south-west Spain. This time period in this area is not as well known as it is in the south-east of Spain and central Portugal. In the south-east of Spain, a major contemporary site is Los Millares (Siret and Siret, 1890; Arribas and Molina, 1982; Molina 1981; Almagro Basch and Arribas, 1963; Chapman, 1981; Ferrer Palma, 1984). Investigations of Late Prehistory in the south-east of the Iberian Peninsula have been prolific, and focused mainly on the origin of social inequality (Chapman, 1990; Gilman and Thornes, 1985; Ramos Muñoz, 1981; Lull, 1983, 1984; Hernando Gonzalo, 1987, 1991; Hernando and Vicent, 1987; Mathers, 1984; Gilman, 2013). In central Portugal, two of the important sites are Vila Nova de Sâo Pedro (VNSP) (Spindler, 1981; Paço and Sangmeister, 1956; Savory, 1970; 1972) and Zambujal (Sangmeister and Schubart, 1981) Despite the relatively close geographic proximity, the imposition of Los Millares, VNSP and Zambujal as models for the southern Iberian Copper Age is inappropriate because the south-west has its own characteristics, with differences from those described by Gilman (1987) and Chapman (2008) in relation to settlement patterns, subsistence patterns and the development of metallurgy (Piñón Varela, 1987d).

3.1.2.- Investigations in the south of Spain

The first explorations of megalithic monuments in the south began in the 19th century with the investigation of some of the most important megalithic complexes in Andalusia, such as Menga (Antequera, Malaga) (Mitjana y Ardison, 1847), La Pastora (Valencina-Castilleja, Seville) (Tubino y Oliva, 1868) and Los Millares (Siret and Siret, 1890). Early reference works offering a compilation of information on most of the megalithic sites in Andalusia were the books by Leisner and Leisner (1943, 1959), as well as the work done by Louis Siret during 1860-1934 in the south-east (Siret, 2001). The 3rd millennium BC has been investigated for over half a century in the south-west of Spain, with the early 1970s marking the start of the first archaeological excavations and research projects. This research focused on the south-west area of Spain/Iberia (Andalusia), which includes the

Middle Guadiana Basin, the Lower and Middle Guadalquivir Basin, and the province of Huelva, but references to the south of Portugal and to the east of Andalusia were also made. The south of Spain is home to a large number of megalithic monuments; in Andalusia alone, approximately 1,560 structures have been found thus far (García Sanjuán, 2009:17). One of the main challenges for the investigation of this time period is the lack of published archaeological reports; data from archaeological excavations undertaken as rescue archaeology predominate with few published scientific papers. Another problem of crucial importance is the lack of calibrated radiocarbon dates as well as ancient and contemporary looting of sites. As of 2010, the actual number of calibrated radiocarbon dates for the whole of Andalusia is 598 (Linares Catela and García Sanjuán, 2010). In the following Tables (3.1 and 3.2), the calibrated dates for south-west Spanish funerary and settlement sites are provided, respectively, including some of the sites subsequently referred to in this text.

SITE	AREA	BP	BC (1σ)	LAB ID	REFERENCE
Los Millares	A	4380 ± 120	3330-2880	KN-72	Almagro Basch, 1959
La Alberquilla (Structure 7)	J	4465 ± 25	3326-3037	CNA603	Camara Serrano et al., 2010
Paraje de Monte Bajo (Tomb 2)	C	4450 ± 40	3324-3024	Beta-233952	Lazarich González et al., 2010
Cuesta de los Almendrillos	M	4450 ± 20	3309-3027	GrN-25302	Fernández Ruiz and Márquez Romero, 2001
Barranquete (Tomb 7)	A	4300 ± 130	3300-2650	CSIC-82	Alonso Mathias et al., 1978
Casullo	H	4410 ± 50	3261-2925	CNA-346	Linares Catela and García Sanjuán, 2010
Barranquete (Tomb 7)	A	4280 ± 130	3091-2669	CSIC-81	Alonso et al., 1978
Cueva de Nerja	M	4260 ± 80	3011-2696	Ua-12466	Jordá Pardo and Aura Tortosa, 2008
Huerta Montero	B	4220±100	2930-2610	GrN-16955	Blasco Rodríguez and Ortiz Alesón, 1991
Paraje de Monte Bajo (Tomb 4)	C	4220 ± 40	2896-2706	Beta-233956	Lazarich González et al., 2010
Paraje de Monte Bajo (Tomb 4)	C	4210 ± 40	2892-2703	Beta-233955	Lazarich González et al., 2010
Valencina (PP4-Montelirio)	S	4160 ± 35	2880-2629	CNA1291	Unpublished
La Pijotilla (Tomb 3)	B	4168 ± 55	2877-2676	CNA-034	Odriozola Lloret et al., 2008
Valencima (El Algarrobillo)	S	4130 ± 30	2871-2581	CNA1272	Unpublished
La Pijotilla (Tomb 3)	B	4130±40	2865-2595	Beta 121143	Hurtado Pérez et al., 2000
Amarguillo II	S	4070±60	2860-2490	Beta-75066	Cabrero et al.,1997
Valencina (PP4-Montelirio)	S	4095 ± 25	2858-2503	CNA1300	Unpublished
Puerto de los Huertos	H	4070 ± 50	2839-2493	CNA-342	Linares Catela and García Sanjuán, 2010
Tesorillo de la Llaná	M	4055 ± 35	2830-2493	GrA-37339	Márquez Romero et al., 2009
Valencina	S	4050±105	2870-2470	I-10187	Fernández Gómez and Oliva Alonso, 1986
Alcaide (Cave 19)	M	4030 ± 110	2860-2458	GrN-16062	Marqués Merelo et al., 2004
Amarguillo	S	4030±65	2862-2361	Oxa-3971	Mederos Martín,1998
La Pijotilla	B	4168± 55	2814-2676	CNA-0034	Odriozola Lloret et al., 2008
La Pijotilla	B	4010±80	2595-2455	Beta 121145	Hurtado Pérez, 1999
Valencina	S	3910 ±110	2580-2270	GIF-4028	Fernández Gómez and Oliva Alonso, 1986
La Alberquilla (Structure 7)	J	3975 ± 35	2566-2467	Ua40060	CámaraSerrano et al., 2010
Puerto de los Huertos	H	3940 ± 50	2560-2346	CNA-344	Linares Catela and García Sanjuán, 2010
Valencina (El Algarrobillo)	S	3950 ± 25	2566-2347	CNA1273	Unpublished
Alcaide (Cave 20)	M	3830 ± 180	2563-2027	GrN-19198	Marqués Merelo et al., 2004
Valencina (La Gallega)	S	3905 ± 35	2484-2236	CNA1264	Unpublished
Los Gabrieles (T.4)	H	3920 ±50	2470-2300	Beta-185649	Linares Catela, 2006
Alcaide (Cave20)	M	3755 ± 210	2469-1903	GrN-19197	Marqués Merelo et al., 2004
La Pijotilla (T. 1)	B	3860 ±70	2460-2280	BM-1603	Hurtado Pérez, 1981
Joaniña	CC	3840 ± 170	2561-2036	Sac-1381	Forte Oliveira, 1998
Los Gabrieles (T. 4)	H	3850 ±40	2410-2200	Beta-185648	Linares Catela, 2006
La Venta	H	3820 ± 50	2395-2150	Beta-150158	Nocete Calvo et al., 2004b
Huerta Montero	B	3720 ±100	2300-1970	GrN-16954	Blasco Rodríguez and Ortiz Alesón, 1991

Key to table: A= Almería; S= Sevilla; B= Badajoz; H= Huelva; C= Cádiz; M= Málaga; J= Jaen; CC= Cáceres.

The dates have been calibrated with the software Calib 501 using the Int. Cal 09 curve.

Table 3.1. Radiocarbon dates from southern Spanish Copper Age funerary contexts.

SITE	AREA	BP	BC (1σ)	LAB ID	REFERENCE
El Negrón	S	4330±35	3030-2910	-	Cruz-Auñón et al., 1992
Papauvas	H	4330±50	3020-2880	CSIC-814	Martín de la Cruz, 1991
La Pijotilla (E-4/31)	B	4360 ± 50	3030-2905	Beta 121147	Hurtado Pérez, 1999
El Negrón	S	4250±35	2920-2880	-	Cruz-Auñón et al., 1992
Cabezo Juré	H	4220±120	2920-2580	Beta 143185	Nocete Calvo et al., 2004b
Valencina (SQ)	S	4295 ± 55	2919-2892	Ua36025	Nocete Calvo et al., 2011
La Junta de los Ríos	H	4210±80	2903-2672	-	Nocete Calvo, 2008
La Paloma	H	4220±40	2890-2700	Beta-150153	Nocete Calvo et al, 2004b
Valencina (SQ)	S	4235 ± 35	2883-2874	Ua36022	Nocete Calvo et al, 2011
Palacio Quemado	B	4140±80	2880-2610	HAR-8249	Hurtado Pérez y Enríquez, 1991
La Venta	H	4200±70	2870-2660	Beta-150157	Nocete Calvo et al, 2005
Papa Uvas	H	4110±50	2870-2600	CSIC-654	Martín de la Cruz, 1986b
Papauvas	H	4110±50	2870-2570	UGRA-91	Martín de la Cruz, 1986b
La Pijotilla (E-4/33)	B	4360±50	2865-2595	Beta- 121143	Hurtado Pérez, 1999
Valencina (SQ)	S	4150 ± 50	2862-2628	Ua19475	Nocete Calvo et al., 2008
Valencina (SQ)	S	4135 ± 45	2856-2622	Ua24557	Nocete Calvo et al., 2008
Valencina (SQ)	S	4120 ± 40	2853-2613	Ua32885	Nocete Calvo et al., 2008
La Junta de los Ríos	H	4090±45	2851-2506	-	Nocete Calvo, 2008
Amarguillo II	S	4070 ± 60	2770- 2460	-	Cabrero et al., 1997
Valencina	S	4050 ± 105	2870-2470	I-10187	Castro Martínez et al., 1996
Amarguillo II	S	4030 ± 65	2870-2409	-	Cabrero et al., 1997
La Pijotilla	B	4110 ± 40	2860-2585	Beta 121146	Hurtado Pérez, 1999
Valencina (SQ)	S	4105 ± 40	2850-2577	Ua36028	Nocete Calvo et al., 2011
Valencina (SQ)	S	4105 ± 40	2850-2577	Ua32042	Nocete Calvo et al., 2011
La Paloma	H	4070 ± 70	2850-2491	Beta-150154	Nocete Calvo et al., 2004b
Cabezo Juré	H	4059 ± 35	2830-2490	CSIC-1479	Nocete Calvo et al., 2004b
Valencina (SQ)	S	4180 ± 35	2796-2691	Ua36029	Nocete Calvo et al., 2011
Valencina (SQ)	S	4215 ± 40	2790-2757	Ua32886	Nocete Calvo et al., 2011
La Pijotilla (E13/3)	B	4010±80	2670-2457	Beta 121145	Hurtado Pérez, 2010
Valencina (SQ)	S	4050 ± 45	2619-2493	Ua22813	Nocete Calvo et al., 2008
Valencina (SQ)	S	4045 ± 50	2619-2487	Ua19474	Nocete Calvo et al., 2008
La Junta de los Ríos	H	4035±45	2619-2481	-	Nocete Calvo, 2008
Valencina (SQ)	S	4030 ± 50	2613-2484	Ua36027	Nocete Calvo et al., 2011
Valencina (SQ)	S	4040 ± 35	2610-2493	Ua36030	Nocete Calvo et al., 2011
La Junta de los Ríos	H	4005±45	2573-2474	-	Nocete Calvo, 2008
La Junta de los Ríos	H	4000±40	2569-2474	-	Nocete Calvo, 2008
La Junta de los Ríos	H	3995±40	2569-2472	-	Nocete Calvo, 2008
La Junta de los Ríos	H	3995±40	2569-2472	-	Nocete Calvo, 2008
La Junta de los Ríos	H	3990±70	2621-2350	-	Nocete Calvo, 2008
La Junta de los Ríos	H	3980±40	2569-2467	-	Nocete Calvo, 2008
Cabezo Juré	H	3980±100	2630-2300	I-18307	Nocete Calvo et al., 2004b
Valencina	S	3910 ± 110	2580-2200	GIF-4028	Castro Martínez et al., 1996
Valencina (SQ)	S	3995 ± 75	2574-2466	Ua24558	Nocete Calvo et al., 2008
Valencina (SQ)	S	4010 ± 35	2556-2484	Ua36031	Nocete Calvo et al., 2011
Valencina (SQ)	S	3985 ± 30	2550-2484	Ua36024	Nocete Calvo et al., 2011
Valencina (SQ)	S	3965 ± 35	2550-2487	Ua36026	Nocete Calvo et al., 2011
La Junta de los Ríos	H	3935±40	2488-2346	-	Nocete Calvo, 2008
La Junta de los Ríos	H	3910±45	2470-2341	-	Nocete Calvo, 2008
La Junta de los Ríos	H	3890±45	2462-2309	-	Nocete Calvo, 2008
La Junta de los Ríos	H	3880±40	2457-2300	-	Nocete Calvo, 2008
Cabezo Juré	H	3880±100	2480-2190	I-18305	Nocete Calvo et al., 2004b
Cabezo Juré	H	3870±100	2470-2190	I-18309	Nocete Calvo et al., 2004b
Cabezo Juré	H	3850±100	2470-2140	I-18308	Nocete Calvo et al., 2004b
Cabezo Juré	H	3830±100	2460-2140	I-19306	Nocete Calvo et al., 2004b
Valencina (SQ)	S	3660 ± 55	2133-1947	Ua36023	Nocete Calvo et al., 2011
Valencina	S	3380 ± 150	1880-1520	UGRA-72	Castro Martínez et al, 1996

Key to table: S= Seville; H= H; B= Badajoz; SQ= Smelting quarter.
The dates have been calibrated with the software Calib 501 using the Int. Cal 09 curve.

Table 3.2. Radiocarbon dates from southern Spanish Copper Age settlement contexts

The Chalcolithic period in south-west Spain is dated to between c. 3300 and 2100 cal BC (Castro Martínez et al, 1996; García Sanjuán, 2006). The different regions that will be considered in this research are:

The Lower and Middle Guadalquivir Basin or Occidental Sierra Morena: Seville, Cádiz and Córdoba provinces. This area corresponds to the Sierra Morena mountain range in the north, the Guadalquivir valley to the south and the Bética mountain range to the south and east.

The Middle Guadiana Basin: located to the north of western Sierra Morena and it is an area of sedimentation of the river Guadiana.

Huelva Province: located to the west of the mouth of the Guadalquivir River and to the east of the Portuguese border.

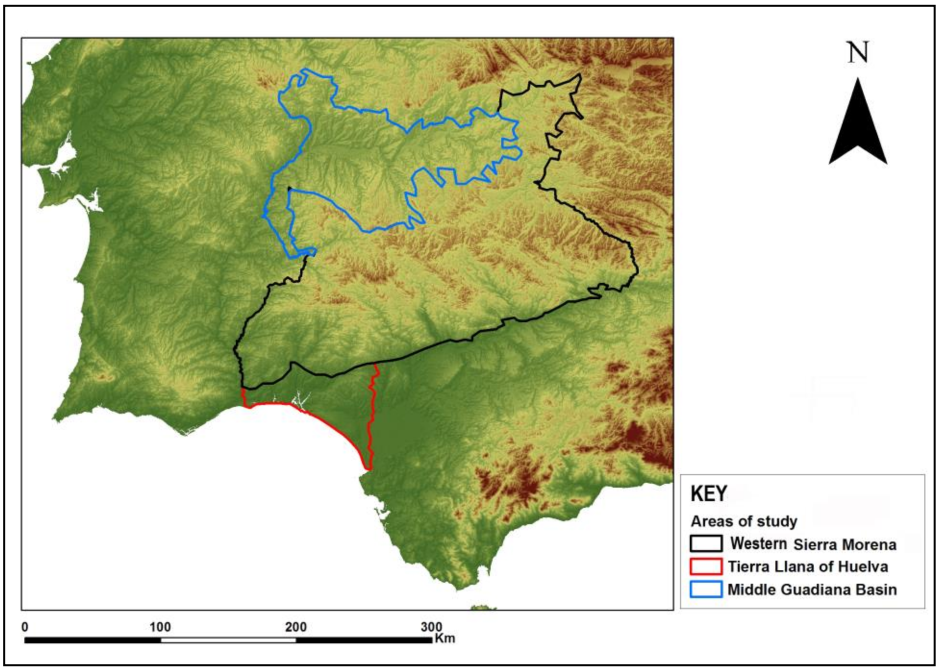


Figure 3.1. Map of the study areas.

3.2.- History of study

3.2.1.- Spain

Investigations of megalithic monuments began in 1984 in Madrid, where one of the first meetings about the megaliths that characterise the Chalcolithic period took place with publication of the proceedings: "*Actas de la Mesa Redonda sobre Megalitismo Peninsular"* (Lucas Pellicer et al., 1984). Some years later, in 1987, the second meeting was held, which was also published and entitled *"El Megalitismo en la Península Ibérica"* (Ferrer Palma, 1987). In 1990, the first Iberian Copper Age Meeting was held, and as a result, one of the few monographs about the Iberian Copper Age was published (Hurtado Pérez, 1995). In the years that followed, many research projects and archaeological excavations were carried out in the south-west and some of the works are synthesised in the Proceedings of the 1st Conference of Archaeology of Iberia (*I Congresso de Arqueología Peninsular*) (Oliveira Jorge, 1995), as well as in the published proceedings for the 2nd (*II Congreso de Arqueología Peninsular*) (Bueno Ramírez and Balbín Behrmann, 1997), the 3rd (3º Congresso de Arqueología Peninsular: UTAD) (Oliveira Jorge, 2000), and the 4th ("IV Congresso de Arqueología Peninsular") (Ferreira and Carvalho, 2006) Conferences on the Archaeology of Iberia.

There is also another more local forum where ideas can be exchanged about the works that are carried out in the south-west of the Iberian Peninsula. These are the "*Encuentros de Arqueología del Suroeste"* meetings. Some of the results of those meetings have been published; one of the few and latest publications is the proceedings of the "*IV Encuentro de Arqueología del Suroeste Peninsular"* (Pérez Macías and Romero Bomba, 2010), held in 2009. The last two meetings were held in 2010, *"V Encuentro de Arqueología del Suroeste Peninsular",* in Almodôvar, Portugal and in 2012 *"VI Encuentro de Arqueología del Suroeste Peninsular"* in Villafranca de los Barros, Badajoz, Spain. Another general overview of the megalithic phenomenon in Andalusia by García Sanjuán and Ruiz González (2010) includes updated information on most of the archaeological sites in southern Spain.

Most of these investigations have focused research on the Lower and Middle Guadalquivir: Cádiz, Seville and Córdoba. During the 1960s, the first archaeological excavations at the site of Valencina de la Concepción (Seville) began, with the study of the Matarrubilla dolmen (Collantes de Terán, 1969) and the discovery of the dolmen de Ontiveros (Carriazo y Arroquia, 1962). During the 1980s, other work promoted the protection of the heritage of the region in the form of "C*artas Arqueológicas*", or administrative documents based on scientific research, mostly completed by archaeological survey of specific areas. Examples come from the Alcores area (Amores Carredano, 1982), the Corbones River (Rodríguez Temiño, 1984) and the Southeast of the province of Seville (Ruíz Delgado, 1985).

During the 1990s, there were favourable circumstances for investigations in Andalucía, promoted by the government. As a result, a Catalogue of Dolmens in the province of Seville (Barrionuevo and Salas, 1991), and a Multimedia Megalithic Catalogue of the province of Seville (IAPH, 2000) were published. During the late 1980s and 1990s, successive rescue excavations were carried out, affecting several archaeological sites, but particularly one of the largest archaeological sites of Andalucía, that of Valencina de la Concepción (from now on "Valencina-Castilleja"). At the present time, well over a hundred excavations have been carried out at this site, including the excavation of Montelirio, a major megalithic monument (Fernández Flores and Aycart Luengo, 2013*).* In November 2010, the monographic conference "*Valencina Prehistórica"* was held, focusing on the research at Valencina de la Concepción-Castilleja de Guzmán archaeological site throughout time (García Sanjuán et al., 2013). Recent work (Costa Caramé et al., 2010) is based on a revision of all archaeological fieldwork carried out at this site, which will be explained in detail in the following section as it is used as a case study in this research.

At the same time that rescue archaeology was extensive, some research projects were also taking place: for example, the project "Estudio del habitat calcolítico en el pie de sierra del bajo valle del Guadalquivir", coordinated by Cruz-Auñon (Cruz Auñón et al., 1992), and the project "Análisis del proceso cultural operado en las sociedades agrarias de la campiña Sevillana entre el IV y el II milenios A.C.", coordinated by Cabrero García (1987, 1993) and Cabrero García et al., (1997). Furthermore, from 1999 to 2001, a project entitled "El paisaje de las Grandes Piedras. Proyecto de Documentación y Apoyo a la Consolidación y Puesta en Valor de Construcciones Megalíticas en Almadén de la Plata (Seville)" (García Sanjuán, 2000; García Sanjuán et al., 2004) was carried out, with the main objective of surveying some areas in the northern province of Seville, as well as the excavation of the prehistoric funerary complex of Palacio III.

The lowlands of the Lower Guadalquivir River are characterised by the absence of fortified structures during the Copper Age. Sites in Seville province include Acebuchal (Lazarich

González et al., 1995), Campo Real (Cruz-Auñón Briones and Jiménez, 1985), La Morita (Acosta Martínez et al, 1987), and El Negrón (Cruz-Auñón Briones et al., 1992). The only fortified settlement in this province is the archaeological site of Marinaleda (Caro Gómez et al., 2004) where ditches enclosures, and walls have been documented.

In the province of Cádiz are the sites Cantarranas (Perdigones et al, 1987; Ruiz Gil and Ruiz Mata, 1999) and Paraje de Monte Bajo (Lazarich González et al., 2010; Lazarich González et al., 2012), while in the province of Córdoba are the sites of Morales (Carrilero et al., 1982) and La Minilla (Ruiz Lara, 1986; 1990). Amarguillo II (Cabrero García, 1987, 1986) is an example of a large settlement with an area of more than 20 hectares; another large settlement, this one with a type of ditch enclosure, is Valencina-Castilleja, which is around 240 hectares in area (Vargas Jiménez, 2004a, 2004b).

Investigations at the Middle Guadiana Basin and La Pijotilla started during the 1970s and 1980s (Hurtado Pérez, 1991). During the 1980s, several excavations were carried out that were crucial in defining the chronology of Extremadura. For example, excavation took place at Araya (Enríquez Navascués, 1981-1982), as well as some archaeological surveys at Tierra de Barros (Rodríguez Díaz, 1986) and other sites around that area (Bueno Ramírez, 1987, 1988). During the 1990s, results from several systematic explorations of this area were published, including some work on Copper Age settlements (Enríquez Navascués, 1990; González et al., 1991). With respect to settlement patterns, this area is characterised by fortified settlements in elevated areas. In the Middle Guadiana Basin, are the sites of Palacio Quemado (Hurtado Pérez and Enríquez Navascués, 1991) and the ditched enclosure of San Blas (Hurtado Pérez, 2000, 2002, 2004a, 2004b), with the latter being around 30 hectares in area and located on a flat area by the Guadiana River's left bank. There are also cases of small non-fortified settlements located in flat areas with natural defenses, such as river banks. These sites range in size from 1 to 5 hectares and up to 20 hectares, examples being Los Cortinales (Gil-Mascarell and Rodríguez Díaz, 1987) and Araya (Enríquez Navascués, 1981-1982). Examples of large settlements with areas greater than 20 hectares in this region include El Lobo (Molina Lemos, 1980) and La Pijotilla (Hurtado Pérez, 1980). La Pijotilla will be described in detail further on in this chapter, as it is the main case study used in this research. The location of some of the sites mentioned before are shown in Figure 3.2.

The area of Huelva has been investigated since the late 1980s when the work of Carta Arqueológica of Picos de Aroche (Pérez Macías, 1987) took place. Some work focused on the population settlement of the area (Piñón Varela, 1986a, 1986b, 1987a, 1989) and the type of megalithic structures (Cabrero García 1985b, 1986). In 1991, the research project "Odiel" started, which was based on archaeological survey around the area of the Odiel River and coordinated by Nocete Calvo (2004). Recent work on a synthesis of the megaliths of the province of Huelva has been published by García Sanjuán and Linares Catela (2010). Settlements in high elevated areas include Cabezo de los Vientos (Piñón Varela, 1987b, 1987c) and Cabezo Juré (Nocete Calvo, 2004a, 2004b). However, there are other sites ranging in size from 1 to 5 hectares and up to 20 hectares where there is no fortification – for example the sites of Papauvas (Martín de la Cruz, 1985, 1986a, 1986b) and another recently excavated site called La Orden-El Seminario (Vera Rodríguez et al., 2010), with a somewhat unusual settlement location, as it is located very near to the coast.

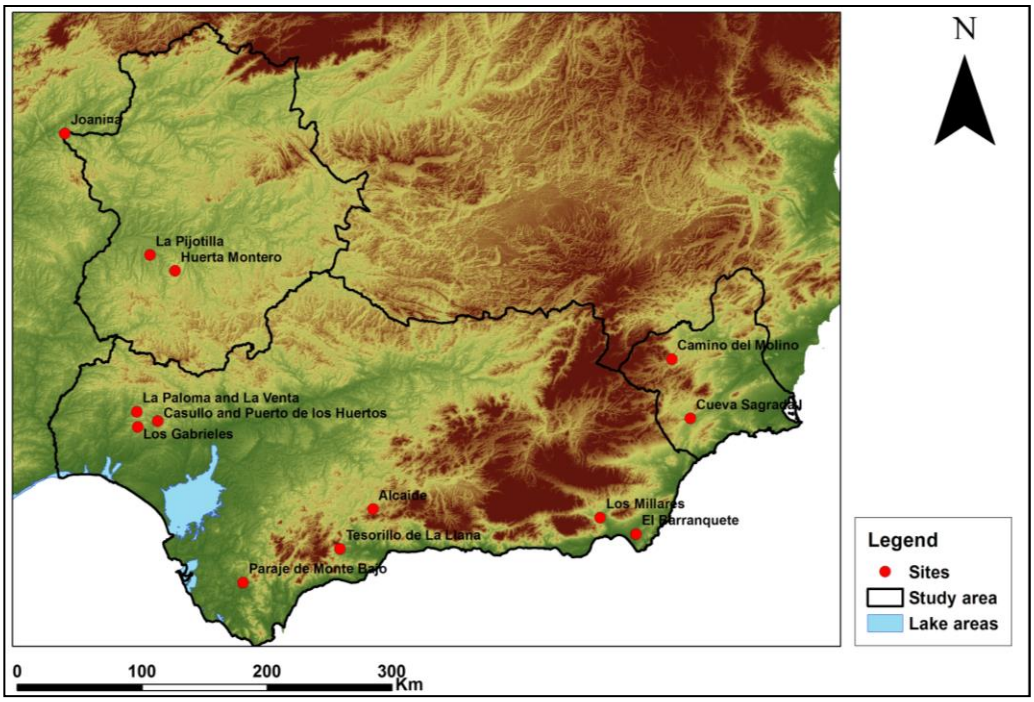


Figure 3.2. Map of the southern Iberian Peninsula with the main Copper Age sites (Figure from Díaz-Zorita Bonilla et al., 2012:52).

3.3.- Funerary patterns in south-west Spain

Based on a review of funerary structures from the Copper Age (Ferrer Palma, 1982; Cruz-Auñón Briones, 1983-1984; Cabrero García, 1985a; García Sanjuán, 1999; Lacalle Rodríguez, 2000; Hoskin, 2001), two main types of constructions used for burial are distinguished: pits, also known in the literature as artificial caves or hypogea (also see section 3.3.2.), and megaliths, as well as some burials documented in natural caves.

3.3.1- Megalithic structures

Megaliths include 1) chambered tombs, 2) passage graves and 3) *tholoi*. Chambered tombs (1) are constructed of large stones with a passage and a main chamber and are normally covered by flat capstones. The most representative examples are at Los Delgados 3 (Cabrero Garcia, 1988a) in Huelva province and at the Viera dolmen (Figure 3.3) (Ferrer Palma and Marqués Melero, 1993) in Antequera (Málaga), among others.

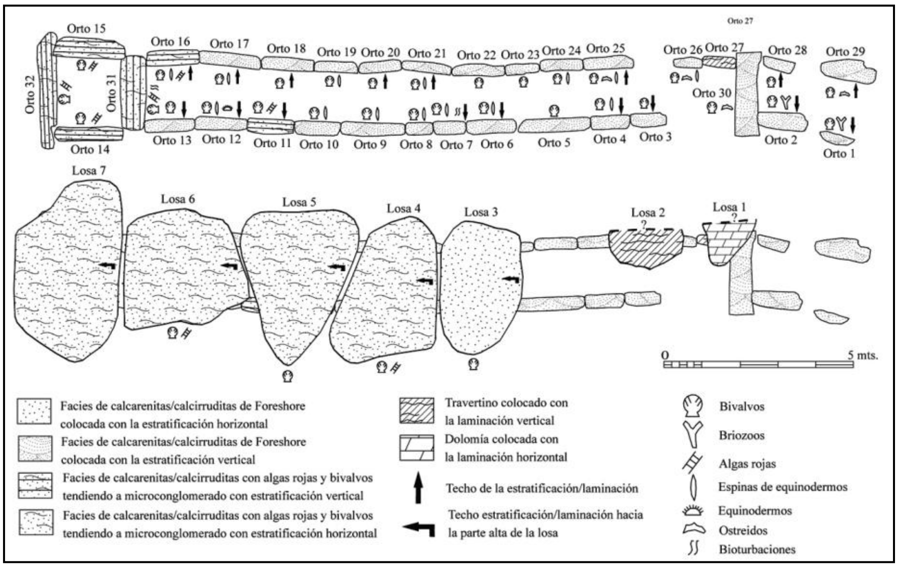


Figure 3.3. Plan view of the chambered tomb of Viera (after Carrión Méndez et al., 2010:66)

On the other hand, passage graves (type 2; Figure 3.4) are structures where the main chamber and the passage are the same; they are constructed of large stones and present a different morphology compared to chambered tombs (Cabrero García, 1988a). Typical examples can be found in the province of Huelva, such as structures 8, 9 and 10 from El Pozuelo (Cano and Vera, 1988), and also at Valdelinares (Romero Bomba, 2001), Los Gabrieles (Figure 3.3) (Cabrero García, 1978) and Soto 2 (Obermaier, 1924).

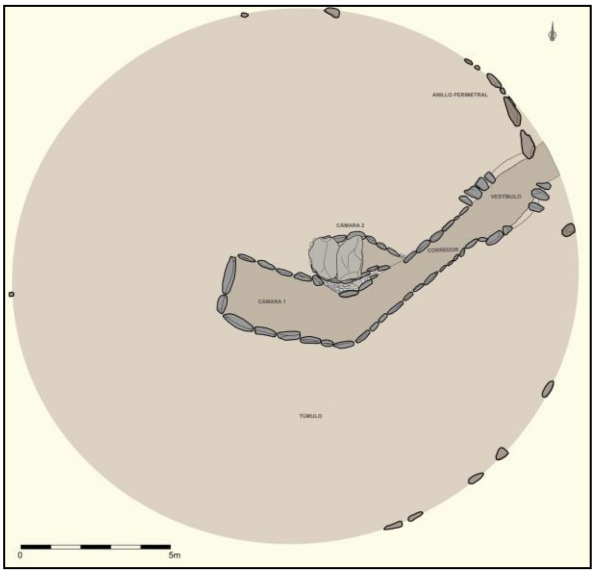


Figure 3.4. Plan view of passage grave Tomb 4 from Los Gabrieles (After Linares Catela, 2009:242).

The last structure type is the *tholos* (type 3; Figures 3.5 and 3.6). These structures begin to appear at the beginning of the 3rd millennium BC (García Sanjuán and Hurtado Pérez, 2001) and consist of a passage and main chamber; they are normally rounded, and covered by a corbelled roof and earth. Some authors, such as Soares and Tavares da Silva (1992), interpret this structure as a new architectural solution to the problem of requiring the involvement of many people for tomb construction, as it reduces the tomb size and does not necessitate a communal effort; single families could construct these tombs. They are usually covered by earthen tumuli. Recent work on the chronology of the *tholoi* structures found that they date to the 3rd millennium BC and were reused in later times (García Sanjuán et al., 2011). Examples of this type are found near the Lower Guadalquivir River and in the southern part of the province of Seville (Table 3.3).

SECTOR	SITE	PROVINCE	REFERENCE
Matarrubilla	Valencina-Castilleja	Seville	Obermaier, 1919; Collantes de Terán, 1969; Tubino, 1876.
Ontiveros	Valencina-Castilleja	Seville	Carriazo y Arroquia, 1962
La Pastora	Valencina-Castilleja	Seville	Tubino, 1876; Almagro Basch, 1962; Martín Espinosa and Ruiz Moreno, 1995
El Vaquero	Las Canteras	Seville	Hurtado Pérez and Amores Carredano,
Cañada	Las Canteras	Seville	Hurtado Pérez and Amores Carredano,
Cañada Real	Cañada Real	Seville	Cabrero et al., 2006
Tholos Palacio III	Palacio III	Seville	García Sanjuán and Wheatley, 2006
Los Delgados 2	Los Delgados	Córdoba	Cabrero García, 1988b
Tomb 1	La Pijotilla	Badajoz	Hurtado Pérez, 1991
Tomb 3	La Pijotilla		Hurtado Pérez, 1991
Huerta Montero	Huerta Montero	Badajoz	Blasco Rodríguez and Ortiz Alesón, 1992
Tesorillo de la Llaná	Tesorillo de la Llaná	Málaga	Márquez Romero et al., 2009

Table 3.3. List of prehistoric *tholoi* structures in southern Spain.

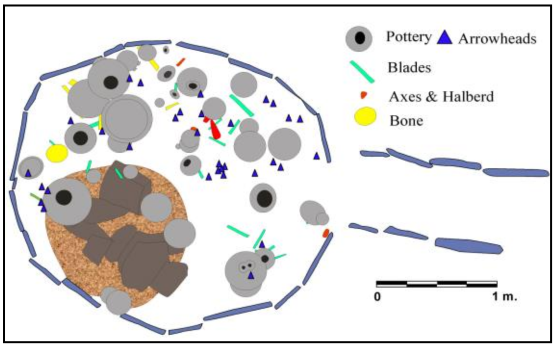


Figure 3.5 and 3.6. Plan view of the *tholos* Palacio III (left) (after García Sanjuán and Wheatley, 2006:481) and structure 10,034 from PP4-Montelirio, Valencina-Castilleja (after Peinado Cucarella, 2008).

Although natural caves were used as funerary "containers" during the Neolithic, in the Copper Age the pattern seems to change and there exist only two such sites in the south-west (García Sanjuán, 2009). These sites are Cueva de la Mora at Jabugo (Pérez Macías et al., 1990; Romero Bomba y Rivera Jiménez, 2004) and Cueva de la Mora de la Umbría at Aracena (Guijo Mauri, 1999), both of which are in Huelva. However, these two sites have been dated based on the associated material culture and we are still lacking radiocarbon dates.

3.3.2.- Non-megalithic structures

Apart from megalithic structures, other type of “structures” or “containers” for the dead exist that, for several reasons, are called “non-megalithic” to distinguish them from the other group. They were excavated in the bedrock, and have been interpreted and named “huts”, “silos”, “pits” and “shafts” in the literature. Several functional interpretations have been suggested for these structures, such as places to store produce, places for habitation, or places to discard waste. However, recent work by Márquez Romero (2001) offers another interpretation of these sites, suggesting that they had a more ritual aspect. Each of these interpretations taken on their own seems inappropriate, because the structures could have had different uses, or their use might have changed during their lifetime. However, more research is needed, as there is a lack of absolute dates and biochemical analyses for the sediments and material culture from these structures.

Returning to the funerary world, there are some examples of burials in these structures at archaeological sites such as La Pijotilla, Perdigoes, La Orden-Seminario and Valencina-Castilleja (Figure 3.7). The number of individuals buried at these structures is highly variable, but there are normally between 1-10 and up to 20 individuals buried per structure. For example, at the archaeological site of Valencina, two individuals were found at La Gallega (Martín Espinosa and Ruiz Moreno, 1992), while 19 individuals where found at El Algarrobillo (Santana Falcón, 1993), and two individuals were found at La Cima (Ruiz Moreno, 1991). Another site is also documented at Puebla del Río (Escacena Carrasco, 1992-1993), where one individual was buried. At the site of Puerto Palmera, two burials were also documented, each of them in a circular structure (pit 3 and pit 4) (Romero Bomba, 2005).

Figure 3.7. Negative structure 10,021 from PP4-Montelirio at the site of Valencina-Castilleja (photograph: José Peinado Cucarella).

Another type of structure with a totally different morphology is the ditch. These structures are also excavated out of the bedrock, they usually have a V- or U-shape, and their dimensions can vary (Figure 3.8). The function of these structures has also created great debate. Due to the numerous ditches found at sites such as Valencina-Castilleja, it has been variously argued that they might have been used to drain water, to defend the settlement, or to discard waste. In addition, human remains have also been found in these structures in Corte A at La Perrera (Fernández Gómez and Oliva Alonso, 1985) at Valencina-Castilleja, and some skulls have been found ditches at La Pijotilla and Marroquíes Bajos (Zafra de la Torre et al., 1999, 2003). At Perdigoes, human remains from two individuals were found in ditches 3 and 4 (Valera and Godinho, 2010), and they are also documented at San Blas (Hurtado Pérez, 2004a, 2004b) and Porto Torrao (Arnaud, 1982; 1984-1988; 1993; Valera and Filipe, 2004). According to Márquez Romero (2001), the human remains allude to the symbolic character of these structures as part of the monumental landscape. This hypothesis could be valid, as current evidence does not support the defensive functional interpretation of these structures, as has been proposed by several authors for the site of Valencina-Castilleja (Fernández Gómez and Oliva Alonso, 1985; Cruz Auñón Briones and Arteaga Matute, 1999a).

Figure 3.8. Ditch from Valencina-Castilleja (after Fernández Gómez, 2013).

3.3.3.- Mortuary practices

Mortuary practices during the Copper Age period in south-west Spain have not been investigated in detail, although some work has been done (Cámara Serrano, 2001). During the Chalcolithic period, the only common feature across south-west Spain is that burial practices are predominantly collective, with interments made simultaneously or at different time periods. Most of the burials are primary, such as at the PP4-Montelirio and Montelirio megaliths, both from the Valencina-Castilleja site (Peinado Cucarella, 2008; Fernández Flores and Aycart Luengo, 2013) and at tomb 3 at La Pijotilla (Hurtado et al., 2000), but there is also evidence of secondary burials at El Algarrobillo and at Depósito de Aguas in Valencina-Castilleja (Santan Falcón, 1993; López Flores, 2004).

Regarding depositional practices, there seems to be widespread evidence of cremation. Although the predominant ritual is inhumation, the burning of bodies is also documented as a type of funerary ritual in south-west Spain. This is most likely in the form of partial cremation, which could be interpreted as part of the funerary ritual in relation to the social status of the individual, or simply as a functional response to the lack of space inside megalithic tombs. Partial cremations are documented in other areas of the Iberian Peninsula during the Copper Age, for example at Central Meseta, eastern Spain (Rojo Guerra and Kunst, 2002) and Portugal (Weiss-Krejci, 2005b). In the south-west, there are also examples of partial cremations at Los Delgados (Fuenteobejuna, Córdoba) (Cabrero García, 1988b), Palacio III (Almadén de la Plata, Seville) (Díaz-Zorita Bonilla and Waterman*,* in press), La Pijotilla (Hurtado et al., 2000), at PP4-Montelirio in Valencina-Castilleja (Robles Carrasco, 2011) and at structure 3 at El Jadramil (Lazarich González, 2003:15).

For those sites where systematic bioarchaeological work has taken place during the excavation, body treatment and burial position was documented. In relation to burial position, the most common body positions were lying on the right or left side, with a few exceptions (supine burials). For most, the lower limbs were flexed.

The relationship of the location of burials to the funerary structures is also interesting. In this sense, there is variability in funerary patterns at these sites because not all burials took place inside the megalithic structures. There are some examples of individuals buried outside the funerary structure, in tumuli or just inside the entrance of the structure. This is the case for three individuals buried at the entrance of the tholos of la Cueva del Vaquero (two were possibly Neolithic - Lazarich González and Sánchez Andreu 2000:331) and another individual at Cañada Honda B; both sites are located at the megalithic necropolis of Gandul (Lazarich González and Sánchez Andréu, 2000). These sites could be explained from two different points of view. They could be burials that took place after the closure of the funerary structure. On the other hand, they could be considered as indications of social differentiation, as these individuals might have been considered to be of different social status or might not have been relatives of those buried inside the structure. Following García Sanjuán (2005), the reuse of these sites during the 2nd millennium BC indicates that these communities emphasised their connection with the land and its ancestors by means of the reuse of ancestral spaces.

For the remains that are buried inside the structures, which seems to be the common practice, it might be said that the location varies depending on the funerary structure type. For *tholoi* structures, the predominant ritual is deposition of the human remains in the main chamber of the structure, but human remains have also been documented in the passage or in adjacent chambers. At dolmen Soto 2, 18 to 20 individuals were buried against the walls of the structure and possibly in both sides chambers (Obermaier 1924: 27). Similarly, at Matarrubilla, two individuals were found in the passage (Obermaier, 1919: 54). At the PEX-1336 archaeological site of La Orden-Seminario, most of the individuals were found in the main chamber, but there are also individuals in the passage (Figure 3.9 and 3.10). The human remains from the Palacio III *tholos*, despite the poor degree of preservation, were placed along the walls of the chamber (García Sanjuán and Wheatley, in press).

Figure 3.9. and 3.10 Chamber of the structure PEX 1336 (left) and view from the entrance of the structure (right) from La Orden-Seminario during the excavation process (after López Flores, 2006).

Regarding ceremonial rites, the use of ochre or natural pigments is found at many sites. Ochre often appears on the bones of skeletons, on grave goods and on the walls of the funerary structure. There are many examples of the use of ochre in the south-west of the Iberian Peninsula, as, for example, in structures 3 and 7 at El Pozuelo, structures 2 and 4 at Los Gabrieles, at Martín Gil, Soto 1, La Zarcita 1, Matarrubilla and Ontiveros (Cabrero García, 1988a). It is also documented at La Pijotilla (Hurtado et al., 2000) and at PP4-Montelirio (Figure 3.11) (Peinado Cucarella, 2008; Robles Carrasco, 2011).

Figure 3.11. Burial 1, Structure 10,049. Detail of the ochre over pelves and ribs (photograph: José Peinado Cucarella).

Based on the mortuary analyses, most of the skeletons are associated with several grave goods which, in some cases, cannot be associated with only one individual and seem to be communal. When an individual is associated with his/her personal grave goods, they are typically quite homogeneous and composed of ceramics and lithics (Figure 3.12). In a few cases, but rarely, grave goods include metal, and in some cases, bone artefacts.

Figure 3.12. Association of grave goods and individuals. Structure 10,034 from PP4-Montelirio (Valencina-Castilleja) (photograph: José Peinado Cucarella).

Other artefacts, such as personal ornaments, as well as some exotic objects made of gold, ivory and amber, have been documented. Gold and amber have been found at Valencina-Castilleja, and at Caño Ronco (Cabrero García, 1985b), and ivory has been found at Matarrubilla (Obermaier, 1919) and at PP4-Montelirio (Figure 3.13 and 3.14) (Peinado Cucarella, 2008).


Figure 3.13 and 3.14. Ivory objects found at Structure 10,042-10,049 from PP4-Montelirio (Valencina-Castilleja) (photograph: José Peinado Cucarella).

There are also other types of artifacts found at these sites, such as idols with different morphologies. Faunal remains have also been documented (wild and domestic), mostly disarticulated and sometimes associated with human burials, and they have been interpreted in most cases as offerings. However, zooarchaeological remains are in need of detailed analysis as, thus far, there is a lack of such studies for most of the Copper Age period.

3.4.- General aspects on funerary practices during the 3rd millennium BC in south-west Spain

3.4.1.- Sites with human remains (MNI)

In the Lower and Middle Guadalquivir Basin, one of the first broad investigations of human remains took place during the 1980s. The first analysis was within the research project *"Amarguillo II (Los Molares, Seville). Análisis del proceso cultural operado en las sociedades agrarias de la campiña Sevillana entre el IV y el II milenios a.C. (Analysis of the agrarian societies cultural process between the 4th and 2nd millennia b.C),* coordinated by Dr. Rosario Cabrero García; here, investigations of human remains focused on four individuals buried at the settlement of Amarguillo. Only one was completely analysed, including trace element analysis (Cabrero García et al., 1997). Another site report incorporating analysis of human remains, and coordinated by the same author, was that of Los Delgados (Fuente Obejuna, Córdoba). The analysis was done by Alcázar Godoy (in Cabrero García, 1988a) and the human remains consisted of a partial cremation of a subadult inside a vessel.

In Seville province, the archaeological site with the highest number of excavated human remains is Valencina-Castilleja. From this settlement, there were 14 individuals buried in the tholos at the sector of Los Cabezuelos (Arteaga Matute and Cruz-Auñón Briones, 1999a), but there are only two short references to the analysis of the human remains, in the still unpublished site report (Guijo Mauri et al., 1995). There is also a brief report of an individual with a pathological condition (Guijo Mauri et al., 1996). However, for the site of Divina Pastora, a complete analysis of the 16 individuals found has been presented (Lacalle Rodríguez et al., 2000). Excavations at the archaeological site of El Roquetito in Seville province uncovered 48 individuals, (Murillo Díaz et al., 1990). In the current study, the human remains from La Alcazaba, El Algarrobillo, La Cima and La Gallega, which have been previously examined (Díaz-Zorita Bonilla, 2007), are re-analysed and included in the overall sample considered.

At the *tholos* structure found at Palacio III, in the northern area of Seville, eight individuals (MNI) were documented (Díaz-Zorita Bonilla, 2007; Díaz-Zorita Bonilla and Waterman, in press). At the site of Cerro del Arca (Puebla del Río), also located in the province of Seville, one individual is documented, having been buried in a circular structure. The analysis of the human remains was done by Hernández Morales (in Escacena Carrasco, 1992-1993. At La Molina (Lora de Estepa, Seville), 10 individuals were found in a negative structure (Lacalle Rodríguez and Guijo Mauri, 2010).

Some human remains have also been excavated in the province of Huelva. Excavations with published analysis of human remains include Cueva de la Mora (Jabugo) (Guijo Mauri et al., 1999) and Cueva de la Mora de la Umbría (Aracena) (Guijo Mauri, 1999). Recent excavations at El Seminario-La Orden (during the 2006 and 2007 field seasons) revealed a number of prehistoric structures with human remains. The analysis of the 12 individuals found at structure PEX 279 was done by López Flores (Vera Rodríguez et al., 2010), while nine individuals were documented at PEX 1336, buried in different structures (Vera

Rodriguez et al., 2010). There are also other structures, such as Soto 2, a megalithic structure non-preserved today, where 18-20 individuals were documented, while at Soto 1 only eight individuals were found (Obermaier, 1924; Cabrero García, 1988a), and the structure of Valdelinares with 10 individuals (Romero Bomba, 2001).

There are other funerary structures with more than 100 individuals, for example in the middle Guadiana Basin site of Huerta Montero (Blasco Rodríguez and Ortiz Alesón, 1991), and at La Pijotilla, with 178 individuals at Tomb 3 (see results in Chapter 4).

In the province of Cádiz is the necropolis of Cerro de la Casería (Alcalá del Valle), where two megalithic structures contained 11 individuals, analysed by Alcázar Godoy (Martínez Rodríguez et al., 1991; Martínez Rodríguez and Alcázar Godoy, 1992). The MNI for each site can be seen in Chapter 6 (section 5.1.1.2.) and the exact location of the sites can be seen in the map provided above (Figure 3.2).

3.4.2.- Taphonomic factors and skeletal remains in south-west Spain

For the 3rd millennium BC in south-west Iberia, the preservation of excavated human remains is highly variable. For this reason, an appreciation of taphonomic factors is fundamental in the final interpretation of skeletal remains. One of the main problems in studying human remains is their differential preservation, which is the result of disposal patterns and post-depositional changes. Taphonomic effects include those related to physical, chemical and biological factors that modify or affect the state of preservation of the body once death has occurred (Ubelaker, 1991, 1997; Haglund and Sorg, 2002). The analysis of those factors can help in understanding the post-depositional processes that have modified the archaeological record. Those extrinsic factors can be classified as environmental and natural or anthropogenic (Haglund and Sorg, 2002).

In most cases, based on personal observation, in south-west Spain around 75% of the skeleton is preserved but fragmentation of bones is very high. On the other hand, there are some skeletons where only the teeth are preserved. Taphonomic factors reduce the possibility of a full study of a skeletal collection, and can prevent the recording of sex, age, pathology and some measurements being taken or observation of non-metric traits.

3.4.2.i.- Extrinsic factors

These type of factors can be classified into environmental and natural factors, the flora and fauna, and human induced factors (Henderson, 1987). According to this author, they act in combination with intrinsic factors (defined as the specific characteristics and composition of the human skeleton, and the preservation based on the estimated sex, age and disease) (Roberts, 2009).

3.4.2.i.1.- Environmental and natural factors

The environmental factors are those factors involving no human intervention. It is difficult sometimes to distinguish between environmental and human-induced (anthropogenic) taphonomic processes because they can act at the same time, or sometimes the evidence left on the bone surface appears quite similar. Differential preservation is one of the most problematic issues when studying human remains. Remains can be in a good or poor state of preservation and the associated archaeological deposit may or may not be intact, but the quality of the bone and environmental factors must also be considered when analysing the state of preservation. The factors that influence the quality of bone include its inherent fragility, chemical composition and density (Behrensmeyer and Kidwell, 1985; Guy et al., 1997; Ubelaker, 1997).

The type of deposit and geographic location also affect preservation, resulting in various levels of destruction. Potentially destructive variables can include soil pH (acidic or alkaline), erosion (due to plant roots, for example) (Figure 3.15), climate (severe heat or cold, or strong wind, for example) and the effects of scavenging animals.

Figure 3.15. Erosion of the dental enamel (labial side on the left and lingual side on the right). PP4- Montelirio (Valencina-Castilleja, Seville, Spain) (photograph: Sonia Robles Carrasco).

One important factor to take into account is soil acidity. In fact, the preservation of the human remains will be strongly connected to oil pH where they are buried (Gordon and Buikstra, 1991). For instance, in places such as in the west of Andalusia, especially in Huelva and northern Seville province, the soil is very acidic and bone does not preserve well. The acidity does not necessarily destroy bone but it makes bone more fragile and subject to fragmentation. The effects of soil acidity, among other factors, are documented in specific studies of human remains in the area, including La Traviesa (Manuel Valdés et al., 1998), Palacio III (López Flores, 2005) and Valdegalaroza and Valdelinares (Romero Bomba, 2003). Those observations also were made at La Pijotilla, where, in some cases, bone fragments can be reduced to less than 2 cm in length.

Other natural factors also affect the preservation of the bone. The most common influencing factor is the climate; included here are the effects of seasonal changes in heat and humidity. The exposure to sun for long periods results in fragility and bleaching, and creates fractures in bones (Figure 3.16). In this specific case, there is a combination of factors are responsible. During the excavation process at this site (PP4 sector Montelirio, Valencina-Castilleja) the burials were revealed and exposed for long periods to ”the elements”. In addition, part of the site was also excavated by machinery, with the consequent damage to skeletons due to the pressure of heavy machinery and trucks; stratigraphy was also not very deep. All the impacts that can be observed in Figure 3.16:

Figure 3.16. Multiple taphonomic effects due to exposure to “the elements” and the excavation process (photograph: José Peninado Cucarella).

3.4.2.i.2.- Human induced factors

Another group of factors are those taphonomic processes where human action is implied, called anthropogenic factors. According to Lyman (1994), anthropogenic factors including modifications of skeletal remains made by humans, for example burning (Figure 3.17)has been recorded in the south-west of Spain. This type of evidence has been found as partial cremation, documented at PP4-Montelirio and La Perrera sectors (Valencina-Castilleja) but also as completely cremated remains as at La Pijotilla (Figure 3.18), Palacio III and El Dorado, although the reasons for burning human remains is still unclear.

One of the major factors affecting human skeletal collections from the 3rd millennium BC in south-west Iberia is damage caused by looters. This is the case at Cueva de la Mora, Valencina-Castilleja, La Pijotilla and Cerro del Arca.

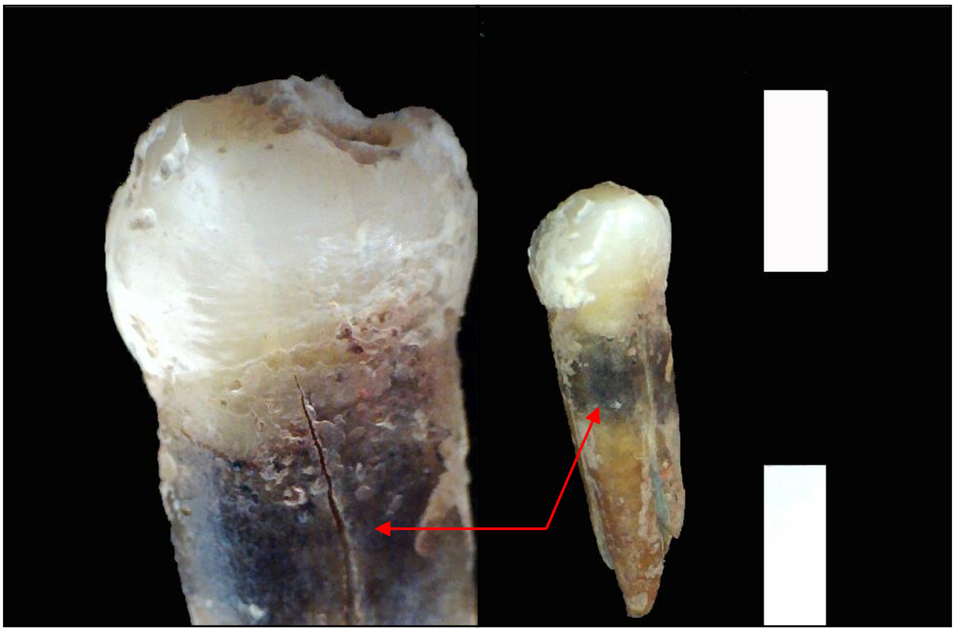


Figure 3.17 Example of the effect of burning on teeth (photograph: Sonia Robles Carrasco) (Scale is in cm).

Figure 3.18. Cremated remains found at Tomb 3 from La Pijotilla. (Scale is in cm).

Archaeological excavation is another taphonomic process that can produce much damage to human remains. This is especially the case when it is still unknown whether human skeletal remains are in situ in context or when the location or extent of burial grounds are not known. Even digging test pits can cause damage to archaeological materials, if the placement or size of the pits is such that they cut through a burial. Postmortem fragmentation of bone can also be produced during excavation by machines or hand-digging tools, such as trowels (Figure 3.19 and Figure 3.20).

Figure 3.19 and Figure 3.20. Fragmentation and damage during the excavation process. (Left photograph: José Peinado Cucarella). (Scale is in cm).

However, there are other extrinsic factors to consider, such as the amount of experience of the team excavating the human remains. The presence on site of a professional bioarchaeologist as part of the excavation team would resolve most of the excavation-related taphonomic factors and would allow relevant data to be collected from the human remains. If there is not a bioarchaeologist on site and the team is not familiar with the anatomy of a human skeleton, they may fail to record aspects related to the funerary ritual of the burial, such as the position and orientation of the skeleton. It is important to also note that inexperienced excavators might adversely affect the recovery of specific groups or types of burial, such as subadults, secondary burials or comingled deposits such as in ossuaries; pathological bones may also not be observed. One of the key challenges in bioarchaeological studies is recognising and understanding the often low numbers of subadults. This might be understood as representing very low infant mortality, or indicate that subadults were buried in a different place, separate also from adult burials, or that subadults were not excavated fully or properly – the small bones of subadults can be easily missed during excavation (Meindl et al., 1983, Buikstra and Konigsberg, 1985). Failure to use sieves, for example, means that subadult bones or small adult elements, like foot phalanges and teeth, may not be recovered, along with microfaunal remains, such as rodent or fish remains. All these factors may be relevant, but the problem remains that subadults are underrepresented in recent prehistory in south-west Spain.

Undoubtedly, key post-depositional factors and their effect on preservation of skeletal remains are related to excavation, processing, transport and storage of the remains. For most Spanish prehistoric sites, excavation occurred many years ago without the guidance of a bioarchaeologist, and the human remains were then curated in storage areas in museums, with poor temperature or humidity control and with poor storage conditions overall, with the added problem of the presence of insects or rodents affecting their integrity. In some cases human remains are not totally dry when stored, with paper labels inside bags and mixed with sediment, small grave goods and faunal remains (Figure 3.21). In other cases the bone covered with pigment, such as cinnabar, are not separated from the preserved properly (Figure 3.22).

Figure 3.21 and 3.22 Incorrect storage of human fragments with mixed remains (left) including pigments without any protection (right).

Finally, the skulls and other bone elements may be curated without sediment, wrapped and then placed together in a cardboard box, one on top of another (Figure 3.23 and 3.24). In these cases, these “packages” are heavy. In addition, the outer identification tag of the remains may be incorrect, and frequently unclear due to incorrect temperature or humidity in the museum storage areas.

Figure 3.23 and 3.24. Incorrect storage of boxes (left) and packaging (right) of human remains

One of the aspects that is particularly important when studying human remains is the representativeness of the sample (Wood et al., 1992). In the reconstruction of past populations, bioarchaeologists must examine whether the expected number of individuals in each age group is observed; in particular, whether the proportion of subadults and old adults is representative of deaths in the once-living population. This is of vital importance, as subsequent interpretation, be it regarding health or population growth, are based on the demographic profile.

3.5.- The sites

With regard to the overall hypothesis, the aims and objectives and research questions, it was necessary to analyse human remains from two key sites dated at the 3rd millennium BC (La Pijotilla and Valencina-Castilleja). These two sites were been selected specifically because they represent two of the largest settlements in the south-west of Spain, both were contemporary in time (with secure radiocarbon analyses) and also had a large number of human bone remains necessary to carry out intra- and inter-site comparisons. Inter-site comparisons included inland and coastal sites. The main site was La Pijotilla, which is located inland near the Middle Guadiana Basin and comprises the human remains from the *tholos* structure referred to as Tomb 3. The second site used for comparative analysis was Valencina-Castilleja, a coastal site in antiquity, located in Western Sierra Morena, which includes human remains from 6 different sectors of the site (El Algarrobillo, La Alcazaba, La Cima, La Gallega, Cerro de la Cabeza and PP4-Montelirio). A third site, La Orden-El Seminario, located by the coast in the province of Huelva, was solely used for comparative purposes for its paleodietary data ($\delta^{13}C$ and $\delta^{15}N$). This site was previously analysed by López Flores (2006, 2007, and 2010). The location of the sites is shown in Figure 1.1.

3.5.1.- La Pijotilla

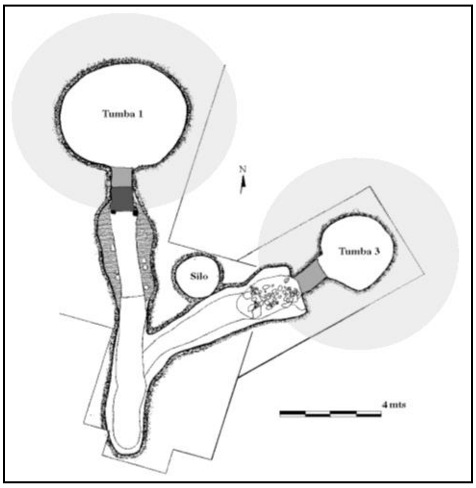
The archaeological site of La Pijotilla is located in the Middle Guadiana Basin in Solana de los Barros, Badajoz, Spain. The region is known as Tierra de Barros and it is located on the left bank of the Guadiana River, on highly agriculturally productive land delimited on the north by the Guadiana River and the south by the Sierra Morena mountain range.

This site represents one of the largest 3rd millennium BC settlements in the Iberian Peninsula with an area of approximately 80 hectares (Hurtado Pérez, 1986). For the past 30 years, archaeological research, including excavation, surface and geophysical survey, and aerial photograpy, has been carried out there. The first work began in 1976 (Hurtado Pérez and Amores Carredano, 1982) with subsequent field seasons from 1979 to 1985 (Hurtado Pérez 1999, 2000) and continuing in 1990 (Hurtado Pérez, 1990, 1991, 1995, 1997 and 2000; Hurtado Pérez and Mondéjar de Quincoces, 2009; Hurtado Pérez, 2003, 2010). In the following years, many other investigations of material culture have been executed. For example, the ceramics have been studied in detail (Hurtado Pérez and Amores Carredano, 1985; Estrada et al., 1999; Gómez Morón, 1999; Khoring et al., 2007; Odriozola Lloret and Hurtado Pérez 2007a, 2007b; Odriozola Lloret et al., 2008), including archaeometric analyses of Bell-Beaker pottery with bone-impressed decoration (Odriozola Lloret and Hurtado Pérez, 2007a, 2007b, Odriozola Lloret et al., 2008, Polvorinos del Río 2002a, 2002b), and morphometric analyses of ceramics (Polvorinos del Río et al., 1999). In addition, recent research includes a study of the faunal remains from Tomb 3 (Bernáldez and Bernáldez, 2002), and some work on figurines found at the site (Hurtado Pérez, 2010, 2013).

La Pijotilla consists of a funerary complex, including *tholoi*, circular structures, pits and a 1km diameter surrounding ditch (Hurtado Pérez, 1986). Within the complex, the necropolis area consists of three tombs: Tomb 1 (MNI= 100), Tomb 2 (MNI = 30) (Hurtado et al, 2000) and Tomb 3 (MNI=178[19]) (Figures 3.25, 3.26, 3.27 and 3.28). La Pijotilla represents a key site for understanding the Late prehistory in this region. Therefore, Tomb 3 was chosen for this research to investigate the social organisation of this Copper Age site using one of the largest and available unstudied collections of human remains in combination with the funerary contextual data. The human remains from Tomb 3 were commingled and highly fragmented, although partial articulation was documented. This site represents an inland site and it was suitable to make inter-site comparisons for paleodietary analysis ($\delta^{13}C$ and $\delta^{15}N$) with other two coastal sites (Valencina-Castilleja and La Orden-El Seminario). This is

[19] This MNI was calculated in this study

also an interesting site to examine the impact of human mobility during the Copper Age in south-west Spain through the analysis of the ratio of strontium ($^{87}Sr/^{86}Sr$), because of the presence of exotic grave goods. This has been also documented at Valencina-Castilleja and inter-site comparisons are also made.



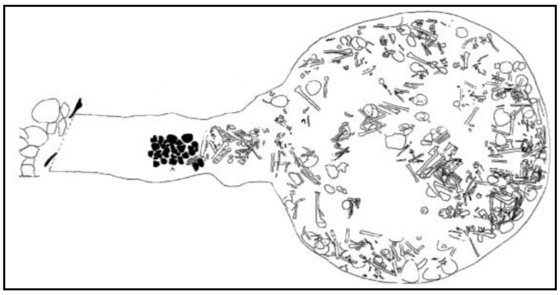


Figure 3.25 and 3.26. Plan view of Tombs 1 and 3 (left) and plan view of Tomb 3 during excavation (right) (after Hurtado et al., 2000:250).

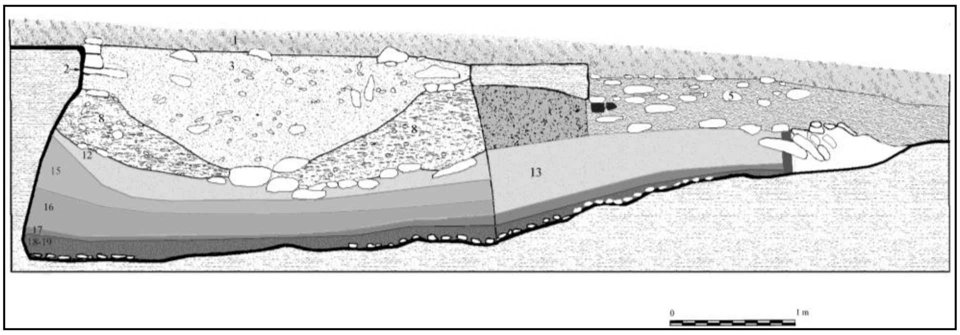


Figure 3.27. Section of Tomb 3 showing stratigraphic units (after Hurtado et al., 2000:253)

Figure 3.28. Excavation in process at Tomb 3 with a partially-articulated skeleton (photograph: Víctor Hurtado Pérez)

The construction of Tombs 1 and 3 correspond to different construction periods in the 3rd and 2nd millennium BC, respectively, or the Chalcolithic period. The absolute dates for the site are as follows (Table 3.4) and they have been calculated (to 1 σ) according to Stuiver and Reimer (1993) and Reimer et al., (2004).

SITE	REGION	BP	BC (1 σ)	LAB ID	CONTEXT	REFERENCE
La Pijotilla	Badajoz	4360±50	3077-2909	Beta-121146	E4. Organic material. At the base of the structure.	Hurtado Pérez, 1999; Odriozola Lloret et al., 2008
		4168 ±55	2870-2676	CNA-034	T3. Charcoal (UE 18)	Odriozola Lloret et al., 2008
		4130±40	2861-2625	Beta-121143	T3. Human bone (UE 15/16)	Hurtado Pérez, 1999; Odriozola Lloret et al., 2008
		4110±40	2854-2582	Beta-121147	E4. Organic material. Intermediate	
		4010±80	2836-2367	Beta-121145	E4. Organic material. Last use of the structure.	
		3860±80	2459-2212	BM-1603	E4. Re-use of the structure.	

Table 3.4 Radiocarbon dates for La Pijotilla.

As noted above, La Pijotilla is surrounded by a ditch with a diameter of 1 km; the whole site has a perimeter of 3 km with the stream called “La Pijotilla” crossing the entire site from north to south. In the western area, inside the outer ditch, there appears a semicircular line (Figure 3.30). Excavations of the eastern part of the site have revealed that the ditch’s dimensions are 4 m in width and 1 m in depth. Next to the ditch, on the inner edge, a curved wall with a length of 14 m was documented. Further north, two parallel walls were located and interpreted as a gate, but without an architectural connection between them. It is clear that both walls were built after the ditch was filled.

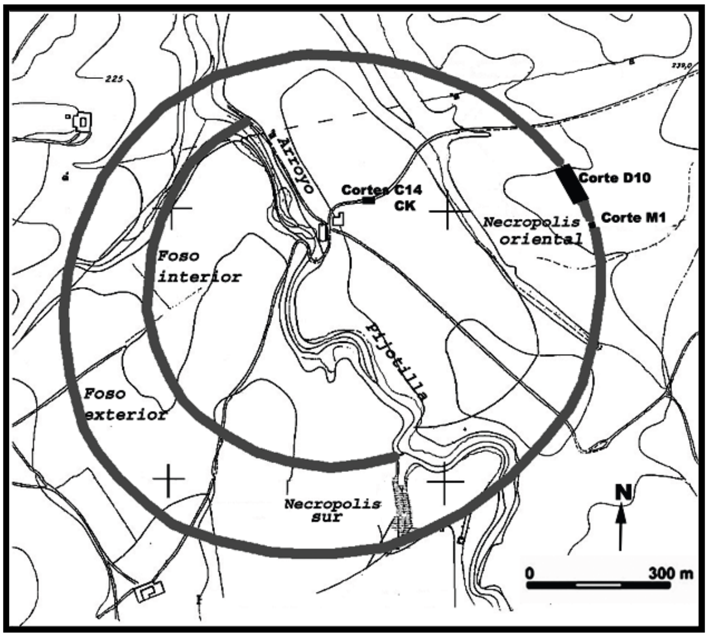


Figure 3.29. Plan view of the settlement of La Pijotilla with the ditch location (after Hurtado Pérez, 2010:113).

In the eastern sector pits, tombs and huts were documented. In addition to a dog skeleton surrounded by stones (Hurtado Pérez 1991:54), human burials have also been documented in pits without associated grave goods. In the southern sector, larger pits were documented with collective burials. In the centre of the site, some huts next to pits were found; this area is interpreted as the settlement area of the site. Inner ditches associated with pits were also documented and several skulls were found. These ditches, dated to the first occupation phase of the settlement, were later filled in, and huts were subsequently built on top of them.

In the western sector, several larger pits (3 m in length x 3 m in depth) were documented and in one of them were remains from a large bovid dated to the 3rd millennium BC, the oldest date at the site, which could be related to a founding ritual (Hurtado Pérez 2003:246). The total area of La Pijotilla is approximately 70 hectares, of which 40 hectares represents the habitation area. The necropolis is located on the southeast of the site.

Relative to the entire distribution of settlements at Tierra de Barros (Badajoz, Extremadura) , and according to Hurtado Pérez and Odriozola Lloret (2009), La Pijotilla is located in a central area and surrounded by other contemporary minor (1-3 hectares) fortified settlements. These fortified sites were aligned north-south on the east side and were all located in high altitude areas and their location was intentional (Hurtado Pérez and Odriozola Lloret, 2009: 270). In summary, this politically organization at Tierra de Barros where there were fortified and non-fortified settlements distributed around the central area of La Pijotilla (Figure 3.30) suggest that it was the economic and religious centre of the region.

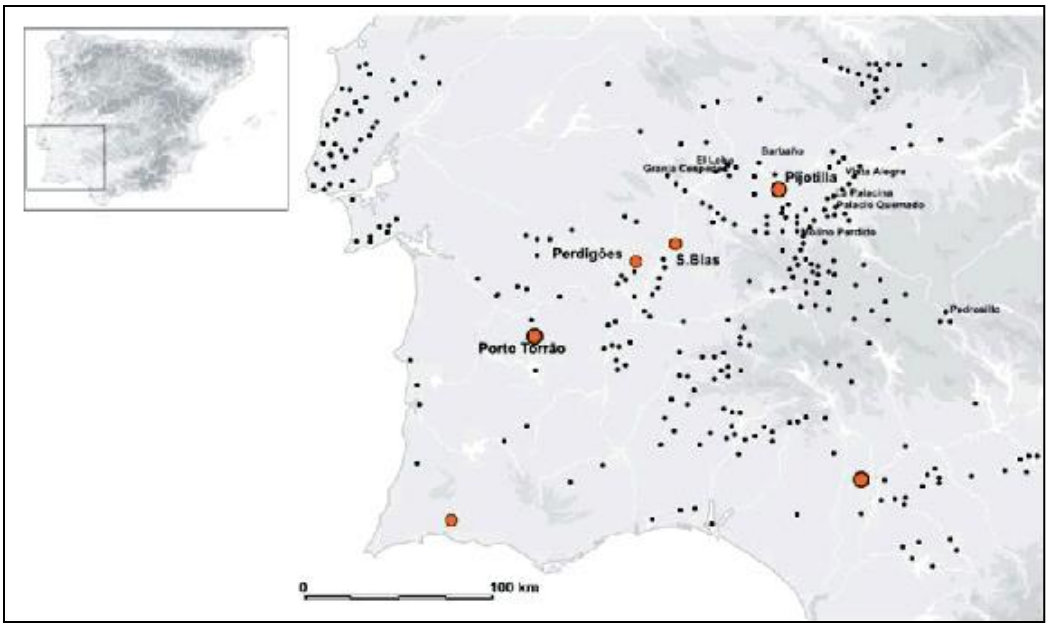


Figure 3.30. Organisation of the territory in the south-west Iberian Peninsula including the Middle Guadiana Basin (after Odrizola Lloret et al., 2007:212)

The Middle Guadiana Basin, and mainly La Pijotilla, has produced the majority of the anthropomorphic Chalcolithic figurines (or idols) currently known from the Iberian Peninsula (Enríquez Navascués, 2000), and this collection has been studied in detail

(Hurtado Pérez, 1980, 1981, 2008, 2013; Hurtado Pérez and Perdigones, 1984). According to the study different communities in the area showed signs of territorial identity based on the typology of the figurines produced at each of the sites (Hurtado Pérez and Odriozola Lloret, 2009).

3.5.2.- Valencina-Castilleja

The archaeological site of Valencina-Castilleja is located 8 km from Seville in the Aljarafe plateau (Figure 3.25). Its exact location is within the two municipal councils of Valencina de la Concepción and Castilleja de Guzmán (Seville, Spain). The settlement is located 160 metres above sea level and its geomorphology is composed of tertiary sediments from the the Lower Pliocene (Vargas Jiménez, 2004a). During prehistory, Valencina-Castilleja was located beside the ancient marine gulf created the Guadalquivir River, which was known and described in ancient texts as the *sinus Tartesii.*

Valencina-Castilleja represents one of the largest prehistoric sites from Iberian Late Prehistory and possibly one of the largest in Europe. The site has been known since the 19th century, due to the discovery of large megalithic structures such as La Pastora, Matarrubilla and Ontiveros. Since then, many different authors have been working in this area, but the majority of archaeological excavations were done in the late 20th and early 21st century, especially after 1980 (Figure 3.31). Most of these excavations are the result of rescue archaeology due to extensive urban development; only a few have been carried out as research projects. Unfortunately, this has had a negative impact on the quality and quantity of the data, in particular data on the human remains, but some of the human remains recovered were used for this research.

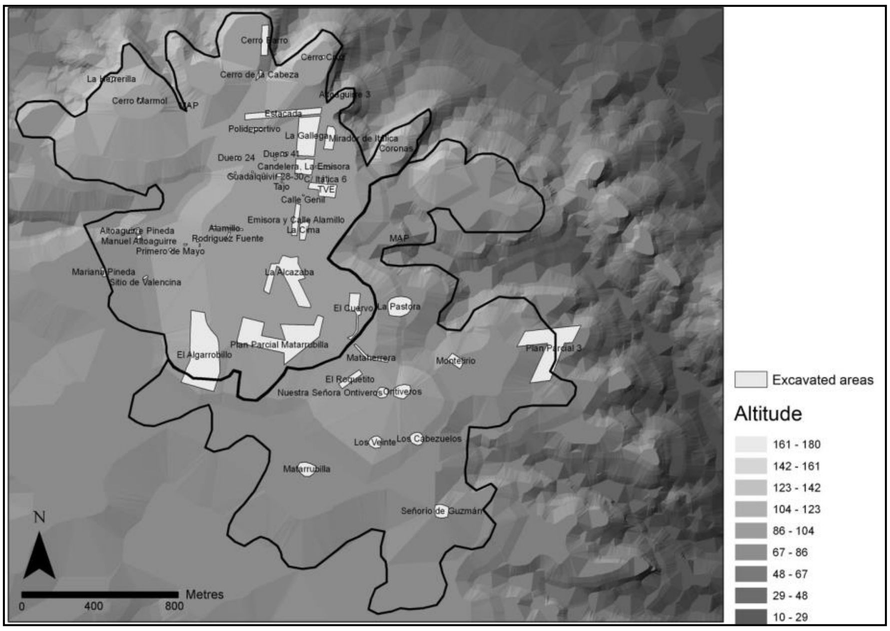


Figure 3.31. Excavated areas at Valencina-Castilleja (after Costa et al, 2010:94)

The first reference to Valencina-Castilleja was made in the second half of the 19th century with the discovery of "*Cueva de la Pastora"* (La Pastora megalith) by Francisco Tubino (1860). During the first half of the 20th century, special attention was paid to large megalithic structures such as La Pastora, Matarrubilla or Ontiveros. The first publication was by Hugo Obermaier in 1919 on Matarrubilla, and the following references about the site come from the second half of the 20th century (Table 3.5):

SECTOR	TYPE	REFERENCE
Ontiveros	M	Carriazo y Arroquia, 1962
La Pastora	M	Almagro Basch, 1962; Martín Espinosa and Ruiz Moreno, 1995
Matarrubilla	M	Collantes de Terán, 1969
Tholos Cerro de la Cabeza	M	Fernández Gómez and Ruiz Mata, 1978; Fernández Gómez and Oliva Alonso, 1986; Fernando Fernández, 2013
El Roquetito	M	Murillo Díaz et al, 1990
Castilleja de Guzmán dolmen	M	Santana Falcón, 1991
La Pastora dolmen	M	Ruiz Moreno and Martín Espinosa, 1995; Martín Espinosa and Ruiz Moreno, 1995
Caño Ronco	M	Cabrero García, 1985a
Los Cabezuelos	M	Arteaga Matute and Cruz-Auñón Briones, 1999a
Divina Pastora	M	Arteaga Matute and Cruz-Auñón Briones, 2001

SECTOR	TYPE	REFERENCE
Montelirio´s dolmen	M	Fernández Flores and Aycart Luengo, 2013
La Perrera	NM	Fernández Gómez and Oliva Alonso, 1985; Blanco Ruiz, 1991
Polideportivo	NM	Murillo Díaz et al., 1987
La Gallega	NM	Martín Espinosa and Ruiz Moreno, 1992
La Emisora	NM	Murillo Díaz, 1991
El Algarrobillo	NM	Santana Falcón, 1993
La Estacada Larga	NM	Cruz-Auñón Briones and Arteaga Matute, 1999b
Calle Alamillo	NM	López Aldana et al., 2001
El Cuervo-RTVA	NM	Arteaga Matute and Cruz-Auñón Briones, 1999b
Mirador Itálica	NM	Ruiz Moreno, 1999
La Alcazaba	NM	Cruz-Auñón and Arteaga Matute, 1999b
PP3	NM	Vera Fernández et al., 2002
Smelting quarter	NM	Nocete Calvo et al., 2008
PP4-Montelirio	M/NM	Peinado Cucarella, 2008; Mora Molina et al., 2013
Pabellón Cubierto	NM	Ortega Gordillo, 2013
La Huera	NM	Méndez Izquierdo, 2013
Avenida de Andalucía	NM	Sardá Piñero, 2013
Calle Dinamarca	NM	Pajuelo Pando and López Aldana, 2013a
Calle Trabajadores	NM	López Aldana and Pajuelo Pando, 2013

Key to table: M=megalithic; NM= non megalithic.

Table 3.5. Reports of archaeological excavations carried out at Valencina-Castilleja

Some studies of funerary practices have been carried out at the site (Guijo Mauri and Lacalle Rodríguez, 2013; Mejías García, 2011; Cruz-Auñón and Mejías García, 2013; García Sanjuán and Díaz-Zorita Bonilla, 2013). Human remains have been found during many excavations (Table 3.6) throughout the site, according to Vargas Jiménez (2004b) and sectors where bones have been excavated can be seen in Figure 3.32. However, the study of human remains from this site is very rare. Because of this, the data obviously has many limitations and might not be accurate at all, but at least the MNI from each of the sectors is the starting point for future bioarchaeological analyses.

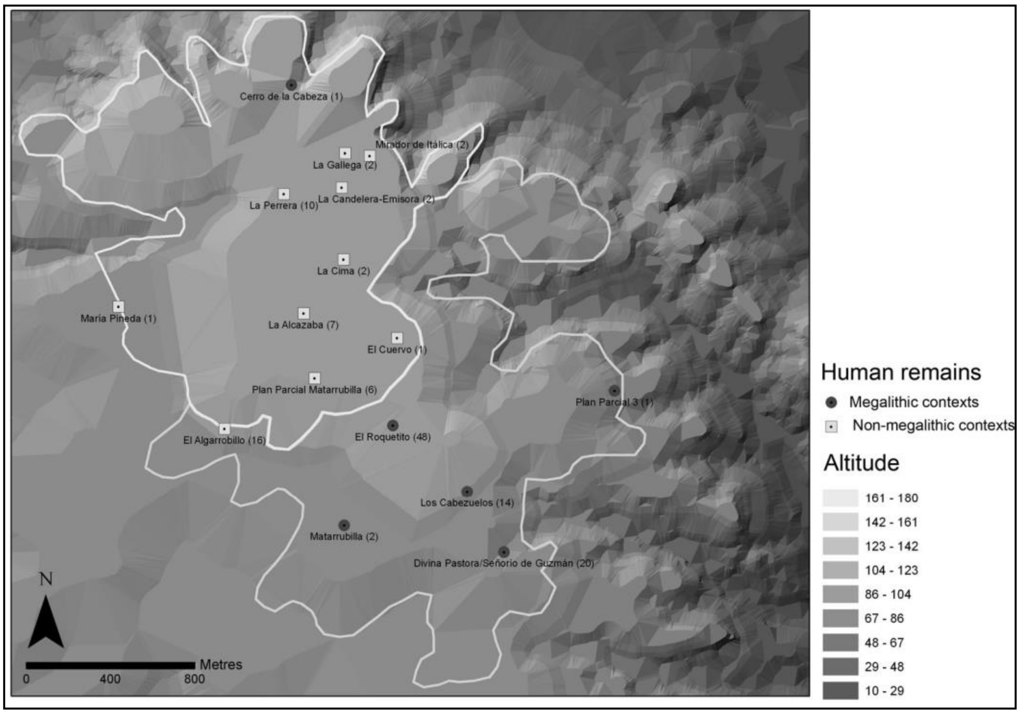


Figure 3.32. Sectors where human remains have been documented at Valencina-Castilleja (after Costa Caramé et al., 2010:95).

SECTOR	REFERENCE
Corte C La Perrera	Basabe and Benassar, 1982
Los Cabezuelos	Arteaga Matute and Cruz-Auñón Briones, 1999a; Guijo Mauri et al., 1995; 1996
Divina Pastora	Lacalle Rodríguez, 2000
La Cima, La Gallega and corte C La Perrera	Alcázar Godoy et al, 1992
El Algarrobillo, La Cima, La Alcazaba and La Gallega	Díaz-Zorita Bonilla, 2007; Díaz-Zorita Bonilla, 2013
PP4-Montelirio	Robles Carrasco, 2011; Robles Carrasco and Díaz-Zorita Bonilla, 2013

Table 3.6. Sectors at Valencina-Castilleja where human remains have been analysed

There have been many other studies at this site, such as historiographic investigations (Murillo Díaz, 2001; Gómez de Terreros Guardiola 2005, 2008; Ruiz Moreno, 2013), analyses of the faunal remains (Hain, 1982; Pajuelo Pando and López Aldana, 2013b; Bernáldez et al., 2013), analysis of the ceramics (Ruiz Mata 1975a, 1975b; González Vilchez et al., 1999), studies of lithics (Ramos Muñoz 1992; Murillo Díaz 1997, 1998, 1999, 2000, 2013; Sánchez Liranzo and Fernández Vera, 2000), studies of the deposit of metal found outside of La Pastora (Almagro Basch 1962; Montero Ruiz and Teneishvili 1996; Mederos Martín 2000), analysis of the metal artefacts (Costa Caramé, 2013), studies of the votive objects, such as idols (Hurtado Pérez, 2013; Fernández Gómez and Oliva Alonso 1980; Martín Espinosa and Ruiz Moreno 1996), analyses of the exotic materials, including ivory (Schuhmacher et al., 2013) and amber (Murillo Barroso and García Sanjuán, 2013), spatial analysis and geophysical survey (Costa Caramé et al., 2010; Wheatley et al., 2012), and geomorphological and paleoenvironmental studies (Llergo López et al., 2013; Cáceres Puro et al., 2013; Borja Barrera, 2013). The archaeological management of the site has also produced several papers (Querol Fernández, 2013; Vargas Jiménez, 2004a, 2004b, 2013; Ruiz Moreno, 1996; Artillo Pabón et al., 2013).

There are few radiocarbon dates from this site, which is surprising considering the enormous amount of archaeological excavation that has been carried out. However, the settlement is mostly dated to the 3rd millennium BC but there are a few dates dating to the 2nd millennium; the radiocarbon dates for Valencina-Castilleja are shown in Table 3.7.

SITE	BP	BC (1σ)	LAB ID	CONTEXT	REFERENCE
Valencina (SQ)	4295 ± 55	2919-2892	Ua36025	Charcoal	Nocete Calvo et al., 2011
Valencina (SQ)	4235 ± 35	2883-2874	Ua36022	Animal bone *(Ovis aries/ Capra hircus)*	Nocete Calvo et al., 2011
Valencina (PP4-M)	4160 ± 35	2880-2629	CNA1291	Human bone	Unpublished
Valencina (SQ)	4150 ± 50	2862-2628	Ua19475	Charcoal	Nocete Calvo et al., 2008
Valencina (SQ)	4150 ± 50	2872-2638	Ua-19475	Charcoal	Nocete Calvo et al., 2008
Valencima (Algarrobillo)	4130 ± 30	2871-2581	CNA1272	Human bone	Unpublished
Valencina (SQ)	4120 ± 40	2859-2620	Ua-32885	Charcoal	Nocete Calvo et al., 2008
Valencina (SQ)	4135 ± 45	2864-2627	Ua-24557	Charcoal	Nocete Calvo et al., 2008
Valencina (SQ)	4135 ± 45	2856-2622	Ua24557	Charcoal	Nocete Calvo et al., 2088
Valencina (SQ)	4120 ± 40	2853-2613	Ua32885	Charcoal	Nocete Calvo et al., 2008
Valencina	4050 ± 105	2870-2470	I-10187	Charcoal	Castro Martínez et al., 1996
Valencina (PP4-M)	4095 ± 25	2858-2503	CNA1300	Human bone	Unpublished
Valencina (SQ)	4105 ± 40	2850-2577	Ua36028	Animal bone *(Ovis aries/Capra hircus)*	Nocete Calvo et al., 2011
Valencina (SQ)	4105 ± 40	2850-2577	Ua32042	Charcoal	Nocete Calvo et al., 2011
Valencina (SQ)	4180 ± 35	2796-2691	Ua36029	Charcoal	Nocete Calvo et al., 2011
Valencina (SQ)	4215 ± 40	2790-2757	Ua32886	Charcoal	Nocete Calvo et al., 2011
Valencina (SQ)	4050 ± 45	2619-2493	Ua22813	Charcoal	Nocete Calvo et al., 2008
Valencina (SQ)	4045 ± 50	2619-2487	Ua19474	Charcoal	Nocete Calvo et al., 2008
Valencina (SQ)	4030 ± 50	2613-2484	Ua36027	Animal bone (Ovis aries/Capra hircus)	Nocete Calvo et al., 2011
Valencina (SQ)	4040 ± 35	2610-2493	Ua36030	Animal bone *(Ovis aries/Capra hircus)*	Nocete Calvo et al., 2011
Valencina	3910 ± 110	2580-2200	GIF-4028	Charcoal	Castro Martínez et al.,1996
Valencina (SQ)	3995 ± 75	2574-2466	Ua24558	Charcoal	Nocete Calvo et al., 2008
Valencina	3950 ± 25	2566-2347	CNA1273	Human bone	Unpublished
Valencina (SQ)	4010 ± 35	2556-2484	Ua36031	Animal bone *(Ovis aries/Capra hircus)*	Nocete Calvo et al., 2011
Valencina (SQ)	3985 ± 30	2550-2484	Ua36024	Animal bone *(Ovis aries/Capra hircus)*	Nocete Calvo et al., 2011
Valencina (SQ)	3965 ± 35	2550-2487	Ua36026	Animal bone *(Ovis aries/Capra hircus)*	Nocete Calvo et al., 2011
Valencina (Gallega)	3905 ± 35	2484-2236	CNA1264	Human bone	Unpublished
Valencina (SQ)	3660 ± 55	2133-1947	Ua36023	Animal bone *(Ovis aries/Capra hircus)*	Nocete Calvo et al., 2011
Valencina (SQ)	3620 ± 55	2112-1920	Ua-32043	Charcoal	Nocete Calvo et al., 2008
Valencina	3380 ± 150	1880-1520	UGRA-72	Charcoal	Castro Martínez et al., 1996

Key to table: SQ= Smelting quarter, PP4-M= PP4-Montelirio.
The dates have been calibrated with the software Calib 501 using the Int. Cal 09 curve.

Table 3.7. Radiocarbon dates from Valencina-Castilleja

There have been many interpretations of the dynamics of the prehistoric settlement and there are a few authors who have interpreted the site based on its function. Some authors, such as Martín de la Cruz and Miranda Ariz (1988), Rodríguez Hidalgo (1991), Santana Falcón (1993), Ruiz Moreno (1996), IAPH (2000) and Arteaga Matute and Cruz-Auñón Briones (1999b) explain the different areas of the archaeological site as separate areas for burial and habitation. In 2004, the "*Carta Arqueológica"* (Archaeological Inventory) was a very useful tool for the management of the site based on an exhaustive inventory of all the excavations done there (Vargas Jiménez, 2004a). This work has reinterpreted the site as having a funerary area comprised an exclusive necropolis of around 223.20 hectares, and a residential and production area of 235.60 hectares. Thus, Valencina-Castilleja has a total area of approximately 468.80 hectares (Vargas Jiménez, 2004b: 127) (Figure 3.33). However, taken on their own, all these interpretations are too simplistic, because in the so-called residential areas many burials have been found, and in the so-called funerary areas different structures exist that are not related to the dead such as structures to store the production. Although more information is needed, 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). Basic osteological information was included (when available) and results show that no spatial pattern was present, based on sex or age of the individuals buried, or burial with metal artefacts or in a particular type of funerary structure. As a consequence, the hypothesis of two functional areas was not supported as the areas overlap in function, the human remains are buried in both areas, and there is not exclusive area for burial.

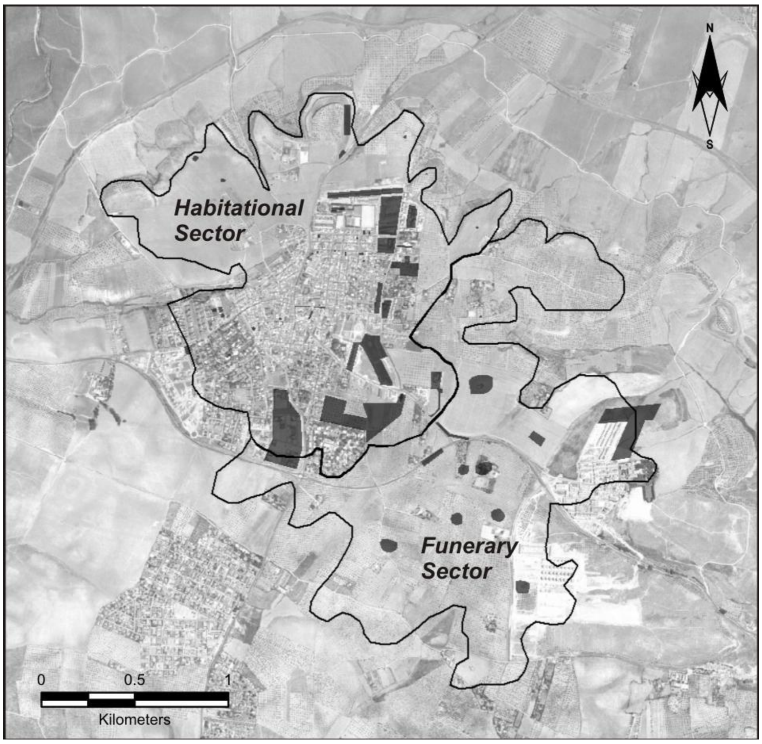


Figure 3.33. Delimitation of the areas by function (after Wheatley et al., 2012:68).

In the following section, the human remains from six sectors at Valencina-Castilleja that were analysed for comparison with Tomb 3 at La Pijotilla are described.

(i) El Algarrobillo

This sector is located in the south-west of Valencina de la Concepción. The excavator, Santana Falcón (1993), found three circular structures. The first structure is about 3.4 m long and 0.9 in width and, according to the author, could possibly be a hut (Figure 3.34) (Santana Falcón 1993: 550). The human remains were commingled and mixed with faunal remains, charcoal, ceramics, lithics, metals and slag.

The second structure had two circular structures connected by a passage oriented northeast-south-west, with length about 3.4 m and width at about 0.9 m. The circular structure (northeast) contained three niches, where ceramics and a flint blade were found. In the main chamber, there was one individual buried and the bones, according to Santana Falcón (1993) were not in anatomical position and could be interpreted as a secondary burial. At the south-west of the passage, the rest (*n* = 6) of the individuals were articulated and associated with polished stone tools and ceramic plates.

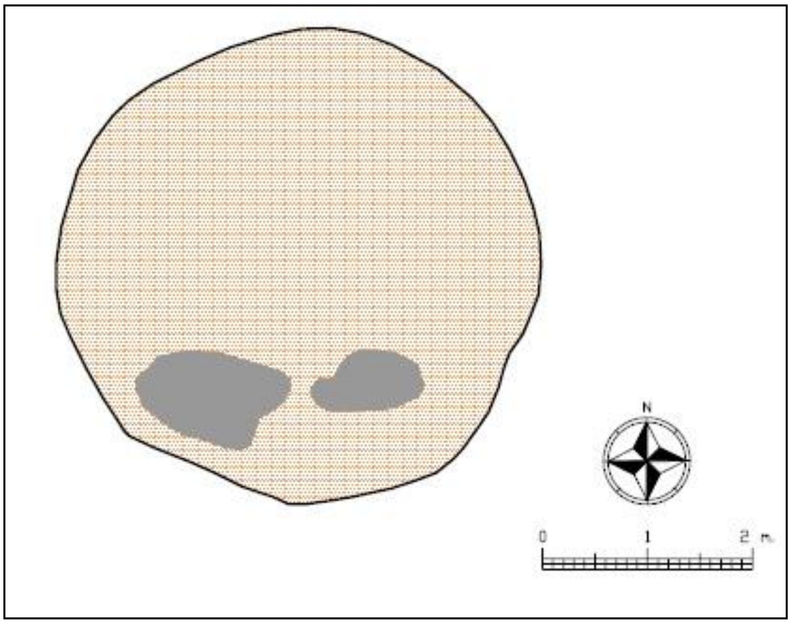


Figure 3.34. Plan view of one of the funerary structures from El Algarrobillo (modified from Vargas Jiménez, 2004a)

(ii) La Alcazaba

This site is located in "Nuestra Señora de la Esperanza", in the south-east area of Valencina de la Concepción. The human remains were found in structure 19. According to Cruz-Auñón and Arteaga Matute (1999a), the structure had a circular shape and the dimensions were 0.53 m in depth and 1.70 m in width. According to the authors, there did not seem to be any ritual pattern and the human remains were commingled and mixed with faunal remains and ceramics.

(iii) La Cima

This site is situated in the east part of Valencina, in the area called "La Cima". During archaeological excavations in this area, numerous circular structures and ditches were discovered. The human bone deposit was found in structure C-6, which had an oval shape and was 2.03 m in width. According to the excavator, the structure is interpreted as a place for habitation (Ruiz Moreno, 1991). Within the structure, human remains from two individuals were found in anatomical position with flexed lower limbs and they were analysed by Alcázar Godoy et al., (1992). Only one of the individuals was deposited in the Archaeological Museum of Seville and was included in this study (for results see Chapter 5).

(iv) La Gallega

This site is located in the northeast area of Valencina de la Concepción, in the area called "La Gallega". Here, during archaeological excavations, according to Martín Espinosa and Ruiz Moreno (1992), more than 23 structures were documented. The human remains were deposited in structures 10 and 11 (Figure 3.35), which are both of circular shape and are linked by a passage. The human remains were found in context with material culture comprised ceramics, lithics, artefacts made of bone, and metal and idols.

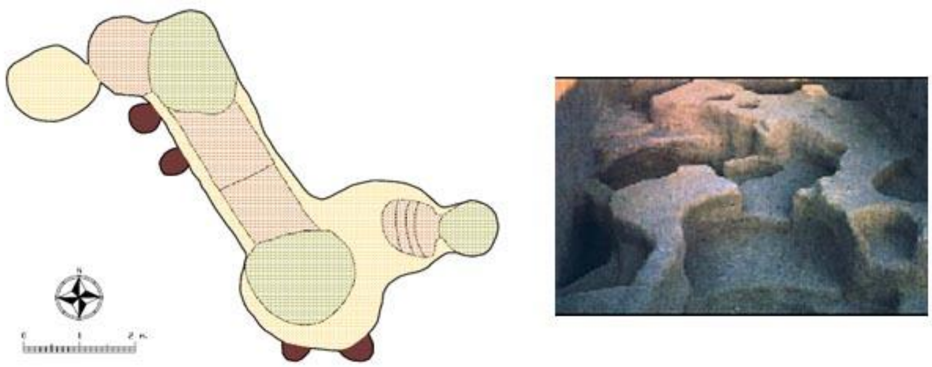


Figure 3.35 Plan view of structures 10 and 11 from La Gallega (left) and photograph during excavation process (right) (after Vargas Jiménez, 2004a).

(v) El Cerro de la Cabeza

This area is located in the north part of Valencina de la Concepción and corresponds to the area surrounding the *tholos* Cerro de la Cabeza (Fernández Gómez y Ruiz Mata 1978). Here, there were many circular structures and ditches filled with artifacts date to the Copper Age (Fernández Gómez, 2013). Within those structures, F-1 corresponds to a pit of approximately 11.36 m in depth and 1.10 m in width (Figures 3.36 and 3.37). Inside this structure, fragmented human and animal bones, figurines made of animal phalanges, large vessels, copper fragments, two anthropomorphic idols, a bronze fragment, arrowheads, and antlers were found. The other structure is a ditch (number 2) where at grid 6 disarticulated human remains with ceramics, a grinding stone and faunal remains were recorded during excavations in 1976 (Fernández Gómez, 2013).

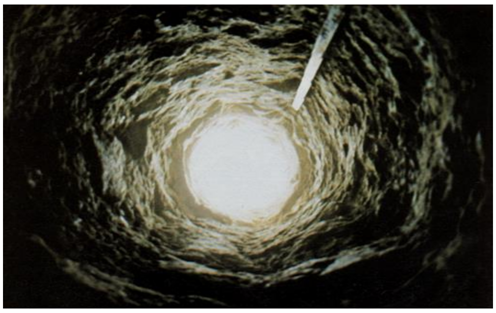



Figure 3.36 and 3.37. Structure F-1 from Cerro de la Cabeza (after Fernández Gómez, personal archive).

(vi) PP4-Montelirio sector

This sector is located in the south of the settlement in an area where there is extensive distribution of archaeological structures and materials (Figure 3.38); sixty-one features have been documented (Mora Molina et al., 2013). These features include two megalithic monuments and other non megalithic structures, such as 12 rock-cut with stone elements and 43 rock-cut structures of circular shape. However, according to a recent geophysical survey there were an estimated 211 structures of which at least 134 were dated to the Copper Age (Wheatley et al., 2012:71).

Figure 3.38. Aerial view of the PP4-Montelirio sector (photograph: José Peinado Cucarella).

The human remains from this sector have been estimated on 150 individuals (MNI) (Peinado Cucarella, 2008) but only a small part have been investigated to date (Robles Carrasco and Díaz-Zorita, 2013; Robles Carrasco, 2011). The reason why this sector is included in this study is because it was sampled for $\delta^{13}C$ and $\delta^{15}N$ stable isotope analysis to investigate paleodiet, and was also sampled for $^{87}Sr/^{86}Sr$ to investigate human mobility. One of the burials (structure 10,049-10,042) is of high status and can be used for comparison with other burials from Valencina-Castilleja in order to explore social differences. The burial is located in structure 10,042-10,049 (Figure 3.39), which is one of the largest megalithic tombs at Valencina-Castilleja, encompassing a double chamber.

Figure 3.39. Burial 10,042-10,049 from PP4-Montelirio (Valencina-Castilleja); arrow pointing to the skeleton (photograph: José Peinado Cucarella)

The individual buried within was a young adult male associated with a remarkable deposit of grave goods (Robles Carrasco and Díaz-Zorita Bonilla, 2013; Mora Molina et al., 2013). The grave goods included an elephant tusk, carved ivory objects, a flint adze, an ivory item, 21 flint blades and an amber pommel. The individual was buried on his right side with the upper and lower limbs flexed, and facing north (Figure 3.40). The skeleton was partly covered by ochre, which has also been seen as part of the burial ritual in other sites in south-west Spain. Fragmentation of the burial was very high, as can be appreciated by the image below.

Figure 3.40. Burial 10,049/667.1 from PP4-Montelirio (Valencina-Castilleja) (photograph: José Peinado Cucarella)

This burial was also compared to other structures found at this sector and those include another megalithic structure (10,034) for which MNI was 7, and other individuals from rock-cut structures (10,031, MNI=3) (Figure 3.41).

Figure 3.41. Funerary structure 10,034 from PP4-Montelirio sector (photograph: José Peinado Cucarella)

To conclude, Valencina-Castilleja represents one of the most important archaeological sites from the 3rd and 2nd millennia BC in south-west Spain. However, due to the number of archaeological excavations carried out at the site and the insufficient contextual information gathered thus far, it is not easy to make interpretations. The human remains are documented in different contexts and types of structures within the settlement. However, the structures included in this study have quite ambiguous (domestic or funerary) contexts and only one chambered tomb was included for isotopic analysis.

The reason why different contexts were selected was to compare inter-sector the data (osteological and isotopical) and make inferences about social differentiation among structures and sectors. This collection represents a coastal site and it was suitable to make inter-site comparisons for paleodietary analysis ($\delta^{13}C$ and $\delta^{15}N$) with an inland (La Pijotilla) and another coastal sites (La Orden-El Seminario). In addition, another of the objectives was to investigate the degree of human mobility during the Copper Age in south-west Spain. For this purpose, Valencina-Castilleja is also suitable since they have been documented exotic grave goods and inter-site comparisons will be made to La Pijotilla.

3.5.3.- La Orden-El Seminario

This coastal site is included here because human bone has been excavated from some of the funerary structures for isotopic analysis (results in Chapter 4) and these data were used as a comparison to the two inland sites of La Pijotilla and Valencina-Castilleja. Most of the human remains from this site were analysed by López Flores (2006, 2007, 2010) and were used for comparative analysis. While data from other researchers can be problematic, in this case the author is experienced and the methods she employed were standard and accepted in bioarchaeology and for basic osteological comparison was good enough. This coastal site belongs to the Plan Parcial 8, which refers to the administrative splitting of the space for modern construction purposes. Today it is called La Orden-El Seminario (González et al., 2008) and is located in the northern area of the city of Huelva (Figure 3.42). The settlement is situated in a peninsula between the estuaries of the rivers Tinto and Odiel. The geomorphology of the site is tertiary clay with sand at the Lower-Middle Pliocene levels.

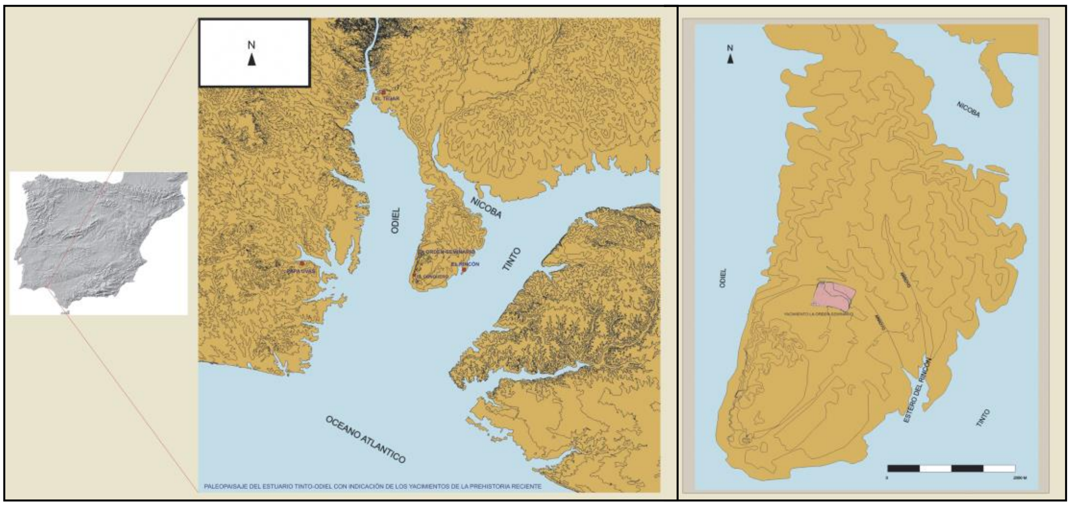


Figure 3.42. Location of La Orden-Seminario (after Vera Rodríguez et al., 2010:203).

The settlement occupies 230,000 square metres (Figure 3.43), and is located 45 metres above sea level (Vera Rodríguez et al., 2010). Since 2005, this site has suffered from the encroachment of extensive urban development and, as a consequence, 16 archaeological excavations have occurred, with different teams working in the area. According to Vera Rodríguez et al., (2010), the quantity and quality of the data are in some cases too poor enough to make interpretations about the archaeological context. This makes interpretation of the site and the study of the material culture in relation to the different contexts difficult.

Figure 3.43 Aerial view of La Orden-El Seminario (after Vera Rodríguez et al., 2010:204).

Approximately 1,000 structures dating from Late prehistory to modern have been found. In this study, the focus is on the prehistoric structures dated to the 4th and 3rd millennium BC (*n* = 250). In this group, as at Valencina-Castilleja, two types of structures have been found: negative structures, mostly with circular or oval shapes, and megalithic structures, such as *tholoi*.

The deposits found inside the negative structures are very diverse (Figure 3.44). There are some structures filled with ceramic vessels, lithics, mudbrick and/or shells. Other structures contain evidence of furnaces, with evidence of soil preparation and combustion of large mudbricks in association with lithics made of quartzite, limestone or sandstone. In other structures, votive deposits such as figurines have been excavated, while in others, deposits of burials with associated grave goods have been found. The function of these structures seems to be highly variable and, according to the authors, some of them are huts, others storage pits (converted later into places to discard waste materials), votive offering areas, and furnaces (Vera Rodríguez et al., 2010).

Figure 3.44. Structure PEX 2169 (left) containing mixed material including ceramic vessels, lithics, mudbrick and/or shells and PEX 3027 (right) containing idol figurines and ceramics (after Vera Rodríguez et al, 2010:213 and 223).

With respect to the funerary structures, burials have been documented in negative structures, as well as in *tholo*i (Figure 3.45) human remains from two structures (PEX 1327 and PEX 7055) were used for isotopical analysis.

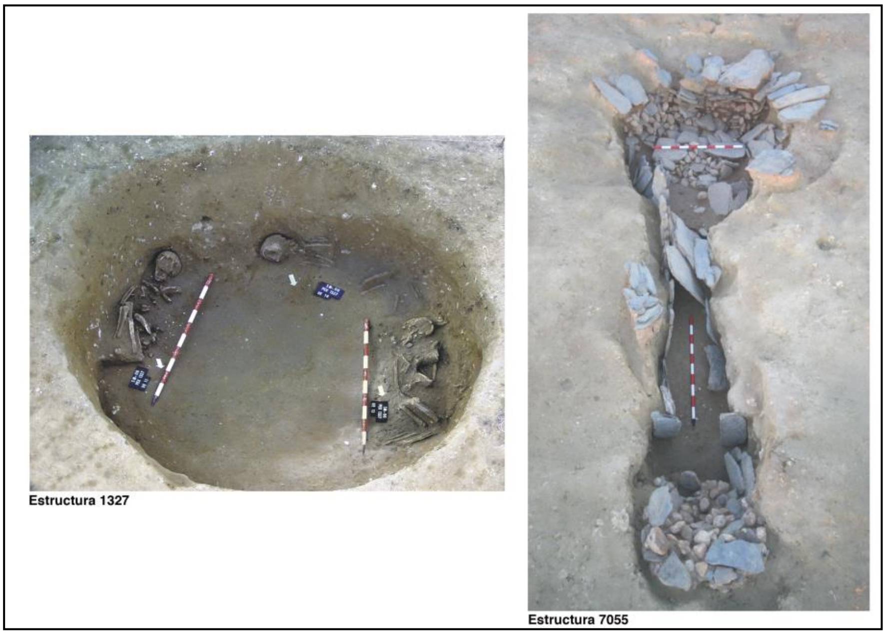


Figure 3.45. Funerary structures PEX 1327 and PEX 7055 containing human remains analysed for isotopical analyses (after Vera Rodríguez et al., 2010:216).

According to Vera Rodríguez et al., (2010), the settlement presents some clustering of structures by function, with three structural types: domestic, funerary and ritual. Based on this assumption, the authors distinguish structures considered residential (domestic), which appear to be associated with other structures used for daily activities, such as in production, consumption and storage. Other structures, located in different areas, were designated as being for burials and ritual practices. In the case of ritual practices, there are two exceptional finds (structures PEX 3027 and PEX 3370), where two large collection of idols with different morphologies and made of different raw materials were documented. According to the excavator (Vera Rodríguez et al., 2010), both structures are located very close to each other and are at the west side of the settlement, along with 8 structures, 5 of them for storage and 3 of them of undetermined function. At PEX 3027, a total of 10 idols were found, along with other material such as marble and ivory items, while at PEX 3370 a collection of 22 idols were documented. Both structures are also associated with some of the few copper objects found at the site. The authors interpreted these structures as part of the “ritual and ideological space” within the settlement since no burials were associated with domestic structures. The site of La Orden-Seminario is still under investigation due to the recent excavation of human remains and their enormous quantity. Radiocarbon dates are expected but, based on the analysis of the material culture and architecture, the site may be preliminarily dated to the 4th and 3rd millennia BC, corresponding to the Late Neolithic and Copper Age.

In summary, this chapter has offered a general overview of the 3rd millennium BC in south-west Spain, including descriptions of the main sites, settlement patterns, funerary practices, and an introduction to the study sites. Primary data has been collected from 6 sectors from La Pijotilla (Tomb 3) and Valencina-Castilleja (La Cima, La Gallega, La Alcazaba, El Cerro de la Cabeza and El Algarrobillo) and three sectors have been used for isotopic comparative analysis (structure 10,042-10,049 from Valencina-Castilleja and PEX 1327 and 7055 from La Orden-El Seminario). These data is summarised in Table 3.8.
Some of the sites that are used for comparison are somewhat ambiguous in function, as evidenced by the different structures documented at each site and, in this sense, more work is needed to clarify several aspects. The conditions of preservation, and quality of excavation of the human remains are different for each site, making preservation one of the most influential factors in the quality of the data in, discussed in Chapter 6. To conclude, another remarkable characteristic is the lack of radiocarbon dates for many of

the archaeological excavations carried out in the south-west. This has been an issue in the interpretation of the chronology of the sites. However, based on the few radiocarbon dates, presence of characteristics ceramics, and metal artifacts, and the funerary architecture from the sites included in this study they have been considered as synchronous. Until more radiocarbon dates are obtained, the chronological sequence of the settlements, and the use of the funerary structures, will remain unclear.

SITE	SECTOR	ARCHAEOLOGICAL FEATURES	HUMAN REMAINS	BP	BC (1σ)	LAB ID	C-14 SAMPLE	REFERENCE
VC	La Gallega	Negative structures. Structures 10 and 11.	MNI= 2. Partial articulation.	3905 ± 35	2484-2236	CNA1264	Human bone	Alcázar Godoy et al., 1992; Díaz-Zorita Bonilla, 2013
VC	El Algarrobillo	Negative structure	MNI= 19. Commingled	4130 ± 30	2871-2581	CNA1272	Human bone	Díaz-Zorita Bonilla, 2013
VC	PP4-M	Megalithic structure. Structure 10,042-10,049	MNI= 5. 1 primary position and 4 (MNI) commingled	4160 ± 35	2880-2629	CNA1291	Human bone	Robles Carrasco, 2011; Robles Carrasco and Díaz-Zorita Bonilla, 2013
VC	Corte C La Perrera	Negative structures. Ditch 2 and structure F-1.	MNI= 6. Commingled	In process	-	-	Human bone	Basabe and Benassar, 1982; Díaz-Zorita Bonilla, 2013
VC	La Cima	Negative structure. Structure C-6.	MNI= 2. Partial articulation.	In process	-	-	Human bone	Alcázar Godoy et al., 1992; Díaz-Zorita Bonilla, 2013
VC	La Alcazaba	Negative structure. Structure 19.	MNI= 6. Commingled	In process	-	-	Human bone	Díaz-Zorita Bonilla, 2013
LP	Tomb 3	Megalithic structure	MNI= 178. Commingled	4168 ±55	2870-2676	CNA-034	Human bone	Odriozola Lloret et al., 2008
				4130±40	2861-2625	Beta-121143	Human bone (UE 15/16)	Hurtado Pérez, 1999; Odriozola Lloret et al., 2008
L-S	PEX 1327	Negative structure	MNI= 23 Commingled	In process	-	-	Human bone	Vera Rodríguez et al., 2010; López Flores, 2006, 2007, 2010
L-S	PEX 7055	Megalithic structure	MNI= 19. Commingled.	In process	-	-	Human bone	Vera Rodríguez et al., 2010; López Flores, 2006, 2007, 2010

Key to table: VC= Valencina-Castilleja; LP= La Pijotilla; LS= La Orden-El Seminario.

Table 3.8. List of sites analysed in this study and sites used for comparative analysis

CHAPTER 4.- METHODS

4.1.- Methods: the analysis of the human remains

The purpose of this chapter is to explain in detail the methods employed in this research. The following methods were specifically selected according to the nature of the human remains (commingled) in order to address the aims and objectives of this research. Prior to study, based on the known condition of the human remains, specific recording forms and a database (using Access 2007, Microsoft) were designed for the systematic collection of data in order to obtain the maximum amount of information, and to facilitate further bioarchaeological study. A photographic record using a Nikon camera type SLR D3000 of the whole process of storage prior to analysis (Figure 4.1 and Figure 4.2.), of cleaning (Figure 4.3 and Figure 4.4) and of classification (Figures 4.5, 4.6, 4.7 and 4.8) was made, as well as of specific human variation traits, non-metric, enthesophytes and pathological cases. Data were recorded on the recording forms and the data input to the database (Figure 4.9 and 4.10; see also Appendices 1 for complete recording forms). During laboratory study, a laboratory notebook was used, along with the recording forms.

Figure 4.1. Storage of the human bone collection

Figure 4.2. Remains before processing


Figure 4.3 and 4.4. The state of preservation of the human remains before cleaning


Figure 4.5 and 4.6. The process of classification


Figure 4.7 and 4.8. The process of data collection

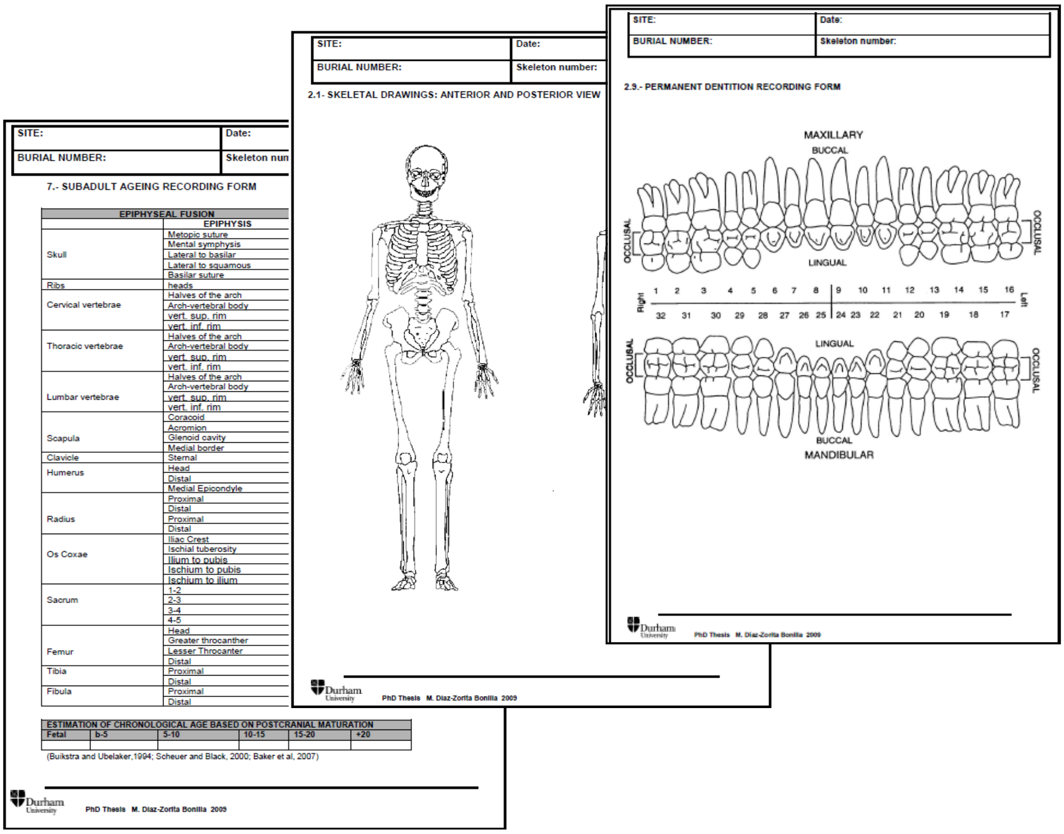


Figure 4.9. Examples of recording forms.

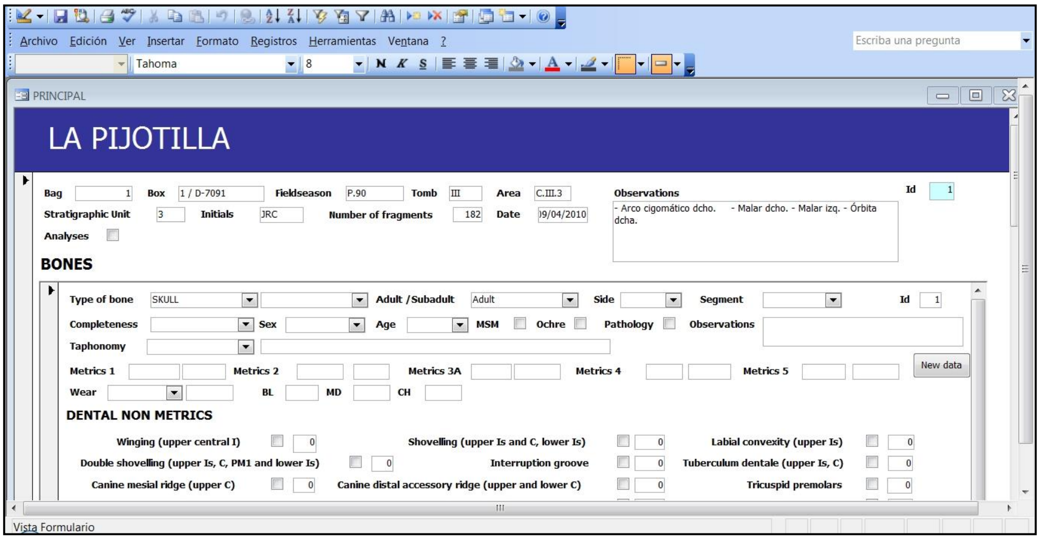


Figure 4.10. Design of the database

4.2.- Identification, classification and recording

Identification of every bone fragment and tooth was classified as follows:

- Human/animal
- Adult/Subadult
- Bone or tooth type
- Side: right (R), left (L), unsideable (U); for teeth: upper or lower
- Bone segments: if a long or short bone: proximal epiphysis (PE), proximal third of diaphysis (P1/3), middle third of diaphysis (M1/3), distal third of diaphysis (D1/3), distal epiphysis (DE); if a vertebra: vertebral body (B), neural arch (NA); if scapula: acromion (A), coracoid process (C), lateral border (LB); if clavicle: sternal end (SE), scapular end (SCE); if pelvis: ilium (I), ischium (IS) or pubis (p).
- Completeness: 1 (>75%), 2 (25-75%), 3 (<25%)

Recording of the bone fragments was done according to the inventory recording form for commingled remains and isolated bones designed for this study (see Appendix 1), following Buikstra and Ubelaker (1994:9)

4.3.- Preservation, conservation and taphonomy

Preservation of this collection was very poor due to the extreme fragmentation of the remains; no complete bones were preserved, with the exception of a few long bones and several metacarpals, metatarsals and phalanges. Preservation of the remains was assessed based on the type of bone and segment present, including the completeness of each bone element, as described in Section 4.2. Taphonomic processes were recorded in order to reconstruct the different factors that might have affected this collection. Taphonomic processes were classified according to the different extrinsic factors, consisting of 1) environmental and natural factors, and 2) human induced factors, as described in Chapter 3, Section 3.4.2.

For this reason, the bone fragment and segment, type of postmortem alteration (weathering, discoloration, polish, cutmarks, gnawing, and other cultural modifications) and colour were recorded, following Buikstra and Ubelaker (1994:105-106). For cremated remains, the following were considered: the surface texture (longitudinally split, transverse and longitudinal, and curved cracks) and deformation were recorded according to Buikstra and Ubelaker (1994:105-106). Additional factors, such as conservation of the remains once stored in the museum, were considered and other attributes were recorded, such as rodent destruction of “packages” (Figure 4.11 and 4.12).

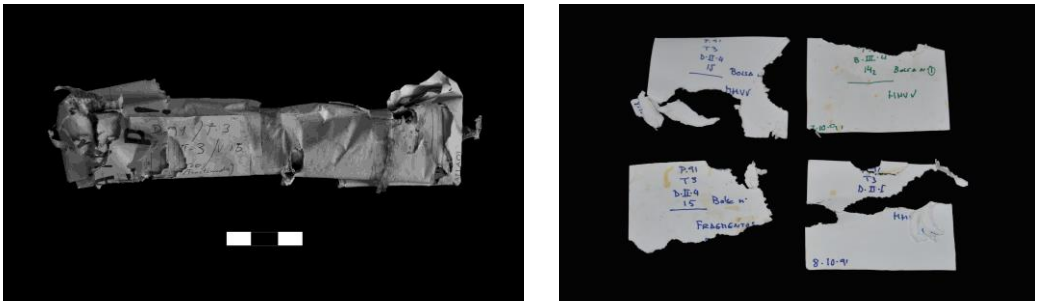


Figure 4.11 and 4.12. Taphonomic process (rodent tooth marks on packaging and labels)

4.4.- Sex estimation

In order to study social differences, sex and age at death were the two fundamental parameters to be estimated as well as the distribution of them by type of funerary structures. Since this collection presents a high degree of fragmentation, sex was estimated on each os coxae or skull fragment whenever possible. Sex was estimated based on the primary features for sex estimation observed in the os coxae, such as the features on the pubic bone and the sciatic notch, following Buikstra and Ubelaker (1994). The following pelvic traits were observed, as appropriate for preservation: ventral arc, subpubic concavity, ischiopubic ramus ridge, greater sciatic notch, subpubic angle, pubic length, obturator foramen, pelvic inlet/outlet, acetabulum, number of sacral segments and sacral morphology.

However, sex was also estimated using the bones of the skull and features such as the glabella, forehead shape, postzygomatic arch, the nuchal crest, orbital margins, supraorbital ridges and mastoid processes. In the mandible, the gonial angle, chin shape, mandibular ramus flexure and the mental eminence were also recorded (Campillo and Subirá, 2004; Buikstra and Ubelaker, 1994).

Every bone fragment was classified into the following categories (Table 4.1):

SEX CATEGORY	**F** (female) **F?** (probably female) **U** (adult indeterminate) **M** (male) **M?** (probably male) **S** (subadult)

Table 4.1. Sex categories

Where possible, metrical data were used to estimate sex based on the maximum diameter of the femoral head, femur bicondylar breadth, humerus head diameter, radius head diameter, scapula glenoid cavity width and clavicle maximum length, following Bass (1995), Brothwell (1981), and Buikstra and Ubelaker (1994) (Table 4.2).

MEASUREMENT	M	F
Maximum diameter of the femoral head	>48 mm	<43 mm
Femur bicondylar width	>76 mm	<74 mm
Humerus head diameter	>47 mm	<43 mm
Radius head diameter	>23 mm	<21 mm
Scapula glenoid cavity width	>28.6 mm	<26.1 mm
Clavicle maximum length	>150 mm	<138 mm

Table 4.2. Metrical data used to determine sex (following Bass, 1995; Brothwell, 1981 and Buikstra and Ubelaker, 1994)

4.5.- Age estimation

4.5.1.- Adult age estimation

Features related to age at death in adults were recorded from the pelvis, as follows: auricular surface changes following Lovejoy et al., (1985) using the 1-8 stage coding system, and pubic symphyseal changes according to the Suchey-Brooks methodology (Brooks and Suchey, 1990) with coding stages 1-6. However, when preservation was sufficiently good, degeneration of the sternal end of the ribs was also considered (Iscan et al., 1984; Iscan and Loth, 1986). Age was also estimated from observations of cranial suture closure on skulls, including their maxillae. The grade of obliteration of each suture was assessed following Meindl and Lovejoy (1985), using the following coding: 0 (open), 1 (minimal closure), 2 (significant closure) and 3 (complete closure).

In younger adults, growth and development was assessed based on epiphyseal union recorded on specific joints: the sternal end of the clavicle, the epiphyseal plates of the vertebral bodies, the heads of the ribs, the iliac crest, the basilar suture on the base of the skull and the individual pieces of the sacrum after Buikstra and Ubelaker (1994) and Brothwell (1981). The degree of dental attrition was also considered (Brothwell, 1981; Smith, 1991)

The general categories used in assigning an overall age were (Table 4.3):

AGE GROUP	CATEGORIES
SUBADULT	**F** (fetal < birth) **I1** (infants birth-6 years) **I2** (children 7-12 years) **AO** (adolescents 13-17)
ADULTS	**YA** (young adults 18-25) **MID** (middle adult 26-35) **MA** (mature adults 36-45) **OA** (old adult >45)

Table 4.3. Age categories used in this study

4.5.2.- Subadult age estimation

Ageing of subadult individuals was based on the stage of development and epiphyseal fusion of the bones following Buikstra and Ubelaker (1994) and the development and eruption of the teeth following Scheuer and Black (2000). Epiphyseal union is a very useful method for aging subadults since it is known that epiphyses fuse at certain ages, but there is some variation according to age and sex, and between individuals of different populations (White and Folkens, 2005: 373). Some forensic studies, such as McKern and Stewart (1957) of known sex and age populations have been proved to work on age estimation and they have been successful later on when they have been compared to a larger collection (Webb and Suchey, 1985). However, this study is not dealing with complete skeletons, and the challenge resides in the estimation of age based on just one bone fragment and not a comparison of multiple epiphyseal fusions. Therefore to the stage of epiphyseal union was coded as follows: open (code 0), partial union (code 1) and complete union (code 2). The areas of the bones recorded are seen in Table 4.4.

Estimation of age at death based on dental development was done following Ubelaker (1989). Nevertheless, limitations of this method and the potential error due wide variation in growth rates of subadults within and between populations are recognised. In addition, this method was originally based on European populations (Schour and Massler, 1941, 1944) and adapted for Native Americans. This has been widely used for ageing European prehistoric populations and has been recognized as a standard method by many specialists (Buikstra and Ubelaker, 1994; Ferembach et al., 1980; Hillson, 1997), it is also recommended for use via methodological assessments (Smith, 2005; Martín Cerrato, 2010) and also by the Workshop of European Anthropologist (WEA, 1980). This method has been also applied to similar commingled prehistoric populations as for example at the Upper Duero (Tomé, 2010) and Poço Velho (Antunes Ferreira, 2005) both in Portugal.
However, due to fragmentation and the absence of complete skeletons, it was impossible to apply multiple methods to estimate precisely the age at death of subadults. In any case, only a few subadults were aging using this method.

BONE	Area
SKULL	Metopic suture
	Mental symphysis
	Lateral to basilar
	Lateral to squamous sutures
	Basilar suture
RIBS	Rib heads
VERTEBRA	Halves of the arch
	Arch to vertebral body
	Vertebral body superior epiphyseal plate
	Vertebral body inferior epiphyseal plate
SCAPULA	Coracoid
	Acromion
	Glenoid cavity
	Medial border
	Sternal end
LONG BONES	Humerus head
	Distal epiphysis
	Medial epicondyle
RADIUS	Proximal end
	Distal epiphysis
OS COXAE	Iliac crest
	Ischial tuberosity
	Ilium to pubis
	Ischium to pubis
	Ischium to ilium
SACRUM	Segments 1-2
	Segments 2-3
	Segments 3-4
	Segments 4-5
FEMUR	Head
	Greater trochanter
	Lesser trochanter
	Distal epiphysis
TIBIA	Proximal epiphysis
	Distal epiphysis
FIBULA	Proximal epiphysis
	Distal epiphysis

Table 4.4. Subadult areas of epiphyseal fusion recorded

Based on cranial and postcranial maturation and following Buikstra and Ubelaker (1994), Schueuer and Black (2000) and Baker et al. (2007), the age ranges used to describe overall age were:

1) Fetal

2) Birth to 5 years

3) 6 to 10 years

4) 11 to 15 years

4.6.- Normal variation: metrical data
4.6.1.- Introduction to metrical data

When preservation permitted, metrical data were recorded for each bone fragment for both adult and subadult bones. The next section describes the measurements taken in this study. The code for each measurement is in parentheses. Measurements were taken with digital calipers and a tape measure in mm. Adult skeletal measurements were recorded following Buikstra and Ubelaker (1994) and Brothwell (1981), while subadult metrical data were recorded according to Buikstra and Ubelaker (1994).

One of the main purposes of collecting metrical data was to estimate the intra-observe error, and to calculate the stature and some indices. The intra-observer error was avoided by taking each tooth measurement[20] (MD and BL) three times from a selected random sample (bag ID 2426 to 2438 (n=61)) and then subtracting a mean from the three measurements as the final measurement. Afterwards, a Mann-Whitney *U* test was performed to compare this group to another random group (from bag ID 425 to 448) of 61 observations. On the other hand, stature and indices were calculated to observe whether social differences could be observed, based on these two parameters, among individuals by sex, age and by the type of funerary structure where they were buried.

[20] Taken of the tooth crown following Moorees and Reed (1964). The crown was chosen instead of the CEJ because measurements of the crown represent the most standard measurements taken by bioarchaeologists, and were appropriate for future comparison with other populations.

4.6.1.- Adult measurements

The complete list of measurements can be found in the recording forms (Appendix 2.1). Due to the high state of fragmentation of this collection, only the measurements listed in Table 4.5 were taken on the skull and mandible, and Table 4.6 shows the measurements taken on the postcranial skeleton.

PART	CRANIAL MEASUREMENTS
SKULL	Mastoid length
	Bizygomatic diameter (GB)
	Bidacryonic breadth (DA)
	Bidacryonic chord (DC)
	Malar height
MANDIBLE	Maximum ramus height
	Bigonial breadth of the mandibular body
	Minimum ramus breadth
	Maximum ramus breadth

Table 4.5. Measurements taken on the skull and mandible following Buikstra and Ubelaker (1994) and Brothwell (1981).

POSTCRANIAL MEASUREMENTS	
CLAVICLE	Sagittal (A-P) diameter at midshaft
	Vertical (S-I) diameter at midshaft
SCAPULA	Glenoid cavity length
	Glenoid cavity width
HUMERUS	Epicondylar breadth
	Vertical diameter of head
	Minimum diameter at midshaft
RADIUS	Maximum length
	A-P (Sagittal) diameter at midshaft
	M-L (Transverse) diameter at midshaft
ULNA	Maximum length
	A-P (Dorso-Volar) diameter
	M-L (Transverse) diameter
	Physiological length
	Minimum circumference
FEMUR	Bicondylar length
	Epicondylar breadth
	Maximum head diameter
	A-P (Sagittal)subtrochanteric diameter
	M-L (Transverse) subtrochanteric diameter
	A-P (Sagittal) midshaft diameter
	M-L (Transverse) midshaft diameter
	Midshaft circumference
TIBIA	Maximum diameter at the nutrient foramen
	M-L (Transverse) diameter at the nutrient foramen
	A-P Diameter at the nutrient foramen
	Circumference at the nutrient foramen
FIBULA	Maximum diameter at midshaft
	Maximum length

Key to table: A-P= antero-posterior; M-L: medio-lateral; S-I: supero-inferior.

Table 4.6. Measurements taken on postcranial bones following Buikstra and Ubelaker (1994) and Brothwell (1981).

4.6.3.- Indices

The complete list of indices calculated can be found in the recording forms (Appendix 1). However, due to the high degree of fragmentation of the skeletal material, only a few indices were generated. Based on the long bone measurements, the following indices (Table 4.7) were calculated following Brothwell (1981) and Bass (2005).

INDICES	FORMULA
Platymeric index	A-P (Sagittal) subtrochanteric diameter x 100 M-L (Transverse) subtrochanteric diameter
Platycnemic index	M-L (Transverse) diameter at nutriet foramen x 100 A-P diameter at nutrient foramen
Radio-Humeral index	Maximum length of radius x 100 Maximum length of humerus

Key to table: A-P= anterior-posterior; M-L= medial-lateral.

Table 4.7. Indices calculated

4.6.4.- Subadult measurements

The list of measurements of the cranial and postcranial skeleton following the method of Buikstra and Ubelaker (1994) can be found in the recording forms (Appendix 2.1).

4.6.5.- Dental measurements

Measurements were also taken on adult teeth that were complete, non-pathological and without tooth wear according to Buikstra and Ubelaker (1994:62). However, in relation to those teeth with wear present, in this study teeth with >5 on the attrition scale were measured following Brothwell (1981:72). The measurements taken were:

1) Mesio-distal diameter (MD)

2) Bucco-lingual (BL)

3) Crown Height (CH)

Measurements were taken with digital calipers accurate to .01 mm and are reported in millimeters following Buikstra and Ubelaker (1994). The definitions for the measurements are in Moorees and Reed (1964). Results can be found in Appendix 2.2.

4.7.- Stature estimation

Stature was estimated for adults based on the maximum lengths of long bones, where preservation permitted, following the methodology of Trotter and Glesser (1958) following the formulae for white men and women according to Table 4.8:

MALE INDIVIDUALS	FEMALE INDIVIDUALS	TYPE OF BONE
3.08H+70.45±4.05	3.36H+57.97±4.45	HUMERUS
3.78R+79.01±4.32	4.74R+54.93±4.24	RADIUS
3.70U+74.05±4.32	4.27U+57.76±4.30	ULNA
2.38F+61.41±3.27	2.47F+54.10±3.72	FEMUR
2.52T+78.62±3.37	2.90T+61.53±3.66	TIBIA
2.68FI+71.78±3.29	2.93F+59.61±3.57	FIBULA

Key to table: H=humerus; R= radius; U=ulna; F=femur; T=tibia; FI=fibula.

Table 4.8. Formulae used to estimate stature for male and female bones following Trotter and Glesser (1958).

4.8.- Normal variation: non-metric traits

4.8.1- Introduction to non-metrical data

Non-metric traits refer to variation in anatomical features found in the skeleton in the form of grooves, foramina, facets, etc., that may or may not be present in the skeleton (Saunders and Rainey, 2008). They are used to estimate biological distance between groups (Tyrrell 2000:301). The most common terms used for these traits are nonmetric, nonmetrical, discrete (Saunders and Rainey 2008:534), epigenetic (Trinkaus 1978:315), but there are other names used (Saunders and Rainey, 2008:538). In this study, non-metric traits were recorded for adult bones (cranial and postcranial) and teeth, although data is very limited. The purpose of recording them was to obtain new bioarchaeological data and to compare this with the available data for the south-west to estimate biological distance among groups.

4.8.1.i.- Cranial non-metric traits

Non-metric traits were recorded as present or absent according to these criteria: Presence (P), Absence (A), left partially present (L part P), left present (LP), left absent (LA), right partially present (R part P), right present (RP), right absent (RA). The following traits (Table 4.9) were recorded according to Berry and Berry (1967).

CRANIAL NON-METRIC TRAITS
Fronto-temporal articulation
Parietal notch
Mandibular torus

Table 4.9. Cranial non-metric traits

4.8.1.ii.- Dental non-metric traits

The following traits (Table 4.10) were recorded according to Turner et al. (1991). The codes used were present (P), and absent (A), along with the grade/severity of each trait.

DENTAL NON-METRIC TRAITS
Shovelling (upper Is and C, lower Is)
Interruption groove (Upper Is)
Bifurcated root (upper Is)
Carabelli's trait (upper Ms)
Dental gemination
Odontome (upper and lower PMs)
Congenital absence
Groove pattern (lower Ms)
Cusp number (lower Ms)
Key to table: Is= incisors; C= canine; Ms= molars; PMs=premolars.

Table 4.10. Dental non-metric traits

4.8.1.iii.- Postcranial non-metric traits

Recording of non-metric traits (Appendix 1) was done based on the presence (P) or absence (A) of each trait on relevant bones and fragments, and by side. These traits were recorded following Finnegan (1978), Buikstra and Ubelaker (1994) and Brothwell (1981) (Table 4.11).

POSTCRANIAL NON-METRIC TRAITS
3rd Trochanter
Supracondylar process
Septal aperture
Preauricular sulcus
Circumflex sulcus
Vastus notch
Olecranon fossa
Talus double facet
Bipartite patella

Table 4.11. Postcranial non-metric traits

4.9.- Abnormal variation

4.9.1.- Enthesophytes

Enthesophytes or entheseal changes refer to those bone changes and irregularities observed at the entheses, or the insertion point of ligaments and tendons (Larsen, 1997:188). They are also known as musculoskeletal stress markers (MSM), referring to them being used to reconstruct activity related patterns. This represents another way to look at social differences among individuals like division of labour between sexes. However, it is essential to compare individuals of unknown occupation with MSM to studies of individuals of known occupation to test those bioarchaeological interpretations (Alves Cardoso and Henderson, 2010). The collection of data on enthesophytes was done according to Merbs (1983), Hawkey and Merbs (1995), Dutour (1986) and Jurmain (1999). But the work of Capasso et al. (1999) was consulted (Table 4.12).

ENTHESOPHYTES
Hypertrophy of the biceps brachii insertion
Flexor digitorum profundus hypertrophy
Insertion of subclavius muscle very pronounced
Hypertrophy of the linea aspera
Achilles tendon enthesophyte
Anterior tibiofibular ligament enthesophyte
Prominent insertion of the sternocleidomastoid muscle
Patellar tendon enthesophyte
Iliocostalis cervicis enthesophyte
Enthesophyte at anterior superior facet
Enthesophyte at extensor digitorum brevis
Third throchanter

Table 4.12. List of enthesophytes

4.9.2.- Paleopathology

Due to the high fragmentation of the human remains in this study, it was impossible to systematically record the distribution pattern of pathological lesions and produce differential diagnoses. Therefore, any pathological lesions on any bone fragment or tooth were recorded as separate entities. Since the bone was so fragmentary, it was also impossible to assess bilaterality. However, when fragmentation permitted, pathological lesions were recorded in order to compare data between sites and correlate it with age and sex of the bone fragment, and isotopic data. Inferences will be made to check social differences among those individuals buried in megalithic monuments (as representatives of high status) and those at non-megalithic monuments.

4.9.2.i.- Preliminary evaluation

Recording pathological lesions was undertaken to evaluate the health status of the individuals buried in tomb 3 in La Pijotilla and the other sectors in Valencina-Castilleja. For this purpose, and according to Roberts and Connell (2004) and Lovell (1997), each bone and tooth was evaluated independently, and brief descriptions of each bone or tooth affected were made.

The following information was recorded for each affected bone and tooth:

- The dimensions of lesions using digital calipers and expressed in millimeters.
- The presence of bone formation or destruction.
- If formation of bone was present, whether the bone was woven or lamellar in nature.
- Whether the lesion was already healed or still in the process of healing.
- If bone destruction was present, whether there were any signs of healing.
- Any deformation of the bone.

Due to the disarticulated nature of the remains, it was not possible to look at distribution patterns of lesions in order to make a differential diagnosis.

4.9.2.ii.- Categories of disease

Following recognition of a pathological lesion, it was classified into one of the following disease categories: infectious, traumatic, metabolic, endocrine, joint, neoplastic, or dental. In the following sections, the observations of specific diseases made for each disease category are described.

4.9.2.ii.a.- Infectious disease

The classification used for bacterially-induced infectious disease was specific or non-specific. Lesions attributable to specific infections are those related to specific microorganisms. Following Roberts and Manchester (2007) and Roberts and Connell (2004) these specific infections include leprosy (Andersen et al., 1992 and 1994, Andersen and Manchester 1987, 1988, and 1992, Rogers and Waldron, 1989; Lewis et al., 1995, Møller-Christensen, 1965 and 1978), tuberculosis (Rogers and Waldron, 1989, Morse 1961 and 1967; Hrdliĉka, 1909; Buikstra, 1981b, Buikstra and Williams, 1991, Pálfi et al., 1999) and treponematosis (Hackett, 1976, and Rogers and Waldron, 1989). The non-specific infections, potentially caused by many different microorganisms, included periostitis (infection of the periosteum), osteomyelitis (infection of the cortical bone) and osteitis (infection of the medullary cavity) (Roberts and Manchester 2007:168).

These bone changes are, in some cases, difficult to assess and diagnose definitively even in a complete skeleton, and additional methods, such as radiography, are often required to determine the cause of the bone changes. However, since this research considered commingled remains, the likelihood of being able to diagnosis infectious disease with this type of material is very limited. It was only possible to describe the abnormal bone changes and in some cases to suggest the category of disease (specific/non-specific) without suggesting a specific diagnosis.

4.9.2.ii.b- Trauma

There are many different types of trauma, including fractures, dislocations, subluxations, soft tissue injury, and “miscellaneous” trauma such as spondylolysis (see below for explanation). Fractures are described as a complete or partial break in the continuity of a bone, which could be the result of accidental or intentional trauma, and could be caused by an acute injury, surgical procedure, repeated stress, or an underlying pathology (Ortner, 2003; Roberts and Connell, 2004). Types of fractures were considered, according to the standards promoted by Waldron (2009: 139) and Roberts and Connell (2004:37), and included transverse, oblique, comminuted, spiral, compression, depressed, crush, wedge, greenstick, pathological and stress (Table 4.13). Other factors, such as the nature of the fracture, if simple or compound, any angulation, apposition or overlap on healing, and the state of healing, were also recorded. In addition, possible complications were recorded such as non-union, necrosis or death of bone, and secondary complications, such as infection and joint disease (Roberts and Connell 2004, Lovell 1997).

TYPE	DEFINITION
Transverse	Fracture at right angles to long axis of bone
Oblique	Fracture at oblique angle to long axis of bone
Spiral	Fracture winds around long axis of bone
Depressed	Skull fracture in which the table(s) of the skull are forced inwards
Crush	Vertebral fracture usually caused by a fall
Wedge	Vertebral fracture secondary to vertebral collapse such as caused by infection or malignant disease; typically seen in osteoporosis
Greenstick	Incomplete fracture seen in children
Pathological	Fracture occurring in a bone affected by some pathological process
Stress	Fracture occurring as the result of repeated loading

Table 4.13 Type of fractures after Waldron (2009:139)

Dislocation or subluxation (partial dislocation) of a joint leads to the bones of the joint being out of normal alignment; this is usually due to trauma (Roberts and Connell, 2004). A dislocation could also be a congenital condition. Furthermore, subluxation may also occur as a result of joint disease such as rheumatoid arthritis (Waldron, 2009:62). Dislocation or subluxation might not leave any traces in the skeleton and, unless the dislocation/subluxation remains unreduced and a new joint surface is formed, they are difficult to identify on skeletal remains (Waldron, 2009). Another type of trauma is soft tissue injury, which is identified as new bone formation at soft tissue attachments to bone.

The “miscellaneous” group includes a variety of trauma-induced conditions, such as spondylolysis, which mostly affects the lumbar vertebrae where there is a separation of the neural arch from the vertebral body (Merbs, 1996; Hitchcock, 1940). Amputation of a bone may also be recognized (i.e. where part of a bone has been removed either surgically or accidentally), and trepanation may be seen, where a hole is intentionally created in the skull (Ortner, 2003; Aufderheide and Rodríguez-Martín, 1998); this latter surgical procedure has been recognized to have been practiced in different ways (e.g. scrape, saw, bore and saw, gouge and drill; Roberts and Connell, 2004:37). Although the different types of trauma are potentially difficult to identify in this skeletal assemblage, fractures are easier to detect and, according to Brickley (2006), are the most common traumatic lesions in the bioarchaeological record, even when fragmentation is high.

4.9.2.ii.c- Joint disease

Joint disease is related to those bone changes located on and around the different types of joints in the skeleton, but the most common joint disease is osteoarthritis (OA) (Jurmain and Kilgore, 1995) affecting the synovial joints (Waldron, 2009:27). The bone changes of joint disease include osteophytes, porosity, eburnation, and fusion of the joint (Rogers and Waldron 1995), and a diagnosis of OA is made when eburnation is present on the joint or when two or more of the other changes are present.

The following joints were recorded for joint disease (Table 4.14)

SITE		R	L
TMJ			
Acromioclavicular			
Sternoclavicular			
Shoulder	Humerus		
	Glenoid		
Elbow	Humerus		
	Ulna		
	Radius		
Hand	Carpus		
	Carpometacarpal		
	Metacarpophalangeal		
	Prox. Interphalangeal		
	Distal Interphalangeal		
Hip	Femur		
	Pelvis		
Knee	Femur/Patella		
	Medial		
	Lateral		
Ankle			
Foot	Tarsus		
	Tarsometatarsal		
	Metatarsophalangeal		
	Prox. Interphalangeal		
	Distal interphalangeal		
Sacroiliac			

Table 4.14. List of joints recorded for disease

Another very common condition only found in the vertebrae are Schmörl´s nodes, which are the result of herniation of the vertebral body surface by the intervertebral disk contents, due to compression; they are most commonly found in thoracic and lumbar vertebrae (Waldron, 2009; Resnick and Niwayama, 1995). As described in Roberts and Connell (2004), joint diseases such as gout, septic arthritis, ankylosing spondylitis and diffuse idiopathic skeletal hyperostosis were also considered, following Rogers and Waldron (1995, 2001) and Bullough (1992).

However, due to the intrinsic nature of this skeletal collection, including extreme fragmentation and disarticulation of the remains, the likelihood of finding these diseases was very limited because the research was restricted to the observation of single bone fragments, and not all bone fragments were preserved joint surfaces. According to Roberts and Manchester (2007), diagnosing joint diseases in skeletal remains requires the observation of the distribution of bone changes, which was not possible in this study.

4.9.2.ii.d.- Metabolic Disease

This group of diseases relates to abnormal metabolism; included here are cribra orbitalia and porotic hyperostosis, scurvy, rickets, osteoporosis, and Harris lines (Roberts and Connell, 2004; Stuart-Macadam, 1989). Scurvy is caused by a lack of vitamin C in the diet, and rickets by a lack of vitamin D, due mainly to lack of ultraviolet light; both cause skeletal changes during growth and development (Roberts and Manchester, 2007; Ortner, 2003). Osteoporosis is described as a loss of bone mass, while Harris lines, which are only detectable on radiographs or broken bones, are transverse lines observed in the ends of long bones and directly related to an episode of stress, although they may be resorbed and become invisible, and may not necessarily form with all stresses (Roberts and Manchester, 2007; Grolleau-Raoux et al., 1997). Porotic hyperostosis was also considered (porosity of the cranial vault) and cribra orbitalia (porosity of the orbits), according to Buikstra and Ubelaker (1994:120); this may be related to anaemia (Stuart-Macadam and Kent, 1992), including the hereditary anaemias (Ortner, 2003,) although the meaning is still unclear (Walker et al., 2009).

The degree of change was coded as 1 (barely discernible), 2 (porosity only), 3 (porosity with coalescence of foramina, no thickening) and 4 (coalescing foramina with increased thickness) Buikstra and Ubelaker (1994:151). For porotic hyperostosis, the bone change was also recorded as follows: 1 (active at time of death), 2 (healed) and 3 (mixed reaction: evidence of healing and active lesions), after Buikstra and Ubelaker (1994: 152).

Again, as in previous sections, not all of these pathological changes are easy to record in a highly fragmented bone assemblage, and also are not easy to detect if the skeleton is incomplete, but an attempt was made to record these pathological changes whenever possible.

4.9.2.ii.e.- Dental disease

In this section, those diseases related to the teeth were included: caries, dental calculus, linear enamel hypoplasia (LEH), and ante-mortem tooth loss. Grading systems were use to code the different dental diseases to avoid subjectivity when recording.

Caries, an infectious disease, is described as destruction of any part of the tooth by the action of plaque bacteria on consumed sugars; it is associated with a diet rich in carbohydrates (Hillson, 1996; Cran, 1959).

It was recorded for each tooth following Buikstra and Ubelaker (1994) (Table 4.15). For the crown, the coding was occlusal, lingual, buccal/labial or mesial/distal and for the cervical surface, it was coded as the cemento-enamel junction (CEJ).

CODE	TYPE	DEFINITION
0	No lesion present	-
1	Occlusal surface	All grooves, pits, cusps, dentin exposures and the buccal and lingual grooves of the molars
2	Interproximal surface	Includes the mesial and distal cervical regions
3	Smooth surface	Buccal (labial) and lingual surfaces other than grooves
4	Cervical caries	Originates at the cemento-enamel junction (CEJ), except the interproximal regions
5	Root caries	Below the CEJ
6	Large caries	Cavities that have destroyed so much of the tooth that they cannot be assigned a surface of origin
7	Noncarious pulp exposure	-

Key to table: CEJ= cemento-enamel junction

Table 4.15. Coding system for caries after Buikstra and Ubelaker (1994:55)

Dental calculus, or calcified plaque, accumulates due to bacterial action and is related to a diet rich in proteins (Hillson, 2000; Arensburg, 1996) but also to other non-dietary practices such as poor dental hygiene and the use of tooth as tools (Lieverse, 1999). An accumulation of dental plaque can lead to peridontal disease. This was also recorded based on the position on the tooth: occlusal (O), distal (D), lingual (L), buccal (B) and mesial (M). The grade of severity was also recorded as follows: slight (S), medium (M) and heavy (H) and also whether it was subgingival or supragingival (after Brothwell, 1981; Hillson 1986, 1996).

Linear Enamel Hypoplasias (LEH), or defects on the tooth enamel, are observed in teeth as a series of lines, grooves or pits, which are related to systemic metabolic stress, hereditary anomalies and trauma (Infante and Gillespie, 1974; Sweeney et al., 1971). LEH were described according to Buikstra and Ubelaker (1994): type of tooth, type of defect (1 – linear horizontal grooves, 2 – linear vertical grooves, 3 – linear horizontal pits, 4 – non-linear array of pits, 5– single pits), the position (1 – cusp, 2 – middle section of crown, 3 – neck), and the type of hypocalcification, if present (1 – yellow-cream, 2 – orange, 3 – brown). Timing of the defect was calculated according to Reid and Dean (2000). However, there are issues when using this method, as it is based on modern tooth development and it cannot be assumed that the growth rate was the same in past populations (Hillson, 1997). LEH was specifically used to test social differences among those individuals buried in megalithic tombs and those in non-megalithic tombs. This was done assuming the fact that those individuals who survived to develop LEH were higher status than the others.

In addition, periapical lesions were documented based on the location and whether there was an association with a carious lesion or tooth wear (Roberts and Connell, 2004; Ogden, 2008). Ante-mortem tooth loss was also recorded and is described as the loss of a tooth before death. It can be the result of a number of conditions, e.g. caries, dental abscess, and periodontal disease (Clarke and Hirsch, 1991; Hildebolt and Molnar, 1991).

4.10.- Isotope analysis

In order to investigate whether social differentiation occured among the individuals buried at La Pijotilla, Valencina-Castilleja and La Orden-El Seminario, residential mobility and paleodiet were analysed (Table 4.16). For this reason, isotopic analysis of the ratio of strontium ($^{87}Sr/^{86}Sr$) was used to estimate mobility (change of residence), while carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) were used to estimate the type of diet consumed.

SITE	N SAMPLES	δ ^{13}C and δ ^{15}N	^{87}Sr/^{86}Sr	LAB
VC	12/44	6 human 6 non-human	-	Max Planck Institute (Leipzig, Germany))
VC	16	-	14 human 1 non-human 1 soil	Arizona State University (USA)
VC	25		19 human 6 non-human	University of Iowa and University of Illinois (USA)
LP	1/58	1 human	-	Max Planck Institute (Leipzig, Germany)
LP	21/30	-	17 human 4 non-human	University of Iowa and University of Illinois (USA)
LS	15/37	2 human 13 non-human	-	Max Planck Institute (Leipzig, Germany)

Key to table: VC= Valencina-Castilleja; LP= La Pijotilla; LS= La Orden-El Seminario.

Table 4.16. Site, number and type of biochemical analysis carried out in this study

4.10.1.- Sampling strategy

The criteria to select the samples for analysis were to choose a representative sample from each of the sites based on the preservation of the samples. Two different types of samples were taken: tooth enamel to exploring mobility and bone collagen to research paleodiet. Prior to conducting these destructive analyses and sampling of the teeth, a photographic record of each bone or tooth used for isotopic analysis was taken. Following this stage, the teeth used for the study were cast. This process was carried out using Alginate Jeltrate Dustless casting material to make dental impressions. Enamel samples were extracted from each permanent tooth giving priority to molars because they are the last to erupt (second molars, third molars and first molars, respectively). When sampling for paleodietary analysis, and because of the fragmentation of the collections, to avoid double sample repetition, a mandibular or skull fragment was used for bone collagen analysis. Faunal enamel and bone collagen samples and an environmental (soil) sample were also used to determine the local baseline for each site (Knudson et al., 2012; Knudson and Price, 2007; Knudson et al., 2004; Price et al., 2002).

The samples were analysed in three different laboratories: for paleodietary analyses, a set of samples were sent to the Max-Planck Institute for Evolutionary Anthropology in Leipzig, and for mobility one set of samples was sent to Arizona State University and others to the University of Iowa and Illinois University. In the following section, the laboratory procedures and the methodology applied for each laboratory will be described in detail.

4.10.2.- Introduction to paleodiet

Studies in paleodiet started in 1977, when one of the first meetings about the application of new biochemical techniques, such as those analysing stable isotopes, was held in the United States. As a result of this meeting, the coordinator and one of the first major experts in this field, Douglas T. Price, edited "The Chemistry of the Prehistoric Human Bone" (Price and Haas, 1989). This book represents a synthesis of one of the first meetings of specialists in biochemistry and documents new applications, mostly of carbon isotope and trace element analyses to human remains to answer questions about diet. Since then, a enormous quantity of analyses have been carried out worldwide and today, the analysis of $\delta\ ^{13}C$ and $\delta\ ^{15}N$ in bone collagen in combination is largely how diet in past populations is explored.

4.10.2.i.- Carbon isotope analysis

Carbon isotope analysis was first used in North America to investigate the introduction of maize in diet (Vogel and Van der Merwe, 1977). However, since then numerous projects have been carried out to research past diets in North America (Bender et al., 1981; Bumsted, 1984; Schwarcz et al., 1985; Farrow, 1986; Boutton et al., 1984; Lovell et al., 1986; Lynott et al., 1986; Buikstra et al., 1988; Fogel et al., 1989; Decker and Tieszen, 1989; Spielmann et al., 1990; Buikstra and Milner, 1991; Matson and Chisholm, 1991; Katzenberg and Kelley, 1991; Schurr, 1992; Ezzo, 1993).

Carbon has two stable isotopes ^{12}C (with a relative abundance of 98.89%) and ^{13}C (with a relative abundance of 1.11%) (Lambert, 1997). It is found in the atmosphere in the form of carbon dioxide (CO_2) with a constant ratio of $^{13}C/^{12}C$ (Chisholm, 1989). Carbon becomes incorporated into plants through photosynthesis and it will vary across plant communities depending on predictable patterns of isotopic fractionation. There are three groups of plants, classified according to their photosynthetic pathways: C_3, CAM and C_4 plants (Bender, 1971). C_3 plants are those that use the Calvin-Benson pathway (Schelesinger, 1997: 129), which results in three composed carbon atoms (phosphoglyceric acid). This group includes all trees, woody shrubs, cereals such as wheat (*Triticum* spp.), barley (*Hordeum vulgare* L.), oat (*Avena sativa*), rye (*Secale cereal)*, fruit, vegetables and most temperate climate grasses (Van der Merwe and Vogel, 1978; Van der Merwe, 1982; Vogel and Van der Merwe, 1977). The second group is represented by the type C_4, which uses the Hatch-Slack cycle, where there is only one molecule of four carbon compounds or oxaloacetic acid. This group includes tropical grasses like maize (*Zea mays)*, millets, sorghum (*Sorghum* spp.) and sugar cane, among others (Whelan et al, 1970; Van der Merwe, 1982). The third group is the CAM (crassulacean acid metabolism) type, which combines C_3 and C_4 and includes succulent plants like pineapple and some types of cacti (Randson and Thomas, 1960; Smith and Epstein, 1971; Smith, 1972; Chisholm, 1989).

The investigation of paleodiet is based on the different composition of plants C_3 or C_4 and the proportion of each, taking into account the shift in values from diet to the human tissue. For instance C_3 plants discriminate more CO_2 than C_4 plants and they fix carbon with an average of -26‰, while the values for C_4 plants have an average of -13‰ (Bender, 1968; Smith and Epstein, 1971; Denies, 1980; O´Leary, 1981). Carbon isotope ratios are also used to discriminate the consumption of plants from a marine against a terrestrial environment. Therefore, marine environments include plants that fix carbon according to the type of C_3 and have an average of -19‰. The exceptions in this group are found in estuaries, with a $\delta^{13}C$ value of -12‰ (Ambrose et al., 1997). According to Ambrose et al., (1997), during prehistory, $\delta^{13}C$ values would probably have been less negative, so in this sense, it is necessary to correct the ratio by -0.5‰ for marine resources, although this is still an estimation. Previous studies on Western Europe show that for this region considered in this work, the average $\delta^{13}C$ is -20 (±1) ‰ (Richards and Hedges, 1999a).

The proportion of stable carbon isotopes is expressed through the delta notation (δ) in relation to a standard, in this case the marine fossil PDB[22] (Pee Dee Belemnite), and corrected by the new standard VPDB[22] (Vienna-Pee Dee Belenmite), which has this formula:

$$\delta^{13}C = ((^{13}C/^{12}C)_{sample}/(^{13}C/^{12}C)_{standard})-1)x\ 1000$$

[21] The PDB value is 0.0112372 after Craig (1957)

[22] According to the International Atomic Energy Agency (IAEA) the VPDB value is 0.011183

Most dietary resources have lower ratios of $^{13}C/^{12}C$ than the PDB and, because of that, the $\delta^{13}C$ results are always negative and are noted in parts per mil (‰).

4.10.2.iii.- Nitrogen isotope analysis

As has been pointed out above, $\delta^{15}N$ is used in combination with $\delta^{13}C$ to explore the diet of ancient populations (DeNiro and Epstein, 1981). In this case paleodiet is investigated according to the different values of $\delta^{15}N$ which depends on the trophic level of the animal diet and, furthermore, is an enrichment of $\delta^{15}N$ of about 3-5‰ at each trophic level (Schoeninger and DeNiro, 1984; Schoeninger, 1985; Minagawa and Wada, 1984; Fizet et al., 1995; Schoeninger et al., 1983; Bocherens and Drucker, 2003).

Nitrogen has two stable isotopes: ^{15}N (with a relative abundance of 0.36 %) and ^{14}N (with a relative abundance of 99.64%). According to Schoeninger and Moore (1992), over 99% of nitrogen is in the atmosphere or in the ocean. Nitrogen isotope ratios are based on the measurement of $\delta^{15}N$ and the international standard is the atmospheric air (AIR) (Mariotti, 1984). The proportion of stable nitrogen isotopes is expressed through the delta notation (δ) in relation to a standard (AIR),expressed in parts per mil (‰),calculated according to the this formula:

$$\delta^{15N} = ((^{15}N/^{14}N)_{sample}/(^{15}N/^{14}N)_{standard})-1)x\ 1000‰$$

The method is based on the comparison of $\delta^{15}N$ from terrestrial to marine environments. In marine environments, animals have higher values than those from terrestrial environments (Schoeninger and DeNiro, 1984) (Figure 4.13).

The stable isotope of nitrogen is used in combination with carbon, according to the mean values of plants ($\delta^{13}C$) and animals ($\delta^{15}N$) respectively. This is very helpful in understanding better the ecological niche of those populations and their subsistence strategy. However, there are other skeletal indicators that add information about dietary deficiencies (e.g. LEH, scurvy) or excess (e.g. gout, DISH) (Roberts and Manchester, 2007).

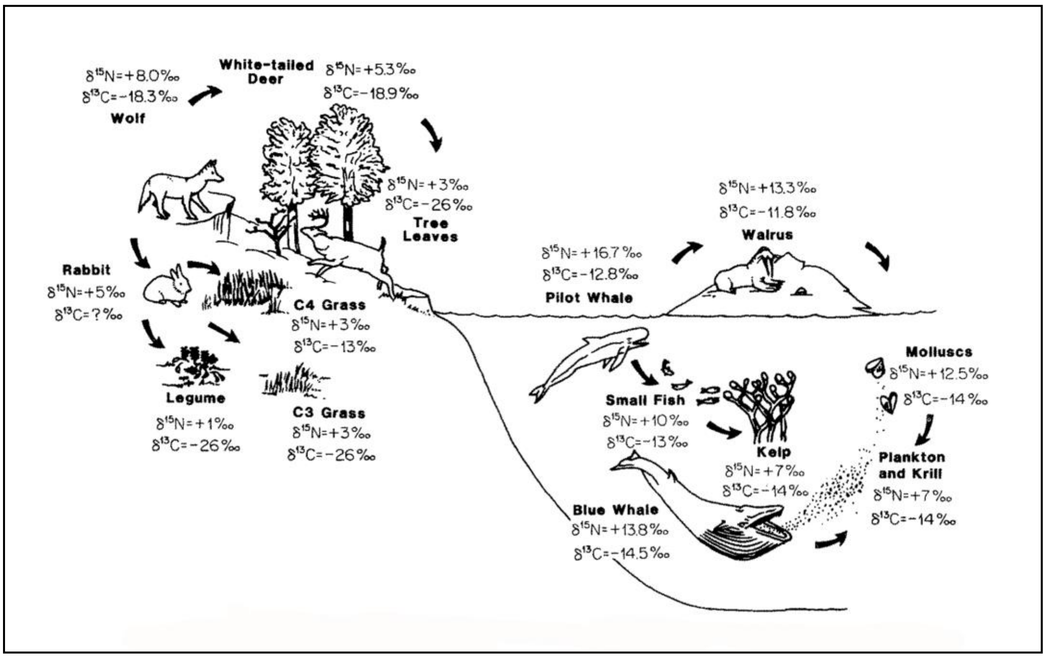


Figure 4.13. Ratios of carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) in the biosphere (after Schoeninger and Moore 1992: 257).

4.10.2.iii.- Analysis of prehistoric diet in the Iberian Peninsula

Stable isotope analysis has been in use for many years now, and there have been many studies around the world investigating paleodiet from different time periods. In the following section, only studies of prehistoric Iberia will be described (Table 4.17). A total of 17 studies have been carried, of which 16 have included human remains from prehistoric Iberia ranging in date from the Paleolithic until the Iron Age. The two main areas that have been mostly investigated are Central and South Portugal and the Spanish Levant (Valencia and Catalonia), mostly dated from the Paleolithic to Neolithic periods. In this sense, this thesis is a contribution to knowledge of diet in the first agricultural societies established in south-west Spain at two of the key sites, Valencina-Castilleja and La Pijotilla.

SITE	PERIOD	REFERENCE
Atapuerca	Pleistocene	García García et al., 2009
Cova Pastora	Paleolithic	McClure et al., 2011
Balma Guilanyá	Paleolithic	García-Guixé et al., 2009
El Collado	Paleolithic	García-Guixé et al., 2006a, 2006b
Muge and Sado	Mesolithic	Umbelino, 2006; Roksandic (2006)
La Poza l´Egua J3 and Colomba	Mesolithic-Neolithic	Arias (2005)
Northern Spain: Cantabrian shellmidens	Mesolithic-Neolithic	Fano (2007)
Central and South Portugal	Mesolithic-Neolithic	Lubell et al., 1994
Valencia	Mesolithic-Neolithic	Salazar García, 2010
Torre la Sal	Neolithic	Salazar García, 2009
Central Portugal	Mesolithic-Bronze Age	Waterman, 2012
Valencina-Castilleja	Copper Age	Fontanals-Colls, et al., 2012; see Chapter 4
La Pijotilla	Copper Age	see Chapter 4
La Vital	Copper Age	Salazar García, 2011a
La Orden-El Seminario	Neolithic-Copper Age	see Chapter 4
Ibiza and Formentera	Copper Age-Medieval	Fuller et al., 2010
Can Marines	Iron Age	Salazar García, 2011b

Table 4.17. List of prehistoric sites with paleodietary ($\delta^{13}C$ and $\delta^{15}N$) studies in the Iberian Peninsula

The Department of Biology from the Autonomous University of Barcelona was a pioneering centre for research on paleodiet based on trace element analysis in Spain. The team, coordinated by Professors Malgosa Morera and Subirá de Galdácano, has directed 15 research projects and published many papers on methodology (Malgosa Morera et al., 1989; Subirá de Galdácano and Malgosa Morera, 1991; Subirá de Galdácano, 1993a, 1993b; Subirá de Galdácano et al., 1995; Malgosa Morera and Subirá de Galdácano, 1996; Subirá de Galdácano and Safont, 1996; Malgosa Morera and Subirá de Galdácano, 1997), and the application of trace element analysis to sites in Catalonia (Malgosa Morera et al., 1989b; Subirá de Galdácano et al., 1994), Valencia (Malgosa Morera et al., 1992) and Andalusia (Malgosa Morera et al., 1992; Cabrero García et al., 1997; Safont et al., 1998). Since scientific methods develop and change, and trace element analysis presented difficulties to deal with diagenesis, for this reason the development of new techniques for paleodietary research has led this group to investigate diet by analysing stable isotopes of

^{13}C and ^{15}N; this has generated new publications on paleodiet in prehistory, such as that based on work in Valencia (García Guixé et al., 2006a, 2006b).

One of the first bioarchaeological projects carried out in the Iberian Peninsula was the work of Rihuete Herrada (2003) at Cova del Carritx (Menorca). This wonderful work is very complete and includes the study of palaeodiet ina large collective burial. A regional project in the south west of the Iberian Peninsula carried out by Cabrero García (1993) entitled "Análisis del proceso cultural operado en las sociedades agrarias de la campiña sevillana entre el IV y el II milenios A.C." also did some biochemical analysis for paleodietary information (Cabrero et al., 1997).

Two other bioarchaeological projects where biochemical analysis has been applied are those at the site of Gatas in the south east of Spain, and Palacio III, located in the south west. These two sites have been explored to document mobility and change of residence for the populations, along with trace elements and $\delta^{13}C$ for paleodiet; $\delta^{13}C$ and $\delta^{15}N$ stable isotope analysis will be undertaken in the future to also investigate diet. The site of Gatas (Díaz-Zorita Bonilla et al., 2012) and the site of Palacio III (Díaz-Zorita Bonilla et al., in press; Díaz-Zorita Bonilla et al., 2009) offer new applications for the investigation of past societies.

Since 2007, the author has been working in collaboration with Prof. Subirá de Galdácano on carbon and nitrogen stable isotope analysis. One of the last sets of analyses has come from Montelirio, one of the largest megalithic monuments of the Copper Age site of Valencina-Castilleja (Fontanals et al., 2012). The results have been included in the discussion in Chapter 5 as a comparative analysis for data generated in this thesis.

4.10.2.iv.- Laboratory sample procedure

Sample preparation for carbon and nitrogen analyses was done in the Department of Human Evolution at the Max-Planck Institute for Evolutionary Anthropology (Leipzig, Germany). A sample of about 90-200 mg was taken from each human and animal bone. To avoid contamination, the bones were initially cleaned using a sand-blaster. The sample procedure to extract collagen was done following the modified protocol of Longin (1971) adding ultrafiltration (Brown et al., 1988) and outlined in Richards and Hedges (1999).

In order to demineralise the bone, the sample was crushed. Afterwards, it was placed into a 10ml test tube and then 0.5M of refrigerated HCl was added into each tube without completely filling them. Each tube was covered with aluminium foil to avoid CO_2 evaporation and then the tubes were left to settle in the refrigerator for several days. The HCl was changed every two days. When the sample was ready and demineralised, the supernatant was decanted and the sample rinsed three times in purified water to achieve near-neutral solution.

The next step was gelatinisation, which consists of the denaturalisation of the collagen to make the protein soluble. For this reason, to denature the collagen, it was heated in a weak acidic (pH3) solution and then diluted in 0.5M HCl; purified water was added to achieve pH3 solution. Test tubes were then sealed to prevent evaporation of the solution and left in a heater block for 48 hours at 75ºC. The samples were then filtered using an Ezee® filter of 5 µm (Evergreen Scientific). The samples were then ultrafiltered with filters of 30 kDa at the first step, then at 10 kDa with dilute 0.5 M NaOH, and then centrifuged at 2,500 rpm for 20 minutes to avoid contamination. The filters were rinsed with MilliQ water (three times for 20 minutes, centrifuged at 2,500 rpm) and the NaOH was discarded. The supernatant was decanted into pre-weighed clean plastic tubes, sealed, and then the samples were frozen at -28ºC. The samples were then lyophilized for 24-48 hours and then the extracted collagen was weighed. The collagen yield was calculated and used as an indicator of the quality of the collagen (Chapter 5) according to this formula:

Weight of collagen/original sampled bone weight x 100

The analysis of the ratio of the stable isotopes of carbon ($^{13}C/^{12}C$) and nitrogen ($^{15}N/^{14}N$) was done over the fraction >30kDa of the liofilized extracted collagen (about 0.5mg). Samples were analysed using ThermoFinnigan Delta XP and ThermoFinnigan Flash or Eurovector elemental analysers.

The data are presented as parts per mil (‰) expressed as $\delta^{13}C$ and $\delta^{15}N$ in relation to the standard V-PDB (Vienna-PeeDee Belenmite) and atmospheric N_2 (AIR-ambient inhalable reservoir standard), respectively. In order to check the biochemical quality of the collagen, the parameters used were: %C (>15), %N (>5) and C:N (2.9-3.6) (De Niro, 1985; Van Klinken, 1999). Three standards (Brad-001 methionine, Liver 1577b and IAEAN1/CH6) of known value (expected $\delta^{13}C$= -29.77‰ and $\delta^{15}N$= -2.22‰, $\delta^{13}C$= -21.17‰ and $\delta^{15}N$=

7.49‰ and $\delta^{13}C$= -10‰ and $\delta^{15}N$= 0.4‰ respectively) were also used. The main objective in using this standard was to calibrate the machine at the beginning and at the end of analysis and to check the values of C and N of each sample after the analysis. Each sample was analysed twice; the results present the average of each sample ($\delta^{13}C_{av}$ and for $\delta^{15}N_{av}$). The analytical error is two standard deviations for $\delta^{13}C$ and an interval of plus or minus < 0.2‰ for $\delta^{15}N$.

4.10.3.- Introduction to mobility and change of residence in the past

The concept of mobility refers to the change of place from one site to another. There are many reasons behind why people move residence, including political conflicts, ecological crisis, environmental catastrophes, social relationships (e.g. marriage), trading, exchange of goods and residential mobility, among others. Research on mobility, in combination with archaeological contextual data, plus radiocarbon and DNA data, are potentially useful tools for investigating human history and the formation and abandonment of archaeological sites, but of course there are other methods like the investigation of the origin of the raw archaeological materials, non-metric traits analysis and metrical data, among others.

The identification of human mobility through the archaeological record is challenging. The method used in this study is radiogenic and stable isotope analyses, in which humans and animals are used as the basis to investigate mobility through comparison of isotope values with geological signatures for each specific area. However, the study of mobility of the living population is much more straight forward (Dobyns, 1993; Edgar, 2007; Weale et al., 2002; Klimentidis et al., 2009; Maggiano et al., 2008; Marchi, 2008).The analysis of mobility patterns allows us to explore the complexity of socio-political and ideological characteristics of human communities in the past. In this research, mobility is considered along with the osteological and contextual evidence to try to better understand social structure of these prehistoric populations in southern Spain.

The analysis of radiogenic stable isotopes of strontium ($^{87}Sr/^{86}Sr$) in bioarchaeology is mainly used to investigate mobility patterns in human and animal populations. Although over the last years there has been an enormous increase in the number of projects, the use of strontium to investigate prehistoric residence started thirty years ago (Ericson, 1981, 1985) but most studies have been produced over the last 15-20 years, and continue today.

Many projects around the world have been carried out where the extent of mobility has been analysed in archaeological populations from a wide chronology, from North America (Price et al., 1994b, 2007; Ezzo et al., 1997; Ezzo and Price, 2002; Ericson, 1985; Quinn et al., 2008; Beehr, 2011), Central America (Lafoon, 2012; Wright, 2005; Wright et al., 2010; Price et al., 2000, 2010; Schroeder et al., 2009; Tiesler et al., 2010; Booden et al., 2008), South America (Slovak et al., 2009; Conlee et al., 2009; Knudson et al., 2004, 2005, 2009, 2012; Knudson and Buikstra, 2007; Knudson and Price, 2007; Knudson and Blom, 2009; Knudson, 2008; Tung and Knudson, 2008, 2010; Knudson and Torres-Rouf, 2009; Turner et al., 2009; Andrushko, et al., 2009, 2011; Bastos et al., 2011), Africa (Cox et al., 2011; Tafuri et al., 2006; Balasse et al., 2002; Copeland et al., 2010; Sillen et al., 1995; Sillen et al., 1998; Buzon et al., 2007; Sealy et al., 1995; Cox and Sealy, 1997), Europe (Roberts et al., 2013; Bentley et al., 2002, 2003, 2004, 2012; Frei and Price, 2012; Knudson et al., 2012; Kendall et al., 2012; Montgomery, 2002; Sjögren et al., 2009; Bentley and Knipper, 2005; Jay et al., 2007; Muldner et al., 2009; Grupe et al., 1997, 1999; Nehlich et al., 2009; Muldner et al., 2009; Montgomery et al., 2000, 2003, 2005, 2007a, 2007b, 2011; Chenery et al., 2010; Chiaradia et al., 2003; Giblin, 2009; Haak et al., 2008; Latkoczy et al., 1998; Nehlich et al., 2009; Oelze et al., 2012a, 2012b; Smits et al., 2010; Price and Gestsdóttir, 2006; Eckhardt et al., 2009; Evans et al., 2006; Budd et al., 2004; Richards et al., 2008; Price et al., 1994a, 1998, 2001), Asia (Kusaka et al., 2009, 2011; Haverkort et al., 2008; Gregoricka, 2011; Perry et al., 2008; Welton, 2010; Valentine et al., 2008; Copeland et al., 2010; Bentley, 2007; Bentley et al., 2005, 2007b, 2009) and Oceania (Bentley et al. 2007a, Shaw et al., 2009, 2010, 2011), among others.

4.10.3.i.- Strontium isotope analysis

Strontium (Sr) is an alkaline earth metal that has four isotopes; three of them are stable ^{84}Sr (with a relative abundance of ~0.5%), ^{86}Sr (~9.8%), ^{83}Sr (~82.5%) – and one of them is radiogenic (^{87}Sr, with a relative abundance of ~7%) as a result of the radioactive decay of rubidium (^{87}Rb), and with a half life of 4.88 x 10^{10} years (Bentley, 2006). The system of decay of Rb-Sr is used in geochemistry and the ratio $^{87}Sr/^{86}Sr$ represents the abundance of Rb and Sr and the age of the rocks or mineral (Bentley, 2006). To compare the abundance of the isotope ^{87}Sr in the different samples, ^{87}Sr is normalized with the non-radiogenic isotope ^{86}Sr, and expressed as the ratio of $^{87}Sr/^{86}Sr$. This ratio is variable according to the age of the rocks and, for example, the lowest ratio could be found in basic volcanic rocks like younger basalts from 0.703-0.704, while the highest ratio of $^{87}Sr/^{86}Sr$ is found in older granites with a maximum of 0.740 (Bentley, 2006). But what is the relationship of the geology to the observed values in humans? Humans incorporate biogenic strontium through their diet and it replaces calcium, fixing the crystalline structure of hydroxyapatite in teeth and bones (Price et al., 1994b).

The concentration of strontium in plants and animals vary by trophic level, although it does not fractionate due to the small mass difference among the ^{84}Sr, ^{86}Sr, ^{88}Sr and ^{87}Sr isotopes (Price et al., 1994b). For instance, strontium will be homogeneously distributed in the skeleton and the value of $^{87}Sr/^{86}Sr$ found in tooth enamel will reflect the value of $^{87}Sr/^{86}Sr$ in plants, animals and water consumed (Figure 4.14), and therefore the isotope ratios found in soil and bedrock of the geological area (Sillen et al., 1998). However, according to Bentley et al. (2012) the values of $^{87}Sr/^{86}Sr$ in tooth enamel reflects the subsistence patterns rather than the exact geological location since this ratio reflects "a mixture of the weathered sediments, stream waters, and prehistoric anthropogenic inputs in agricultural soils" (Bentley et al., 2012: 9327). In addition, according to Montgomery (2010) other factors need also to be considered such as the effect of cooking, drift geology, and water supplies on ratios.

This method is based on the assumption that humans obtain their food from the locality, and therefore, if there are any outliers, it may be concluded that food supplies were obtained from a different geological region. This is done based on the fact that tooth enamel starts forming in childhood and does not change its signature (teeth do not remodel like bone), the $^{87}Sr/^{86}Sr$ ratio will reflect the place where the individual spent their childhood. If there is an understanding of the local geology and the animal truly reflect the local bioavailable Sr, then individuals could be interpreted as locals or non-locals according to these facts.

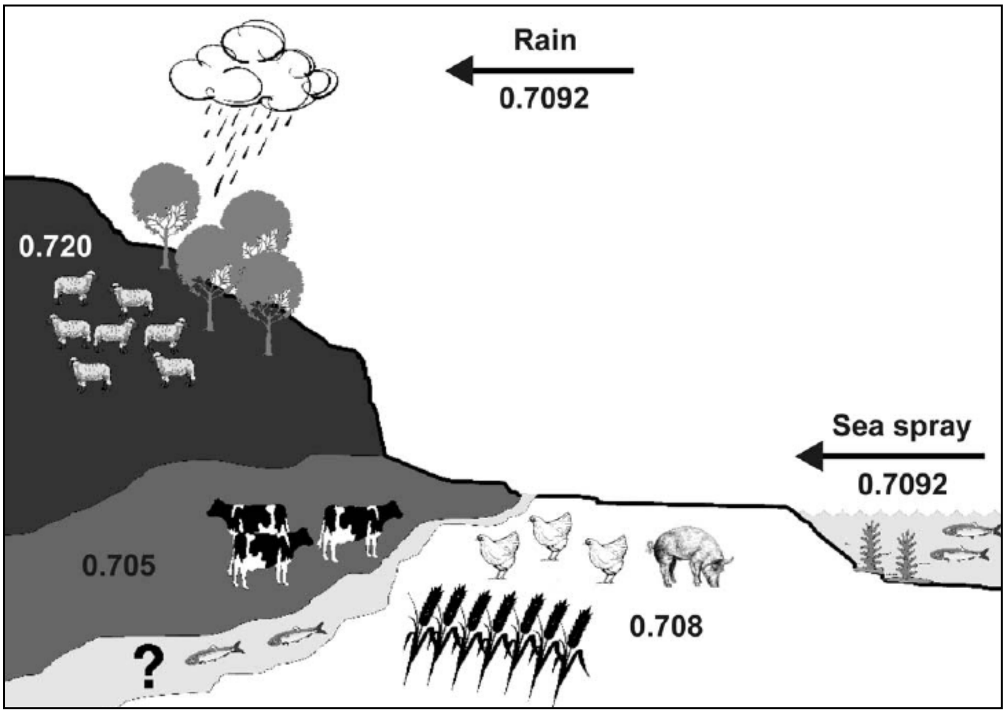


Figure. 4.14. Different sources of Sr that could be incorporated into the human diet (after Montgomery, 2010)

4.10.3.ii.- How to interpret the values and to define the local range

There are different ways to define the local range, and one of the methods uses isotope ratios from enamel compared to bone from the same individual (Price et al., 1994a). In this case enamel will reflect the place of origin, and differences in observed values between enamel and bone could identify non-local individuals. This method has a key problem, discussed before, where diagenesis affects bone and ratios they might not reflect the biogenic Sr (Lee-Thorp, 2002; Budd et al., 2000). The second method uses statistical analyses to define the local vs. non local individuals based on the human enamel Sr data, and has been used before with success (Grupe et al., 1997; Price et al., 1994a, 2001; Bentley et al., 2002, 2004). The local range is estimated based on the mean of all isotopic ratios at two standard deviations (mean $\pm 2\sigma$). This approach could be problematic as the range could include most of the values and underestimate the non-local individuals.

The third of the methods incorporates environmental samples such as bedrock, plants, soil and water which could reflect the local ratios, assuming that the ratio is similar to those local individuals (Evans et al., 2009, 2010, 2012; Wright, 2005). However, the major issue with using these baseline samples is that these values will represent a wider isotopic variation than the dental enamel signature (Price et al., 2002; Bentley et al., 2002, 2004). Previous research in Neolithic samples showed that they will reflect the heterogeneity of the catchment area and, for instance, subsistence patterns, rather than the exact local geology (Bentley et al., 2012:9327).

A fourth method uses contemporary faunal remains from the archaeological site to ascertain locality. In this case, using local fauna with restricted mobility is recommended (Price et al., 2002). For example, transhumant animals might not be acceptable as they might show a wider range of strontium. However, small animals like rabbits and domestic animals, such as cattle (if not mobile) and pigs could be very useful because their catchment range would be similar to that of the humans. Obviously, this sampling strategy might vary according to the chronology and geology of the site location and may need to be redefined for each study. This has been well investigated in some studies (Bentley et al. 2002, 2004).

In this thesis, the strategy chosen to define the local range of Sr was to use a combination of archaeological tooth enamel from fauna who lived locally at the same time as the humans, and human enamel and soil samples. Since in an end-member system strontium ratios are not normally distributed (Montgomery, 2010), the isotopic data from the human and the animal strontium values was statistically analysed to identify outliers. Afterwards, strontium values from the remains were compared to the available ratios of $^{87}Sr/^{86}Sr$ from the sites. This strategy has been used before with success with other European prehistoric remains (Bentley et al., 2002, 2003, 2004).

Although stable isotope analysis provides interesting results and answers archaeological questions, there are limitations. The use of the ratio of strontium might not be suitable for all archaeological questions. However, it is assumed that Copper Age communities were settled communities and that most of the individuals were presumably locals. However, before starting isotopic analysis to investigate human mobility, a clear sampling strategy needs to be designed. An hypothesis and questions to be answered need to be developed according to what is known about the site/period/region, and the possible effect of diagenesis on sample selection needs also to be considered.

Strontium diagenesis has been discussed by many authors (e.g. Sillen, 1986, 1989; Sillen and LeGeros, 1991). There is a need to discriminate biogenic strontium, since some diagenetic minerals could have been incorporated from the burial environment. However, the use of bone is not now accepted because of digenetic effects (Hoppe et al., 2003; Lee-Thorp, 2002; Nelson et al., 1986; Nielsen-Marsh and Hedges, 2000; Tuross et al., 1989). According to several studies (Budd et al., 2000; Chiaradia et al., 2003; Hillson, 1997; Hoppe et al., 2003; Horn et al., 1994; Price et al., 2001; Trickett et al., 2003) enamel appears to be a reliable source of strontium which makes it a valid material for mobility studies because it is resistant to any chemical change (Ericsson, 1993; Budd et al., 2000; Lee-Thorp and Van der Merwe, 1991; Montgomery et al., 2000; Price et al., 1994a, 2002; Trickett et al., 2003). In this thesis, to avoid problems with diagenesis, only human and faunal tooth enamel was analysed.

4.10.3.iii.- Strontium isotopes studies in the Iberian Peninsula

However, in relation to strontium isotopes studies of human mobility in the Iberian Peninsula, only seven projects have been carried out, which chronologically span from the Neolithic up to the Medieval Period. From these projects, only five have been published already or are accepted for publication (Díaz-Zorita Bonilla et al., 2009, 2012, in press; Romero et al., 2009; Waterman, 2012) three of them are conference posters (Díaz-Zorita Bonilla et al, 2009; Waterman et al., 2011; Boaventura et al., 2010) and a short published conference abstract (Prevedorou et al., 2009). There is also an ongoing project titled "Approach to Early Neolithic Communities in the north-east of the Iberian Peninsula Through Their Burial Practices[23]" directed by J. Gibaja Bao (CSIC-Barcelona) where isotopic analysis of strontium ($^{87}Sr/^{86}Sr$) will be carried out to analyse change of residence of the last-hunter gatherers and the first agriculturalist societies in north-east Spain.

[23] The author of this work is member of this project and involved in the biochemical analysis

The debate about human mobility in the Iberian Peninsula has always focused on material culture as a way to detect human interactions, based on the exchange or diffusion of ideas, materials and artefacts (Lillios, 1997, 1999; Close, 2000; Cardoso and Carvalhosa, 1995). During the Copper Age, foreign exotic raw materials such as amber, greenstones, red pigments, flint, ostrich egg or ivory appear at large settlements and enclosures such as at Valencina-Castilleja (Vargas Jiménez, 2004a, 2004b; Costa Caramé et al., 2010; Schuhmacher et al., in 2013; Murillo Barroso and García Sanjuán, 2013) and La Pijotilla (Hurtado Pérez et al., 2000). This evidence suggests that there was contact, exchange and trade over both short and long distances. One of the relevant topics of research for this thesis is to explore the extent of that mobility associated with "foreign" materials and if this also implies short or long distance movements and, if so, what are the social implications for the communities living in the area. However, mobility of people has not been investigated yet for the sites which are the subject of this research.

4.10.3.iv.- Laboratory sample procedures

4.10.3.iv.a.- Arizona State University

The samples were of approximately 8 mg of tooth enamel powder. To avoid contamination, the samples were treated with 0.5 ml of 5M of nitric acid HNO_3 and then heated to 100ºC for approximately 40 minutes to allow for evaporation. Once the strontium was obtained, 0.25 ml of 5 M HNO_3 was added to the sample and they were then purified through ionic exchange columns that contained 0.1ml of EiChrom Sr Spec resin (50-100 µL diameter), previously washed twice with 0.750 ml de 5M HNO_3. The sample was precipitated in 0.25 ml of HNO3, and columns were washed three times with a dilution of 1.5 ml of distilled water. Once the samples were dried at 100ºC, they were dissolved in 0.64mL of 5M HNO_3. The next step was to dissolve the samples in 9.36 ml of distilled water. Finally the samples were diluted into 1.0 mL of 0.32M HNO_3 and analysed in the Thermo Neptune MC-ICP-MS by Dr G. Gordon at the W. M. Keck Foundation Laboratory for Environmental Biogeochemistry at Arizona State University

4.10.6.i.b.- The University of Iowa and Illinois University

At the University of Iowa, a small amount of enamel was removed (4-10 mg) with a Dremel drill and 1/16" diamond drill bits from the tooth of each selected human or animal. Before each sample was collected, the enamel surface was cleaned with acetone and then the top layer of enamel was removed using a burr drill bit. The surface and drill bits were then cleaned in acetone again before the enamel samples were removed. For the rabbits, both enamel and mandibular bone was sampled, as the dental structures were too small to be sampled independently. For the snails, shell fragments were removed using the same methodology used for the dental remains. Each enamel sample was prepared in the University of Iowa Department of Geoscience clean laboratory where the strontium was separated out from each sample using Eichrom Sr Spec resin and the following methodology. One mL of 3 M HNO_3 was added to each sample and then the samples were sonicated for 10 minutes to aid dissolution. Next, pipette tip columns were prepared by inserting 300 µL of Sr spec resin into each column using a pre-cleaned pipette and conditioning the columns first with 3 mL of H_2O (10 column volumes) and then with 3 mL of 3 M HNO_3 (10 c.v.). After the columns were prepared, the samples were loaded into each column; each sample was washed through first with 450 µL of 3 M HNO_3, then with 750 µL of 3 M HNO_3 and finally with 2.0 mL of 3 M HNO_3. The Sr was then collected in 4.5 mL of MQ H_2O. The collected samples were then dried on a hotplate. After all samples were dry, one drop of concentrated HNO_3 was added to each, and they were dried a second time. Next, the samples were rediluted in 3 M HNO_3 and $^{87}Sr/^{86}Sr$ ratios were obtained by running each sample on the Nu Plasma HR multicollector inductively-coupled-plasma mass spectrometer (MC-ICP-MS) housed at the University of Illinois Department of Geology Multicollector ICP Mass Spectrometer Laboratory under the supervision of Dr. Craig Lundstrom. Any minor isobaric interference of ^{87}Rb on ^{87}Sr was corrected by monitoring mass 85 and using the natural $^{87}Rb/^{85}Rb$ ratio (0.3855). Sr isotope ratios were then corrected for instrumental mass fractionation using the exponential law and the accepted value for $^{86}Sr/^{88}Sr = 0.1194$.

4.11.- Radiocarbon analysis (AMS)

In order to have secure archaeological contexts for some of the different structures used in this research, a selection of 39 bone samples were sent to the *Centro Nacional de*

Aceleradores at the University of Seville to be dated. Due to technical problems, only 5 of them were measured in time and the results can be found in chapter 5, section 5.10.

4.12.- Statistical analysis

The results of the bioarchaeological study were analysed through the application of statistics using the Statistical Package for the Social Sciences (SPSS) for Windows version 19, Paleontological Statistics (PAST) software for Windows (Hammer and Harper, 2006) and Microsoft Excel for Windows for data analysis. The data was analysed using the t-test, one-way ANOVA, Mann-Whitney *U* test and χ^2 (e.g. Chamberlain, 2006; Redfern et al., 2010; Britton et al., 2008; Richards et al., 2006; Jennings, 2010).

Intra-observer error testing

To check the intra observer error, the Mann-Whitney *U* test was done. This test is usually performed with continuous data to identify if two groups of data have a similar average. In this case this does not need to be normally distributed. This test was performed to estimate intra-observer error based on two independent samples (BL and MD measurements of teeth).

Intra- and inter site differences

The next tests were used to check intra- and inter-site differences among La Pijotilla and Valencina-Castilleja. The t-test is normally used to identify if two sample populations have a normal distribution and a similar average. This was used specifically to check whether there were intra-site differences according to the different type of structures (megalithic vs. non-megalithic) at Valencina-Castilleja based on the analysis of $\delta^{13}C$ and $\delta^{15}N$**.** The one-way ANOVA test is normally employed with continuous data to check whether in two or more sample populations there are normal distribution and a similar variance. This was used at an intra-site level of analysis at the site of Valencina-Castilleja to check the degree of mobility among individuals by different sectors. On the other hand, the chi square analysis is used for qualitative data to check whether two groups of data have the same distribution or not. This was used to check whether there were significant differences among the non-local vs. local individuals by sex and/or age category at Valencina-Castilleja. The significance level was set at $P \leq 0.05$.

CHAPTER 5. RESULTS

5.1.- Number of bones and teeth/fragments

The database just for the site of La Pijotilla contains 10,580 records corresponding to the 10,580 bags. A total of 283,329 bone and tooth fragments were identified from this site.

5.2. The MNI (minimum number of individuals)

5.2.1.- La Pijotilla

The MNI (minimum number of individuals) was calculated based on the most frequently occurring bone or tooth, taking into consideration the different age categories. In Tomb 3 at La Pijotilla, the MNI was calculated two ways, in order to compare the resulting MNIs: based on the petrous portion of the left temporal bone, and on the mental protuberance of the mandible. The temporal bone total MNI was 170, where 155 were adults and 15 were subadults. In terms of MNI based on the mental protuberance, the total number of individuals was only 85; when focusing on the subadults, the total MNI was 12. Overall, there are at least five subadults in the I1 category (birth-6 years old) and another five in the I2 category (7-12 years old). The most frequently occurring bone was the temporal for adults and adolescents, and the mental protuberance for subadults aged 12 and under; thus, the total MNI estimation for La Pijotilla was 178 (Table 5.1).

BONE	ELEMENT	SUBADULT			ADULT	TOTAL
		I1	I2	ADOLESCENT		
L Temporal	Left petrous	1	1	13	155	170
Mandible	Mental protuberance	5	5	2	73	85
MNI		**5**	**5**	**13**	**155**	**178**

Key to table: I1=birth-6 years; I2= 7-12 years; Adolescent: 13-17 years.

Table 5.1. MNI (minimum number of individuals) based on left petrous portion of the temporal bone and mental protuberance from La Pijotilla

5.2.2.- Valencina-Castilleja

The MNI at the settlement of Valencia-Castilleja has previously been estimated in various publications (listed in Table 5.2.), for various sectors of the site. Here, MNI was re-evaluated, based on the highest number of bone elements or teeth for each of the five sectors, according to bone elements most frequently represented and estimated age at death. This corresponded to an MNI of 33 adults and 3 subadult individuals. The sectors are listed in Tables 5.2 and 5.3.

SECTORS	MNI	REFERENCE
La Cima	2	Ruiz Moreno, 1991; Alcázar Godoy et al., 1992; Díaz-Zorita Bonilla, 2007
El Cerro de la Cabeza	6	Fernández Gómez, 2013
La Alcazaba	7	Cruz-Auñón Briones and Arteaga Matute, 1999a; Díaz-Zorita Bonilla, 2007
La Gallega	2	Martín Espinosa and Ruiz Moreno, 1992; Alcázar Godoy et al., 1992; Díaz-Zorita Bonilla, 2007
El Algarrobillo	19	Santana Falcón, 1993; Díaz-Zorita Bonilla, 2007
TOTAL	**36**	-

Key to table: MNI=minimum number of individuals.

Table 5.2. MNI in sectors from Valencina-Castilleja

Table 5.3. presents the elements used from MNI and their frequencies in this study:

SECTOR	BONE	SUBADULT			ADULT					TOTAL
		I 1	I 2	AO	YA	20-30	30-40	>45	A	
La Cima	Skull (complete)	0	1	0	1	0	0	0	0	2
El Cerro de la Cabeza	Occipital	0	0	0	4	2	0	0	0	6
La Alcazaba	1/3 D R Femur	1	0	0	4	1	1	0	0	7
La Gallega	Skull (complete)	0	1	0	0	0	0	1	0	2
El Algarrobillo	L Parietal	0	0	0	6	6	0	0	8	19

Key to table: R=right; L= left; D= diaphysis; I1=birth-6 years old; I2=7-12; AO= adolescent 13-17; YA= young adult; A=adult.

Table 5.3. MNI count for single bone elements from Valencina-Castilleja

5.3.- Distribution of age and sex
5.3.1.- La Pijotilla
5.3.1.i.- Age distribution

Estimation of age at death in Tomb 3 was originally based on the full range of indicators for subadults and adults. However, due to extensive post-excavation fragmentation, adult ages were estimated solely on available os coxae fragments, particularly the auricular surface and the pubic symphysis. It was possible to assess age based on 19 os coxae (Table 5.4):

N	BAG ID	BONE	ELEMENT	SIDE	S	AGE	CATEGORY	REFERENCE
1	963	Os coxae	Auricular surface	?	4	35-39	M	Lovejoy et al., 1985
2	1073	Os coxae	Auricular surface	?	4	35-39	M	Lovejoy et al., 1985
3	4170	Os coxae	Pubis	?	1	19-20	YA	Brooks and Suchey, 1990
4	4178	Os coxae	Auricular surface	?	3	30-34	MID	Lovejoy et al., 1985
5	4425	Os coxae	Auricular surface	?	5	40-44	M	Lovejoy et al., 1985
6	4493	Os coxae	Pubis	R	1	20-21	YA	Brooks and Suchey, 1990
7	4597	Os coxae	Pubis	R	4	30-35	MID	Brooks and Suchey, 1990
8	4965	Os coxae	Auricular surface	?	3	30-34	MID	Lovejoy et al., 1985
9	5134	Os coxae	Auricular surface	L	3	30-34	MID	Lovejoy et al., 1985
10	5185	Os coxae	Pubis	L	2	20-21	YA	Brooks and Suchey, 1990
11	5432	Os coxae	Pubis	R	1	18-19	YA	Brooks and Suchey, 1990
12	5473	Os coxae	Pubis	L	1	18-19	YA	Brooks and Suchey, 1990
13	6017	Os coxae	Pubis	R	2	20-21	YA	Brooks and Suchey, 1990
14	6424	Os coxae	Auricular surface	L	3	30-34	MID	Lovejoy et al., 1985
15	7352	Os coxae	Auricular surface	L	0	>20	YA	Lovejoy et al., 1985
16	8684	Os coxae	Auricular surface	L	3	30-34	MID	Lovejoy et al., 1985
17	9187	Os coxae	Auricular surface	L	2	25-29	MID	Lovejoy et al., 1985
18	9389	Os coxae	Auricular surface	R	1	20-24	YA	Lovejoy et al., 1985
19	9464	Os coxae	Pubis	R	1	15-24	YA	Brooks and Suchey, 1990

Key to table: R= right; L= left; ?= undetermined; S=score; YA= Young adult; MID= middle adult; M= mature adult.

Table 5.4. Adult age estimates for Os coxae from La Pijotilla

The estimation of age at death for subadults was based on bone and tooth development; 25 bone fragments were assessed According to the methods that were used, in this dissertation individuals were divided into four general categories for subadults (fetal= < birth; infan 1= birth to 6 years; children= 7-12 years; adolescents= 13-17) and four general categories for adults (young adult=18-25; middle adult= 26-35; mature= 36-45 and old adult= >45). However, there are 5 individuals whose age was calculated based on tooth development (Table 5.5):

N	BAG ID	BONE	ELEMENT	SIDE	AGE*	CATEGORY	REFERENCE
1	1408	Mandible	Mental protuberance	-	7-12	I2	Scheuer and Black, 2000
2	4766	Mandible	Mental protuberance	-	7-12	I2	Scheuer and Black, 2000
3	4891	Mandible	Mental protuberance	-	13-17	AO	Scheuer and Black, 2000
4	5321	Mandible	Mental protuberance + tooth development	-	5 ± 1,5	I1	Ubelaker, 1989
5	2084	Mandible	Mental protuberance	-	-	AO	Scheuer and Black, 2000
6	2494	Mandible	Mental protuberance	-	-	AO	Scheuer and Black, 2000
7	2492	Mandible	Mental protuberance	-	-	I2	Scheuer and Black, 2000
8	2493	Mandible	Mental protuberance	-	-	AO	Scheuer and Black, 2000
9	9323	Mandible	Mental protuberance	-	-	I2	Scheuer and Black, 2000
10	9167	Mandible	Mental protuberance + tooth development	-	3 ± 1	I1	Ubelaker, 1989
11	9700	Mandible	Mental protuberance	-	-	I1	Scheuer and Black, 2000
12	10633	Mandible	Mental protuberance	-		I1	Scheuer and Black, 2000
13	6216	Skull	Petrous portion	L	-	I2	Scheuer and Black, 2000
14	4865	Skull	Petrous portion	L	-	AO	Scheuer and Black, 2000
15	8270	Skull	Petrous portion	L	-	AO	Scheuer and Black, 2000
16	8476	Skull	Petrous portion	L	-	I1	Scheuer and Black, 2000
17	9696**	Skull	Petrous portion	L	-	AO	Scheuer and Black, 2000
18	9696	Skull	Petrous portion	L	-	AO	Scheuer and Black, 2000
19	9696	Skull	Petrous portion	L	-	AO	Scheuer and Black, 2000
20	9696	Skull	Petrous portion	L	-	AO	Scheuer and Black, 2000
21	9696	Skull	Petrous portion	L	-	AO	Scheuer and Black, 2000
22	9696	Skull	Petrous portion	L	-	AO	Scheuer and Black, 2000
23	9696	Skull	Petrous portion	L	-	AO	Scheuer and Black, 2000
24	9696	Skull	Petrous portion	L	-	AO	Scheuer and Black, 2000
25	10333	Skull	Petrous portion	L	-	AO	Scheuer and Black, 2000

* Age is calculated in years. **This bag contains 8 petrous portions of the temporal bone.
Key to table: L= left; I1= 0-6 years; I2= 7-12 years; AO= 13-17 years.

Table 5.5. Subadult age estimates for bone elements from La Pijotilla

The distribution of bone elements by age categories in La Pijotilla can be observed in Table 5.6 and multiple observations by bone fragments can be checked in Appendix 5.1.

AGE	CATEGORY	N	%
BIRTH-6	I1	5	2.80
7-12	I2	5	2.80
13-17	AO	13	7.30
18-25	YA	8	4.49
26-35	MID	8	4.49
36-45	M	3	1.68
>45	OA	0	0
ADULT	A	136	76.40
TOTAL	-	178	100

Key to table: R=right; L= left; I1=birth-6 years old; I2=7-12; AO= adolescent 13-17; YA= young adult; MID= middle adult; M= mature adult; OA= old adult; A=adult.

Table 5.6. Distribution of age categories based on the bones comprising the MNI (La Pijotilla)

The representation of the different age categories of the bone elements by MNI at La Pijotilla can be seen in Figure 5.1:

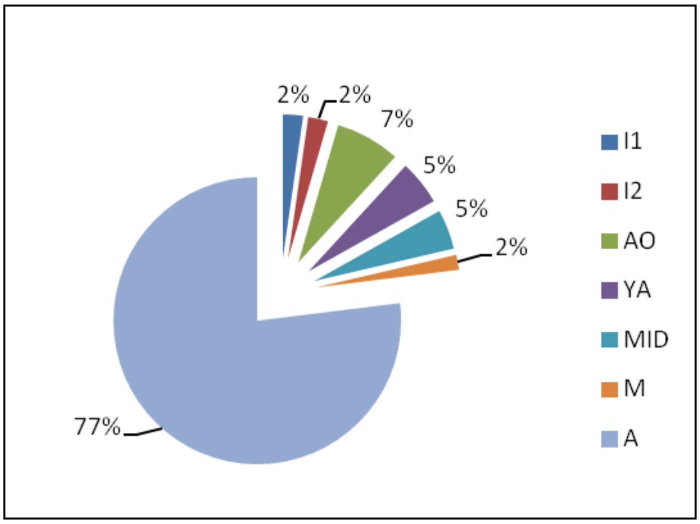


Figure 5.1. Distribution of bone fragments by age categories at La Pijotilla

5.3.1.ii.- Sex distribution

In Table 5.7, the bone from which each fragment originated and the element used for sex estimation in Tomb 3 is listed:

N	BAG	BONE	ELEMENT	SIDE	SEX	METHOD
1	2776	Femur	Head	R	F	Bass, 1995:230
2	2992	Skull	Supraorbital margin + prominence of glabella	L	M?	Buikstra and Ubelaker, 1994:20
3	3097	Scapula	Glenoid fossa (width)	R	F	Brothwell, 1981
4	4170	Os Coxae	Pubis	?	M?	Buikstra and Ubelaker, 1994:17
5	4346	Skull	Prominence of	-	M?	Buikstra and Ubelaker, 1994:20
6	4363	Skull	Supraorbital margin + prominence of glabella	L	F?	Buikstra and Ubelaker, 1994:20
7	4451	Femur 1	Head	L	F	Bass, 1995:230
8	4451	Femur 2	Head	L	F	Bass, 1995:230
9	4493	Os Coxae	Pubis	R	M	Buikstra and Ubelaker, 1994:17
10	4498	Mandible	Mental eminence	?	M?	Buikstra and Ubelaker, 1994:20
11	4597	Os Coxae	Pubis	R	M	Buikstra and Ubelaker, 1994:17
12	4748	Humerus	Vertical head	L	F	Bass, 1995:152
13	4755	Skull	Prominence of	-	M?	Buikstra and Ubelaker, 1994:20
14	4784	Mandible	Gonial angle	L	M?	Campillo and Subirá, 2004:181
15	4785	Mandible	Mandibular condyle	L	F?	Campillo and Subirá, 2004: 181
16	4882	Skull	Mastoid + supraorbital margin + prominence of glabella	R	M?	Buikstra and Ubelaker, 1994:20
17	5005	Skull	Prominence of glabella		M?	Buikstra and Ubelaker, 1994:20
18	5032	Femur	Head	R	F	Bass, 1995:230
19	5036	Mandible	Mental eminence	R	M?	Buikstra and Ubelaker, 1994:20
20	5042	Humerus	Vertical head diameter	R	F?	Bass, 1995:152
21	5190	Mandible	Mental eminence+	-	M?	Buikstra and Ubelaker, 1994:20
22	5192	Mandible	Mental eminence	-	M?	Buikstra and Ubelaker, 1994:20
23	5442	Mandible	Mental eminence	-	M?	Buikstra and Ubelaker, 1994:20
24	5887	Skull	Prominence of glabella	-	M?	Buikstra and Ubelaker, 1994:20
25	5924	Mandible	Gonial angle	L	M?	Campillo and Subirá, 2004: 181
26	6512	Os coxae	Illium (auricular	L	F	Buikstra and Ubelaker, 1994:19
27	6689	Skull	Mastoid	R	M?	Buikstra and Ubelaker, 1994:20
28	6748	Scapula	Glenoid fossa (width)	R	F	Brothwell, 1981
29	6815	Femur	Head	L	F	Bass, 1995:230
30	6816	Skull	Supraorbital margin + prominence of glabella	R	M?	Buikstra and Ubelaker, 1994:20
31	7726	Os coxae	Illium (auricular	R	F	Buikstra and Ubelaker, 1994:19
32	7798	Skull	Supraorbital ridges	-	M?	Buikstra and Ubelaker, 1994:20
33	7847	Scapula	Glenoid fossa (width)	L	M	Brothwell, 1981
34	8100	Mandible	Mental eminence	-	M?	Buikstra and Ubelaker, 1994:20
35	9039	Mandible	Mental eminence	-	M?	Buikstra and Ubelaker, 1994:20
36	9157	Mandible	Mental eminence	-	M?	Buikstra and Ubelaker, 1994:20
37	9176	Scapula	Glenoid fossa (width)	L	F	Brothwell, 1981
38	9220	Scapula	Glenoid fossa (width)	R	F	Brothwell, 1981
39	9441	Mandible	Mental eminence	-	M?	Buikstra and Ubelaker, 1994:20
40	9840	Skull	Supraorbital margin	R	M?	Buikstra and Ubelaker, 1994:20
41	9994	Scapula	Glenoid fossa (width)	L	F	Brothwell, 1981
42	10072	Mandible	Mental eminence	-	M?	Buikstra and Ubelaker, 1994:20
43	10107	Scapula	Glenoid fossa (width)	L	F	Brothwell, 1981
44	10246	Skull	Mastoid process	R	M?	Buikstra and Ubelaker, 1994:20
45	10648	Skull	Supraorbital margin+ prominence of glabella	R	F?	Buikstra and Ubelaker, 1994:20

Key to table: R= right; L= left; M=male; F=female; M?= possible male; F?= possible female; ?= undetermined.

Table 5.7. Bone elements and part of bone on which sex was estimated (La Pijotilla)

Due to the high fragmentation of this assemblage, it was only possible to estimate sex for 45 of 178 bone fragments; of the 45, 18 fragments were female (9.47 %) and 27 were male (14.21 %). It must be pointed out that since we are dealing just with bone fragments and not with complete skeletons, other bone elements from the same individual could not be examined and the presence of robusticity in some of the elements could have overestimated the number of fragments assigned male. The overall distribution of sex based on bone fragments at La Pijotilla can be seen in Table 5.8:

SEX	N	%
FEMALE	18	9.47
MALE	27	14.21
SUBADULT	23	12.92
UNSEXED	110	61.79
TOTAL	178	100

Table 5.8. Distribution of sex based on the bone fragment MNI from La Pijotilla

The representation of the different sex categories at La Pijotilla, based on bone fragment MNI, can be seen in Figure 5.2:

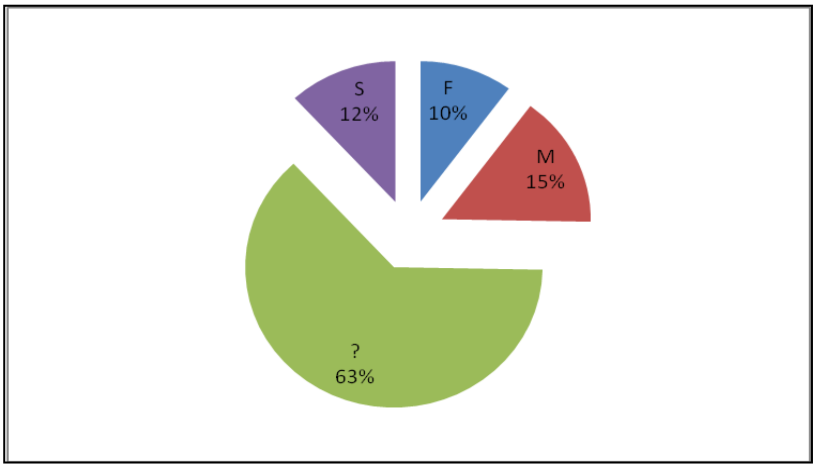


Figure 5.2. Distribution of bone fragments by sex from La Pijotilla

5.3.2.- Valencina-Castilleja
5.3.2.i.- Age distribution

Due to fragmentation and the absence of pelves, age estimation at Valencina was based on the skull. For those cases where the skull was also missing, dental attrition was considered (Table 5.9). For multiple observations on skeleton/bone fragment see Appendix 5.1.

N	SECTOR	INDIVIDUAL	BONE	ELEMENT	SIDE	S	AGE	CATEGORY	REFERENCE
1	ALG	ALG-1	Teeth	Molars	R, L	2+	18-25	YA	Brothwell, 1981
2	ALG	ALG-2	Teeth	Molars	R, L	2+	18-25	YA	Brothwell, 1981
3	ALG	ALG-3	Teeth	Molars	R, L	2+	18-25	YA	Brothwell, 1981
4	ALG	ALG-4	Teeth	Molars	R, L	2+	18-25	YA	Brothwell, 1981
5	ALG	ALG-5	Teeth	Molars	R, L	3+	26-35	MID	Brothwell, 1981
6	ALG	ALG-6	Skull	Temporal	R	-	A	A	Buikstra and Ubelaker, 1994
7	ALG	ALG-7	Teeth	Molars	R, L	2+	18-25	YA	Brothwell, 1981
8	ALG	ALG-8	Skull	Temporal, frontal, occipital	R, L	-	A	A	Buikstra and Ubelaker, 1994
9	ALG	ALG-9	Skull	Frontal, temporal	R	-	A	A	Buikstra and Ubelaker, 1994
10	ALG	ALG-10	Teeth	Molars	R, L	3+	26-35	MID	Brothwell, 1981
11	ALG	ALG-11	Teeth	Molars	R, L	2+	18-25	YA	Brothwell, 1981
12	ALG	ALG-12	Teeth	Molars	R, L	3+	26-35	MID	Brothwell, 1981
13	ALG	ALG-13	Teeth	Molars	R, L	3+	26-35	MID	Brothwell, 1981
14	ALG	ALG-14	Skull	Parietal, temporal	R, L	-	A	A	Buikstra and Ubelaker, 1994
15	ALG	ALG-15	Teeth	Molars	R, L	3+	26-35	MID	Brothwell, 1981
16	ALG	ALG-16	Teeth	Molars	R, L	3+	26-35	MID	Brothwell, 1981
17	ALG	ALG-17	Teeth	Molars	R, L	3+	26-35	MID	Brothwell, 1981
18	ALG	ALG-18	Skull	Frontal, temporal	R	-	A	A	Buikstra and Ubelaker, 1994
19	ALG	ALG-19	Skull	Occipital, parietal	?	-	A	A	Buikstra and Ubelaker, 1994
20	AL	A-1	Teeth	Molars	R, L	3+	26-35	MID	Brothwell, 1981
21	AL	A-2	Os Coxaa	Auricular surface	L	3	30-34	MID	Lovejoy et al., 1985
22	AL	A-3	Long Bones	Long bones	-	-	A	A	Buikstra and Ubelaker, 1994
23	AL	A-4	Long Bones	Long bones	-	-	A	A	Buikstra and Ubelaker, 1994
24	AL	A-5	Long Bones	Long bones	-	-	A	A	Buikstra and Ubelaker, 1994
25	AL	A-6	Long Bones	Long bones	-	-	A	A	Buikstra and Ubelaker, 1994
26	AL	A-7	Rib	Shaft	R,L	-	0-6	I1	Scheuer and Black, 2000
27	C	C-1	Teeth	Molars	R, L	2+	18-25	YA	Brothwell, 1981
28	C	C-2	Skull	Occipital, temporal	R,L	-	7-12	I2	Scheuer and Black, 2000
29	G	G-1	Teeth	Molars	R,L	5++	>45	OA	Brothwell, 1981
30	G	G-2[24]	Skull and long bones	Complete skull and long bones	R,L	-	7-12	I2	Scheuer and Black, 2000

[24] This individual was not analysed in this study because he or she is on display in the museum at Casa de la Cultura de Valencina.

N	SECTOR	INDIVIDUAL	BONE	ELEMENT	SIDE	S	AGE	CATEGORY	REFERENCE
31	CC	CC-1	Teeth	Molars	R, L	2+	18-25	YA	Brothwell, 1981
32	CC	CC-2	Teeth	Molars	R, L	2+	18-25	YA	Brothwell, 1981
33	CC	CC-3	Teeth	Molars	R, L	2+	18-25	YA	Brothwell, 1981
34	CC	CC-4	Teeth	Molars	R, L	2+	18-25	YA	Brothwell, 1981
35	CC	CC-5	Skull	Occipital	-	-	A	A	Buikstra and Ubelaker, 1994
36	CC	CC-6	Skull	Frontal, occipital, parietal	L	-	A	A	Buikstra and Ubelaker, 1994

Key to table: ALG= El Algarrobillo; AL= La Alcazaba; C= La Cima; G= La Gallega; CC= Cerro de la Cabeza; R= right; L= left; A= adult; YA= young adult; I2= 7-13 years; I1= 0-6 years; OA= >45; MID= 36-45.

Table 5.9. Age estimation based on bone fragments analysed from Valencina-Castilleja

The distribution of age based on bone fragments at Valencina-Castilleja can be seen in Figure 5.3

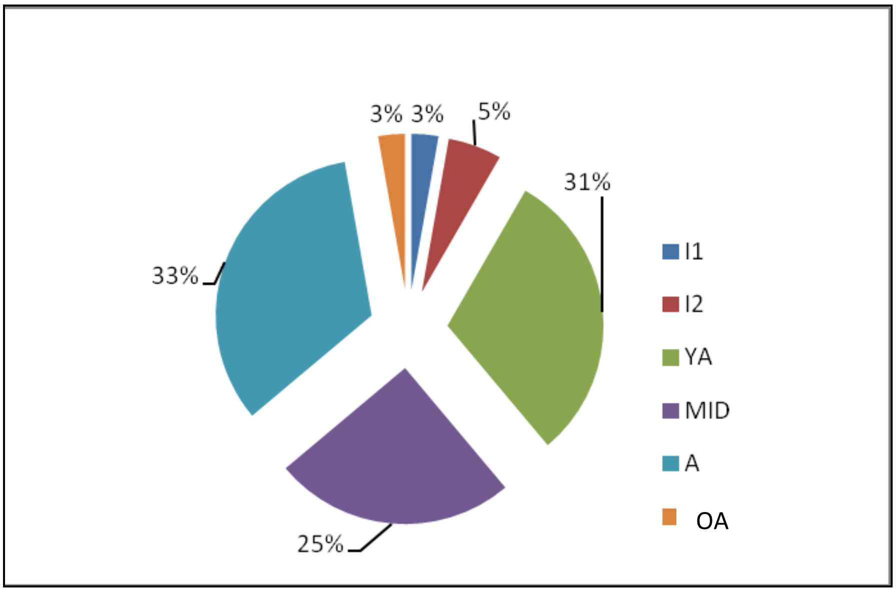


Figure 5.3. Distribution of bone fragments by age categories from Valencina-Castilleja

5.3.2.ii.- Sex distribution

The distribution of bone fragments by sex at Valencina-Castilleja can be seen in Table 5.10 :

N	SECTOR	INDIVIDUAL	BONE	ELEMENT	SIDE	SEX	METHOD
1	El Algarrobillo	ALG-1	Skull	Mastoid, occipital	R	M?	Buikstra and Ubelaker, 1994:20
2	El Algarrobillo	ALG-2	Skull	Supraorbital margin + prominence of glabella	-	M?	Buikstra and Ubelaker, 1994:20
3	El Algarrobillo	ALG-3	Skull	Fragments	-	U	Buikstra and Ubelaker, 1994
4	El Algarrobillo	ALG-4	Skull, ribs	Temporal, shaft	R	U	Buikstra and Ubelaker, 1994
5	El Algarrobillo	ALG-5	Skull	Mastoid + supraorbital margin + prominence of glabella	R, L	F?	Buikstra and Ubelaker, 1994:20
6	El Algarrobillo	ALG-6	Skull	Parietal, occipital	L	M?	Buikstra and Ubelaker, 1994:20
7	El Algarrobillo	ALG-7	Skull	Supraorbital margin + prominence of glabella	L	M?	Buikstra and Ubelaker, 1994:20
8	El Algarrobillo	ALG-8	Skull	Mastoid	R, L	M?	Buikstra and Ubelaker, 1994:20
9	El Algarrobillo	ALG-9	Skull	Mastoid + supraorbital margin + prominence of glabella	R, L	U	Buikstra and Ubelaker, 1994:20
10	El Algarrobillo	ALG-10	Skull	Mastoid + supraorbital margin + prominence of glabella	R, L	M?	Buikstra and Ubelaker, 1994:20
11	El Algarrobillo	ALG-11	Skull	Mastoid + supraorbital margin + prominence of glabella	R, L	M?	Buikstra and Ubelaker, 1994:20
12	El Algarrobillo	ALG-12	Skull	Supraorbital margin + prominence of glabella	-	F?	Buikstra and Ubelaker, 1994:20
13	El Algarrobillo	ALG-13	Skull	Mastoid + supraorbital margin	-	F	Buikstra and Ubelaker, 1994:20
14	El Algarrobillo	ALG-14	Skull	Parietal, temporal, frontal	L, R	U	Buikstra and Ubelaker, 1994:20
15	El Algarrobillo	ALG-15	Skull	Mastoid + supraorbital margin + prominence of glabella	L, R	M?	Buikstra and Ubelaker, 1994:20
16	El Algarrobillo	ALG-16	Skull	Parietal, temporal	L	U	Buikstra and Ubelaker, 1994:20
17	El Algarrobillo	ALG-17	Skull	Parietal, occipital, temporal	L	U	Buikstra and Ubelaker, 1994:20
18	El Algarrobillo	ALG-18	Skull	Mastoid + supraorbital margin	R	U	Buikstra and Ubelaker, 1994:20
19	El Algarrobillo	ALG-19	Skull	Occipital, parietal	-	U	Buikstra and Ubelaker, 1994:20

N	SECTOR	INDIVIDUAL	BONE	ELEMENT	SIDE	SEX	METHOD
20	La Alcazaba	A-1	Skull	Complete	-	F	Buikstra and Ubelaker, 1994:20
21	La Alcazaba	A-2	Os coxa	Illium (auricular surface)	L	M	Buikstra and Ubelaker, 1994:19
22	La Alcazaba	A-3	Long bones	Long bones	-	U	Buikstra and Ubelaker, 1994
23	La Alcazaba	A-4	Long bones	Long bones	-	U	Buikstra and Ubelaker, 1994
24	La Alcazaba	A-5	Long bones	Long bones	-	U	Buikstra and Ubelaker, 1994
25	La Alcazaba	A-6	Long bones	Long bones	-	U	Buikstra and Ubelaker, 1994
26	La Alcazaba	A-7	Rib	Shaft	-	S	Scheuer and Black, 2000
27	La Cima	C-1	Skull	Supraorbital margin + prominence of glabella	-	F	Buikstra and Ubelaker, 1994
28	La Cima	C-2	Skull	Occipital, temporal	R, L	S	Scheuer and Black, 2000
29	La Gallega	G-1	Skull	Mastoid + supraorbital margin + prominence of glabella	L, R	F	Buikstra and Ubelaker, 1994:20
30	La Gallega	G-2[25]	Skull, long bones	Skull, long bones	L,R	S	Scheuer and Black, 2000
31	Cerro de la Cabeza	CC-1	Skull	Mastoid + supraorbital margin + prominence of glabella	L, R	F?	Buikstra and Ubelaker, 1994:20
32	Cerro de la Cabeza	CC-2	Skull	Parietal, occipital	R	U	Buikstra and Ubelaker, 1994:20
33	Cerro de la Cabeza	CC-3	Skull	Mastoid	L	F	Buikstra and Ubelaker, 1994:20
34	Cerro de la Cabeza	CC-4	Skull	Mastoid + supraorbital margin + prominence of glabella	L	F?	Buikstra and Ubelaker, 1994:20
35	Cerro de la Cabeza	CC-5	Skull	Temporal	L	U	Buikstra and Ubelaker, 1994:20
36	Cerro de la Cabeza	CC-6	Skull	Frontal	-	U	Buikstra and Ubelaker, 1994:20

Key to table: L=left; R=right; U=undetermined; F?= possibly female; S=subadult; M?= possibly male?;

Table 5.10. Sex estimation based on bone fragments analysed from Valencina-Castilleja

Based on the 33 bone fragments from which sex could be estimated from Valencina-Castilleja, 9 (27.27 %) were male, and 9 (27.27 %) were female. A further 15 fragments could not be sexed; 3 more were assigned as subadult .

The distribution of age and sex at Valencina-Castilleja can be seen in Figure 5.4:

[25] This individual has not been analysed in this study because he or she is on display in the museum at Casa de la Cultura de Valencina.

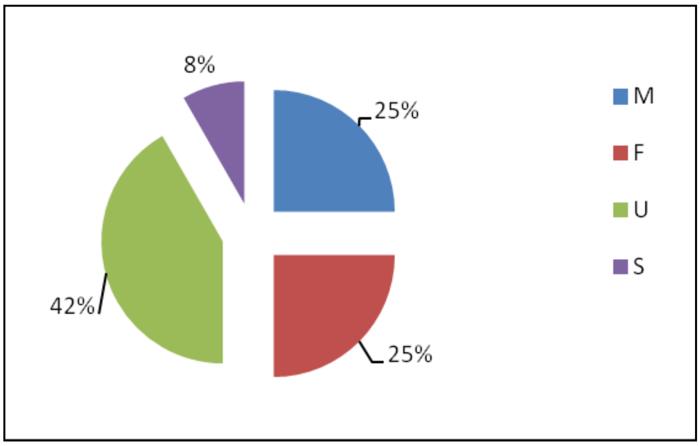


Figure 5.4. Distribution of bone fragments by sex categories from Valencina-Castilleja (M=male; F=female; U=undetermined; S=subadult).

5.4. Normal variation
5.4.1.- Metrical analysis

Measurements of the skull and long bones can be seen in Appendix 2.1.

5.4.1.i.- Calculation of stature
5.4.1.i.a.- La Pijotilla

At La Pijotilla, there were only five complete bones from Tomb 3: three adult radii, an adult fibula and a right adult ulna. Clearly, the mean stature of this "population" cannot be suggested based only on these measurements, but an estimation is shown based on the maximum length measurements in Table (5.11):

BAG ID	TYPE OF BONE	SIDE	N	Trotter & Gleser 1958 MALE	FEMALE
2930	RADIUS	L	221	1.62 ± 4.32	1.59 ± 4.24
2968	RADIUS	R	221	1.62 ± 4.32	1.59 ± 4.24
1730	FIBULA	L	351	1.72 ± 3.29	1.62 ± 3.57
5810	ULNA	R	234	1.60 ± 4.32	1.57 ± 4.30
7212	RADIUS	L	227	1.64 ± 4.32	1.62 ± 4.24

Key to table: N = maximum length of bone in millimetres; stature estimates given in metres ± standard deviation in centimetres.

Table 5.11. Estimation of stature at La Pijotilla

Apart from measuring these bones, many other measurements were taken of other bones and the data can be seen in the Appendix 2.1.

5.4.1.i.b.- Valencina-Castilleja

Of the 36 bone fragments studied from Valencina-Castilleja, it was possible to estimate stature for only one bone, an ulna (El Algarrobillo - ALG-5) – see Table (5.12):

INDIVDUAL	SECTOR	TYPE OF BONE	N	Trotter & Gleser 1958 FEMALE
ALG-5	El Algarrobillo	ULNA	261	1.69 ± 4.30

Table 5.12. Estimation of stature at Valencina-Castilleja

Again, many more measurements were taken of the 36 bone fragments from Valencina-Castilleja (see Appendix 2.1).

5.4.2.- Intraobserver error

In relation to the mesio-distal (MD) measurement of teeth, the first group that was randomly selected (*n* = 61) have a mean of 8.39 mm and (1 σ) ± 2.97 while the second group (also a random selection) (*n* = 61) have a mean of 8.32 mm (1 σ) ± 3.08. The Mann-Whitney *U* test show no significant differences (Mann-Whitney *U*= 1779, p= 0.6782) (Figure 5.5.).

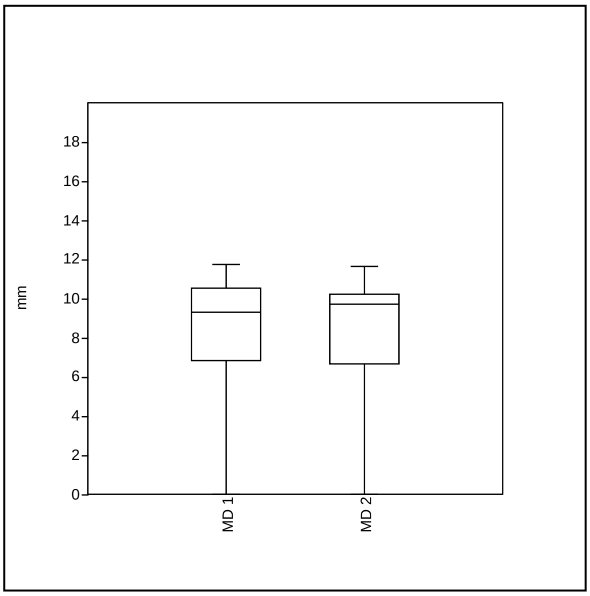


Figure 5.5. Mesio-distal measurements between groups for intraobserver error

In relation to the bucco-lingual (BL) measurement, the first group (*n* = 61) have a mean of 7.65 mm and (1 σ) ± 2.95 while the second group (*n* = 61) have a mean of 7.81 mm (1 σ) ± 3.07. The Mann-Whitney *U* test show no significant differences (Mann-Whitney *U*= 1748, p= 0.5662) (Figure 5.6).

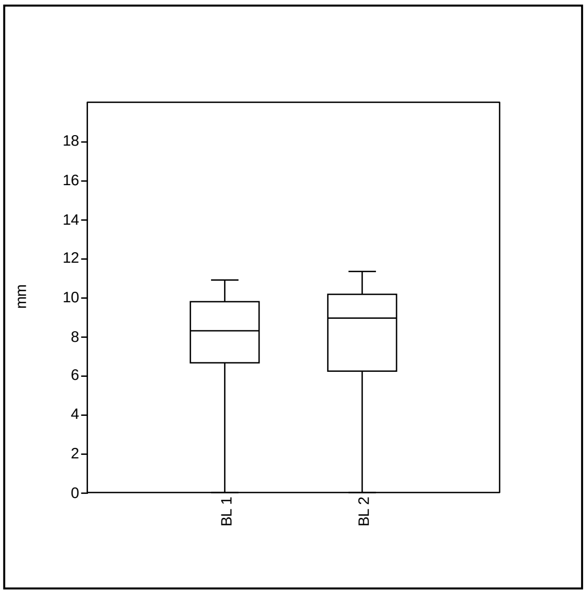


Figure 5.6. Bucco-lingual measurements between groups for intraobserver error

In summary, the intraobserver error based on two dental measurements (BL and MD) applied to two independent and random samples, and showed no significant differences according to the results of the Mann-Whitney *U* test.

5.5.- Normal variation: non-metric analyses
5.5.1.- La Pijotilla
5.5.1.i.- Cranial and postcranial non-metric traits

At Tomb 3 at La Pijotilla, a total of 20 non-metric traits were identified on the bone fragments recovered. The results can be seen in Table 5.13:

N	BAG	BONE	ELEMENT	SIDE	AGE	SEX	NON METRIC
1	558	Patella	Patella	L	A	-	Vastus notch
2	695	Humerus	Distal end	R	A	-	Septal aperture
3	825	Humerus	Distal end	R	A	-	Septal aperture
4	3077	Patella	Patella	R	A	-	Vastus notch
5	8888	Humerus	M 1/3	L	A	-	Supracondylar process
6	9119	Patella	Patella	R	A	-	Bipartite patella
7	8786	Skull	Parietal	R & L	A	-	Parietal notch
8	4094	Humerus	Distal end	R	A	-	Septal aperture
9	9697	Humerus	Distal end	L	A	-	Septal aperture
10	8844	Humerus	Distal end	L	A	-	Septal aperture
11	4340	Humerus	Distal end	L	A	-	Septal aperture
12 12	1830	Hand	Metacarpal 4 M phalanx		A	-	Foramen at dorsal side
13	558	Patella	Patella	L	A	-	Vastus notch
14	695	Humerus	Distal end	R	A	-	Septal aperture
15	696	Feet	Talus	R	A	-	Double facet
16	825	Humerus	Distal end	R	A	-	Septal aperture
17	212	Humerus	Complete	L	A	-	Septal aperture
18	6994	Clavicle	Diaphysis	R	A	-	Foramen at superior part
19	6764	Hands	3rd P	R	A	-	Foramen on palm side
20	9289	Humerus	Diaphysis	L	AO	S	Septal aperture

Key to table: R=right; L=left; P= proximal; A=adult; S= subadult; I2= 7-12; AO= 13-17

Table 5.13. Non-metric traits identified at La Pijotilla

Most of the non-metric traits observed at La Pijotilla were in bones of the infracranial skeleton, mostly belonging to the upper limb . This reflects taphonomic factors affecting the skull, as well as overall fragmentation of the assemblage. As can be seen in Tables 5.13 and 5.14, the most common non-metric trait was the septal aperture (*n* = 10) (Figure 5.7) followed by the vastus notch (*n* = 3) (Figure 5.8). Unfortunately, no relationships could be analysed with respect to age or sex, as 9 of 10 were classed as unsexed adult and one was from an adolescent.

Figure 5.7. Septal aperture (ID 4340) of an adult (left), and (ID 9289) of a subadult (right) (adolescent 13-17 years old). (Scale is in cm).

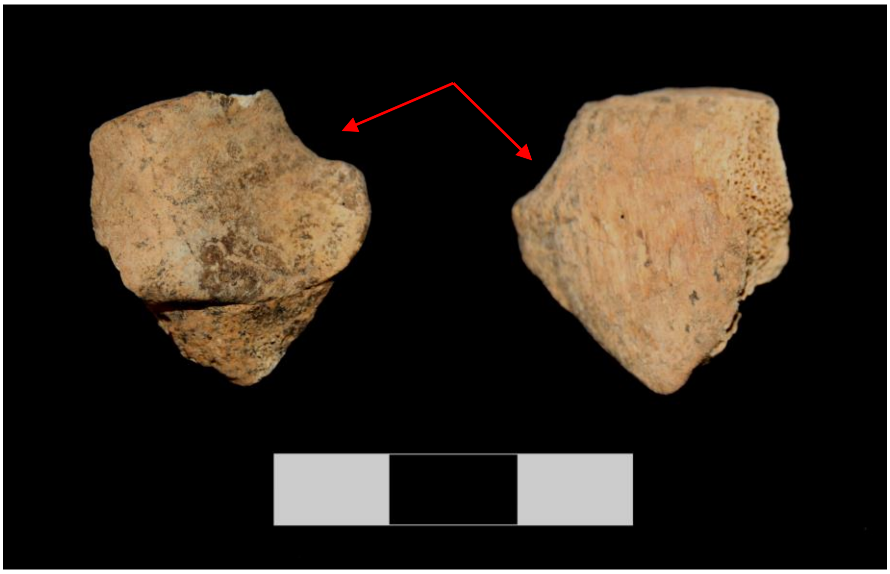


Figure 5.8. Vastus notch (ID 9119). Posterior (left) and anterior (right) views. (Scale is in cm)

5.5.1.ii.- Non-metric dental traits

At La Pijotilla, 16 of 2944 (0.54%) of the teeth presented a non-metric trait. The most common trait was shovelling (8 of 16). Other traits include three dental foramina on the labial surfaces (ID 437 and ID 438), two Carabelli traits (ID 6805 and ID 9125) (Figure 5.9), an interruption groove on the cingulum (ID 7378), a forked root (ID 8388) and a dental gemination (ID 9149) (Figure 5.10). All the non-metric dental traits were on adult teeth, except for ID 6686 (subadult I2, or 7-12 years old). The data can be seen in Table 5.14:

N	BAG ID	BONE	ELEMENT	AGE	SEX	NON METRIC	DEGREE
1	437	Tooth	LLM2	A	-	Dental foramen on labial surface	-
2	438	Tooth	LRM2	A	-	Dental foramen on labial surface	-
3	437	Tooth	LLM3	A	-	Dental foramen on labial surface	-
4	6458	Tooth	URI1	A	-	Shovelling	3
5	6550	Tooth	ULI1	A	-	Shovelling	3
6	6686	Tooth	ULI1	I2	-	Shovelling	1
7	6766	Tooth	URI2	A	-	Shovelling	3
8	6805	Tooth	ULM3	A	-	Carabelli trait	5
9	7378	Tooth	ULI2	A	-	Interruption groove	-
10	8388	Tooth	ULI2	A	-	Forked root	-
11	9125	Tooth	URM1	A	-	Carabelli trait	5
12	9141	Tooth	ULI2	YA	-	Shovelling	3
13	9149	Tooth	Canine	A	-	Dental gemination	-
14	9618	Tooth	ULI2	A	-	Shovelling	4
15	10348	Tooth	ULI2	A	-	Shovelling	3
16	10349	Tooth	URdC	A	-	Shovelling	3

Key to table: L= lower; R: right; L= left; C= canine; P= premolar; I= incisor; M= molar; A= adult; I2= 7-12 years old.

Table 5.14. Dental non-metric traits from La Pijotilla (after Turner et al, 1991)

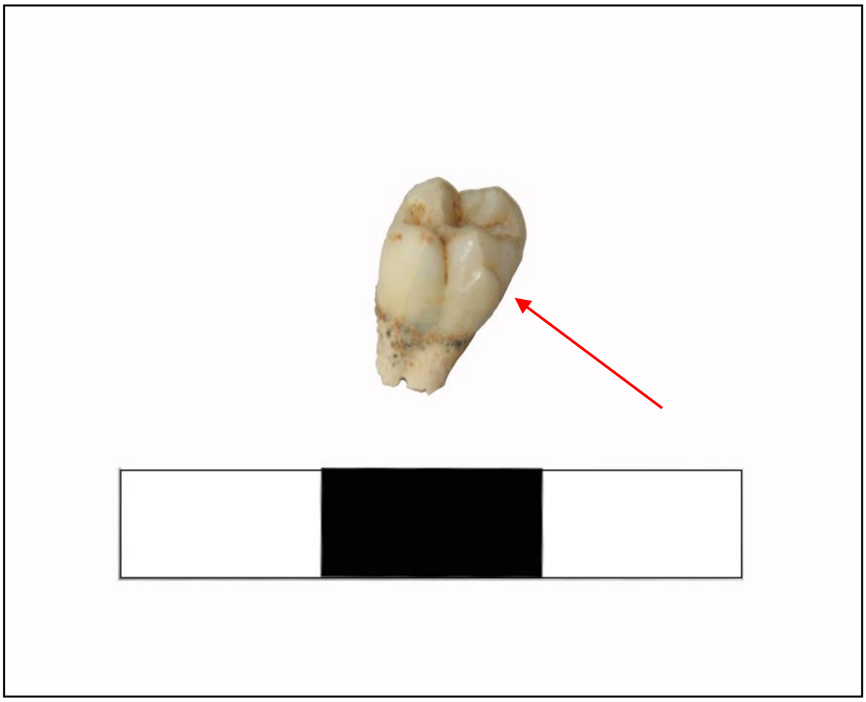


Figure 5.9. Carabelli´s trait (ID 9125).

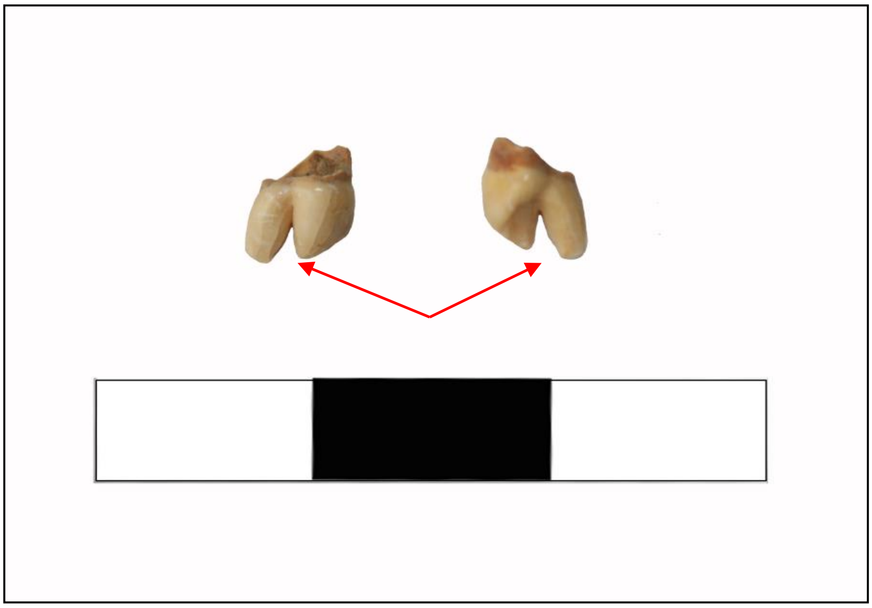


Figure 5.10. Dental gemination (ID 9149).

5.5.2.- Valencina-Castilleja
5.5.2.i.- Cranial and postcranial non-metric traits

At this site, seven non-metric traits were found on three skulls, one humerus, one patella and two teeth. There are some traits in common with La Pijotilla, for example, the vastus notch (*n* = 4 at La Pijotilla) and septal aperture (*n* = 11 at La Pijotilla) are present at both sites. The list of non-metric traits is shown Table (5.15):

SECTOR	INDIVIDUAL	SEX	AGE	BONE	ELEMENT	SIDE	TYPE
La Cima	C-1	F	18-25	Patella	Patella	L	Vastus notch
La Cima	C-1	F	18-25	Tooth	ULI2, URI2	L & R	Interruption groove
La Cima	C-1	F	18-25	Tooth	ULI2, URI2	L & R	Shovelling
La Cima	C-1	F	18-25	Humerus	Distal end	R	Septal aperture
La Gallega	G-1	F	>45	Skull	Occipital	L & R	Parietal foramen
El Algarrobillo	ALG-10	M	26-35	Skull	Frontal	R	Fronto-temporal articulation
El Algarrobillo	ALG-10	M	26-35	Skull	Temporal	R	Auditory torus

Key to table: L=left; R=right; F= female; M= male; U= upper; L= lower; R: right; L= left; C= canine; I= incisor.

Table 5.15. Non-metric traits identified at Valencina-Castilleja

5.5.2.ii.- Non–metric dental traits

In terms of non-metric dental traits, four cases were found in a single individual. Shovelling (*n* = 2) was found at La Cima in C-1 in two teeth (ULI2 and URI2) from a female aged 18-25 years. On the same teeth, a groove was also found in the cingula. The data can be seen in Table 5.16:

N	SECTOR	INDIVIDUAL	BONE	ELEMENT	AGE	SEX	NON METRIC
1	La Cima	C-1	Tooth	URI2	YA	F	Shovelling (degree 3)
2	La Cima	C-1	Tooth	ULI1	YA	F	Shovelling (degree 3)
3	La Cima	C-1	Tooth	URI2	YA	F	Interruption groove
4	La Cima	C-1	Tooth	ULI1	YA	F	Interruption groove

Key to table: U= upper; L= lower; R: right; L= left; C= canine; P= premolar; I= incisor; M= molar; A= adult, F= female.

Table 5.16. Teeth with non-metric traits at Valencina-Castilleja from individual C-1 (after Turner et al, 1991).

5.6.- Abnormal variation

5.6.1.- Enthesopyhtes

In this study, enthesopythes were included in the category of abnormal human variation. Enthesopythes are those bone changes that affect the entheses. The bone changes present a different morphology both between and within individuals and these differences might be caused by different factors.

5.6.1.i.- La Pijotilla

A total of 14 enthesophytes were observed (Table 5.17):

N	BAG	BONE	ELEMENT	SIDE	AGE	SEX	OBSERVATION
1	1043	Radius	P 1/3	R		U	Hypertrophy of the biceps brachii insertion
2	1098	Hands	MC2 P	-	A	U	Flexor digitorum profundus hypertrophy
3	1374	Hands	MC3 P	R	A	U	Flexor digitorum profundus hypertrophy
4	1923	Clavicle	Acromion	L	A	U	Insertion of subclavius muscle very pronounced
5	2682	Femur	Diaphysis	L	A	U	Hypertrophy of the linea aspera
6	2683	Femur	Diaphysis	R	A	U	Hypertrophy of the linea aspera
7	3416	Feet	Calcaneum	L	A	U	Achilles tendon enthesophyte
8	4435	Fibula	Distal end	L	A	U	Anterior tibiofibular ligament enthesophyte
9	5888	Skull	Mastoid process	L	A	U	Prominent insertion of the sternocleidomastoid muscle
10	7094	Patella	Patella	L	A	U	Patellar tendon enthesophyte
11	7262	Feet	Calcaneum	L	A	U	Achilles tendon enthesophyte
12	10209	Ribs	Shaft	-	A	U	Iliocostalis cervicis enthesophyte
13	10189	Patella	Patella	R	A	U	Enthesophyte at anterior superior facet
14	10144	Feet	2nd P phalanx	-	A	U	Enthesophyte at extensor digitorum brevis

Key to table: R: right; L= left; A= adult; AO= 13-17. M= male; F= female; M?= possible male; U= undetermined; P= proximal; P=proximal; MC = metacarpal

Table 5.17. Enthesophytes identified at La Pijotilla

Some of the less common enthesophytes will be explained in detail in this section; the remainder are described in Appendix 3.1.

In relation to the skull, only one individual presented a "marker" at the insertion of the sternocleidomastoid muscle (ID 5888) (Figure 5.11).

Figure 5.11. Insertion of the sternocleidomastoid muscle (ID 5888)

There were six examples of enthesophytes in the upper skeleton (upper limbs and thorax). One was identified on a left adult clavicle at the insertion of the subclavius muscle (ID 1923); there was also a radius showing hypertrophy of the biceps brachii insertion (ID 1043). The rest of the enthesophytes of upper limb bone fragments are represented by hypertrophy of the phalanx flexors on a proximal 2nd metacarpal (ID 1098) and a 3rd metacarpal (ID 1374). In relation to the ribs, an adult rib showed a prominent insertion area for the iliocostalis cervicis (ID 10,209)

With respect to the lower limbs, there were 9 bone fragments showing enthesopythes. There were two cases of hypertrophy of the linea aspera on left (ID 2682) and right adult femora (ID 2683) that, due to their discovery in the same stratigraphic unit and having a similar morphology, could have belonged to the same individual. In relation to the feet, two examples of an Achilles tendon enthesophyte were identified on left adult calcaneii (ID 3416 and ID 7262) and an enthesophyte at extensor digitorum brevis in an adult proximal 2nd metacarpal (ID 10144). There was an example of an anterior tibiofibular ligament enthesophyte (D 4435) (Figure 5.12) and two patellae with enthesophytes on the superior part of the anterior facet (ID 10,189) (Figure 5.13), and another enthesophyte at the patellar tendon insertion on a left patella (bone ID 7094 - Figure 5.14).

Figure 5.12. Anterior tibiofibular ligament enthesophyte (ID 4435, lateral malleolus and malleolar articular surface).

Figure 5.13. Patella with enthesophyte on the superior part of the anterior facet (ID 10189)

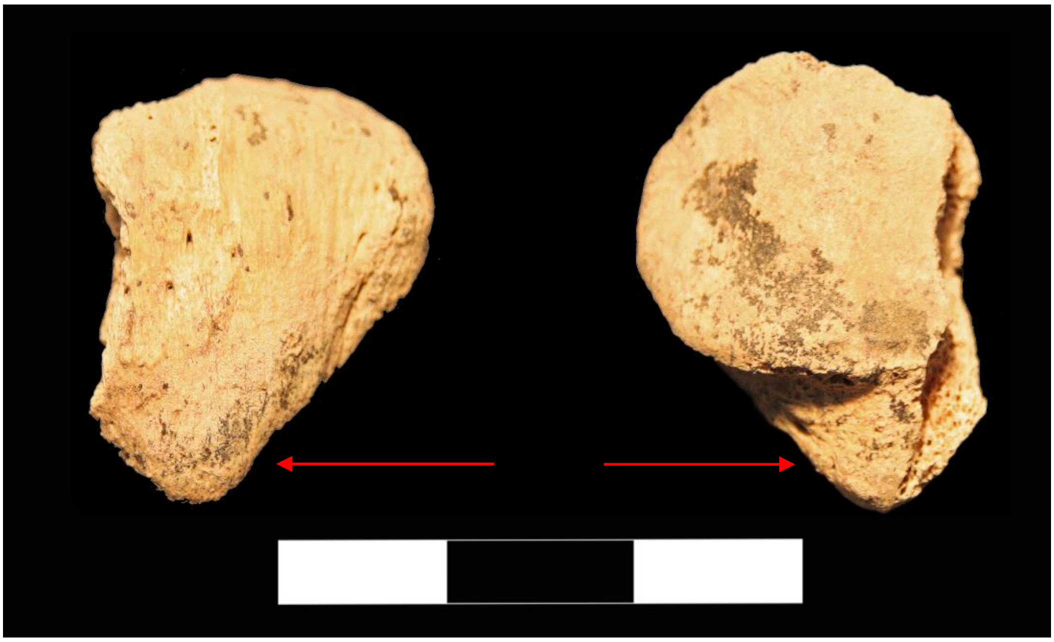


Figure 5.14. Patellar tendon enthesophyte (bone ID 7094: anterior and posterior view). (Scale is in cm)

In summary, most of the entesophytes observed at La Pijotilla were found on bones from the lower limbs. However, there were also some on bones of the upper limbs.

5.6.1.ii.- Valencina-Castilleja

At Valencina-Castilleja, only one enthesophyte was found on a bone (C-1 from La Cima a femur with a robust third trochanter.

5.6.2.- Other examples of normal variation

There are three bones with changes at La Pijotilla that are not strictly considered to be non-metric traits but are also not classified as enthesophytes that were documented. The first case was on a scaphoid bone where flat articular facets were seen on the lunate and capitate. This particular example (bone ID 10,282 - Figure 5.15) concerns a right adult scaphoid that appears to have a very flat palmar surface. While the articular facets for the lunate and the capitate could not be observed directly, in addition to the flat palmar surface of the scaphoid, the interior surface for articulation with the radius has a bony projection in the form of a spur that might be related to the flattened scaphoid. In this sense, it may be interpreted as a marker of the "stress" produced by pronation and supination. However, the scaphoid did not present any evidence of joint disease.
In terms of other normal variation, a patella had asymmetrical facets (ID 4601 – Figure 5.16). The third case is an example of hyperplatycnemia (ID 5839) on a left adult tibia, which represents normal variation. All are listed in the Table 5.18.

N	BAG ID	BONE	ELEMENT	SIDE	AGE	SEX	DESCRIPTION
1	10282	Hands	Scaphoid	R	A	U	Flattened articular facets forlunate and capitate
2	4601	Patella	Patella	R	A	U	Asymmetry between facets
3	5839	Tibia	Diaphysis	L	A	U	Hyperplatycnemia

Key to table: R= right; L= left; A= adult; U= undetermined.

Table 5.18. Bone elements with "other" features of normal variation

Figure 5.15. Flat articular facets for the lunate and capitate bones on the scaphoid bone (bone ID 10,282) (palmar surface is uppermost. Left = view from the capitate, and right = view from the radius).

5.6.3.- Abnormal variation: Paleopathology

Bones and bone fragments showing pathological changes at La Pijotilla showed evidence of joint disease (N of fragments observed= 1711 ; N affected= 44 or 2.57%), followed by trauma (N of fragments observed= 623; N affected=1.12%), metabolic disease (N of fragments observed= 84 ; N affected=6 or 7.14%) and dental pathologies (dental calculus: N of teeth observed= 1866 ; N affected=98 or 5.25%; LEH: N of teeth observed= 697, N affected= 21 or 3.01%; caries: N of teeth observed= 514, N affected= 9 or 1.75%). However, It should be noted that because of the characteristics of this assemblage and the absence of complete skeletons, the likelihood of finding pathological changes and actually diagnosing a specific disease in this skeletal material was very low and very challenging due to high fragmentation; thus the normal process of exploring distribution patterns of pathological bones in a complete skeleton, and developing differential diagnoses was not possible . Every pathological bone reported here consists of only bone fragments and not complete skeletons.

5.6.3.i.- Joint disease

5.6.3.i.a.- La Pijotilla

In terms of joint disease, 44 bone fragments with joint disease changes were found at La Pijotilla. The most common disease represented was osteoarthritis (24 of 44 bones), (Figures 5.16 and 5.17); most of the evidence was seen in foot phalanges (15 in total) (Figures 5.18 and 5.19). Osteophytes were also found (Figures 5.20 and 5.21).

In Table (5.19), a description of every pathological bone is provided:

N	BAG ID	BONE	N observed	N affected	% rate	ELEMENT	SIDE	SEX	AGE	OBSERVATIONS
1	30	Thoracic Vertebra	18	3	16.66	Body	-	-	A	Schmörl's node
2	54	Ulna	7	1	14.28	Distal end	L	-	YA	Osteophyte
3	300	Feet	106	1	0.94	Navicular, PE	R	-	A	OA, porosity
4	383	Feet	2	1	50	Phalanx PE	-	-	A	OA at plantar surface of an articular facet
5	459	Thoracic Vertebra	18	3	16.66	Body	-	-	A	Spondylosis on the body surface
6	487	Vertebra	98	3	3.06	Body	-	-	A	Schmörl's nodes
7	691	Axis	60	3	5	Odontoid process	-	-	A	Osteophyte
8	696	Feet	92	1	1.08	Talus	R	-	A	OA at calcaneal articular facets
9	1005	Feet	38	1	2.63	4th D phalanx	-	-	A	OA at plantar surface of an articular facet
10	1308	Vertebra	98	3	3.06	Body	-	-	A	Spondylosis on the body surface
11	3416	Feet	92	1	1.08	Talus	R	-	A	OA at distal end
12	3425	Feet	19	1	5.26	1st D phalanx	L	-	A	OA at plantar surface of an articular facet
13	3483	Feet	8	1	12.5	M Phalanx DE	-	-	A	Symphalangism
14	3486	Feet	97	1	1.03	Calcaneum	R	-	A	Osteophyte at prox epiphysis
15	3510	Vertebra	33	5	15.15	Lumbar	-	-	A	Spondylosis on the body surface
16	3551	Vertebra	33	5	15.15	Lumbar	-	-	A	Marginal osteophytes
17	3563	Vertebra	6	1	16.66	T 7	-	-	YA	Schmörl's nodes on inferior surface
18	3577	Vertebra	33	5	15.15	Lumbar			A	Marginal osteophytes
19	3824	Hands	23	1	4.34	3rd D phalanx	-	-	A	Osteophyte on superior surface at PE
20	4189	Vertebra	10	2	20	Cervical	-	-	A	Spondylosis on the body surface
21	4277	Feet	18	1	5.55	3rd M phalanx	.	.	A	OA at plantar surface of an articular facet

N	BAG ID	BONE	N observed	N affected	% rate	ELEMENT	SIDE	SEX	AGE	OBSERVATIONS
22	4383	Feet	15	1	6.66	5th D phalanx	-	-	A	OA at plantar surface of an articular facet at distal end
23	4416	Feet	6	1	16.66	P phalanx	L	-	A	OA at plantar surface of an articular facet at
24	4496	Feet	8	1	12.5	5th D phalanx	R	-	A	OA at plantar surface of an articular facet at
25	4723	Vertebra	98	3	3.06	Body	-	-	A	Osteophyte at border
26	4733	Feet	12	1	8.33	2nd M phalanx	L	-	A	OA at plantar surface of an articular facet at distal end
27	5086	Feet	19	1	5.26	1st D phalanx	L	-	A	OA at plantar surface of an articular facet at distal end
28	5188	Vertebra	33	5	15.15	Lumbar	-	-	A	Osteophyte at border
29	5288	Hands	1	1	100	Distal phalanx	-	-	A	OA at palmar surface at distal end
30	5553	Feet	51	1	1.96	1st MT	R	-	A	OA at plantar surface of an articular facet at DE
31	5816	Axis	60	3	5	Odontoid process	-	-	A	OA at the posterior facet of the dens
32	7120	Hand	21	2	9.52	MC 1	R	-	A	OA at palmar surface of an articular facet at the DE
33	7140	Vertebra	3	1	33.3	5th lumbar	-	-	A	Flattened body and spondylosis on the body surface
34	8873	Fibula	26	1	3.84	Distal end	R	-	A	OA at distal end on medial surface
35	9138	Axis	60	3	5	Odontoid process	-	-	A	OA at the anterior facet of the dens
36	9295	Mandible	39	1	2.56	R condyle	R	-	A	OA at mandibular condyle
37	9863	Patella	133	1	0.75	Patella	-	-	A	OA at anterior surface
38	9966	Hands	5	2	40	MC 1	L	-	A	OA at palmar surface at distal end
39	10069	Thoracic Vertebra	18	3	16.6	Body	-	-	A	Spondylosis on the body surface
40	10275	Axis	60	3	5	Odontoid process	-	-	A	OA at the posterior facet of the dens
41	10118	Feet	1	1	100	1st phalanx	-	-	A	OA at plantar surface of an articular facet at DE and PE

N	BAG ID	BONE	N observed	N affected	% rate	ELEMENT	SIDE	SEX	AGE	OBSERVATIONS
42	10212	Vertebra	33	5	15.15	Lumbar	-	-	A	Osteophyte around the border
43	10221	Vertebra	2	1	50	2nd cervical	-	-	A	Spondylosis on the body surface
44	10322	Vertebra	98	3	3.06	Body	-	-	A	Osteophyte around the border

Key to table: R= right; L=left; A= adult; PE= proximal end;M= medial; DE= distal end; YA= 18-25; OA= osteoarthritis. D=distal

Table 5.19. Joint disease on bones and fragments identified at La Pijotilla

Figure 5.16 Osteoarthritis including an osteophyte on the mandibular condyle (ID 9295)

Figure 5.17. Osteoarthritis on the C1 articular facet of the dens (ID 5816) (Scale is in cm).

Figure 5.18. Symphalangism of middle and distal feet phalange.s On the left superior view and on the right inferior view (ID 3483). (Scale is in cm).

Figure 5.19. Osteoarthritis at plantar surface of an articular facet at distal end. Left: superior view; right: inferior view (ID 4733) (Scale is in cm).

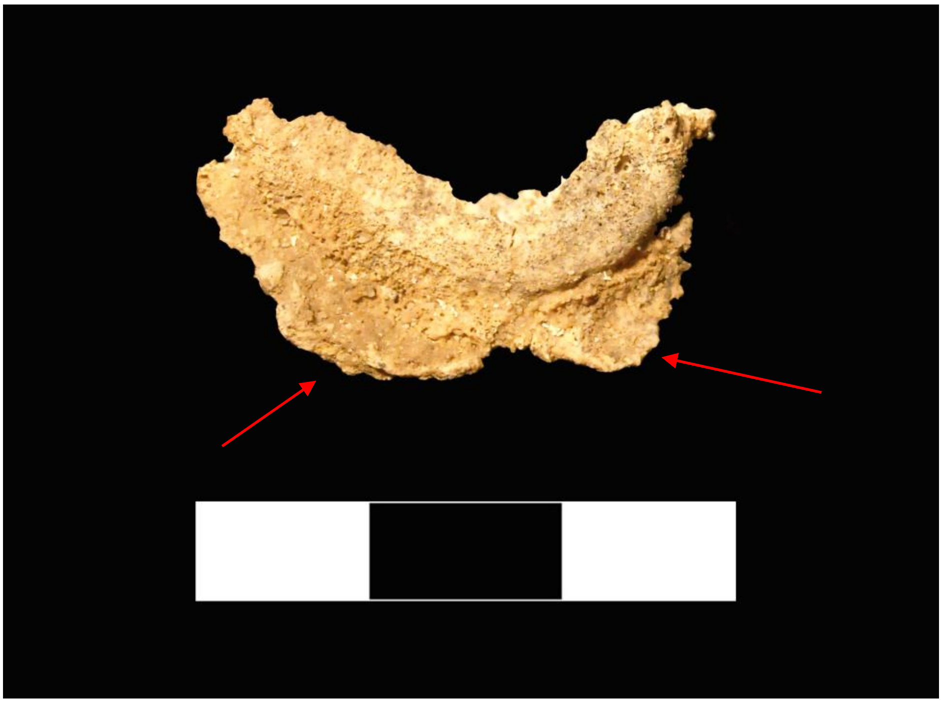


Figure 5.20. Marginal osteophyte at border in a lumbar vertebrae (ID 5188) (Scale is in cm).

Figure 5.21 Osteophyte on the anterior facet of the dens of axis (ID 9138) Posterior (left) and anterior (right) views. (Scale is in cm).

These data show that most of the evidence for joint disease recorded at La Pijotilla was found in the vertebrae (8.69%), hands (8%), long bones (6.06%) and foot bones (3.44%). Table 5.20, shows the percentage of bones affected, by bone type, can be seen:

BONE	N observed	N affected	%
VERTEBRAE	230	20	8.69
HANDS	50	4	8
LONG BONES	33	2	6.06
FEET	465	16	3.44
MANDIBLE	39	1	2.56
PATELLA	133	1	0.75
TOTAL	**950**	**44**	**-**

Table 5.20. Bone types affected by joint disease from La Pijotilla

At La Pijotilla the platycnemic and the platymeric indices of bones were also estimated to compare with the evidence of joint disease found in the bones of the lower limbs and feet. This was done to check whether hyperplatycnemia and hyperplatymeria was correlated with joint disease and hence whether this could suggest biomechanical adaptation. Results showed that all the observations for the platycnemic index (15 of 15) were mesocnemic and for the platymeric index (41 of 41) they were eurymeric. The results can be found in Appendix 2.

5.6.3.i.b.- Valencina-Castilleja

At Valencina-Castilleja, there was only one bone with evidence of joint disease recorded. The bone ID 7 from Cerro de la Cabeza presents evidence of OA on the left condyle.

5.6.3.ii- Metabolic disease

5.6.3.ii.a.- La Pijotilla

There were a total of six bone elements with pathological changes consistent with metabolic disease (Table 5.21); however, porotic hyperostosis of the skull vault and cribra orbitalia on the orbital roof were the only bone changes seen that were suggestive of metabolic disease. In terms of cribra orbitalia, there were five orbits affected, with four affected in the right orbit (ID 369, ID 6817, ID 6862 and ID 6887) (Figure 5.22) and two in the left orbit (ID 6817 and ID 6924) (Figure 5.23). There was one skull with bilateral cribra orbitalia (ID 6817).

TYPE	LOCATION	N
Cribra orbitalia	R Orbit (n=4); L Orbit (N=1)	5
Porotic hyperostosis	Skull (N=1)	1
TOTAL		6

Table 5.21. Bone changes consistent with metabolic disease at La Pijotilla

In Table (5.22), a description of each bone with changes consistent with cribra orbitalia or porotic hyperostosis recorded at La Pijotilla is shown.

N	BAG	BONE	ELEMENT	SIDE	N observed	N affected	% rate	SEX	AGE	OBSERVATIONS
1	369	Skull	Orbit	R	49	4	8.16	-	A	Cribra orbitalia grade 1
2	6817	Skull	Orbit	R & L	49 35	4 (R) 2 (L)	8.16 5.71	-	A	Cribra orbitalia grade 1 (R) and grade 2 (L)
3	6862	Skull	Orbit	R	49	4	8.16	-	A	Cribra orbitalia grade 2
4	6887	Skull	Orbit	R	49	4	8.16	-	A	Cribra orbitalia grade 2
5	6924	Skull	Orbit	L	35	2	5.71	-	A	Cribra orbitalia grade 3

Key to table: R=right; L=left; A=adult.

Table 5.22. Bones changes consistent with cribra orbitalia at La Pijotilla

Figure 5.22. Right orbit affected by cribra orbitalia, grade 2 (ID 6887) (Scale is in cm).

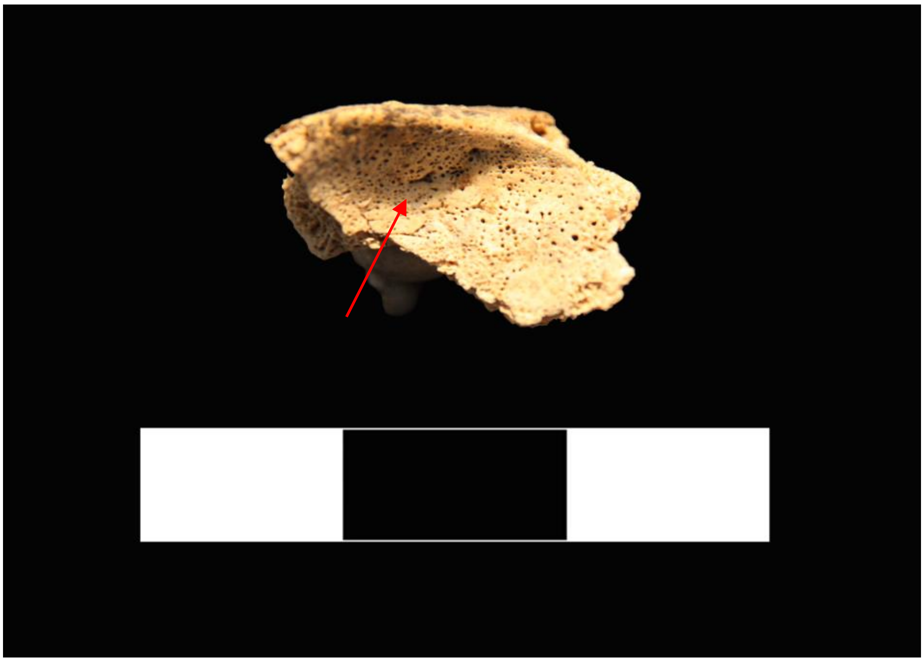


Figure 5.23. Left orbit affected by cribra orbitalia, grade 3 (ID 6924) (Scale is in cm).

5.6.3.ii.b.- Valencina-Castilleja

At this site, six bones with changes consistent with metabolic disease were recorded from three different sectors. All the bones affected belonged to the skull and were described as porotic hyperostosis (1) or cribra orbitalia (5) (Figure 5.24). The bones of two females (C-1 and CC-1) and one male (ALG-2) were affected. However, there were three bones where sex could not be estimated. In relation to age at death, all the bones were classified as adult, with three belonging to the young adult category (C-1, ALG-2 and CC-1) (Figure 5.25). The results can be seen in Table 5.23:

N	INDIV	BONE	ELEMENT	SIDE	N observed	N affected	% rate	SEX	AGE	OBSERVATIONS
1	C-1	Skull	Orbit	R L	1 1	1 1	100 100	F	18-25	Cribra orbitalia grade 2
2	ALG-2	Skull	Orbit	L	6	1	16.66	M	18-25	Cribra orbitalia grade 1
3	CC-1	Skull	Orbit	L	2	2	100	F	18-25	Cribra orbitalia grade 3
4	CC BAG 7	Skull	Parietal	R & L	2	2	100	-	A	Porotic hyperostosis
5	CC-5	Skull	Orbit	L	2	2	100	U	A	Cribra orbitalia grade 2
6	CC-6	Skull	Orbit	R	1	1	100	U	A	Cribra orbitalia grade 3

Key to table: R=right; L=left; A=adult.

Table 5.23. Bone changes consistent with metabolic disease at Valencina-Castilleja

Figure 5.24. Right orbit affected by cribra orbitalia, grade 3 (CC-6)

Figure 5.25. Left orbit affected by cribra orbitalia, grade 1 (ALG-2)

5.6.3.iii.- Trauma
5.6.3.iii.a.- La Pijotilla

At La Pijotilla, seven bones with evidence of trauma were documented (Table 5.24). At least five were fractures of the rib, all of them healed. According to Brickley (2006), rib fractures are among the most well-represented traumatic lesions in the bioarchaeological record but, due to fragmentation of this assemblage, no further rib fractures were documented.

Concerning other bone fragments, an adult fibula with a possible fracture of the diaphysis was recorded (ID 10,136) and a second metatarsal (ID 7285).

N	BAG	UE	BONE	ELEMENT	N observed	N affected	% rate	SIDE	SEX	AGE	OBSERVATIONS
1	1604	14-2	Rib	Shaft	582	3	0.51	-	-	Adult	Healed fracture
2	3285		Rib	Shaft	6	2	33.33	L	-	Adult	Healed fracture
3	3293	15	Rib	Shaft	6	2	33.33	L	-	Adult	Healed fracture
4	4262	16	Rib	Shaft	582	3	0.51	-	-	Adult	Healed fracture
5	5840	16	Rib	Shaft	582	3	0.51	-	-	Adult	Healed fracture
6	7285	17	Feet	2nd MT	40	1	25	R	-	Adult	Possible fracture
7	10136	19	Fibula	Diaphysis	31	1	3.22	-	-	Adult	Possible fracture

Key to table: L= left; R= right; MT= metatarsal.

Table 5.24 Bone fragments with evidence of trauma from La Pijotilla

One example of rib trauma with evidence of healing and new woven formation (on the left side) is ID 3293. This is the only fragment from this rib and sex and age could not be assessed (Figure 5.26).

Figure 5.26. Anterior (left) and posterior view (right) of a healed rib fracture at La Pijotilla (ID 3293).

Another example of a rib trauma with evidence of healing and new callus formation including some periosteal reaction can be seen in Figure (5.27):

Figure 5.27. Anterior and inferior view of healed rib fracture (ID 3285).

Bone fragment ID 7285 showed a possible fracture to the proximal end of the second metatarsal at the base with bursitis. The fracture line is oblique, from the medial to the lateral side, with consolidation, and new bone formation on the plantar side (Figure 5.28).A comparison to a normal second metatarsal is also showed (Figure 5.29).

Figure 5.28. Lateral and medial view of a possible fracture of a second metatarsal (ID 7285) (Scale is in cm).

Figure 5.29. Normal metatarsal (photograph: Inmaculada López Flores) (Scale is in cm).

5.6.3.iv.- Dental pathology
5.6.3.iv.a.- La Pijotilla

At this site, 2,944 dental fragments (of tooth crown or root) were identified. Some of these fragments exhibited evidence of dental disease; the most frequent conditions found were calculus, enamel hypoplasia and caries. The list of the teeth affected by these three conditions are listed in Tables 5.27, 5.28 and 5.29.

Dental calculus affected 99 of 2944 tooth fragments (3.36%), mainly on the labial surfaces of the teeth (%) and mostly of grade 1 (%) (Buikstra and Ubelaker 1994: 56). The list of the teeth affected by calculus can be seen in Table (5.25), along with the attrition score:

N	SITE	BAG ID	TOOTH	WEAR	SCORE	MD	BL	CH	CODE	LOCATION
1	LP	418	LLI1	S	4	4.04	5.56	0	2	Buccal and labial
2	LP	422	URP2	S	4	8.7	5.92	7.01	1	Labial
3	LP	422	URP1	S	3	8.71	6.51	8.25	1	Labial
4	LP	425	ULM3	B	2	8.39	8.23	7.79	1	Buccal
5	LP	429	LRM3	B	3+	8.94	11.07	4.29	-	Labial
6	LP	432	URM2	B	2+	11.2	8.94	7.35	1	Labial
7	LP	444	LRI2	S	2	5.88	5.52	7.03	2	Labial
8	LP	445	LRC	S	5	8.49	8.04	0	1	Labial
9	LP	447	URI1	S	4	7.92	8.86	10.27	1	Labial
10	LP	719	URP1	S	5	0	0	0	2	Labial
11	LP	719	LLP2	S	5	7	6.61	5.52	2	Labial
12	LP	719	ULC	S	5	6.09	7.59	0	1	Labial
13	LP	719	LLM1	B	5	0	10.07	0	1	Labial
14	LP	719	URC	S	5	7.94	5.66	0	2	Labial
15	LP	719	LRI1	S	6	0	0	0	2	Labial and lingual
16	LP	719	LLI1	S	5	0	0	0	2	Labial and lingual
17	LP	721	URI2	S	3	6.65	6.42	9.39	1	Labial CEJ
18	LP	721	URP1	S	4	9.09	7.23	6.73	1	Labial
19	LP	1397	URP1	S	5	9.59	7.15	7.76	1	-
20	LP	1397	URP2	S	4	10.0	7.47	6.99	1	-
21	LP	1411	ULC	S	4	7.8	7.6	9.52	1	Labial
22	LP	1413*	LLC	S	3	7.2	7.22	11.67	1	Distal and lingual
23	LP	1413*	LRI2	S	3	5.77	5.99	9.91	1	Labial
24	LP	1413*	LRI1	S	3	5.88	5.45	3.55	1	Labial
25	LP	1413*	LLI2	S	2	5.77	6.17	9.74	2	Labial
26	LP	1413*	LLI1	S	4	5.82	5.23	9.63	2	Labial
27	LP	1413*	LRP2	S	4	7.84	6.87	7.25	1	Labial
28	LP	1413*	LLM2	B	2+	10.1	11.18	5.42	1	Lingual
29	LP	1413*	LLP2	S	3	7.86	6.94	7.66	2	Lingual
30	LP	1413*	LLP1	S	4	6.85	6.91	8.58	1	Lingual
31	LP	1413*	LRP1	S	3	7.76	6.67	8.15	1	Lingual
32	LP	1417	ULM2	B	3	10.4	8.06	6.46	1	Distal and labial
33	LP	1417	ULM3	B	2+	10.1	9.33	6.07	1	Distal and labial
34	LP	1417	ULM1	B	3	11.0	9.77	5.85	1	Lingual
35	LP	1424	LRM2	B	3	9.98	10.81	6.24	1	Lingual
36	LP	1427	LRM2	B	3	9.94	9.88	6.39	1	Lingual
37	LP	1427	LRM1	B	4	10.1	9.98	5.6	1	Lingual
38	LP	2414	LLP2	S	3	8.06	7.51	5.45	2	Labial and distal
39	LP	2415	ULC	S	2	8.76	6.95	11.01	1	Labial

N	SITE	BAG ID	TOOTH	WEAR	SCORE	MD	BL	CH	CODE	LOCATION
40	LP	2415	ULP2	S	2	9.2	6.34	7.39	1	Lingual
41	LP	2420	LLI2	S	4	6.61	6.21	7.46	1	Labial
42	LP	3164	LRM2	B	3+	10.4	10.92	6.57	1	Labial
43	LP	3165	LLM1	B	3+	10.9	11.28	6.42	1	Buccal
44	LP	4784	LRM1	B	3	10.8	10.63	5.22	1	Distal
45	LP	5029	URP1	S	4	9.18	6.52	6.89	1	Labial
46	LP	5029	URP2	S	2	8.97	5.97	4.55	2	Labial
47	LP	5153	ULM3	B	2	10.6	7.82	6.09	1	Linea CEJ
48	LP	5153	ULP1	S	3	9.34	6.79	6.28	1	At CEJ
49	LP	5153	ULM1	B	3	11.0	9.92	6.37	1	Labial linea CEJ
50	LP	5914	ULP2	S	2	9.46	6.16	6.6	1	Labial
51	LP	6204	LLI1	S	3	4.72	5.35	8.04	1	Labial CEJ
52	LP	6204	LRI1	S	3	4.99	5.65	8.27	1	Labial linea CEJ
53	LP	6766	URI2	S	2	5.99	6.02	9.78	1	Labial
54	LP	7328	LRP1	S	3	8.25	7.49	7.13	1	Labial
55	LP	7328	LLP1	S	3	7.31	7.23	7.62	1	Labial and bucal
56	LP	7355	LLP2	S	3	7.57	6.67	5.66	1	-
57	LP	7611	LRI2	S	4	5.22	5.35	7.16	1	Distal
58	LP	7611	LRM1	B	2	9.89	11.87	5.9	1	Distal
59	LP	8110	LLP2	S	2	8.59	7.1	7.4	1	Buccal and labial
60	LP	8181	Lower Incisor	S	5++	0	0	0	1	Buccal and lingual
61	LP	8181	Incisor	S	5++	0	0	0	1	Buccal
62	LP	8181	LLC	S	5++	0	0	0	2	Labial and buccal
63	LP	8181	ULC	S	5++	0	0	0	2	Mesial
64	LP	8181	Premolar	S	5	0	0	0	2	Buccal, lingual
65	LP	8200	URM1	B	3	10.4	10.86	7.46	1	Labial
66	LP	8251	LLM2	B	5+	10.0	10.52	0	2	Buccal
67	LP	8251	LLM1	B	5+	10.7	11.03	0	2	Buccal
68	LP	8309	LRM1	B	3+	10.5	11.11	6.66	2	Lingual
69	LP	8388	ULC	S	4+	6.27	6.22	7.79	2	CEJ labial
70	LP	8388	URC	S	4	6.21	6.62	9.18	2	Labial and lingual
71	LP	8388	LRI1	S	4	3.57	5.55	6.04	2	Labial
72	LP	9023	LRP1	S	3	7.48	6.88	7.22	1	Labial
73	LP	9024	ULC	S	5	7.75	7.31	8.12	2	Labial
74	LP	9048	LLM3	B	3	9.67	9.26	4.33	1	Labial, distal and bucal
75	LP	9048	URM3	B	4	10.7	8.12	5.59	1	Labial distal
76	LP	9048	LLI2	S	2	3.58	5.18	9.87	1	Lingual
77	LP	9149	ULI2	S	4	5.04	6.31	6.61	1	Labial
78	LP	9149	LLI1	S	4	4.35	5.17	6.83	2	Labial
79	LP	9311	URP1	S	3	9.29	7.23	6.49	1	Labial
80	LP	9441	LLP2	S	4	8.26	0	0	3	Labial
81	LP	9633	LRI1	S	4	4.93	5.46	7.28	1	Labial
82	LP	9633	URI1	B	2	5.09	6.63	7.97	1	CEJ labial
83	LP	9633	LRI1	S	2	4.48	7.78	9.19	1	Labial
84	LP	9854	LLI2	-	0	0	0	0	1	Labial
85	LP	9867	ULC	S	2	5.57	6.78	10.86	1	Mesial
86	LP	9867	LLI1	S	4	4.25	5.63	6.85	1	Labial
87	LP	9916	Lower premolar	-	0	0	0	0		Labial; excessive calculus
88	LP	9916	ULI1	S	3	4.18	6.82	8.05	1	Mesial and distal
89	LP	9916	LRC	S	3	4.16	6.3	9.07	2	Labial and mesial
90	LP	9916	LRC	S	2	7.55	6.98	7.8	2	Labial at CEJ
91	LP	10345	URC	S	4	6.22	7.25	9.62	1	Labial
92	LP	10346	LLI2	S	4	3.77	5.89	8.45	1	Buccal
93	LP	10347	ULI2	S	4	5.26	5.78	0	1	Labial
94	LP	10347	URC	S	5	8.46	7.42	0	2	Labial

N	SITE	BAG ID	TOOTH	WEAR	SCORE	MD	BL	CH	CODE	LOCATION
95	LP	10348	LLI2	S	3	3.66	5.17	6.3	2	Labial
96	LP	10349	ULI2	S	3	4.16	7.44	9.24	1	Labial and mesial
97	LP	10350	URM2	B	4+	10.4	9.14	6.38	1	Buccal
98	LP	10350	URI2	S	4	6.06	6.41	7.62	1	Labial at CEJ
99	LP	10591	Molar	-	-	-	-	-	-	Labial

*Bag ID 1413= teeth belong to the same individual.
Key to table: MD= mesio-distal diameter; BL= bucco-lingual diameter; CH= crown height; W= wear; S= score LP= La Pijotilla; L= lower; U=upper; R: right; L= left; C= canine; P= premolar; I= incisor; M= molar; CEJ= cemento-enamel junction; B= Brothwell, S= Smith..

Table 5.25. Teeth affected by dental calculus from La Pijotilla

Calculus mainly affected the maxillary teeth (54 of 98, or 55.10% of the total). However, a similar percentage of the mandibular teeth were also affected (42 of 98 teeth, or 42.85 %). Calculus was recorded by degree (Figures 5.30, 5.31 and 5.32). The types of teeth affected by calculus can be seen in Table 5.26:

Figure 5.30. Molar affected by calculus (ID 8502) (Scale is in cm).

Figure 5.31. Dental calculus. Labial view (left), mesial view (centre) and occlusal view (right) (ID 10,591)

Figure 5.32. Lower premolar affected by calculus (ID 9116)

TOOTH	N observed	N affected	%
Incisor	15	1	6.66
LLC	33	2	6.06
LLI1	50	6	12
LLI2	46	7	15.21
LLM1	74	3	4.05
LLM2	76	2	2.63
LLM3	37	1	2.70
LLP1	43	2	4.65
LLP2	48	6	12.5
Lower Incisor	4	1	25
Lower premolar	34	1	2.94
LRC	35	3	8.57
LRI1	30	6	20
LRI2	24	3	12.5
LRM1	105	4	3.80
LRM2	90	3	3.33
LRP1	42	3	7.14
LRP2	49	1	2.04
Premolar	33	1	3.03
ULC	72	7	9.72
ULI1	65	1	1.53
ULI2	58	3	5.17
ULM1	75	2	2.66
ULM2	82	1	1.21
ULM3	51	3	5.88
ULP1	57	1	1.75
ULP2	49	2	4.08
URC	59	4	6.77
URI1	53	2	3.77
URI2	43	3	6.97
URM1	73	1	1.36
URM2	84	2	2.38
URM3	63	1	1.58
URP1	62	6	9.67
URP2	52	3	5.76

Key to table: L= lower; U=upper; R: right; L= left; C= canine; P= premolar; I= incisor; M= molar

Table 5.26 Proportion of individual teeth affected by dental calculus

Linear enamel hypoplasia (LEH) was the second most frequently represented dental disease at La Pijotilla. Nineteen teeth were affected, primarily canines (*n* = 11), premolars (*n* = 5), incisors (*n* = 2) and molars (*n* = 1). They were all affected between 2.7 and 5.6 years of age; some teeth had two or three hypoplastic defects. The teeth affected by LEH can be seen in Table (5.27 and 5.28):

N	SITE	ID	TOOTH	MD	BL	CH	M	YEAR
1	LP	6458	LRM2	10.57	10.47	4.74	1.33	-
2	LP	8488	ULC	4.96	5.88	0	1.44 and 3.49	5.6 – 4.9; 4.2 -3.6
3	LP	2429	ULP1	8.79	6.28	8.19	1.72	5.6 – 4.9
4	LP	6479	LLP2	8.33	7.63	8.08	1.73 , 4.26 and 5.83	5.6 – 4.9
5	LP	6204	LLC	5.76	7.38	8.64	1.85 , 2.27 and 4.52	5.6 – 4.9 4.9 – 4.2 3.1 – 3.7
6	LP	2429	ULP2	9.21	6.65	7.09	1.67	5.6- 4.9
7	LP	8254	URC	5.56	6.66	9.1	3.10 and 4.76	4.2. – 3.6
8	LP	8185	ULC	6.06	6.45	9.73	3.20, 4.48 and 6.28	3.8 – 3.4 3.4 – 3.0 2.7 – 2.4
9	LP	10350	ULI1	3.88	9.17	10.48	3.39	3.9 – 3.4
10	LP	2429	ULC	7.13	7.56	11.36	3.58 and 2.13	3.8 – 3.4 4.3 – 3.8
11	LP	6458	LRP2	8	7.35	8.46	3.84	4.2 – 3.6
12	LP	9048	LRC	6.71	7.48	8.18	5.61	3.1 – 2.7
13	LP	5914	URP1	9.33	6.51	7.48	1.80 and 1.73	4.8 – 4.3
14	LP	6204	LRC	5.97	6.34	10.07	1.89, 3.19 and 6.98	5.6 – 4.9 4.2 – 3.6 2.7 – 2.3
15	LP	5914	URC	8.63	7.99	8.92	1.54 and 2.85	4.8 – 4.3 4.3 – 2.8
16	LP	6204	URI2	4.49	6.46	8.72	1.74 and 2.49	4.6 – 4.1 4.1 – 3.7
17	LP	7200	LLC	6.22	7.84	9.18	4.28 and 3.58	3.6 – 3.1 4.9 – 4.2
18	LP	1394	LLC	7.39	6.64	11.11	2.45 and 3.53	5.6 – 4.9 4.2 – 3.6
19	LP	5914	ULC	8.22	7.75	10.47	2.40	5.6 – 4.9

Key to table: MD= mesio-distal diameter; BL= bucco-lingual diameter; CH= crown height; W= wear; S= score LP= La Pijotilla; L= lower; U=upper; R: right; L= left; C= canine; P= premolar; I= incisor; M= molar; CEJ= cemento-enamel junction; Year=age when LEH occurred

Table 5.27. Teeth affected by LEH at La Pijotilla

All the teeth with more than one hypoplastic defect were incisors and the individuals to whom these teeth belonged were affected between 2 and 5 years of age.

TOOTH	N observed	N affected	%
LRM2	90	1	1.11
ULC	72	4	5.55
ULP1	57	1	1.75
LLP2	48	1	2.08
LLC	33	3	9.09
ULP2	49	1	2.04
URC	59	2	3.38
ULI1	65	1	1.53
LRP2	49	1	2.04
LRC	35	2	5.71
URP1	62	1	1.61
URI2	43	1	2.32

Key to table: L= lower; U=upper; R: right; L= left; C= canine; P= premolar; I= incisor; M= molar

Table 5.28. Proportion of individual teeth affected by LEH at La Pijotilla

There were nine teeth with evidence of caries at La Pijotilla; eight were molars and, of these, three were from the mandible and six from the maxilla; two premolars were also affected (Figure 5.33). The list of teeth affected can be seen in Table 5.30:

N	SITE	ID	TOOTH	MD	BL	CH	LOCATION	N
1	LP	426	ULP1	0	0	0	Distal	3.53
2	LP	1792	ULM2	10.62	0	0	Distal CEJ	5.85
3	LP	1413	LLM1	0	0	0	Disto-lingual surface.	7.50
4	LP	8388	URM3	11.29	8.95	6.43	Mesial CEJ	9.66 width x 3.79 height
5	LP	429	ULP2	9.05	5.92	6.53	Mesial CEJ	2.64
6	LP	2449	URM2	0	0	0	Double on root	-
7	LP	1413	LRM1	11.27	0	5.97	Mesial from occlusal to CEJ	5.86
8	LP	1429	LRM1	10.5	11.31	6.33	Occlusal surface	2.99
9	LP	7302	URM2	0	0	0	Distal	9.50

Key to table= MD= mesio-distal diameter; BL= bucco-lingual diameter; CH= crown height; W= wear; S= score ; LP= La Pijotilla; L= lower; U=upper; R: right; L= left; C= canine; P= premolar; I= incisor; M= molar; CEJ= cemento enamel junction.

Table 5.29. Teeth affected by caries at La Pijotilla

TOOTH	N observed	N affected	%
ULP1	57	1	1.75
ULM2	82	1	1.21
LLM1	74	1	1.35
URM3	63	1	1.58
ULP2	49	1	2.04
URM2	84	2	2.38
LRM1	105	2	1.90

Key to table: L= lower; U=upper; R: right; L= left; C= canine; P= premolar; I= incisor; M= molar

Table 5.30. Proportion of individual teeth affected by caries at La Pijotilla

As well as these three dental diseases, there were other dental pathologies found at La Pijotilla. Due to the high fragmentation of this assemblage, they were not easy to identify.There were two examples of dental abcess (ID 654 and ID 10,400) (Figure 5.34), the first of which was on a partially preserved maxilla, near the upper right second premolar (URP2), and approximately 4 mm in diameter (ID 10,400, Figure 5.35). The other was found on a partially preserved mandible (ID 654), and was 5.66 mm in diameter width over the LLP2, with reabsorption of the LLM2. There were also three examples of caries that have obliterated the entire tooth crown: of both central upper incisor teeth (ID 2497), of ULP1 and ULP2 (ID 5029), and of lower incisors, canines and premolars (ID 8776).

Alveolar bone recession has been found in one individual (ID 2039). There is a possible case of mandibular torus (normally it is found more posteriorly), but it is only partially visible due to fragmentation in the area of the LRM3 (ID 9977) (Figure 5.36).

Dental wear was recorded for every tooth, and the score results are quite wide-ranging (one example can be seen on Figure 5.37). These data can be seen in Appendix 2.2.

In summary, of the 2944 teeth found at La Pijotilla, 143 teeth or tooth sockets were affected by dental pathology representing 4.85%. Calculus was the most well-represented pathology (3.32%, 98 of 2944), followed by LEH (0.64 %, 19 of 2944), AMTL (3.03%, 13 of 429), caries (0.30%, 9 of 2944), and dental abcess (0.46 %, 1 out of 429). The data can be seen in Table 5.31:

TYPE	N observed	N affected	%
CALCULUS	2944	98	3.32
AMTL	429	14	3.26
CARIES	2944	9	0.30
HYPOPLASIA	2944	19	0.64
DENTAL ABCESS	429	2	0.46
TOTAL	-	141	-

Table 5.31. Percentage of teeth and tooth sockest with different dental diseases from La Pijotilla

Figure 5.33. Dental caries on an upper right second molar (ID 7302) (Scale is in cm).

Figure 5.34. Dental abcess cavity (ID 10400) (Scale is in cm).

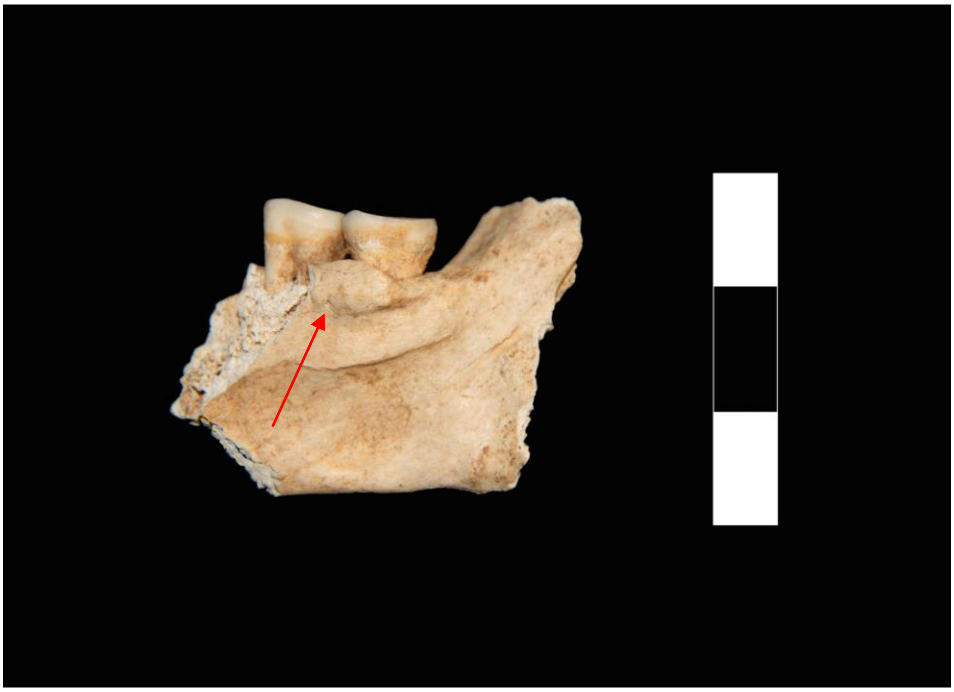


Figure 5.35 Mandibular torus on right side (ID 9977) (Scale is in cm).

Ante mortem tooth loss was represented by 14 examples (Table 5.32):

N	SITE	ID	TOOTH SOCKETS
1	LP	654	LLM
2	LP	936	MANDIBLE
3	LP	2497	Incisor
4	LP	2497	Incisor
5	LP	5029	ULP1
6	LP	5029	ULP2
7	LP	8776	LLI1
8	LP	8776	LLI2
9	LP	8776	LLC
10	LP	8776	LLC
11	LP	8776	LLP1
12	LP	8776	LLP2
13	LP	8776	LRP1
14	LP	8776	LRP2

Key to table: LP= La Pijotilla; L=left; M=molar; P=premolar; L=lower.

Table 5.32. Antemortem tooth loss at La Pijotilla

Figure 5.36 Severe dental attrition (ID 3108) (Scale is in cm).

5.6.3.iv.b.- Miscellaneous

In this section, an example of dental modification found at La Pijotilla is described. The teeth affected were both first permanent incisors from one individual (ID 10,381) (Figure 5.37). Both teeth present a groove on the occlusal surface from the labial to the lingual side.

Figure 5.37. Dental modification on both upper central incisors at La Pijotilla (ID 10381) (Scale is in cm).

5.6.3.iv.c.- Valencina-Castilleja

At this site there were 15 teeth with dental calculus, mostly from individual ALC-1 from La Alcazaba (who had 12 teeth with calculus) and from individual ALG-10 from El Algarrobillo (2 teeth with calculus). Most of the affected teeth were mandibular, and the calculus was usually located on the labial surface with a score of 2, following Buikstra and Ubelaker (1994). The data can be seen in Table 5.33 and Table 5.34.:

N	SECTOR	INDIVIDUAL	TOOTH	MD	BL	CH	TYPE	LOCATION
1	A	ALC-1	LLM2	8.96	9.83	-	2	Labial, buccal, distal
2	A	ALC-1	LLP2	7.43	6.32	4.47	2	Labial, buccal
3	A	ALC-1	LLP1	7.09	5.72	6.35	2	Buccal
4	A	ALC-1	LLC	-	-	-	2	Labial, buccal
5	A	ALC-1	LLI2	-	-	-	2	Buccal
6	A	ALC-1	LRM1	10.39	9.68	6.00	1	Buccal
7	A	ALC-1	LRP2	7.40	6.54	5.29	2	Buccal
8	A	ALC-1	LRP1	7.16	5.35	6.76	2	Labial, buccal
9	A	ALC-1	LRI2	5.54	4.51	6.21	2; 1	Labial; buccal
10	A	ALC-1	LLI1	4.99	4.23	6.56	1	Labial, buccal
11	A	ALC-1	ULC	7.74	7.21	8.36	-	Labial
12	A	ALC-1	URP1	8.34	6.23	7.45	2	Labial
13	A	Bag 2a	URI1	6.44	8.95	11.48	1	Labial
14	ALG	ALG-10	URM2	10.78	8.96	6.64	1	Labial
15	ALG	ALG-10	ULI2	-	-	7.78	1	Labial

Key to table: MD= mesio-distal diameter; BL= bucco-lingual diameter; CH = crown height; W= wear; S = score; A = La Alcazaba; ALG = El Algarrobillo; L= lower; U = upper; R: right; L= left; C= canine; P = premolar; I= incisor; M= molar; B = Brothwell; S = Smith.

Table 5.33. Teeth affected by calculus from Valencina-Castilleja

TOOTH	SECTOR	INDIVIDUAL	N observed	N affected	% rate
URM2	ALG	ALG-10	3	1	33.33
ULI2	ALG	ALG-10	2	1	50
LLM2	A	ALC-1	1	1	100
LLP2	A	ALC-1	1	1	100
LLP1	A	ALC-1	1	1	100
LLC	A	ALC-1	1	1	100
LLI2	A	ALC-1	1	1	100
LRM1	A	ALC-1	1	1	100
LRP2	A	ALC-1	1	1	100
LRP1	A	ALC-1	1	1	100
LRI2	A	ALC-1	1	1	100
LLI1	A	ALC-1	1	1	100
ULC	A	ALC-1	1	1	100
URP1	A	ALC-1	1	1	100
URI1	A	ALC-1	1	1	100

Key to table: A = La Alcazaba; ALG = El Algarrobillo; L= lower; U = upper; R: right; L= left; C= canine; P = premolar; I= incisor; M= molar.

Table 5.34. Proportion of teeth affected by calculus from Valencina-Castilleja

LEH was also found at Valencina-Castilleja, affecting four teeth (N observed= 1, N affected= 1, % rate= 100 for each type of tooth). All the teeth were incisors and the LEH occurred between 2 and 4 years of age (Reid and Dean 2000). The data can be seen in Table 5.35:

N	SECTOR	INDIVIDUAL	TOOTH	MD	BL	CH	MEASUREMENT	YEAR
1	A	ALC-1	ULI2	5.64	4.64	6.26	2.83 and 1.59	4.1 – 3.7 4.6 – 4.1
2	A	ALC-1	URI1	6.73	7.54	8.80	6.36	2.0 – 1.8
3	A	ALC-1	ULI1	6.70	7.71	8.65	5.76	2.4 – 2.0
4	CC	VA 4676 F1 126	LRI1	-	4.68	6.92	2.02, 2.38, 2.96 and 4.23	3.9 -3.4 2.9 -2.4

Key to table: MD= mesio-distal diameter; BL= bucco-lingual diameter; CH= crown height; A= La Alcazaba; CC= Cerro de la Cabeza ; L= lower; U=upper; R: right; L= left; C= canine; P= premolar; I= incisor; M= molar.

Table 5.35. Teeth with LEH from Valencina-Castilleja

Other examples of dental diseases were noted at Valencina-Castilleja, such as alveolar bone resorption in two individuals from La Alcazaba (ALC-1 and 2-e). However in ALC-1, the obliteration of the tooth sockets was not complete. Antemortem tooth loss (AMTL) was documented in five alveolar bone fragments from La Alcazaba (ALC-1) and Cerro de la Cabeza (ID 26926). Congenital absence of both lower third molars was also found at Cerro de la Cabeza (ID 26,926). There was one example of a dental abcess (sinus) in an alveolar bone fragment at Cerro de la Cabeza with an approximate diameter of 9.33 mm (ID F1 128). The data can be seen in Table 5.36:

N	SECTOR	ID	TOOTH	MD	BL	CH	OBSERVATION
1	A	ALC-1	M1II	-	-	-	AMTL
2	CC	2-e	M1II	-	-	-	Alveolar bone obliteration
3	CC	26926	P2ID	-	-	-	AMTL
4	CC	26926	M1ID	-	-	-	AMTL
5	CC	26926	M3ID	-	-	-	Congenital absence
6	CC	26926	P2II	-	-	-	AMTL
7	CC	26926	M1II	-	-	-	AMTL
8	CC	26926	M3II	-	-	-	Congenital absence
9	CC	F1 128	ULC	-	-	-	Dental abscess

Key to table: ID: identification; MD= mesio-distal diameter; BL= bucco-lingual diameter; CH= crown height; W= wear; S= score; A= La Alcazaba; CC= Cerro de la Cabeza; L= lower; U=upper; R: right; L= left; C= canine; P= premolar; I= incisor; M= molar; B= Brothwell; S= Smith; AMTL=antemortem tooth loss.

Table 5.36. Teeth with pathological lesions found at Valencina-Castilleja

Dental wear was also recorded at Valencina-Castilleja and the data are shown in Appendix 2.2.

5.6.3.v.- Miscellaneous
5.6.3.v.a.- La Pijotilla

There are four cases of bone change of unknown aetiology that have been classified in the 'Miscellaneous' group; these can be seen in Table 5.37:

N	BAG	UE	BONE	ELEMENT	SIDE	N observed	N affected	% rate	SEX	AGE	OBSERVATIONS
1	4497	16	Ulna	Diaphysis	L	48	1	2.08	-	A	Periostitis
2	6507	17	Vertebra	T10	-	1	1	100	-	A	Asymmetry
3	6854	17	Ulna	PE	L	52	1	1.92	-	A	New bone formation
4	9680	19	Ulna	1/3 D	L	7	1	14.2	-	AO	Periostitis

Key to table: T=thoracic; PE= proximal end; D=distal; A= adult; AO= adolescent

Table 5.37. Miscellaneous pathological conditions found at La Pijotilla

Bone element ID 6854 shows new bone formation of unknown cause on the medial side of the proximal articulation (Figure 5.38). Although this might have imply some complications along with the distal epiphysis of the humerus, for example a fracture, it is not possible to determine the cause of this bone formation.

Figure 5.38. New bone formation on the ulna articulation. On the left is the lateral view and on the right is the posterior view (ID 6854) (Scale is in cm).

The following bone element (ID 4497) presented new bone formation on the distal third of the anterior side of the left tibia (Figure 5.39). The cause of this periostosis is unknown.

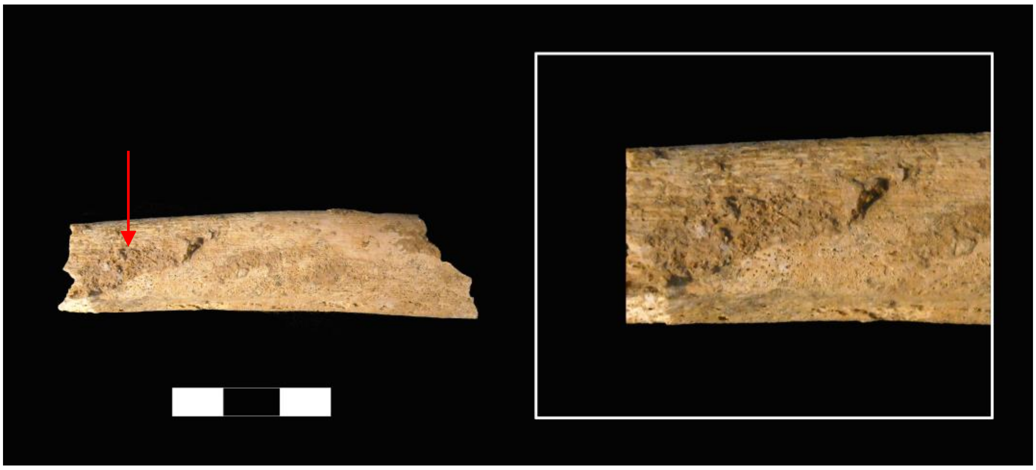


Figure 5.39. Left adult tibia with periostosis on the distal third of the diaphysis (ID 4497) (Scale is in cm).

The bone element ID 6507 is an asymmetrical vertebral body; the cause of the asymmetry is unknown. Due to fragmentation of this collection, this vertebra represents an isolated fragment and it is not possible to compare it with the rest of the spine (Figure 5.40).

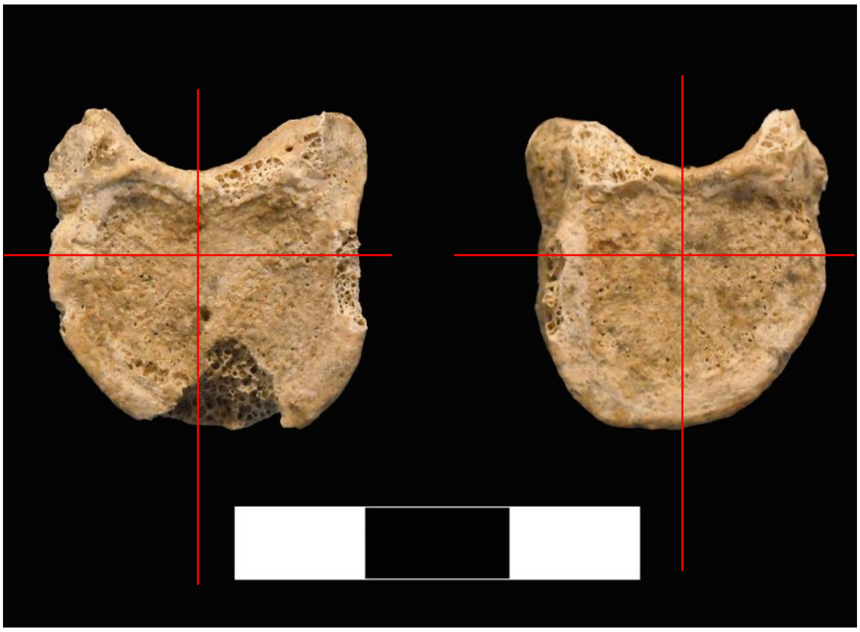


Figure 5.40. Asymmetrical vertebral body (superior and inferior views) with unknown cause (ID 6507) (Scale is in cm).

BoneD 9680, the left ulna of an adolescent, there is new bone formation on the interosseous crest. The pathological bone elements can be seen in Figure 5.41:

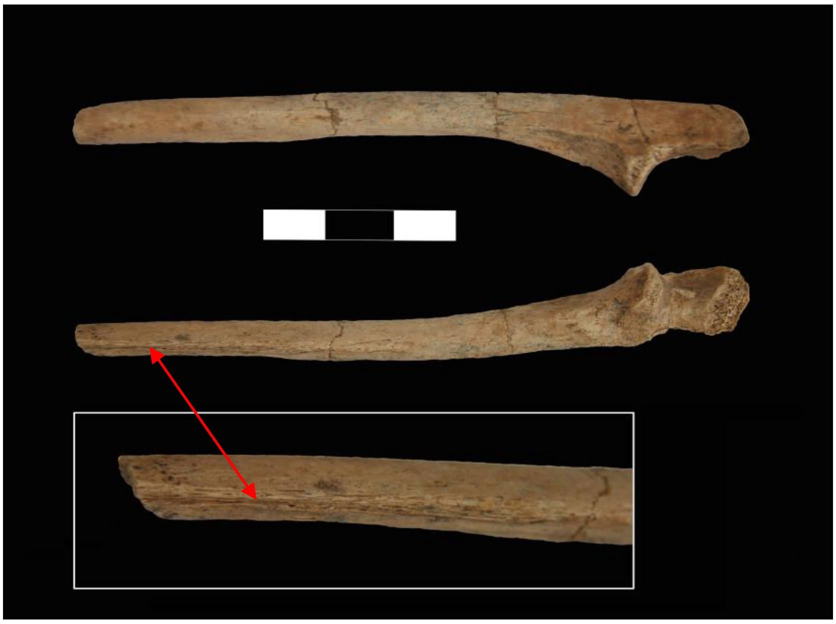


Figure 5.41. New bone formation in the interosseous crest of the ulna (ID 9880). Top: posterior view, Centre:anterior, and Bottom: detail view. (Scale is in cm).

5.7.- The exceptional burial of individual 10,049/667.1 (PP4-Montelirio, Valencina-Castilleja)

This individual has already been analysed (Robles Carrasco, 2011; Robles Carrasco and Díaz-Zorita Bonilla, 2013) and was included for comparative isotopical analyses to investigate subsistence and origin. Description of the context could be found in Chapter 3, section 3.5.2. As a summary of the methods employed, due to fragmentation sex was estimated based on skull traits, following Buikstra and Ubelaker (1994), and age was estimated based on the sternal ends of the ribs, following Iscan et al. (1984). As a result this individual was considered a male young adult (18-25 years old). Health indicators showed that this individual had degenerative disease in the form of spinal osteophytes, as well as dental disease in the form of dental calculus and LEH (Figure 5.42). In terms of non-metric traits, this individual displayed a dental foramen in the second right molar (Figure 5.43).

Figure 5.42. Dental calculus found at individual 10,049/667.1 (Photograph: Sonia Robles Carrasco).

Figure 5.43. Non-metric trait consisting of a dental foramen at the lower right second molar (individual 10,049/667.1). (Photograph: Sonia Robles Carrasco).

5.8.- Diet: carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotope analyses

5.8.1.- Results from La Pijotilla

From this site, 58 bone samples were sent to the Max Planck Institute for Evolutionary Anthropology in Leipzig (Germany) to be analysed; this included 50 human and 8 animal bones. However, due to poor preservation of the collagen, only 1 of the 58 samples (1.72%) provided good collagen data.

The sample which provided good collagen (ID 2093) (LAB ID= S-EVA22181a, %C= 17, %N= 6.0 and $C:N_{(A)}$= 3.2) presents a value of $\delta^{13}C$ (VPDB) -19.4‰ while the $\delta^{15}N$ (AIR) data show a value of 9.2‰. This sample has been identified from an adult individual of undetermined sex located in stratigraphic unit 17, and presents a diet consisting mainly of C_3 plants and it is in the same range as the other two sites analysed.

Since the other samples from this site did not provide acceptable values due to poor collagen preservation, this site is interpreted in the context of the 3rd millennium BC and compared to Valencina-Castilleja and La Orden-El Seminario (Chapter 6).

5.8.2.- Valencina-Castilleja

From this site, 44 bone samples were sent to the Max Planck Institute for Evolutionary Anthropology in Leipzig (Germany) to be analysed; this included 22 human and 22 non-human bones. However, due to poor preservation of the collagen, only 12 of the 44 (27.27%) samples provided good collagen data. The results of the $\delta^{13}C$ and $\delta^{15}N$ can be shown in Table (5.38) and Figure 5.44.

The $\delta^{13}C$ data show that the human samples (*n* = 6) have values for $\delta^{13}C$ ranging from -18.8‰ (maximum) to -19.8‰ (minimum), while the $\delta^{15}N$ data show values from 6.5‰ to 10.4‰. The mean for $\delta^{13}C \pm 1\sigma$ is -19.1 ± 0.4‰, and the mean for $\delta^{15}N \pm 1\sigma$ is 8.5 ± 1.3‰.

With respect to the faunal remains, this data has been analysed independently according to trophic level. Unfortunately, there was only good collagen data from herbivores, identified as bovids and ovicaprids. The $\delta^{13}C$ data for the herbivores (*n* = 6) show values ranging from -18.4‰ (maximum) to -20.1‰ (minimum), while the $\delta^{15}N$ data show values from 3.3‰ to 9.9‰. The mean for $\delta^{13}C \pm 1\sigma$ is 19.3 ± 0.7‰, and the mean for $\delta^{15}N \pm 1\sigma$ is 6.1 ± 2.3‰.

N	SECTOR	INDIVIDUAL	SAMPLE	SAMPLE	LAB ID	SEX	AGE	$\delta^{13}C_{(av)}$	$\delta^{15}N_{(av)}$	%C	%N	$C:N_{(A)}$
1	La Alcazaba	ALC-1	1	Humerus	S-EVA-23185	F	25-35	-19.0	9.0	23.7	8.4	3.2
2	La Alcazaba	ALC-4	3	Humerus	S-EVA-23187	U	A	-18.8	8.7	33.1	11.4	3.3
3	La Cima	C-1	7	Rib	S-EVA-23191	F	18-25	-19.8	6.5	22.7	7.4	3.5
4	El Algarrobillo	ALG-13	14	Mandible	S-EVA-23198	F	25-35	-18.8	8.7	15.1	5.4	3.2
5	Cerro Cabeza	CC-1	18	Skull	S-EVA-23202	F	18-25	-18.9	7.5	21.6	7.5	3.3
6	PP4-Montelirio	10.049-1	PP4-10049	Rib	S-EVA-23169	M	18-25	-19.1	9.9	15.0	4.7	3.6
7	La Alcazaba	Bovid	26	Mandible	S-EVA-23210	-	A	-18.8	3.3	19.6	6.7	3.3
8	La Alcazaba	Bovid	28	2nd R	S-EVA-23212	-	A	-20.0	6.3	33.3	11.7	3.3
9	La Alcazaba	Bovid	29	2nd R	S-EVA-23213	-	A	-19.8	7.7	17.6	6.3	3.2
10	La Alcazaba	Bovid	36	Atlas	S-EVA-23220	-	A	-18.8	9.9	22.7	8.1	3.2
11	Cerro Cabeza	Ovicaprid	43	R femur	S-EVA-23227	-	S	-18.4	4.4	17.5	6.0	3.4
12	Cerro Cabeza	Ovicaprid	44	Left	S-EVA-23228	-	A	-20.1	5.2	21.2	7.3	3.4

Key to table:U= undetermined; A= adult; F= female; M= male; S= subadult.

Table 5.38. Data for $\delta^{13}C$ and $\delta^{15}N$ analyses from Valencina-Castilleja

Based on these results and considering the tropic level enrichment of about 3-5‰ (Bocherens and Drucker, 2003) most of the individuals obtained their protein from C_3-consuming herbivores, with the exception of a single individual from La Cima who had low nitrogen isotope values and carbon isotope values both similar to the herbivores. If this is a human bone sample, then this individual obtained their protein mainly from plants.

In relation to the faunal remains, there is one sample (number 36) that has been identified as herbivorous (a bovid) and shows atypical values for this group of $\delta^{13}C$ -18.9‰ and $\delta^{15}N$ 9.9‰. This is an extremely high nitrogen isotope result for a herbivore, and, if it is indeed a bovid bone then perhaps it was from another very arid region, where background nitrogen isotope values were higher.

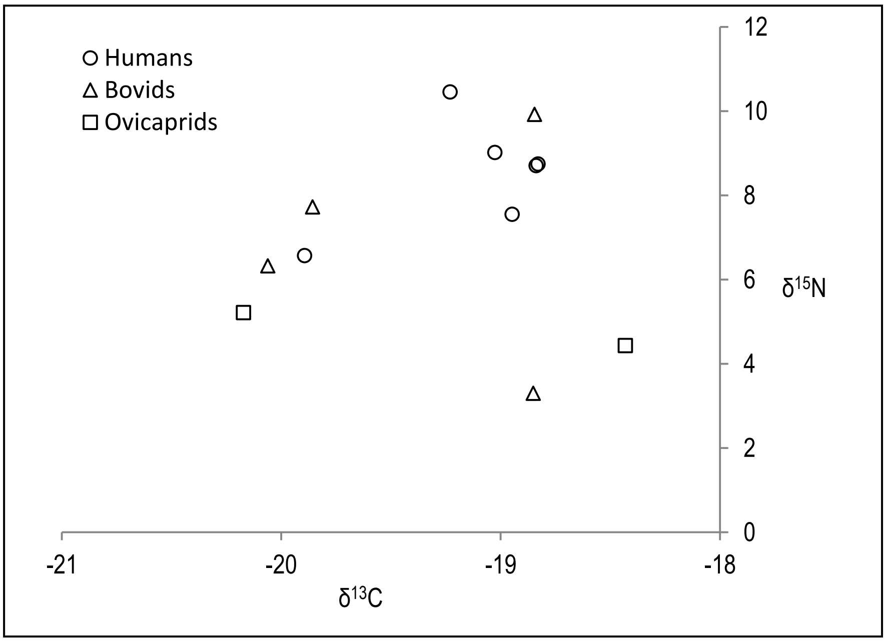


Figure 5.44. Scatter plot of the data for $\delta^{13}C$ and $\delta^{15}N$ analyses from Valencina-Castilleja.

5.8.3.- Results of La Orden-El Seminario

From this site, 37 samples were sent to the Max Planck Institute in Leipzig (Germany) to be analysed; this included 26 human samples and 11 faunal samples. Due to poor collagen preservation, only 15 of the 37 samples (40.54%) provided good collagen data. The results of the $\delta^{13}C$ and $\delta\ ^{15}N$ analyses are shown in Table 5.39.The $\delta^{13}C$ data show that the human samples (*n* = 2) have values of $\delta^{13}C$ -19.0‰ and -19.1‰, while the $\delta\ ^{15}N$ data show values of 7.8‰ and 8.7‰ respectively.

With respect to the faunal remains, these data have been analysed independently according to their trophic level. The $\delta^{13}C$ data for the herbivores (equids, bovids and ovicaprids) (*n* = 9) show values ranging from -18.6‰ (maximum) to -20.5 (minimum), while the $\delta\ ^{15}N$ data show values from 6.2‰ to 9.6‰. The mean for $\delta^{13}C \pm 1\sigma$ is 19.7‰ $\pm$ 0.6, and the mean for $\delta\ ^{15}N \pm 1\sigma$ is 7.5‰ $\pm$ 1.0. For the omnivores (suids) (*n* = 3), $\delta^{13}C$ shows values ranging from -19.4‰ (maximum) to -20.5‰ (mínimum) and the $\delta\ ^{15}N$ data show values from 4‰ to 9.0‰. The mean for $\delta^{13}C \pm 1\sigma$ is -19.9‰ $\pm$ 0.5, and the mean for $\delta\ ^{15}N \pm 1\sigma$ is 6.8‰ $\pm$ 2.5.

Based on the two human samples, considering also the shifting of values due to enrichment, a diet consisting of C_3 plants with perhaps a small protein input (ca. 10%) from marine sources is suggested. In relation to the faunal remains, all of them show typical values for their trophic level except for one of the samples (sample 38) identified as a dog, with a $\delta^{13}C$ value of -17‰ and a $\delta\ ^{15}N$ value of 14.5‰, values that suggest the consumption of marine foods. The results are shown in Figure 5.45:

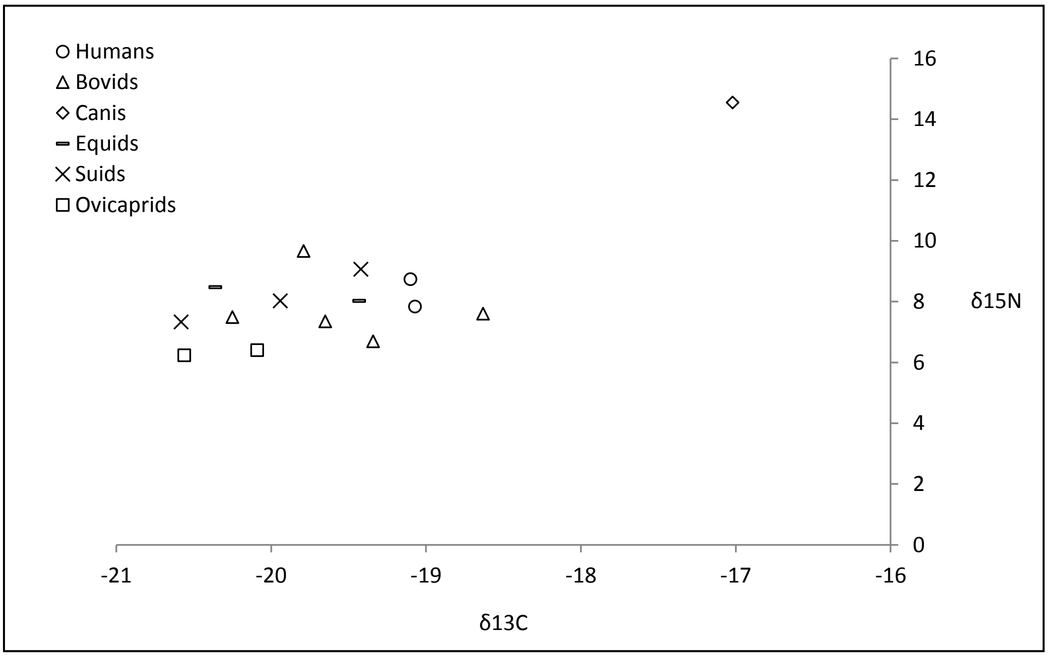


Figure 5.45. Scatterplot of the results of the $\delta^{13}C$ and $\delta\ ^{15}N$ analyses from La Orden-El Seminario.

N	SECTOR	SAMPLE ID	TYPE OF SAMPLE	LAB ID	SPECIES	AGE	$\delta^{13}C_{(av)}$	$\delta^{15}N_{(av)}$	%C	%N	$C:N_{(A)}$
1	7055	PP8-7055-186	Long bone	S-EVA-23144	Human	A	-19.1	8.7	16.5	5.7	3.3
2	1336	PP8-1336-81	MT	S-EVA-23163	Human	A	-19.0	7.8	18	6.5	3.2
3	2806	PP8-2806	Left humerus	S-EVA-23170	Bovid	A	-19.3	6.6	24.5	8.6	3.3
4	2808	PP8-2808	Left MT	S-EVA-23171	Bovid	A	-20.2	7.4	19.2	6.7	3.3
5	2810	PP8-2810	Left Humerus	S-EVA-23172	Bovid	A	-19.7	9.6	38.2	13.6	3.2
6	2800	PP8-2800	Left part Mandible	S-EVA-23173	Bovid	A	-19.6	7.3	15.1	5.1	3.4
7	3051	PP8-3051	Scapula	S-EVA-23174	Bovid	A	-18.6	7.6	28.1	9.8	3.3
8	2798	PP8-2798	Mandible	S-EVA-23175	Suid	A	-19.4	9.0	25.2	9.5	3.0
9	2792	PP8-2792	Mandible	S-EVA-23176	Ovicaprid	A	-20.5	6.2	41.4	14.9	3.2
10	2963	PP8-2963	Left ulna	S-EVA-23177	Ovicaprid	A	-20.0	6.4	41.5	15.1	3.1
11	2214	PP8-2214	Metapodial	S-EVA-23178	Equid	A	-20.3	8.4	35.8	13.1	3.1
12	2789	PP8-2789	Mandible	S-EVA-23179	Equid	A	-19.4	8.0	36.0	13.1	3.2
13	3793	PP8-3793	MC/MT	S-EVA-23180	Suid	A	-19.9	4.0	22.7	7.3	3.6
14	2213	sample 38	Long bone	S-EVA-23181	Canis	A	-17.0	14.5	33.8	12.2	3.2
15	1766	N°inv.2956 7780	Long bone	S-EVA-23182	Suid	A	-20.5	7.3	42.1	15.2	3.2

Key to table: A= adult; MT= metatarsal; MC= metacarpal; U= undetermined; A= adult.

Table 5.39. Results of $\delta^{13}C$ and $\delta^{15}N$ analyses from La Orden-El Seminario

5.9.- Mobility: strontium ($^{87}Sr/^{86}Sr$)
5.9.1.- Results for La Pijotilla

To investigate the mobility patterns of people buried at La Pijotilla, 30 tooth enamel apatite samples were sent to be processed at the Department of Anthropology, University of Iowa, and to be measured at the Department of Geology, University of Illinois (United States) for $^{87}Sr/^{86}Sr$ analysis. It was possible to measure only 21 of the samples for $^{87}Sr/^{86}Sr$, of which 17 were human and 4 were faunal samples. The list of samples can be seen in Table 5.40:

SAMPLE	BAG ID	TOOTH	UNIT	BAG	$^{87/86}Sr$	SEX	AGE
1	16	URM3	3	16	0.71136	U	36-45
2	171	URM2	12	171	0.71340	U	26-35
3	421	ULM1	12	421	0.71353	U	18-25
4	422	URM3	12	422	0.71482	U	18-25
5	716	URM2	13	716	0.71343	U	18-25
6	719	LLM3	13	719	0.71168	U	26-35
7	1392	LLM2	14	1392	0.70972	U	Adult
8	1393	ULM1	14	1393	0.71335	U	18-25
9	1411	UIM2	14	1411	0.71612	U	18-25
10	1412	ULM3	14	1412	0.71279	U	26-35
11	1415	ULM2	14	1415	0.71307	U	26-35
12	1420	LLM2	14	1420	0.71371	U	26-35
13	2415	URM3	14_2	2415	0.71059	U	26-35
14	2495	LRM2	19	2495	0.71319	U	26-35
15	2499	LRM2	12	2499	0.71425	U	26-35
16	4640	URM3	16	4640	0.71390	U	26-35
17	10373	LRM1	16	10373	0.71278	U	18-25
21	Fauna	Rodent	13	Fauna	0.71518	U	Adult
23	Fauna	Rabbit	13	Fauna	0.71444	U	Adult
25	Fauna	Rodent	12	Fauna	0.71473	U	Adult
26	Fauna	Rodent	12	Fauna	0.71475	U	Adult

Key to table: U=undetermined; L= left; R= right; M= molar; U=upper; L= lower.

Table 5.40. Samples analysed for $^{87}Sr/^{86}Sr$ from La Pijotilla

From the 17 human samples analysed, the range for $^{87}Sr/^{86}Sr$ was 0.70972 to 0.71612. Since the range is very large, the mean and the standard deviation were not calculated. The strontium isotope ratios from the four faunal samples (rodents and lagomorphs) ranged from $^{87}Sr/^{86}Sr$ 0.71444 to 0.71518. The mean for the faunal remains was 0.71477 ±0.00030 (1σ, $n = 4$). This small range of $^{87}Sr/^{86}Sr$ values reflect that all the animals were feeding in a similar area since they have restricted mobility. However, the human samples show a wide range of $^{87}Sr/^{86}Sr$, from 0.709 to 0.716. Based on statistical analyses of the data itself, it could be observed that there are clear outliers (Figure 5.46).

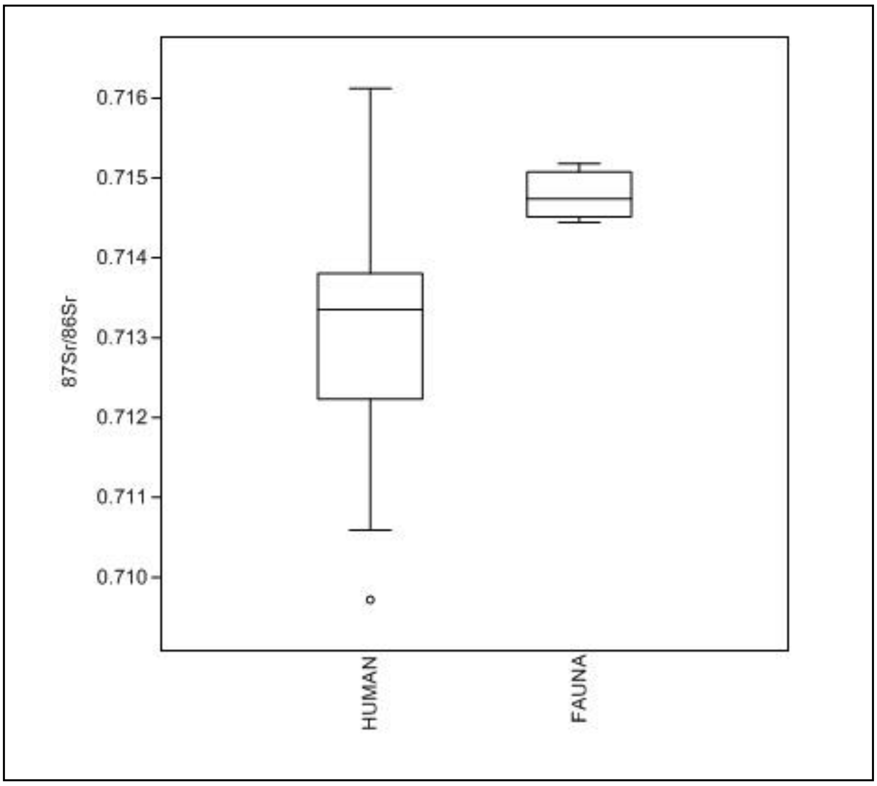


Figure 5.46. Box plot of $^{87}Sr/^{86}Sr$ results for human and faunal samples from La Pijotilla

In this case, most of the human samples seems to have values of $^{87}Sr/^{86}Sr$ around 0.713-0.714 (Figure 5.47), close to the range of the faunal remains, which might explain that they are locals to the area but that their diet consisted of a wide variety of calcium and strontium sources from vegetables and animals which were feeding in a broader geological landscape. Within the human group, it is clear that there is not a normal distribution and it must be noted that there are five individuals whose strontium levels are above or below those values. Therefore, one individual is above 0.714 (sample 9, $^{87}Sr/^{86}Sr$ 0.71612) and four individuals below 0.712 (sample 1, $^{87}Sr/^{86}Sr$ 0.71136; sample 2, $^{87}Sr/^{86}Sr$ 0.70972; sample 6, $^{87}Sr/^{86}Sr$ 0.71168; sample 13, $^{87}Sr/^{86}Sr$ =0.71059. Therefore, these 5 individuals could be considered as non locals to the area of La Pijotilla.

Assuming that the $^{87}Sr/^{86}Sr$ teeth enamel values from the faunal remains are reflecting the environment of La Pijotilla, and observing the wide range of the $^{87}Sr/^{86}Sr$ teeth enamel values from the humans, we could considered a local range for this area of about $^{87}Sr/^{86}Sr$ 0.712-0.715.

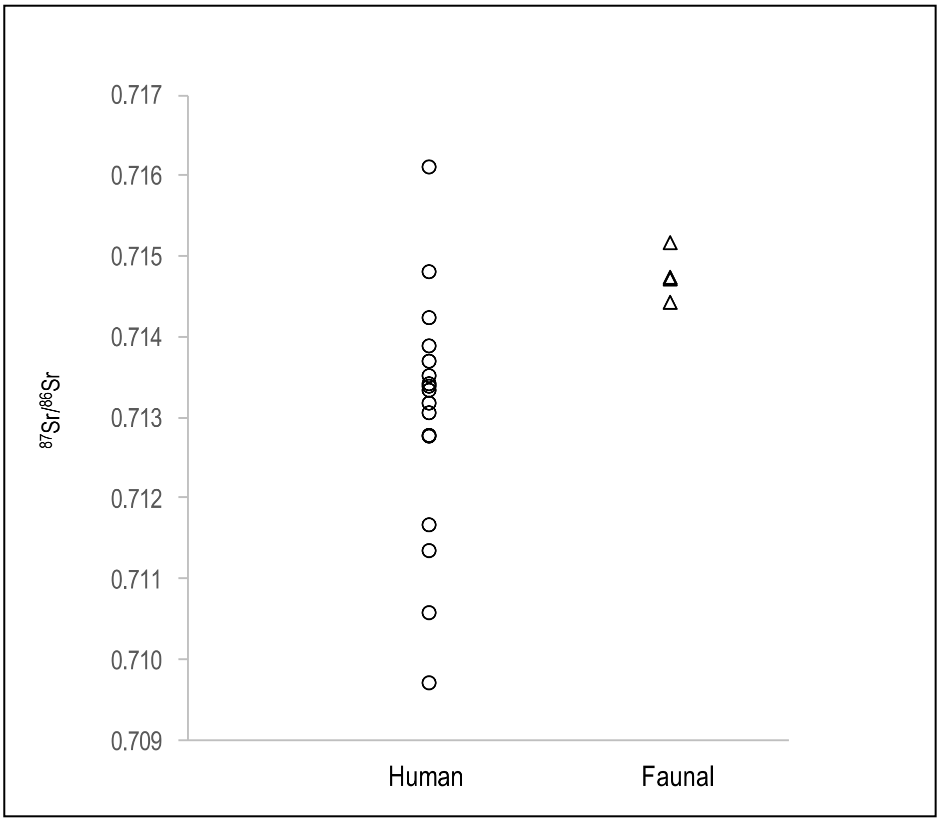


Figure 5.47. Scatter plot of the $^{87}Sr/^{86}Sr$ results for human and faunal samples from La Pijotilla.

The explanation for these differences of $^{87}Sr/^{86}Sr$ values in the five outlying samples found at La Pijotilla is in relation to the different geological areas where the individuals spent their early lives. The individual providing sample 9 ($^{87}Sr/^{86}Sr$ = 0.716) had different strontium ratio values when compared to the rest of the outliers (samples 1, 6, 7 and 13 have $^{87}Sr/^{86}Sr$ values below 0.712). A possible explanation for this is that they were coming from different geological areas and they were obtaining their food from different landscapes.

In order to interpret the $^{87}Sr/^{86}Sr$ values to assess the locality of the samples, the geological background of the surrounding areas must be established. The geology of Spain is quite diverse and complex. In order to simplify, it is divided in the following major components (Fig. 5.48, in clockwise order): the Pyrenees, the Catalonian Coastal Range (CCR), the Spanish Central System (SCS), Ossa-Morena Zone (OMZ), the South Portuguese Zone (SPZ), the Central Iberian Zone (CIZ), the West Asturian Leonese Zone (WALZ) and the Cantabrian Zone (CZ).

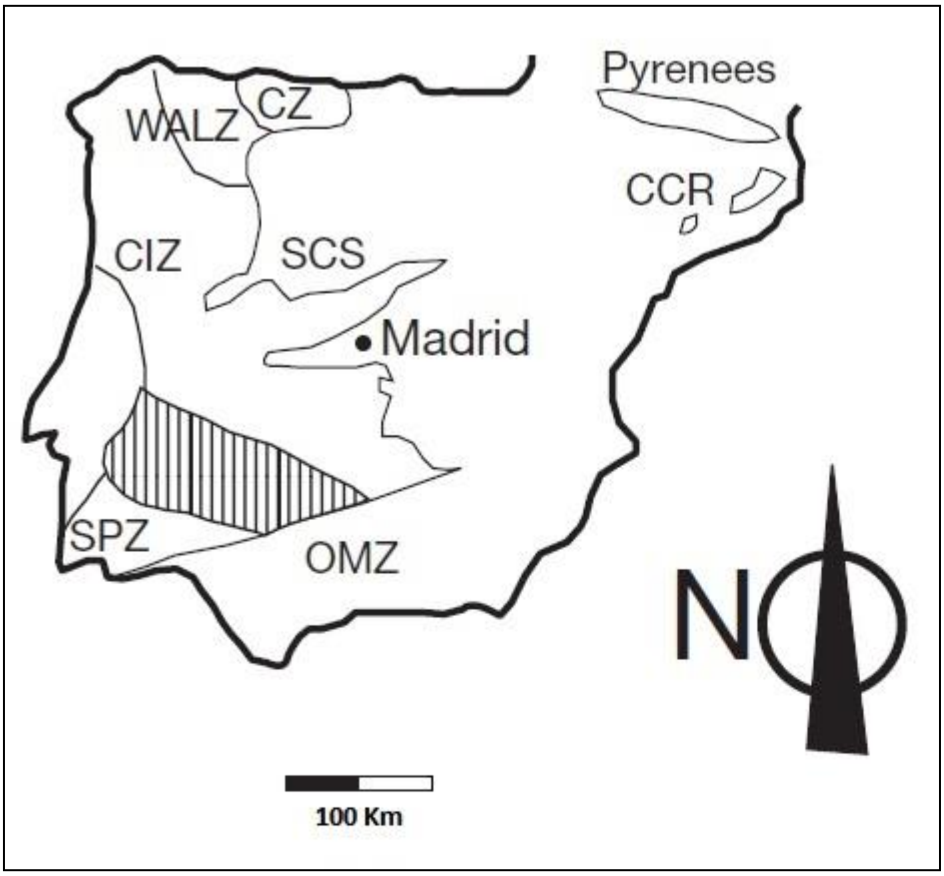


Figure 5.48. Simplified geological map of Spain (modified from Tornos and Charadia 2004: 967).

The area in which La Pijotilla is located belongs to Ossa-Morena Zone (OMZ) in the south-west of the Iberian Peninsula. This area is surrounded by the Central Iberian Zone (CIZ) in the north, the South Portuguese Zone (SPZ) in the south-west and the Cenozoic Basins in the south. Valencina-Castilleja is located at the very end limit of Ossa-Morena Zone on the Cenozoic Basins close to the Guadalquivir river. The geological background in which both sites are located is also complex and diverse (Figure 5.49 and 5.50).

Figure 5.49. Geological map of the Iberian Peninsula (from IGME, 2006) (the red rectangule delimites the study area where La Pijotilla and Valencina-Castilleja are located).

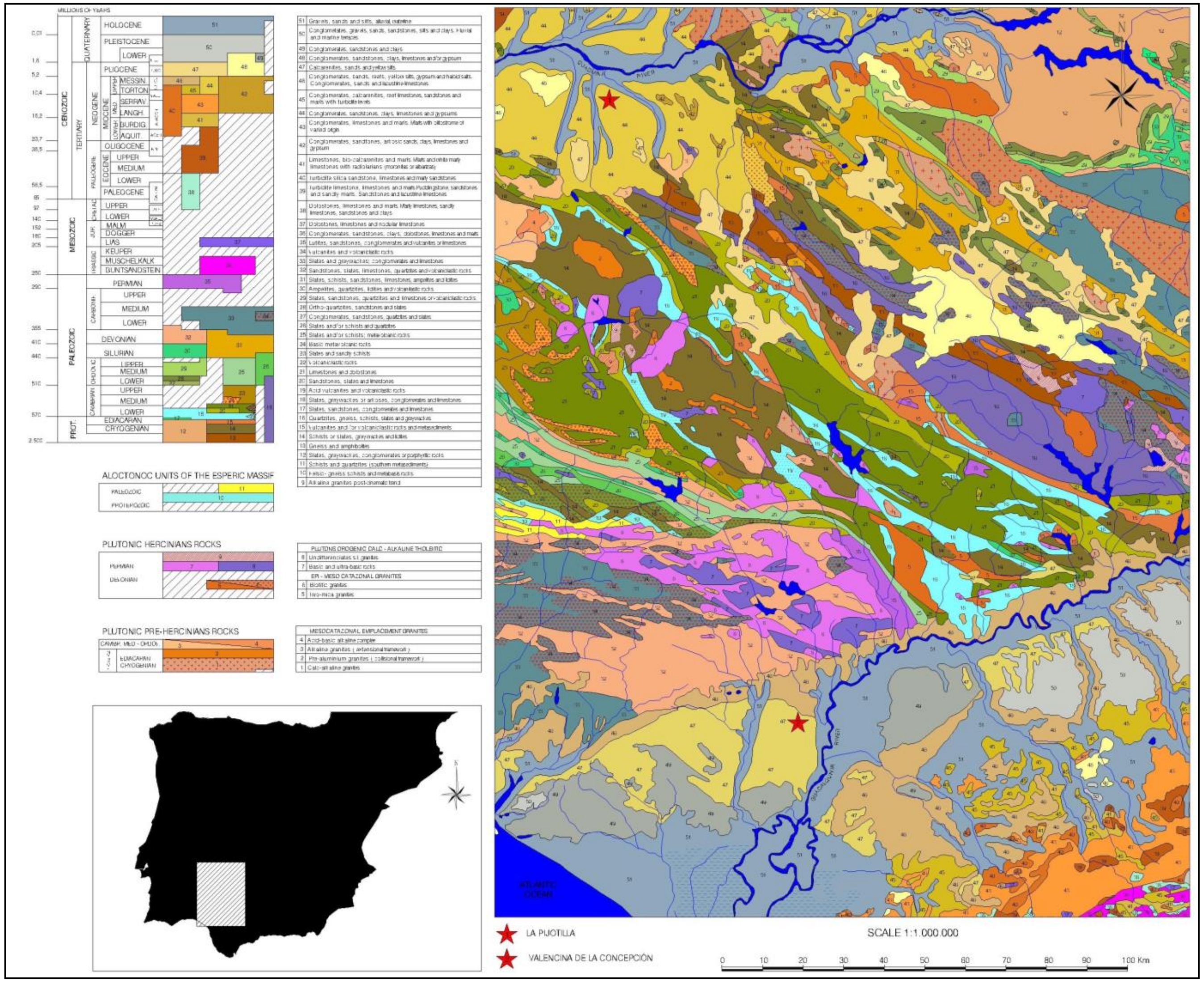


Figure 5.50. Detailed geological map of south-west Spain including the analysed sites.

La Pijotilla is located in Badajoz, Extremadura, on the second fluvial terrace of the Guadiana river next to the left bank in the geological background of the Neogenic levels of Tierra de Barros. The surface geology consists of conglomerate, sandstone, arkosic sandstone, clay, limestone and gypsum. The entire site of La Pijotilla extends over a Tertiary fluvial terrace corresponding to the Miocenic levels. The **north area** of the settlement is limited by the Quaternary bank of the Guadiana river belonging to the Holocenic level. These Miocenic and Quaternary levels are the best lands for agriculture located in a topography amenable for farming. On the **west** side, next to the border with Portugal, the predominant geological levels are Paleozoic (Ordovician and Cambrian) composed of slates, schists, quartzites and conglomerates. The **southern** part is quite complex and diverse, consisting of Paleozoic and Proterozoic levels composed mainly of schist, quartzites, dolomites, gneiss and anphibolites. The area surrounding Almendralejo consists of young deposits and the Almendralejo Gneiss gives $^{87}Sr/^{86}Sr$ values of 0.7090 and an age of 475 Ma (García Casquero et al., 1985). Next to this area there is the Ribera del Fresno Gneiss, with average $^{87}Sr/^{86}Sr$ values of 0.722± 0.013 (2σ) and an age of 423 Ma (López del Moro et al., 2012). According to these authors, the orthogneisses could have been derived from granites. Although little is understood about how the granites function with respect to the bioavailable strontium, mainly due to their heterogeneity, they are unlikely to preserve human bones (Montgomery, 2010). In addition, they seem to be more radiogenic than the rest of the samples.

The **eastern** area is dominated by Protozeroic slates, greywackes and conglomerates or porfiriods. Towards the east there is Variscan sedimentary and volcanic rocks and the Plutonic rocks from Pedroches batholiths. At this side the Santa Olalla Plutonic complex is also found and composed mainly of the norites and gabbros of the Aguablanca Stock, which is the main igneous sequence that includes the Aguablanca Stock and Santa Olalla Main Pluton rocks. The igneous rocks have an age of 338 Ma and $^{87}Sr/^{86}Sr$ values ranging between 0.7082 and 0.7100. The gabbros and norites have a ratio of $^{87}Sr/^{86}Sr$ of 0.7082, while the igneous sequence ranges between $^{87}Sr/^{86}Sr$ 0.7085 and 0.7100 where most rocks have values of $^{87}Sr/^{86}Sr$ between 0.7092-0.7095 (Tornos et al., 2002). There is also a plutonic massif in this area named Burguillos del Cerro and Brovales. The age of these rocks are approximately 338 Ma and present $^{87}Sr/^{86}Sr$ values as low as 0.70459; however, most of the values of the igneous rocks, however, range between $^{87}Sr/^{86}Sr$ 0.7082-0.7100 (IGME, 2006). From this same site there are also nine other measurements of Sr which give values $^{87}Sr/^{86}Sr$ ranging from 0.7086 and 0.7092 and are dated to 330 Ma (Bachiller et al., 1997). The difference between the two areas –the Aguablanca stock and the Burguillos Pluton- is that the Aguablanca presents significantly more $^{87}Sr/^{86}Sr$ radiogenic values (García Casquero et al, 1985; Tornos et al, 2002). The list of all the values can be found in Table 5.41, along with the different geological settings including the $^{87}Sr/^{86}Sr$ values,in Figure 5.51.

AREA	SITE	TEXTURE	$^{87}Sr/^{86}Sr$	N	REFERENCE
Badajoz	Cerrillo del Campo (1)	Igneous rocks	0.7086-0.7092	9	Bachiller et al, 1997
Badajoz	Ribera del Fresno (2)	Orthogneisses	0.7220	5	López Moro et al, 2012
Badajoz	Plutonic massif of Burguillos (3)	Igneous rocks	0.7082-0.7100	-	IGME, 2006
Badajoz	Santa Olalla Plutonic complex (4)	Igneous rocks	0.7092-0.7095	-	Tornos et al, 2002
Almendralejo	Almendralejo Gneiss (5)	Gneiss	0.7090	-	Casquero et al, 1985

Key to table: each site is located in the following map (Figure 5.51)

Table 5.41. List of $^{87}Sr/^{86}Sr$ values in the province of Badajoz (south-west Spain)

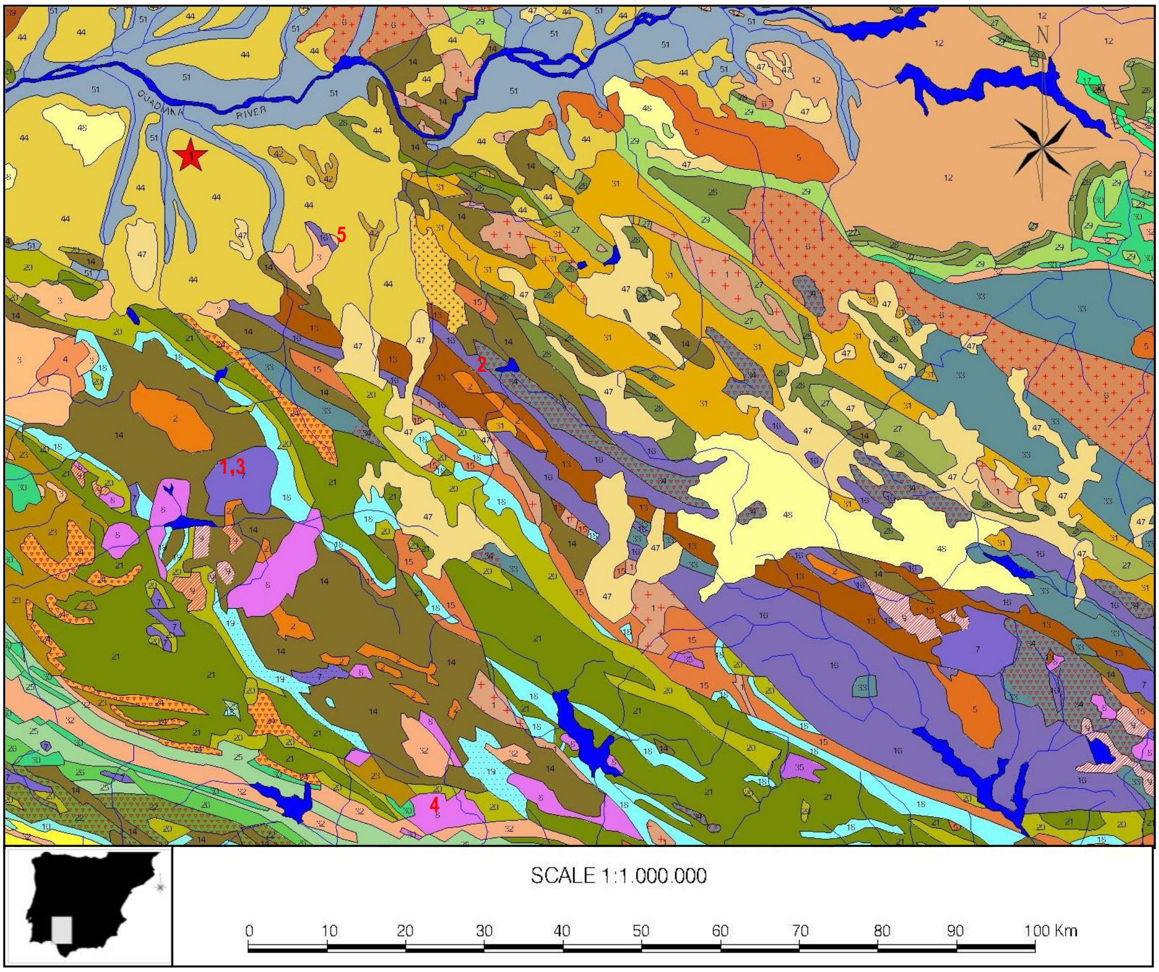


Figure 5.51. Geological map including $^{87}Sr/^{86}Sr$ measurements in the area of La Pijotilla (for legend see figure 5.50)

5.9.2.– Results for Valencina-Castilleja

In order to explore mobility at Valencina-Castilleja, strontium ($^{87}Sr/^{86}Sr$) isotope analysis was carried out on a total of 16 teeth enamel samples from human (*n* = 14) and animal (*n* = 1) teeth, plus one soil sample from the following sectors of the site: El Algarrobillo (*n* = 10), La Cima (*n* = 1), La Gallega (*n* = 1), La Alcazaba (*n* = 2), and PP4-Montelirio (*n* = 2). Sample preparation was carried out at the Center for Bioarchaeological Research at Arizona State University, Tempe, and the measurement of the samples at the W.M. Keck Foundation Laboratory for Environmental Biogeochemistry, also at Arizona State University. The data can be seen in Table 5.42:

N	SECTOR	INDIVID	LAB ID	SAMPLE	SAMPLE	$^{87}Sr/^{86}Sr$	SEX	AGE
1	La Cima	C-1	ACL-3254	VC-001	URM2	0.71149	F	18-25
2	La Gallega	G-1	ACL-3256	VC-003	URI1	0.70961	F	>45
3	La Alcazaba	ALC-1	ACL-3258	VC-005	LRM1	0.70905	F	25-35
4	La Alcazaba	ALC-2	ACL-3260	VC-007	URM3	0.71291	F	30-34
5	El Algarrobillo	ALG-1	ACL-3262	VC-009	URM3	0.70906	M	18-25
6	El Algarrobillo	ALG-2	ACL-3264	VC-0011	URM1	0.71296	M	18-25
7	El Algarrobillo	ALG-7	ACL-3266	VC-0013	URM3	0.70902	F	25-35
8	El Algarrobillo	ALG-10	ACL-3270	VC-0017	URM2	0.70948	M	25-35
9	El Algarrobillo	ALG-11	ACL-3272	VC-0019	URM3	0.70837	M	18-25
10	El Algarrobillo	ALG-12	ACL-3274	VC-0021	ULM2	0.71217	F	25-35
11	El Algarrobillo	ALG-13	ACL-3276	VC-0023	URM3	0.71450	F	25-35
12	El Algarrobillo	ALG-16	ACL-3278	VC-0025	URP1	0.70885	U	A
13	El Algarrobillo	ALG-17	ACL-3280	VC-0027	URM2	0.70898	U	A
14	PP4-Montelirio	PP4-M-1	ACL-3282	VC-0029	URM1	0.70929	M	18-25
15	PP4-Montelirio	PP4-M-9	ACL-3292	VC-0039	Tooth	0.70863	Bovid	A
16	El Algarrobillo	Soil	ACL-3294	VC-0041	Soil	0.71510	-	-

Key to table: M= male; F= female; U= undetermined; L= left; R= right; U= upper ; P= premolar ; M= molar ; MT II= second metatarsal;

Table 5.42. Samples of dental enamel and soil for $^{87}Sr/^{86}Sr$ analyses measured at Arizona State University

From Valencina-Castilleja, 25 more samples were also analysed but at a different laboratory (human *n* =19 and fauna *n*= 6). The results are shown in Table 5.43. These samples were processed and analysed in the Department of Anthropology at the University of Iowa and measured at the Department of Geology at the University of Illinois (United States).

N	INDIVIDUAL	SPECIES	SAMPLE	$^{87/86}$Sr	SEX	AGE
1	189.1	Human	ULM3	0.70906	U	YA
2	444.1	Human	URM3	0.70914	U	AO-YA
3	484.1	Human	URM2	0.71341	U	YA
4	446.3.1	Human	LRM2	0.70900	U	AO-YA
5	446.2	Human	LLM3	0.70901	U	YA
6	360.1	Human	ULM2	0.70903	U	YA
7	360.2	Human	URM3	0.70909	U	YA
8	447.1	Human	ULM1	0.70907	U	AO-YA
9	446.3	Human	LLM2	0.71883	U	AO-YA
10	730.1	Human	URM3	0.70995	U	A
11	505.1	Human	LRP4	0.71323	U	A
12	453.1	Human	LRM2	0.71341	M	25-35
13	453.2	Human	LLM2	0.71216	F?	18-25
14	453.3	Human	LRM1	0.71170	U	INF II
15	449.1	Human	URM2	0.71028	M?	18-25
16	449.3	Human	ULM1	0.70907	U	25-35
17	449.4	Human	URM3	0.70970	M	25-35
18	449.6	Human	ULM1	0.70917	M	25-35
19	449.7	Human	URM2	0.70912	U	25-35
20	919.1	Bos	Tooth	0.70866	U	A
21	74.2	Suid	Tooth	0.70909	U	A
22	259.3	Ovicaprid	Tooth	0.71611	U	A
23	259.1	Bos	Tooth	0.70914	U	A
24	447.1	Helix	Snail shell	0.70904	U	A
25	447.1	Helix	Snail Shell	0.70897	U	A
26	83.1	Helix	Snail shell	0.70897	U	A

Key to table: M= male; F=female; U= undetermined; F?= possible female; M?= possible male; INF II= 7-12; AO= 13-17; YA= 18-25.

Table 5.43. Samples of dental enamel and snail shell for ^{87}Sr/^{86}Sr measured at The University of Iowa and Illionis University

A total of 33 human teeth dental samples were analysed from V-C and, from those, a range of 0.70837 to 0.71883 was established for ^{87}Sr/^{86}Sr . As for La Pijotilla, the range is very wide and there is no reason to calculate the mean and the standard deviation for this group. A total of 7 faunal tooth or shell samples were analysed from gastropods and mammals. The mean for the faunal remains has not been calculated either because there is a very wide range from ^{87}Sr/^{86}Sr 0.70863 to 0.71611) (Figure 5.52). In addition, a soil sample gave a value ^{87}Sr/^{86}Sr of 0.7151.

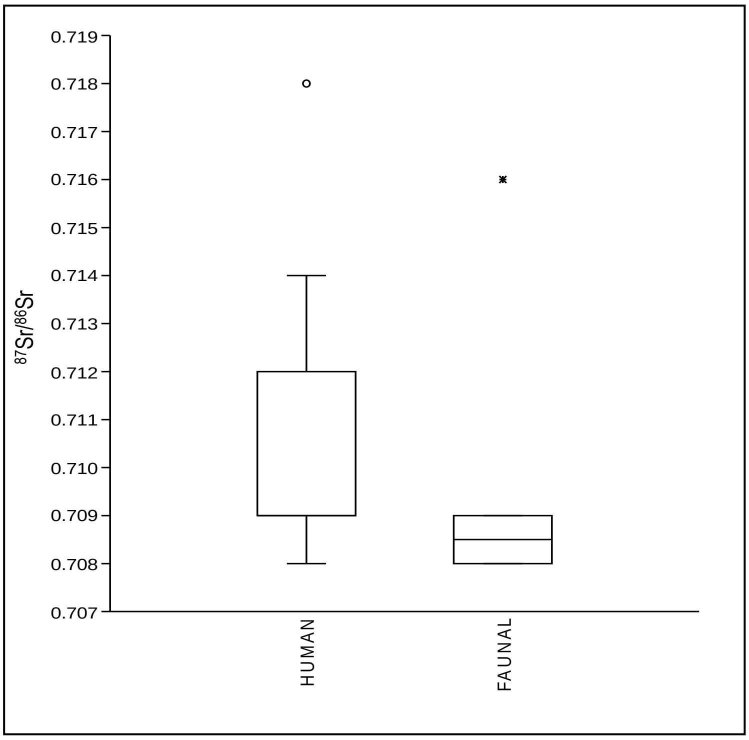


Figure 5.52. Box plot of $^{87}Sr/^{86}Sr$ results for human and faunal samples from Valencina-Castilleja.

Looking at the faunal $^{87}Sr/^{86}Sr$ values, it is clear that all of the teeth except for one range between 0.708 and 0.709, showing maybe a more restricted local range for Valencina-Castilleja. Within this group there are one suid and three bovid teeth and two gastropods. However, the exception is one sample identified as an ovicaprid who is showing an outlying value of 0.716. In this case, this animal could have been brought from another different region or have been transhumant which could suggest that it was grazing in areas with variable geological background. In this case, to calculate the local bioavailability of Sr, only those faunal specimens (n = 6) which clustered between 0.708-0.709 were considered. If we accept the values of $^{87}Sr/^{86}Sr$ as valid for the local Valencina-Castilleja range, then the individuals with values between $^{87}Sr/^{86}Sr$ 0.708-0.709 could be considered as locals, probably also including in this group the individuals ranging below $^{87}Sr/^{86}Sr$ 0.710 and then the individuals over $^{87}Sr/^{86}Sr$ 0.712 as non locals. In addition, an estimation of the local range for Valencina-Castilleja could be $^{87}Sr/^{86}Sr$ 0.708-0.710 (Figure 5.53).

Therefore, at least eleven teth presented a non-local signature for $^{87}Sr/^{86}Sr$, with values from 0.712-0.714. These teeth came from different sectors at Valencina; there were three individuals from El Algarrobillo, one individual from La Alcazaba, one individual from La Cima and six from PP4-Montelirio.

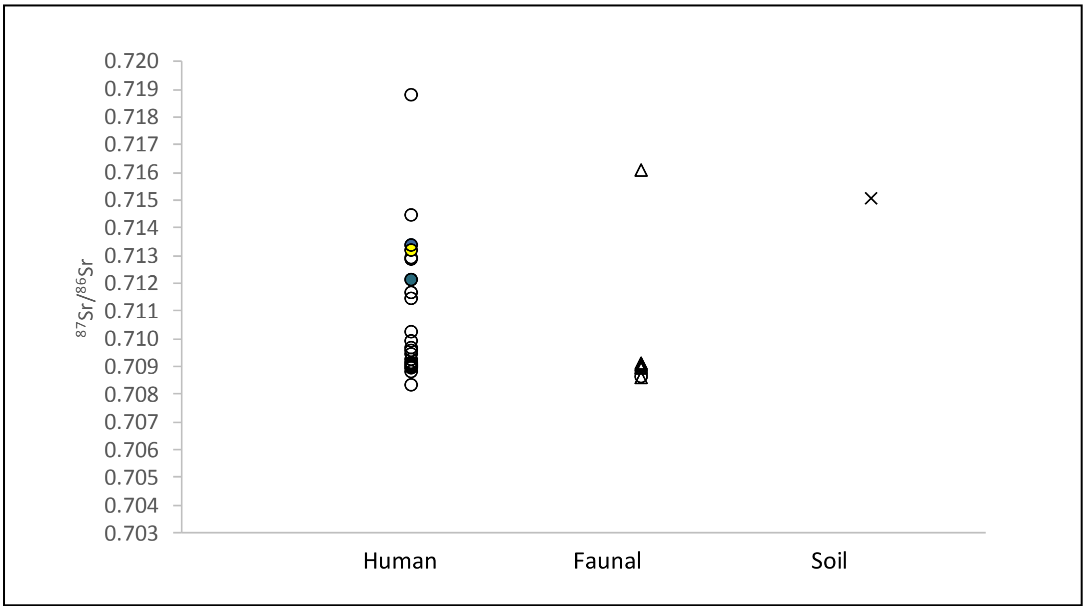


Figure 5.53. Scatter plot of the $^{87}Sr/^{86}Sr$ data for human, faunal and environmental samples from Valencina-Castilleja.

There seem to be two different groups illustrated plus some outlier individuals (human and faunal); one group is considered as non local clustering, between $^{87}Sr/^{86}Sr$ of 0.712-0.714, and another group clustering between $^{87}Sr/^{86}Sr$ of 0.708-0.710 and considered as locals. Until more faunal remains are analysed, as well as some other environmental samples, the Valencina-Castilleja local range cannot be defined more accurately. Sample ACL=3294 taken from El Algarrobillo showed a higher than expected $^{87}Sr/^{86}Sr$ ratio when compared to the available data for the human and animal values. This result must be taken with caution because analysis of soils has not been done for some studies (Maurer et al., 2012).

When these non-local teeth are considered with respect to age and sex, there were five femaleteeth (ALG-12, ALG-13, CIM-1, PP4-453.2 and ALC-2), two male teeth (ALG-2 and PP4-453.1) and four of undetermined sex (PP4-484.1, PP4-453.3, PP4-505.1 and PP4-446.3). The age categories included subadults (7-12 years old) (PP4-453.3), adolescents (PP4-446.3), young adults (ALG-2, PP4-484.1, PP4-453.2 and CIM-1), middle adults (ALG-13, ALG-12, ALC-2 and PP4-453.1) and adults (PP4-505.1). In relation to paleodemography, it is not possible to draw any particular mobility pattern based on the sex or the age of the individuals since still most of the individuals were not sexed and the sample size is too small anyway.

Valencina-Castilleja is located underneath the contemporary towns of Valencina de la Concepción and Castilleja de Guzmán, located in the province of Seville. The archaeological site is quite large, about 400 Ha (for a complete description see Chapter 3, section 3.5.2) and is located in the Aljarafe Plateu. This geological formation is dated to the Tertiary, and is mainly of Lower Pliocene levels and consisting of blue loess and conglomerates. The Aljarafe Plateau is located over the Tertiary Miocene and Pliocene levels which are composed mainly of sandstone (on the northern area of Valencina-Castilleja). On the **west zone** there is a natural barrier delimited by the Guadiamar river but with the same homogeneous geological feature composed of blue loess and conglomerates which continue through to the west. The **southern zone** is chalk composed by limestone and yellow loess. The **eastern zone** is delimited by the banks of the Guadalquivir river which, in antiquity, was a large lake known as the *sinus Tartesii*. This area is dated from the Quaternary and is composed of alluvial and coalluvial levels. Although the area where Valencina-Castilleja lies is quite homogeneous in terms of geological background, the neighbouring northern and the eastern areas are geologically quite complex. The eastern and northern areas may have been where individuals foraged for resources. The North of the Aljarafe Plateau is the Ossa Morena Zone (OMZ) of Precambric and Carboniferous levels with metamorphism and plutonic intrusions (Morbidelli et al., 2007). In the **north-west zone**, towards Minas de Riotinto, the Sierra de Alcántara is of Variscan origin, representing an area of slates, limonites, sandstone and quartzites dated to the Paleozoic. However, towards the northern area of the province of Seville, the geology is quite complex and diverse. While there are some granitic areas dated to the Cambric and Ordovician, there are also some areas dominated by slates and greywacke corresponding to the Cambric period. Around the Permic levels of the Viar river, the geological background changes into conglomerates, lutites, red sandstones and basalts. In the area corresponding to Almadén de la Plata, there are several $^{87}Sr/^{86}Sr$ measurements from the detritic-carbonates corresponding to the Lower Cambrian period. The core of Almadén de la Plata shows high-grade metamorphism with an amphibolitic facies (Morbidelli et al., 2007: 127). The samples from this area come from two quarries: Las Cabreras and Los Covachos. Las Cabreras represents marble with quartz and phyllosilicates composed of calcite and dolomite, showing a $^{87}Sr/^{86}Sr$ range of $^{87}Sr/^{86}Sr$ 0.70926-0.71342 (Morbidelli et al., 2007). The marble from Los

Covachos is made up of calcites and quartz and small portions of muscovite, biotite and siderite showing values of $^{87}Sr/^{86}Sr$ 0.70865-0.70916 (Morbidelli et al., 2007). From the same area there is also one measurement of $^{87}Sr/^{86}Sr$ from the burial sediment of the megalithic monument Palacio 3 (Díaz-Zorita Bonilla et al., 2009) which is located in an area of Cambric grey and green slates with acid and basic vulcanites, giving a value $^{87}Sr/^{86}Sr$ of 0.7070 (Díaz-Zorita Bonilla et al., 2009). The list of all the values can be found in Table 5.44 and the different geological setting including the $^{87}Sr/^{86}Sr$ values in Figure 5.54.

AREA	SITE	TEXTURE	$^{87}Sr/^{86}Sr$	N	REFERENCE
Almadén de la Plata	Palacio 3 (1)	Burial sediment	0.7070	1	Díaz-Zorita et al, 2009
Valencina de la Concepción	El Algarrobillo (2)	Burial sediment	0.71510	1	Unpublished
Almadén de la Plata	Las Cabreras (3)	Amphibolitic Granuloblastic and Lepidoblastic	0.70926-0.71342	6	Morbidelli et al, 2007
Almadén de la Plata	Los Covachos (4)	Amphibolitic Heterometric and Homeometric	0.70865-0.70916	6	Morbidelli et al, 2007

Key to table: each site is located in the following map (Figure 5.54)

Table 5.44. List of $^{87}Sr/^{86}Sr$ measurements from environmental samples in the province of Seville (south-west Spain)

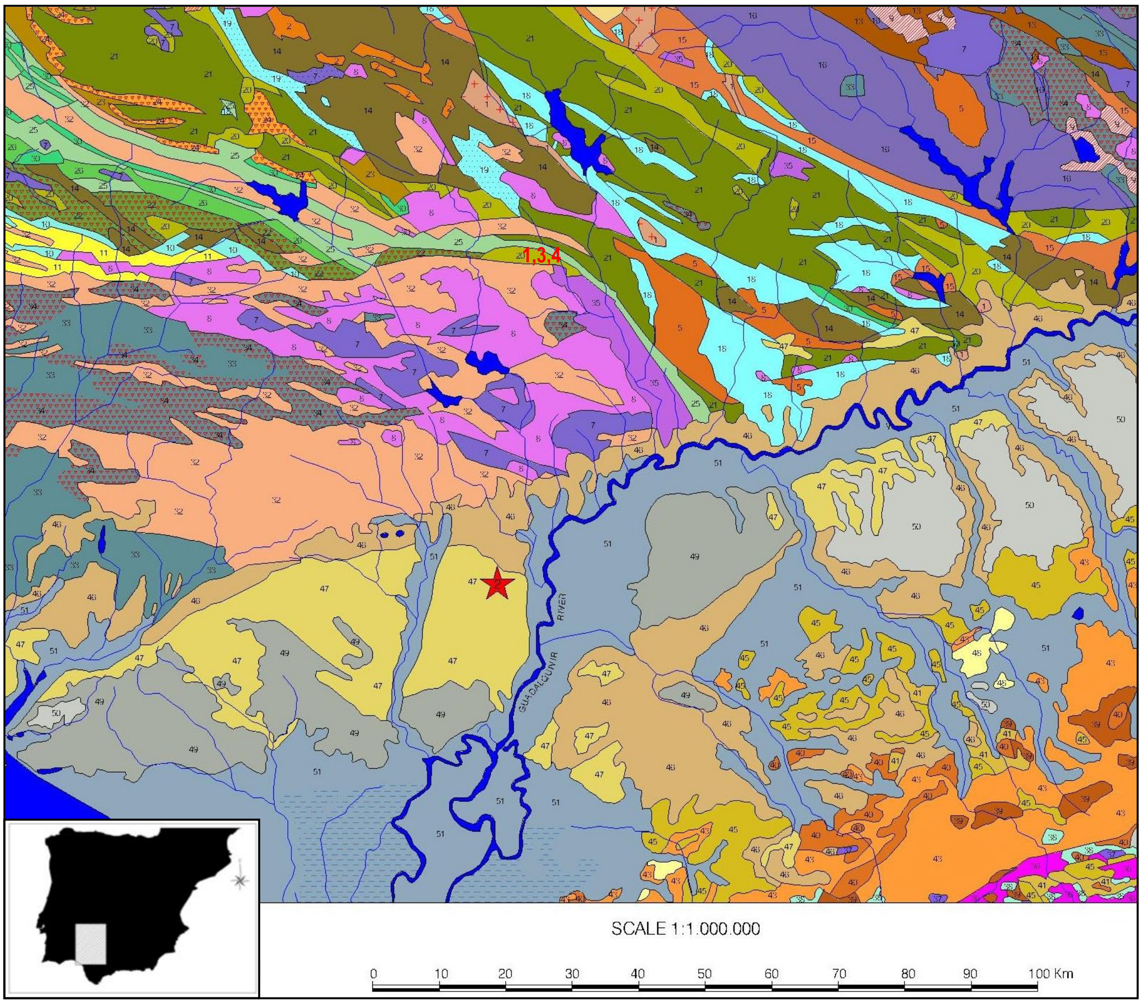


Figure 5.54. Geological map including $^{87}Sr/^{86}Sr$ measurements in the area of Valencina-Castilleja (for legend see figure 5.50).

5.10.- Radiocarbon dating

Among the different bioarchaeological analyses, it is of crucial importance to obtain radiocarbon dates from the samples that are examined. The need to contextualise the collection is essentialin order to combine these results with other biochemical analyses such as $^{87}Sr/^{86}Sr$ to research mobility and stable $\delta^{13}C$ and $\delta^{15}N$ isotopes to elucidate ancient diet.

For this reason, several bone samples (*n* = 39) were sent to be analysed at the *Centro Nacional de Aceleradores* at the University of Seville. So far, only a few of them have been measured (*n* = 5) and the results obtained are in Table 5.45 and Figure 5.55:

N	SECTOR	LAB ID	SAMPLE	INDIVIDUAL	U	S	BONE	BP	BC (2σ)
1	La Gallega	CNA1264	GAL5	GAL-1	-	-	Skull	3905 ± 35	2484-2236
2	El Algarrobillo	CNA1272	ALG13	ALG-12	-	-	Skull	4130 ± 30	2871-2581
3	El Algarrobillo	CNA1273	ALG14	ALG-13	-	-	Skull	3950 ± 25	2566-2347
4	PP4-Montelirio	CNA1291	PP4-2	1	211	10.042	L Ulna	4160 ± 35	2880-2629
5	PP4-Montelirio	CNA1300	PP4-12	1	453	10.031	Skull 1	4095 ± 25	2858-2503

Key to table: U= stratigraphic unit; S:structure; BP= before present; BC= before Christ.

Table 5.45. Radiocarbon dates from Valencina-Castilleja

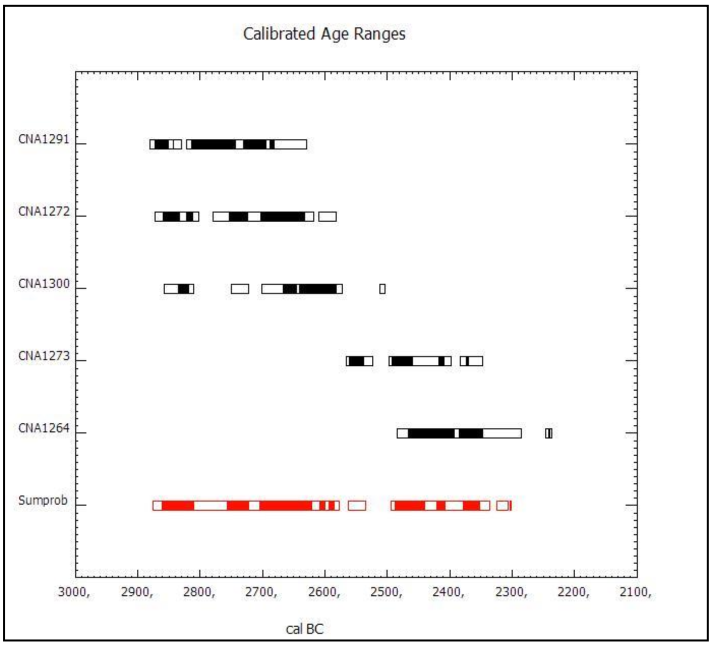


Figure 5.55. Calibrated radiocarbon analyses from Valencina-Castilleja.

CHAPTER 6. DISCUSSION

6.1.- Understanding the Copper Age period in south-west Spain from a multidisciplinary overview

In this section a comparative analyses of the results obtained in this study are made and discussed according to published and available data. To investigate whether social differences are present at different sites, the funerary context is also analysed within the south-west Spanish context. In addition, the different type of structures and burial positions are considered, and correlated with biological data. Diet and mobility is also explored as a social inequality indicator.

6.1.1.- Comparative analysis

Previous research on the bioarchaeology of later prehistory in southern Spain over the past 30 years has focused on the south-east, and has been carried out mainly by researchers based at the Laboratory of Physical Anthropology, University of Granada (Botella López, 1976; Botella López et al., 1986; Jiménez Brobeil et al., 2001; Walker, 1986; Jiménez Brobeil and García Sánchez, 1989-1990; Botella López et al., 1995; Jiménez Brobeil et al., 1995; Alemán et al., 1996; Alemán et al., 1997; Jiménez Brobeil et al., 2004; Al Oumaoui et al., 2004; Al Oumaoui et al., 2008; Al Oumaoui and Jiménez Brobeil, 2009, 2010; Al Oumaoui et al., 2010). However, there have been a few investigations from other universities (Buikstra et al., 1995; Montero Ruiz et al., 1999; Buikstra and Hoshower, 1995, Palomo Laburu, 1999). Nonetheless, paleodemographic studies in the south-west as a whole have been lacking, but some general paleodemographic studies from the Mesolithic to the Copper Age in southern Iberia have been attempted (Díaz-Zorita Bonilla et al., 2012), as well as in-depth research at the archaeological site of Valencina-Castilleja (Costa Caramé et al., 2010).

In this section, comparisons are made between population samples from SW Spain. The areas considered for comparison are western Sierra Morena, the Middle Guadiana Basin and the provinces of Cádiz, Córdoba and Huelva. In order to allow comparisons among different sites to be made, only those sites for which previous basic anthropological analyses exist were considered. Specifically, only those sites where the MNI (minimum number of individuals) was presented, along with records of estimated sex and age, and disease are included. Table 6.1 shows the sites where human remains have been recorded, along with their respective MNI:

N	SITE & SECTOR	PROVINCE	MNI	REFERENCE
1	VC-Matarrubilla	Seville	2	Obermaier, 1919
2	VC-Los Cabezuelos	Seville	14	Guijo Mauri et al., 1995; 1996
3	VC-Cerro de la Cabeza	Seville	1	Fernández Gómez and Ruiz Mata, 1978
4	VC-El Roquetito	Seville	48	Murillo Díaz et al., 1990
5	VC-Divina Pastora - Señorío de Guzmán	Seville	20	Lacalle Rodríguez et al., 2000
6	VC-Norte Castilleja	Seville	1	Vargas Jiménez, 2004ª
7	VC-Dolmen de Montelirio	Seville	26	Fernández Flores and Aycart Luengo, 2013
8	VC-El Algarrobillo	Seville	19	Unpublished
9	VC-La Alcazaba	Seville	6	Unpublished
10	VC-La Cima	Seville	2	Unpublished
11	VC-La Gallega	Seville	2	Unpublished
12	VC-La Perrera	Seville	4	Basabe and Benassar, 1982
13	VC-P.P. Matarrubilla	Seville	6	Vargas Jiménez, 2004a
14	VC-El Cuervo	Seville	1	Arteaga and Cruz-Auñón, 1999b
15	VC-Mirador de Itálica	Seville	2	Ruiz Moreno, 1999
16	VC-Mariana Pineda	Seville	1	Vargas Jiménez, 2004a
17	VC-La Candelera-Emisora	Seville	2	Murillo Díaz, 1991
18	VC-C/Dinamarca	Seville	74	Pajuelo Pando and López Aldana, 2013
19	VC-C/Trabajadores	Seville	12	López Aldana and Pajuelo Pando,2013
20	VC-Mariana Pineda UA 3	Seville	18	Vargas Jiménez, 2004a
21	VC-Depósito de Agua	Seville	4	López Flores, 2004
22	VC-La Huera	Seville	20	Méndez Izquierdo, 2013
23	VC-Cerro de la Cabeza	Seville	6	Unpublished
24	VC-PP4-MONTELIRIO	Seville	150	Peinado Cucarella, 2008
25	VC-La Perrera	Seville	6	Vargas Jiménez, 2004a
26	La Molina	Seville	10	Lacalle Rodríguez and Guijo Mauri, 2010
27	*Tholos* Palacio III	Seville	8	Díaz-Zorita Bonilla, 2007; Díaz-Zorita Bonilla and Waterman, in press
28	Amarguillo II	Seville	4	Cabrero García et al., 1997
29	Cerro del Arca	Seville	1	Escacena Carrasco, 1992-1993
30	Puerto de la Palmera	Seville	2	Romero Bomba, 2005
31	Huerta Montero	Badajoz	100	Blasco Rodríguez and Ortiz Alesón, 1991
32	LP- Tomb 3	Badajoz	178	Unpublished
33	LP- Tomb 1	Badajoz	72	Jiménez Brobeil, unpublished
34	La Orden-Seminario (PEX 1336)	Huelva	23	Vera Rodriguez et al., 2010
35	La Orden-Seminario (PEX 7016)	Huelva	11	Vera Rodriguez et al., 2010
36	La Orden-Seminario (PEX 7055)	Huelva	19	Vera Rodriguez et al., 2010
37	Cueva de la Mora	Huelva	3	Guijo Mauri et al., 1999
38	Cueva de la Mora de la Umbría	Huelva	8	Guijo Mauri, 1999
39	Valdelinares	Huelva	10	Romero Bomba, 2001
40	Paraje de Monte Bajo	Cádiz	71	Lazarich et al., 2010
41	El Jadramil	Cádiz	6	Bueno Sánchez, 2003
42	Cerro de la Casería T5	Cádiz	3	Martínez et al, 1991; Martínez and Alcázar,
43	Cerro de la Casería T7	Cádiz	8	Martínez et al, 1991; Martínez and Alcázar,
44	El Dorado	Córdoba	1	Cabrero García, 1988a
-	**TOTAL**	-	985	-

Key to table: VC= Valencina-Castilleja; LP= La Pijotilla

Table 6.1. Comparative sites in south-west Spain

The demographic picture described below and based on the sites in Table 6.1, dates to the 3rd millennium BC, and is comprised of data from 44 groups of individuals (from 44 funerary structures). Some groups of individuals come from the same archaeological site, but sites from five different provinces and three geographic areas are combined for the purpose of paleodemographic analysis. The area with the most sites included in this analysis was western Sierra Morena (*n* = 30, 68.18%) (Figure 6.1). The province with the largest MNI was the province of Seville with a total of 30 funerary structures (68.18 %); the site of Valencina-Castilleja represents 25 of 44 funerary sites, representing 56.8 % of the total number of groups of individuals (Figure 6.2).

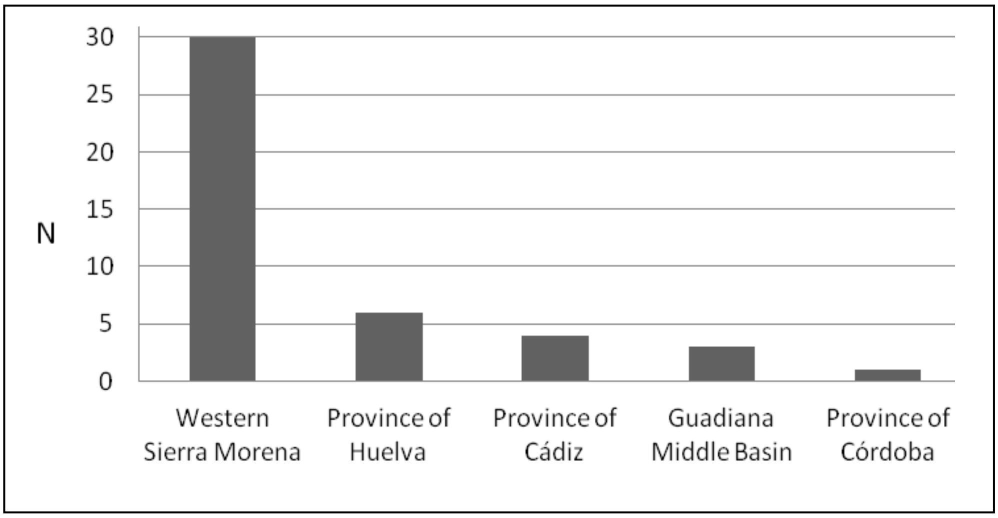


Figure 6.1. Number of funerary structures by area included in this study

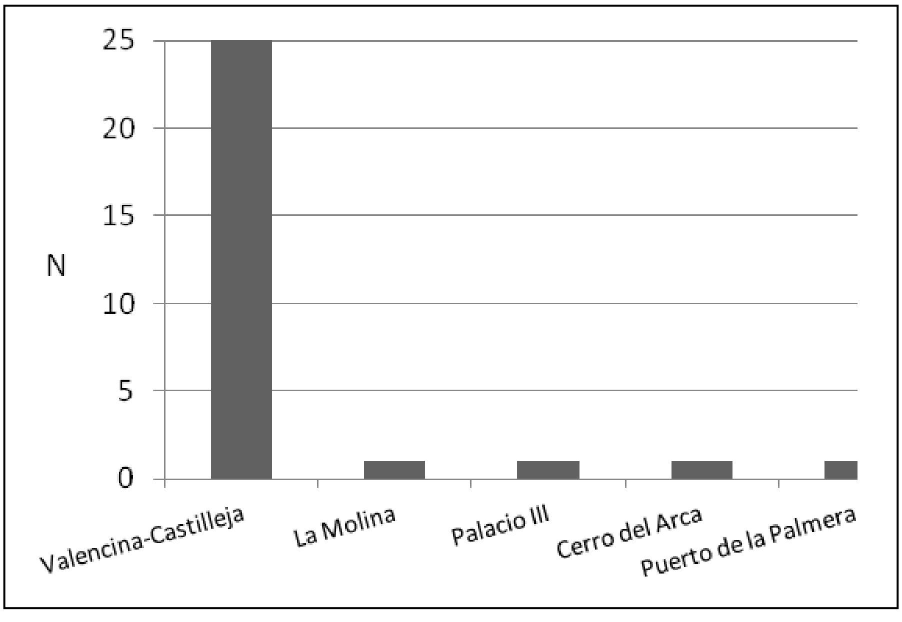


Figure 6.2. Funerary structures by archaeological site in the province of Seville

The MNI per structure is highly variable, ranging between two and four individuals, up to 10; in one case an MNI of 178 has been established (at La Pijotilla). This section describes the MNI buried at each site. Despite the fact that the data are highly variable, and in some cases incomplete, a comparative site-by-site analysis is attempted. The data by region and by site are also presented.

Remains of an MNI of at least 985 individuals from Copper Age south-west Spain have been excavated, although 495 have not yet been examined from an anthropological perspective. This means that the characteristics of half of the MNI are unknown, representing 50.25% of the total. For those sites that have been examined, there seems to be an equal distribution of the sexes and most of the ages assigned, according to bone/bone fragment, fall into the young adult category (see Table 6.2).

Undoubtedly, when dealing with commingled and fragmented human remains, it is very difficult to obtain representative data from the archaeological record (Wood et al., 1992). In addition, despite the limitations of the study, which have been discussed before, results show that this observed pattern might not be what is expected for European prehistoric populations (Bocquet-Appel and Naji, 2006). This is mainly because what is recovered from the archaeological record is just a sample of the living population. However, the expected pattern for prehistoric populations may be variable worldwide and each group should be analysed independently. For instance, the percentage of subadult bone fragments (8%) over the whole population seems lower than expected. For example, when comparing to hunter-gatherers and Neolithic population from the Levant (Eshed et al., 2004) the Natufian subadult group shows about a 14% representation while the Neolithic subadult group is represented by approximately 16%. Other examples from the Mesolithic-Neolithic transition in Europe in comparison to several samples from North America, shows that for European prehistory the subadult group normally comprises 20-30% and for the American populations is about 40% (Bocquet-Appel and Naji, 2006). The data from this study clearly show a different pattern from that found already for the Copper Age in south-west Spain. However, the number of non-studied individuals is very high, and therefore more data need to be incorporated which might change the profile and give a better approximation of subadults for these populations.

	FEMALE					MALE							?					
SITE & SECTOR	20-30	30-45	>45	A	YA	20-30	30-45	YA	>45	A	S	A	YA	?	20-30	30-45	>45	TOTAL
VC-Matarrubilla	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
VC-Los Cabezuelos	2	0	0	1	0	2	1	0	0	0	1	0	0	5	0	2	0	14
VC-Cerro de la Cabeza	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
VC-El Roquetito	0	0	0	2	0	0	0	0	0	0	0	0	0	46	0	0	0	48
VC-Divina Pastora- Señorío de Guzmán	3	1	0	3	1	3	3	0	0	0	5	0	0	1	0	0	0	20
VC-Norte Castilleja	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
VC-Dolmen de Montelirio	13	1	0	5	0	0	1	0	0	1	0	4	0	0	0	1	0	26
VC-El Algarrobillo	4	0	0	1	0	3	0	1	0	5	0	2	2	0	1	0	0	19
VC-La Alcazaba	0	1	0	1	0	0	0	0	0	1	1	2	0	0	0	0	0	6
VC-La Cima	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
VC-La Gallega	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
VC-La Perrera	0	0	0	0	1	0	1	0	1	1	0	0	0	0	0	0	0	4
VC-P.P. Matarrubilla	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	6
VC-El Cuervo	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
VC-Mirador de Itálica	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
VC-Mariana Pineda	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
VC-La Candelera-Emisora	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
VC-C/Dinamarca	0	0	0	0	0	0	0	0	0	0	0	0	0	74	0	0	0	74
VC-C/Trabajadores	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	12
VC-Mariana Pineda UA 3	2	0	3	0	0	1	1	0	0	0	4	2	0	0	2	2	1	18
VC-Depósito de Agua	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	4
VC-La Huera	0	0	0	4	0	0	0	0	0	5	7	4	0	0	0	0	0	20
VC-La Pijotilla T 3	0	0	0	18	0	0	0	0	0	27	23	93	2	0	8	9	0	178
VC-La Pijotilla T 1	0	0	0	20	0	0	0	0	0	25	19	8	0	0	0	0	0	72
VC-Cerro de la Cabeza	0	0	0	0	3	0	0	0	0	0	0	2	1	0	0	0	0	6
La Molina	0	2	0	2	0	0	1	0	1	2	1	1	0	0	0	0	0	10
Huerta Montero	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	100
VC-PP4-Montelirio	0	0	0	2	1	0	3	2	0	1	1	3	0	135	0	2	0	150

SECTOR	FEMALE					MALE						UNDETERMINED						
	20-30	30-45	>45	A	YA	20-30	30-45	YA	>45	A	S	A	YA	?	20-30	30-45	>45	TOTAL
VC-La Perrera	0	0	0	0	3	0	0	0	0	0	0	2	1	0	0	0	0	6
La Orden-Seminario (PEX 1336)	0	0	0	0	0	0	0	0	0	4	0	5	1	13	0	0	0	23
La Orden-Seminario (PEX 7016)	0	0	0	0	0	1	0	0	0	1	0	0	0	9	0	0	0	11
La Orden-Seminario (PEX 7055)	0	0	0	0	0	0	0	0	0	0	1	0	0	18	0	0	0	19
Tholos Palacio III	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	8
Amarguillo II	0	0	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	4
Paraje de Monte Bajo (E-2)	0	0	0	0	0	0	0	0	0	0	0	0	0	60	0	0	0	60
Paraje de Monte Bajo (E-3)	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	3
Paraje de Monte Bajo (E-4)	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	8
Cueva de la Mora	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	3
El Jadramil (silo 1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
El Jadramil (silo 2)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
El Jadramil (silo 3)	0	0	0	1	0	0	0	0	0	1	0	2	0	0	0	0	0	4
Cerro de la Casería T5	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Cerro de la Casería T7	0	0	0	2	1	0	0	1	1	1	0	2	0	0	0	0	0	8
El Dorado	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Cerro del Arca	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cueva de la Mora de la Umbría	0	0	0	0	0	0	0	0	0	0	5	1	2	0	0	0	0	8
Valdelinares	0	0	0	1	0	0	0	0	0	2	5	2	0	0	0	0	0	10
Puerto de la Palmera	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	2
TOTAL	**26**	**6**	**4**	**66**	**11**	**12**	**12**	**5**	**3**	**78**	**77**	**161**	**17**	**495**	**11**	**17**	**1**	**985**

Key to table: VC= Valencina-Castilleja; A=adult; YA= young adult; S= subadult; ?= undetermined

Table 6.2. Demographic data for Copper Age funerary contexts in south-west Spain

6.1.1.i.- Age and sex distribution

The distribution of individuals by sex, calculated based on the ratio of individuals included in the MNI whose sex could be identified, indicates that 49% (*n* = 114) are female and 51% (*n* = 111) are male (Figure 6.3). Subadult individuals represent 8% of the identified individuals (*n* = 77). However, the percentage of unsexed adult individuals (those not yet examined) is very high (67% or *n* = 683) (Figure 6.4). Therefore, until more bioarchaeological analyses are completed, these data must be taken as preliminary.

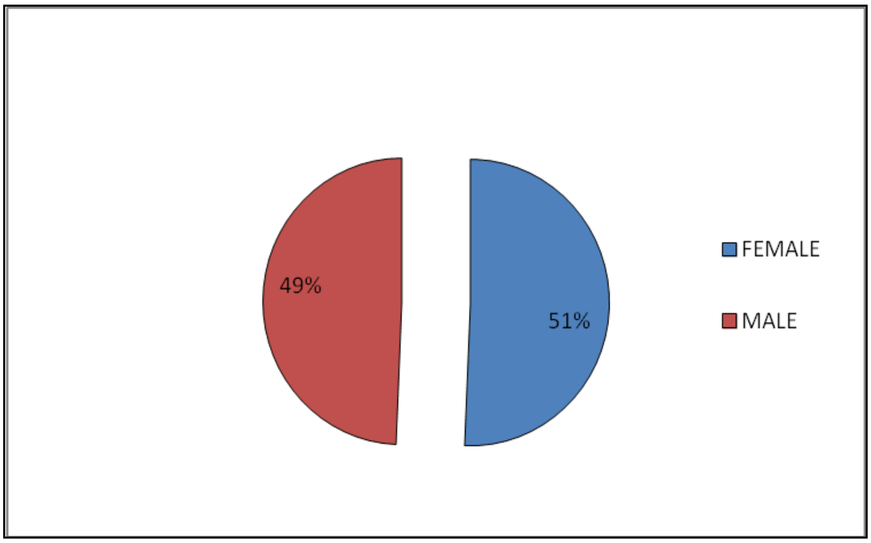


Figure 6.3. Distribution of female vs. male individuals

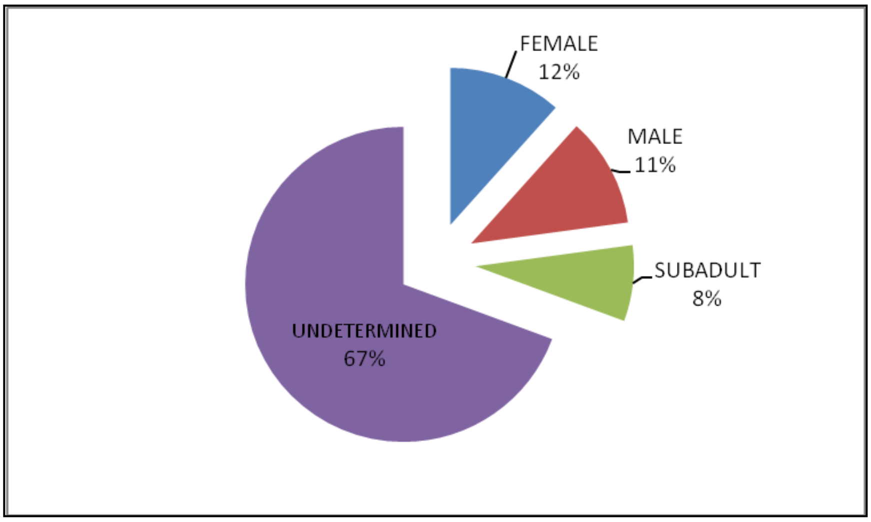


Figure 6.4. Sex distribution including individuals of undetermined sex

In relation to the distribution of bone fragments by age at death, they are distributed as follows: 8% were subadults (*n* = 77), 4% were young adults (18-25, *n* = 37), 5% were middle adults (25-36, *n* = 50), 3% were mature adults (36-45, *n* = 35), and 1% were >45 (*n* = 8) (Figure 6.5). However, half of the individuals could not be aged (50%). There was also a group classified as "adult" without any age category assigned (as it was not possible to estimate age more precisely), comprising 29% of the sample (*n* = 282) (Figure 6.6).

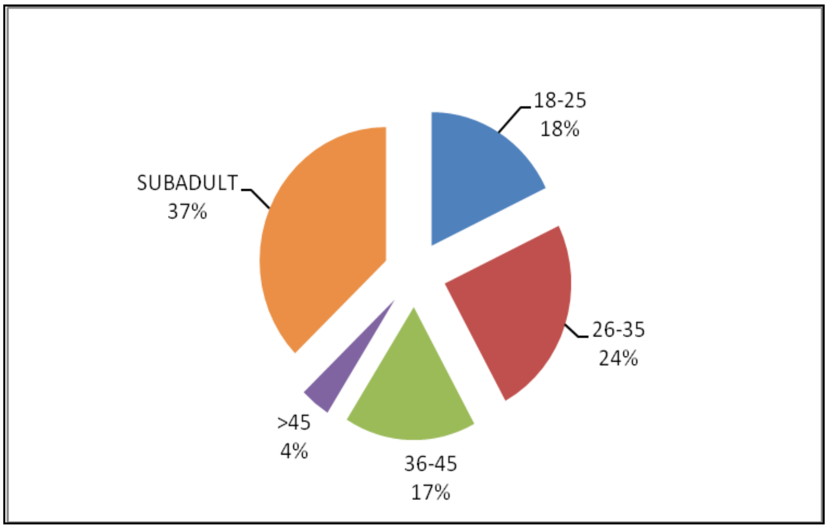


Figure 6.5. Distribution of individuals by age categories

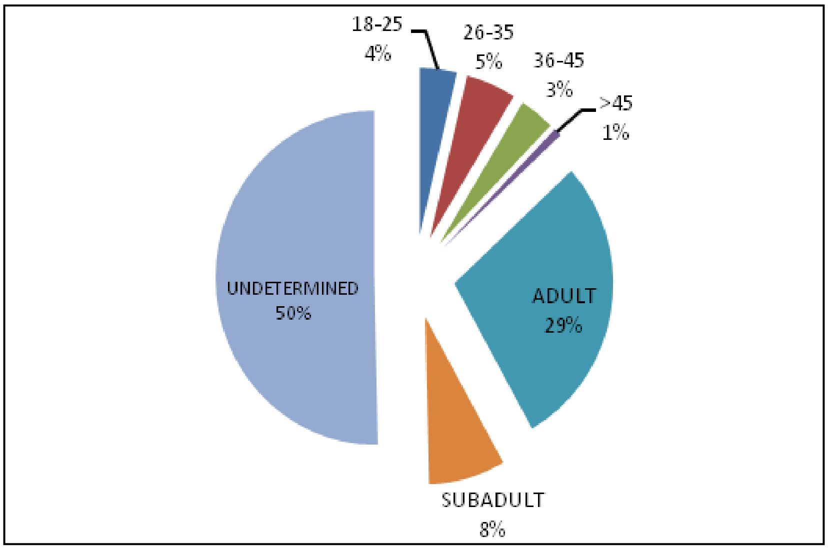


Figure 6.6. Age distribution including individuals of undetermined age.

The paleodemographic picture for the 3rd millennium BC in south-west Spain shows that the subadult group represents 8% (*n* = 77) of the population and, considering the fragility and relatively smaller size of the bones compared to adults, and the issues surrounding excavation of subadult remains, such as unfamiliarity with the anatomy of subadults and the difficult recovery process (Buikstra and Ubelaker, 1994; Ubelaker, 1989; Baker et al., 2005), their representation in this sample seems lower than expected. The adults represent a significantly larger group [χ^2 (2)=8.391, p=0.015]. However, for the older age categories, there are only 8 bone fragments (1% of the total). This lack of representation of older individuals may be the result of the limitations of the age estimation methods used as applied to this fragmented material. The major issue when using only a bone fragment or tooth to estimate age is that it might only be possible to use one method (e.g. dental attrition, or pubic symphyseal degeneration). A related fundamental issue is that within any one individual, different parts of the skeleton degenerate, or age, at different rates – so one ageing method using a particular bone may provide a different age estimate compared to another method based on a different bone, applied to the same individual (Roberts, 2009). Furthermore, the use of different anatomical parts of different bones to estimate sex is a challenge for maintaining consistency in sex estimation. Therefore, “accurate” demographic descriptions for these types of sites are simply not attainable because of these problems. However, in this study, most of the possible methods for sex and age estimation were used in order to obtain the maximum amount of data given the high levels of fragmentation.

6.1.2.- Normal variation
6.1.2.i.- Metrical analyses
6.1.2.i.a.- Stature

Stature was calculated for 36 individuals from different archaeological sites in south-west Spain. Of these individuals, five were presented in this study and come from La Pijotilla; the rest belong to Valencina-Castilleja (*n* = 18), La Molina (*n* = 5), Amarguillo (*n* = 1) and Puerto de la Palmera (*n* = 2). Results can be seen in Table 6.3:

N	SITE	SECTOR	F	M	REFERENCE
1	Valencina-Castilleja	Depósito de Agua	1.40	1.59 ± 6.96	López Flores, 2004
2	Valencina-Castilleja	Depósito de Agua	1.43 ± 6.96	-	López Flores, 2004
3	Valencina-Castilleja	Señorío de Guzmán	1.48	1.65	Lacalle et al., 2000
4	Valencina-Castilleja	El Algarrobillo	1.69 ± 4.30	-	Unpublished
5	Valencina-Castilleja	La Cima	1.58	-	Alcázar Godoy et al.,1992
6	Valencina-Castilleja	La Perrera	-	1.76	Basabe y Benassar, 1982
7	La Molina	Individual 1	1.38	-	Guijo and Lacalle, 2010
8	La Molina	Individual 2	-	1.62	Guijo and Lacalle, 2010
9	La Molina	Individual 5	1.56	-	Guijo and Lacalle, 2010
10	La Molina	Individual 6	1.47	-	Guijo and Lacalle, 2010
11	La Molina	Individual 8	1.51	-	Guijo and Lacalle, 2010
12	La Pijotilla	BAG ID 1730	1.62 ± 3.57	1.72 ± 3.29	Unpublished
13	La Pijotilla	BAG ID 2930	1.59 ± 4.24	1.62 ± 4.32	Unpublished
14	La Pijotilla	BAG ID 2968	1.59 ± 4.24	1.62 ± 4.32	Unpublished
15	La Pijotilla	BAG ID 5810	1.57 ± 4.30	1.60 ± 4.32	Unpublished
16	La Pijotilla	BAG ID 7212	1.62 ± 4.24	1.64 ± 4.32	Unpublished
19	Valencina-Castilleja	Divina Pastora T1	1.40	-	Lacalle et al., 2000
20	Valencina-Castilleja	Divina Pastora T2	1.52	1.53	Lacalle et al., 2000
21	Valencina-Castilleja	Divina Pastora T3	1.52	1.60	Lacalle et al., 2000
22	Valencina-Castilleja	Divina Pastora T4	1.56	1.60	Lacalle et al., 2000
23	Valencina-Castilleja	Divina Pastora T5	1.55	1.74	Lacalle et al., 2000
24	Valencina-Castilleja	Divina Pastora T5	-	1.66	Lacalle et al., 2000
25	Amarguillo II	Amarguillo II	1.54	-	Cabrero García, 1993
26	Puerto de la Palmera	E3	-	1.66	Romero Bomba, 2005
27	Puerto de la Palmera	E4	-	1.62	Romero Bomba, 2005

Key to table: F= female; M= male. Stature is calculated in metres and standard deviation is given in centimetres.

Table 6.3. Comparative stature estimation for south-west Spain

Although most of the studies did not explicitly state the methodology used for stature calculations, a comparative analysis is attempted in this work. Results of the comparative stature analysis for the female individuals (*n* = 20) show that minimum stature was 1.38 m and maximum was 1.69 m ± 0.08 (1 σ), while the mean was 1.53 m. On the other hand, for male individuals (*n* = 16) the minimum was 1.53 m and the maximum was 1.76 m ± 0.05 (1 σ), with a mean of 1.64 m. According to these data, male individuals are 11 cm taller than female individuals. In Figure (6.7), these differences between female and male individuals can be seen although the sample is very small and more data need to be incorporated.

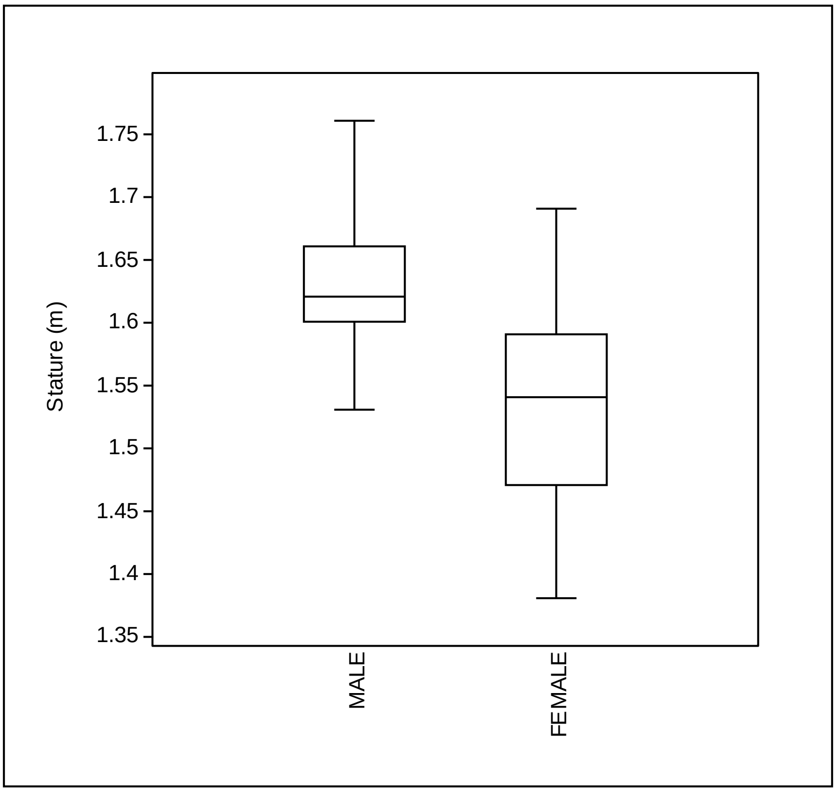


Figure 6.7. Box plot of comparative stature by sex in south-west Spain

Stature was calculated to check whether this could be another factor reflecting social differences among individuals. However, this could also indicate stress, again possibly a reflection of inequality (Wood et al., 2000). This has been studied before in Monte Albán, Mexico, where high status individuals were shorter in height than those of lower status (Wilkinson and Norelli, 1981). However, the contrary pattern is observed in Tikal, Guatemala (Haviland, 1967) and at Hopewell, Ilinois (Buikstra, 1976). Height versus funerary structure (megalithic vs. non-megalithic) was explored among individuals. The data showed that stature was greater, as reflected in male than in female bones but no significant differences were found in bones from megalithic and non-megalithic structures since most of the bones on which stature was calculated were from non-megalithic monuments.

6.1.2.ii.- Non-metric analyses

Non-metric traits are not always included in bioarchaeological reports but they can be very useful to characterise normal variation in populations and may indicate biological distance within and between them. For south-west Spain, again, the quantity of data is insufficient for a comparative analysis. However, from the two sites presented in this study it has been possible to make a comparison with two other sites (La Molina and PP4-Montelirio).

The results show that most of the non-metric traits observed in skeletal remains of this period in south-west Spain are found in the postcranial skeleton mainly because most of the skulls did not preserve well. All information about each of these traits can be seen in Appendix 3. The most commonly represented non-metric traits are the septal aperture (*n* = 12), the double faceted talus (*n* = 10), the vastus notch (*n* = 5) and the third trochanter (*n* = 3) (Table 6.4, Figure 6.8).

NMT	SECTOR	Area N. observations	NMT observed	% rate	SITE	REFERENCE
Septal aperture	Tomb 3	58	10	17.24	LP	Unpublished
Vastus notch	Tomb 3	126	3	2.38	LP	Unpublished
Talus double facet	Tomb 3	138	1	0.72	LP	Unpublished
Supracondylar process	Tomb 3	29	1	3.44	LP	Unpublished
Parietal notch	Tomb 3	5	1	20	LP	Unpublished
Bipartite patella	Tomb 3	126	1	2.38	LP	Unpublished
Vastus notch	La Cima	2	1	50	VC	Unpublished
Septal aperture	La Cima	2	1	50	VC	Unpublished
Fronto-temporal articulation	El Algarrobillo	7	1	14.28	VC	Unpublished
Auditory torus	El Algarrobillo	6	1	16.66	VC	Unpublished
Parietal foramen	La Gallega	2	2	100	VC	Unpublished
Septal aperture	PP4-Montelirio 10.042	1	1	100	VC	Robles Carrasco, 2011
Vastus notch	PP4-Montelirio 10.042	1	1	100	VC	Robles Carrasco, 2011

Key to table: NMT= non metric traits; LP= La Pijotilla; VC= Valencina-Castilleja; LM= La Molina; CM: Cueva de la Mora; PP: Puerto Palmera

Table 6.4. Sites with the most common non-metric traits found in skeletal remains

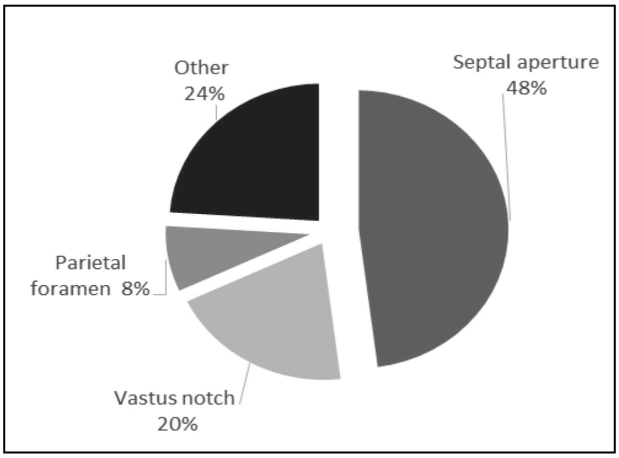


Figure 6.8. Number of observations of most frequently represented non-metric skeletal traits in south-west Spain

In relation to non-metric dental traits, the most frequently represented were shovelling (n = 17), a groove on the cingula (n = 15), an extra cusp (n = 9), Carabelli's cusp (n = 5) and dental foramina (n = 4). (Table 6.5, Figure 6.9).

NMT	SECTOR	Area N. observations	NMT observed	% rate	SITE	REFERENCE
Dental foramen on labial surface	Tomb 3	161	3	1.86	LP	Unpublished
Shovelling	Tomb 3	231	7	3.03	LP	Unpublished
Carabelli trait	Tomb 3	221	2	0.90	LP	Unpublished
Forked root	Tomb 3	-	1	-	LP	Unpublished
Dental gemination	Tomb 3	-	1	-	LP	Unpublished
Interruption groove	Tomb 3	231	1	0.43	LP	Unpublished
Interruption groove	La Cima (Ind. 2)	4	2	50	VC	Unpublished
Shovelling	La Cima (Ind. 2)	4	2	50	VC	Unpublished
Shovelling	Puerto Palmera	-	2	-	PP	Romero Bomba, 2005
Carabelli trait	La Molina (Ind. 3)	-	1	-	LM	Lacalle Rodríguez and Guijo Mauri, 2010
Five cusps	La Molina (Ind. 3)	-	2	-	LM	Lacalle Rodríguez and Guijo Mauri, 2010
Interruption groove	PP4 10.031 (1)	4	1	25	VC	Robles Carrasco, 2011
Dental foramen on lingual surface	PP4 10.031 (2)	6	2	33.33	VC	Robles Carrasco, 2011
Carabelli trait	PP4 10.031 (2)	6	3	50	VC	Robles Carrasco, 2011
Interruption groove	10.042 (UE 640)	2	1	50	VC	Robles Carrasco, 2011
Shovelling	10.042	4	1	25	VC	Robles Carrasco, 2011

Key to table: NMT= non metric traits; LP= La Pijotilla; VC= Valencina-Castilleja; LM= La Molina.

Table 6.5. Sites with the most common non-metric dental traits in south-west Spain

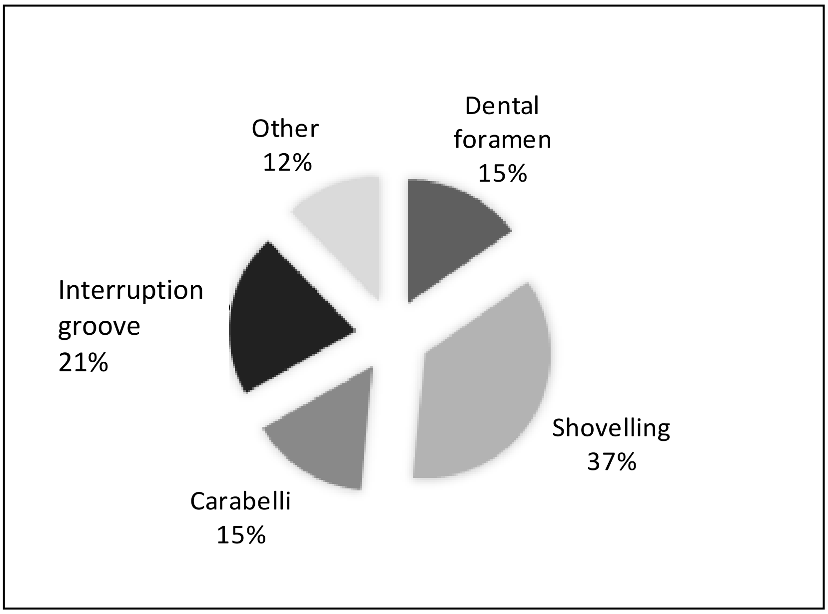


Figure 6.9. Number of observations of most common non-metric dental traits in south-west Spain

The quantity of the data was insufficient to make a comparative analysis and check population affinities between samples because in most cases (except for PP4-Montelirio and Puerto de la Palmera), each of the non-metric traits were not associated with an individual skeleton (because the skeletons are disarticulated). In addition, the total number of bones and/or teeth was not presented in the reports associated with each assemblage.

6.1.3.- Abnormal variation

6.1.3.i.- Enthesophytes

In this study, enthesophytes were classified as abnormal variation but for most of the sites of south-west Spain data are not available.

Eighteen enthesophytes were recorded, all in adult bones. Most (16 out of 18 or 88.9 %) were recorded in this study at La Pijotilla and Valencina-Castilleja and two examples were recorded at PP4-Montelirio (*n* = 1) and La Molina (*n* = 1) (Appendix 3.1). Most (70.6%) were observed in the lower limbs and feet (12 of 17). Two were located at the patella (sample 11 and 17), which may have been the result of extended use of the patellar tendon and the *quadriceps femoris* tendon during physical activity (the inferior margin of the patella has developed and projected inferiorly, possibly because of stress placed on the tendon). There were also two femora with hypertrophy of the linea aspera (cases 5 and 6) and two Achilles tendon related enthesophytes on calcaneii (cases 7 and 12), which may be the result of physical activity. Several studies have been carried out to reconstruct prehistoric life ways (Molnar et al., 2011; Lieverse et al., 2009; Molnar, 2006; 2008; Hawkey and Merbs, 1995; Merbs, 1983). However, there has been much debate about the correlation of the skeletal trait to a specific type of activity (Jurmain, 1999). In this study, it is not possible to determine the exact cause, but one hypothesis could be that long distance walking for long periods of time over rough surfaces may have led to these enthesophytes. There is, however, no clinical evidence to support this statement and obviously there might be other activities in play that are not visible to us today.

There were six enthesophytes on bones of the skull and upper skeleton; three (cases 1, 2 and 3) were found on the upper extremities and hands, and could have been a consequence of manual work that required repeated pronation and supination over a long time period (Chew and Giuffrè, 2005). Because most of the affected bones come from collective burials and all of the evidence comes from adult bone fragments, interpretations are problematic because distribution patterns of enthesophytes cannot be observed.

6.1.3.ii.- Paleopathology

6.1.3.ii.a.- Joint disease

In relation to joint disease, 46 pathological bones were observed in south-west Spain. Of these, 44 were examined in this research and all come from La Pijotilla. The other two come from Valencina-Castilleja (Cerro de la Cabeza, *n* = 1 and PP4-Montelirio, *n* = 1). In terms of joint disease, most of the bones affected were vertebrae, which presented with osteophytes, but the most common joint disease was osteoarthritis (OA), affecting 25 out of 44 bones. The most commonly affected bones were those from the feet (*n* = 16) and hands (*n* = 2), the mandibular condyles (*n* = 2), long bone articulations (*n* = 2) and the patellae (*n* = 2) (Table 6.6).

BONE	N. of observed bones	N affected	% rate
VERTEBRAE	918	21	2.28
FEET	1680	16	0.95
HANDS	1489	4	0.26
LONG BONES	2357	2	0.08
PATELLAE	144	1	0.69
MANDIBLES	430	2	0.46
TOTAL	**7,018**	**46**	**-**

Table 6.6. Bone elements and bone groups affected by joint disease from south-west Spain

Most of the joint disease affects the vertebrae and bones of the feet. Vertebral osteophytosis and osteoarthritis can be caused by many factors, but they are classified as degenerative joint disease alterations *per se*. Six lumbar, six cervical, and four thoracic vertebrae, and five unclassified vertebral fragments were affected. According to Jurmain and Kilgore (1995:448) involvement of the lumbar vertebrae could be due to weight bearing, while in other vertebrae, it could be due to different movements, such as rotation and flexion. In relation to the feet, four tarsals, one metatarsal, and eleven phalanges were affected. If these data are correlated with the enthesophyte data, and then compared with a case study from the Neolithic Sahara (Dutour, 1985), similarities suggest that a possible explanation for the osteophytosis and osteoarthritis found here could be functional-mechanical causes. However, age-related changes could lead also to a degenerative joint disease.

6.1.3.ii.b.- Metabolic disease

Fifteen bone elements were affected by metabolic disease and all were identified as cribra orbitalia. From those 15 bones, 14 were presented in this study (La Pijotilla, *n* = 6 and Valencina-Castilleja, *n* = 8), with only one from Cueva de la Mora available for comparative analysis. The latter was an adult male (Guijo, 1999). The prevalence of this condition shows that the right orbit was affected in seven cases and the left in seven cases. The data are shown in Appendix 3.2. When analysed by sex and age, there were two females, one male and nine unsexed bone fragments, of which three were from young adults and eight were from adults. An interpretation of metabolic disease in relation to social inequality will be made in Sections 6.2.3.

6.1.3.ii.c.- Trauma

Eight fractures were recorded in bones and bone fragments; of those, six are presented in this study and belong to La Pijotilla and the two others were from Cerro de la Casería and from Los Cabezuelos (see data in Appendix 3.2). Four of the eight affected ribs and the remainder affected second metatarsal, fibula, skull and mandible.

6.1.3.ii.d.- Dental pathology

6.1.3.ii.d.1.- Calculus

Calculus has been observed on 202 teeth from sites in south-west Spain. There were 99 teeth affected by calculus at La Pijotilla and 103 at Valencina-Castilleja; at La Alcazaba, 13 teeth were affected, at El Algarrobillo there were 2, and at PP4-Montelirio, there were 89 teeth affected. Most presented calculus classified as type 1, with a few of type 2, and most were located on the labial surface. The most commonly affected tooth was the upper left canine (ULC, n = 14), followed by the lower left second incisor (LLI2, n = 11), the lower left first incisor (LLI1, n = 10), the lower left first premolar (LLP1, n = 9) and the upper left third molar (ULM3, n = 9). The rest of the teeth presented lower percentages of calculus (see Table 6.7):

SITE	SECTOR	TOOTH	N observed	N affected	%
VC	ALG	URM2	3	1	33.33
VC	ALG	ULI2	2	1	50
VC	A	LLM2	1	1	100
VC	A	LLP2	1	1	100
VC	A	LLP1	1	1	100
VC	A	LLC	1	1	100
VC	A	LLI2	1	1	100
VC	A	LRM1	1	1	100
VC	A	LRP2	1	1	100
VC	A	LRP1	1	1	100
VC	A	LRI2	1	1	100
VC	A	LLI1	1	1	100
VC	A	ULC	1	1	100
VC	A	URP1	1	1	100
VC	A	URI1	1	1	100
LP	Tomb 3	Incisor	15	1	6.66
LP	Tomb 3	LLC	33	2	6.06
LP	Tomb 3	LLI1	50	6	12
LP	Tomb 3	LLI2	46	7	15.21
LP	Tomb 3	LLM1	74	3	4.05
LP	Tomb 3	LLM2	76	2	2.63
LP	Tomb 3	LLM3	37	1	2.70
LP	Tomb 3	LLP1	43	2	4.65
LP	Tomb 3	LLP2	48	6	12.5
LP	Tomb 3	Lower Incisor	4	1	25
LP	Tomb 3	Lower premolar	34	1	2.94
LP	Tomb 3	LRC	35	3	8.57
LP	Tomb 3	LRI1	30	6	20
LP	Tomb 3	LRI2	24	3	12.5
LP	Tomb 3	LRM1	105	4	3.80
LP	Tomb 3	LRM2	90	3	3.33
LP	Tomb 3	LRP1	42	3	7.14
LP	Tomb 3	LRP2	49	1	2.04
LP	Tomb 3	Premolar	33	1	3.03
LP	Tomb 3	ULC	72	7	9.72
LP	Tomb 3	ULI1	65	1	1.53
LP	Tomb 3	ULI2	58	3	5.17
LP	Tomb 3	ULM1	75	2	2.66
LP	Tomb 3	ULM2	82	1	1.21
LP	Tomb 3	ULM3	51	3	5.88
LP	Tomb 3	ULP1	57	1	1.75
LP	Tomb 3	ULP2	49	2	4.08
LP	Tomb 3	URC	59	4	6.77
LP	Tomb 3	URI1	53	2	3.77
LP	Tomb 3	URI2	43	3	6.97
LP	Tomb 3	URM1	73	1	1.36
LP	Tomb 3	URM2	84	2	2.38
LP	Tomb 3	URM3	63	1	1.58
LP	Tomb 3	URP1	62	6	9.67
LP	Tomb 3	URP2	52	3	5.76
VC	Ind. 1/ 453/19	LLP2	1	1	100
VC	Ind. 1/ 453/21	LRP2	1	1	100
VC	Ind. 1/ 453/15	LLP1	1	1	100
VC	Ind. 1/ 453/27	LRP1	1	1	100
VC	Ind. 1/ 453/26	LLC	1	1	100
VC	Ind. 1/ 453/16	LRC	1	1	100
VC	Ind. 1/ 453/22	LRI2	1	1	100
VC	Ind. 1/ 453/23	LRI1	1	1	100
VC	Ind. 1/ 453/31	LLI1	1	1	100
VC	Ind. 1/ 453/12	LRM1	1	1	100
VC	Ind. 1/ 453/10	LLM3	1	1	100
VC	Ind. 2/ 453/1.1	LLM1	1	1	100
VC	Ind. 2/ 453/1.4	LLC	1	1	100
VC	Ind. 2/ 453/1.5	LLI2	1	1	100
VC	Ind. 2/ 453/1.6	LLI1	1	1	100
VC	Ind. 2/ 453/1.8	LRI2	1	1	100
VC	Ind. 2/ 453/1.9	LRC	1	1	100
VC	Ind. 2/ 453/1.10	LRP1	1	1	100
VC	Ind. 2/ 453/1.11	LRP2	1	1	100
VC	Ind. 2/ 453/1.15	LRM3	1	1	100
VC	Ind. 2/ 453/1.16	LLM3	1	1	100
VC	Ind. 2/ 453/10	URC	1	1	100
VC	Ind. 2/ 453/9	ULC	1	1	100
VC	Ind. 2/ 453/11	URP1	1	1	100
VC	Ind. 2/ 453/6	URP2	1	1	100
VC	Ind. 2/ 453/3.2	ULP2	1	1	100

SITE	SECTOR	TOOTH	N observed	N affected	%
VC	Ind. 2/ 453/2	URM2	1	1	100
VC	Ind. 2/ 453/8	ULM2	1	1	100
VC	Ind. 2/ 453/7	URM3	1	1	100
VC	Ind. 2/ 453/4	ULM3	1	1	100
VC	Ind. 2/ 453/13	URM1	1	1	100
VC	211/1	ULC	1	1	100
VC	211/2	UC	1	1	100
VC	211/3	URP2	1	1	100
VC	211/4	URP2	1	1	100
VC	211/5	ULM3	1	1	100
VC	211/6	URP2	1	1	100
VC	211/7	ULC	1	1	100
VC	211/10	LLM3	1	1	100
VC	211/11	LRI2	1	1	100
VC	211/12	LLC	1	1	100
VC	211/13	LLC	1	1	100
VC	211/14	LRP1	1	1	100
VC	211/15	LLI2	1	1	100
VC	211/9.2	LLP2	1	1	100
VC	615/11	ULC	1	1	100
VC	615/16	ULM3	1	1	100
VC	615/4	LLI1	1	1	100
VC	615/6	LLP1	1	1	100
VC	640/1	URI2	1	1	100
VC	640/2	URI1	1	1	100
VC	640/5	ULM3	1	1	100
VC	640/4.1	URI2	1	1	100
VC	640/4.2	URC	1	1	100
VC	640/10	LRP1	1	1	100
VC	648/3	ULP2	1	1	100
VC	648/5	URC	1	1	100
VC	648/1	LLI2	1	1	100
VC	648/4	LLC	1	1	100
VC	Ind. 1/ 667	LRM3	1	1	100
VC	Ind. 1/ 667	LRM2	1	1	100
VC	Ind. 1/ 667	LRM1	1	1	100
VC	Ind. 1/ 667	LRP2	1	1	100
VC	Ind. 1/ 667	LRP1	1	1	100
VC	Ind. 1/ 667	LLM2	1	1	100
VC	Ind. 1/ 667	LLM1	1	1	100
VC	Ind. 1/ 667	LLP2	1	1	100
VC	Ind. 1/ 667	LLP1	1	1	100
VC	Ind. 1/ 667	LLC	1	1	100
VC	Ind. 1/ 667	LLI2	1	1	100
VC	Ind. 1/ 667	ULI1	1	1	100
VC	Ind. 1/ 667	URC	1	1	100
VC	Ind. 1/ 667	URM3	1	1	100
VC	Ind. 1/ 667	URM2	1	1	100
VC	Ind. 1/ 667	URP1	1	1	100
VC	Ind. 1/ 667	URP2	1	1	100
VC	Ind. 1/ 667	URI1	1	1	100
VC	Ind. 1/ 667	ULM3	1	1	100
VC	Ind. 1/ 667	ULM2	1	1	100
VC	Ind. 1/ 667	ULM1	1	1	100
VC	Ind. 1/ 667	ULP2	1	1	100
VC	Ind. 1/ 667	ULP1	1	1	100
VC	499/4	ULC	1	1	100
VC	499/11	LLC	1	1	100
VC	Ind. 1/ 453/4	ULM3	1	1	100
VC	Ind. 1/ 453/29	ULP1	1	1	100
VC	Ind. 1/ 453/28	ULC	1	1	100
VC	Ind. 1/ 453/32	URI2	1	1	100
VC	Ind. 1/ 453/17	ULI2	1	1	100

Key to table: V-C= Valencina-Castilleja; LP= La Pijotilla; A= La Alcazaba; ALG= El Algarrobillo; L= lower; U=upper; R: right; L= left; C= canine; P= premolar; I= incisor; M= molar

Table 6.7. Proportion of individual teeth affected by calculus in south-west Spain

From the 202 observed teeth, it should be noted that 49% come from La Pijotilla, 44.1% from PP4-Montelirio (Valencina-Castilleja) and 5.9% from La Alcazaba (Valencina-

Castilleja). Unfortunately, there was little comparative data but two possible explanations are provided to explain the calculus prevalence in this sample. The first is the absence of systematic studies of dental anthropology, and thus no comparative data are available. The second explanation is related to dietary patterns, in that calculus presence may be related to a diet rich in protein (Hillson, 2000).

Results of $\delta^{13}C$ and $\delta^{15}N$ analyses from these sites show that some of the individuals had a diet higher in $\delta^{15}N$ proteins than others. However it was not possible to relate isotope data with specific individuals whose teeth had calculus on them. Calculus may have been present in those individuals with higher status i.e, those with access to a high protein diet. For teeth with calculus from specific discrete individuals, its presence in relation to a high protein diet can be seen in, for example, individual ALC-1 from La Alcazaba (female, 25-35 years) with values $\delta^{13}C$ of -19.03‰ and $\delta^{15}N$ of 9.02‰, and individual 10,049,667,1 from PP4-Montelirio (male, 18-25 years) with similar values ($\delta^{13}C$, -19.15‰ and $\delta^{15}N$, 9.92‰). The final individual is ALG-10 (male, 25-35 years) with values $\delta^{13}C$ of -20.01‰ and $\delta^{15}N$ of 5.08‰, which show lower nitrogen values; the explanation here could be that the diet might have been rich in carbohydrates and not protein.

In addition, the correlation to the frequency of dental calculus to the type of funerary structure showed that 146 affected teeth (78%) were found at megalithic tombs, while 45 teeth (22%) were documented at non-megalithic structures. This means that social differences existed and those individuals with higher status were buried in megalithic tombs. In addition, they presented higher proportion of calculus which means that enjoyed diet rich in proteins. Unfortunately due to poor collagen preservation, there is not enough data of $\delta^{13}C$ and $\delta^{15}N$ to correlate calculus, diet and type of structure.

6.1.3.ii.d.2.- Linear Enamel Hypoplasia (LEH)

At least 70 teeth with LEH are recorded from south-west Spain, from the following sites: La Pijotilla (*n* = 19), Cueva de la Mora de la Umbría (*n* = 5), Cueva de la Mora (*n* = 2), Paraje de Monte Bajo (*n* = 1), Valencina-Castilleja (*n* = 32, divided between Divina Pastora, *n* = 2, and PP4-Montelirio, *n* = 30) and *Tholos* Palacio III (*n* = 11). This dental condition has been commonly observed in skeletal remains dated to the 3rd millennium BC in south-west Spain and mostly affects maxillary teeth. In addition, the most commonly affected teeth are the incisors, canines, and premolars. The stress causing the defects occurred mostly between the ages of 3.5 to 5 years old. A complete description and information about each tooth can be seen in Appendix 3.2 and the list of observed teeth, affected teeth and the percentage of the total affected can be seen in Table 6.8:

SITE	SECTOR	TOOTH	N observed	N affected	%
LP	Tomb 3	LRM2	90	1	1.11
LP	Tomb 3	ULC	72	4	5.55
LP	Tomb 3	ULP1	57	1	1.75
LP	Tomb 3	LLP2	48	1	2.08
LP	Tomb 3	LLC	33	3	9.09
LP	Tomb 3	ULP2	49	1	2.04
LP	Tomb 3	URC	59	2	3.38
LP	Tomb 3	ULI1	65	1	1.53
LP	Tomb 3	LRP2	49	1	2.04
LP	Tomb 3	LRC	35	2	5.71
LP	Tomb 3	URP1	62	1	1.61
LP	Tomb 3	URI2	43	1	2.32
P III	*Tholos*	LLC	2	1	50
P III	*Tholos*	LRC	4	1	25
P III	*Tholos*	LRI1	1	1	100
P III	*Tholos*	ULC	2	2	50
P III	*Tholos*	ULI2	3	2	66.66
P III	*Tholos*	ULM1	4	1	25
P III	*Tholos*	URC	4	3	75
CM	-	ULC	-	1	-
CM	-	URC	-	1	-
CU	-	LC	-	1	-
CU	-	URP1	-	1	-
CU	-	ULP2	-	1	-
CU	-	LLP2	-	1	-
CU	-	ULM2	-	1	-
PMB	E-4	-	-	1	-
VC	DP-1	-	-	2	-
VC	PP4-M	LLC	10	4	
VC	PP4-M	LLI1	7	1	
VC	PP4-M	LLI2	8	1	
VC	PP4-M	LRC	3	1	
VC	PP4-M	LRI2	5	2	
VC	PP4-M	LRP1	6	1	
VC	PP4-M	LRP2	5	1	
VC	PP4-M	UC	22	1	
VC	PP4-M	ULC	9	4	
VC	PP4-M	ULM2	5	1	
VC	PP4-M	ULM3	9	1	
VC	PP4-M	ULP1	11	1	
VC	PP4-M	ULP2	8	3	
VC	PP4-M	URC	11	3	
VC	PP4-M	URI1	8	1	
VC	PP4-M	URI2	8	1	
VC	PP4-M	URM2	8	1	
VC	PP4-M	URP1	7	1	
VC	PP4-M	URP2	11	1	

Key to table: L= lower; U=upper; R: right; L= left; C= canine; P= premolar; I= incisor; M= molar; VC= Valencina-Castilleja; LP= La Pijotilla; P III= Palacio III; PMB= Paraje de Monte Bajo; CM= Cueva de la Mora; CU= Cueva de la Mora de la Umbría.

Table 6.8. Proportion of individual teeth affected by LEH in south-west Spain

There are two other sites where LEH is documented, but published information does not provide information on the specific teeth affected. In skeletal remains from Tombs 2, 3 and 5 at Divina Pastora (Valencina-Castilleja), more than 50% of teeth were affected, and the age of the stress episode occurred at >4 years old (Lacalle Rodríguez et al., 2000: 349) The second site was La Molina, where individual 3 presented stress that occurred between 4 and 5 years of age, but the tooth or teeth affected were not specified (Lacalle Rodríguez and Guijo Mauri, 2010). The proportion of LEH in relation to the type of funerary structures in the south-west of Spain showed that there are 42 teeth (60%) documented at megalithic structures, while there are 21 teeth (30%) from non-megalithic structures and 7 (10%) from natural caves.

The causes of LEH in these populations should include several factors, such as metabolic stress following a change in subsistence pattern, along with the effects of weaning and childhood disease (Goodman and Rose, 1991; Goodman, 1988; Goodman et al., 1987). However, these data are limited because all of the recorded evidence is from (usually) single teeth – usually, the interpretation of LEH is often related to systemic stress (Goodman et al., 1980). Another interpretation could be that these individuals who survived to develop LEH were stronger immunity wise. According to the issues raised by the Osteological Paradox (Wood et al., 1992) these individuals could represent higher status (better health) and for instance social differences can be observed.

6.1.3.ii.d.3.- Caries

The third most frequently represented dental pathology in south-west Spain was dental caries. There were 16 teeth affected: from La Pijotilla (n = 9), Cueva de la Mora de la Umbría (n = 1), *Tholos* III (n = 4), Valencina-Castilleja (n = 1) and El Jadramil (n = 1). Caries mostly affected molars and premolars and 18.75% of teeth affected with caries were lower first molars and upper right second molars. Most caries were located on the distal and occlusal surfaces (see Table 6.9).

SITE	SECTOR	TOOTH	N observed	N affected	%
P III	*Tholos*	LRM1	6	2	33.33
P III	*Tholos*	URM2	4	1	25
P III	*Tholos*	LLM1	4	1	25
CU	*Tholos*	URM1	2	1	50
J	Ind. 1	-	-	1	-
VC	DP	-	-	1	-
LP	Tomb 3	ULP1	57	1	1.75
LP	Tomb 3	ULM2	82	1	1.21
LP	Tomb 3	LLM1	74	1	1.35
LP	Tomb 3	URM3	63	1	1.58
LP	Tomb 3	ULP2	49	1	2.04
LP	Tomb 3	URM2	84	2	2.38
LP	Tomb 3	LRM1	105	2	1.90
TOTAL	-	-		16	-

Key to table: L= lower; U=upper; R: right; L= left; C= canine; P= premolar; I= incisor; M= molar; ?= unidentified; VC= Valencina-Castilleja; LP= La Pijotilla; P III= Palacio III; J= El Jadramil; DP= Divina Pastora.

Table 6.9. Proportion of individual teeth affected by caries in south-west Spain

There were some sites, for example, El Jadramil, where the teeth affected were not specified, although the authors note that caries appear on lower molars, without specifying frequency of occurrence (Bueno Sánchez, 2003:173). Caries is also related to other dental and metabolic diseases, including calculus and LEH, and also relates to a high carbohydrate diet (Hillson, 2000). This dental disease is not frequently found during prehistoric periods (Hillson, 1997) but according to some studies (Larsen et al., 1991; Cook, 1990) there is an increase in caries from hunter-gatherers to agriculturalists. In this study, caries was documented mostly associated to megalithic tombs (*n = 15)* rather than to non-megalithic tombs *(n= 1)*, although this data is very limited due to very small sample size.

6.1.3.ii.d.4.- Dental wear

Dental wear for each tooth was recorded from La Pijotilla and Valencina-Castilleja (see Appendix 2.2), but due to the lack of data recorded for other skeletal remains from south-west Spain, it is not possible to make a comparison between sites. For most other sites, dental wear has been recorded for the mandibular but not maxillary teeth, and the attrition scoring method is not described. In other cases, such as at El Jadramil, dental wear was documented according to the author (Bueno Sánchez, 2003), and one individual was described as affected mostly in the maxillary teeth (no teeth specified).

6.1.3.ii.d.5.- Antemortem tooth loss (AMTL)

There were 14 cases of antemortem tooth loss at La Pijotilla (Chapter 5, Section 5.6.3.iv.a.). Again, as in the preceding section, this was not recorded systematically and has only been documented at the site of Los Cabezuelos (Guijo Mauri et al., 1995; 1996) and in the following teeth: LRP2, LRP1, LRC, LLM2. However, there is no information about the correlation with the frequency of tooth loss for each tooth type individual numbers of the teeth or tomb.

In relation to dental pathology, a summary of total (%) of observed pathological teeth is presented in Figure 6.10:

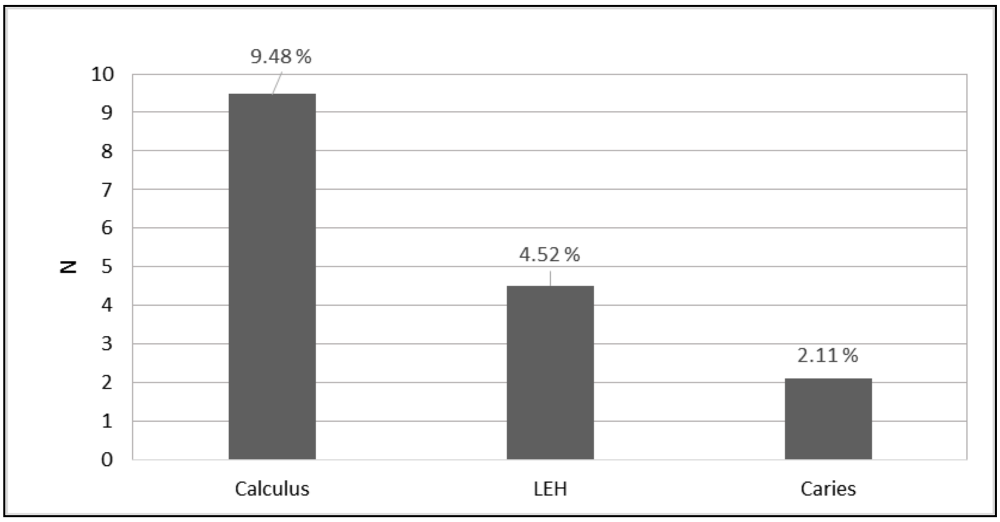


Figure 6.10. Percentage of teeth affected by different types of dental disease in south-west Spain

6.1.3.ii.d.6.- Miscellaneous

In this section, a case of dental modification have been reported at La Pijotilla (see chapter 5, section 5.6.3.iv.b). One possible interpretation is the use of the teeth as tools for handling or cutting some sort of material, but it could also be due to defective enamel[26]

[26] Jane Buikstra´s personal communication.

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However, according to Schultz (1977), it might be the result of multiple causes. The relationship of occupation to dental modifications has been documented previously in the literature (Schultz, 1977; Stewart and Groome, 1968; Ubelaker et al., 1984; Romero Molina 1958, 1986; Goose, 1963; Haour and Pearson, 2005; Alt et al, 1998). Similar dental modification has been also detected in the archaeological record in a 3rd millenium population from Valencina-Castilleja at structure 10,042 (Robles Carrasco and Díaz-Zorita Bonilla, 2013).

6.1.4.- Summary of the osteological data

With reference to the findings from comparative analyses, despite the high number of "undetermined" bones/teeth fragments (those where sex or age are unknown because the skeletons were not analysed), there were substantial enough data to describe the demographic profile of this part of Spain for the 3rd millennium BC. According to these data, the distribution of individuals by sex was about 50% for males and females, and the subadult group was under-represented (8%) (*n* = 77). In relation to the age categories, interpretation of the distribution is problematic because of the difficulties of estimating age on bone fragments and individual teeth, but the distribution by bone fragment for each age group based on the MNI can be seen in Figure 6.11:

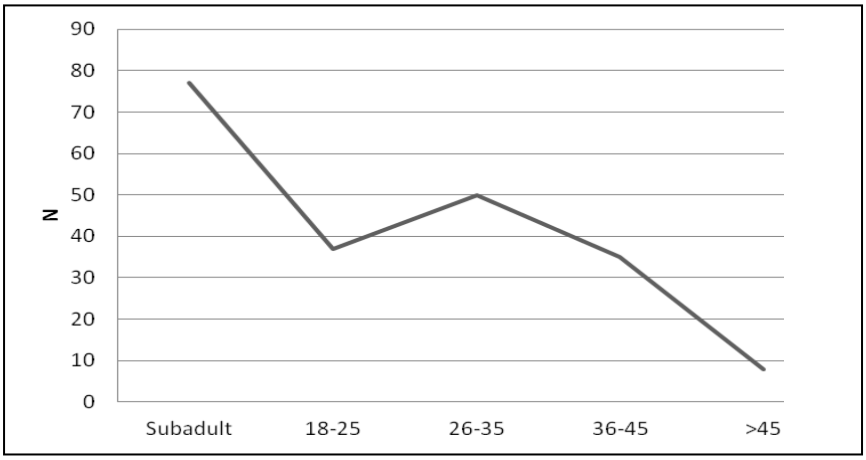

Figure 6.11. Representation of age groups in south-west Spain based on bone fragments and teeth

The study of non-metric traits has demonstrated that four bone and six dental traits predominated, despite the difficulty in recording these traits from fragmentary bones and teeth. These data could be used to infer biological distance for these Chalcolithic communities and also to investigate hidden heterogeneity within the collections (Wright and Yodder, 2003). However, many of them are not inherited (Tyrrell, 2000) and the only method that could be argued to be useful in this respect is DNA analysis; therefore, until ancient DNA analysis is done on these individuals, relatedness remains a hypothesis.

In relation to health status, a few instances of enthesophytes were recorded, mostly at La Pijotilla and Valencina-Castilleja. These enthesopathies may be related to biomechanics and, if correlated with pathological data such as joint disease, an explanation for these bone changes could be physical activity. These populations had some degree of social differentiation and were builders of large dolmens, and other megalithic structures, but also large negative structure such as ditches and pits. Trade and exchange of raw materials also played a key role in their societies but, according to Weiss and Jurmain (1999), osteoarthritis is not a good indicator of activity since the causes are multifactorial. Rates of osteoarthritis increase with age and physical activity and is influenced by biological sex and genetics.

Oral pathology was represented by calculus, caries and LEH and all are directly related to diet, among other factors. Diet is a key factor in determining social inequality and resources were not equally accessible for all people, based on the interpretation of the stable isotope data for $\delta^{13}C$ and $\delta^{15}N$ where individuals buried in megalithic structures seem to have higher $\delta^{15}N$ in their diets. Discussion of diet is further seen in Section 6.3.

The health status and the frequency of pathologies of the Copper Age populations in south-west Spain, showed a very low percentage of bone pathologies. In relation to the questions raised by the Osteological Paradox (Wood et al., 1992) this could be interpreted as an indicator of good health, but according to these authors, this could also means high frailty. However, with respect to the teeth pathologies, LEH and calculus were documented and they were mostly associated to individuals buried in megalithic monuments. Although LEH represent individuals who survived stress episodes, and calculus means a diet rich in proteins (Hillson, 2000), according to Wood et al. (1992) the combination of both factors showed higher status. Differences among individuals buried in megalithic tombs and those buried in non-megalithic tombs were detected among Copper Age populations according to the health status and the type of diet.

In general, the collection and evaluation of comparative data from human remains south-west Spain was difficult. This was because of problems in accessing the information, which in some cases is still unpublished. In addition, published reports or papers are not easy to find, authors were not easy to contact and information was not always shared. Most publications are in local journals or presented as book chapters, with little dissemination of results to wider audiences.

6.2.- Funerary practices in south-west Copper Age Spain and the implications for social differentiation

In this section, three indicators were used to explore social inequality: funerary structures, biological data and biochemical results. For example, funerary patterns were observed in order to establish whether significant social differences could be found among individuals. Each bone/tooth fragment (when information was available) was examined in relation to individual biological information and social status based on the analysis of funerary structure type, type of diet and the degree of mobility.

Copper Age communities in south-west Spain represent significant differences in terms of the structure of funerary monuments; some are megalithic tombs, while others are simple pits or so-called negative structures. For this reason, intra- and inter-site comparisons focused on the type of funerary structure (megalithic or non-megalithic). In this section the biological data, including the results of the biochemical analyses ($\delta^{13}C$, $\delta^{15}N$ and $^{87}Sr/^{86}Sr$), will be correlated with the funerary contextual data to make inferences about social equality or inequality using the relationship described above.

A very intensive debate has been taking place for many years about the Copper Age in the south-east Iberian Peninsula, regarding the increase of social inequality during the 3rd millennium BC (Chapman, 1990; Gilman and Thornes, 1985; Ramos Muñoz, 1981; Lull, 1983, 1984). However, much less is known about the Copper Age period in south-west Spain. This is because of the absence of systematic excavations and the lack of radiocarbon dates for the sites that have been excavated. Nevertheless, since the late 1980s, great progress has been made towards the application of scientific methods in fieldwork to explore the characteristics of past societies, especially in the Copper Age period. Most of the latest publications related to south-west Copper Age Spain are devoted to the main archaeological site in the south-west such as Valencina-Castilleja. This has led to a debate about the causes of social inequality in the south-west (Arteaga Matute and Cruz-Auñón Briones, 1996a, 1996b, 1997; Cruz-Auñón Briones and Arteaga Matute, 1996; López Aldana and Pajuelo Pando, 2001; López Aldana, 2001; Nocete, 2001; Costa Caramé el al., 2010; Cruz-Auñón Briones et al., 2010). However, the data are still inadequate to argue for social complexity with differential social status for the Copper Age in south-west Spain, due to the large amount of unpublished excavated material and the, as yet unstudied, associated material culture. In any case, and despite the lack of radiocarbon dates and general lack of information, based on the analysis that is presented here, some inferences will be attempted.

In relation to the absolute chronology of the south of Spain outlined in Chapter 3, most of the Copper Age funerary structures with associated radiocarbon dates are summarised here. There were a total of 39 radiocarbon dates for funerary structures and 55 for settlements. If we take into account that there are about 1,560 megalithic structures (García Sanjuán 2009:17) in the south of Spain, only 2.5% of the funerary structures have been dated as yet, and there is still much work to be done to understand the continued use of funerary structures.

6.2.1.- Type of funerary structures

The first level of analysis considers the distribution of individuals (using the MNI) based on the type of structure. For this analysis, the structures were divided into megalithic and non-megalithic types. There was also another type of funerary "container" in the form of natural caves. The second level of analysis was the examination of the distribution of individuals by sex in order to investigate whether social differences based on this parameter occur in this region. Megalithic monuments could have been restricted to high status individuals while non-megalithic structures could have been the destiny of the lower status individuals. In Table 6.10, the sites included in a comparative analysis of demographic data are listed, but only those sites that have individuals of identified age and sex. The results show that there were a minimum of 840 individuals within all structures; the MNI for megalithic monuments was 533, while the MNI for non-megalithic monuments was 307. Two sites were excluded from this analysis, the burials in natural caves at Cueva de la Mora and Cueva de la Mora de la Umbría, because their different "funerary container" cannot be classified into either the megalithic or non-megalithic category for comparative analysis.

N	SITE & SECTOR	PROVINCE	STRUCTURE	MNI	F	M
1	VC-Matarrubilla	Seville	Megalithic	2	0	0
2	VC-Los Cabezuelos	Seville	Megalithic	14	3	1
3	VC-Cerro de la Cabeza	Seville	Megalithic	1	0	0
4	VC-El Roquetito	Seville	Megalithic	48	2	0
5	VC-Divina Pastora- Señorío de	Seville	Megalithic	20	8	6
6	VC-Norte Castilleja	Seville	Non-megalithic	1	0	1
7	VC-Dolmen de Montelirio	Seville	Megalithic	26	19	2
8	VC-El Algarrobillo	Seville	Non-megalithic	19	5	9
9	VC-La Alcazaba	Seville	Non-megalithic	7	2	1
10	VC-La Cima	Seville	Non-megalithic	2	1	0
11	VC-La Gallega	Seville	Non-megalithic	2	1	0
12	VC-La Perrera	Seville	Non-megalithic	4	1	3
13	VC-P.P. Matarrubilla	Seville	Non-megalithic	6	0	0
14	VC-El Cuervo	Seville	Non-megalithic	1	0	0
15	VC-Mirador de Itálica	Seville	Non-megalithic	2	0	0
16	VC-Mariana Pineda	Seville	Non-megalithic	1	0	0
17	VC-La Candelera-Emisora	Seville	Non-megalithic	2	0	0
18	VC-C/Dinamarca	Seville	Non-megalithic	74	0	0
19	VC-C/Trabajadores	Seville	Non-megalithic	12	0	0
20	VC-Mariana Pineda UA 3	Seville	Non-megalithic	18	0	0
21	VC-Depósito de Agua	Seville	Non-megalithic	4	3	1
22	VC-La Huera	Seville	Non-megalithic	20	4	5
23	VC-Cerro de la Cabeza	Seville	Non-megalithic	6	3	0
24	La Molina	Seville	Non-megalithic	10	4	4
25	PP4-MONTELIRIO (10,049)	Seville	Megalithic	5	2	2
26	PP4-MONTELIRIO (10,034)	Seville	Megalithic	7	0	2
27	PP4-MONTELIRIO (10,031)	Seville	Non-megalithic	3	0	1
28	VC-La Perrera	Seville	Non-megalithic	6	3	0
29	Tholos Palacio III	Seville	Megalithic	8	0	0
30	Amarguillo II	Seville	Non-megalithic	4	1	0
31	Cerro del Arca	Seville	Non-megalithic	1	1	0
32	Puerto de la Palmera	Seville	Non-megalithic	2	0	2
33	LP- Tomb 3	Badajoz	Megalithic	178	18	27
34	LP- Tomb 1	Badajoz	Megalithic	72	20	25
35	Huerta Montero	Badajoz	Megalithic	100	0	0
36	La Orden-Seminario (PEX 1336)	Huelva	Non-megalithic	23	0	0
37	La Orden-Seminario (PEX 7016)	Huelva	Megalithic	11	0	11
38	La Orden-Seminario (PEX 7055)	Huelva	Megalithic	19	0	0
39	Paraje de Monte Bajo	Cádiz	Non-megalithic	71	0	2
40	El Jadramil	Cádiz	Non-megalithic	6	1	1
41	Cerro de la Casería T5	Cádiz	Megalithic	3	3	0
42	Cerro de la Casería T7	Cádiz	Megalithic	8	3	3
43	El Dorado	Córdoba	Megalithic	1	0	0
44	Valdelinares	Huelva	Megalithic	10	1	0
TOTAL				840	109	110

Key to table: VC= Valencina-Castilleja; LP= La Pijotilla

Table 6.10. Comparative MNI and sex data for Copper Age sites in south-west Spain

In relation to the megalithic structures (*n* = 18), the highest number of individuals represented was 178 and the lowest was 1. The mean (1 σ) number of individuals per megalithic structure was 19.11 ± 45.67 and the median was 10. The representation of female bone fragments varied from 1 to 20 per megalithic structure, with a mean (1 σ) of 4.38 ± 7.02 and a median of 1.5. For male bone fragments, between 1 and 27 individuals per structure was estimated, the mean (1 σ) being 3.83 ± 8.21 and the median being 0.5.

On the other hand, for non-megalithic structures (*n* = 26), the highest MNI was 74 and the lowest was 1. The mean (1 σ) MNI per non-megalithic structure was 11.76 ± 19.01 and the median was 5. The distribution of bone fragments by sex showed that MNI for females varied between sites from 1 to 5, with a mean (1 σ) of 1.15 ± 1.54 and a median of 0.5. With respect to males, the MNI varies from 1 to 9 individuals per structure, the mean (1 σ) was 1.15 ± 2.09 and the median was 0.

From these data, there were more individuals buried in megalithic structures (*n* = 533, 63.52%) than in non-megalithic structures (*n* = 306, 36.47%), but in relation to sex, the mean (1 σ) for female individuals (*n* = 79, 14.82%) in megalithic structures was 7.9 ± 7.89, while the mean (1 σ) for males (*n* = 79, 14.82%) in megalithic structures was 8.77 ± 10.24. According to these data, there was an equal sex distribution of individuals buried in the megalithic structures (Figure 6.12). In relation to the non-megalithic structures, the mean (1 σ) for female individuals (*n* = 30, 9.80%) was 2.3 ±1.43 and the mean (1 σ) for males (*n* = 31, 10.13%) was 2.5 ± 2.42. Again, for this type of structure, there was an equal distribution based on sex (Figure 6.13).

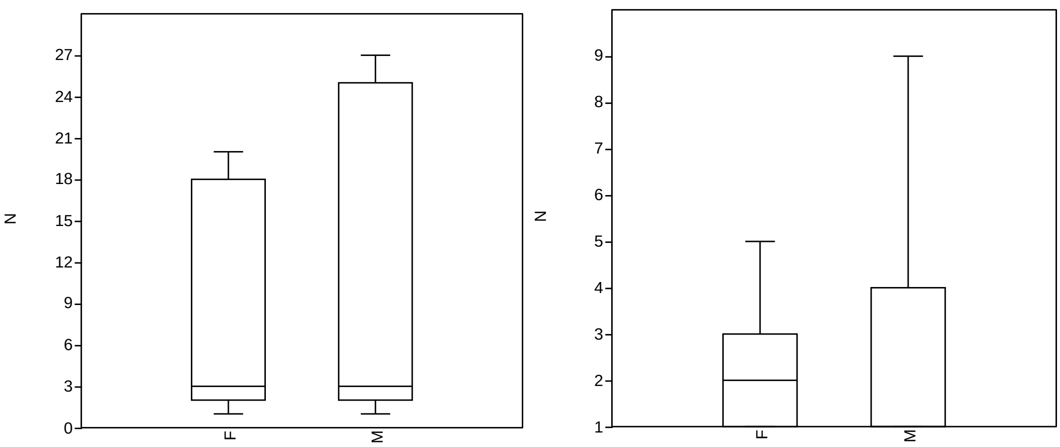

Figure 6.12 and 6.13. Distribution of male and female individuals in megalithic structures (left) and non-megalithic structures (right).

6.2.2.- Burial positions

In order to explore funerary practices, the burial positions of the individuals at megalithic and non-megalithic monuments were considered. However, there was a lack of information on burial position due to the absence of a bioarchaeologist on site during archaeological excavations of the sites under study. In most cases, excavations were carried out as "rescue" archaeology instead of as systematic research projects, and therefore the quantity and quality of the data is insufficient to provide a complete understanding of burial position, burial orientation, and whether grave goods were present in burial sites in Chalcolithic south-west Spain. Data on the type of predominant positions can be seen in Table 6.11 and Figure 6.14:

SITE	R	L	SU	D	?	TOTAL
C/Dinamarca (Valencina-Castilleja, Seville)	3	1	1	0	69	74
PP4-Montelirio (Valencina-Castilleja, Seville)	4	0	0	11	135	150
Norte Castilleja (Valencina-Castilleja, Seville)	1	0	0	0	?	1
La Gallega (Valencina-Castilleja, Seville)	0	1	0	0	1	2
El Algarrobillo (Valencina-Castilleja, Seville)	0	0	0	19	0	19
La Alcazaba (Valencina-Castilleja, Seville)	0	0	0	6	0	6
La Orden-El Seminario (PEX 1336) (Huelva)	1	1	0	7	5	14
La Orden-Seminario (PEX 7016) (Huelva)	0	1	0	10	?	11
La Orden-El Seminario (PEX 7055) (Huelva)	0	1	0	18	?	19
La Cima (Valencina-Castilleja, Seville)	1	0	0	0	1	2
Puerto de la Palmera (Puebla de los I. Seville)	0	2	0	0	0	2
TOTAL	10	7	1	72	211	300

Key to table = R: Right; L: Left; SU: Supine; D: Disarticulated; ?: No information

Table 6.11. Position of the body at funerary sites in south-west Spain

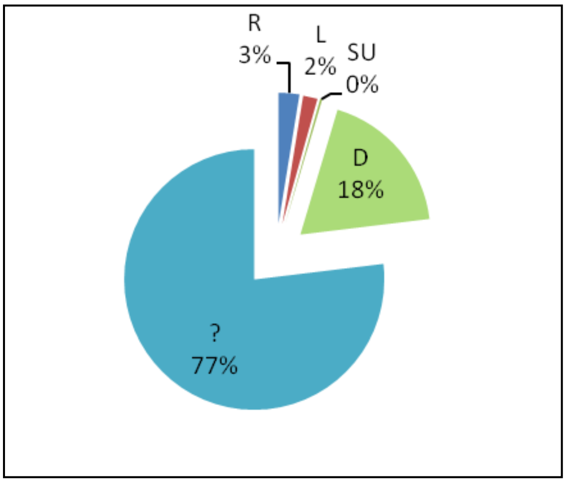

Figure 6.14. Distribution of burial positions

According to these data, from those sites where body position was recorded, most of the remains were secondary burials or disarticulated (*n* = 72, 18%). From the evidence for articulated skeletons, 3% (*n* = 10) appear to have been placed on their right side, while 2% (*n* = 7) were on their left. However, there is a high percentage of individuals with an unknown burial position (77%, *n* = 211).

Since the great majority of the remains were commingled, the deposits in many cases were mixed and it was not possible to record the burial positions of the individuals. Another taphonomic problem to consider was that many of these funerary structures have been re-used, re-visited and sometimes looted since antiquity until recent times. As a consequence, it was not often possible to document burial positions, as the original burial position was disturbed. On the other hand, there are many references to sites with *in situ* human remains where this information was not recorded at all, due to the absence of a bioarchaeologist on the site to supervise the excavation of the human remains. It seems that most individuals were buried on their right or left sides with flexed upper and lower limbs. Most of the skeletons were found next to the walls of the funerary structure, whether megalithic or non-megalithic. There were many cases where the position of the body was impossible to record, and this was likely due to the continuous use of the funerary structure. In some cases, the structure was used for over a millennium, as at tomb 3 from La Pijotilla, which has burial levels dating from the beginning of the 3rd millennium BC up to the beginning of the 2nd millennium BC (Odriozola LLoret et al., 2008; Hurtado Pérez, 1999). In this case, an original primary deposit may have been removed later and the bones placed towards the end of the funerary chamber next to the walls of the structure. In some cases, as at Valencina-Castilleja, lack of space led to some bones being selected and kept in the funerary structure as the burial of new bodies continued; this occurred at Depósito de Aguas (López Flores, 2004) and El Algarrobillo (Santana Falcón, 1993). In some instances, according to the directors of the archaeological excavations, the remains appear to be secondary burial, and this is the case for El Jadramil (Lazarich González, 2003) and Tomb 5 and 7 at Cerro de la Casería (Martínez Rodríguez et al., 1991).

6.2.3.- Health status

Another indicator of status is health. Among the few metabolic pathologies found in this study, cribra orbitalia may be considered an indicator of social status. For this purpose, a comparison of pathological bones and their association with megalithic or non-megalithic structures was attempted.

SITE	SECTOR	TYPE	MNI	N observed	N affected	% rate
LP	Tomb 3	Megalithic	178	84	6	7.14
VC	La Cima	Non-megalithic	2	2	2	100
VC	El Algarrobillo	Non-megalithic	19	6	1	16.66
VC	Cerro de la Cabeza	Non-megalithic	6	3	3	100
LM	La Molina	Non-megalithic	10	-	1	-

Key to table: LP= La Pijotilla; VC= Valencina-Castilleja; LM= La Molina; MNI= minimum number of individuals; N= number of orbits.

Table 6.12. Bone fragments with cribra orbitalia by type of structure

SITE	SECTOR	TYPE	N observed	N affected	% rate
LP	Tomb 3	Megalithic	697	21	3.01
CMU	Cueva de la Mora Umbría	Natural cave	-	5	-
LM	La Molina	Non-megalithic	-	2	-
PMB	E4	Non-megalithic	-	1	-
VC	Divina Pastora (T1 and 4)	Megalithic	-	2	-
VC	PP4-Montelirio 10,042/49	Megalithic	74	15	20.27
VC	PP4-Montelrio 10,034	Megalithic	56	2	3.57
VC	La Alcazaba (ALC-1)	Non-megalithic	3	3	100
VC	Cerro de la Cabeza (F-1)	Non-megalithic	1	1	100
VC	PP4-Montelrio 10,031	Non-megalithic	84	13	15.47
CM	Cueva de la Mora	Natural cave	-	2	-
P III	*Tholos* Palacio III	Megalithic		11	

Key to table: LP= La Pijotilla; CMU= Cueva de la Mora de la Umbría; LM= La Molina; PMB= Paraje de Monte Bajo; V-C= Valencina-Castilleja; CM= Cueva de la Mora; P III= Palacio III;

Table 6.13. Number of teeth affected by LEH by type of structure

According to the data (Tables 6.12 and 6.13), bone fragments with cribra orbitalia (*n = 13*) were documented equally in megalithic but also at non-megalithic structures. On the other hand, if teeth with dental LEH are considered, 51 of 78 teeth with LEH (65.3%) were found at megalithic structures, while 20 of 78 teeth with LEH (25.6%) were found at non-megalithic structures and 7 of 78 (8.9%) in natural caves. In this case, LEH affected a higher percentage of teeth found buried in megalithic tombs than in non-megalithic tombs. Following the issues raised by the Osteological Paradox (Wood et al., 1992) and in relation to the hypothesis of this thesis, this is another evidence to check social differences among individuals by funerary structures based on the health status. This could argue that high status individuals (those buried at megaliths) survived to stress episodes rather than those buried in non-megalithic monuments and for instance had better health status. However, since we are looking at single bone fragment/teeth from disarticulated material, the percentage of individuals with this condition is unknown, so these data must be seen as preliminary.

According to the funerary and the bioarchaeological data presented in this section, there does not seem to be a pattern based on the sex of the individuals or by the distribution by type of funerary structure. However, this data is still preliminary and more individuals need to be examined.

6.3.- Diet as an indicator of social inequality in Copper Age communities

Paleodietary analysis may also be considered a method to generate data to explore access to foodstuffs in past societies. Therefore, does diet show social differences among these Iberian Copper Age communities? Considering that social inequality can also be investigated through bioarchaeology based on health status, perhaps in relation to immune system strength, and dietary lack or excess, differences in diet might be related to different social and economic status or to a different access to resources (Cohen, 1989; Danforth, 1999). For instance, if differential access to food is considered to be an indication of social differentiation, one way to test this is through biochemical analyses of $\delta^{13}C$ and $\delta^{15}N$ from bone collagen. This approach has been tested before with success in other prehistoric past populations, but from Central America (Hatch and Geidel, 1985; Reed, 1992; White and Schwarcz, 1989; White et al., 1993a, 1993b). This type of analysis in this study to La Pijotilla, Valencina-Castilleja and La Orden-El Seminario, and inter-site comparisons were made. Specifically for Valencina-Castilleja, an intra-site comparative analysis was also done to investigate potential differences within the community.

Despite the large number of excavated archaeological sites dated to the 3rd millennium BC in south-west Spain, paleodiet using stable isotope analysis has been little explored. There are only two studies, both of which involve the archaeological site of Valencina-Castilleja and specifically Montelirio, one of the largest megalithic structures (Fontanals et al., 2011, 2012). The data for $\delta^{13}C$ and $\delta^{15}N$ were assessed and compared with the data from La Pijotilla, Valencina-Castilleja and La Orden-El Seminario presented in Chapter 4. However, overall, stable isotope this analysis has limitations because of the hot climate in the south of the Iberian Peninsula and subsequent poor collagen preservation. As a result, about 50% to 60% of the samples from the three sites were outside of the acceptable range for preservation (2.9 - 3.6%) and were not included in this comparative analysis.

The three sample sets that have been used for this comparative analysis represent one inland site (La Pijotilla) and two coastal sites (Valencina-Castilleja and La Orden-El Seminario). The purpose of making a comparison between them was to observe whether social differences between sites occurred based on their geographic location and their economic strategy. At an intra-site level of analysis, the isotopic data were also examined relative to social status in two ways: by type of structure (high status megalithic vs. low status non megalithic) and by the association of prestige grave goods. In terms of $\delta^{13}C$ and $\delta^{15}N$ human collagen values, the relevant data for this comparison are as follows: for La Pijotilla (n = 1), the value for $\delta^{13}C$ was -19.2‰ and for $\delta^{15}N \pm$ was 9.2‰; for Valencina-Castilleja (n = 12), the mean for $\delta^{13}C \pm 1\sigma$ was -19.1‰ $\pm$ 0.4‰, and the mean for $\delta^{15}N \pm 1\sigma$ was 8.5‰ $\pm$ 1.3‰; and for La Orden-El Seminario (n = 2), the $\delta^{13}C$ data showed values of $\delta^{13}C$ -19.0‰ and -19.1‰, while the $\delta^{15}N$ data show values of 7.8‰ and 8.7‰ respectively.

According to these data, the diet of these inland and coastal communities was very homogeneous. There were no significant differences between them, and the three sites all showed a diet where the protein sources were most likely from herbivores (Figure 6.15). The only slight difference that could be observed in the coastal site of La Orden-El Seminario was a small input of marine protein. This is consistent with the enormous quantities of shell-fish found at the site during the archaeological excavations and it might also explain the marine contribution to the diet of the humans in this site.

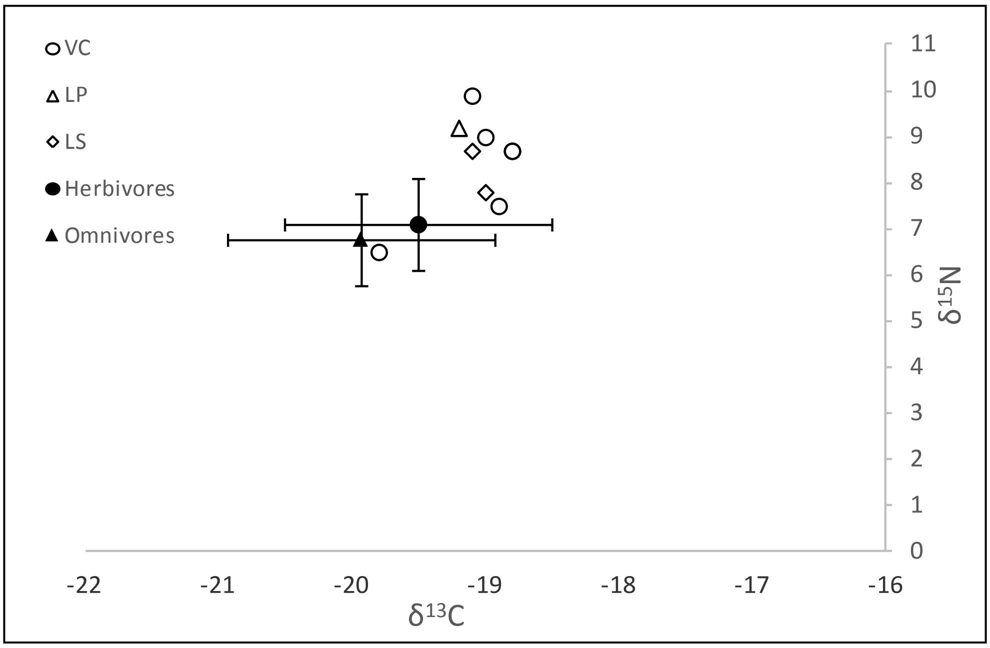

Figure 6.15. Comparative analysis of $\delta^{13}C$ and $\delta^{15}N$ at the three sites studied

6.3.1.- Valencina-Castilleja (coastal)

The paleoedietary data from Valencina-Castilleja were obtained from individuals buried in different types of structures. These data were analysed according to the different funerary structures, it is possible to explore whether social differences were expressed through different funerary practices. The data from La Alcazaba (*n* = 2) showed $\delta^{13}C$ values of -18.8‰ (maximum) to -19‰ (minimum) and the data for $\delta^{15}N$ show values of 8.7‰ to 9‰. Data from La Cima (*n* = 1) give a $\delta^{13}C$ value of -19.8‰ and a $\delta^{15}N$ of 6.5‰, while at El Algarrobillo (*n* = 1) the $\delta^{13}C$ value was -18.8‰ and $\delta^{15}N$ of 8.7‰. The site of Cerro de la Cabeza (*n* = 1) provided a $\delta^{13}C$ value of -18.9‰ and a $\delta^{15}N$ of 7.5‰.The sector of PP4-Montelirio (*n* = 1) showed a $\delta^{13}C$ value of -19.1‰ and a $\delta^{15}N$ value of 9.9‰ (Figure 6.16).

This analysis shows that most of the individuals from La Alcazaba, El Algarrobillo, La Cima and Cerro de la Cabeza, who are all buried in non-megalithic structures, had lower values of $\delta^{15}N$ than the high prestige individual buried at PP4-Montelirio (the primary single burial documented in the main chamber of the megalithic structure 10,042-10,049). Although these differences are about 1-4‰ in $\delta^{15}N$, the most significant difference is between PP4-

Montelirio and La Cima. Dietary differences are therefore present among people buried in different funerary structures, although sample size is very small.

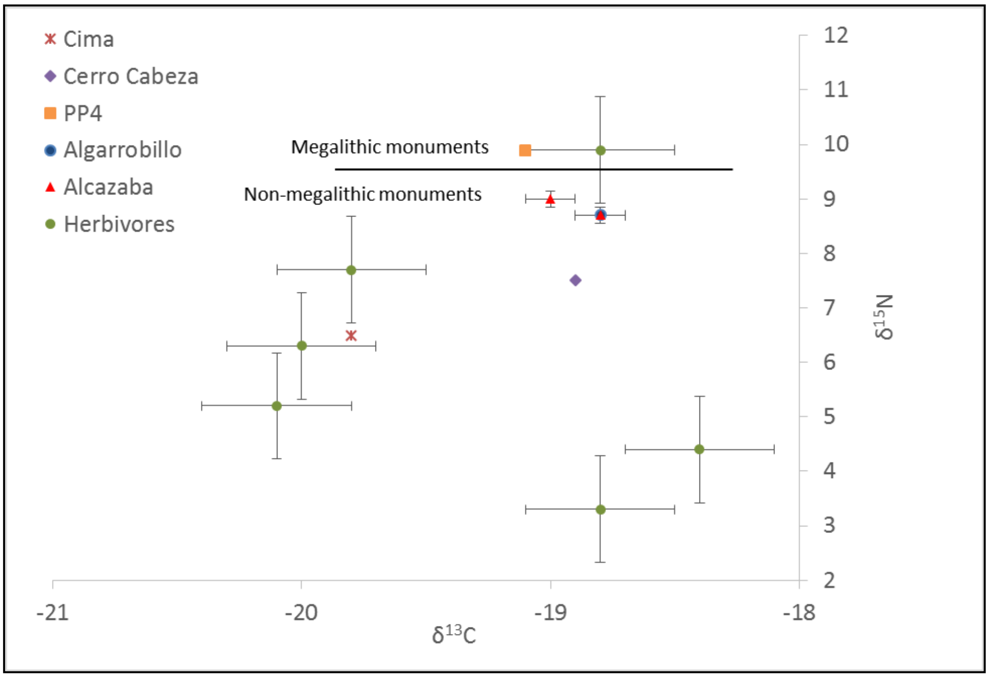

Figure 6.16. Comparative analysis of $\delta^{13}C$ and $\delta^{15}N$ for human remains from funerary structures at Valencina-Castilleja.

6.3.2.i.- Valencina-Castilleja and Montelirio (both coastal)

The data from each of the sectors at Valencina-Castilleja can next be compared to one of the most recent excavations at V-C that has revealed high status burials within the settlement, the large megalithic construction of Montelirio (Fernández Flores and Aycart Luego, 2013). The report for Montelirio (Fontanals Coll et al., 2011) presents the stable isotope data from the individuals buried at this funerary structure (with a sample size of *n* = 11); the $\delta^{13}C$ values range from -18.3‰ (maximum) to -20.3‰ (minimum), while the $\delta^{15}N$ data give values ranging from 8.7‰ to 10‰. The mean for $\delta^{13}C \pm 1\sigma$ was -19.5 ± 0.5‰ and for $\delta^{15}N$, the mean ± 1σ was 9.1 ± 0.3‰ (Figure 6.17).

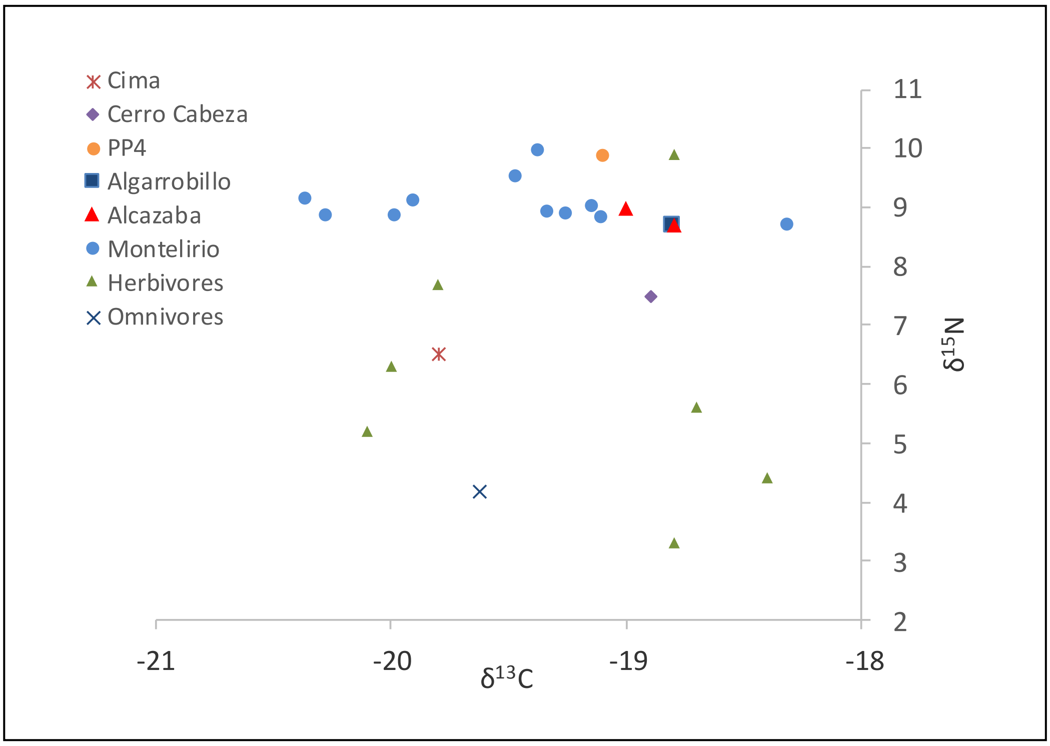

Figure 6.17. Comparative analysis of $\delta^{13}C$ and $\delta^{15}N$ between sectors at Valencina-Castilleja

These data can be compared to burial 10,042-10,049 at PP4-Montelirio, which also represents a high status burial at Valencina-Castilleja. Paleodietary data from these sectors show that, for Montelirio (*n* = 11), there was a mean $\delta^{13}C \pm 1\sigma$ of -19.5 ± 0.5‰ and for $\delta^{15}N$ the mean $\pm 1\sigma$ was 9.1 ± 0.3‰, while for PP4-Montelirio (*n* = 1), the $\delta^{13}C$ value was -19.1‰ and for $\delta^{15}N$, the value was 9.9‰. However, we must take into account that the sample analysed from PP4-Montelirio represents a single burial (but in the same structure, but different chamber, four other individuals were also documented) and Montelirio represents a collective burial (MNI = 26).

These data were then used to perform an intra-site comparative analysis of Valencina-Castilleja, comparing megalithic (Montelirio and PP4-Montelirio (10,042-10,049 structure)) and non- megalithic structures (La Alcazaba, La Cima and El Algarrobillo) (Table 6.14). Using t-test for testing significance of the comparisons, the data for $\delta^{15}N$ show that there were significant differences [$t(16.63) = -4.54$, $p<0.001$] between non-megalithic (m = 7.5‰, sd = 1.1) and megalithic structures (m=9.1‰, sd=0.4), while the results for $\delta^{13}C$ show that there were no significant differences [t(20.38) = 0.70, p = 0.496] between non-megalithic (m = -19.3‰, sd = 0.4) and megalithic structures (m = -19.4‰, sd = 0.5).

In summary, those buried in megalithic structures had a higher proportion of animal protein in their diet, suggesting that there were significant social differences among these individuals based on the pattern of burial and access to food resources (Figure 6.18). The differences in $\delta^{15}N$ values correspond to the varying proportion of animal protein ingested by the individuals where differences in consumption have been found among individuals (Figure 6.19). However, there are no differences in $\delta^{13}C$ because this reflects the consumption of C_3 plants, or animals feeding on C_3 plants, which seem to have been consumed regularly, as expected for prehistoric European individuals (Richards and Hedges, 1999b).

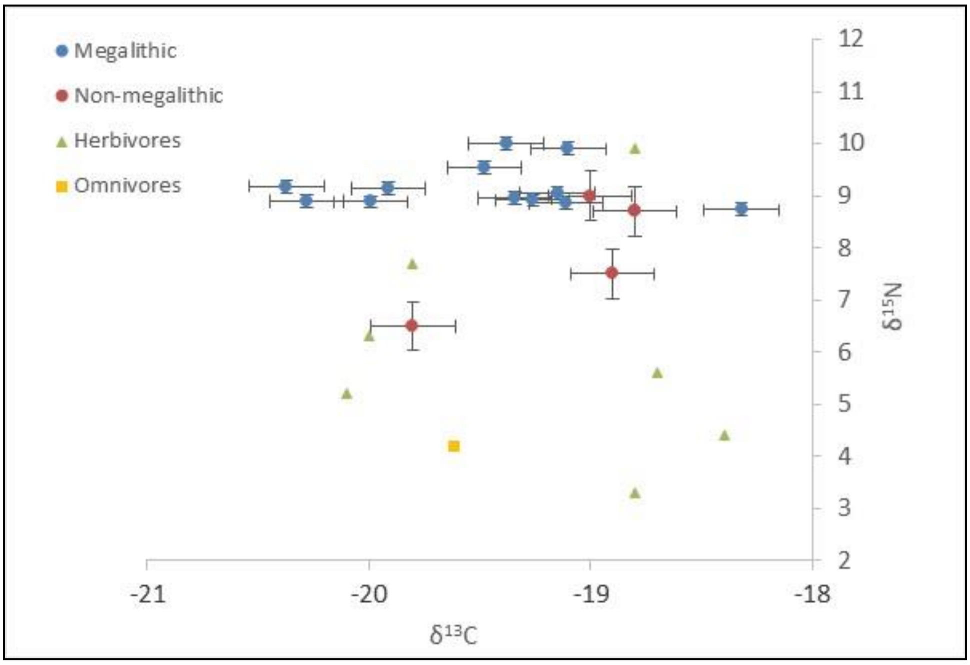

Figure 6.18. Comparative analysis of $\delta^{13}C$ and $\delta^{15}N$ between megalithic vs. non megalithic monuments in Valencina-Castilleja

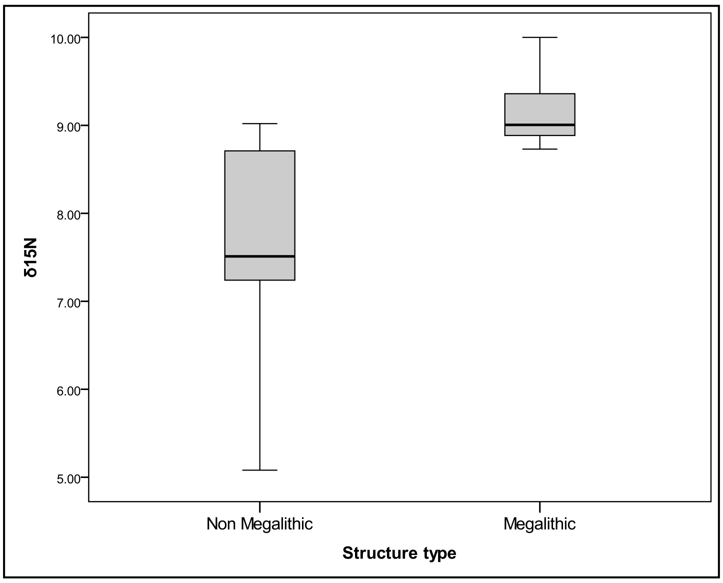

Figure 6.19. Comparative analysis of $\delta^{15}N$ between megalithic vs. non-megalithic structures and $\delta^{15}N$ values

N	SECTOR	INDIVIDUAL	SAMPLE	SAMPLE TYPE	LAB ID	SEX	AGE	$\delta^{13}C_{(av)}$	$\delta^{15}N_{(av)}$	%C	%N	$C:N_{(A)}$
1	La Alcazaba	ALC-1	1	Humerus	S-EVA-23185	F	25-35	-19.0	9.0	23.7	8.4	3.2
2	La Alcazaba	ALC-4	3	Humerus	S-EVA-23187	U	A	-18.8	8.7	33.1	11.4	3.3
3	La Cima	C-1	7	Rib	S-EVA-23191	F	18-25	-19.8	6.5	22.7	7.4	3.5
4	El Algarrobillo	ALG-13	14	Mandible	S-EVA-23198	F	25-35	-18.8	8.7	15.1	5.4	3.2
5	Cerro Cabeza	CC-1	18	Skull	S-EVA-23202	F	18-25	-18.9	7.5	21.6	7.5	3.3
6	PP4-Montelirio	10.049-1	PP4-10049	Rib	S-EVA-23169	M	18-25	-19.1	9.9	15.0	4.7	3.6
7	La Alcazaba	Bovid	26	Mandible	S-EVA-23210	U	A	-18.8	3.3	19.6	6.7	3.3
8	La Alcazaba	Bovid	28	2nd R phalanx	S-EVA-23212	U	A	-20.0	6.3	33.3	11.7	3.3
9	La Alcazaba	Bovid	29	2nd R phalanx	S-EVA-23213	U	A	-19.8	7.7	17.6	6.3	3.2
10	La Alcazaba	Bovid	36	Atlas	S-EVA-23220	U	A	-18.8	9.9	22.7	8.1	3.2
11	Cerro Cabeza	Ovicaprid	43	R femur	S-EVA-23227	U	S	-18.4	4.4	17.5	6.0	3.4
12	Cerro Cabeza	Ovicaprid	44	L scapula	S-EVA-23228	U	A	-20.1	5.2	21.2	7.3	3.4
13	Montelirio	Mo-2	Mo-2	-	Mo-2	F	A	-18.3	8.7	-	-	3.4
14	Montelirio	Mo-3	Mo-3	-	Mo-3	F	A	-19.1	9.0	-	-	3.3
15	Montelirio	Mo-4	Mo-4	-	Mo-4	F	A	-19.1	8.8	-	-	3.3
16	Montelirio	Mo-5	Mo-5	-	Mo-5	F	A	-19.9	9.1	-	-	3.3
17	Montelirio	Mo-6	Mo-6	-	Mo-6	F	A	-19.4	10.0	-	-	3.3
18	Montelirio	Mo-10	Mo-10	-	Mo-10	F	A	-20.3	8.9	-	-	3.4
19	Montelirio	Mo-11	Mo-11	-	Mo-11	F	A	-19.5	9.5	-	-	3.3
20	Montelirio	Mo-13	Mo-13	-	Mo-13	F	A	-19.9	8.8	-	-	3.2
21	Montelirio	Mo-14	Mo-14	-	Mo-14	F	A	-19.2	8.9	-	-	3.3
22	Montelirio	Mo-15	Mo-15	-	Mo-15	F	A	-19.3	8.9	-	-	3.3
23	Montelirio	Mo-16	Mo-16	-	Mo-16	F	A	-20.4	9.1	-	-	3.3
24	Montelirio	Suid	Mo-F-17	-	Mo-F-17	-	A	-19.6	4.1	-	-	3.3
25	Montelirio	Ovicaprid	Mo-F-18	-	Mo-F-18	-	A	19.3	5.6	-	-	3.3
26	Montelirio	Ovicaprid	Mo-F-19	-	Mo-F-19	-	A	-18.7	5.6	-	-	3.2

Key to table:U= undetermined; A= adult; F= female; M= male; S= subadult.

Table 6.14. Results of $\delta^{13}C$ and $\delta^{15}N$ from Valencina-Castilleja, including Montelirio

In summary, despite the problem of collagen preservation in a hot climate such as the south of Spain, there are sufficient data to explore paleodiet in these three sample populations. Results show no significant differences between the coastal sites (Valencina-Castilleja and La Orden-El Seminario) and the inland site (La Pijotilla). However, differences have been seen among individuals buried in the same site, but within different funerary structure. In relation to funerary practices and paleodiet, the data suggest that individuals with higher in animal protein diets are associated with megalithic tombs, when compared to those buried in non-megalithic structures. The same pattern is observed for the analysis of health status, most of the individuals observing LEH (those adults that suffered during infancy but surveyed) are associated to megalithic monuments. Social differences may be responsible, depending upon the funerary structure being analysed, but those differences do not seem to be related to sex or age of the bone fragments and teeth analysed.

6.4.- Exchange of goods, trade and mobility in the south-west Spanish Copper Age

Mobility is intrinsic to human societies and the movement of populations implies changes within a community (Cabana and Clark, 2011). The human movement is not just a physical act, but is also social and cultural. But, what is the impact of change of residence on a community, and how can we measure it?

Movements of people may occur because of different factors but, in economic terms, may be detected through trade and exchange of items, such as those used as grave goods. At the two sites under consideration, exotic raw materials have been documented in association with funerary practices. Therefore, the hypothesis that trade and exchange of objects later used as grave goods is as a way to investigate human mobility can be tested. Certain isotopic variability among individuals from both sites was expected due to the appearance of these exotic grave goods, especially at Valencina. Isotopic variability can be used to explore to what extent these populations presented a high or low mobility pattern, but the “real” distance of movements cannot yet be measured. However, due to being able to trace the origin of some exotic and rare raw materials, mobility can be considered in the context of long and short distances, and therefore isotopic data can be interpreted within a wider picture. The nature of the movement, be it seasonal, temporary or permanent, is still unclear for most human groups in the past but this hypothesis can be tested in an archaeological context through the analysis of the ratio of $^{87}Sr/^{86}Sr$ or $\delta^{18}O$ in human remains.

Human mobility has been explored before in south-west Spain, at the single funerary structure of Palacio III (Díaz-Zorita et al., 2009; Díaz-Zorita et al., in press). However, this research is the first attempt to assess human mobility in the region in Late prehistory at a broader scale with inter-site comparisons. Based on dental analysis at La Pijotilla and Valencina-Castilleja were compared to make inferences about the socioeconomic dynamics of these human groups in relation to social inequality. These data are also compared to the data from Palacio III.

6.4.1.- Comparison of Valencina-Castilleja and La Pijotilla

At Valencina-Castilleja, data show that eleven teeth (out of 33) had strontium values outside the estimated local range (Figure 6.21). As a consequence, the individuals represented by these teeth may have ingested their childhood strontium from geological areas other than the local and may have moved into Valencina-Castilleja later in their life. There is also an ovicaprid tooth that shows values from outside Valencina-Castilleja. This might be because the animal was brought from a different geological area to Valencina, or it could have been a particularly mobile individual, grazing over a broader landscape.

On the other hand, at La Pijotilla there were five individuals (out of 17) for whom values fall outside the local range for La Pijotilla (Figure 6.20). These individuals are suggested to be non-locals, originating from a geological area other than the Middle Guadiana Basin.

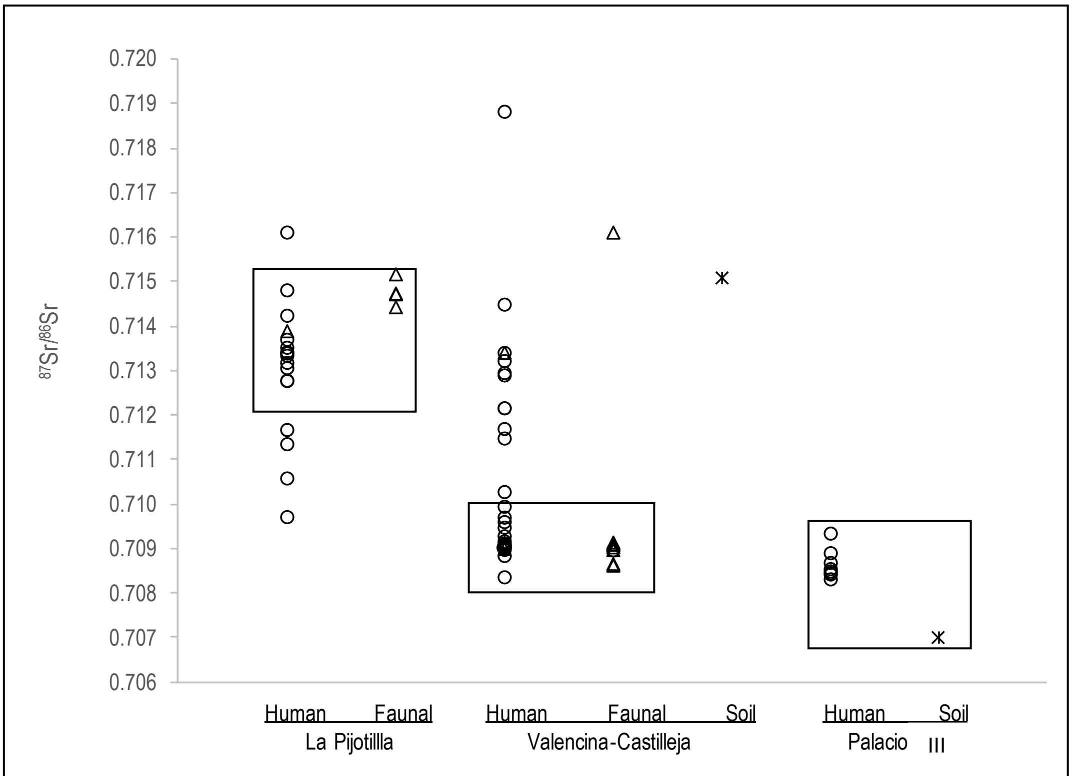

Figure 6.20. Comparison of $^{87}Sr/^{86}Sr$ ratios among south-west Copper Age sites (within the box, the estimated local individuals for each site)

Valencina-Castilleja and La Pijotilla-are two of the largest Chalcolithic sites found to date in the south-west of Spain. This study of human mobility has found non-locals at both Valencina-Castilleja and at La Pijotilla. However, in the first study ever done in the area (and also in the Iberian Peninsula), at Palacio III (*n* = 8) (Díaz-Zorita et al., 2009; Díaz-Zorita et al., in press), data show that the sample population was quite homogeneous and, when compared to the environmental strontium levels, they fall within the local range for the area ($^{87}Sr/^{86}Sr$= 0.708-0.709). This site represents a single megalithic funerary structure in the Western Sierra Morena area (Figure 6.21). The geological background corresponds to the Ossa-Morena Zone where, at the northern part of the Seville province, the area of Almadén de la Plata consists mainly of Lower Paleozoic, Cambrian rocks (Ordovician and Silurian). The Ordovician lithology is composed of green shales, siltstones, micaceous sandstones and limestones (Wagner and Mayoral, 2007; Robadert and Gutiérrez-Marco, 2004).

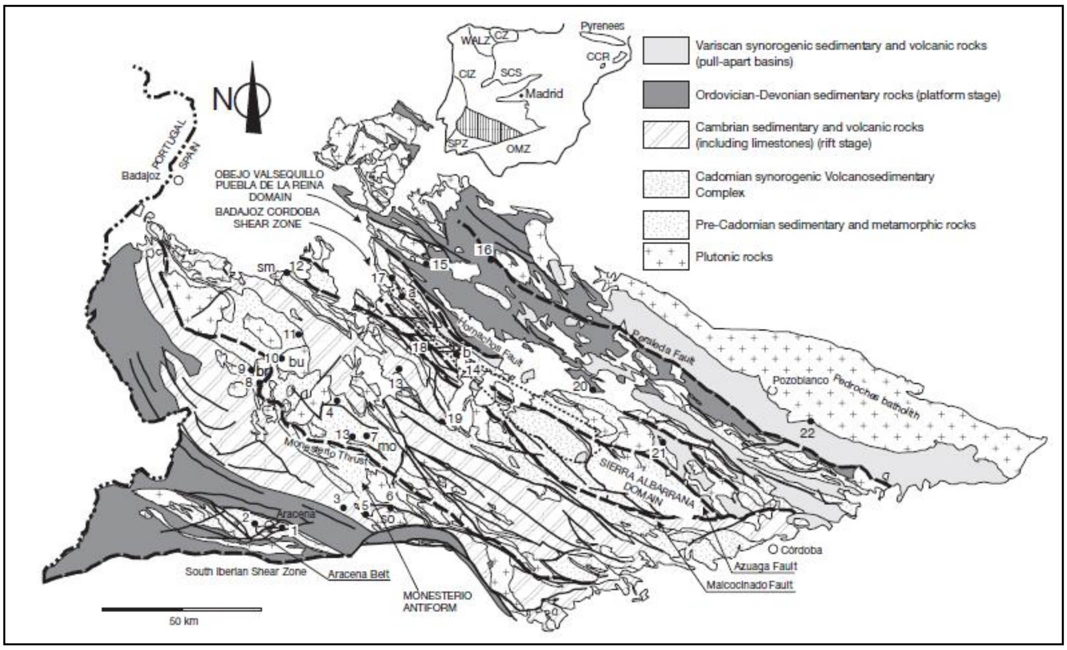

Figure 6.21.- Geological map of the northern area of the province of Seville (after Tornos and Charadia 2004:967)

The local range for Valencina-Castilleja ($^{87}Sr/^{86}Sr$= 0.708-0.710) coincide with the local range of Palacio III ($^{87}Sr/^{86}Sr$= 0.708-0.709). However, the estimated range for La Pijotilla ($^{87}Sr/^{86}Sr$= 0.712-0.715) is more radiogenic. A comparison between the two large settlements and this funerary structure (Palacio III) shows that the samples from La Pijotilla and Valencina-Castilleja are more heterogeneous with respect to the different $^{87}Sr/^{86}Sr$ signatures and the presence of non-local individuals (Figure 6.21). However, Palacio III could be interpreted as a locally born and raised population, and the absence of exotic raw material might be interpreted as the absence of long distance trade, or at least a stable population with restricted mobility and limited access to foreign and exotic materials. The presence of exotic materials at La Pijotilla and Valencina-Castilleja might be related to other factors, such as trade and the exchange of goods, which could have been restricted to certain places. La Pijotilla and Valencina display all of these characteristics and may have been central places for trade and exchange, as meeting places, and for ritual purposes.

What seems to be interesting is that 2/5 samples of the outliers from La Pijotilla have the same $^{87}Sr/^{86}Sr$ values as the local individuals Valencina-Castilleja (sample 7, $^{87}Sr/^{86}Sr$ =0.70972; sample 13, $^{87}Sr/^{86}Sr$ =0.71059). On the other hand, 8/11 samples from Valencina-Castilleja (ALC-2, $^{87}Sr/^{86}Sr$ =0.7129, PP4-453.1, $^{87}Sr/^{86}Sr$ =0.71341, PP4 505.1, $^{87}Sr/^{86}Sr$ =0.71323; PP4 484.1, $^{87}Sr/^{86}Sr$ =0.71341; ALG-13, $^{87}Sr/^{86}Sr$ =0.71449; ALG-2, $^{87}Sr/^{86}Sr$ =0.712959; PP4-453.2 $^{87}Sr/^{86}Sr$ =0.71217 and ALG-12, $^{87}Sr/^{86}Sr$ = 0.71217) have the same $^{87}Sr/^{86}Sr$ values for the estimated local range for La Pijotilla. From both sites there are two outlier samples that probably derive from more radiogenic soils, one being sample 9 ($^{87}Sr/^{86}Sr$ = 0.71612) from La Pijotilla and another with even higher $^{87}Sr/^{86}Sr$ values from Valencina-Castilleja (PP4 446.3, $^{87}Sr/^{86}Sr$= 0.71883).

6.4.2.- Paleodiet vs. locality

The results from the analysis of diet ($\delta^{13}C$ and $\delta^{15}N$) and mobility ($^{87}Sr/^{86}Sr$) in combination apply to only four individuals from Valencina-Castilleja (Table 6.15). Therefore, within this group there are two individuals (ALG-13 and C-1) with non-local values for strontium. However, based on the analysis of $\delta^{13}C$ and $\delta^{15}N$ there does not seem to be any differences in the diet of these individuals and those showing local values; all of them mostly obtained their protein from C_3-consuming herbivores. However, the number of individuals with both measurements is very limited, due to collagen preservation, and many more individuals need to be analysed in order to make more realistic inferences about diet and mobility patterns in these communities.

N	SECTOR	INDIVIDUAL	SAMPLE	SEX	AGE	$\delta^{13}C_{(av)}$	$\delta^{15}N_{(av)}$	$^{87/86}Sr$
1	La Alcazaba	ALC-1	1	F	25-35	-19.0	9.0	0.70905
2	La Cima	C-1	7	F	18-25	-19.8	6.5	0.71149
3	El Algarrobillo	ALG-13	14	F	25-35	-18.8	8.7	0.71450
4	PP4-Montelirio	10.049-1	PP4-10049	M	18-25	-19.1	9.9	0.70929

Table 6.15. List of dental enamel and bone samples with $\delta^{13}C$, $\delta^{15}N$ and $^{87}Sr/^{86}Sr$ values from Valencina-Castilleja

6.4.3.- Non-local demographic distribution

A comparison between bone fragments for non-local individuals at La Pijotilla (*n* = 5) and those from Valencina-Castilleja (*n* = 11) (Table 6.16) based on chi square analysis [$\chi^2_{(1)}$=0.24, p=0.62] showed that there were no significant differences between the age and sex of the fragments for these non-local individuals at the two sites. In addition, intra-site analysis in relation to the proportion of locals to non-locals showed no significant differences within La Pijotilla for locals (*n* = 12, 70.6%) or non-locals (*n* = 5, 29.4%). In the case of Valencina-Castilleja, the proportion of locals (*n* = 22, 66.6%) to non-locals (*n* = 11, 33.3%) was also not significantly different.

6.4.4.- Non-local individuals and sex

Of the 16 individuals considered to be non-local to the south-west of Spain, there were only seven where sex was identified; of those seven, all derived from Valencina-Castilleja, and the distribution of the sexes showed more female than male individuals. There were two males (13%), five females (31%) and the rest (*n* = 9) were of undetermined sex (56%) (Table 6.16).

N	SITE	SECTOR	INDIVIDUAL	TYPE OF STRUCTURE	$^{87}Sr/^{86}Sr$	SEX	AGE
1	VC	PP4-Montelirio	484.1	Non-megalithic	0.71341	U	18-25
2	VC	PP4-Montelirio	446.3	Megalithic	0.71883	U	AO-YA
3	VC	PP4-Montelirio	505.1	Non-megalithic	0.71323	U	A
4	VC	PP4-Montelirio	453.1	Non-megalithic	0.71341	M?	26-35
5	VC	PP4-Montelirio	453.3	Non-megalithic	0.7117	U	Inf II
6	VC	PP4-Montelirio	453.2	Non-megalithic	0.71216	F	18-25
7	VC	La Alcazaba	ALC-2	Non-megalithic	0.71291	F	30-34
8	VC	El Algarrobillo	ALG-2	Non-megalithic	0.71296	M	18-25
9	VC	El Algarrobillo	ALG-12	Non-megalithic	0.71217	F	26-35
10	VC	El Algarrobillo	ALG-13	Non-megalithic	0.71450	F	26-35
11	VC	La Cima	C-1	Non-megalithic	0.71149	F	18-25
12	LP	Tomb 3	ID 16	Megalithic	0.71136	U	36-45
13	LP	Tomb 3	ID 719	Megalithic	0.71168	U	26-35
14	LP	Tomb 3	ID 1411	Megalithic	0.71612	U	18-25
15	LP	Tomb 3	ID 2415	Megalithic	0.71059	U	26-35
16	LP	Tomb 3	ID 1392	Megalithic	0.70972	U	A

Key to table: M= male; F=female; U= undetermined; M?= possible male; AO= 13-17; YA= 18-25; A= adult; INF II= 7-12;

Table 6.16. List of enamel samples providing a non-local $^{87}Sr/^{86}Sr$ ratio

Based on these preliminary results, and according to chi square analysis data [χ^2= 6.2, p=0.09], the mobility pattern was not based on the sex of the non-local individuals. Even including the unknown sex group and the subadult group, there does not seem to be any particular identifiable mobility pattern based on the sex of the non-local individuals (Table 6.17). However, this dataset is still very small and more date should be incorporated.

SEX LOCALITY CROSSTABULATION		LOCALITY		TOTAL
		LOCAL	NON-LOCAL	
Female	Count	3	5	8
	% within Sex	37.5%	62.5%	100.0%
Male	Count	7	2	9
	% within Sex	77.8%	22.2%	100.0%
Subadult	Count	1	0	1
	% within Sex	100.0%	.0%	100.0%
Unknown	Count	24	9	33
	% within Sex	72.7%	27.2%	100.0%
Total	Count	34	16	50
	% within Sex	68%	32%	100.0%

Table 6.17. Comparative analysis of sex vs. local and non-local individuals

6.4.5.- Non-local individuals and age

Most of the age categories were represented among the non-local individuals, subadult (*n* = 1, 6.2%), young adult (*n* = 6, 37.5%), middle adult (*n* = 7, 43.7%) and adult (*n* = 2, 12.5%). These preliminary data, according to chi square analysis [χ^2=2.20, p=0.53], showed no significant differences among the different age groups (Table 6.18).

AGE LOCALITY CROSSTABULATION				
		LOCALITY		
AGE		LOCAL	NON LOCAL	TOTAL
Subadult	Count	1	0	1
	% within Age	100.0%	0.0%	100.0%
18-25	Count	16	6	22
	% within Age	72.7%	27.2%	100.0%
26-35	Count	14	7	21
	% within Age	66.6%	33.3%	100.0%
>45	Count	1	0	1
	% within Age	100.0%	0.0%	100.0%
Adult	Count	3	2	5
	% within Age	60%	40%	100.0%
Total	Count	34	16	50
	% within Age	68%	32%	100.0%

Table 6.18. Comparative analysis of age vs. local and non-local individuals

6.4.6.- Non-local and local individuals and funerary structure

When comparing the proportion of non-local and local individuals by type of funerary structure, locals tend to be associated with megalithic and non-megalithic structures in about the same percentage (Table 6.19). In megalithic structures, there were 16 local and six non local individuals. However, in non-megalithic structures, there are 18 local and ten non-local individuals buried. Therefore, it seems that the majority of the funerary space is restricted to those from the locality and they are buried in both types of structures with about a 50% frequency; in non-megalithic structures (*n* = 18, 64%), but also in megalithic structures (*n*= 72%). There are also other structures allocated to non-locals, such as non-megalithic structures (*n*= 10, 36%) and at megalithic structures (*n* = 6, 28%).

STRUCTURE LOCALITY CROSSTABULATION				
		LOCALITY		
STRUCTURE		LOCAL	NON LOCAL	TOTAL
Megalithic	Count	16	6	22
	% within Structure	72.7%	27.7%	100.0%
Non megalithic	Count	18	10	28
	% within Structure	64.2%	35.7%	100.0%
Total	Count	34	16	50
	% within Structure	68%	32%	100.0%

Table 6.19. Comparative analysis of local and non-local individuals compared to type of structure

However, the number of non-megalithic structures that have been excavated is far higher than that of megalithic monuments. In addition, it seems that there is an unequal access for the dead to megalithic monuments which could be restricted for some specific groups or lineages. In addition, when comparing to recent work at eight Late Neolithic-Copper Age sites in *Estremadura*, Portugal (Waterman, 2012; Waterman et al., 2011), the data show that non-local individuals seem to cluster in some structures or areas of the settlement, while other areas were restricted to the locals. Although this might not be the case for Valencina-Castilleja, until more data are available, this pattern cannot be confirmed as the sample population likely does not reflect the entire living population (Wood et al., 1992).

6.4.6.i.- Valencina-Castilleja

6.4.6.i.a.- Intra-site analysis at Valencina-Castilleja

Based on an ANOVA analysis, there were no significant differences in $^{87}Sr/^{86}Sr$ among non-local individuals by sector at Valencina-Castilleja [F(4)= 0.87, p=0.496]. However, more data are needed for comparison.

6.4.6.i.b.- Non local individuals and sex

The distribution of non-local individuals (based on bone fragments) by sex was 31.2% females (*n* = 5) and 12.5% male (*n* = 2), while for local individuals, the female individuals represented 8.8% (*n* = 3) of the total males represented 20.5% (*n* = 7). Based on cross tabulation analysis, there were no significant differences among local and non-local individuals based on sex (Table 6.20).

LOCALITY SEX CROSSTABULATION LOCALIT		F	M	S	U	TOTAL
Local	Count	3	7	0	24	34
	% within Locality	8.8%	20.5%	0%	70.5%	100.0%
Non-local	Count	5	2	1	8	16
	% within Locality	31.2%	12.5%	6.2%	50%	100.0%
Total	Count	8	9	1	32	50
	% within Locality	16%	18%	2%	64%	100.0%

Key to table: F=female; M=male; S=subadult; U= unknown

Table 6.20. Comparative analysis of local and non-local individuals by sex

In relation to the distribution of the age of the individuals, cross tabulation analysis shows that the non-local individuals were aged at death between 18-25 (*n* = 6, 37.5%) and 26-35 (*n* = 7, 43.7%) (Table 6.21). Therefore, almost 100% of the non-local individuals were aged between 18 and 35 years. However, we cannot conclude at what age exactly those individuals moved.

LOCALITY AGE CROSSTABULATION		AGE					TOTAL
		SUBADULT	18-25	26-35	>45	ADULT	
Local	Count	0	16	14	1	3	34
	% within Locality	0%	47%	41.1%	2.9%	8.8%	100.0%
Non-local	Count	1	6	7	0	2	16
	% within Locality	6.2%	37.5%	43.7%	0%	12.5%	100.0%
Total	Count	1	22	21	1	5	50
	% within Locality	2%	44%	42%	2%	10%	100.0%

Table 6.21. Comparative analysis of local and non-local individuals by age group

6.4.7- The European context: inter-area comparison

In this section, the results of the strontium analyses from the site of La Pijotilla and Valencina-Castilleja are compared within the Late European Prehistory context with the available $^{87}Sr/^{86}Sr$ values. From these two sites, only two outliers with the most radiogenic values are considered for this comparison. They consist of two samples, one individual from La Pijotilla (sample 9, $^{87}Sr/^{86}Sr$ = 0.71612) and another from Valencina-Castilleja (PP4 446.3, $^{87}Sr/^{86}Sr$= 0.71883). When comparing these values, they fit with more radiogenic rocks coming probably from Paleozoic formations, consisting of gneiss, granites, schist and metamorphic rocks of about 300-400 Ma, that present similar higher $^{87}Sr/^{86}Sr$ values (~0.715-0.717).

The first comparison, because of the proximity and the contemporaneity of the sites, is made with the available $^{87}Sr/^{86}Sr$ measurements from two sites in Portugal. The first site to be investigated is tomb 1 from Perdigôes (4th-3rd millennia archaeological settlement from Central Portugal, Figure 6.22, code 1), located in the Alentejo region and composed of Paleozoic granites and schists. The Perdigôes bioavailable strontium based on the local fauna is estimated at $^{87}Sr/^{86}Sr$ 0.7148-0.7182[27]. The second comparison is made to Carcavelos and Estria (two megalithic structures dated to the 4th-3rd millennia BC, Figure 6.22, code 2) which are located in the area of Lisbon (Estremadura) and composed mainly of Cretaceous sedimentary rocks such as limestone, marl and sandstone. The local range for this area has been estimated as $^{87}Sr/^{86}Sr$ 0.7070-0.7081[28]. The third comparative group is of seven sites located in the Zambujal region mainly composed of Cretaceous and Jurassic levels in Central and Southern Portugal and dated to the Late Neolithic-Early Bronze Age (4th-2nd millennia BC) where human remains from the sites of Zambujal, Lapa de Rainha II, Bolores, Feteira II, Paimogo I, Cova da Moura and Cabeco de Arruda I were analysed (Figure 6.22, code 3). The local available $^{87}Sr/^{86}Sr$ values for this region have been estimated to between 0.709-0.714 (Waterman, 2012).

When comparing strontium values within the Central and Northern European context, these outlier values ($^{87}Sr/^{86}Sr$ 0.716 and $^{87}Sr/^{86}Sr$ 0.718) from La Pijotilla and Valencina-Castilleja, respectively, have also been reported from environmental samples from the

[27, 28] Rui Boaventura (personal communication)

Black Forest (Germany) measured in granites, gneisses and schists (Bauman and Hoffman, 1988), in tooth enamel from pigs (Bentley and Knipper, 2005), and in stream water from Vosges (France) (Bentley, 2006). In addition there is one individual from the Bell Beaker period from Ausburg (southern Bavaria, Germany) identified as a non-local also showing a value $^{87}Sr/^{86}Sr$ of 0.71638 (Price et al., 2004). Values such as these have also been found on the Outer Hebrides, Scotland in Lewisian gneiss bedrock (water leach of soil and rock sample Cnip-S4, $^{87}Sr/^{86}Sr$= 0.715205) (Montgomery, 2002; Montgomery and Evans, 2006; Montgomery et al., 2003) and in tooth enamel from pigs at Warberg in the Bavarian Forest in Germany (Bentley and Knipper, 2005). There are also similar values from the region of Vinschgau and Ötzal in the Alps. The latter data derive from the Iceman "Ötzi" ($^{87}Sr/^{86}Sr$ from enamel= 0.7203–0.7214, bone hydroxyapatite from the pelvis, $^{87}Sr/^{86}Sr$= 0.7175 and 0.7181 and trabecular bone, $^{87}Sr/^{86}Sr$= 0.7184) (Kutschera and Müller, 2003), suggesting $^{87}Sr/^{86}Sr$ measurements of between 0.717-0.719 during his lifetime (Müller et al., 2003).

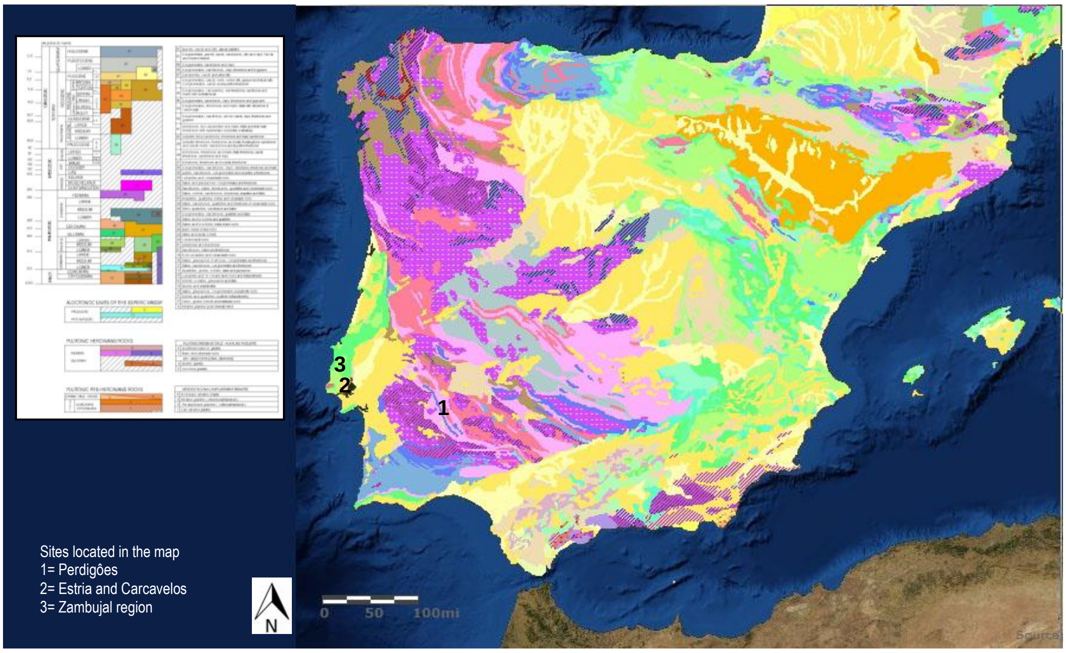

Figure 6.22. Map of the Iberian Peninsula including the sites with $^{87}Sr/^{86}Sr$ values from Portugal.

According to available $^{87}Sr/^{86}Sr$ values from the Iberian Peninsula and Central and Northern Europe, from where did these two non-local individuals from La Pijotilla and Valencina-Castilleja originate?. The data are such that we are not yet in a position to answer this question as there is not a complete understanding of how and why geological signals for Sr vary between different types of samples (environmental, enamel and bone) (Maurer et al, 2013). Therefore, assessing an individuals´s origin is not possible at the moment. In addition, bioavailable Sr isotope ratios are not available for most of Portugal and Spain. However, based on the available data and understanding of the archaeological context, an hypothesis of interaction among large Iberian Copper Age sites could be presented.

Taking into account available resources, technology and the distances between settlements in prehistory, we can hypothesize that the areas most closely located to another would demonstrate the highest amount of interaction. This could mean trade and exchange of items and the movement of populations in two different directions. Of course, this scenario does not exclude long-distance interaction with other areas, since at Valencina-Castilleja there is evidence of exotic grave goods such as amber from Sicily (Murillo Barroso and García Sanjuán, 2013; Murillo Barroso and Martinón Torres, 2012) and ivory from Africa and Asia (Schuhmacher et al., 2013). In any case, when compared to the Portuguese isotope data, according to archaeological data associated with those sites, non-locals appear to be related to large settlement enclosures. This means that in large settlements, the degree of mobility is higher than at smaller sites. For example, for all three sites (La Pijotilla, Valencina-Castilleja and Perdigôes), trade and exchange of goods might have played a major role. Perdigôes individuals show a higher degree of mobility when compared to Carcavelos and Estria and the same situation occurs when comparing La Pijotilla and Valencina-Castilleja to Palacio III. Interestingly, at small sites, such as Palacio III (Díaz-Zorita et al., 2009; Díaz-Zorita et al., in press), Carcavelos and Estria (Boaventura et al., 2010) and Paimogo I, Bolores, Feteira II, and Lapa de Rainha II (Waterman, 2012) non-local individuals have not been identified, which may suggest a more stable local population with a more static settlement pattern.

The presence of exotic raw material at La Pijotilla, Valencina-Castilleja and Perdigôes represents a key piece of evidence in the interpretation of long distance trade at these sites. Furthermore, there are other common features shared by these large enclosure and settlements such as a large population aggregation and the evidence for several types of funerary sites. All these factors together lead to an interpretation of these sites as important central places, where people from the vicinity might meet for trade and exchange, as a social gathering place or to participate in rituals. In addition, in relation to the social organisation, all of these features require a certain level of organization and specialization that is not detected at the small sites with restricted mobility.

The $^{87}Sr/^{86}Sr$ results show that non-local individuals from La Pijotilla and from Valencina-Castilleja might originate from a similar landscape as those individuals from Perdigôes where the predominant underlying geology are Paleozoic granites and schists, but there are other landscapes showing similar values in Central Europe such as the Black Forest, or in Northern Europe (such as the Outer Hebrides or Norway). However, the scenario of increased human interaction between La Pijotilla, Valencina-Castilleja and Perdigôes could be quite plausible since the archaeological data suggest the three sites acted as central places during Late Prehistory and all are contemporary in time.

6.5.- Summary

In this research project, social inequality was explored in Copper Age south-west Spain through the use of bioarchaeological analyses. Social differences were found and were mainly evidenced by:

- the type of funerary structure in which people were buried
- the health status
- the type of diet they ate

From the Late Neolithic to the Early Bronze Age, there was a gradual increase in social inequality and these social differences were observed during the 3rd millennium BC through mortuary practices and bioarchaeological data (García Sanjuán, 2013) From the Late Neolithic period, burials were collective, but by the end of the 3rd millennium BC, a change in funerary pattern can be observed, where single inhumations began to appear, although older megalithic monuments and artificial caves were still re-used. This also affected the type of funerary structure used to contain those burials, in that natural caves and large dolmens were still used, but the most common structures were the *tholos*-type tombs and negative structures. During this process, where individualisation took place, social differences among the members of the community began to be more prominent and some individuals clearly had higher status than others. This difference in status in this study has been observed in differences in mortuary ritual, associated grave goods, type of diet, health status and type of funerary structure.

There was also a change in the social structure of the community, where communalism and inter-group solidarity were gradually replaced by increasing social differences with a few high status individuals. In this sense, the development of social differences might have increased throughout the 3rd millennium BC, with an increase in social inequality directly related to differential access to foodstuffs and prestige items made of exotic raw materials, and perhaps the privilege of being buried in certain structures like megalithic monuments (although the latter is a more complex debate). However, access to resources does not seem to be influenced either by the sex of the individuals or age group, based on the analysis of human remains represented by bones, bone/fragments and tooth fragments. The question of the geographic origin of the individuals and the degree of mobility of these communities might be explained by socio- economic dynamics, whereby trade and exchange of goods played a key role in the intra-group dynamics of competition. In larger settlements such as Valencina-Castilleja and La Pijotilla, the presence of non-local individuals and exotic raw materials suggests that they may have acted as important central places. However, the possession of this exotic raw material, very scarce, was possibly restricted to some members of the community, those of higher social status, and only in specific funerary structures, mostly megalithic; in addition, some non-megalithic funerary structures seem to be restricted to non-local individuals. This shows that social differences existed and became more acute towards the end of the 3rd millennium BC in south-west Spain, with one of the best examples provided by the PP4-Montelirio *tholos* (10,042-10,049 structure).

The diachronic evolution of societies in south-west Spain, notably at Valencina-Castilleja, still remains unclear, but most of the radiocarbon dates belong to the 3rd millennium BC, and indicate that this settlement was occupied for well over a millennium. However, we must consider that some of the sectors might be synchronic, while others might be diachronic. For example, Montelirio is dated to the first half of the 3rd millennium BC (Fernández Flores and Aycart Luengo, 2013), structure 10.042/211.1 in PP4-Montelirio is dated to 2880 to 2629 BC (2σ), and structure 10.031/453.1 is dated to 2858 to 2503 BC

(2σ), while La Gallega is dated to 2484 to 2236 BC (2σ) and El Algarrobillo is dated from 2871-2581(2σ) to 2556-2347 BC (2σ).

If these data are compared to the Los Millares culture (Copper Age) or to the Early Bronze Age or El Argar culture (2200-1600/1550 cal BC) in the Spanish south-east, each area has its own characteristics. For this comparison, Valencina-Castilleja is used as a case study, since it provides characteristics representative of the south-west. There are different socio-political dynamics for the two areas that are identifiable in the archaeological record. The settlement pattern at these sites is quite different. At Los Millares there is evidence of stone walls (fortified structures), and sites from the El Argar culture are located at high altitude. On the other hand, the settlement pattern at Valencina-Castilleja is characterised by the absence of stone walling.

A lack of radiocarbon dates is one of the current gaps in knowledge for research for the south-west of Spain. Analysis of more samples will lead to better understanding of the different phases of use of Valencina-Castilleja, and to establish whether or not all structures were synchronic and in use from the late 4th to the mid-2nd millennium BC (García Sanjuán and Murillo Barroso, 2013). In relation to mortuary analysis, in the south-east, the space dedicated to the dead is clearly defined, while at Valencina-Castilleja, funerary containers are highly variable and located everywhere within the settlement (Costa Caramé et al., 2010). A multidimensional approach must be taken to investigate funerary practices as a whole, using a combination of biological and funerary contextual data. This will help investigate whether significant differences exist in social status or funerary treatment based on the age and the sex of the individuals. Furthermore, inferences could be made about the possible expected inherited social ranking. This was investigated at Valencina-Castilleja but the results do not show a statistically significant concentration in any one sector of individuals in relation to age or sex, the type of structure or association of metal objects (Costa Caramé et al., 2010). However, in the Early Bronze Age and in Argaric burials in the south-east of Spain, there is evidence for metallurgy, and metal objects in burials (which are scarce in the south-west). In relation to the burials, in the south-east, they are mostly discrete individuals and in the south-west they are mostly collective, and the fact that subadults are buried with prestige grave goods is evidence of an early inherited class-based (Lull, 1983, 1984; Lull and Micó, 2007) which has not been documented until now in the south-west. Although subadults are buried in the south-west in collective tombs along with adults, there is no significantly different burial treatment for them. Nonetheless, the available mortuary data are still scarce and these interpretations have their limitations.

In summary, social differences are found in both areas but, in the south-east, those differences are more marked and the social change that occurred at the end of the 3rd millennium is hierarchical, leading to more institutionalised differences in status. That change is not so marked in the south-west, if we take Valencina-Castilleja as a representative example site. This community shows several elements of a social structure in which social inequality is marked by funerary ideology, while at the same time other indicators suggest principles of social solidarity and economic communalism (García Sanjuán, 1999, 2000, 2005; García Sanjuán and Hurtado Pérez, 1997). Social organisation was hierarchical but based chiefly on unequal access to funerary rituals and exotic paraphernalia. Social differences in the access to foodstuffs are also suggested by the empirical evidence (biological and bioarchaeological data) but the implications of these differences within a wider social context remain to be understood.

CHAPTER 7.- CONCLUSIONS

7.1. Summary of study

The aim of this study was to contribute new data to achieve a better understanding of the social organisation of communities dating to the 3rd millennium BC in south-west Spain. To achieve this, two sample populations were analysed (La Pijotilla and Valencina-Castilleja) from a bioarchaeological perspective, including using stable isotope analysis as a means to explore diet ($\delta^{13}C$ and $\delta^{15}N$) and mobility ($^{87}Sr/^{86}Sr$).

The results from these two sites were compared with bioarchaeological data from a further 44 Copper Age funerary structures. These structures provide good-quality bioarchaeological data (i.e. sex, age, metrical, non metrical and paleopathological data) suitable for a comparative analysis, and are mostly located in Western Sierra Morena (*n* = 30) or in different sectors of Valencina-Castilleja (*n* = 25).

To explore dietary patterns, three populations were analysed isotopically, two in this study (La Pijotilla and Valencina-Castilleja) with one additional site included (La Orden-El Seminario) as a representative coastal site. This sampling strategy was undertaken in order to compare different subsistence patterns at the sites. Results were then compared with other published studies. Isotopic data on human mobility were generated only at La Pijotilla and Valencina-Castilleja only and then compared to the (few) other published studies within Later prehistoric Iberia.

7.1.2 Summary of results

7.1.2.i.- Age, sex and stature

For south-west Spain as a whole, the total MNI estimate indicated 985 individuals from 44 funerary structures and 19 different archaeological sites. However, of these 985 individuals, for 495 (50.25%) age and sex remain “undetermined” because they have not yet been analysed. The application of standard bioarchaeological methods generated much useful data, despite the highly fragmented nature of the remains involved. The results showed that at La Pijotilla and Valencina-Castilleja, both sexes were represented with more male fragments than female. At La Pijotilla, females were represented by 18 fragments (9.47%) and males by 27 fragments (14.21%). At Valencina-Castilleja, both males and females are represented by nine fragments (27.27%) of the total for each sex category.

The distribution of ages at death shows that for La Pijotilla, the fragments represented:

- 0-6 year category= 2.80% (*n* = 5)
- 7-12 year category= 2.80% (*n* =5)
- 13-17 year category: 7.30% (*n* =13)
- 18-25 year category: 4.49% (*n* =8)
- 26-35 year category: 4.49% (*n* =8)
- 36-45 year category: 1.68% (*n* =3)

At Valencina-Castilleja, the fragments were classified as follows:

- 0-6 year category= 3% (*n* =1)
- 7-12 year category= 5% (*n* = 2)
- 13-17 years category = 0
- 18-25 year category= 31% (*n* =11)
- 26-35 year category= 25% (*n*= 9)
- >45 year category= 3% (*n* =1)

For those individuals where sex was assessed, the distribution among identifiable skeletal elements in the south-west shows that there was an equal representation of both sexes, with 12% females (*n* = 114) and 11% males (*n* = 111). Age at death could not be established for half of the individuals (*n* = 496), again because they have not yet been examined. Another group is considered “adult”, but not assigned to any age category (*n* = 282, 29%), owing to the lack of diagnostic skeletal ageing criteria.

Stature estimations calculated on bones from La Pijotilla and Valencina-Castilleja were compared to other sites in south-west Spain. In total, stature for 36 bones was calculated, 20 female and 16 male. Results showed that the mean (1 σ), for females was 1.52 ± 0.08 m and the mean for males was 1.64 m ± 0.05. Height was calculated to check whether this could reflect also social differences among individuals. In addition, this was correlated to the type of funerary structure (megalithic vs. non megalithic) but no significant differences were found among them since most of them were from non-megalithic structures.

Non-metrical trait data showed features shared in common between the two sample populations and the rest of the comparative sites from south-west Spain. The most common traits are the septal aperture (n = 12) and the double faceted talus (n = 10), while non-metrical dental trait data showed that shovelling (n = 17), interruption groove (n = 15) and extra cusps (n = 9) were the most common findings. Although this data is preliminary, this could be used in combination with mobility studies (through $^{87}Sr/^{86}Sr$ analyses) to investigate the hidden heterogeneity within these populations. Until further analysis is conducted, biological distance cannot be estimated for these groups because of an overall lack of data.

7.1.2.ii.- Health

The general picture suggests that most of the pathological changes observed relate to joint disease, located mainly on the joints of the 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. Evidence for other diseases, such as metabolic conditions, and trauma, was found, but in low frequencies. 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. In relation to enamel hypoplasia and calculus, the data was correlated to the type of funerary structure and results showed that higher frequencies of LEH (60%) and calculus (78%) were found at megalithic structures rather than at non-megalithic (LEH= 30% and calculus= 22%). Following the issues raised by the Osteological Paradox (Wood et al., 1992), social differences could be observed based on the health status of the individuals. In addition, higher status burials survived stress episodes and enjoyed better health (and diet) than those buried at non-megalithic structures.

7.1.2.iii.- Diet

Dietary reconstruction showed differential use of, or access to, food resources among certain individuals at Valencina-Castilleja. Most individuals from La Pijotilla and Valencina-Castilleja obtained their protein from C_3-consuming herbivores, and the individuals from the coastal site of La Orden-El Seminario showed similar characteristics but with a small protein input (ca. 10%) from marine sources. Diet was analysed for the human remains found in different structures at Valencina-Castilleja, and the results showed that there were significant differences between those buried in megalithic versus non-megalithic structures. Individuals buried in the megalithic monuments had higher $\delta^{15}N$ values, indicative of diets higher in proteins. This demonstrates that not all individuals were equal in their community, and that there was a segment of society who enjoyed better food quality and access to higher protein foods. Inter-site comparisons between coastal and inland sites showed no statistically significant differences. Until more data are obtained, this could be interpreted as suggesting that the communities shared the same economic strategy and that fishing may not have made a large overall contribution to their diet.

7.1.2.iv.- Mobility

Contact and interaction between these communities and externally sourced ores (even possibly extra-peninsular) have been inferred from the discovery of exotic raw materials such as ivory, amber, variscite, cinnabar and ostrich egg shells associated with burials at the SW Spanish sites. This was first pointed out by Siret and Siret (1890) and then discussed by Harrison and Gilman (1977) and later on by Chapman (1990). From the discovery of ivory and ostrich egg-shells in archaeological sites of southern Iberia, the authors suggested trade with North Africa and the Mediterranean. Recent investigations into the provenance of amber found in different burial contexts on the Iberian Peninsula (including Valencina-Castilleja) suggested sources in Sicily (Murillo Barroso and Martinón Torres, 2012; Murillo-Barroso and García Sanjuán, 2013), which indicated long-range contact with other Mediterranean regions during the 3rd millennium BC. In addition to this, African and Asian ivory has been found throughout southern Iberia (Schuhmacher et al., 2009; 2013). For this reason, the hypothesis that trade and exchange of exotic goods played a key role during the 3rd millennium BC with the import of material from long-distance sources, is now being supported in more recent analyses. The presence of materials from North Africa, the Mediterranean, and Central Europe also suggests that the movement of materials and the exchange and trade were very important during the Copper Age, which reflects that these populations engaged in long distance movement.

The fact that these exotic objects are found also in prestigious burials offers a new way to explore social inequality in south-west Spain. This exogenous material has so far only been found associated with local individuals. The relationship of individuals (locals versus non-locals) to social inequality is another factor that can be used to distinguish social differences. In this study, non-local samples were identified at La Pijotilla (n = 5 out of 17 analysed individuals or 29.41%) and at Valencina-Castilleja (n = 11 out of 33 analysed individuals or 33.33%).

Inter-site comparative analysis of human mobility in broader European context, showed that the highest degree of mobility was found in large settlements and always in association with exotic raw materials. This is the case for La Pijotilla, Valencina-Castilleja and Perdigôes. By contrast, there were other small funerary structures in Western Sierra Morena, Alentejo and Estremadura that did not reveal non-local individuals. These three large settlements were clearly part of wide-ranging networks for the exchange of exotic goods, but the origin of the non-local individuals cannot be ascertained at this point.

The Early Bronze Age Argaric site of Gatas provides the basis for a comparison (Chapman et al., 1987; Buikstra et al., 1995). Here, analysis of the ratio of $^{87}Sr/^{86}Sr$ in 33 individuals was conducted and results showed exclusively local values (Díaz-Zorita Bonilla et al., 2012). However, it is not clear if, during the Early Bronze Age, the amount of exotic raw material decreased, and ivory and amber were to some extent replaced by metal objects. Use of metals was not very significant during the Copper Age, but in the Early Bronze Age, an increasing number of metal objects were included with burials.

7.1.2.v.- Settlement and funerary context

There were two types of sites: open-air enclosures of different sizes, and small fortified settlements. In relation to the type of structures built at the sites, there were two types of funerary structures, which have been classified in this study as megalithic and non-megalithic. These funerary structures mainly seem to contain human burials, but other archaeological material has been found at some sites. Despite the fact that the structures are strictly funerary, it seems that some might have been used for domestic purposes originally, with a different use later in their history. All 44 funerary structures considered for comparison are collective burials. The funerary patterns were largely primary, but also secondary, burials (which might explain the disarticulated and mixed contexts) (Chapman, 2008; Díaz-Zorita Bonilla et al., in press; García Sanjuán, 2005; Hurtado Pérez et al, 2000; etc.). In the case of primary burials, the prevalent position was on the right or left side. However, information about the nature of the burial was usually not recorded for most sites. Reuse of funerary spaces has also been observed in megalithic structures, where primary and secondary practices are represented and both appear to have been taken place simultaneously. Some of the burials may have been synchronic, but other burials in shared spaces could have spanned centuries, because these structures remained open for long time periods (Hurtado Pérez et al., 2000). The use of systematic radiocarbon dating will contribute to a better understanding of the biography of these monuments.

The end of the 3rd millennium seems to have been a period of transition, where changes such as an increase in social inequality determined new settlement patterns and social and economic organisation. New settlement patterns introduced large-scale stone architecture, which might also relate to a change in social structure from solidarity and communalism (García Sanjuán, 1999, 2000, 2005; García Sanjuán and Hurtado Pérez, 1997) toward more hierarchical societies where social differences began to increase (García Sanjuán, 2006). This is also reflected in mortuary practices, where large megalithic structures (and later on, the *tholoi*) ceased to be built and used (García Sanjuán, 2006). Another remarkable change is observed in burial patterns, where there was a shift from mostly collective primary and secondary burials, to individual primary burials. One of the best examples of this change can be observed at the archaeological site of Valencina-Castilleja. Here, while most of the burials included in this study were collective and some of them commingled, there were also at least two single burials. These two burials were found at the Los Cabezuelos and at PP4-Montelirio sectors, and possibly dated to the end of the 3rd millennium BC. Both of them had exceptional grave goods: in the case of Los Cabezuelos, the burial was associated with the Bell Beaker culture while in the case of PP4-Montelirio, the single inhumation represents a high status single burial with exotic and exclusive raw materials, and the person consumed a diet with higher $\delta^{15}N$ values -presumably of high status- and was local to the area of Valencina-Castilleja.

In summary, according to the results obtained in this study, the Copper Age was a period of growing social differentiation, detected through variation in specific funerary structures, grave goods, health status and diet.

7.1.3 Addressing the aims, objectives, hypothesis and questions

The aims of this thesis were:

- To investigate social structure and social differences during the 3rd millennium BC
- To obtain new bioarchaeological data
- To consider evidence for variability in funerary practices
- To explore the impact of subsistence strategies in different environments on demography, health, diet and mobility (e.g. coastal vs. inland)
- To investigate the degree of mobility of Copper Age populations,

with the objective of understanding, via bioarchaeological and contextual data, the impact of changing social organisation and subsistence patterns on mortality, morbidity and health. The results of this thesis showed that the aims and objectives of the study have all been addressed and achieved. The hypothesis that social differences were present at different sites during the 3rd millennium BC in south-west Spain, was supported based on the data provided in this research supplying new evidence for social inequality and differentiation.

The **two key research questions** posed were answered:

1. Are social differences manifested in mortality, morbidity, diet and mobility patterns in these samples?

This comparative bioarchaeological analysis of Copper Age south-west Spain showed homogeneity in the distribution of individuals by sex and age within funerary structures at different sites such as La Pijotilla and Valencina-Castilleja. However, differences in health status between those buried at megalithic and non-megalithic monuments are apparent and represented by the frequency of dental enamel hypoplasia. Teeth affected were more associated with megalithic tombs rather than to non-megalithic tombs. In relation to the "osteological paradox" for inferring health from skeletal remains (Wood et al., 1992), this could be viewed as representing healthy people of higher status i.e. those who survived "stress" and developed LEH.

In addition, the analysis of diet showed that most individuals from the three sites had similar diets and that they mostly ate C_3-consuming herbivores. However, the teeth from individuals with higher protein diets (higher $\delta^{15}N$ values) were associated with megalithic tombs (and based on $^{87}Sr/^{86}Sr$ were mostly local to the area), and significant differences were found at Valencina-Castilleja when compared to teeth from those buried in non-megalithic structures. The presence of exotic raw materials and their association with specific individuals and funerary structures, and the high degree of mobility (16 out of 50 individuals were non-locals) may reflect social differences related to the ability to move residence. Burial structure, burial position and the quality and quantity of associated grave goods were other factors used to identify social differentiation. Therefore, social differences seemed to be present, but those differences did not seem to be related to sex or age.

2. Is there a relationship between Copper Age social differences and funerary patterns?

The study of the different funerary patterns, including the type of burial structure (megalithic *vs*. non-megalithic), the association of grave goods and the burial position of the skeletal remains, alongside the bioarchaeological data, are three variables, among others, that can be use to analyse social structure. This study has offered new data for the interpretation of Copper Age communities where social differences have been explored through the study of mortuary practices. Differences in funerary patterns, in the number of individuals buried and their sex, age and health have contributed to the interpretation of the status of the individuals in these populations. In addition, biochemical analyses have shown great potential for the investigation of social differences; diet is a good indicator of access to foodstuffs and, where differences are observed, they can be used to infer social inequality in combination with other available bioarchaeological data.

Although the funerary patterns seemed to be highly variable, the fact that most of the burials were collective, and there was an equal distribution of individuals by age and sex in relation to the type of funerary structure, suggested that social structure of populations in the south-west was largely based on solidarity and communalism, with growing social differences, visible in some elite groups endowed with better access to food resources, exotic prestige grave goods and large-scale burial structures.

7.1.4.- Limitations

This research is the first step towards a better knowledge of Copper Age communities in south-west Spain from bioarchaeological analysis, but it had its limitations. The nature of the human remains was a limitation in itself, because working with commingled remains is a challenge for bioarchaeologists. The study of small bone fragments requires more time for identification and, although about 80% of the bone fragments from the study sites were identified to skeletal element, some fragments remain unidentified. Since fragmentation was so high for these two skeletal samples (e.g. at La Pijotilla 178 individuals were represented by 283,329 fragments), the poor preservation of the anatomical areas used to estimate sex and age at death made this information unavailable for a percentage of the remains. Furthermore, in all cases, the sex, age at death, and pathologies could not be associated with individual skeletons because of the disarticulated nature of the materials being studied. However, even though the data are non-significant now, more data should be collected, as the first step to assess further the biological affinities among Copper Age populations. This was also the case for both the metrical and non-metrical analysis, because most of the bones could not be measured and most of the non-metric traits could not be recorded. Therefore, caution should be exercised when making inferences in this study based on metrical, non-metrical and health data, due to the nature of the skeletal assemblages.

In order to reconstruct a paleodemographic profile using this type of (disarticulated) assemblage, the effort is doubled, when compared to an articulated assemblage, since in the case of disarticulated remains sex and age have to be estimated from bone fragments and not individual skeletons. Another disadvantage was not having been present during the excavation of the human remains from the study sites. Taking information from reports and publications, or even directly from the excavators, is challenging for interpretation, because it can be difficult to understand those aspects of the burial deposit that are not described in great detail.

Another limitation is the collagen survival which do not preserve well in hot climates such as the south of the Iberian Peninsula. This obviously conditioned the results (only 28 out of 139 samples or the 20% showed acceptable values). The lack of available radiocarbon dates is also an obstacle for the interpretation of the archaeological record for prehistoric sites in south-west Spain. However, most of the sites used for comparison were considered Late Neolithic-Copper Age in date and fell within the 3rd millennium BC. This assumption is based not only on the available radiocarbon dates (n = 94) but also the associated material culture and funerary architecture. In this research, five new radiocarbon dates were presented. Thirty-five more bone samples were sent for C14 AMS analysis but, due to technical problems in the laboratory and the need to repeat the second set of samples, the results were not available to be included in this thesis. Nonetheless, future research, including more radiocarbon dates, would be beneficial to understand the evolution of these sites.

The linking of non-local individuals, exotic raw materials and metal ores with their origin is still unclear owing to the absence of much data. Undoubtedly, this will be one of the major areas for investigation in the future, where analysis of more human remains, raw materials and some analysis of possible source sites, such as those in North Africa, will definitely help in the understanding of human mobility and the trade and exchange of goods.

A final limitation of this research was the absence of well-documented site reports and high quality publications, including results of human bone analyses. The lack of high quality research on archaeological sites is another problematic factor in the investigation of social inequality. The absence of high impact research studies using multiple lines of evidence (material culture, biological data, funerary architecture etc.), means that the current research remains only one piece of a large jigsaw puzzle that future research will hopefully complement. Undoubtedly, incorporating more studies in combination with biochemical analysis and radiocarbon dating will contribute positively to research on social inequality in the prehistory of south-west Spain.

7.1.5.- Future work

The results of this research have opened the door to reconstructing past funerary patterns in Copper Age communities in south-west Spain, as well as new social and economic interpretations. The combination of standard macroscopic bioarchaeological methods, along with biochemical analysis, offers a new perspective for answering questions relating to social inequality in prehistory.

However, this is just the beginning and there still much work to do. This is the first time that these methods have been all combined and applied to human remains from this particular area and time period, and more data are needed in order to do more inter-site comparisons. In addition, more samples will be required to analyse diet through $\delta^{13}C$ and $\delta^{15}N$ and human mobility through $^{87}Sr/^{86}Sr$. In the future, it is intended that a biosphere map for south-west Spain will be created, incorporating a substantial number of environmental samples from different geological areas, so that a baseline reference for the distribution of ratios of $^{87}Sr/^{86}Sr$ is available. All of this, in combination with the essential radiocarbon dates, will be the key to further reconstructing past life ways of Copper Age communities in south-west Spain.

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SITE:	Date:
BURIAL NUMBER:	Skeleton number:

1.- INVENTORY COMPLETE SKELETONS RECORDING FORM

BONE	L	M	R
CRANIAL BONE AND JOINT SURFACES			
FRONTAL			
PARIETAL			
OCCIPITAL			
TEMPORAL			
TMJ			
SPHENOID			
ZYGOMATIC			
MAXILLA			
PALATINE			
MANDIBLE			
POSTCRANIAL BONES AND JOINT SURFACES			
CLAVICLE			
MEDIAL			
LATERAL			
SCAPULA BODY			
CORACOID			
ACROMIUM			
PATELLA			
SACRUM			
OS COXAE			
ILLIUM			
ISQUIUM			
PUBIS			
ACETABULUM			
AURICULAR SURFACE			
VERTEBRAE		**CENTRUM**	**NEURAL ARCH**
C1			
C2			
C3			
C4			
C5			
C6			
C7			
T1			
T2			
T3			
T4			
T5			
T6			
T7			
T8			
T9			
T10			
T11			
T12			
L1			
L2			
L3			
L4			
L5			
STERNUM			
MANUBRIUM			

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

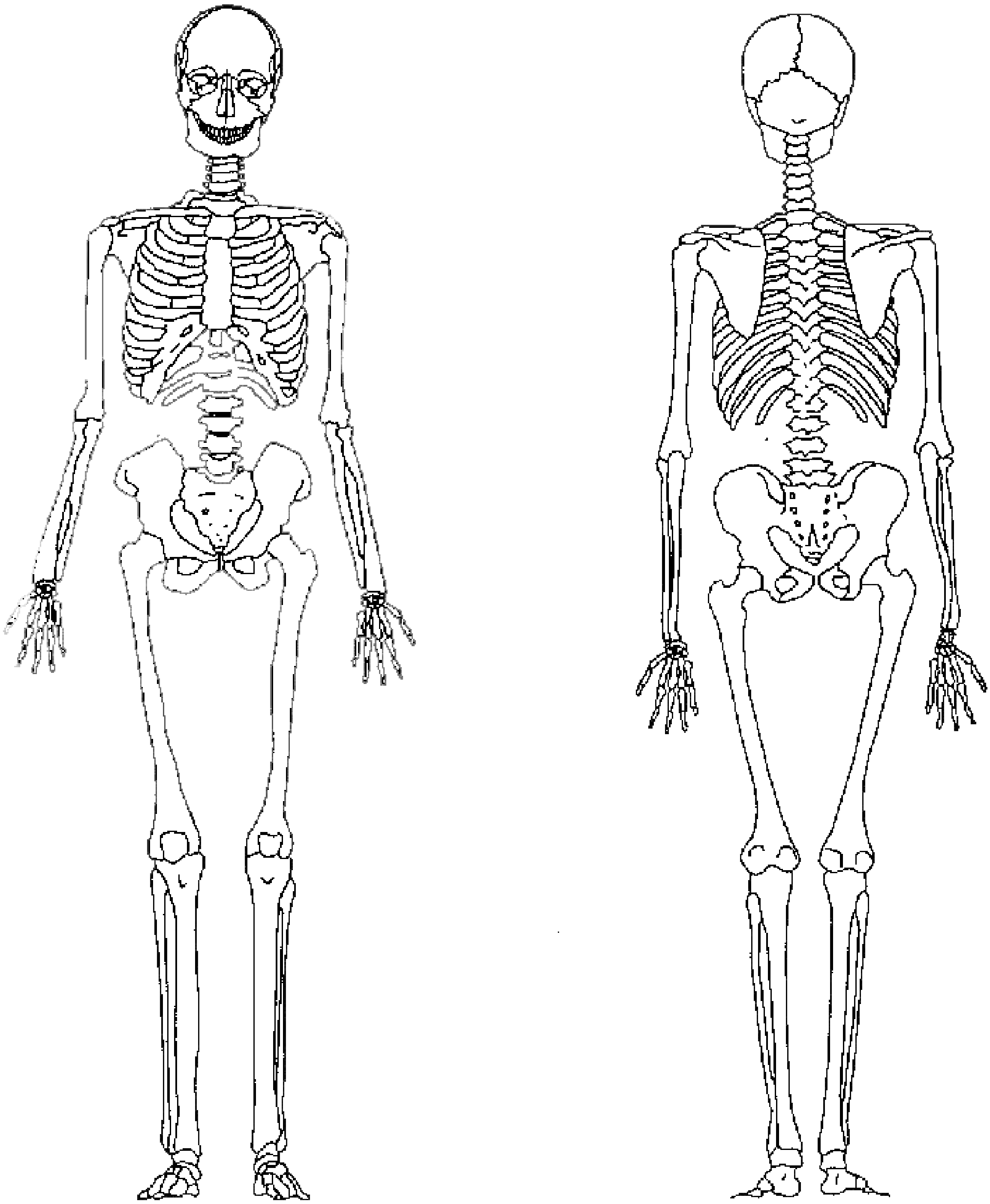
LONG BONES	DIAPHYSIS			
	RIBS	UNSIDED	L	R
	1st			
	2nd			
	3-10 (Present / Complete)		/	/
	11th			
	12th			

	PROX. EPIPHYSIS	PROX. THIRD	MIDDLE THIRD	DISTAL THIRD	DISTAL EPIPHYSIS
L HUMERUS					
R HUMERUS					
L RADIUS					
R RADIUS					
L ULNA					
R ULNA					
L FEMUR					
R FEMUR					
L TIBIA					
R TIBIA					
L FIBULA					
R FIBULA					
L TALUS					
R TALUS					
L CALCANEUS					
R CALCANEUS					

HAND CARPALS	L	R	UNSIDED
LUNATE			
HAMATE			
CAPITATE			
PISIFORM			
TRAPEZOID			
TRAPEZIUM			
TRIQUETAL			
SCAPHOID			
METACARPALS			
1st			
2nd			
3rd			
4th			
5th			
PHALANGES			
DISTAL			
MEDIAL			
PROXIMAL			
FOOT TARSALS			
CUBOID			
NAVICULAR			
LATERAL			
INTERMEDIATE			
MEDIAL CUNEIFORM			
METATARSALS			
1st			
2nd			
3rd			
4th			
5th			
PHALANGES			
DISTAL			
MEDIAL			
PROXIMAL			

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

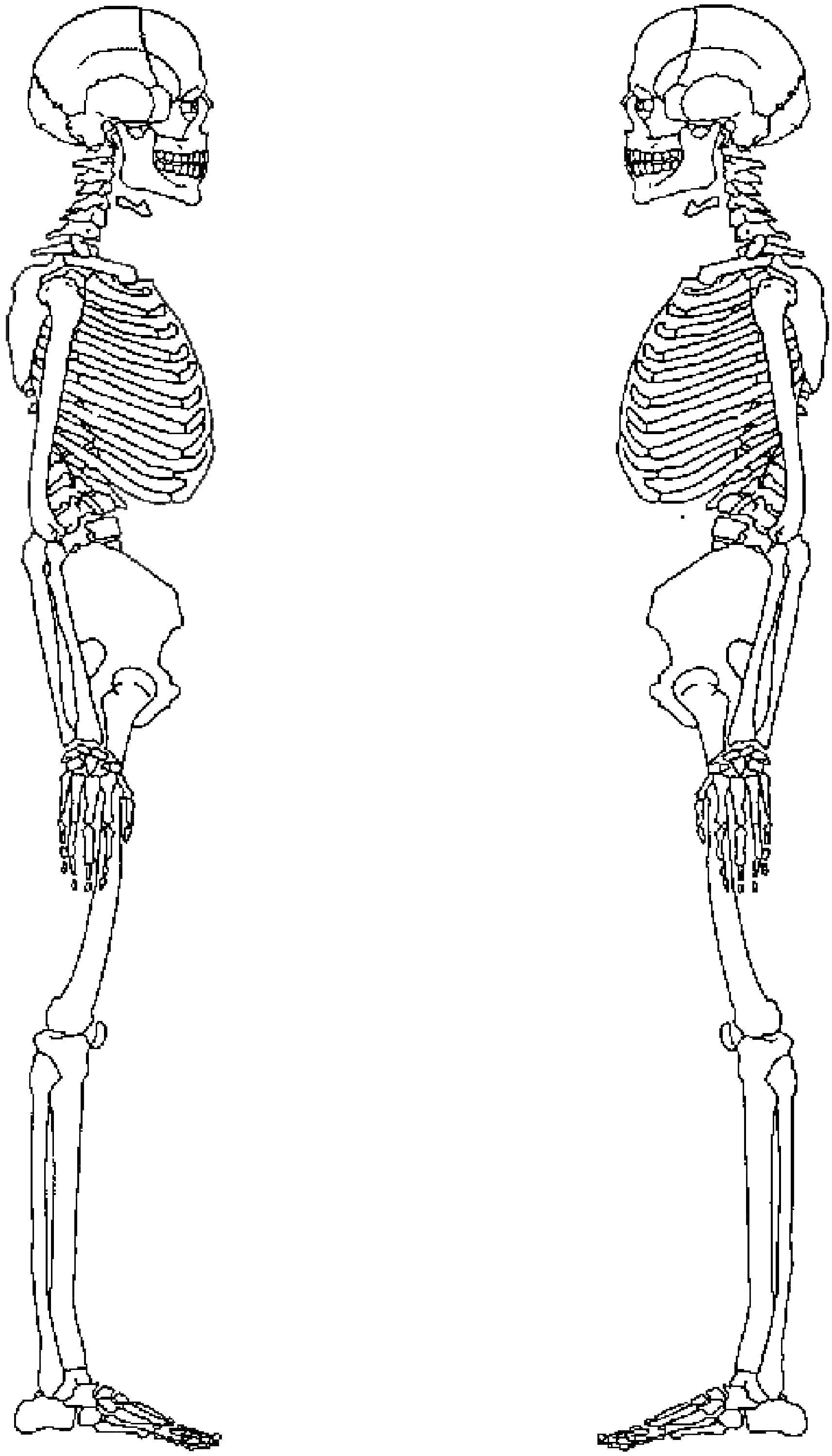
2.1- SKELETAL DRAWINGS: ANTERIOR AND POSTERIOR VIEW



(after Buikstra and Ubelaker, 1994)

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

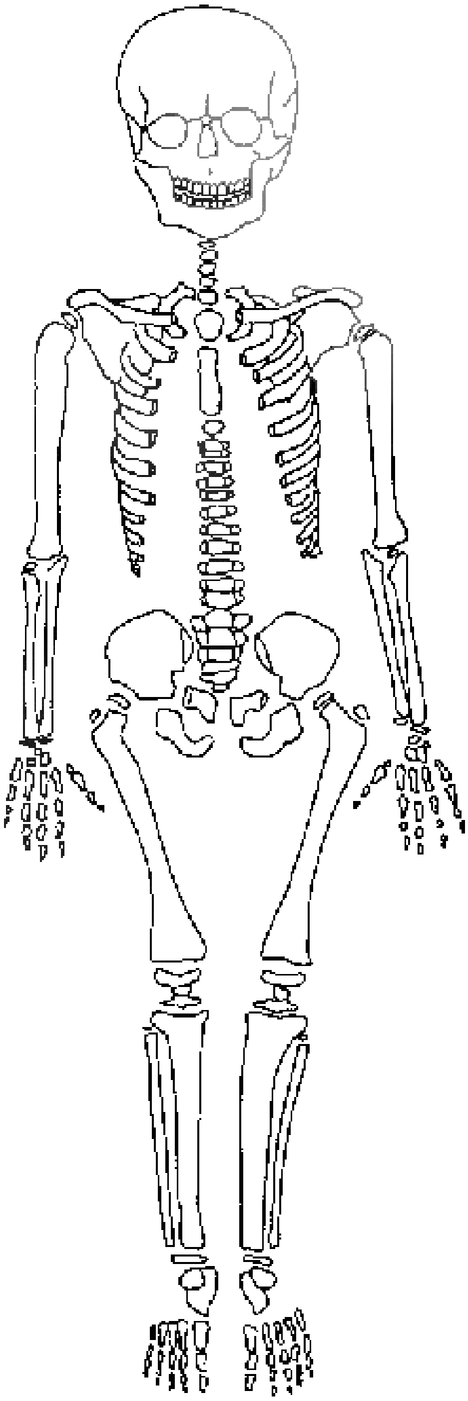
2.2- SKELETAL DRAWINGS: RIGHT LATERAL AND LEFT LATERAL VIEW

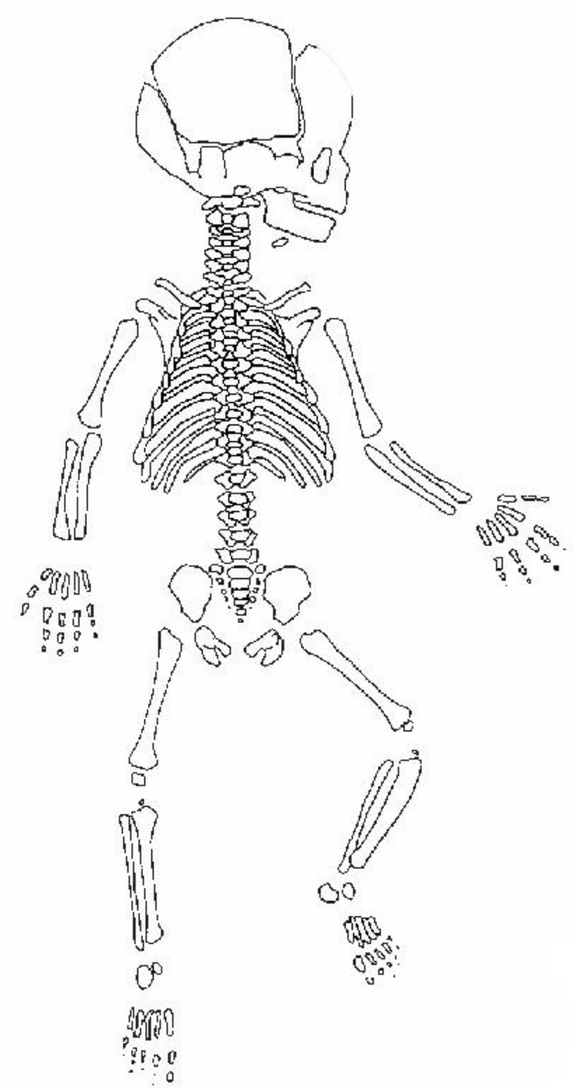


(after Buikstra and Ubelaker, 1994)

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

2.3.- SKELETAL DRAWINGS: THE CHILD AND FETUS SKELETON

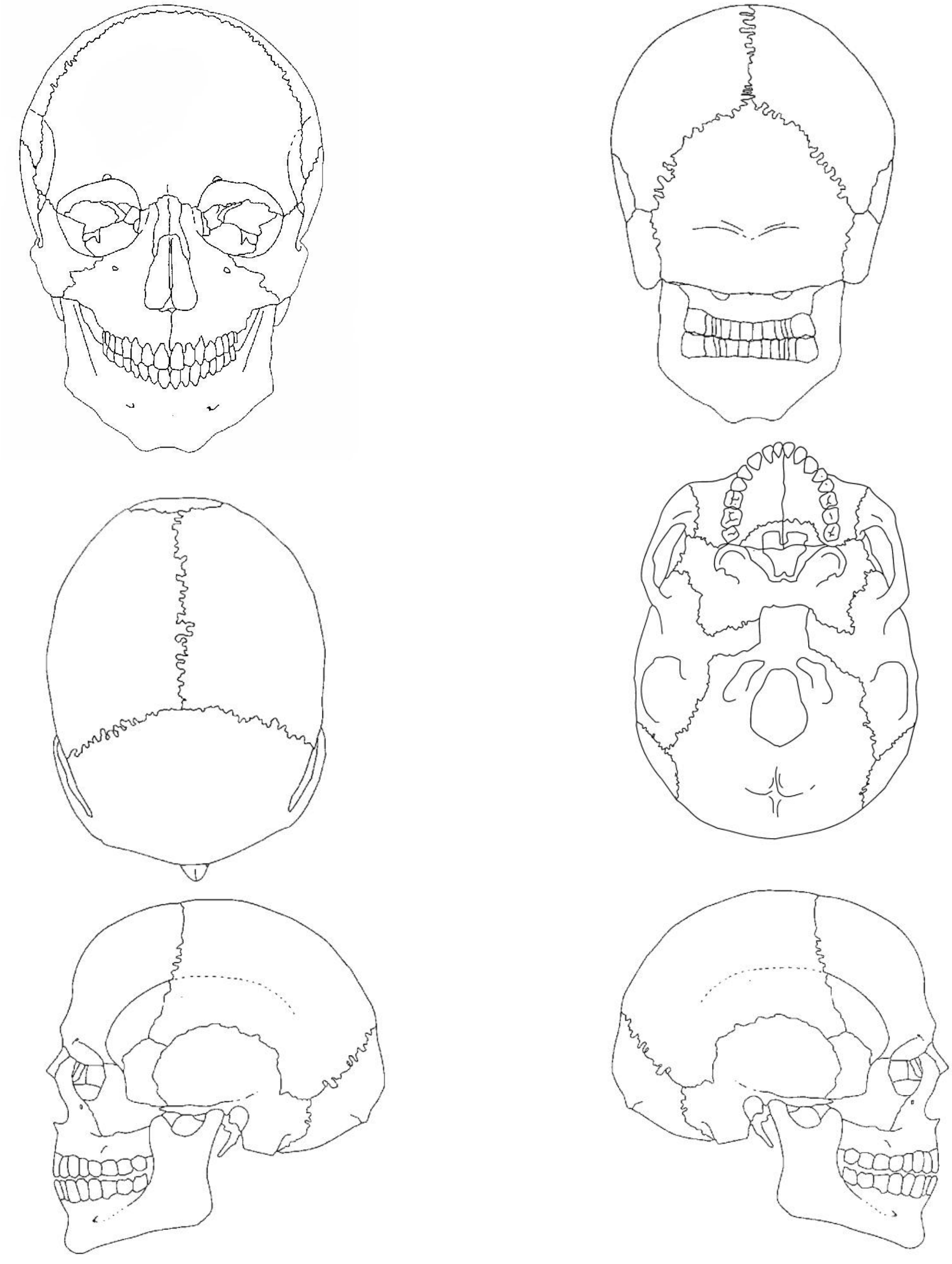




(after Buikstra and Ubelaker, 1994)

SITE:	**Date:**
BURIAL NUMBER:	**Skeleton number:**

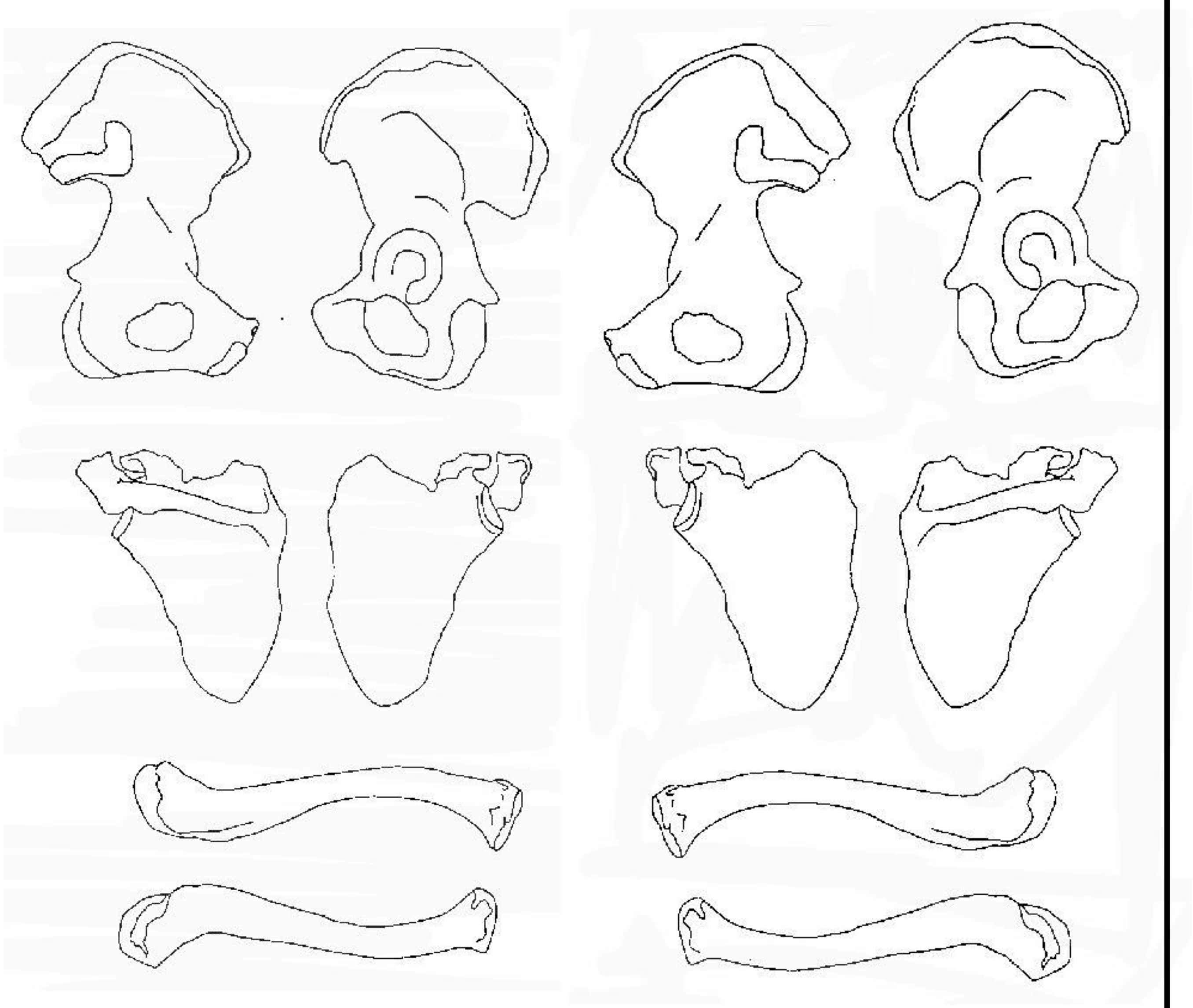
2.4.- SKELETAL DRAWINGS: THE SKULL



(after Buikstra and Ubelaker, 1994)

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

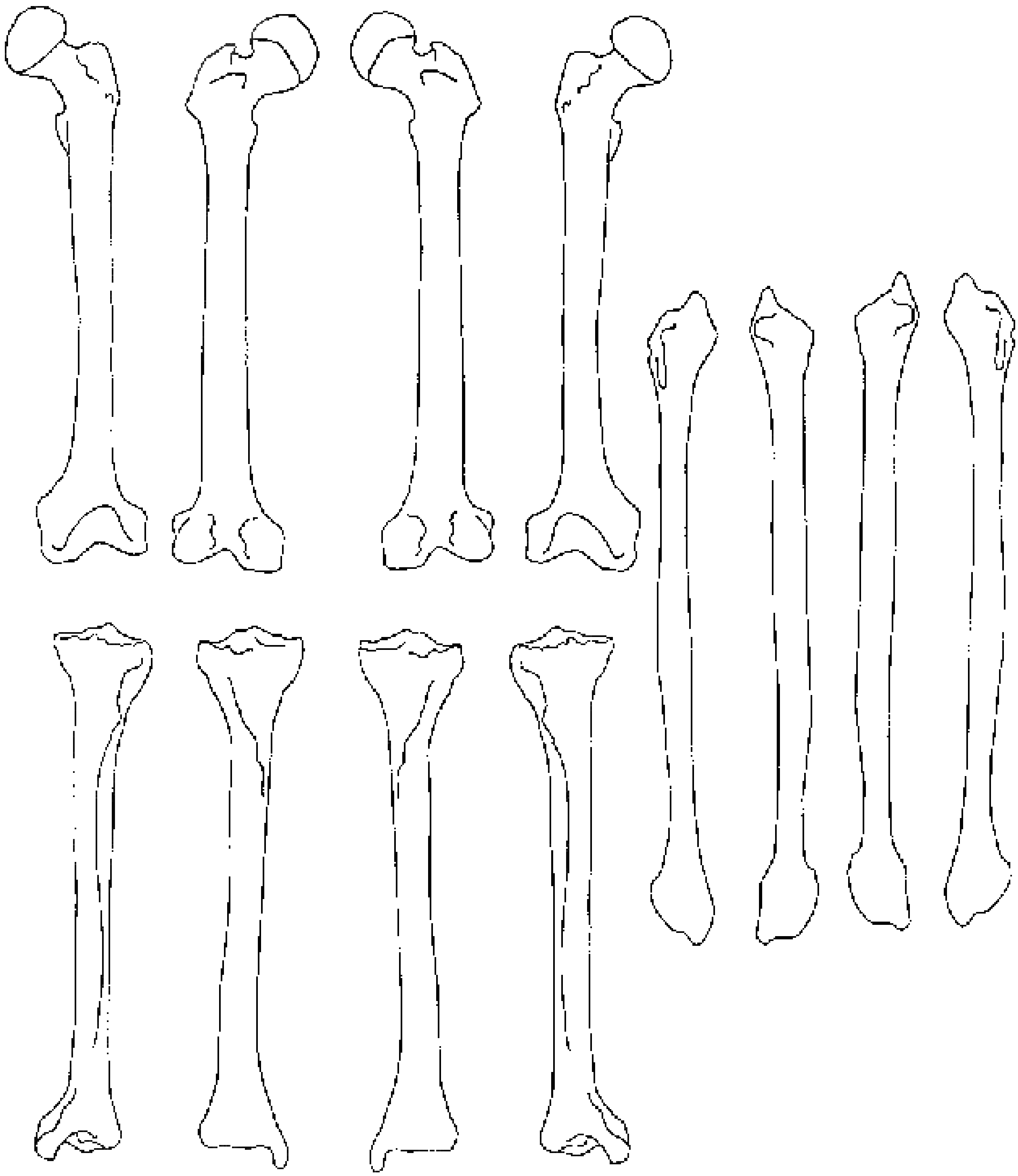
2.5.- SKELETAL DRAWINGS: LEFT AND RIGHT FLAT BONES



(after Buikstra and Ubelaker, 1994)

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

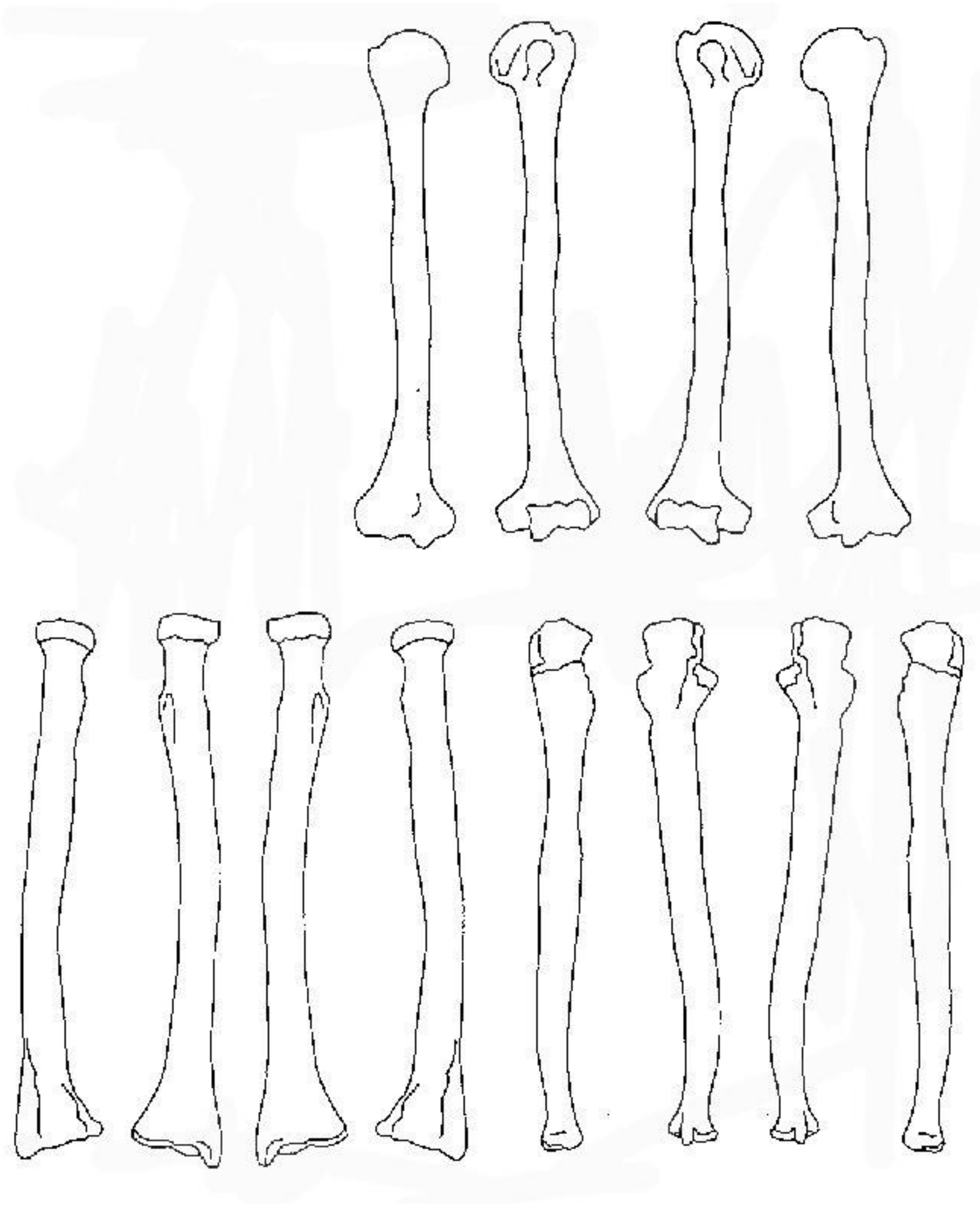
2.6.- SKELETAL DRAWINGS: LEFT AND RIGHT LOWER LIMBS



(after Buikstra and Ubelaker, 1994)

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

2.7.- SKELETAL DRAWINGS: LEFT AND RIGHT UPPER LIMBS

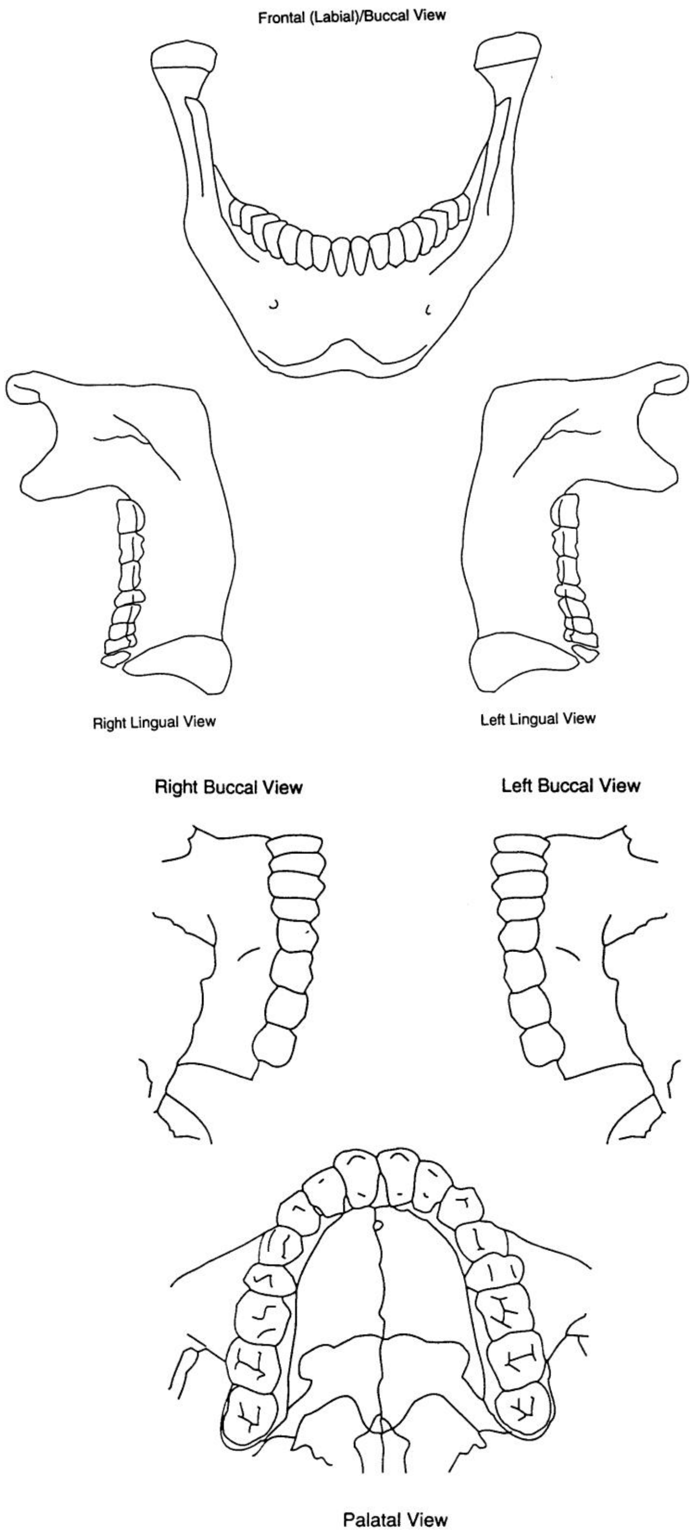


(after Buikstra and Ubelaker, 1994)

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

2.8.- SKELETAL DRAWINGS: ADULT DENTITION RECORDING

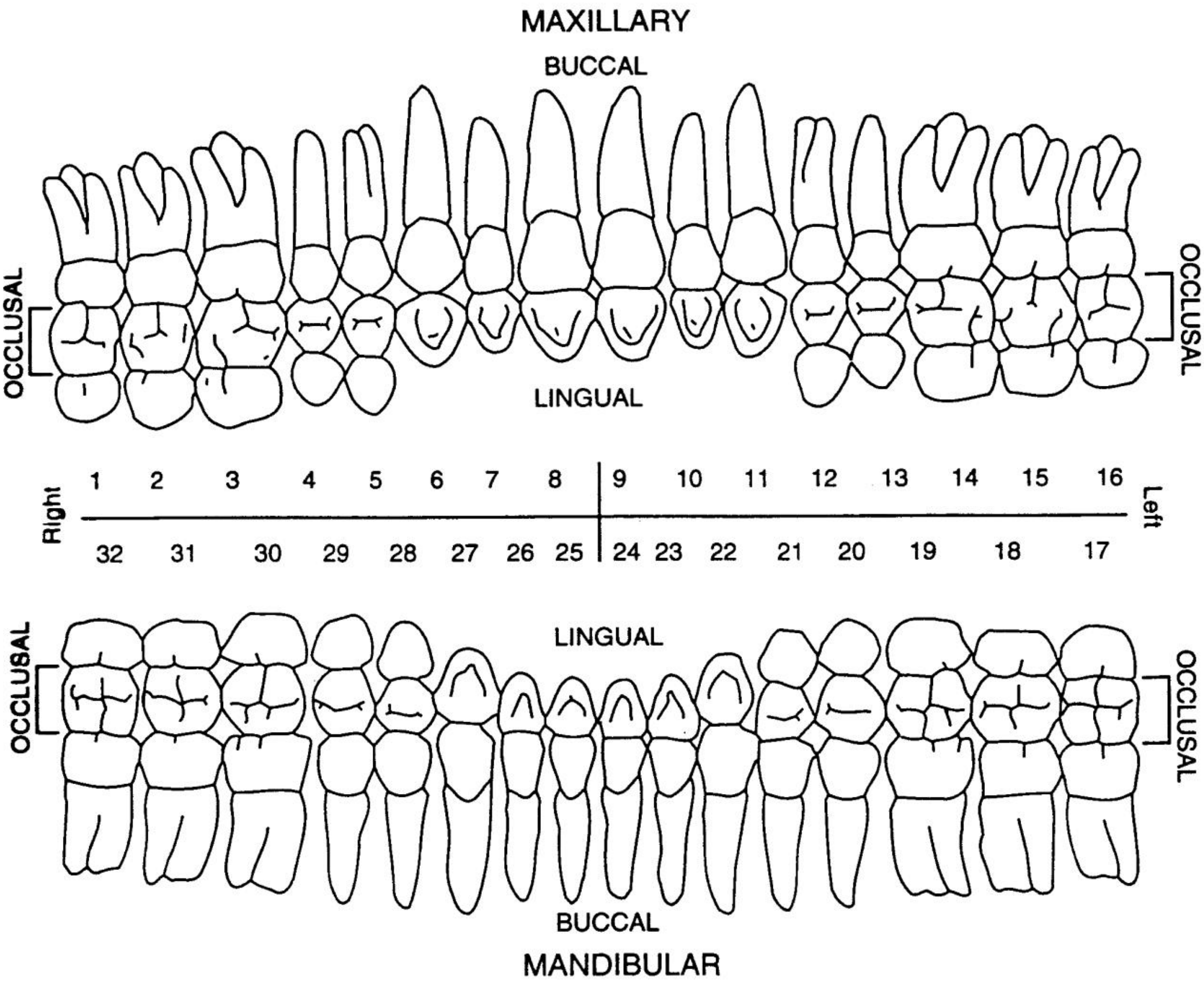
2.8.a- SKELETAL DRAWINGS: MANDIBULAR AND MAXILLAE RECORDING



(after Buikstra and Ubelaker, 1994)

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

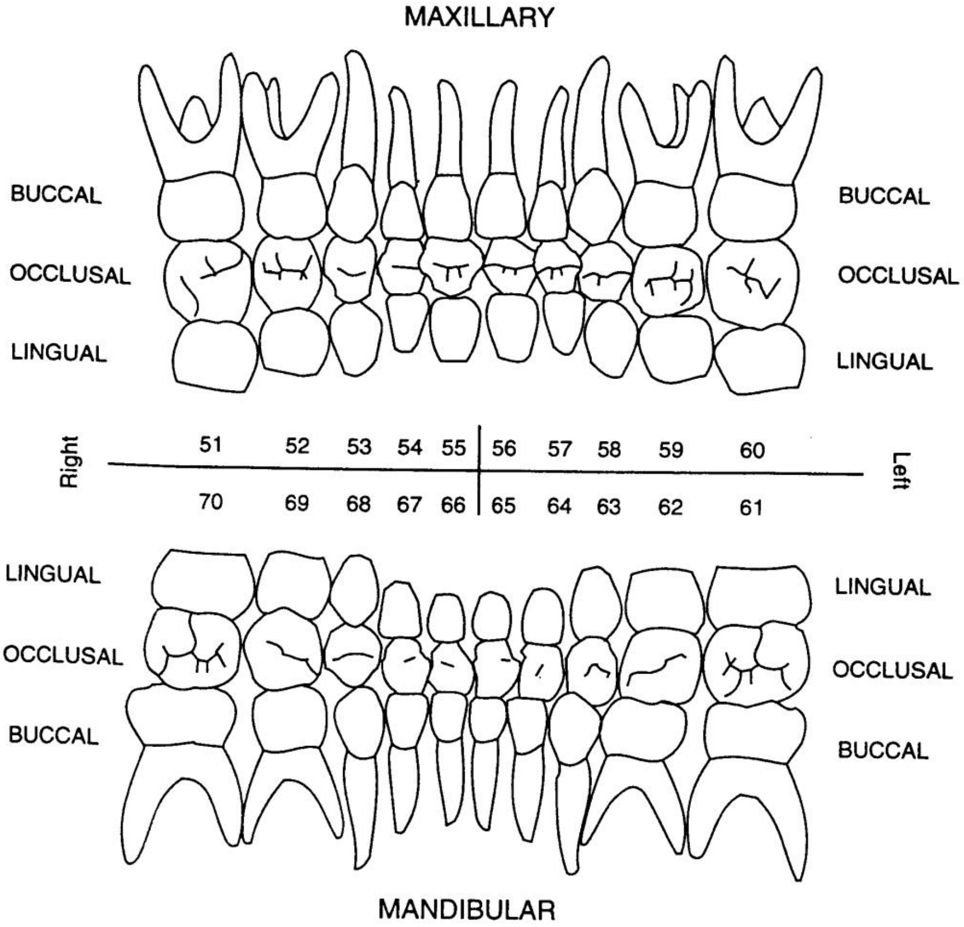
2.9.- PERMANENT DENTITION RECORDING FORM



(after Buikstra and Ubelaker, 1994)

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

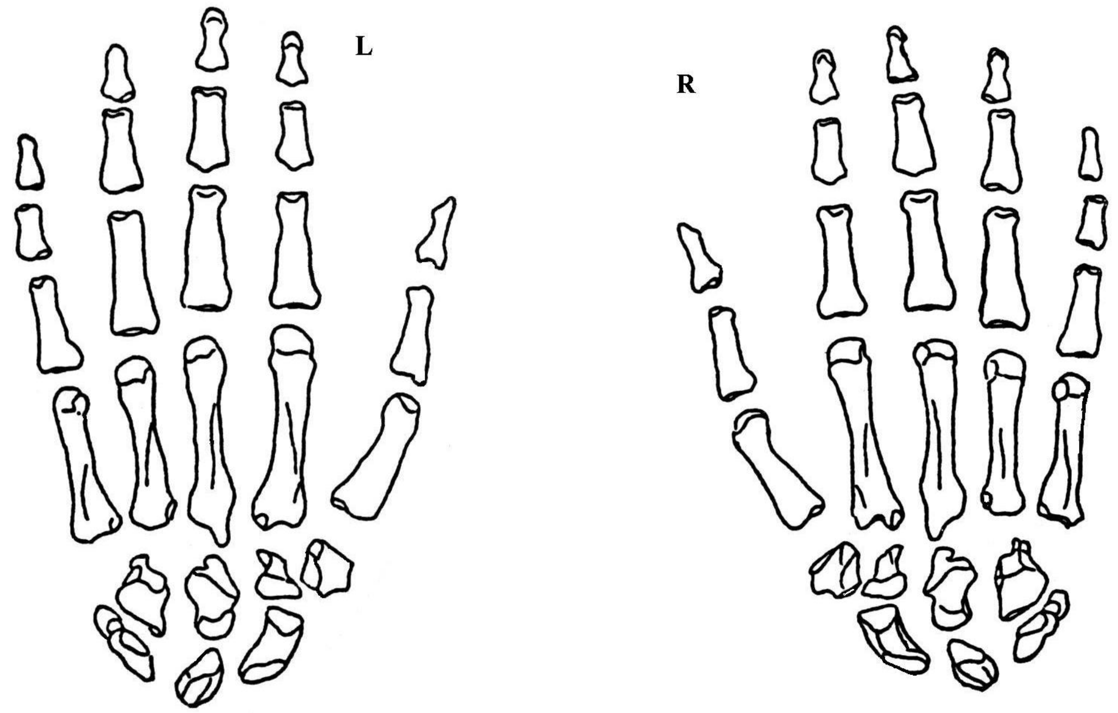
2.10.- DECIDUOS DENTITION RECORDING FORM



(after Buikstra and Ubelaker, 1994)

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

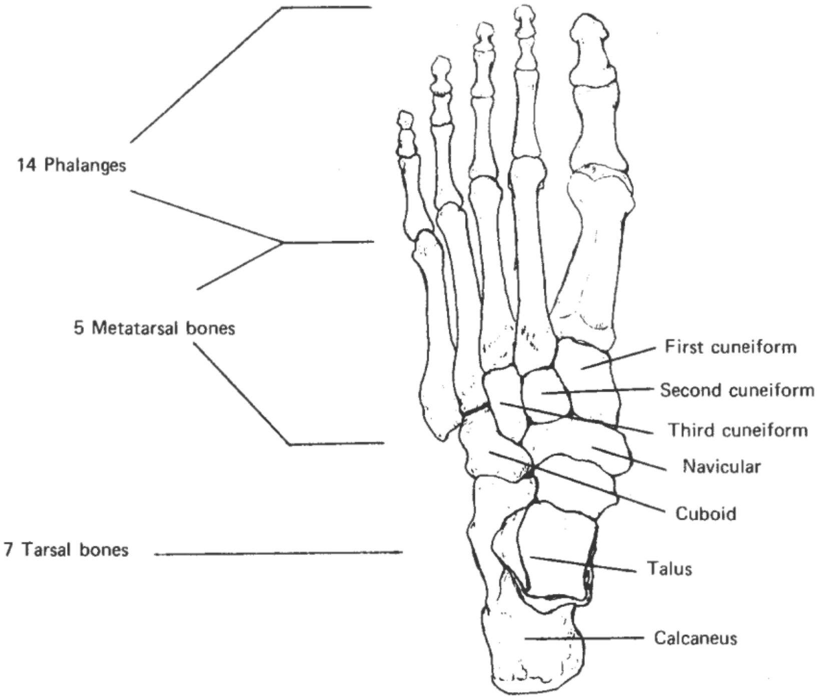
2.11.a- HANDS RECORDING FORM

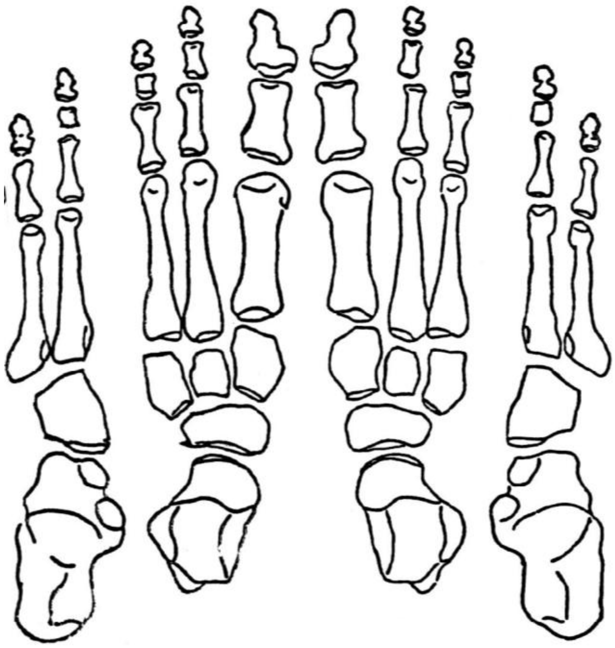


(after Bass, 1995)

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

2.12.- LEFT AND RIGHT FEET RECORDING FORM





(after Bass, 1995)

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

3.- INVENTORY RECORDING FORM FOR COMMINGLED REMAINS AND ISOLATED BONES

Bone	Side	Segment	Completeness	MNI	Ct/Wt	Age	Sex

Report all cranial bones separately. Group cervical vertebrae 3-6; thoracic vertebrae 1-9; ribs 3-10; carpals; metacarpals; tarsals (other than talus and calcaneus); metatarsals; hand and foot phalanges. **Side L**(left) R(right) **U**(insidable). **Segments PE**(proximal epiphysis)**P1/3**(proximal third of diaphysis),**M1/3**(middle third of diaphysis), **D1/3**(distal third of diaphysis) **DE**(distal epyphisis), **B**(vertebral body),**NA** (neural arch)otherwise leave it blank. **Completeness 1**(≥75%) **2**(25%-75%)**3**(≤25%). **Ct**(number of fragments) **Wt**(weight of fragments). **Age F**(fetal ≤birth) **I1**(infants b-6 years) **I2**(children 7-12 years) **AO**(adolescents 13-17) **YA**(18-25) **MID** (middle adult 26-35) **M** (mature adult 36-45) **OA**(old adults ≥45). **Sex M** (male) **M?** (possibly male) **F**(female)**F?**(possibly female) ?(indetermined).

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

4.- ADULT SEX RECORDING FORM

PELVIS	F	F?	?	M?	M
Ventral arc					
Subpubic concavity					
Ischiopubic Ramus Ridge					
Greater Sciatic Notch					
Subpubic angle					
Pubic length					
Obturator foramen					
Pelvic inlet/outlet					
Acetabulum					
Sacrum segments					
Sacrum morphology					
Estimated sex					

SKULL	L	M	R
Nuchal crest			
Mastoid process			
Supraorbital margin			
Glabella			
Mental eminence			
Forehead			
Post zygomatic arch			
Chin			
Mandibular ramus flexure			

METRICS	F	F?	?	M	M?
Maximum diameter of the femoral head					
Femur bycondilar width					
Humerus head diameter					
Radius head diameter					
Scapula glenoid cavity width					
Clavicle maximum length					
Estimated sex					

1. >48mm = Male <43mm = Female
2. >76mm = Male <74mm = Female
3. >47mm = Male <43mm = Female
4. >23mm = Male <21mm = Female
5. >28.6mm = Male <26.1mm = Female
6. >150mm = Male <138mm = Female

References:
Pelvis+Skull: Buikstra and Ubelaker,1994.
Metrics: Bass, 1985; Buikstra and Ubelaker,1994.

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

5.- ADULT AGE RECORDING FORM

AURICULAR SURFACE	L	R
Stages 1-8		
Estimated sex		

Meindl and Lovejoy, 1989. For charts see appendix

PUBIC SYMPHYSIS	L	R
Todd (1-10)		
Suchey-Brooks (1-6)		
[illegible]		

Todd 1921a, 1921b. Brooks and Suchey, 1990. For charts see appendix

Ribs	M	F
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Estimated age		
Iscan and Loth 1984,1985. For charts see appendix		

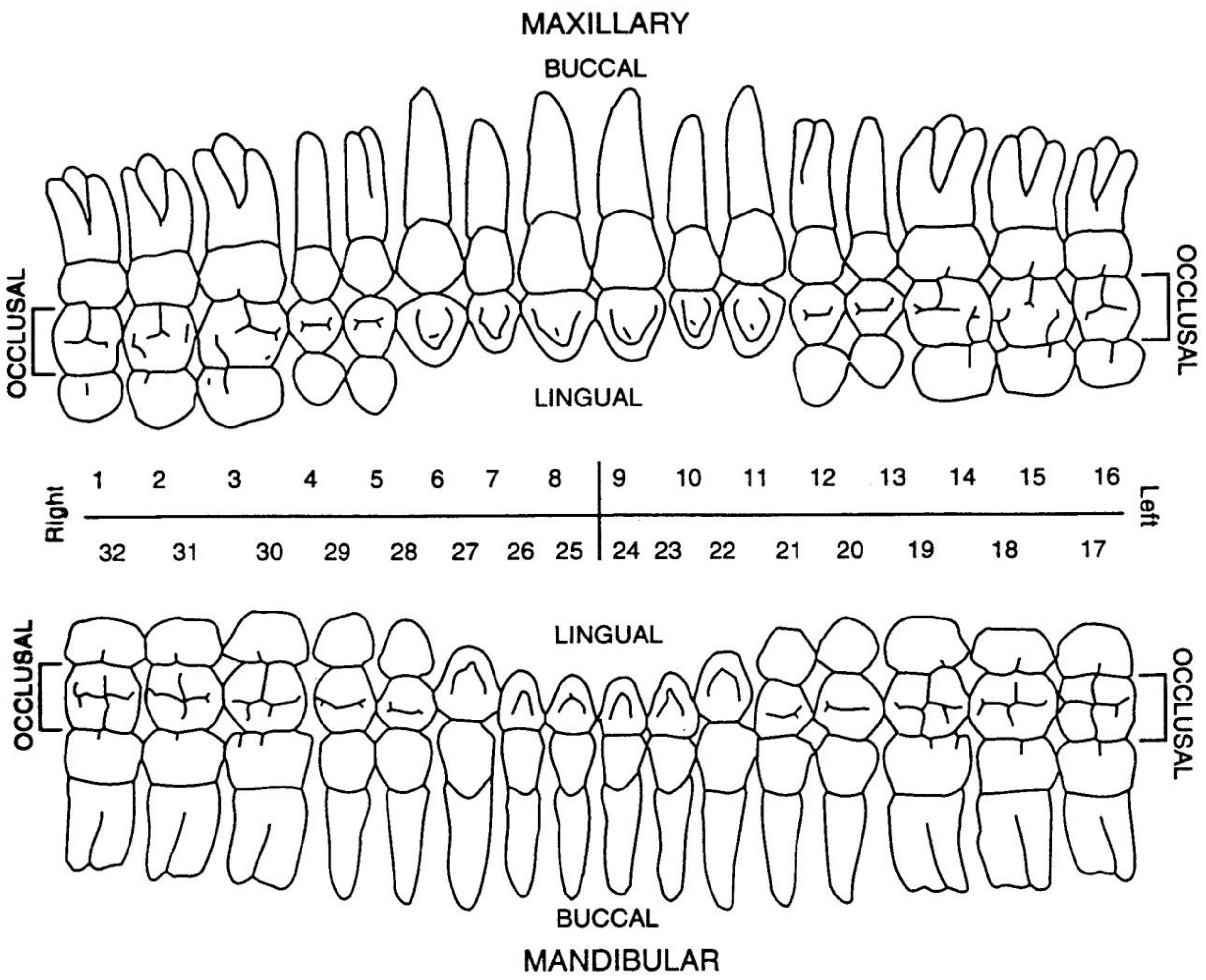
SUTURE CLOSURE	LOCATION	BLANK	0	1	2	3
Midlamboid	Skull					
Lambda	Skull					
Obelion	Skull					
Anterior Sagittal	Skull					
Bregma	Skull					
Mi	Skull					
Pterion	Skull					
Sphenofrontal	Skull					
Inferior	Skull					
Superior	Skull					
Incisive	Palate					
Anterior Median	Palate					
Posterior Median	Palate					
Transverse Palatine	Palate					
Sagittal	Internal					
Left Lambdoid	Internal					
Left Coronal	Internal					
Estimated age						
Blank: unobservable, 0: open, 1: minimal, 2: significant, 3: complete (Meindl and Lovejoy, 1985)						

Degenerative Joints	Years	Check
Sternal end of clavicle	21-29	
Epiphyseal plates of the vertebral bodies	by 25	
Heads of ribs	by 25	
Iliac crest	18	
Basilar suture on base of skull	LA	
Individual pieces of the sacrum	25	
Estimated age		
(Buikstra and Ubelaker, 1994, Brothwell, 1981)		

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

6.- ADULT WEAR AND METRICS RECORDING FORM

	Method	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Wear	Brothwell, 1981																
	Smith, 1982																
Metrics	MD																
	BL																
	CH																
Caries																	
Calcul	Brothwell, 1981																



	Method	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Wear	Brothwell, 1981																
	Smith, 1982																
Metrics	MD																
	BL																
	CH																
Caries																	
Calculu																	

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

7.- SUBADULT AGEING RECORDING FORM

EPIPHYSEAL FUSION		SIDE	
	EPIPHYSIS	R	L
Skull	Metopic suture		
	Mental symphysis		
	Lateral to basilar		
	Lateral to squamous		
	Basilar suture		
Ribs	heads		
Cervical vertebrae	Halves of the arch		
	Arch-vertebral body		
	vert. sup. rim		
	vert. inf. rim		
Thoracic vertebrae	Halves of the arch		
	Arch-vertebral body		
	vert. sup. rim		
	vert. inf. rim		
Lumbar vertebrae	Halves of the arch		
	Arch-vertebral body		
	vert. sup. rim		
	vert. inf. rim		
Scapula	Coracoid		
	Acromion		
	Glenoid cavity		
	Medial border		
Clavicle	Sternal		
Humerus	Head		
	Distal		
	Medial Epicondyle		
Radius	Proximal		
	Distal		
	Proximal		
	Distal		
Os Coxae	Iliac Crest		
	Ischial tuberosity		
	Ilium to pubis		
	Ischium to pubis		
	Ischium to ilium		
Sacrum	1-2		
	2-3		
	3-4		
	4-5		
Femur	Head		
	Greater throcanther		
	Lesser Throcanter		
	Distal		
Tibia	Proximal		
	Distal		
Fibula	Proximal		
	Distal		

Stage of union:

0 (open)
1(partial union)
2(complete union)

ESTIMATION OF CHRONOLOGICAL AGE BASED ON POSTCRANIAL MATURATION					
Fetal	b-6	7-12	13-17	18-20	>20
Buikstr a and Ubelaker, 1994; Sch euer and Black, 2000; Baker et al, 2007)					

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

8.- ADULT METRICS FORM

PART	CRANIAL MEASUREMENTS	R	M	L
SKULL	Maximum cranial length (g-op)			
	Maximum cranial breadth (eu-eu)			
	Bizygomatic diameter (zy-zy)			
	Basion-bregma height (ba-b)			
	Cranial base length (ba-n)			
	Basion-prosthion length (ba-pr)			
	Maxillo-alveolar breadth (ecm-ecm)			
	Maxillo-alveolar length (pr-alv)			
	Biauricular breadth (au-au)			
	Basion-nasal length (LB)			
	Nasion-alveolar			
	Basion-alveolar length (GL)			
	Basion-asterion chord			
	Porion-bregma height (po-b)			
	Upper facial height (n-pr)			
	Minimum frontal breadth (ft-ft)			
	Upper facial breadth (fmt-fmt)			
	Upper facial height (G' H)			
	Nasal height (n-ns)			
	Nasal Breadth (al-al)			
	Orbital breadth (d-ec)			
	Orbital height (en oblicuo)			
	Biorbital breadth (ec-ec)			
	Interorbital breadth			
	Frontal chord (n-b)			
	Frontal arch			
	Parietal Chord (b-l)			
	Parietal Arch			
	Occipital chord (l-op)			
	Occipital Arch			
	Foramen magnum length			
	Foramen magnum breadth			
	Mastoid length			
	Byzygomatic breadth (GB)			
	Bi-dacryonic breadth (DA)			
	Bi-dacryonic chord (DC)			
	Maximum horizontal perimeter (U)			
	Transverse biporial arch (po-po)			
	Malar height			
MANDIBLE	Chin height (id-gn)			
	Height of the mandibular body			
	Breadth of the mandibular body			
	Bigonial width			
	Bicondylar breadth			
	Minimum ramus breadth			
	Maximum ramus breadth			
	Maximum ramus height (condylar length CYL)			
	Mandibular length			
	Mandibular angle			
	Bymaxillary breadth (GB)			

*All measurements are recorded in mm. (Buikstra and Ubelaker, 1994; Brothwell, 1981).

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

POSTCRANIAL MEASUREMENTS		R	M	L
Clavicle	Max. length			
	ant.-post. Diameter at midshaft			
	sup.-inf. Diameter at midshaft			
Scapula	height			
	Breadth			
	Glenoid cavity length			
	Glenoid cavity width			
Humerus	max. length			
	Epicondylar breadth			
	Vertical diameter of head			
	Minimum diameter at midshaft			
Radius	Max. length			
	Ant.-post. Diameter at midshaft			
	Med.-lat. Diameter at midshaft			
Ulna	Max. length			
	Ant.-post. Diameter			
	Med.-lat. Diameter			
	Physiological length			
	Minimum circumference			
Sacrum	Anterior Length			
	Anterior superior breadth			
	Max. transverse diameter of base			
	Maximum length			
Os Coxae	Height			
	Illiac breadth			
	Pubis length			
	Oschium length			
Femur	Maximum length			
	Bicondylar breadth			
	Epicondylar breadth			
	Max. diameter of the femur head			
	Ant.-post. Subtochanteric diameter			
	Med.-lat. Subthrocanteric diameter			
	Ant.-post. Midshaft diameter			
	Med.-Lat. Midshaft diameter			
	Midshaft circumference			
Tibia	Max Length			
	Max. proximal epiphyseal breadth			
	Max. distal epiphyseal breadth			
	Max. diameter at the nutrient foramen			
	Med.-Lat. Diameter at the nutrient foramen			
	A-P Diameter at the nutrient foramen			
	Circumference at the nutrient foramen			
Fibula	Maximum length			
	Maximum diameter at midshaft			
Calcaneus	Maximum length			
	Middle breadth			
Sternum	Max length body			
	Max length manubrium			
Atlas	Max. Int. Width			
*All measurements are recorded in mm (Buikstra and Ubelaker, 1994; Brothwell, 1981).				

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

9.- INDICES

INDICES	FORMULA	RESULTS
Cephalic index	Max skull breadth x 100 Max skull length	
Foraminal index	Foramen magnum breadth Foramen magnum length	
Mean porion-height index	Porion-bregma height x 100 Cranial length+cranial breadth/2	
Platymeric index	A-P subtrochanteric diameter x 100 mediolateral subtrochanteric diameter	
Platyenemic index	Medio-lateral diameter at nutriet foramen x 100 antero-posterior diameter at nutrient foramen	
Radio-Humeral index	Max length of radius x 100 Maximum length of humerus	
Robusticity index of humerus	Mid-shaft circumference of humerus x 100 Max length of humerus	
Ischio-pubis index	Pubis length x 100 Ischial length	
Femoral index	FeD3+FeD4 x 100 FeL2 (oblique length)	
Orbital index	Orbital height x 100 orbital breadth	
Palatal index	Max. palatal breadth x 100 max. palatal length	
Upper facial index	Upper facial height x 100 bizygomatic breadth	
Nasal index	Nasal breadth x 100 nasal height	
Cranial index	Length+Breadth+Height 3	
Length-Height	Basion-bregma height x 100 Max length	
Breadth Height	Basion-bregma height x 100 Max breadth	
For charts see appendix. (Brothwell, 1981; Bass, 2005)		

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

10.- SUBADULT MEASUREMENT RECORDING FORM

CRANIAL MEASUREMENTS		L	M	R
Lesser wing of the sphenoid	Length			
	Width			
Greater wing of the sphenoid	Length			
	Width			
Body of the sphenoid	Length			
	Width			
Petrous and Mastoid portions of the temporal	Length			
	Width			
Basilar part of the occipital	Length			
	Width			
Zygomatic	Length			
	Width			
Maxilla	Length			
	Width			
	Height			
Mandible	Length of the body			
	Width of the Arc			
	Full length of half mandible			

POSTCRANIAL MEASUREMENTS		R	L
Clavicle	Length		
	Diameter		
Scapula	Length (height)		
	Width		
	Length of the spine		
Ilium	Length		
	Width		
Ischium	Length		
	Width		
Pubis	Length		
Humerus	Length		
	Width		
	Diameter		
Ulna	Length		
	Diameter		
Radius	Length		
	Diameter		
Femur	Length		
	Width		
	Diameter		
Tibia	Length		
	Diameter		
Fibula	Length		
	Diameter		

All measurements are recorded in mm (Buikstra and Ubelaker, 1994).

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

11.- ADULT NON-METRIC TRAITS

CRANIAL NON METRIC TRAITS	Present	Absent	L part P	L P	L A	R part P	R P	R A
Highest nuchal line								
Lambda ossicle								
Lambdoid foramen								
Parietal foramen								
Bregmatic Bone								
Metopism								
Coronal ossicle								
Epipteric bone								
Fronto-temporal articulation								
Parietal notch								
Ossicle at Asterion								
Auditory torus								
Foramen of Huschke								
Mastoid foramen exsutural								
Mastoid foramen absent								
Postcondylar facet								
Condylar facet double								
Precondilar tubercle								
Anterior condylar canal double								
Foramen ovale incomplete								
Foramen spinosum open								
Accesory lesser palate								
Palatine torus present								
Maxillary torus								
Zygomatico-facial foramen								
Supraorbital foramen complete								
Frontal foramen								
Anterior ethmoid foramen								
Post ethmoid foramen								

L part P (left part present), LP (left present), LA (left absent), R part P (right part present), RP(right present), RA right absent). (Berry and Berry, 1967)

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

DENTAL NON METRICS	Present	Absent	Grade/Severity
Winging (upper central I)			
Shovelling (upper Is and C, lower Is)			
Labial convexity (upper Is)			
Double shovelling (upper Is, C, PM1 and lower Is)			
Interruption groove			
Tuberculum dentale (upper Is, C)			
Canine mesial ridge (upper C)			
Canine distal accessory ridge (upper and lower C)			
Tricuspid premolars			
Distosagittal ridge (upper PM1)			
Metacone (upper molars)			
Hypocone (upper Ms)			
Metaconule (upper Ms)			
Carabelli’s trait (upper Ms)			
Parastyle (upper Ms)			
Enamel extensions (upper PMs andMs)			
Premolar root number (upper PMs)			
Upper molar root number (upper Ms)			
Radical number (all teeth)			
Peg-shaped incisor (upper lateral I)			
Peg-shaped molar (upper M3)			
Odontome (upper and lower PMs)			
Congenital absence			
Premolar lingual cusp variation (lower PMs) Anterior			
Groove pattern (lower Ms)			
Cusp number (lower Ms)			
Deflecting wrinkle (lower M1)			
Distal trigonid crest (lower Ms)			
Protostylid (lower Ms)			
Cusp 5 (lower Ms)			
Cusp 6 (lower Ms)			
Cusp 7 (lower Ms)			
Canine root number			
Tomes’s root (lower PM1)			
Lower molar root number (lower Ms)			
Torsomolar angle (lower M3)			
Rocker jaw			
(Turner et al, 1991)			

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

11.2- POSTCRANIAL NON METRICS TRAITS

POSTCRANIAL NON METRICS	P/A	LEFT PART	L	RIGHT PART	R
Allen's fossa					
Poirier's facet					
Plaque formation					
Hypotrochanteric fossa					
Trochanteric fossa exostosis					
3rd Trochanter					
Medial tibial squatting facet					
Lateral tibial squatting facet					
Supra-condylar process					
Septal aperture					
Acetabular notch					
Preauricular sulcus					
Accesory sacral facets					
Acromial artic. facet					
Supraescapular foramen					
Circumflex sulcus					
Vastus notch					
Vastus fossa					
Emarginate patella					
Os trigonum					
Medial talar facet					
Lateral talar extensio					
Inferior talar articulation surface					
Anterior calcanean facet double					
Anterior calcanean facet absent					
Peroneal tubercle					
Atlas facet					
P/A (present/absent), L (left), R (right)					

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

POSTCRANIAL NON METRICS	P/A	LEFT PART	L	RIGHT PART	R
Posterior bridge					
Axis Spine bifid					
Transv. Foramen bipartite					
Sternal foramen					
Rectangular acromion					
Glenoid extensions					
Acetabular crease					
Bipartite patella					
Lateral talar extension					
Talus squatting facets					
P/A (present/absent), L (left), R (right). (Finnegan, 1978; Brothwell, 1981)					

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

12.1- INVENTORY OF PALEOPATHOLOGY RECORDING FORM

IDENTIFICATION OF BONE/TOOTH: ____

DESCRIPTION:

____
____
____
____
____

I.-BASIC INFORMATION:

Solitary or multiple lesions? ____

Are the lesions different in appearance?____

Distribution pattern of the lesion Is it bi-lateral? ______________________________________

Dimensions of the lesion ____

Forming bone: 1. Woven

2. Lamellar 2.1- Healed

2.2- In process of healing

Destroying bone: Signs of healing? ____

Hypertrophy/ Athrophy compared to normal bone or opposite side?___________________________

Any deformation visible on the bone surface?____

Comments on the severity of the lesion____

II.- TYPES OF DISEASES

II.1.- Infectious disease

	Periostitis	Osteomyelitis	Osteitis	Leprosy	TB	Treponema
NonSpecific						
Specific						

II.2.- Trauma

TYPE	SIMPLE/COMPOU	ANGULATION	APPOSITION	OVERLAP	HEALING	COMPLICATIONS

Type: spiral, comminuted, transverse, oblique, greenstick, wedge, pathological, stress, compression, depressed. Complications: non-union, pseudoarthritis, necrosis or death of bone, secondary complications such as infection and joint disease. **(**Roberts and Connell, 2004; Lovell, 1997; Waldron, 2009)

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

SITE		R	L
TMJ			
Acromioclavicular			
Sternoclavicular			
Shoulder	Humerus		
	Glenoid		
Elbow	Humerus		
	Ulna		
	Radius		
Hand	Carpus		
	Carpometacarpal		
	Metacarpophalangeal		
	Prox. Interphalangeal		
	Distal Interphalangeal		
Hip	Femur		
	Pelvis		
Knee	Femur/Patella		
	Medial		
	Lateral		
Ankle			
Foot	Tarsus		
	Tarsometatarsal		
	Metatarsophalangeal		
	Prox. Interphalangeal		
	Distal interphalangeal		
Sacro-iliac			

	P	OA	OP	FUSION	IVD	SN	LF
C1							
C2							
C3							
C4							
C5							
C6							
C7							
T1							
T2							
T3							
T4							
T5							
T6							
T7							
T8							
T9							
T10							
T11							
T12							
L1							
L2							
L3							
L4							
L5							

OA: osteoarthritis; OP: osteophyte; SN: Schmorl’s nodes; IVD: intravertebral disc disease; LF: calcified ligamentum flavum

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

12.2.- INVENTORY OF PALEOPATHOLOGY RECORDING FORM

Comments on Joint Disease: ____

____

____

Other:
1. Gout
2. Septic Arthritis
3. Ankylosing Spondylitis
4. Diffuse Idiopathic Skeletal Hyperostosis

II.3.- Metabolic Disease

Pathology	Degree	Activity	Present/Absent
Porotic Hyperostosis			
Scurvy			
Rickets			
Osteoporosis			
Harris Lines			

PH degree=1(Barely discernible), 2(porosity only), 3(porosity with coalescence of foramina, no thickening), 4(coalescing foramina with increased thickness). A=1(active at time of death), 2(healed), 3(mixed reaction: evidence of healing+active lesions) after Buikstra and Ubelaker (1994).

COMMENTS:____

____

____

____

____

____

II.4- ENDOCRINE DISEASE

Observations____

____

____

____

II.5.- NEOPLASTIC DISEASE

Observations____

____

____

____

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

13.- DENTAL DISEASE

For caries and calculus see recording form 2.10 (subadults) and 6 (adults).

TOOTH	TYPE	POSITION	HYPOCALCIFICATIONS	TIMING

Type 1(linear horizontal grooves), **2**(linear vertical grooves),3 (linear horizontal pits), **4(**non-linear array of pits), **5** (single pits). **Position 1**(cusp), **2**(middle section of crown), **3**(neck). **Hypocalcifications 1**(yellow-cream), **2**(orange**),** **3**(brown). (Buikstra and Ubelaker, 1994; Rose et. Al 1985; Reid and Dean, 2000; Goodman and Rose 1990).

Periapical lesions

Location:____

Should it be associated to carious lesion?_____ Should it be associated to tooth wear?_____

Other dental lesions____

GENERAL COMMENTS

____
____
____
____
____
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DIFFERENTIAL DIAGNOSIS

____
____
____
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____
____
____

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

14.- TAPHONOMY RECORDING FORM

BONE	LOCATION	ALTERATION	COLOUR% / gr. AFFECTED	SURFACE TEXTURE	DEFORMED

Alteration: **W**(weathering), **D**(discoloration), **P**(polish), **C**(cutmarks), **G** (gnawing), **C**(cultural modifications).
For the case of weathering follow Behrensmeyer (1978) charts (see appendix).
Recording of colour: Munsell charts. Surface texture of cremated remains: **L** (longitudinally split),
T (transverse and longitudinal checking), **C**(curved cracks). Reference: Buikstra and Ubelaker, 1994.

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

GENERAL COMMENTS ON TAPHONOMY

SITE:	**Date:**
BURIAL NUMBER:	**Skeleton number:**

15.- LIST OF PHOTOGRAPHS FORM

PHOTO n.	INDIVIDUAL	BONE	SIDE	ASPECT	COMMENTS

SITE:	Date:
BURIAL NUMBER:	Skeleton number:

16.- LIST OF SAMPLES FOR STABLE ISOTOPES ANALYSIS

INDIVIDUAL	BONE	SIDE	SAMPLE (Total w.)	$\delta^{18}O$	$^{87/86}Sr$	$\delta^{13}C$	$\delta^{15}N$	CAST

Sample: record total weight. Record weight taken for each analysis $\delta^{13}C$,$\delta^{18}O$, $\delta^{15}N$ and $^{87/86}Sr$. Cast: Y(yes), N(no).

APPENDIX 2.1.- SKULL AND LONG BONE MEASUREMENTS

SITE	SECTOR	INDIVIDUAL	BAG	BONE	ELEMENT	SIDE	MEASUREMENT	N
VC	La Cima	C-1	-	Femur	Diaphysis	L	Midshaft circumference	74
VC	La Cima	C-1	-	Femur	Diaphysis	L	A-P Midshaft diameter	23.07
VC	La Cima	C-1	-	Femur	Diaphysis	L	M-L Midshaft diameter	21.80
VC	La Cima	C-1	-	Femur	Diaphysis	L	Max. diam. head	38.49
VC	La Cima	C-1	-	Femur	Diaphysis	R	Midshaft circumference	73
VC	La Cima	C-1	-	Femur	Diaphysis	R	M-L Midshaft diameter	23.78
VC	La Cima	C-1	-	Femur	Diaphysis	R	A-P Midshaft diameter	21.91
VC	La Cima	C-1	-	Humerus	Diaphysis	L	Midshaft circumference	54
VC	La Cima	C-1	-	Humerus	Diaphysis	L	M-L Midshaft diameter	14.17
VC	La Cima	C-1	-	Humerus	Diaphysis	L	Minimum diameter at	17.24
VC	La Cima	C-1	-	Humerus	DE	R	Epicondylar breadth	45.76
VC	La Cima	C-1	-	Tibia	Diaphysis	L	A-P Midshaft diameter	27.60
VC	La Cima	C-1	-	Tibia	Diaphysis	L	M-L Midshaft diameter	19.15
VC	La Cima	C-1	-	Radius	Diaphysis	R	A-P Midshaft diameter	11.21
VC	La Cima	C-1	-	Radius	Diaphysis	R	M-L Midshaft diameter	8.92
VC	La Cima	C-1	-	Ulna	Diaphysis	R	A-P diameter	15.65
VC	La Cima	C-1	-	Ulna	Diaphysis	R	M-L Diameter	17.08
VC	La Cima	C-1	-	Clavicle	Diaphysis	L	Midshaft circumference	34
VC	La Cima	C-1	-	Fibula	Diaphysis	L	Midshaft circumference	40
VC	La Cima	C-1	-	Fibula	Diaphysis	L	A-P Midshaft diameter	9.60
VC	La Cima	C-1	-	Fibula	Diaphysis	L	M-L Midshaft diameter	13.49
VC	La Cima	C-1	-	Fibula	Diaphysis	R	A-P Midshaft diameter	11.17
VC	La Cima	C-1	-	Fibula	Diaphysis	R	M-L Midshaft diameter	12.98
VC	La Gallega	G-1	-	Clavicle	Diaphysis	R	Midshaft circumference	33
VC	La Gallega	G-1	-	Scapula	Glenoid	L	Glenoid cavity length	32.95
VC	La Alcazaba	ALC-1	1	Humerus	Diaphysis	R	Minimum d. at midshaft	60
VC	La Alcazaba	ALC-1	1	Humerus	Diaphysis	R	Midshaft circumference	64
VC	La Alcazaba	ALC-1	1	Humerus	Diaphysis	R	M-L Midshaft diameter	22.12
VC	La Alcazaba	ALC-1	1	Humerus	Diaphysis	R	A-P Midshaft diameter	13.90
VC	La Alcazaba	ALC-1	1	Humerus	Diaphysis	L	Minimum d. at midshaft	61
VC	La Alcazaba	ALC-1	1	Humerus	Diaphysis	L	Midshaft circumference	63
VC	La Alcazaba	ALC-1	1	Humerus	Diaphysis	L	M-L Midshaft diameter	19.43
VC	La Alcazaba	ALC-1	1	Humerus	Diaphysis	L	A-P Midshaft diameter	15.83
VC	La Alcazaba	ALC-1	1	Femur	Diaphysis	R	A-P Subtrochanteric	24.23
VC	La Alcazaba	ALC-1	1	Femur	Diaphysis	R	M-L Subtrochanteric	29.65
VC	La Alcazaba	ALC-1	1	Femur	Diaphysis	R	Midshaft circumference	78
VC	La Alcazaba	ALC-1	1	Skull	Mastoid	L	Lenght	24.63
VC	La Alcazaba	ALC-1	1	Skull	Mastoid	L	Height	23.87
VC	La Alcazaba	ALC-1	1	Mandible	Mandible	-	Length	82.23
VC	La Alcazaba	ALC-1	1	Mandible	Mandible	-	Maximum ramus height	68.38
VC	La Alcazaba	ALC-1	1	Mandible	Mandible	-	Maximum ramus	32.74
VC	La Alcazaba	-	1	Humerus	Diaphysis	R	Minimum diameter at	54
VC	La Alcazaba	-	1	Humerus	Diaphysis	R	Midshaft circumference	57
VC	La Alcazaba	-	1	Humerus	Diaphysis	R	M-L Midshaft diameter	18.88
VC	La Alcazaba	-	1	Humerus	Diaphysis	R	A-P Midshaft diameter	13.42
VC	La Alcazaba	-	2	Clavicle	Diaphysis	R	Midshaft circumference	36
VC	La Alcazaba	-	2	Humerus	Diaphysis	R	Minimum diameter at	55
VC	La Alcazaba	-	2	Humerus	Diaphysis	R	Midshaft circumference	59
VC	La Alcazaba	-	2	Humerus	Diaphysis	R	M-L Midshaft diameter	17.98
VC	La Alcazaba	-	2	Humerus	Diaphysis	R	A-P Midshaft diameter	15.39
VC	La Alcazaba	-	2	Radius 1	Diaphysis	L	Maximum	40
VC	La Alcazaba	-	2	Radius 1	Diaphysis	L	Minimum d. at midshaft	34
VC	La Alcazaba	-	2	Radius 1	Diaphysis	L	Midshaft circumference	34
VC	La Alcazaba	-	2	Radius 1	Diaphysis	L	M-L Midshaft diameter	11.39
VC	La Alcazaba	-	2	Radius 1	Diaphysis	L	A-P Midshaft diameter	9.39
VC	La Alcazaba	-	2	Radius 2	Diaphysis	L	Maximum	48
VC	La Alcazaba	-	2	Radius 2	Diaphysis	L	Midshaft circumference	40

APPENDIX 2.1.- SKULL AND LONG BONE MEASUREMENTS

SITE	SECTOR	INDIVIDUAL	BAG	BONE	ELEMENT	SIDE	MEASUREMENT	N
VC	La Alcazaba	-	2	Radius 2	Diaphysis	L	M-L Midshaft diameter	13.87
VC	La Alcazaba	-	2	Radius 2	Diaphysis	L	A-P Midshaft diameter	10.44
VC	La Alcazaba	-	2	Radius 2	Diaphysis	L	Minimum diameter at	37
VC	La Alcazaba	-	2	Ulna 1	Diaphysis	L	A-P Diameter	14.26
VC	La Alcazaba	-	2	Ulna 1	Diaphysis	L	M-L Diameter	18.38
VC	La Alcazaba	-	2	Ulna 1	Diaphysis	L	Minimum d. at midshaft	35
VC	La Alcazaba	-	2	Ulna 1	Diaphysis	L	Maximum circumference	43
VC	La Alcazaba	-	2	Ulna 1	Diaphysis	L	M-L Midshaft diameter	11.56
VC	La Alcazaba	-	2	Ulna 1	Diaphysis	L	A-P Midshaft diameter	14.22
VC	La Alcazaba	-	2	Ulna 1	Diaphysis	R	Minimum diameter at	28
VC	La Alcazaba	-	2	Ulna 1	Diaphysis	R	Maximum circumference	39
VC	La Alcazaba	-	2	Ulna 1	Diaphysis	R	M-L Midshaft diameter	14.08
VC	La Alcazaba	-	2	Ulna 1	Diaphysis	R	A-P Midshaft diameter	11.76
VC	La Alcazaba	-	2	Clavicle	Diaphysis	L	Midshaft circumference	31
VC	La Alcazaba	-	2	Scapula	Glenoid	L	Glenoid width	22.67
VC	La Alcazaba	-	2	Clavicle	Diaphysis	R	Midshaft circumference	34
VC	La Alcazaba	-	2	Ulna 2	Diaphysis	L	A-P Diameter	12.70
VC	La Alcazaba	-	2	Ulna 2	Diaphysis	L	M-L Diameter	15.45
VC	La Alcazaba	-	2	Ulna 2	Diaphysis	L	Minimum d. at midshaft	30
VC	La Alcazaba	-	2	Ulna 2	Diaphysis	L	Maximum circumference	38
VC	La Alcazaba	-	2	Ulna 2	Diaphysis	L	A-P Midshaft diameter	10.98
VC	La Alcazaba	-	2	Ulna 2	Diaphysis	L	M-L Midshaft diameter	12.05
VC	La Alcazaba	-	2	Ulna 3	Diaphysis	L	A-P Diameter	14.32
VC	La Alcazaba	-	2	Ulna 3	Diaphysis	L	M-L Diameter	17.64
VC	La Alcazaba	-	2	Ulna 3	Diaphysis	L	Minimum d. at midshaft	38
VC	La Alcazaba	-	2	Ulna 3	Diaphysis	L	Maximum circumference	43
VC	La Alcazaba	-	2	Ulna 3	Diaphysis	L	A-P Midshaft diameter	14.01
VC	La Alcazaba	-	2	Ulna 3	Diaphysis	L	M-L Midshaft diameter	12.37
VC	La Alcazaba	-	3	Clavicle	Diaphysis	R	Maximum circumference	29
VC	La Alcazaba	-	3	Femur	Diaphysis	R	A-P Midshaft diameter	23.57
VC	La Alcazaba	-	3	Femur	Diaphysis	R	M-L Midshaft diameter	24.15
VC	La Alcazaba	-	3	Femur	Diaphysis	R	Midshaft circumference	75
VC	La Alcazaba	-	3	Humerus	Diaphysis	L	A-P Midshaft diameter	17.63
VC	La Alcazaba	-	3	Humerus	Diaphysis	L	M-L Midshaft diameter	17.52
VC	La Alcazaba	-	3	Humerus	Diaphysis	L	Midshaft circumference	56
VC	La Alcazaba	-	3	Ulna	Diaphysis	R	A-P Diameter	13.17
VC	La Alcazaba	-	3	Ulna	Diaphysis	R	M-L Diameter	15.29
VC	La Alcazaba	-	3	Ulna	Diaphysis	R	Midshaft circumference	45
VC	La Alcazaba	-	3	Ulna	Diaphysis	R	A-P Midshaft diameter	14.03
VC	La Alcazaba	-	3	Ulna	Diaphysis	R	M-L Midshaft diameter	12.32
VC	La Alcazaba	-	4	Humerus	Diaphysis	R	A-P Midshaft diameter	19.70
VC	La Alcazaba	-	4	Humerus	Diaphysis	R	M-L Midshaft diameter	19.45
VC	La Alcazaba	-	4	Humerus	Diaphysis	R	Midshaft circumference	65
VC	La Alcazaba	-	4	Femur	Diaphysis	R	A-P Midshaft diameter	24.74
VC	La Alcazaba	-	4	Femur	Diaphysis	R	M-L Midshaft diameter	23.82
VC	La Alcazaba	-	4	Femur	Diaphysis	R	Midshaft circumference	72
VC	La Alcazaba	-	4	Fibula	Diaphysis	R	A-P Midshaft diameter	14.88
VC	La Alcazaba	-	4	Fibula	Diaphysis	R	M-L Midshaft diameter	9.04
VC	La Alcazaba	-	4	Fibula	Diaphysis	R	Midshaft circumference	41
VC	La Alcazaba	-	4	Humerus	Diaphysis	L	A-P Midshaft diameter	14.97
VC	La Alcazaba	-	4	Humerus	Diaphysis	L	M-L Midshaft diameter	17.44
VC	La Alcazaba	-	4	Humerus	Diaphysis	L	Midshaft circumference	54
VC	La Alcazaba	-	4	Tibia	Diaphysis	L	A-P d. at the nutrient f.	31.31
VC	La Alcazaba	-	4	Tibia	Diaphysis	L	M-L d.at the nutrient f.	20.64
VC	La Alcazaba	-	4	Tibia	Diaphysis	L	Circ. at the nutrient f.	83
VC	La Alcazaba	-	4	Tibia	Diaphysis	L	A-P Midshaft diameter	27.78
VC	La Alcazaba	-	4	Tibia	Diaphysis	L	M-L Midshaft diameter	14.27

APPENDIX 2.1.- SKULL AND LONG BONE MEASUREMENTS

SITE	SECTOR	INDIVIDUAL	BAG	BONE	ELEMENT	SIDE	MEASUREMENT	N
VC	La Alcazaba	-	4	Tibia	Diaphysis	L	Midshaft	75
VC	La Alcazaba	-	4	Radius	Diaphysis	R	Maximum	46
VC	La Alcazaba	-	4	Radius	Diaphysis	R	Midshaft	40
VC	La Alcazaba	-	4	Radius	Diaphysis	R	A-P Midshaft diameter	11.02
VC	La Alcazaba	-	4	Radius	Diaphysis	R	M-L Midshaft diameter	14.34
VC	La Alcazaba	-	5	Femur	Diaphysis	L	A-P subthrochanteric	24.99
VC	La Alcazaba	-	5	Femur	Diaphysis	L	M-L subthrochanteric	34.37
VC	La Alcazaba	-	5	Scapula	Diaphysis	R	Glenoid cavity length	31.05
VC	La Alcazaba	-	5	Scapula	Diaphysis	R	Glenoid cavity width	18.27
VC	La Alcazaba	-	6	Humerus	Diaphysis	L	A-P midshaft diameter	19.73
VC	La Alcazaba	-	6	Humerus	Diaphysis	L	M-L midshaft diameter	16.14
VC	La Alcazaba	-	6	Humerus	Diaphysis	L	Midshaft	59
VC	La Alcazaba	-	6	Radius	Diaphysis	R	A-P midshaft diameter	10.32
VC	La Alcazaba	-	6	Radius	Diaphysis	R	M-L midshaft diameter	13.57
VC	La Alcazaba	-	6	Radius	Diaphysis	R	Midshaft	38
VC	La Alcazaba	-	6	Radius	Diaphysis	R	Minimum d at midshaft	36
VC	El Algarrobillo	ALG-1	1	Skull	Mastoid	R	Lenght	39.51
VC	El Algarrobillo	ALG-1	1	Skull	Mastoid	R	Height	18.84
VC	El Algarrobillo	ALG-7	7	Ulna	Diaphysis	R	Maximum lenght	261
VC	El Algarrobillo	ALG-7	7	Ulna	Diaphysis	R	A-P diameter	13.66
VC	El Algarrobillo	ALG-7	7	Ulna	Diaphysis	R	M-L diameter	18.82
VC	El Algarrobillo	ALG-7	7	Ulna	Diaphysis	R	Minimum diameter at	40
VC	El Algarrobillo	ALG-7	7	Ulna	Diaphysis	R	Midshaft	50
VC	El Algarrobillo	ALG-7	7	Ulna	Diaphysis	R	A-P midshaft diameter	15.60
VC	El Algarrobillo	ALG-7	7	Ulna	Diaphysis	R	M-L midshaft diameter	12.22
VC	El Algarrobillo	ALG-7	7	Ulna	DE	R	Maximum distal end	15.64
VC	El Algarrobillo	ALG-7	7	Skull	Palate	-	Lenght	46.81
VC	El Algarrobillo	ALG-7	7	Skull	Palate	-	Width	36.88
VC	El Algarrobillo	ALG-7	7	Skull	Palate	-	Maxillo-Alveolar lenght	58.73
VC	El Algarrobillo	ALG-7	7	Skull	Palate	-	Maxillo-Alveolar	67.98
VC	El Algarrobillo	ALG-8	8	Skull	Mastoid	R	Lenght	33.87
VC	El Algarrobillo	ALG-8	8	Skull	Mastoid	R	Width	24.16
VC	El Algarrobillo	ALG-10	10	Skull	Mastoid	R	Lenght	29.87
VC	El Algarrobillo	ALG-10	10	Skull	Mastoid	R	Width	23.60
VC	El Algarrobillo	ALG-11	11	Skull	-	-	Maximum breadth	200
VC	El Algarrobillo	ALG-11	11	Skull	-	-	Maximum frontal	120
VC	El Algarrobillo	ALG-11	11	Skull	Mastoid	R	Lenght	33.72
VC	El Algarrobillo	ALG-11	11	Skull	Mastoid	R	Width	20.22
VC	El Algarrobillo	ALG-11	11	Skull	Mastoid	L	Lenght	36.52
VC	El Algarrobillo	ALG-11	11	Skull	Palate	-	Maxillo-Alveolar	67.39
VC	El Algarrobillo	ALG-11	11	Skull	Palate	-	Maxillo-Alveolar lenght	62.39
VC	El Algarrobillo	ALG-11	11	Skull	Palate		Width	36.97
VC	El Algarrobillo	ALG-11	11	Skull	Palate		Length	52.34
VC	El Algarrobillo	ALG-12	12	Skull	Skull	-	Maximum frontal	113.59
VC	El Algarrobillo	ALG-12	12	Skull	Skull	L	Orbital height	33.16
VC	El Algarrobillo	ALG-12	12	Skull	Skull	L	Orbital breadth	41.96
VC	El Algarrobillo	ALG-12	12	Skull	Skull	-	Biorbital breadth	20.81
VC	El Algarrobillo	ALG-12	12	Skull	Skull	R	Orbital breadth	42.12
VC	El Algarrobillo	ALG-13	13	Skull	Skull	-	Maximum length	183
VC	El Algarrobillo	ALG-13	13	Skull	Skull	-	Maximum breadth	140
VC	El Algarrobillo	ALG-13	13	Skull	Skull	-	Biauricular breadth	138
VC	El Algarrobillo	ALG-13	13	Skull	Skull	-	Maximum horizontal	548
VC	El Algarrobillo	ALG-13	13	Skull	Mastoid	R	Lenght	29.67
VC	El Algarrobillo	ALG-13	13	Skull	Mastoid	R	Width	21.03
VC	El Algarrobillo	ALG-14	14	Skull	Mastoid	L	Lenght	27.92
VC	El Algarrobillo	ALG-14	14	Skull	Mastoid	L	Width	23.97
VC	Cerro de la	CC-3	-	Skull	Mastoid	R	Lenght	26.97
VC	Cerro de la	CC-3	-	Skull	Mastoid	R	Width	20.57
VC	Cerro de la	CC-3	-	Mandible	Mandible	-	Maximum ramus	54.76

APPENDIX 2.1.- SKULL AND LONG BONE MEASUREMENTS

SITE	SECTOR	INDIVIDUAL	BAG	BONE	ELEMENT	SIDE	MEASUREMENT	N
VC	Cerro de la	CC-3	-	Mandible	Mandible	-	Maximum ramus	46.50
VC	Cerro de la	CC-3	-	Radius	PE	L	Maximum head	17.47
VC	Cerro de la	CC-3	-	Radius	Diaphysis	L	Minimum diameter at	35
VC	Cerro de la	-	7	Clavicle	-	R	Maximum length	120.32
VC	Cerro de la	-	7	Clavicle	Diaphysis	R	Midshaft	33
VC	Cerro de la	-	7	Clavicle	Diaphysis	R	Midshaft	33
VC	Cerro de la	-	7	Mandible	Mandible	-	Length	91.07
VC	Cerro de la	-	7	Mandible	Mandible	-	Maximum ramus	27.96
VC	Cerro de la	-	7	Mandible	Mandible	-	Maximum ramus	42.01
VC	Cerro de la	-	9	Femur	Diaphysis	R	Midshaft	62
VC	Cerro de la	-	9	Femur	Diaphysis	R	A-P midshaft diameter	21.34
VC	Cerro de la	-	9	Femur	Diaphysis	R	M-L midshaft diameter	18.45
VC	Cerro de la	-	9	Femur	Diaphysis	L	Midshaft	64
VC	Cerro de la	-	9	Femur	Diaphysis	L	A-P midshaft diameter	20.98
VC	Cerro de la	-	9	Femur	Diaphysis	L	M-L midshaft diameter	19.40
VC	Cerro de la	-	9	Tibia	Diaphysis	L	Circ. at the nutrient f.	71
VC	Cerro de la	-	9	Tibia	Diaphysis	L	A-P d at the nutrient f.	26.09
VC	Cerro de la	-	9	Tibia	Diaphysis	L	M-L d at the nutrient f.	19.78
VC	Cerro de la	-	9	Tibia	Diaphysis	L	Midshaft	66
VC	Cerro de la	-	9	Tibia	Diaphysis	L	A-P midshaft diameter	23.94
VC	Cerro de la	-	9	Tibia	Diaphysis	L	M-L midshaft diameter	16.20
LP	Tomb 3	-	24	Femur	P 1/3	L	A-P midshaft diameter	17.75
LP	Tomb 3	-	24	Femur	P 1/3	L	M-L midshaft diameter	24.41
LP	Tomb 3	-	1730	Fibula	Complete	L	Long max	351
LP	Tomb 3	-	1810	Femur	Diaphysis	R	Maximum diameter	43.58
LP	Tomb 3	-	1998	Humerus	Diaphysis	R	Minimum diameter	42.81
LP	Tomb 3	-	1998	Humerus	Diaphysis	R	Epicondilar breadth	57,4
LP	Tomb 3	-	2682	Fibula	Diaphysis	L	A-P midshaft diameter	31.75
LP	Tomb 3	-	2682	Fibula	Diaphysis	L	M-L midshaft diameter	25.84
LP	Tomb 3	-	2685	Fibula	Complete	L	A-P midshaft diameter	14.58
LP	Tomb 3	-	2685	Fibula	Complete	L	M-L midshaft diameter	11.02
LP	Tomb 3	-	2685	Fibula	Complete	L	Distal width	24.13
LP	Tomb 3	-	2694	Fibula	D 1/3	R	Distal width	28.15
LP	Tomb 3	-	2694	Fibula	D 1/3	R	A-P midshaft diameter	15.85
LP	Tomb 3	-	2694	Fibula	D 1/3	R	M-L midshaft diameter	13.58
LP	Tomb 3	-	2704	Radius	Proximal	L	Width	22.11
LP	Tomb 3	-	2729	Radius	PE	I	Proximal end	20.23
LP	Tomb 3	-	2735	Radius	Distal	R	Distal width	32.49
LP	Tomb 3	-	2737	Humerus	M 1/3	L	A-P midshaft diameter	16.84
LP	Tomb 3	-	2737	Humerus	M 1/3	L	M-L midshaft diameter	18.49
LP	Tomb 3	-	2748	Femur	M 1/3	R	A-P midshaft diameter	30.82
LP	Tomb 3	-	2748	Femur	M 1/3	R	M-L midshaft diameter	26.25
LP	Tomb 3	-	2754	Humerus	M 1/3	L	A-P midshaft diameter	20.82
LP	Tomb 3	-	2754	Humerus	M 1/3	L	M-L midshaft diameter	23.81
LP	Tomb 3	-	2776	Femur	Proxima	R	Proximal end	43.27
LP	Tomb 3	-	2782	Femur	Complete	R	A-P midsharft	29.93
LP	Tomb 3	-	2782	Femur	Complete	R	M-L midshaft diameter	27.36
LP	Tomb 3	-	2789	Tibia	Diaphysis	R	A-P midshaft diameter	28.33
LP	Tomb 3	-	2789	Tibia	Diaphysis	R	M-L midshaft diameter	19.77
LP	Tomb 3	-	2798	Humerus	D 1/3	L	A-P midshaft diameter	17.1
LP	Tomb 3	-	2798	Humerus	D 1/3	L	M-L midshaft diameter	22.47
LP	Tomb 3	-	2801	Ulna	Proxima	L	A-P diameter	17.4
LP	Tomb 3	-	2801	Ulna	Proxima	L	M-L diameter	17.38
LP	Tomb 3	-	2801	Ulna	Proxima	L	A-P midshaft diameter	13.73
LP	Tomb 3	-	2801	Ulna	Proxima	L	M-L midshaft diameter	11.02
LP	Tomb 3	-	2802	Fibula	M 1/3	R	A-P midshaft diameter	14.53

APPENDIX 2.1.- SKULL AND LONG BONE MEASUREMENTS

SITE	SECTOR	INDIVIDUAL	BAG	BONE	ELEMENT	SIDE	MEASUREMENT	N
LP	Tomb 3	-	2802	Fibula	M 1/3	R	M-L midshaft	11.76
LP	Tomb 3	-	2811	Ulna	Diaphysis	R	M-L diameter	17.28
LP	Tomb 3	-	2811	Ulna	Diaphysis	R	A-P diameter	15.12
LP	Tomb 3	-	2821	Femur	M 1/3	R	A-P midshaft diameter	21
LP	Tomb 3	-	2821	Femur	M 1/3	R	M-L midshaft diameter	24.85
LP	Tomb 3	-	2858	Radius	DIAM 1/3	L	Distal end width	30.41
LP	Tomb 3	-	2858	Radius	M 1/3	L	A-P midshaft diameter	11.2
LP	Tomb 3	-	2858	Radius	M 1/3	L	M-L midshaft diameter	14.04
LP	Tomb 3	-	2876	Radius	M 1/3	L	A-P midshaft diameter	12.17
LP	Tomb 3	-	2876	Radius	M 1/3	L	M-L midshaft diameter	16.54
LP	Tomb 3	-	2877	Radius	M 1/3	R	A-P midshaft diameter	11.06
LP	Tomb 3	-	2877	Radius	M 1/3	R	M-L midshaft diameter	15.15
LP	Tomb 3	-	2878	Femur	Diaphysis	Ind	A-P midshaft diameter	32.65
LP	Tomb 3	-	2878	Femur	Diaphysis	Ind	M-L midshaft diameter	27.98
LP	Tomb 3	-	2880	Humerus	Diaphysis	R	A-P midshaft diameter	16.32
LP	Tomb 3	-	2880	Humerus	Diaphysis	R	M-L midshaft diameter	16.33
LP	Tomb 3	-	2888	Tibia	M 1/3	R	A-P midshaft diameter	33.45
LP	Tomb 3	-	2888	Tibia	M 1/3	R	M-L midshaft diameter	21.32
LP	Tomb 3	-	2891	Femur	M 1/3	R	A-P midshaft diameter	27.7
LP	Tomb 3	-	2891	Femur	M 1/3	R	M-L midshaft diameter	33.26
LP	Tomb 3	-	2898	Humerus	Dia M 1/3	R	A-P midshaft diameter	19.82
LP	Tomb 3	-	2898	Humerus	Dia M 1/3	R	M-L midshaft diameter	18.51
LP	Tomb 3	-	2920	Ulna	Diaphysis	L	A-P midshaft diameter	12.65
LP	Tomb 3	-	2920	Ulna	Diaphysis	L	M-L midshaft diameter	10.82
LP	Tomb 3	-	2930	Radius	Complete	L	Max. length	220.87
LP	Tomb 3	-	2930	Radius	Complete	L	Maximum head	20.04
LP	Tomb 3	-	2930	Radius	Complete	L	Distal end width	28.52
LP	Tomb 3	-	2930	Radius	Complete	L	A-P midshaft diameter	10.07
LP	Tomb 3	-	2930	Radius	Complete	L	M-L midshaft diameter	14.31
LP	Tomb 3	-	2939	Femur	Diaphysis	R	A-P midshaft diameter	29.07
LP	Tomb 3	-	2939	Femur	Diaphysis	R	M-L midshaft diameter	26.27
LP	Tomb 3	-	2944	Femur	Diaphysis	R	A-P midshaft diameter	15.22
LP	Tomb 3	-	2944	Femur	Diaphysis	R	M-L midshaft diameter	15.95
LP	Tomb 3	-	2968	Radius	Diaphysis	R	Max Length	220.95
LP	Tomb 3	-	2968	Radius	Diaphysis	R	Maximum head	19.54
LP	Tomb 3	-	2968	Radius	Diaphysis	R	A-P midshaft diameter	10.06
LP	Tomb 3	-	2968	Radius	Diaphysis	R	M-L midshaft diameter	12.73
LP	Tomb 3	-	2978	Tibia	Diaphysis	R	A-P midshaft diameter	38.15
LP	Tomb 3	-	2978	Tibia	Diaphysis	R	M-L midshaft diameter	24.26
LP	Tomb 3	-	2983	Radius	DE	R	Distal end width	32.96
LP	Tomb 3	-	2983	Radius	Proximal	R	Maximum head	21.61
LP	Tomb 3	-	2985	Femur	M 1/3	R	A-P midshaft diameter	23.41
LP	Tomb 3	-	2985	Femur	M 1/3	R	M-L midshaft diameter	20.19
LP	Tomb 3	-	2995	Radius	Head	R	Maximum head	20.02
LP	Tomb 3	-	3045	Humerus	Diaphysis	R	A-P midshaft diameter	18.02
LP	Tomb 3	-	3045	Humerus	Diaphysis	R	M-L midshaft diameter	23.03
LP	Tomb 3	-	3050	Humerus	Dia M 1/3	R	A-P midshaft diameter	19.69
LP	Tomb 3	-	3050	Humerus	Dia M 1/3	R	M-L midshaft diameter	18.85
LP	Tomb 3	-	3097	Scapula	Glenoid	R	Widht	22.96
LP	Tomb 3	-	3097	Scapula	Glenoid	R	Heigh	34.79
LP	Tomb 3	-	3157	Mandible	LLM1	-	MD	11.47
LP	Tomb 3	-	3157	Mandible	LLM1	-	BL	10.05
LP	Tomb 3	-	3157	Mandible	LLM1	-	CH	7.11
LP	Tomb 3	-	3948	Tibia	M 1/3	R	A-P midshaft diameter	28.36
LP	Tomb 3	-	3948	Tibia	M 1/3	R	M-L midshaft diameter	22.45
LP	Tomb 3	-	3962	Ulna	DE	R	Minimun d. at midshaft	39
LP	Tomb 3	-	4073	Femur	M 1/3	R	Tranverse diameter	34.06

APPENDIX 2.1.- SKULL AND LONG BONE MEASUREMENTS

SITE	SECTOR	INDIVIDUAL	BAG	BONE	ELEMENT	SIDE	MEASUREMENT	N
LP	Tomb 3	-	4073	Femur	M 1/3	R	M-L midshaft	29.02
LP	Tomb 3	-	4094	Long	Diaphysis	-	Transverse d.	21.35
LP	Tomb 3	-	4094	Long	Diaphysis	-	M-L mishaft	16.21
LP	Tomb 3	-	4094	Long	Diaphysis	-	Minimum diameter	66
LP	Tomb 3	-	4130	Humerus	Diaphysis	R	A-P midshaft	9.4
LP	Tomb 3	-	4130	Humerus	Diaphysis	R	M-L midshaft	10.79
LP	Tomb 3	-	4144	Humerus	Proximal	R	A-P midshaft	17.45
LP	Tomb 3	-	4144	Humerus	Proximal	R	M-L midshaft	21.05
LP	Tomb 3	-	4144	Humerus	Proximal	R	Minimum diameter	69
LP	Tomb 3	-	4148	Radius	Diaphysis	R	A-P midshaft	10.61
LP	Tomb 3	-	4148	Radius	Diaphysis	R	M-L midshaft	15.62
LP	Tomb 3	-	4148	Radius	Diaphysis	R	Minimum diameter	45
LP	Tomb 3	-	4152	Humerus	Diaphysis	I	A-P midshaft	16.83
LP	Tomb 3	-	4152	Humerus	Diaphysis	I	M-L midshaft	20.55
LP	Tomb 3	-	4152	Humerus	Diaphysis	I	Minimum diameter	67
LP	Tomb 3	-	4175	Femur	Diaphysis	I	A-P midshaft	30.26
LP	Tomb 3	-	4175	Femur	Diaphysis	I	M-L midshaft	22.9
LP	Tomb 3	-	4175	Femur	Diaphysis	I	Minimum diameter	89
LP	Tomb 3	-	4194	Ulna	DE	I	Dist width	18.92
LP	Tomb 3	-	4194	Ulna	DE	I	Minimum diameter	35
LP	Tomb 3	-	4195	Ulna	Diaphysis	I	A-P midshaft	12.08
LP	Tomb 3	-	4195	Ulna	Diaphysis	I	M-L midshaft	10.78
LP	Tomb 3	-	4198	Radius	Proximal	I	Diameter head	21.17
LP	Tomb 3	-	4248	Humerus	M 1/3	L	A-P midshaft	11.67
LP	Tomb 3	-	4248	Humerus	M 1/3	L	M-L midshaft	12.86
LP	Tomb 3	-	4250	Humerus	Diaphysis	L	A-P midshaft	18.82
LP	Tomb 3	-	4250	Humerus	Diaphysis	L	M-L midshaft	20.2
LP	Tomb 3	-	4271	Clavicle	Diaphysis	L	Minimum diameter	38
LP	Tomb 3	-	4321	Radius	M 1/3	L	A-P midshaft	10.68
LP	Tomb 3	-	4321	Radius	M 1/3	L	M-L midshaft	13.12
LP	Tomb 3	-	4333	Humerus	Diaphysis	R	A-P midshaft	17.05
LP	Tomb 3	-	4333	Humerus	Diaphysis	R	M-L midshaft	23.26
LP	Tomb 3	-	4339	Hands	5th D ph	R	Distal width	65.84
LP	Tomb 3	-	4350	Femur	M 1/3	L	A-P midshaft	30.88
LP	Tomb 3	-	4350	Femur	M 1/3	L	M-L midshaft	24.15
LP	Tomb 3	-	4370	Humerus	M 1/3	R	A-P midshaft	21.12
LP	Tomb 3	-	4370	Humerus	M 1/3	R	M-L midshaft	18.83
LP	Tomb 3	-	4370	Humerus	M 1/3	R	Minimum diameter	62
LP	Tomb 3	-	4385	Radius	Diaphysis	R	Diameter at radial	53
LP	Tomb 3	-	4385	Radius	Diaphysis	R	A-P midshaft	11
LP	Tomb 3	-	4385	Radius	Diaphysis	R	M-L midshaft	15.54
LP	Tomb 3	-	4417	Femur	Diaphysis	L	A-P midshaft	27.14
LP	Tomb 3	-	4417	Femur	Diaphysis	L	M-L midshaft	23.12
LP	Tomb 3	-	4435	Fibula	Diaphysis	L	Distal width	27.74
LP	Tomb 3	-	4441	Tibia	M 1/3	R	A-P midshaft	37.55
LP	Tomb 3	-	4441	Tibia	M 1/3	R	M-L midshaft	22.7
LP	Tomb 3	-	4441	Tibia	M 1/3	R	Diam nutrient	100
LP	Tomb 3	-	4451	Femur	Diaphysis	L	A-P midshat	20.61
LP	Tomb 3	-	4451	Femur	Diaphysis	L	M-L midshaft	26.24
LP	Tomb 3	-	4451	Femur	Diaphysis	L	A-P midshaft	24.32
LP	Tomb 3	-	4451	Femur	Diaphysis	L	M-L midshaft	24.06
LP	Tomb 3	-	4451	Femur	Diaphysis	L	Minimum diameter	89
LP	Tomb 3	-	4451	Femur	Proxima	L	Head	37.29
LP	Tomb 3	-	4451	Femur	Proxima	L	Head	37.01
LP	Tomb 3	-	4454	Ulna	Diaphysis	L	A-P subthrochanteric	14.77
LP	Tomb 3	-	4454	Ulna	Diaphysis	L	M-L subthrochanteric	17.94
LP	Tomb 3	-	4476	Humerus	Diaphysis	R	A-P midshaft	16.13
LP	Tomb 3	-	4476	Humerus	Diaphysis	R	M-L midshaft	20.12
LP	Tomb 3	-	4484	Ulna	Diaphysis	L	A-P	16.2

APPENDIX 2.1.- SKULL AND LONG BONE MEASUREMENTS

SITE	SECTOR	INDIVIDUAL	BAG	BONE	ELEMENT	SIDE	MEASUREMENT	N
LP	Tomb 3	-	4484	Ulna	Diaphysis	L	M-L	17.7
LP	Tomb 3	-	4495	Femur	Diaphysis	R	A-P midshaft	34.42
LP	Tomb 3	-	4495	Femur	Diaphysis	R	M-L midshaft	25.98
LP	Tomb 3	-	4495	Femur	Diaphysis	R	Diameter	100
LP	Tomb 3	-	4504	Humerus	DE	L	Distal width	55.05
LP	Tomb 3	-	4504	Humerus	DE	L	A-P midshaft	17.1
LP	Tomb 3	-	4504	Humerus	DE	L	M-L midshaft	19.25
LP	Tomb 3	-	4504	Humerus	DE	L	D. at midshaft	92
LP	Tomb 3	-	4534	Femur	M 1/3	L	A-P midshaft	27.68
LP	Tomb 3	-	4534	Femur	M 1/3	L	M-L midshaft	31.59
LP	Tomb 3	-	4534	Femur	M 1/3	L	Midshaft	95
LP	Tomb 3	-	4564	Humerus	Diaphysis	R	A-P midshaft	18.32
LP	Tomb 3	-	4564	Humerus	Diaphysis	R	M-L midshaft	18.9
LP	Tomb 3	-	4564	Humerus	Diaphysis	R	Midshaft	64
LP	Tomb 3	-	4633	Femur	Diaphysis	L	A-P midshaft	27.11
LP	Tomb 3	-	4633	Femur	Diaphysis	L	M-L midshaft	30.04
LP	Tomb 3	-	4633	Femur	Diaphysis	L	Midshaft	96
LP	Tomb 3	-	4646	Radius	Diaphysis	L	A-P midshaft	9.49
LP	Tomb 3	-	4646	Radius	Diaphysis	L	M-L midshaft	12.83
LP	Tomb 3	-	4646	Radius	Diaphysis	L	Midshaft	38
LP	Tomb 3	-	4687	Ulna	Diaphysis	L	A-P midshaft	10.29
LP	Tomb 3	-	4687	Ulna	Diaphysis	L	M-L midshaft	14.43
LP	Tomb 3	-	4687	Ulna	Diaphysis	L	Midshaft	43
LP	Tomb 3	-	4688	Humerus	Dia M 1/3	R	A-P midshaft	15.08
LP	Tomb 3	-	4688	Humerus	Dia M 1/3	R	M-L midshaft	19.35
LP	Tomb 3	-	4688	Humerus	Dia M 1/3	R	Midshaft	60
LP	Tomb 3	-	4715	Femur	Diaphysis	L	A-P midshaft	26.31
LP	Tomb 3	-	4715	Femur	Diaphysis	L	M-L midshaft	25.9
LP	Tomb 3	-	4715	Femur	Diaphysis	L	Midshaft	84
LP	Tomb 3	-	4725	Radius	Diaphysis	R	Head	20.23
LP	Tomb 3	-	4737	Fibula	DE	R	Dist W	23.88
LP	Tomb 3	-	4743	Fibula	DE	R	Dist W	19.15
LP	Tomb 3	-	4748	Humerus	Proximal	L	Vert H	41.94
LP	Tomb 3	-	4748	Humerus	Diaphysis	L	A-P midshaft	16.98
LP	Tomb 3	-	4748	Humerus	Diaphysis	L	M-L midshaft	18.4
LP	Tomb 3	-	4748	Humerus	Diaphysis	L	Midshaft	63
LP	Tomb 3	-	4752	Fibula	Diaphysis	-	A-P midshaft	16.51
LP	Tomb 3	-	4752	Fibula	Diaphysis	-	M-L midshaft	12.96
LP	Tomb 3	-	4752	Fibula	Diaphysis	-	Midshaft	51
LP	Tomb 3	-	4767	Humerus	Diaphysis	R	A-P midshaft	15.51
LP	Tomb 3	-	4767	Humerus	Diaphysis	R	M-L midshaft	19.34
LP	Tomb 3	-	4767	Humerus	Diaphysis	R	Midshaft	61
LP	Tomb 3	-	4777	Femur	Diaphysis	L	A-P midshaft	26.65
LP	Tomb 3	-	4777	Femur	Diaphysis	L	M-L midshaft	26.97
LP	Tomb 3	-	4777	Femur	Diaphysis	L	Midshaft	88
LP	Tomb 3	-	4794	Ulna	Diaphysis	R	A-P midshaft	10.95
LP	Tomb 3	-	4794	Ulna	Diaphysis	R	M-L midshaft	10.2
LP	Tomb 3	-	4794	Ulna	Diaphysis	R	Midshaft	40
LP	Tomb 3	-	4819	Radius	Diaphysis	L	A-P midshaft	11.61
LP	Tomb 3	-	4819	Radius	Diaphysis	L	M-L midshaft	14.2
LP	Tomb 3	-	4819	Radius	Diaphysis	L	Midshaft	44
LP	Tomb 3	-	4834	Humerus	Dia M 1/3	L	A-P midshaft	17.92
LP	Tomb 3	-	4834	Humerus	Dia M 1/3	L	M-L midshaft	18.82
LP	Tomb 3	-	4834	Humerus	Dia M 1/3	L	Midshaft	66
LP	Tomb 3	-	4845	Tibia	Diaphysis	R	A-P midshaft	27.57
LP	Tomb 3	-	4845	Tibia	Diaphysis	R	M-L midshaft	21.9
LP	Tomb 3	-	4845	Tibia	Diaphysis	R	Midshaft	83
LP	Tomb 3	-	4853	Fibula	Diaphysis	L	A-P midshaft	17.07
LP	Tomb 3	-	4853	Fibula	Diaphysis	L	M-L midshaft	11.14

APPENDIX 2.1.- SKULL AND LONG BONE MEASUREMENTS

SITE	SECTOR	INDIVIDUAL	BAG	BONE	ELEMENT	SIDE	MEASUREMENT	N
LP	Tomb 3	-	4853	Fibula	Diaphysis	L	Midshaft	51
LP	Tomb 3	-	4857	Radius	Diaphysis	L	A-P midshaft	11.62
LP	Tomb 3	-	4857	Radius	Diaphysis	L	M-L midshaft	16.75
LP	Tomb 3	-	4857	Radius	Diaphysis	L	Midshaft	47
LP	Tomb 3	-	4870	Radius	Diaphysis	R	A-P midshaft	10.45
LP	Tomb 3	-	4870	Radius	Diaphysis	R	M-L midshaft	13.86
LP	Tomb 3	-	4870	Radius	Diaphysis	R	Midshaft	41
LP	Tomb 3	-	4882	Skull	Mastoid	R	Height	34.45
LP	Tomb 3	-	4882	Skull	Mastoid	R	Width	25.72
LP	Tomb 3	-	4890	Tibia	Dia M 1/3	R	A-P midshaft	33.51
LP	Tomb 3	-	4890	Tibia	Dia M 1/3	R	M-L midshaft	21.98
LP	Tomb 3	-	4890	Tibia	Dia M 1/3	R	Midshaft	93
LP	Tomb 3	-	4893	Fibula	Dia M 1/3	R	A-P midshaft	18.66
LP	Tomb 3	-	4893	Fibula	Dia M 1/3	R	M-L midshaft	10.67
LP	Tomb 3	-	4893	Fibula	Dia M 1/3	R	Midshaft	48
LP	Tomb 3	-	4911	Tibia	Diaphysis	L	A-P midshaft	27.86
LP	Tomb 3	-	4911	Tibia	Diaphysis	L	M-L midshaft	19.9
LP	Tomb 3	-	4911	Tibia	Diaphysis	L	Midshaft	81
LP	Tomb 3	-	4921	Femur	Diaphysis	R	A-P midshaft	28.16
LP	Tomb 3	-	4921	Femur	Diaphysis	R	M-L midshaft	27.9
LP	Tomb 3	-	4921	Femur	Diaphysis	R	Midshaft	90
LP	Tomb 3	-	4930	Humerus	Diaphysis	L	A-P midshaft	16.98
LP	Tomb 3	-	4930	Humerus	Diaphysis	L	M-L midshaft	13.03
LP	Tomb 3	-	4930	Humerus	Diaphysis	L	Midshaft	57
LP	Tomb 3	-	4947	Ulna	DE	L	Distal width	19.84
LP	Tomb 3	-	4950	Ulna	Diaphysis	R	A-P midshaft	16.71
LP	Tomb 3	-	4950	Ulna	Diaphysis	R	M-L midshaft	21.34
LP	Tomb 3	-	5006	Fibula	Dia M 1/3	R	A-P midshaft	13.64
LP	Tomb 3	-	5006	Fibula	Dia M 1/3	R	M-L midshaft	10.64
LP	Tomb 3	-	5006	Fibula	Dia M 1/3	R	Midshaft diameter	40
LP	Tomb 3	-	5011	Clavicle	Diaphysis	L	Diameter midshaft	37
LP	Tomb 3	-	5032	Femur	Proximal	R	Vertical H	36.24
LP	Tomb 3	-	5032	Femur	Proximal	R	Horizontal H	36.26
LP	Tomb 3	-	5032	Femur	Dia M 1/3	R	A-P midshaft	16.31
LP	Tomb 3	-	5032	Femur	Dia M 1/3	R	M-L midshaft	17.13
LP	Tomb 3	-	5032	Femur	Dia M 1/3	R	Midshaft diameter	57
LP	Tomb 3	-	5037	Femur	Dia M 1/3	L	A-P midshaft	25.01
LP	Tomb 3	-	5037	Femur	Dia M 1/3	L	M-L midshaft	25.65
LP	Tomb 3	-	5037	Femur	Dia M 1/3	L	Midshaft diameter	86
LP	Tomb 3	-	5042	Humerus	Dia PE	R	Vert H	38.23
LP	Tomb 3	-	5042	Humerus	Dia PE	R	A-P midshaft	15.61
LP	Tomb 3	-	5042	Humerus	Dia PE	R	M-L midshaft	19.91
LP	Tomb 3	-	5042	Humerus	Dia PE	R	Minimum diameter	60
LP	Tomb 3	-	5042	Humerus	Dia PE	R	Maximum diameter	63
LP	Tomb 3	-	5042	Humerus	P 1/3	R	Transverse	62
LP	Tomb 3	-	5055	Fibula	Distal end	R	Dist width	23.42
LP	Tomb 3	-	5099	Ulna	Distal end	R	Dist width	20.35
LP	Tomb 3	-	5181	Humerus	Diaphysis	R	A-P midshaft	17.69
LP	Tomb 3	-	5181	Humerus	Diaphysis	R	M-L midshaft	19.22
LP	Tomb 3	-	5181	Humerus	Diaphysis	R	Midshaft diameter	62
LP	Tomb 3	-	5203	Ulna	Dia M 1/3	L	A-P midshaft	8.77
LP	Tomb 3	-	5203	Ulna	Dia M 1/3	L	M-L midshaft	10.04
LP	Tomb 3	-	5203	Ulna	Dia M 1/3	L	Midshaft diameter	32
LP	Tomb 3	-	5239	Fibula	Distal End	R	Distal width	21.93
LP	Tomb 3	-	5264	Humerus	Diaphysis	R	A-P midshaft	14.84
LP	Tomb 3	-	5264	Humerus	Diaphysis	R	M-L midshaft	17.82
LP	Tomb 3	-	5264	Humerus	Diaphysis	R	Midshaft diameter	54
LP	Tomb 3	-	5305	Humerus	Diaphysis	L	A-P midshaft	18.17
LP	Tomb 3	-	5305	Humerus	Diaphysis	L	M-L midshaft	18.58

APPENDIX 2.1.- SKULL AND LONG BONE MEASUREMENTS

SITE	SECTOR	INDIVIDUAL	BAG	BONE	ELEMENT	SIDE	MEASUREMENT	N
LP	Tomb 3	-	5305	Humerus	Diaphysis	L	Midshaft diameter	64
LP	Tomb 3	-	5309	Clavicle	Diaphysis	L	Midshaft diameter	41
LP	Tomb 3	-	5342	Femur	P 1/3	L	A-P midshaft	9.57
LP	Tomb 3	-	5342	Femur	P 1/3	L	M-L midshaft	12.37
LP	Tomb 3	-	5342	Femur	P 1/3	L	Midshaft diameter	39
LP	Tomb 3	-	5362	Radius	Diaphysis	L	A-P midshaft	11.3
LP	Tomb 3	-	5362	Radius	Diaphysis	L	M-L midshaft	13.71
LP	Tomb 3	-	5362	Radius	Diaphysis	L	Midshaft diameter	42
LP	Tomb 3	-	5362	Radius	Diaphysis	L	Distal width	30.63
LP	Tomb 3	-	5382	Fibula	Diaphysis	R	Minimum diameter	30
LP	Tomb 3	-	5382	Fibula	Diaphysis	R	A-P midshaft	6.66
LP	Tomb 3	-	5382	Fibula	Diaphysis	R	M-L midshaft	8.94
LP	Tomb 3	-	5382	Fibula	Diaphysis	R	Maximum diameter	33
LP	Tomb 3	-	5398	Ulna	Diaphysis	L	A-P midshaft	10.61
LP	Tomb 3	-	5398	Ulna	Diaphysis	L	M-L midshaft	13.17
LP	Tomb 3	-	5398	Ulna	Diaphysis	L	Minimum diameter	43
LP	Tomb 3	-	5398	Ulna	Diaphysis	L	Midshaft diameter	46
LP	Tomb 3	-	5420	Humerus	Diaphysis	L	A-P midshaft	17.47
LP	Tomb 3	-	5420	Humerus	Diaphysis	L	M-L midshaft	17.98
LP	Tomb 3	-	5420	Humerus	Diaphysis	L	Midshaft diameter	61
LP	Tomb 3	-	5426	Clavicle	Complete	R	Midshaft diameter	22
LP	Tomb 3	-	5450	Radius	Dia M 1/3	L	Midshaft diameter	19
LP	Tomb 3	-	5450	Radius	Dia M 1/3	L	A-P midshaft	5.41
LP	Tomb 3	-	5450	Radius	Dia M 1/3	L	M-L midshaft	7.2
LP	Tomb 3	-	5478	Tibia	Diaphysis	L	A-P nutrient	18.61
LP	Tomb 3	-	5478	Tibia	Diaphysis	L	M-L nutrient	13.66
LP	Tomb 3	-	5478	Tibia	Diaphysis	L	Diameter at nutrient	54
LP	Tomb 3	-	5491	Fibula	Diaphysis	R	A-P midshaft	10.83
LP	Tomb 3	-	5491	Fibula	Diaphysis	R	M-L midshaft	9.24
LP	Tomb 3	-	5491	Fibula	Diaphysis	R	Midshaft diameter	35
LP	Tomb 3	-	5492	Fibula	Diaphysis	L	A-P midshaft	12.7
LP	Tomb 3	-	5492	Fibula	Diaphysis	L	M-L midshaft	10.51
LP	Tomb 3	-	5492	Fibula	Diaphysis	L	Maximum Diameter	41
LP	Tomb 3	-	5504	Tibia	Diaphysis	R	A-P midshaft	25.32
LP	Tomb 3	-	5504	Tibia	Diaphysis	R	M-L midshaft	15.62
LP	Tomb 3	-	5504	Tibia	Diaphysis	R	Maximum diameter	72
LP	Tomb 3	-	5523	Fibula	Diaphysis	L	A-P midshaft	8.79
LP	Tomb 3	-	5523	Fibula	Diaphysis	L	M-L midshaft	6.79
LP	Tomb 3	-	5523	Fibula	Diaphysis	L	Maximum	29
LP	Tomb 3	-	5524	Humerus	Diaphysis	R	A-P midshaft	17.79
LP	Tomb 3	-	5524	Humerus	Diaphysis	R	M-L midshaft	21.52
LP	Tomb 3	-	5524	Humerus	Diaphysis	R	Maximum Diameter	66
LP	Tomb 3	-	5524	Humerus	Diaphysis	R	Minimum Diameter	63
LP	Tomb 3	-	5540	Femur	Dia M 1/3	R	A-P midshaft	19.05
LP	Tomb 3	-	5540	Femur	Dia M 1/3	R	M-L midshaft	19.13
LP	Tomb 3	-	5540	Femur	Dia M 1/3	R	Maximum diameter	67
LP	Tomb 3	-	5550	Humerus	Diaphysis	R	A-P midshaft	22.56
LP	Tomb 3	-	5550	Humerus	Diaphysis	R	M-L midshaft	16.08
LP	Tomb 3	-	5550	Humerus	Diaphysis	R	Maximum diameter	68
LP	Tomb 3	-	5594	Femur	Diaphysis	R	A-P midshaft	25.42
LP	Tomb 3	-	5594	Femur	Diaphysis	R	M-L midshaft	21.42
LP	Tomb 3	-	5594	Femur	Diaphysis	R	Maximum diameter	76
LP	Tomb 3	-	5647	Humerus	Diaphysis	L	A-P midshaft	10.23
LP	Tomb 3	-	5647	Humerus	Diaphysis	L	M-L midshaft	11.92
LP	Tomb 3	-	5647	Humerus	Diaphysis	L	Maximum diameter	0
LP	Tomb 3	-	5651	Ulna	Dia P 1/3	R	A-P midshaft	17
LP	Tomb 3	-	5651	Ulna	Dia P 1/3	R	M-L midshaft	17.5
LP	Tomb 3	-	5652	Fibula	Diaphysis	L	A-P midshaft	15.2
LP	Tomb 3	-	5652	Fibula	Diaphysis	L	M-L midshaft	13.07

APPENDIX 2.1.- SKULL AND LONG BONE MEASUREMENTS

SITE	SECTOR	INDIVIDUAL	BAG	BONE	ELEMENT	SIDE	MEASUREMENT	N
LP	Tomb 3	-	5652	Fibula	Diaphysis	L	Maximum diameter	51
LP	Tomb 3	-	5667	Radius	P 1/3	-	Transverse	30
LP	Tomb 3	-	5699	Clavicle	Diaphysis	R	Maximum diameter	36
LP	Tomb 3	-	5740	Tibia	Diaphysis	L	A-P nutrient	42.61
LP	Tomb 3	-	5740	Tibia	Diaphysis	L	M-L nutrient	28.75
LP	Tomb 3	-	5740	Tibia	Diaphysis	L	Diameter at nutrient	120
LP	Tomb 3	-	5742	Femur	Dia M 1/3	R	A-P midshaft	22.92
LP	Tomb 3	-	5742	Femur	Dia M 1/3	R	M-L midshaft	22.22
LP	Tomb 3	-	5742	Femur	Dia M 1/3	R	Maximum diameter	75
LP	Tomb 3	-	5810	Ulna	Complete	R	Lengh	234
LP	Tomb 3	-	5810	Ulna	Complete	R	A-P midshaft	12.66
LP	Tomb 3	-	5810	Ulna	Complete	R	M-L midshaft	14.48
LP	Tomb 3	-	5810	Ulna	Complete	R	Minimum diameter	33
LP	Tomb 3	-	5810	Ulna	Diaphysis	R	A-P midshaft	12.5
LP	Tomb 3	-	5810	Ulna	Diaphysis	R	M-L midshaft	10.71
LP	Tomb 3	-	5810	Ulna	Diaphysis	R	Maximum diameter	41
LP	Tomb 3	-	5839	Tibia	Diaphysis	L	A-P Nutrient	33.5
LP	Tomb 3	-	5839	Tibia	Diaphysis	L	M-L Nutrient	15.52
LP	Tomb 3	-	5850	Humerus	Diaphysis	L	A-P midshaft	20.35
LP	Tomb 3	-	5850	Humerus	Diaphysis	L	M-L midshaft	19.55
LP	Tomb 3	-	5850	Humerus	Diaphysis	L	Maximum diameter	68
LP	Tomb 3	-	6035	Femur	Diaphysis	R	A-P midshaft	23.98
LP	Tomb 3	-	6035	Femur	Diaphysis	R	M-L midshaft	20.05
LP	Tomb 3	-	6035	Femur	Diaphysis	R	Maximum diameter	73
LP	Tomb 3	-	6064	Fibula	Diaphysis	R	A-P midshaft	11.11
LP	Tomb 3	-	6064	Fibula	Diaphysis	R	M-L midshaft	8.22
LP	Tomb 3	-	6064	Fibula	Diaphysis	R	Maximum diameter	37
LP	Tomb 3	-	6064	Fibula	Diaphysis	R	Minimum diameter	30
LP	Tomb 3	-	6088	Humerus	Diaphysis	R	A-P midshaft	13.29
LP	Tomb 3	-	6088	Humerus	Diaphysis	R	M-L midshaft	18.48
LP	Tomb 3	-	6088	Humerus	Diaphysis	R	Maximum diameter	90
LP	Tomb 3	-	6098	Tibia	Diaphysis	L	A-P midshaft	28.25
LP	Tomb 3	-	6098	Tibia	Diaphysis	L	M-L midshaft	19.92
LP	Tomb 3	-	6098	Tibia	Diaphysis	L	Maximum diameter	82
LP	Tomb 3	-	6107	Radius	Diaphysis	R	A-P midshaft	9.77
LP	Tomb 3	-	6107	Radius	Diaphysis	R	M-L midshaft	11.86
LP	Tomb 3	-	6107	Radius	Diaphysis	R	Maximum diameter	36
LP	Tomb 3	-	6116	Ulna	Proximal	L	A-P midshaft	13.34
LP	Tomb 3	-	6116	Ulna	Proximal	L	M-L midshaft	15.88
LP	Tomb 3	-	6125	Humerus	Dia M 1/3	R	A-P midshaft	18.84
LP	Tomb 3	-	6125	Humerus	Dia M 1/3	R	M-L midshaft	18.68
LP	Tomb 3	-	6125	Humerus	Dia M 1/3	R	Maximum diameter	64
LP	Tomb 3	-	6138	Femur	Diaphysis	L	A-P midshaft	24.24
LP	Tomb 3	-	6138	Femur	Diaphysis	L	M-L midshaft	21.81
LP	Tomb 3	-	6138	Femur	Diaphysis	L	Maximum diameter	78
LP	Tomb 3	-	6139	Humerus	Diaphysis	L	A-P midshaft	9.77
LP	Tomb 3	-	6139	Humerus	Diaphysis	L	M-L midshaft	11.76
LP	Tomb 3	-	6139	Humerus	Diaphysis	L	Maximum diameter	41
LP	Tomb 3	-	6199	Humerus	Diaphysis	L	A-P midshaft	13.25
LP	Tomb 3	-	6199	Humerus	Diaphysis	L	M-L midshaft	16.34
LP	Tomb 3	-	6199	Humerus	Diaphysis	L	Maximum diameter	54
LP	Tomb 3	-	6199	Humerus	Diaphysis	L	Minimum diameter	53
LP	Tomb 3	-	6243	Humerus	Diaphysis	R	A-P midshaft	14.12
LP	Tomb 3	-	6243	Humerus	Diaphysis	R	M-L midshaft	17.26
LP	Tomb 3	-	6243	Humerus	Diaphysis	R	Maximum diameter	57
LP	Tomb 3	-	6416	Humerus	Diaphysis	L	A-P midshaft	13.02
LP	Tomb 3	-	6416	Humerus	Diaphysis	L	M-L midshaft	14.74
LP	Tomb 3	-	6416	Humerus	Diaphysis	L	Maximum diameter	53
LP	Tomb 3	-	6418	Radius	Diaphysis	R	A-P midshaft	11.83

APPENDIX 2.1.- SKULL AND LONG BONE MEASUREMENTS

SITE	SECTOR	INDIVIDUAL	BAG	BONE	ELEMENT	SIDE	MEASUREMENT	N
LP	Tomb 3	-	6418	Radius	Diaphysis	R	M-L midshaft	16.23
LP	Tomb 3	-	6418	Radius	Diaphysis	R	Maximum diameter	49
LP	Tomb 3	-	6535	Femur	Diaphysis	R	A-P midshaft	14
LP	Tomb 3	-	6535	Femur	Diaphysis	R	M-L midshaft	14.73
LP	Tomb 3	-	6535	Femur	Diaphysis	R	Maximum diameter	48
LP	Tomb 3	-	6599	Fibula	Diaphysis	R	A-P midshaft	13.79
LP	Tomb 3	-	6599	Fibula	Diaphysis	R	M-L midshaft	9.78
LP	Tomb 3	-	6599	Fibula	Diaphysis	R	Maximum diameter	42
LP	Tomb 3	-	6641	Radius	Distal end	L	Distal width	29.46
LP	Tomb 3	-	6641	Radius	Distal end	L	A-P midshaft	9.81
LP	Tomb 3	-	6641	Radius	Distal end	L	M-L midshaft	12.51
LP	Tomb 3	-	6641	Radius	Distal end	L	Maximum diameter	39
LP	Tomb 3	-	6648	Ulna	Dia M 1/3	R	A-P midshaft	10.56
LP	Tomb 3	-	6648	Ulna	Dia M 1/3	R	M-L midshaft	11.93
LP	Tomb 3	-	6648	Ulna	Dia M 1/3	R	Maximum diameter	39
LP	Tomb 3	-	6648	Ulna	Dia M 1/3	R	A-P midshaft	11.5
LP	Tomb 3	-	6648	Ulna	Dia M 1/3	R	M-L midshaft	13.58
LP	Tomb 3	-	6660	Humerus	Dia M 1/3	R	A-P midshaft	16.6
LP	Tomb 3	-	6660	Humerus	Dia M 1/3	R	M-L midshaft	21.56
LP	Tomb 3	-	6660	Humerus	Dia M 1/3	R	Maximum diameter	67
LP	Tomb 3	-	6689	Mastoid	-	R	Height	30.66
LP	Tomb 3	-	6689	Mastoid	-	R	Width	24.26
LP	Tomb 3	-	6690	Clavicle	Diaphysis	R	Maximum diameter	39
LP	Tomb 3	-	6692	Femur	Dia M 1/3	L	A-P midshaft	22.35
LP	Tomb 3	-	6692	Femur	Dia M 1/3	L	M-L midshaft	25.06
LP	Tomb 3	-	6692	Femur	Dia M 1/3	L	Maximum diameter	78
LP	Tomb 3	-	6720	Clavicle	Complete	R	Maximum lenght	116
LP	Tomb 3	-	6733	Femur	Dia M 1/3	R	A-P midshaft	33.82
LP	Tomb 3	-	6733	Femur	Dia M 1/3	R	M-L midshaft	24.99
LP	Tomb 3	-	6733	Femur	Dia M 13	R	Maximum diameter	96
LP	Tomb 3	-	6735	Clavicle	Diaphysis	R	Maximum diameter	40
LP	Tomb 3	-	6748	Scapula	Glenoid	R	Width	22.46
LP	Tomb 3	-	6758	Fibula	Distal end	R	Distal width	22.01
LP	Tomb 3	-	6789	Radius	Diaphysis	R	A-P midshaft	10.34
LP	Tomb 3	-	6789	Radius	Diaphysis	R	M-L midshaft	14.3
LP	Tomb 3	-	6789	Radius	Diaphysis	R	Maximum diameter	42
LP	Tomb 3	-	6815	Femur	Proximal	L	Vertical diameter	42.08
LP	Tomb 3	-	6815	Femur	Proximal	L	Horizontal diameter	42.19
LP	Tomb 3	-	6815	Femur	Dia M 1/3	L	A-P midshaft	30.57
LP	Tomb 3	-	6815	Femur	Dia M 1/3	L	M-L midshaft	25.21
LP	Tomb 3	-	6815	Femur	Dia M 1/3	L	Maximum diameter	89
LP	Tomb 3	-	6822	Tibia	Diaphysis	L	A-P midshaft	22.52
LP	Tomb 3	-	6822	Tibia	Diaphysis	L	M-L midshaft	17.34
LP	Tomb 3	-	6822	Tibia	Diaphysis	L	Maximum diameter	69
LP	Tomb 3	-	6850	Radius	Diaphysis	L	Transverse	48
LP	Tomb 3	-	6850	Radius	Diaphysis	L	A-P midshaft	10.82
LP	Tomb 3	-	6850	Radius	Diaphysis	L	M-L midshaft	13.9
LP	Tomb 3	-	6850	Radius	Diaphysis	L	Maximum diameter	46
LP	Tomb 3	-	6850	Radius	Diaphysis	L	Minimum diameter	41
LP	Tomb 3	-	6854	Ulna	Diaphysis	L	A-P midshaft	17.24
LP	Tomb 3	-	6854	Ulna	Diaphysis	L	M-L midshaft	17.76
LP	Tomb 3	-	6871	Humerus	Diaphysis	L	A-P midshaft	15.54
LP	Tomb 3	-	6871	Humerus	Diaphysis	L	M-L midshaft	16.47
LP	Tomb 3	-	6871	Humerus	Diaphysis	L	Maximum diameter	58
LP	Tomb 3	-	6874	Radius	Complete	L	Transverse d.	46
LP	Tomb 3	-	6874	Radius	Complete	L	Minimum diameter	37
LP	Tomb 3	-	6874	Radius	Complete	L	A-P midshaft	9.88
LP	Tomb 3	-	6874	Radius	Complete	L	M-L midshaft	11.4
LP	Tomb 3	-	6874	Radius	Complete	L	Maximum diameter	38

APPENDIX 2.1.- SKULL AND LONG BONE MEASUREMENTS

SITE	SECTOR	INDIVIDUAL	BAG	BONE	ELEMENT	SIDE	MEASUREMENT	N
LP	Tomb 3	-	6888	Radius	Diaphysis	R	A-P midshaft	9.18
LP	Tomb 3	-	6888	Radius	Diaphysis	R	M-L midshaft	11.61
LP	Tomb 3	-	6888	Radius	Diaphysis	R	Maximum diameter	39
LP	Tomb 3	-	6891	Femur	Diaphysis	R	A-P midshaft	28.5
LP	Tomb 3	-	6891	Femur	Diaphysis	R	M-L midshaft	25.09
LP	Tomb 3	-	6891	Femur	Diaphysis	R	Maximum diameter	89
LP	Tomb 3	-	6894	Femur	Dia M 1/3	L	A-P midshaft	25.61
LP	Tomb 3	-	6894	Femur	Dia M 1/3	L	M-L midshaft	23.78
LP	Tomb 3	-	6894	Femur	Dia M 1/3	L	Maximum diameter	78
LP	Tomb 3	-	6906	Ulna	Proximal	L	A-P midshaft	10.75
LP	Tomb 3	-	6906	Ulna	Proximal	L	M-L midshaft	11.38
LP	Tomb 3	-	6906	Ulna	Proximal	L	Maximum diameter	39
LP	Tomb 3	-	6929	Tibia	Dia M 1/3	L	A-P midshaft	31.56
LP	Tomb 3	-	6929	Tibia	Dia M 1/3	L	M-L midshaft	22.59
LP	Tomb 3	-	6929	Tibia	Dia M 1/3	L	Maximum diameter	88
LP	Tomb 3	-	6931	Fibula	Diaphysis	L	A-P midshaft	15.49
LP	Tomb 3	-	6931	Fibula	Diaphysis	L	M-L midshaft	9.2
LP	Tomb 3	-	6931	Fibula	Diaphysis	L	Maximum diameter	47
LP	Tomb 3	-	6931	Fibula	diaphysis	L	Minimum diameter	40
LP	Tomb 3	-	6976	Ulna	Dia P 1/3	L	A-P midshaft	12.35
LP	Tomb 3	-	6976	Ulna	Dia P 1/3	L	M-L midshaft	15.96
LP	Tomb 3	-	6976	Ulna	Dia M 1/3	L	A-P midshaft	12.27
LP	Tomb 3	-	6976	Ulna	Dia M 1/3	L	M-L midshaft	11.71
LP	Tomb 3	-	6976	Ulna	Dia M 1/3	L	Maximum diameter	41
LP	Tomb 3	-	6976	Ulna	Dia M 1/3	L	Minimum diameter	38
LP	Tomb 3	-	6982	Radius	Diaphysis	R	A-P midshaft	4.66
LP	Tomb 3	-	6982	Radius	Diaphysis	R	M-L midshaft	7.24
LP	Tomb 3	-	6982	Radius	Diaphysis	R	Maximum diameter	26
LP	Tomb 3	-	6996	Femur	Dia M 1/3	R	A-P midshaft	31.2
LP	Tomb 3	-	6996	Femur	Dia M 1/3	R	M-L midshaft	24.31
LP	Tomb 3	-	6996	Femur	Dia M 1/3	R	Maximum diameter	90
LP	Tomb 3	-	7009	Fibula	Dia M 1/3	L	Dist width	21.74
LP	Tomb 3	-	7012	Fibula	Diaphysis	R	A-P midshaft	14.96
LP	Tomb 3	-	7012	Fibula	Diaphysis	R	M-L midshaft	9.3
LP	Tomb 3	-	7012	Fibula	Diaphysis	R	Maximum diameter	49
LP	Tomb 3	-	7024	Femur	Dia P 1/3	L	A-P midshaft	11.53
LP	Tomb 3	-	7024	Femur	Dia P 1/3	L	M-L midshaft	13.66
LP	Tomb 3	-	7024	Femur	Dia P 1/3	L	Maximum diameter	42
LP	Tomb 3	-	7030	Femur	Dia M 1/3	L	A-P midshaft	14.39
LP	Tomb 3	-	7030	Femur	Dia M 1/3	L	M-L midshaft	16.41
LP	Tomb 3	-	7030	Femur	Dia M 1/3	L	Maximum diameter	53
LP	Tomb 3	-	7031	Femur	Diaphysis	R	A-P midshaft	20.72
LP	Tomb 3	-	7031	Femur	Diaphysis	R	M-L midshaft	19.24
LP	Tomb 3	-	7031	Femur	Diaphysis	R	Maximum diameter	68
LP	Tomb 3	-	7117	Ulna	Dia P 1/3	L	A-P midshaft	15.14
LP	Tomb 3	-	7117	Ulna	Dia P 1/3	L	M-L midshaft	19.05
LP	Tomb 3	-	7118	Radius	Diaphysis	L	Head diameter	22.82
LP	Tomb 3	-	7118	Radius	Diaphysis	L	Transverse	54
LP	Tomb 3	-	7125	Tibia	Diaphysis	-	A-P midshaft	28.37
LP	Tomb 3	-	7125	Tibia	Diaphysis	-	M-L midshaft	19.78
LP	Tomb 3	-	7125	Tibia	Diaphysis	-	Maximum diameter	80
LP	Tomb 3	-	7157	Radius	Dia M 1/3	R	Minimum diameter	43
LP	Tomb 3	-	7157	Radius	Dia M 1/3	R	Transverse	54
LP	Tomb 3	-	7157	Radius	Dia M 1/3	R	A-P midshaft	11.55
LP	Tomb 3	-	7157	Radius	Dia M 1/3	R	M-L midshaft	14.81
LP	Tomb 3	-	7157	Radius	Dia M 1/3	R	Maximum diameter	45
LP	Tomb 3	-	7157	Radius	Proximal	R	Head diameter	22.04
LP	Tomb 3	-	7209	Clavicle	Diaphysis	L	Midshaft diameter	37
LP	Tomb 3	-	7212	Radius	Proximal	L	Lengh	227

APPENDIX 2.1.- SKULL AND LONG BONE MEASUREMENTS

SITE	SECTOR	INDIVIDUAL	BAG	BONE	ELEMENT	SIDE	MEASUREMENT	N
LP	Tomb 3	-	7212	Radius	Proximal	L	Distal width	28.31
LP	Tomb 3	-	7212	Radius	Proximal	L	Head diameter	21.04
LP	Tomb 3	-	7212	Radius	Proximal	L	Diameter at radial	49
LP	Tomb 3	-	7212	Radius	Proximal	L	Midshaft diameter	41
LP	Tomb 3	-	7212	Radius	Distal end	L	Midshaft diameter	41
LP	Tomb 3	-	7212	Radius	Distal end	L	A-P midshaft	10.63
LP	Tomb 3	-	7212	Radius	Distal end	L	M-L midshaft	13.21
LP	Tomb 3	-	7216	Femur	Diaphysis	R	A-P midshaft	23.35
LP	Tomb 3	-	7216	Femur	Diaphysis	R	M-L midshaft	23.49
LP	Tomb 3	-	7216	Femur	Diaphysis	R	Maximum diameter	77
LP	Tomb 3	-	7227	Femur	Dia M 1/3	R	A-P midshaft	28.41
LP	Tomb 3	-	7227	Femur	Dia M 1/3	R	M-L midshaft	26.36
LP	Tomb 3	-	7227	Femur	Dia M 1/3	R	Maximum diameter	86
LP	Tomb 3	-	7227	Femur	Dia M 1/3	R	A-P midshaft	23.94
LP	Tomb 3	-	7227	Femur	Dia M 1/3	R	M-L midshaft	28.13
LP	Tomb 3	-	7233	Radius	Diaphysis	R	Transverse	50
LP	Tomb 3	-	7233	Radius	Diaphysis	R	Head diameter	20.2
LP	Tomb 3	-	7233	Radius	Diaphysis	R	A-P midshaft	11.24
LP	Tomb 3	-	7233	Radius	Diaphysis	R	M-L midshaft	14.42
LP	Tomb 3	-	7233	Radius	Diaphysis	R	Maximum diameter	0
LP	Tomb 3	-	7266	Humerus	Dia M 1/3	R	A-P midshaft	15.81
LP	Tomb 3	-	7266	Humerus	Dia M 1/3	R	M-L midshaft	20.6
LP	Tomb 3	-	7266	Humerus	Dia M 1/3	R	Maximum diameter	66
LP	Tomb 3	-	7274	Radius	Proximal	L	Head diameter	22.49
LP	Tomb 3	-	7274	Radius	Proximal	L	Diameter at radial	53
LP	Tomb 3	-	7308	Radius	Distal end	L	Distal width	31.12
LP	Tomb 3	-	7477	Femur	Dia M 1/3	L	A-P midshaft	22.84
LP	Tomb 3	-	7477	Femur	Dia M 1/3	L	M-L midshaft	23.23
LP	Tomb 3	-	7477	Femur	Dia M 1/3	L	Maximum diameter	75
LP	Tomb 3	-	7498	Ulna	Diaphysis	L	A-P midshaft	14.74
LP	Tomb 3	-	7498	Ulna	Diaphysis	L	M-L midshaft	17.16
LP	Tomb 3	-	7498	Ulna	Diaphysis	L	Maximum diameter	50
LP	Tomb 3	-	7516	Radius	Proximal	R	Head	22.6
LP	Tomb 3	-	7516	Radius	Proximal	R	A-P midshaft	11.52
LP	Tomb 3	-	7516	Radius	Proximal	R	M-L midshaft	15.37
LP	Tomb 3	-	7517	Femur	Dia M 1/3	R	A-P midshaft	30.99
LP	Tomb 3	-	7517	Femur	Dia M 1/3	R	M-L midshaft	29.15
LP	Tomb 3	-	7517	Femur	Dia M 1/3	R	Maximum diameter	96
LP	Tomb 3	-	7517	Femur	Dia P 1/3	R	A-P	26.05
LP	Tomb 3	-	7517	Femur	Dia P 1/3	R	M-L	30.69
LP	Tomb 3	-	7554	Radius	Dia M 1/3	L	A-P midshaft	12.73
LP	Tomb 3	-	7554	Radius	Dia M 1/3	L	M-L midshaft	15.84
LP	Tomb 3	-	7554	Radius	Dia M 1/3	L	Maximum Diameter	47
LP	Tomb 3	-	7554	Radius	Proximal	L	Head	20.32
LP	Tomb 3	-	7554	Radius	Proximal	L	Diameter at radial	48
LP	Tomb 3	-	7559	Fibula	Distal end	R	Distal width	21.83
LP	Tomb 3	-	7583	Humerus	Dia M 1/3	R	A-P midshaft	20.14
LP	Tomb 3	-	7583	Humerus	Dia M 1/3	R	M-L midshaft	16.61
LP	Tomb 3	-	7583	Humerus	Dia M 1/3	R	Maximum diameter	63
LP	Tomb 3	-	7584	Radius	Proximal	R	A-P midshaft	10.94
LP	Tomb 3	-	7584	Radius	Proximal	R	M-L midshaft	15.26
LP	Tomb 3	-	7584	Radius	Proximal	R	Maximum diameter	46
LP	Tomb 3	-	7584	Radius	Proximal	R	Distal width	29.79
LP	Tomb 3	-	7584	Radius	Proximal	R	Diameter at radial	50
LP	Tomb 3	-	7584	Radius	Distal end		Minimum diameter	40
LP	Tomb 3	-	7587	Humerus	Proximal	R	Vertical head	38.37
LP	Tomb 3	-	7615	Radius	Dia M 1/3	L	Transverse	49
LP	Tomb 3	-	7615	Radius	Dia M 1/3	L	A-P midshaft	11.93
LP	Tomb 3	-	7615	Radius	Dia M 1/3	L	M-L midshaft	14.63

APPENDIX 2.1.- SKULL AND LONG BONE MEASUREMENTS

SITE	SECTOR	INDIVIDUAL	BAG	BONE	ELEMENT	SIDE	MEASUREMENT	N
LP	Tomb 3	-	7615	Radius	Dia M 1/3	L	Maximum diameter	44
LP	Tomb 3	-	7626	Scapula	Glenoid	L	Width	26.48
LP	Tomb 3	-	7645	Radius	Proximal	L	Minimum Diameter	45
LP	Tomb 3	-	7645	Radius	Dia M 1/3	L	Lengh	241
LP	Tomb 3	-	7645	Radius	Dia M 1/3	L	Diameter at radial	51
LP	Tomb 3	-	7645	Radius	Dia M 1/3	L	A-P midshaft	11.15
LP	Tomb 3	-	7645	Radius	Dia M 1/3	L	M-L midshaft	15.56
LP	Tomb 3	-	7645	Radius	Dia M 1/3	L	Maximum diameter	43
LP	Tomb 3	-	7652	Radius	Dia M 1/3	L	A-P midshaft	11.42
LP	Tomb 3	-	7652	Radius	Dia M 1/3	L	M-L midshaft	12.05
LP	Tomb 3	-	7652	Radius	Dia M 1/3	L	Maximum diameter	40
LP	Tomb 3	-	7662	Fibula	Diaphysis	R	A-P midshaft	11.27
LP	Tomb 3	-	7662	Fibula	Diaphysis	R	M-L midshaft	18.1
LP	Tomb 3	-	7662	Fibula	Diaphysis	R	Maximum diameter	55
LP	Tomb 3	-	7664	Radius	Dia M 1/3	R	Diameter at radial	54
LP	Tomb 3	-	7664	Radius	Dia M 1/3	R	A-P midshaft	11.95
LP	Tomb 3	-	7664	Radius	Dia M 1/3	R	M-L midshaft	14.7
LP	Tomb 3	-	7664	Radius	Proximal	R	Head	20.19
LP	Tomb 3	-	7692	Fibula	Diaphysis	L	A-P midshaft	17.16
LP	Tomb 3	-	7692	Fibula	Diaphysis	L	M-L midshaft	13.43
LP	Tomb 3	-	7692	Fibula	Diaphysis	L	Maximum diameter	57
LP	Tomb 3	-	7692	Fibula	Distal end	L	Distal width	25.18
LP	Tomb 3	-	7709	Femur	Diaphysis	L	A-P midshaft	28.42
LP	Tomb 3	-	7709	Femur	Diaphysis	L	M-L midshaft	26.76
LP	Tomb 3	-	7709	Femur	Diaphysis	L	Maximum diameter	90
LP	Tomb 3	-	7768	Ulna	Diaphysis	L	A-P midshaft	11.43
LP	Tomb 3	-	7768	Ulna	Diaphysis	L	M-L midshaft	14.65
LP	Tomb 3	-	7768	Ulna	Diaphysis	L	Maximum diameter	44
LP	Tomb 3	-	7784	Ulna	Proximal	L	A-P midshaft	14.04
LP	Tomb 3	-	7784	Ulna	Proximal	L	M-L midshaft	15.03
LP	Tomb 3	-	7803	Femur	Dia M 1/3	R	A-P midshaft	34.55
LP	Tomb 3	-	7803	Femur	Dia M 1/3	R	M-L midshaft	25.51
LP	Tomb 3	-	7803	Femur	Dia M 1/3	R	Maximum diameter	95
LP	Tomb 3	-	7834	Femur	Dia M 1/3	R	A-P midshaft	28.35
LP	Tomb 3	-	7834	Femur	Dia M 1/3	R	M-L midshaft	24.76
LP	Tomb 3	-	7834	Femur	Dia M 1/3	R	Maximum diameter	87
LP	Tomb 3	-	7840	Ulna	Diaphysis	R	A-P midshaft	14.48
LP	Tomb 3	-	7840	Ulna	Diaphysis	R	M-L midshaft	11.97
LP	Tomb 3	-	7840	Ulna	Diaphysis	R	Maximum diameter	43
LP	Tomb 3	-	7843	Ulna	Dia P 1/3	R	A-P midshaft	18.95
LP	Tomb 3	-	7843	Ulna	Dia P 1/3	R	M-L midshaft	19.93
LP	Tomb 3	-	7843	Ulna	Dia P 1/3	R	A-P midshaft	15.4
LP	Tomb 3	-	7843	Ulna	Dia P 1/3	R	M-L midshaft	14.39
LP	Tomb 3	-	7843	Ulna	Dia P 1/3	R	Maximum diameter	50
LP	Tomb 3	-	7847	Scapula	Glenoid	L	Width	29.76
LP	Tomb 3	-	7851	Fibula	Diaphysis	L	A-P midshaft	10.35
LP	Tomb 3	-	7851	Fibula	Diaphysis	L	M-L midshaft	14.33
LP	Tomb 3	-	7851	Fibula	Diaphysis	L	Maximum diameter	43
LP	Tomb 3	-	7860	Fibula	Diaphysis	R	A-P midshaft	11.6
LP	Tomb 3	-	7860	Fibula	Diaphysis	R	M-L midshaft	15.46
LP	Tomb 3	-	7860	Fibula	Diaphysis	R	Maximum diameter	50
LP	Tomb 3	-	7881	Humerus	Diaphysis		A-P midshaft	19.27
LP	Tomb 3	-	7881	Humerus	Diaphysis		M-L midshaft	16.75
LP	Tomb 3	-	7881	Humerus	Diaphysis		Maximum diameter	60
LP	Tomb 3	-	7894	Radius	Diaphysis	R	A-P midshaft	10.35
LP	Tomb 3	-	7894	Radius	Diaphysis	R	M-L midshaft	12.3
LP	Tomb 3	-	7894	Radius	Diaphysis	R	Maximum diameter	42
LP	Tomb 3	-	7899	Tibia	Diaphysis	R	A-P midshaft	16.4
LP	Tomb 3	-	7899	Tibia	Diaphysis	R	M-L midshaft	9.1

APPENDIX 2.1.- SKULL AND LONG BONE MEASUREMENTS

SITE	SECTOR	INDIVIDUAL	BAG	BONE	ELEMENT	SIDE	MEASUREMENT	N
LP	Tomb 3	-	7899	Tibia	Diaphysis	R	Maximum diameter	65
LP	Tomb 3	-	7927	Humerus	Distal end	L	Distal width	62.45
LP	Tomb 3	-	8001	Femur	Diaphysis	-	A-P midshaft	20.93
LP	Tomb 3	-	8001	Femur	Diaphysis	-	M-L midshaft	18.93
LP	Tomb 3	-	8001	Femur	Diaphysis	-	Maximum diameter	64
LP	Tomb 3	-	8039	Radius	Dia P 1/3	L	Diameter at radial	50
LP	Tomb 3	-	8039	Radius	Dia M 1/3	L	A-P midshaft	11.28
LP	Tomb 3	-	8039	Radius	Dia M 1/3	L	M-L midshaft	13.29
LP	Tomb 3	-	8039	Radius	Dia M 1/3	L	Maximum diameter	40
LP	Tomb 3	-	8056	Humerus	Diaphysis	L	A-P midshaft	17.32
LP	Tomb 3	-	8056	Humerus	Diaphysis	L	M-L midshaft	17.34
LP	Tomb 3	-	8056	Humerus	Diaphysis	L	Maximum diameter	61
LP	Tomb 3	-	8062	Fibula	Dia M 1/3	L	A-P midshaft	12.53
LP	Tomb 3	-	8062	Fibula	Dia M 1/3	L	M-L midshaft	12.09
LP	Tomb 3	-	8062	Fibula	Dia M 1/3	L	Maximum diameter	43
LP	Tomb 3	-	8062	Fibula	Distal end	L	Dis width	26.06
LP	Tomb 3	-	8096	Humerus	Dia M 1/3	L	A-P midshaft	19.6
LP	Tomb 3	-	8096	Humerus	Dia M 1/3	L	M-L midshaft	19.1
LP	Tomb 3	-	8096	Humerus	Dia M 1/3	L	Maximum diameter	65
LP	Tomb 3	-	8234	Fibula	Distal end	L	Distal width	24.1
LP	Tomb 3	-	8234	Fibula	Proximal	L	A-P midshaft	16-61
LP	Tomb 3	-	8234	Fibula	Proximal	L	M-L midshaft	9.8
LP	Tomb 3	-	8234	Fibula	Proximal	L	Maximum Diameter	47
LP	Tomb 3	-	8150	Radius	Proximal	R	Head diameter	20.75
LP	Tomb 3	-	8150	Radius	Proximal	R	Transverse	54
LP	Tomb 3	-	8150	Radius	Dia P 1/3	R	A-P midshaft	16.29
LP	Tomb 3	-	8150	Radius	Dia P 1/3	R	M-L midshaft	13.36
LP	Tomb 3	-	8150	Radius	Dia P 1/3	R	Maximum diameter	49
LP	Tomb 3	-	8155	Ulna	Proximal	L	A-P midshaft	18.63
LP	Tomb 3	-	8155	Ulna	Proximal	L	M-L midshaft	19.93
LP	Tomb 3	-	8183	Fibula	Dia M 1/3	L	A-P midshaft	11.97
LP	Tomb 3	-	8183	Fibula	Dia M 1/3	L	M-L midshaft	10.08
LP	Tomb 3	-	8183	Fibula	Dia M 1/3	L	Maximum diameter	39
LP	Tomb 3	-	8183	Fibula	Distal end	L	Distal width	19.64
LP	Tomb 3	-	8211	Fibula	Distal end	L	Distal width	21.02
LP	Tomb 3	-	8223	Radius	Proximal	R	Head diameter	18.14
LP	Tomb 3	-	8298	Fibula	Distal end	L	Distal width	26.26
LP	Tomb 3	-	8406	Skull	Mastoid	R	Heigh	30.69
LP	Tomb 3	-	8406	Skull	Mastoid	R	Width	22.5
LP	Tomb 3	-	8421	Femur	Diaphysis	L	A-P midshaft	26.34
LP	Tomb 3	-	8421	Femur	Diaphysis	L	M-L midshaft	25.37
LP	Tomb 3	-	8421	Femur	Diaphysis	L	Maximum diameter	84
LP	Tomb 3	-	8424	Ulna	Diaphysis	R	A-P midshaft	15.5
LP	Tomb 3	-	8424	Ulna	Diaphysis	R	M-L midshaft	12.95
LP	Tomb 3	-	8424	Ulna	Diaphysis	R	Maximum diameter	45
LP	Tomb 3	-	8440	Fibula	Dia M 1/3	L	A-P midshaft	15.13
LP	Tomb 3	-	8440	Fibula	Dia M 1/3	L	M-L midshaft	9.7
LP	Tomb 3	-	8440	Fibula	Dia M 1/3	L	Maximum diameter	46
LP	Tomb 3	-	8456	Radius	Proximal	R	Head	20.13
LP	Tomb 3	-	8460	Ulna	Proximal	R	A-P midshaft	18.11
LP	Tomb 3	-	8460	Ulna	Proximal	R	M-L midshaft	14.58
LP	Tomb 3	-	8496	Fibula	Diaphysis	L	A-P midshaft	16.36
LP	Tomb 3	-	8496	Fibula	Diaphysis	L	M-L midshaft	8.71
LP	Tomb 3	-	8496	Fibula	Diaphysis	L	Maximum diameter	48
LP	Tomb 3	-	8504	Radius	Dia P 1/3	R	Maximum diameter	47
LP	Tomb 3	-	8522	Humerus	Distal end	R	Distal width	55.92
LP	Tomb 3	-	8547	Radius	Proximal	L	Head	18.75
LP	Tomb 3	-	8569	Humerus	Dia M 1/3	R	A-P midshaft	18.03
LP	Tomb 3	-	8569	Humerus	Dia M 1/3	R	M-L midshaft	16.38

APPENDIX 2.1.- SKULL AND LONG BONE MEASUREMENTS

SITE	SECTOR	INDIVIDUAL	BAG	BONE	ELEMENT	SIDE	MEASUREMENT	N
LP	Tomb 3	-	8569	Humerus	Dia M 1/3	R	Maximum diameter	58
LP	Tomb 3	-	8596	Ulna	Distal end	L	Distal width	15.13
LP	Tomb 3	-	8602	Ulna	Dia M 1/3	L	A-P midshaft	12.24
LP	Tomb 3	-	8602	Ulna	Dia M 1/3	L	M-L midshaft	14.77
LP	Tomb 3	-	8602	Ulna	Dia M 1/3	L	Maximum diameter	42
LP	Tomb 3	-	8641	Clavicle	Diaphysis	L	Midshaft diameter	38
LP	Tomb 3	-	8655	Fibula	Diaphysis	R	A-P midshaft	15.84
LP	Tomb 3	-	8655	Fibula	Diaphysis	R	M-L midshaft	12.29
LP	Tomb 3	-	8655	Fibula	Diaphysis	R	Maximum diameter	52
LP	Tomb 3	-	8672	Tibia	Diaphysis	R	A-P midshaft	32.56
LP	Tomb 3	-	8672	Tibia	Diaphysis	R	M-L midshaft	20.35
LP	Tomb 3	-	8672	Tibia	Diaphysis	R	Maximum diameter	89
LP	Tomb 3	-	8694	Radius	Distal end	R	Distal width	28.44
LP	Tomb 3	-	8812	Ulna	Proximal	R	A-P midshaft	12.94
LP	Tomb 3	-	8812	Ulna	Proximal	R	M-L midshaft	16.02
LP	Tomb 3	-	8846	Femur	Diaphysis	L	A-P midshaft	32.48
LP	Tomb 3	-	8846	Femur	Diaphysis	L	M-L midshaft	24.87
LP	Tomb 3	-	8846	Femur	Diaphysis	L	Maximum diameter	94
LP	Tomb 3	-	8873	Fibula	Dia M 1/3	R	A-P midshaft	15.21
LP	Tomb 3	-	8873	Fibula	Dia M 1/3	R	M-L midshaft	11.14
LP	Tomb 3	-	8873	Fibula	Dia M 1/3	R	Maximum diameter	46
LP	Tomb 3	-	8873	Fibula	Distal end	R	Distal width	30.1
LP	Tomb 3	-	8888	Humerus	Dia D 1/3	L	A-P midshaft	19.45
LP	Tomb 3	-	8888	Humerus	Dia D 1/3	L	M-L midshaft	18.07
LP	Tomb 3	-	8888	Humerus	Dia D 1/3	L	Maximum diameter	64
LP	Tomb 3	-	8917	Humerus	Diaphysis	L	A-P midshaft	18.57
LP	Tomb 3	-	8917	Humerus	Diaphysis	L	M-L midshaft	16.83
LP	Tomb 3	-	8917	Humerus	Diaphysis	L	Maximum Diameter	61
LP	Tomb 3	-	8938	Ulna	Dia M 1/3	L	A-P midshaft	12.84
LP	Tomb 3	-	8938	Ulna	Dia M 1/3	L	M-L midshaft	9.76
LP	Tomb 3	-	8938	Ulna	Dia M 1/3	L	Maximum diameter	42
LP	Tomb 3	-	8999	Fibula	Diaphysis	L	A-P midshaft	12.69
LP	Tomb 3	-	8999	Fibula	Diaphysis	L	M-L midshaft	11.06
LP	Tomb 3	-	8999	Fibula	Diaphysis	L	Maximum diameter	42
LP	Tomb 3	-	9010	Ulna	Diaphysis	R	A-P midshaft	12.7
LP	Tomb 3	-	9010	Ulna	Diaphysis	R	M-L midshaft	12.17
LP	Tomb 3	-	9010	Ulna	Diaphysis	R	Maximum diameter	42
LP	Tomb 3	-	9045	Clavicle	Diaphysis	L	Diameter at	35
LP	Tomb 3	-	9057	Humerus	Distal end	L	Distal width	59.48
LP	Tomb 3	-	9078	Humerus	Dia M 1/3	R	A-P midshaft	20.31
LP	Tomb 3	-	9078	Humerus	Dia M 1/3	R	M-L midshaft	18.68
LP	Tomb 3	-	9078	Humerus	Dia M 1/3	R	Maximum Diameter	65
LP	Tomb 3	-	9176	Scapula	Glenoid	L	Width	23.07
LP	Tomb 3	-	9218	Fibula	Distal end	R	Distal width	24.33
LP	Tomb 3	-	9220	Scapula	Glenoid	R	Width	24.34
LP	Tomb 3	-	9230	Tibia	Distal end	L	Distal width	48.92
LP	Tomb 3	-	9313	Fibula	Distal end	L	Distal width	25.36
LP	Tomb 3	-	9334	Ulna	Distal end	L	Distal width	16.14
LP	Tomb 3	-	9385	Radius	Proximal	L	Head	21.5
LP	Tomb 3	-	9385	Radius	Proximal	L	Transverse	56
LP	Tomb 3	-	9409	Clavicle	Diaphysis	L	Diameter at	36
LP	Tomb 3	-	9428	Fibula	Distal end	R	Distal width	25.06
LP	Tomb 3	-	9494	Scapula	Glenoid	L	Width	27.01
LP	Tomb 3	-	9661	Radius	Proximal	I	Head	21.96
LP	Tomb 3	-	9675	Radius	Proximal	I	Width	24.29
LP	Tomb 3	-	9690	Radius	Dia P 1/3	R	Transverse	55
LP	Tomb 3	-	9701	Fibula	Distal end	L	Distal width	20.67
LP	Tomb 3	-	9717	Femur	Dia M 1/3	R	A-P midshaft	27.26
LP	Tomb 3	-	9717	Femur	Dia M 1/3	R	M-L midshaft	27.14

APPENDIX 2.1.- SKULL AND LONG BONE MEASUREMENTS

SITE	SECTOR	INDIVIDUAL	BAG	BONE	ELEMENT	SIDE	MEASUREMENT	N
LP	Tomb 3	-	9849	Fibula	Distal end	R	Width	25.14
LP	Tomb 3	-	9870	Radius	Dia P 1/3	L	Transverse	5.56
LP	Tomb 3	-	9914	Clavicle	Diaphysis	R	Midshaft diameter	41
LP	Tomb 3	-	9980	Humerus	Distal end	l	Distal width	56.73
LP	Tomb 3	-	10057	Tibia	Distal end	R	A-P midshaft	31.02
LP	Tomb 3	-	10057	Tibia	Distal end	R	M-L midshaft	19.93
LP	Tomb 3	-	10057	Tibia	Distal end	R	Maximum diameter	85
LP	Tomb 3	-	10107	Scapula	Glenoid	L	Width	28.49
LP	Tomb 3	-	10136	Fibula	Dia M 1/3	R	A-P midshaft	15.88
LP	Tomb 3	-	10136	Fibula	Dia M 1/3	R	M-L midshaft	9.45
LP	Tomb 3	-	10136	Fibula	Dia M 1/3	R	Maximum diameter	46
LP	Tomb 3	-	10167	Humerus	Distal end	R	Distal width	51.52
LP	Tomb 3	-	10309	Fibula	Distal end	L	Width	23.37

Key to table: L= left; R= right; M-L= medial-lateral; A-P= anterior-posterior; Circ.= circumference; G= glenoid fossa; DE= distal end; d.= diameter; f.= foramen; M= midshaft; D= distal. All measurements are in mm.

Table A.2.1.i. Skull and long bone measurements

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	13	LLP1	Smith	3	0	0	0
LP	14	ULP1	Smith	7	0	0	0
LP	25	LLI1	Smith	4	0	0	0
LP	26	URC	-	0	0	0	0
LP	26	URM1	-	0	0	0	0
LP	26	URM2	-	0	0	0	0
LP	26	ULI2	-	0	0	0	0
LP	26	ULC	-	0	0	0	0
LP	26	ULM1	-	0	0	0	0
LP	47	TOOTH	-	0	0	0	0
LP	120	TOOTH	-	0	0	0	0
LP	171	LRP1	Smith	4	0	0	0
LP	171	LLM1	Brothwell	4+	0	0	5
LP	171	URM2	Brothwell	3	0	0	0
LP	171	LLI2	Smith	4	0	0	0
LP	171	LRI1	Smith	6	0	0	0
LP	417	Fragments	-	-	0	0	0
LP	417	ULM2	Brothwell	5	10.05	9.34	3.21
LP	417	URM2	Brothwell	5	10.25	0	0
LP	418	LLI1	Smith	4	4.04	5.56	0
LP	418	LLC	Smith	5	4.66	6.95	8.85
LP	418	LRC	Smith	5	0	0	0
LP	419	ULP1	Smith	6	8.23	6.23	6.02
LP	420	URM2	Brothwell	2+	11.74	9.61	6.01
LP	421	ULM1	Brothwell	1	10.33	11.04	0
LP	421	URM1	Brothwell	1	11.15	0	0
LP	421	URdC	-	0	0	0	0
LP	421	ULdM2	-	0	8.57	10.09	6.32
LP	421	ULdM1	-	0	8.25	6.95	6.76
LP	421	ULdM2	-	0	8.67	9.31	5.83
LP	422	URP2	Smith	4	8.7	5.92	7.01
LP	422	URP1	Smith	3	8.71	6.51	8.25
LP	422	URM3	Brothwell	2+	10.33	9.98	6.67
LP	422	URM2	Brothwell	2	10.88	10.02	6.78
LP	422	URM1	Brothwell	4	10.69	10.78	6.55
LP	422	URC	Smith	3	6.68	7.32	9.33
LP	423	LRP1	Smith	7	0	0	0
LP	423	LRP2	Smith	7	0	0	0
LP	423	LRI1	Smith	7	0	0	0
LP	423	LRI2	Smith	7	0	0	0
LP	423	LRC	Smith	7	0	0	0
LP	425	ULM3	Brothwell	2	8.39	8.23	7.79
LP	425	ULI1	Smith	7	0	0	0
LP	425	LLM3	Brothwell	2+	10.52	11.64	5.94
LP	425	LLM2	Brothwell	3	10.59	10.73	5.18
LP	425	LLM1	Brothwell	3+	0	0	0
LP	425	LLP2	Smith	2	8.57	6.83	0
LP	425	ULM2	Brothwell	5+	0	0	0
LP	426	ULP1	Smith	6	0	0	0
LP	426	URdM1	-	0	8.23	7.11	3.76
LP	426	LRI2	Smith	7	6.42	5.63	6.82
LP	426	URP1	Smith	2	8.85	6.52	8.51
LP	426	LLI1	Smith	4	5.55	5.08	7.42
LP	426	URdI1	-	0	6.03	6.14	8.2
LP	426	LRI1	Smith	6	5.92	5.12	0
LP	426	LRC	Smith	6	6.66	6.22	0
LP	426	URP2	Smith	5	8.27	6.45	4.87
LP	426	LRdM2	-	0	10.09	9.42	6.18
LP	427	root	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	428	LLI1	Smith	4	3.92	4.03	5.3
LP	429	ULP2	Smith	5	9.05	5.92	6.53
LP	429	LRM3	Brothwell	3+	8.94	11.07	4.29
LP	429	ULP1	Smith	4	9.97	7.04	6.76
LP	429	ULM2	Brothwell	3	10.79	8.68	5.18
LP	429	URM2	Brothwell	3	10.68	8.99	6.2
LP	430	ULdC	-	0	5.91	7.36	6.05
LP	431	ULM3	Brothwell	2	10.22	9.24	6.57
LP	431	ULM2	Brothwell	3	11.64	10.23	6.81
LP	431	URM3	Brothwell	2+	10.84	9.78	7.42
LP	431	LRM3	Brothwell	1	8.76	10.31	4.95
LP	431	ULP2	Smith	5	8.48	6.05	6.72
LP	431	LRM1	Brothwell	2+	0	0	0
LP	431	URM3	Brothwell	2	10.23	9.31	5.26
LP	431	ULM3	Brothwell	10,57	8.92	8.92	7.52
LP	432	URM2	Brothwell	2+	11.21	8.94	7.35
LP	432	ULM2	Brothwell	2+	11.16	8.95	6.84
LP	432	URI2	Smith	5	5.63	5.15	5.77
LP	432	URC	Smith	4	0	0	0
LP	432	ULM1	Brothwell	3+	11.29	9.57	5.44
LP	432	URM1	Brothwell	3+	9.71	9.54	6.74
LP	432	URM1	Brothwell	2+	11.33	9.14	6.62
LP	432	ULP1	Smith	5	9.79	7.51	6.77
LP	432	URM2	Brothwell	3	11.57	8.92	6.32
LP	432	ULP2	Smith	5	9.87	6.68	6.68
LP	433	LRM1	Brothwell	3	9.72	11.02	5.37
LP	434	LLI2	Smith	5	5.46	4.97	7.58
LP	435	URM3	Brothwell	2	10.13	8.56	6.05
LP	436	LLM2	Brothwell	2+	9.59	10.74	5.74
LP	436	LLM1	Brothwell	3+	10.61	11.33	6.05
LP	437	LLM3	Brothwell	2	9.37	10.75	5.72
LP	437	LRM2	Brothwell	3+	9.78	10.33	5.63
LP	437	LLM3	Brothwell	2	9.37	10.75	5.72
LP	437	LLM2	Brothwell	2+	9.65	10.02	4.82
LP	438	LRM2	Brothwell	2+	9.91	9.97	5.61
LP	438	LRM1	Brothwell	3+	10.29	10.17	4.4
LP	438	LRM3	Brothwell	2	9.93	10.16	5.82
LP	440	URM3	Brothwell	5	0	0	0
LP	440	LRM1	Brothwell	3	10.36	10.97	6.45
LP	440	URM2	Brothwell	5	9.78	9.83	0
LP	440	URM1	Brothwell	4+	10.22	11.11	4.4
LP	440	LRM3	Brothwell	4+	9.84	10.5	4.5
LP	440	LLM2	Brothwell	4+	9.72	10.1	3.91
LP	440	URC	Smith	5	6.48	6.71	9.95
LP	440	URP1	Smith	5	7.87	6.94	5.34
LP	440	TOOTH	-	0	0	0	0
LP	440	LLM2	Brothwell	5+	0	0	0
LP	444	LRI2	Smith	2	5.88	5.52	7.03
LP	444	LRP1	Smith	3	7.06	6.42	8.62
LP	444	LRM3	Brothwell	2	10.11	11.2	5.49
LP	444	LRM2	Brothwell	3	9.8	9.96	5.19
LP	444	LRM1	Brothwell	3	10.66	10.28	5.84
LP	444	LRP2	Smith	3	8.32	6.77	7.6
LP	445	LRC	Smith	5	8.49	8.04	0
LP	445	LLM2	Brothwell	2+	9.94	10.61	6.1
LP	445	ULM2	Brothwell	3	10.85	9.87	6.92
LP	445	URM1	Brothwell	2	10.06	11.38	6.06
LP	445	ULP1	Smith	4	8.81	6.09	7.48
LP	445	URM3	Brothwell	2	10.06	8.23	5.8

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	445	URM2	Brothwell	2+	10.5	9.05	6.12
LP	445	LRP1	Smith	6	8.09	6.77	0
LP	445	RI1	Smith	4	5.96	5.58	6.49
LP	446	ULM1	Brothwell	5++	0	0	0
LP	446	ROOT	-	0	0	0	0
LP	446	ULC	Smith	4	5.96	6.19	8.29
LP	446	ULM2	Brothwell	5	10.23	8.78	0
LP	446	URM2	Brothwell	5+	0	0	0
LP	446	LRC	Smith	6	6.7	6.12	0
LP	446	LP	Smith	7	0	0	0
LP	446	LP	Smith	7	0	0	0
LP	447	URI1	Smith	4	7.92	8.86	10.27
LP	447	URC	Smith	4	8.43	7.81	10.41
LP	447	URM3	Brothwell	2	9.74	8.54	4.6
LP	447	URM2	Brothwell	2+	11.13	8.74	7.28
LP	447	URP1	Smith	4	8.73	6.9	7.89
LP	480	ULM2	Brothwell	4	0	0	0
LP	654	LLC	Smith	6	0	0	0
LP	654	LLP1	Smith	6	0	0	0
LP	716	URM2	Brothwell	2+	11.62	9.93	7.61
LP	717	ULC	Smith	5	0	0	0
LP	718	LRM2	Brothwell	3	11.05	10.63	6.33
LP	718	LRM1	Brothwell	4	11.34	11.65	0
LP	718	LRP2	Smith	4	8.83	7.62	6.98
LP	718	LRM3	Brothwell	2	9.74	10.52	7.21
LP	718	MOLAR	-	0	0	0	0
LP	719	URP1	Smith	5	0	0	0
LP	719	LLP2	Smith	5	7	6.61	5.52
LP	719	ULC	Smith	5	6.09	7.59	0
LP	719	LLM1	Brothwell	5	0	10.07	0
LP	719	URC	Smith	5	7.94	5.66	0
LP	719	LRI1	Smith	6	0	0	0
LP	719	LLI1	Smith	5	0	0	0
LP	719	LLP1	Smith	4	6.32	6.89	6.02
LP	719	ULM2	Brothwell	5++	0	0	0
LP	719	ULM3	Brothwell	5++	0	0	0
LP	719	LLM2	Brothwell	5	9.64	9.56	0
LP	719	LRP2	Smith	4	7.02	6.22	4.64
LP	719	Fragments	-	0	0	0	0
LP	719	LLM3	Smith	4+	8.59	9.4	0
LP	720	ROOT	-	0	0	0	0
LP	721	URI2	Smith	3	6.65	6.42	9.39
LP	721	URP1	Smith	4	9.09	7.23	6.73
LP	721	LLP1	Smith	5	9.04	7.31	6.43
LP	721	URM1	Brothwell	3+	11.33	11.32	6.46
LP	721	URP2	Smith	4	9.26	6.31	7.69
LP	721	ULM1	Brothwell	3+	11.53	11.43	6.44
LP	721	ULM3	Brothwell	2+	9.71	9.93	6.71
LP	721	LLP2	Smith	4	7.68	6.77	0
LP	721	LLM1	Brothwell	4	10.86	11.78	6.84
LP	721	LRC	Smith	5	0	0	0
LP	721	LRM3	Brothwell	3	0	11.42	7.59
LP	721	LLC	Smith	5	9.05	7.33	9.62
LP	721	ULP1	Smith	4	9.67	6.89	0
LP	721	URC	Smith	5	7.9	7.22	9.33
LP	721	URI1	Smith	5	6.91	8.57	0
LP	721	ULP2	Smith	4	9.03	6.29	0
LP	721	ULM2	Brothwell	3	12.07	9.56	6.41

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	722	ULC	Smith	6	8.29	7.28	0
LP	723	URI2	-	0	0	0	0
LP	723	URI1	-	0	0	0	0
LP	723	ULI2	Smith	5	5.86	5.63	0
LP	723	ULC	Smith	5	6.51	6.66	0
LP	723	ULI1	Smith	4	5.95	5.38	6.98
LP	723	ULM1	Brothwell	4	11.17	0	0
LP	723	ULP1	Smith	4	8.07	6.9	7.42
LP	724	LLM3	Brothwell	2+	8.85	9.14	6
LP	725	Root	-	0	0	0	0
LP	725	LRC	Smith	5	0	0	0
LP	726	ULC	Smith	6	7.77	6.21	0
LP	726	URI2	Smith	6	6.36	6.24	0
LP	726	ULI1	Smith	6	7.19	7.19	0
LP	726	ULM1	Brothwell	4+	10.67	9.6	4.63
LP	726	Premolar	-	0	0	0	0
LP	726	URP1	Smith	7	6.02	4.25	0
LP	726	URP2	Smith	6	6.19	4.23	0
LP	726	Fragments	-	0	0	0	0
LP	726	URI1	Smith	6	7.35	0	0
LP	786	Fragments	-	0	0	0	0
LP	903	Fragments	-	0	0	0	0
LP	1336	Root	-	0	0	0	0
LP	1360	Incisive	-	0	0	0	0
LP	1369	Fragment	-	0	0	0	0
LP	1392	LLM2	-	0	0	0	0
LP	1393	LRC	Smith	N/A	7.65	7.06	9.57
LP	1393	LRC	Smith	2	7.54	6.64	9.97
LP	1393	LLP2	Smith	2	9.04	7.8	6.97
LP	1393	LLM1	Brothwell	2	9.54	11.31	7.5
LP	1393	LLM3	Brothwell	1	8.66	10.15	6.42
LP	1393	LLdI2	Smith	1	4.28	4.98	6.16
LP	1393	LLdM2	Brothwell	1	7.66	10.29	5.53
LP	1393	Fragments	-	0	0	0	0
LP	1393	LRM2	Brothwell	4+	9.92	10.12	3.87
LP	1393	URdM2	Brothwell	1	10.94	9.34	0
LP	1393	URP1	Smith	5	9.76	7.46	0
LP	1393	URP1	Smith	1	9.83	7.47	0
LP	1393	URM1	Brothwell	3	11.88	10.69	7.02
LP	1393	URM2	Brothwell	2+	12.15	10.1	0
LP	1393	URM1	Brothwell	2+	11.71	10.95	0
LP	1393	URdM1	Brothwell	1	9.47	10.43	0
LP	1393	ULM3	Brothwell	2	9.94	9.94	6.46
LP	1393	LRP2	Smith	2	8.34	7.4	7.8
LP	1393	LRI2	Smith	1	6.34	5.75	10.01
LP	1393	LRdC	Smith	1	8.8	7.84	0
LP	1393	LRM1	Brothwell	2+	10.5	10.98	7.21
LP	1393	URdC	-	0	0	0	0
LP	1393	URI2	Smith	1	6.74	6.36	0
LP	1393	URI1	Smith	1	7.07	9.59	0
LP	1393	ULdI2	Smith	1	6.67	6.49	0
LP	1393	ULM1	Brothwell	2	11.11	10.19	0
LP	1393	LLdC	Smith	1	6.11	6.53	0
LP	1393	URM3	Brothwell	1	8.99	7.46	6.75
LP	1393	ULdM1	Brothwell	1	8.86	10.57	0
LP	1393	ULdM2	Brothwell	1	10.94	10.08	0
LP	1393	ULP2	Smith	3	9.53	8.24	8.25
LP	1393	LLdC	Smith	1	8.6	7.72	0
LP	1394	LLC	Smith	4	7.39	6.64	11.11

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	1394	URP1	Smith	3	9.05	6.59	0
LP	1394	LRI1	Smith	2	5.1	5	0
LP	1394	ULC	Smith	4	8.45	7.5	11.02
LP	1395	LLC	Smith	5	7.47	6.13	6.06
LP	1395	LLP1	Smith	6	8.03	6.32	4.2
LP	1395	LLM3	Brothwell	2	8.64	9.25	5.89
LP	1395	ULP2	Smith	5	8.38	6.22	5.21
LP	1396	Fragments	-	0	0	0	0
LP	1397	URP1	Smith	5	9.59	7.15	7.76
LP	1397	URP2	Smith	4	10.01	7.47	6.99
LP	1397	ULC	Smith	4	7.81	7.73	10.74
LP	1397	URM2	Brothwell	3	12.44	9.81	0
LP	1397	URM1	Brothwell	4	11.59	9.73	4.87
LP	1397	URC	Smith	5	8.79	8.07	8.55
LP	1397	ULM1	Brothwell	4+	11.74	10.26	6.43
LP	1397	ULP1	Smith	4	9.53	7.08	8.01
LP	1397	ULM2	Brothwell	3+	12.65	9.65	6.97
LP	1397	ULM3	Brothwell	3	13.34	9.45	6.81
LP	1397	LLP1	Smith	3	7.39	6.92	6.49
LP	1397	ULP2	Smith	5	10.49	6.92	7.45
LP	1398	LLI1	Smith	4	5.41	4.99	7.5
LP	1398	LLM3	Brothwell	2	9.24	9.9	6.17
LP	1398	LRP1	-	0	8.34	6.7	6.87
LP	1398	LLC	Smith	4	7.44	6.73	9.99
LP	1398	URI1	Smith	4	5.87	8.11	9.89
LP	1398	LLI2	Smith	3	6.09	5.62	9.02
LP	1398	LRM1	Brothwell	3+	10.52	11.12	6.35
LP	1398	LRM2	Brothwell	3	10	10.67	6.18
LP	1398	LRI1	Smith	3	5.22	5.34	9.14
LP	1399	ULM1	Brothwell	4	9.77	9.97	0
LP	1399	ULM2	Brothwell	2+	0	8.56	5.14
LP	1400	URM3	Brothwell	3	0	0	0
LP	1400	Fragments	-	0	0	0	0
LP	1400	LRM3	Brothwell	1	9.89	9.05	0
LP	1400	LRP1	Smith	6	0	0	0
LP	1400	LRC	Smith	4	7.6	6.43	9.22
LP	1400	LLP1	Smith	6	0	0	0
LP	1400	LLC	Smith	6	9.16	0	0
LP	1400	ULM2	Brothwell	5+	11.49	10.17	0
LP	1400	URP1	Smith	6	8.52	0	0
LP	1400	URP2	Smith	4	8.54	6.29	6.73
LP	1400	URM1	Brothwell	2+	10.31	10.19	6.9
LP	1400	URM3	Brothwell	3	8.68	6.65	5.03
LP	1400	ULP2	Smith	6	0	0	0
LP	1400	ULP1	Smith	6	9.22	6.05	0
LP	1400	ULM1	Brothwell	5++	0	0	0
LP	1400	ULC	Smith	5	6.93	6.16	0
LP	1401	LLdM1	Smith	1	8.32	7.46	6.07
LP	1401	LRI2	Smith	5	6.3	5.2	0
LP	1401	LRC	Smith	5	7.22	6.25	0
LP	1402	LRC	Smith	4	8.76	7.79	10.97
LP	1402	LLM2	Brothwell	3+	11.61	9.3	0
LP	1402	URM2	Brothwell	5+	10.49	9.02	0
LP	1402	URP2	Smith	6	9.98	6.89	0
LP	1402	Root	-	0	0	0	0
LP	1402	LRM2	Brothwell	4+	11.6	9.72	4.83
LP	1402	URP1	Smith	5	9.83	6.81	0
LP	1402	LLI2	Smith	4	6.35	6.53	9.21
LP	1402	ULP1	Smith	6	9.18	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	1402	URI2	Smith	5	6.5	6.85	0
LP	1402	URI1	Smith	5	6.91	8.46	0
LP	1402	ULP2	Smith	6	9.23	6.63	0
LP	1402	ULC	Smith	4	8.57	7.62	9.58
LP	1402	ULP1	Smith	5	9.26	6.83	0
LP	1402	ULP2	Smith	6	8.89	0	0
LP	1404	Root	Smith	5++	0	0	0
LP	1404	LLP1	Smith	5	7.26	6.26	0
LP	1404	LLP2	Smith	6	7.4	6.27	0
LP	1405	ULP1	Smith	4	8.69	6.75	7.22
LP	1406	LLM2	Brothwell	2+	10.36	10.9	6.58
LP	1406	LRM3	Brothwell	2	9.91	10.78	8.03
LP	1406	LRM2	Brothwell	2+	9.99	10.92	8.16
LP	1406	LRM1	Brothwell	3	9.42	9.68	5.3
LP	1407	URI2	Smith	3	4.95	5.73	9.23
LP	1408	LRM2	-	0	0	0	0
LP	1408	ULI2	Smith	2	5.4	6.51	0
LP	1408	LRM1	Brothwell	2+	10.09	11.26	8.61
LP	1408	Premolar	Smith	7	0	0	0
LP	1408	LRdM2	Brothwell	1	8.95	9.98	6.6
LP	1408	LRdM1	Brothwell	1	6.73	7.55	6.18
LP	1408	LLdM2	Brothwell	1	8.89	10.2	5.89
LP	1408	LRdM1	Brothwell	1	6.85	7.37	5.53
LP	1408	LLI2	-	0	0	0	0
LP	1408	LLdM1	Brothwell	1	6.66	7.87	5.53
LP	1409	ULI2	Smith	5	6.71	6.39	0
LP	1409	URC	Smith	5	6.13	6.04	0
LP	1409	URP2	Smith	5	7.71	6.26	0
LP	1409	URM2	Brothwell	2+	11.22	9.96	0
LP	1409	LRI1	Smith	5	5.83	4.27	0
LP	1409	LLI2	Smith	5	5.58	4.78	0
LP	1409	LRC	Smith	5	7.05	6.7	0
LP	1410	ULP2	Smith	4	8.67	6.7	7.03
LP	1410	ULP1	Smith	4	8.29	6.7	7.3
LP	1411	ULC	Smith	4	7.8	7.6	9.52
LP	1411	ULP2	Smith	5	9.13	6.35	0
LP	1411	ULP1	Smith	4	8.57	6.17	8.33
LP	1411	ULM2	Brothwell	2+	10.78	9.81	7.03
LP	1411	LLM1	Brothwell	3	10.98	10.42	6.67
LP	1411	ULM1	Brothwell	2	11.33	10.72	0
LP	1412	URM2	Brothwell	4	13.16	9.18	5.58
LP	1412	URM1	Brothwell	4+	11.27	9.99	5.16
LP	1412	Fragments	-	-	0	0	0
LP	1412	ULM3	Brothwell	3	9.85	8.95	5.64
LP	1412	URP2	Smith	4	9.16	7.32	0
LP	1412	ULM2	Brothwell	4	12.59	8.91	6.91
LP	1412	ULP1	Smith	5	9.9	7.22	0
LP	1412	URC	Smith	5	8.53	7.05	0
LP	1412	URP1	Smith	5	9.95	7.04	0
LP	1413	LLC	Smith	3	7.2	7.22	11.67
LP	1413	LLM1	Brothwell	3	0	0	0
LP	1413	LRM1	Brothwell	4	11.27	0	5.97
LP	1413	LRI2	Smith	3	5.77	5.99	9.91
LP	1413	LRI1	Smith	3	5.88	5.45	3.55
LP	1413	LLI2	Smith	2	5.77	6.17	9.74
LP	1413	LLI1	Smith	4	5.82	5.23	9.63
LP	1413	LRP2	Smith	4	7.84	6.87	7.25
LP	1413	LLM2	Brothwell	2+	10.13	11.18	5.42
LP	1413	LLP2	Smith	3	7.86	6.94	7.66

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	1413	LLP1	Smith	4	6.85	6.91	8.58
LP	1413	LRP1	Smith	3	7.76	6.67	8.15
LP	1413	LRM2	Brothwell	3	9.69	10.24	6.12
LP	1414	Fragments	-	0	0	0	0
LP	1415	ULM1	Brothwell	4+	10.58	11.65	5.11
LP	1415	ULC	Smith	7	7.51	5.86	0
LP	1415	ULdI1	Smith	1	4.75	6.91	0
LP	1415	LRP1	Smith	5	7.96	7.47	0
LP	1415	MOLAR	-	0	0	0	0
LP	1415	ULM2	Brothwell	3	11.24	9.28	5.7
LP	1415	Root	-	0	0	0	0
LP	1416	ULP1	Smith	1	9.44	6.79	0
LP	1417	ULM2	Brothwell	3	10.49	8.06	6.46
LP	1417	ULM3	Brothwell	2+	10.16	9.33	6.07
LP	1417	ULM1	Brothwell	3	11.03	9.77	5.85
LP	1417	ULP2	Smith	3	9.09	6.29	7.7
LP	1417	ULC	Smith	4	3.7	4.18	6.57
LP	1417	ULP1	Smith	3	9.07	7.15	8.51
LP	1418	Premolar	-	0	0	0	0
LP	1418	Fragments	-	0	0	0	0
LP	1418	URP1	Smith	5	9.59	6.4	0
LP	1418	LRM1	Brothwell	2+	10.14	11.38	7.56
LP	1419	URM1	Brothwell	4+	0	0	0
LP	1420	LLI2	Smith	4	0	0	0
LP	1420	LLM2	Brothwell	3+	9.81	0	5.48
LP	1420	LLP2	Smith	5	6.76	6.64	0
LP	1421	ULP2	Smith	3	8.46	7.06	6.64
LP	1421	ULdM2	-	-	8.39	6.74	5.45
LP	1422	URdI2	Smith	1	4.3	5.2	5.72
LP	1422	Fragment	-	0	0	0	0
LP	1422	ULM1	Smith	1	7.13	9.26	0
LP	1423	Fragments	-	0	0	0	0
LP	1424	LRM2	Brothwell	3	9.98	10.81	6.24
LP	1424	LRM3	Brothwell	1	9.39	10.56	5.68
LP	1424	LRM1	Brothwell	3+	10.18	10.88	5.8
LP	1424	LRP2	Smith	3	7.89	6.58	5.16
LP	1425	LRC	Smith	3	7.54	7.73	10.37
LP	1425	LRP1	Smith	3	7.41	7.35	9.31
LP	1425	URM3	Brothwell	1	7.62	12.55	6.71
LP	1425	URP2	Smith	3	9.29	7.02	7.93
LP	1425	URM1	Brothwell	3	10.61	10.15	6.6
LP	1425	LRI2	Smith	5	0	0	0
LP	1425	URM2	Brothwell	2+	12.5	9.89	6.61
LP	1425	LRP2	Smith	3	8.4	7.4	7.65
LP	1425	LLPC	Smith	4	7.52	6.72	11.76
LP	1425	LLP2	Smith	2	8.46	7.34	6.93
LP	1425	LLM1	Brothwell	3	10.84	11.35	6.73
LP	1425	LLM3	Brothwell	1	9.78	10.36	6.99
LP	1425	LLM2	Brothwell	2	10.21	11.12	6.3
LP	1425	LRM1	Brothwell	3	10.74	11.38	5.96
LP	1425	LLI2	Smith	3	6.48	5.72	10.07
LP	1425	LRM3	Brothwell	1	10.51	11.84	0
LP	1425	LRI1	Smith	4	5.82	4.44	8.79
LP	1425	LLI1	Smith	4	5.82	4.72	9.2
LP	1425	URC	Smith	3	7.95	7.76	10.03
LP	1425	LRM2	Brothwell	2+	11.48	10.18	6.04
LP	1425	ULP1	Smith	2	7.15	7.36	8.65
LP	1425	ULI2	Smith	2	6.38	5.66	9.83
LP	1425	ULC	Smith	4	7.42	5.97	11.23

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	1425	URI2	Smith	2	5.91	5.68	8.87
LP	1425	ULP2	Smith	3	8.61	6.6	8.14
LP	1425	ULM3	Brothwell	1	12.41	10.17	7.14
LP	1425	ULM2	Brothwell	2+	11.32	9.29	6.91
LP	1425	ULM1	Brothwell	2	11.32	9.69	6.94
LP	1426	LRM3	Brothwell	1	9.59	10.85	0
LP	1426	URM1	Brothwell	3+	0	0	0
LP	1426	URM2	Brothwell	3	11.44	8.36	5.77
LP	1426	URM3	Brothwell	2+	10.88	9.43	6.25
LP	1426	LRM2	Brothwell	3	9.8	10.25	6.36
LP	1426	ULM2	Brothwell	3	10.4	0	0
LP	1426	ULM3	Brothwell	2+	9.61	10.3	5.03
LP	1426	ULM1	Brothwell	4	9.93	9.29	5.66
LP	1426	ULP2	Smith	6	9.25	6.14	0
LP	1426	ULP1	Smith	6	9.17	6.06	0
LP	1426	URI1	Smith	7	8.67	7.11	0
LP	1426	LLM2	Brothwell	3+	9.92	0	0
LP	1426	Fragments	-	0	0	0	0
LP	1426	LLM3	Brothwell	2	0	12.33	7.41
LP	1427	LRM2	Brothwell	3	9.94	9.88	6.39
LP	1427	LRM1	Brothwell	4	10.12	9.98	5.6
LP	1427	LRP2	Smith	3	8.17	7.24	0
LP	1427	LRP1	Smith	3	6.93	6.67	7.68
LP	1427	LRM3	Brothwell	2+	8.81	8.95	0
LP	1428	ULP2	Smith	5	9.12	7.11	4.42
LP	1428	ULM1	Brothwell	4+	11.18	9.91	5.64
LP	1429	LRM1	Brothwell	3+	10.5	11.31	6.33
LP	1429	LRM2	Brothwell	2+	10.91	10.77	7.48
LP	1429	LRM3	Brothwell	2+	8.91	10.87	6.62
LP	1429	Root	-	0	0	0	0
LP	1429	ULI1	Smith	5	6.33	8.28	0
LP	1429	ULC	Smith	4	6.47	6.33	10.79
LP	1429	ULP1	Smith	3	8.79	6.33	0
LP	1429	URI1	Smith	5	6.89	8.51	0
LP	1429	ULM2	Brothwell	2+	10.49	9.14	6.2
LP	1429	LLM1	Brothwell	3+	10.54	11.51	6.15
LP	1429	LLC	Smith	3	5.08	6.35	9.23
LP	1429	URM3	Brothwell	2	10.17	9.03	0
LP	1429	ULM3	Brothwell	2	10.57	8.6	0
LP	1429	URM2	Brothwell	2+	9.88	9.51	6.84
LP	1429	URM1	Brothwell	2+	0	10.5	0
LP	1429	URP2	Smith	3	8.47	6.37	5.99
LP	1429	LLM2	Brothwell	3	10.96	10.53	0
LP	1429	LLM3	Brothwell	2	9.27	10.62	5.86
LP	1429	LRP1	Smith	3	7.3	6.47	8.38
LP	1429	LRP2	Smith	3	7.65	7.06	0
LP	1430	LLM2	Brothwell	2+	9.15	10.18	5.15
LP	1430	LRM3	-	0	0	0	0
LP	1430	LLP1	Smith	3	7.3	6.32	8.65
LP	1430	LLC	Smith	3	6.02	0	12.45
LP	1430	LLM1	Brothwell	3+	9.91	9.97	6.19
LP	1430	LLP2	Smith	3	8.29	5.81	7.41
LP	1430	LRM1	Brothwell	3+	10.06	10.39	6.3
LP	1430	LRM2	Brothwell	2+	9.4	10.13	5.73
LP	1430	LLI2	Smith	3	5.79	6.16	9.93
LP	1430	LRP2	Smith	3	8.64	6.89	6.96
LP	1430	LLM3	Brothwell	1	7.96	8.87	5.66
LP	1431	ULC	Smith	2	7.52	7.56	9.76
LP	1431	Incisor	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	1431	ULP2	Smith	2	8.65	6.35	7.93
LP	1431	ULM2	Brothwell	3	10.74	10.63	6.58
LP	1431	LRdI2	Smith	1	4.26	5.76	0
LP	1431	LRM2	Brothwell	2+	8.53	9.29	6.27
LP	1431	LRM3	Brothwell	2	9.2	10.18	5.99
LP	1431	ULM3	Brothwell	2+	11.3	9.28	0
LP	1431	LLdI2	Smith	1	4.51	5.49	0
LP	1431	LLdI1	Smith	1	5.11	4.72	0
LP	1431	LRM1	Brothwell	2	9.61	10.8	0
LP	1431	LLdC	Smith	1	5.06	6.51	0
LP	1431	URdM2	Brothwell	1	9	9.71	6.25
LP	1431	ULdM2	Brothwell	1	8.82	9.73	5.93
LP	1431	LRdC	Smith	1	4.9	6.89	0
LP	1431	LRdI1	Smith	1	4.86	4.87	0
LP	1431	LRM3	Brothwell	2	9.88	11.67	6.64
LP	1431	LRC	Smith	4	6.83	6.55	12.14
LP	1431	LRM1	Brothwell	2	9.77	10.91	0
LP	1431	URP2	Smith	2	9.21	6.8	6.6
LP	1431	URP1	Smith	3	8.61	6.68	7.63
LP	1431	URM3	Brothwell	3	8.59	8.37	5.32
LP	1431	LRI2	Smith	3	4.83	5.89	9.72
LP	1431	LRI2	Smith	4	5.06	0	0
LP	1431	URM2	Brothwell	2+	10.83	10.7	7.24
LP	1432	ULC	Smith	6	8	7.34	0
LP	1432	URP2	Smith	6	7.73	7.51	0
LP	1433	Canine	-	0	0	0	0
LP	1433	Lower	-	0	0	0	0
LP	1434	Fragments	-	0	0	0	0
LP	1434	ULM2	Brothwell	5	0	9.77	0
LP	1434	URI1	Smith	5	0	0	0
LP	1434	ULI1	Smith	4	6.01	7.96	8.74
LP	1434	ULC	Smith	6	8.19	6.66	0
LP	1435	LRP1	Smith	5	7.26	6.81	0
LP	1436	LLdM1	Brothwell	1	7.35	8.62	5.6
LP	1436	LRdM1	Brothwell	1	7.04	8.15	6.09
LP	1792	ULM2	Brothwell	3	10.62	0	0
LP	1948	Roots	-	0	0	0	0
LP	2037	ULC	-	0	6.95	6.75	5
LP	2037	ULI1	Smith	4	7.12	8.53	10.5
LP	2039	LLM1	Brothwell	4	9.81	10.09	4.8
LP	2039	LLM2	Brothwell	4	9.34	9.57	5.49
LP	2039	LLM3	Brothwell	3	9.46	9.82	5.58
LP	2039	LLI1	Smith	4	5.78	5.48	8.6
LP	2039	LLC	Smith	4	7.88	6.4	10.33
LP	2039	LLP1	Smith	4	7.46	6.61	7.66
LP	2039	LLP2	Smith	6	7.66	5.58	0
LP	2039	ULI2	Smith	2	4.72	7.05	9.33
LP	2039	LLP1	Smith	3	7.6	7.35	7.79
LP	2039	LLP2	Smith	3	7.04	6.75	9.23
LP	2040	LRM3	Brothwell	3+	9.78	10.74	6.3
LP	2040	LRM1	Brothwell	5	10.76	10.75	0
LP	2040	LRM2	Brothwell	4+	10.95	9.69	5.66
LP	2040	LRM3	Brothwell	4+	9.9	10.41	6.06
LP	2040	LLM1	Brothwell	4+	10.37	10.26	5.27
LP	2040	LRM2	Brothwell	4+	10.27	9.8	5.13
LP	2090	LLP2	Smith	6	7.95	6.45	0
LP	2090	LLM2	Brothwell	5	9.67	9.35	0
LP	2091	LLM2	Brothwell	3*	10.38	11.17	6.71
LP	2091	LLM3	Brothwell	3	10.33	10.64	6.38

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	2410	LRM1	-	0	10.84	11.16	5.54
LP	2410	ULI1	-	0	4.17	8.7	0
LP	2410	Premolar	-	0	0	0	0
LP	2410	URdC	-	0	4.49	6.7	5.6
LP	2411	Incisive	-	0	0	0	0
LP	2412	LRM1	Brothwell	0	0	0	0
LP	2412	LLM1	Brothwell	3	9.55	10.94	6.91
LP	2412	Canine	-	0	0	0	0
LP	2412	URM2	Brothwell	3+	11.34	8.86	7.24
LP	2412	Incisive	-	0	0	0	0
LP	2412	URP2	Smith	no wear	10.13	7.39	7.29
LP	2412	URM1	Brothwell	4	11.35	10.26	6.09
LP	2412	ULM2	Brothwell	3	11.03	10.33	6.66
LP	2412	ULM3	Brothwell	2+	11.89	9.4	6.17
LP	2413	LRM3	Brothwell	2	9.12	10.28	6.12
LP	2413	Canine	-	0	0	0	0
LP	2413	LLM3	Brothwell	2	9.4	10.16	5.71
LP	2414	LLPM2	Smith	3	8.06	7.51	5.45
LP	2415	ULC	Smith	2	8.76	6.95	11.01
LP	2415	ULP2	Smith	2	9.2	6.34	7.39
LP	2415	URM3	Brothwell	2+	11.48	9.82	7.11
LP	2415	URM2	Brothwell	2+	10.9	9.99	7.45
LP	2415	URM1	Brothwell	4	11.37	10.56	6.78
LP	2415	URP1	Smith	3	9.31	6.75	7.98
LP	2415	URC	Smith	3	8.35	7.42	9.77
LP	2415	ULI2	Smith	2	5.79	6.71	10.13
LP	2415	URI2	Smith	1	5.77	6.4	9.75
LP	2415	ULP1	Smith	2	9.07	6.51	8.06
LP	2415	ULM2	Brothwell	4	11.89	9.94	6.45
LP	2415	URI1	Smith	3	6.34	8.58	10.23
LP	2416	ULPM1	Smith	1	9.03	6.75	7.33
LP	2416	ULdM1	Brothwell	0	8.51	6.64	4.37
LP	2416	ULM2	Brothwell	2	9.83	8.97	5.63
LP	2416	LRPM2	Smith	1	8.48	8.11	10.41
LP	2416	ULPM2	Smith	NO	8.61	6.89	5.44
LP	2416	ULI1	Smith	1	5.58	9.19	11.52
LP	2417	ULC	Smith	2	8.31	7.73	10
LP	2418	Premolar	-	0	0	0	0
LP	2419	Root	-	0	0	0	0
LP	2419	LLM2	Brothwell	5+	10.7	10.58	0
LP	2419	URI1	Smith	3	7.51	9.19	10.06
LP	2420	LLI2	Smith	4	6.61	6.21	7.46
LP	2420	Roots	-	0	0	0	0
LP	2420	LRM2	Brothwell	3+	9.81	10.77	4.58
LP	2420	LRM1	Brothwell	5	10.27	10.61	0
LP	2420	LRP2	Smith	5	7.48	0	4.2
LP	2420	LRM1	Brothwell	5	10.17	0	0
LP	2420	LRM2	Brothwell	4	10.05	10.66	6.16
LP	2420	LLI1	Smith	4	0	0	0
LP	2420	LRM3	Brothwell	5	0	0	0
LP	2421	Premolar	Smith	3	0	0	0
LP	2422	Root	-	0	0	0	0
LP	2423	Molar	-	0	0	0	0
LP	2423	LLI1	Smith	5	6.42	4.63	5.87
LP	2423	ULM2	Brothwell	2+	10.84	9.39	6.93
LP	2424	ULP2	Smith	3	8.37	6.73	7.9
LP	2424	URM2	Brothwell	2+	10.87	9.6	7.08
LP	2424	ULP1	Smith	3	9.39	6.99	7.33
LP	2424	URM1	Brothwell	2+	10.61	9.91	6.94

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	2424	URP1	Smith	3	8.5	6.79	8.29
LP	2424	ULI2	Smith	5	6.06	5.34	0
LP	2424	URP1	Smith	3	9.22	7.39	7.28
LP	2425	I1SI	-	0	0	0	0
LP	2426	URM3	Brothwell	2+	10.53	8.7	6.9
LP	2426	URM2	Brothwell	3	10.83	9.83	6.37
LP	2426	URP2	Smith	5	9.39	6.54	0
LP	2426	URP1	Smith	5	9.19	6.85	6.78
LP	2426	ULM2	Brothwell	4	10.63	9.38	5.28
LP	2426	ULM3	Brothwell	3	10.49	8.27	6.78
LP	2426	URM3	Brothwell	2+	10.53	8.7	6.9
LP	2426	URM2	Brothwell	3	10.83	9.83	6.37
LP	2426	UURP2	Smith	5	9.39	6.54	0
LP	2426	URP1	Smith	5	9.19	6.85	6.78
LP	2426	ULM3	Brothwell	3	10.49	8.27	6.78
LP	2426	ULM2	Brothwell	4	10.63	9.38	5.28
LP	2427	LLM3	Brothwell	3	9.27	10.63	5.04
LP	2427	LLP1	Smith	4	7.19	6.86	6.45
LP	2427	LLM2	Brothwell	4+	10.86	10.87	4.99
LP	2427	LRI2	Smith	4	6.63	5.09	5.67
LP	2427	LRM2	Brothwell	3+	10.37	10.79	5.43
LP	2427	LLP2	Smith	4	7.6	6.93	6.58
LP	2428	URP1	Smith	5	8.82	6.45	0
LP	2429	ULP1	Smith	4	8.79	6.28	8.19
LP	2429	ULP2	Smith	4	9.21	6.65	7.09
LP	2429	ULC	Smith	3	7.13	7.56	11.36
LP	2429	ULI2	Smith	3	5.01	6.68	9.42
LP	2429	URC	Smith	4	0	0	0
LP	2429	URM3	Brothwell	2	9.95	8.76	5.64
LP	2429	URI1	Smith	5	6.41	8.59	9.64
LP	2429	ULM2	Brothwell	3	10.54	8.75	6.21
LP	2429	URM1	Brothwell	4	11.12	10.4	6.46
LP	2429	ULI1	Smith	3	6.85	9.99	11.72
LP	2429	URM2	Brothwell	2+	10.63	8.69	6.56
LP	2429	URM1	Brothwell	3	10.66	10.62	7.31
LP	2429	URP2	Smith	3	9.5	6.26	6.05
LP	2429	URP1	Smith	3	9.3	7.17	7.85
LP	2429	ULM3	Brothwell	2	10.01	8.72	5.01
LP	2429	URI2	Smith	3	6.25	6.41	8.58
LP	2430	LLM2	Brothwell	4	10.3	10.89	5.06
LP	2431	ULM2	Brothwell	4+	11.33	9.36	4.98
LP	2432	URP1	Smith	4	8.67	6.4	6.18
LP	2432	ULM3	Brothwell	2+	11.32	9.78	5.77
LP	2433	URdI2	-	0	4.99	6.98	5.39
LP	2433	LLDC	-	0	6.55	8.29	8.28
LP	2433	LRdC	-	0	6.81	7.97	8.56
LP	2433	ULdI1	-	0	4.72	0	0
LP	2433	LRI2	Smith	2	5.73	5.58	8.75
LP	2433	ULI1	Smith	5	6.52	7.97	0
LP	2433	URM1	Brothwell	2+	11.61	10.1	6.97
LP	2433	URI1	Smith	5	6.83	7.97	0
LP	2433	Root	-	0	0	0	0
LP	2433	ULdM1	-	0	8.55	7.71	6.55
LP	2434	URI1	-	0	3.78	8.94	0
LP	2434	URM1	Brothwell	3	11.74	10.49	7.71
LP	2435	URM1	Brothwell	3	10.44	10.49	5.87
LP	2435	URM3	Brothwell	2+	10.63	9.11	7.56
LP	2436	ULM2	Brothwell	5++	10.29	10	0
LP	2436	LLM2	Brothwell	4+	10.41	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	2437	URM2	Brothwell	2+	9.91	10.2	6.13
LP	2437	URM3	Brothwell	2	8.51	9.6	6.21
LP	2438	Root	-	0	0	0	0
LP	2438	MOLAR	-	-	0	0	0
LP	2438	ULM3	Brothwell	2+	10.04	9.68	6.78
LP	2438	ULM1	Brothwell	3	11.15	10.1	5.66
LP	2438	URP1	Smith	2	8.09	6.65	7.56
LP	2438	Root	-	0	0	0	0
LP	2438	URP2	Smith	2	8.82	6.42	7.99
LP	2438	LLP2	Smith	2	7.6	7.61	9.59
LP	2439	Premolar	-	0	-	-	-
LP	2440	URM3	Brothwell	5	10.91	8.99	4.6
LP	2440	Premolar	-	0	0	0	0
LP	2440	LLM1	Brothwell	4+	11.34	10.92	5.45
LP	2440	LLC	Smith	4	7.63	6.76	9.08
LP	2440	LLI2	Smith	2	6.3	5.76	9.98
LP	2440	URM1	Brothwell	4+	10.96	11.12	6.76
LP	2440	LRM1	Brothwell	4	11.36	11.07	5.71
LP	2440	ULI1	-	0	0	0	0
LP	2440	LRP2	Smith	6	8.45	7.24	0
LP	2440	URM2	Brothwell	3	11.86	9.89	6.99
LP	2440	ULM3	Brothwell	3	10.06	0	0
LP	2440	ULM2	Brothwell	3+	11.13	10.4	5.87
LP	2440	ULP1	Smith	6	8.97	6.49	0
LP	2441	ULP2	Smith	4	11.11	7.38	7.97
LP	2441	ULM3	Brothwell	2	12.57	9.92	0
LP	2441	ULM1	Brothwell	4	11.99	10.85	6.15
LP	2441	ULP1	Smith	4	10.27	7.87	8.42
LP	2441	URM1	Brothwell	3+	11.07	10.72	6.56
LP	2441	URM2	Brothwell	4+	12.64	9.67	7.14
LP	2441	URM3	Brothwell	3	12.01	10.65	7.14
LP	2441	LRP1	Smith	3	7.69	6.65	6.9
LP	2441	ULM3	Brothwell	3	13.14	9.2	7.01
LP	2442	LRP2	Smith	6	8.22	6.92	0
LP	2442	LRP1	Smith	5	7.9	7.19	0
LP	2442	ULI1	Smith	2	5.83	7.68	10.64
LP	2443	LLP1	Smith	5	7.58	6.53	0
LP	2444	URC	Smith	3	7.91	8.08	11.67
LP	2445	ULM2	Brothwell	3	11.16	10.45	5.14
LP	2445	ULM1	Brothwell	5	11.41	10.55	0
LP	2445	ULP2	Smith	5	9.42	7.1	5.76
LP	2445	ULP1	Smith	3	8.85	7.18	8.32
LP	2445	ULI1	Smith	5	6.24	6.31	0
LP	2445	URC	Smith	5	6.98	5.18	0
LP	2445	URP1	Smith	6	9.28	6.84	5.48
LP	2445	URP2	Smith	5	9.48	6.49	6.56
LP	2445	Root	-	0	0	0	0
LP	2445	URM1	Brothwell	3	10.75	10.1	6.62
LP	2445	URM2	Brothwell	4	11.41	10.13	5.08
LP	2446	URM2	Brothwell	3	10.3	9.56	6.32
LP	2446	URM3	Brothwell	3	9.82	8.89	5.83
LP	2446	LLM3	Brothwell	2	9.88	10.6	4.78
LP	2446	LLM2	Brothwell	2	9.6	11.17	7.47
LP	2446	LRP1	Smith	3	7.48	7.08	8.09
LP	2446	LRP2	Smith	3	6.83	6.89	8.85
LP	2446	Root	-	0	0	0	0
LP	2446	Molar	-	0	0	0	0
LP	2446	URC	-	0	0	0	0
LP	2446	Premolar	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	2446	URM1	Brothwell	4	10.97	10.16	5.77
LP	2446	URP1	Smith	4	8.96	7.28	7.78
LP	2446	ULP2	Smith	4	9.06	7.3	8.19
LP	2446	ULP1	Smith	5	8.95	6.83	6.33
LP	2446	ULC	Smith	5	8.65	7.73	0
LP	2446	ULI1	Smith	4	6.43	8.45	9.21
LP	2447	URC	Smith	6	7.31	7.07	0
LP	2447	URI1	Smith	6	6.62	7.62	0
LP	2447	URP1	Smith	6	8.12	5.85	0
LP	2447	LRP2	Smith	5	7.29	7.06	7.14
LP	2447	Fragments	-	0	0	0	0
LP	2448	ULM1	Brothwell	3+	10.7	11.09	6.2
LP	2448	ULC	Smith	3	7.1	6.54	10.13
LP	2448	ULI2	Smith	3	6.19	6.13	8.54
LP	2448	URI2	Smith	3	6.32	5.94	8.75
LP	2448	URP1	Smith	5	9.31	6.5	5.64
LP	2448	URP2	Smith	5	8.78	6.38	7.51
LP	2448	Root	-	0	0	0	0
LP	2449	URM2	Brothwell	4+	0	0	0
LP	2450	LRI2	Smith	4	5.71	6.65	8.76
LP	2451	ULM2	Brothwell	3	10.63	10.34	4.32
LP	2451	URM1	Brothwell	1	10.72	9.93	5.71
LP	2451	URC	Smith	5	7	6.73	0
LP	2451	ULI1	Smith	5	6.88	7.76	0
LP	2451	ULC	Smith	5	8.9	7.86	0
LP	2451	Root	-	0	0	0	0
LP	2452	Root	-	0	0	0	0
LP	2454	ULP1	Smith	4	9.24	7.08	7.07
LP	2454	Root	-	0	0	0	0
LP	2454	Incisor	-	0	0	0	0
LP	2455	root	-	0	0	0	0
LP	2456	Premolar	-	0	0	0	0
LP	2457	URI1	Smith	5	7.94	8.34	0
LP	2457	ULC	Smith	4	8.45	7.39	7.2
LP	2457	ULP1	Smith	3	8.19	6.61	6.07
LP	2458	ULP1	Smith	5	8.43	6.59	6.28
LP	2458	LLI2	Smith	4	6.53	5.65	7.61
LP	2458	LRC	Smith	4	8.51	7.73	10.39
LP	2458	ULP2	Smith	4	8.39	6.35	6.74
LP	2459	Fragments	-	0	0	0	0
LP	2460	Incisor	-		0	0	0
LP	2461	LRM2	Brothwell	3	11.06	10.85	5.77
LP	2461	Incisor	-		0	0	0
LP	2462	ULM3	Brothwell	5	10.39	8.58	4.64
LP	2463	URM2	Brothwell	2	10.71	9.73	7.04
LP	2463	ULM3	Brothwell	2	10.15	9.79	8.21
LP	2463	ULM2	Brothwell	3	11.39	9.6	7.11
LP	2463	LRM2	Brothwell	4	9.93	10.8	5.44
LP	2465	Root	-	0	0	0	0
LP	2466	URM3	Brothwell	3	12.84	9.17	4.78
LP	2466	URM2	Brothwell	3	11.06	8.84	4.2
LP	2466	URM1	Brothwell	3	11.65	10.7	5.42
LP	2466	ULM2	Brothwell	3	10.86	9.08	6.69
LP	2466	ULM1	Brothwell	3+	11.36	10.6	5.2
LP	2473	ULM2	Brothwell	5++	10.81	9	0
LP	2473	Premolar	-	0	0	0	0
LP	2485	LRdM2	-	0	0	0	0
LP	2489	LLdM2	-	0	0	0	0
LP	2489	LLdM1	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	2489	LRdM2	-	0	0	0	0
LP	2489	LRdM1	-	0	0	0	0
LP	2489	LRdM1	-	0	0	0	0
LP	2489	LLdM2	-	0	0	0	0
LP	2489	LRdM2	-	0	0	0	0
LP	2489	LLdM1	-	0	0	0	0
LP	2490	LLdM2	-	0	0	0	0
LP	2490	LRdM2	-	0	0	0	0
LP	2490	LRdM1	-	0	0	0	0
LP	2490	URI1	Smith	2	5.37	7.63	11.82
LP	2490	LRM2	Brothwell	4	10.14	10.95	5.07
LP	2490	URP2	-	0	0	0	0
LP	2490	URP1	Smith	6	9.22	7.07	0
LP	2490	URC	Smith	5	8.48	8.07	8.95
LP	2494	LRM1	Brothwell	1	10.16	11.73	6.9
LP	2494	LRM1	Brothwell	1	10.16	11.73	6.9
LP	2495	LRP2	Smith	5	8.45	7.11	4.57
LP	2495	LLP1	Smith	3	7.66	6.82	6.12
LP	2495	LRP1	Smith	4	7.41	7.06	7.29
LP	2495	LRM2	Brothwell	4+	10.49	11.13	3.93
LP	2495	LRM1	Brothwell	4	9.9	4.7	0
LP	2495	LRM2	Brothwell	4+	10.49	11.13	3.93
LP	2495	LRM1	Brothwell	4	9.9	4.7	0
LP	2495	LRP2	Smith	5	8.45	7.11	4.57
LP	2495	LRP1	Smith	4	7.41	7.06	7.29
LP	2495	LLP1	Smith	3	7.66	6.82	6.12
LP	2498	LLM3	Brothwell	4+	9.21	10.26	0
LP	2498	LLM2	Brothwell	4+	9.5	9.36	0
LP	2498	LLM1	Brothwell	5+	10.16	8.59	0
LP	2498	LRM1	Brothwell	2	9.32	10.27	7.8
LP	2498	LRdM1	-	0	0	0	0
LP	2498	LLM3	Brothwell	4+	9.21	10.26	0
LP	2498	LLM2	Brothwell	4+	9.5	9.36	0
LP	2499	LRM2	Brothwell	3+	10.21	10.04	4.98
LP	2499	LRM1	Brothwell	2	9.88	10.29	5.3
LP	2499	LRM2	Brothwell		9.58	10.03	5.78
LP	2501	LRdM1	-	0	0	0	0
LP	2501	LRM1	Brothwell	3+	9.85	11.3	5.53
LP	3157	LLM1	Brothwell	3	11.47	10.05	7.11
LP	3158	ULM2	Brothwell	4	10.34	11.13	0
LP	3161	LRM2	Brothwell	2+	10.07	10.06	6.93
LP	3161	LRM1	Brothwell	3	11.39	10.37	7.03
LP	3161	LRP2	Smith	3	8.8	7.33	6.19
LP	3161	LRP1	Smith	2	7.77	6.56	7.41
LP	3164	LRM2	Brothwell	3+	10.45	10.92	6.57
LP	3164	LRM3	Brothwell	3	10.53	10.97	6.17
LP	3165	LLM1	Brothwell	3+	10.93	11.28	6.42
LP	3165	LLM3	Brothwell	3	10.79	11.84	6.84
LP	3165	LLM2	Brothwell	4+	10.97	11.29	6.54
LP	3171	LRP2	Smith	4	9.91	7.13	6.14
LP	3171	LRM1	Brothwell	3+	10.29	10.9	5.92
LP	3194	LRM2	Brothwell	2	8.95	10.27	6.23
LP	4000	ULM1	-	0	0	0	0
LP	4000	UL1	-	0	0	0	0
LP	4000	ULdM2	-	0	0	0	0
LP	4000	ULdM1	-	0	0	0	0
LP	4173	URdI1	-	0	0	0	0
LP	4173	URdM2	-	0	0	0	0
LP	4328	Root	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	4359	Root	-	0	0	0	0
LP	4362	Root	-	0	0	0	0
LP	4498	LRP2	Smith	4	6.1	7.55	0
LP	4498	LRP1	Smith	4	7.47	6.59	5.37
LP	4498	LRM2	Brothwell	3	9.3	0	0
LP	4498	LRM3	Brothwell	3	0	0	0
LP	4558	Upper incisor	-	0	0	0	0
LP	4575	Root	-	0	0	0	0
LP	4605	ULP2	Smith	3	8.38	5.6	5.4
LP	4618	URC	Smith	2	7.35	6.52	9.49
LP	4640	LRM3	Brothwell	3	8.62	8.45	0
LP	4657	URM2	Brothwell	2	11.04	9.55	7.71
LP	4669	Fragments	-	0	0	0	0
LP	4784	LRM1	Brothwell	3	10.84	10.63	5.22
LP	4784	LRM2	Brothwell	3	10.32	10.5	4.17
LP	4871	Fragments	-	0	0	0	0
LP	5029	URP1	Smith	4	9.18	6.52	6.89
LP	5029	URP2	Smith	2	8.97	5.97	4.55
LP	5029	ULC	Smith	2	6.3	7.07	0
LP	5030	URdM2	-	0	10.57	9.33	6.27
LP	5030	URdM1	-	0	9.02	7.74	5.88
LP	5036	LRM2	Brothwell	5	10.25	10.01	0
LP	5036	LRM1	Brothwell	5	11.34	0	0
LP	5112	Molar	-	0	0	0	0
LP	5153	ULM3	Smith	2	10.69	7.82	6.09
LP	5153	ULP1	Smith	3	9.34	6.79	6.28
LP	5153	ULM1	Brothwell	3	11.09	9.92	6.37
LP	5153	ULM2	Brothwell	2	10.91	8.76	6.79
LP	5190	LLM1	Brothwell	5+	0	0	0
LP	5190	LRM1	Brothwell	5+	10.73	10.4	0
LP	5259	LLP1	Smith	2	7.38	6.24	7.61
LP	5259	LLP2	Smith	2	7.71	5.99	6.65
LP	5259	LLM1	Brothwell	3	10.12	10.89	5.68
LP	5270	LRC	-	0	0	0	0
LP	5270	LRP1	-	0	0	0	0
LP	5270	LRP2	-	0	0	0	0
LP	5270	LRM1	-	0	0	0	0
LP	5270	LRI2	-	0	0	0	0
LP	5306	Fragments	-	0	0	0	0
LP	5315	Fragments	-	0	0	0	0
LP	5331	Fragment	-	0	0	0	0
LP	5333	Fragments	-	0	0	0	0
LP	5337	Fragment	-	0	0	0	0
LP	5366	Root	-	0	0	0	0
LP	5395	Fragment	-	0	0	0	0
LP	5422	LRM1	Brothwell	4	10.6	10.67	5.18
LP	5480	Root	-	0	0	0	0
LP	5482	URM2	Brothwell	2	10.26	8.92	6.44
LP	5526	Root	-	0	0	0	0
LP	5555	LLM2	Brothwell	3	9.93	11.32	5.26
LP	5591	Fragments	-	0	0	0	0
LP	5598	Root	-	0	0	0	0
LP	5609	Premolar	-	0	0	0	0
LP	5618	Enamel	-	0	0	0	0
LP	5620	LRM3	Brothwell	2	9.43	9.79	5.09
LP	5701	Molar	-	0	0	0	0
LP	5755	Molar	-	0	0	0	0
LP	5755	Fragments	-	0	0	0	0
LP	5755	ULM1	Brothwell	4	10.53	10.66	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	5778	URP2	Smith	5	8.27	6.25	0
LP	5795	LLI2	Smith	2	3.92	5.33	8.39
LP	5828	Fragments	-	0	0	0	0
LP	5831	Molar	-	0	0	0	0
LP	5831	LLI2	Smith	2	5.97	6.04	8.51
LP	5831	ULI2	Smith	1	4.32	6.77	10.07
LP	5858	ULdI1	-	0	0	0	0
LP	5858	LRdC	-	0	0	0	0
LP	5858	Canine	-	0	0	0	0
LP	5893	Molar	-	0	0	0	0
LP	5910	URP1	Smith	2	8.49	6.3	8.07
LP	5914	ULP2	Smith	2	9.46	6.16	6.6
LP	5914	URP1	Smith	2	9.33	6.51	7.48
LP	5914	URC	Smith	3	8.63	7.99	8.92
LP	5914	ULC	Brothwell	2	8.22	7.75	10.47
LP	5914	ULP1	Smith	3	9.26	6.49	7.81
LP	5935	Incisor	-	0	0	0	0
LP	5942	LLI2	Smith	3	3.31	3.71	7.46
LP	5942	LLI1	Smith	2	4.44	5.21	7.96
LP	5950	Premolar	-	0	0	0	0
LP	5971	ULC	Smith	2	6.75	7.55	10.19
LP	5990	No identified	-	0	0	0	0
LP	5990	Fragments	-	0	0	0	0
LP	6025	ULP1	Smith	3	10.42	7.53	6.14
LP	6025	ULM2	Brothwell	3	11.87	9.08	6.86
LP	6025	ULM1	Brothwell	4+	11.03	9.82	6.14
LP	6033	Premolar	-		0	0	0
LP	6059	LRM2	Brothwell	3	9.17	10.5	7.11
LP	6059	LRM1	Brothwell	3	9.65	11.26	6.83
LP	6059	Root	-	0	0	0	0
LP	6075	LLM2	Brothwell	3	9.86	10.53	0
LP	6075	URP1	Smith	3	9.21	6.58	5.44
LP	6075	URM3	Brothwell	2	11.28	8.88	0
LP	6075	ULM3	Brothwell	2	11.51	7.94	0
LP	6128	LLP2	Smith	2	7.01	7.12	0
LP	6128	LRM1	Brothwell	2	9.56	11.32	7.05
LP	6128	URM1	Brothwell	3+	10.99	10.41	6.4
LP	6129	URM2	Brothwell	2	10.7	9.32	6.58
LP	6158	Molar	-	0	0	0	0
LP	6164	LRM1	Brothwell	5	10.38	0	0
LP	6171	Molar	-	0	0	0	0
LP	6184	Premolar	-	0	0	0	0
LP	6198	LRdC	-	0	0	0	0
LP	6204	LLI1	Smith	3	4.72	5.35	8.04
LP	6204	LRI1	Smith	3	4.99	5.65	8.27
LP	6204	LLC	Smith	1	5.76	7.38	8.64
LP	6204	LRC	Smith	1	5.97	6.34	10.07
LP	6204	URI2	Smith	1	4.49	6.46	8.72
LP	6212	Fragment	-	0	0	0	0
LP	6234	Molar	-	0	0	0	0
LP	6244	Fragment	-	0	0	0	0
LP	6251	Molar	-	0	0	0	0
LP	6251	URM3	Brothwell	4	6.97	8.17	4.16
LP	6251	ULM2	Brothwell	4	10.09	0	5.13
LP	6251	LRM3	Brothwell	1	10.06	9.71	0
LP	6251	ULI2	Smith	3	5.38	8.34	10.58
LP	6251	ULI1	Smith	3	5.15	8.4	10.92
LP	6251	ULC	Smith	1	6.81	7.57	10.94
LP	6251	Molar	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	6251	ULM3	Brothwell	4	6.48	0	0
LP	6265	ULI1	Smith	4	7.29	7.95	0
LP	6265	ULM2	Brothwell	2	11.15	9.74	6.66
LP	6265	ULM1	Brothwell	4+	11.91	10.29	5.45
LP	6275	Molar	-	0	0	0	0
LP	6279	URM2	Brothwell	1	9.94	10.02	0
LP	6279	URM3	Brothwell	1	9.93	8.93	0
LP	6291	LLC	Smith	4	6.92	0	7.6
LP	6291	LRM2	Brothwell	5	9.98	9.98	0
LP	6295	Fragment	-	0	0	0	0
LP	6343	LRM2	Brothwell	1	10.27	11.6	0
LP	6343	LLI2	Smith	1	4.34	6.01	9.22
LP	6343	Molar	-	0	0	0	0
LP	6388	URM3	Brothwell	5	10.77	7.97	0
LP	6388	LLI2	Smith	4	4.67	5.54	6.66
LP	6388	ULM1	Brothwell	1	10.58	10.61	0
LP	6419	LRP2	Smith	1	7.81	7.46	0
LP	6419	LRM2	Brothwell	1	0	0	0
LP	6419	LRM1	Brothwell	1	9.89	11.59	0
LP	6419	LRP1	Smith	1	7.33	6.81	0
LP	6419	URI1	Smith	5+	0	8.4	0
LP	6458	LRM2	Brothwell	4	10.57	10.47	4.74
LP	6458	LRP2	Smith	2	8	7.35	8.46
LP	6458	URI1	Smith	3	5.54	7.16	0
LP	6458	ULM3	Brothwell	2+	10.76	9.39	6.88
LP	6458	URM2	Brothwell	3	10.83	8.81	8.69
LP	6458	URM2	Brothwell	5+	11.7	0	0
LP	6458	ULM2	Brothwell	5	11.69	10.2	0
LP	6458	URM2	Brothwell	4	11.14	9.17	6.02
LP	6458	LLC	Smith	5	5.14	6.51	0
LP	6458	URM3	Brothwell	3	11.19	9.08	4.9
LP	6458	Molar	-	0	0	0	0
LP	6458	LLM3	Brothwell	2	10.04	9.92	5.87
LP	6458	URI1	Smith	4	5.57	8.04	8.85
LP	6458	LLC	Smith	5	6.53	5.7	0
LP	6458	ULM3	Brothwell	3+	10.62	8.62	0
LP	6458	LRM2	Brothwell	1	9.09	10.48	0
LP	6458	LLI1	Smith	4	5.55	4.92	0
LP	6458	ULM1	Brothwell	4+	11.28	9.98	0
LP	6479	LLP2	Smith	2	8.33	7.63	8.08
LP	6479	Incisor	-	0	0	0	0
LP	6479	Root	-	0	0	0	0
LP	6499	Premolar	-	0	0	0	0
LP	6516	Fragment	-	0	0	0	0
LP	6546	ULM2	Brothwell	4	11.61	10.47	6.09
LP	6548	LLdM2	Brothwell	1	7.97	10.12	0
LP	6550	ULI1	Smith	1	6.78	7.77	9.02
LP	6550	ULC	Smith	5	6.82	0	0
LP	6561	URC	Smith	4	8.57	7.9	8.32
LP	6574	Fragment	-	0	0	0	0
LP	6591	URM1	Brothwell	4	9.14	10.63	0
LP	6639	Canine	-	0	0	0	0
LP	6651	Molar	-	0	0	0	0
LP	6651	ULM3	Brothwell	2	12.32	8.61	0
LP	6652	ULP1	Smith	5+	0	0	0
LP	6652	ULP2	Smith	5+	0	0	0
LP	6686	ULI1	Smith	1	0	8.43	0
LP	6686	ULI2	Smith	1	0	0	0
LP	6686	URM1	Brothwell	1	10.85	10.24	6.63

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	6711	ULdC	Smith	4	0	0	0
LP	6742	URC	Smith	3	6.71	7.37	8.92
LP	6742	URM2	Brothwell	4	10.56	8.63	5.38
LP	6742	URM1	Brothwell	4++	12.05	0	0
LP	6743	LRI2	Smith	4	5.24	0	0
LP	6744	URP1	Smith	1	9.02	6.86	0
LP	6744	Fragments	-	0	0	0	0
LP	6745	LLM3	-	0	0	0	0
LP	6745	URM2	-	0	0	0	0
LP	6745	MOLAR	-	0	0	0	0
LP	6754	Molar	-	0	0	0	0
LP	6754	ULP1	-	0	0	0	0
LP	6754	URP2	Smith	1	8.64	7.01	0
LP	6754	Molar	-	0	0	0	0
LP	6756	ULdM1	-	0	0	0	0
LP	6760	ULC	Smith	5	6.9	6.95	0
LP	6766	URI2	Smith	2	5.99	6.02	9.78
LP	6766	ULM1	Brothwell	3	11.54	9.98	5.76
LP	6773	ULP2	Smith	4	9.13	6.67	6.1
LP	6775	Molar	-	0	0	0	0
LP	6777	Fragments	-	0	0	0	0
LP	6783	ULC	Smith	5	8.6	7.37	0
LP	6783	URI1	Smith	5+	7.08	7.61	0
LP	6786	Molar	-	0	0	0	0
LP	6805	ULM3	Brothwell	2	11.99	9.88	6.62
LP	6805	ULP2	Smith	1	9.09	6.92	7.77
LP	6805	URM3	Brothwell	2+	11.26	8.73	7.82
LP	6805	URP2	Smith	1	8.98	6.8	7.32
LP	6805	LRdC	-	0	0	0	0
LP	6805	Molar	-	0	0	0	0
LP	6809	URP2	Smith	5	8.74	6.37	0
LP	6810	ULC	Smith	3	0	0	0
LP	6810	Root	-	0	0	0	0
LP	6810	LRP1	Smith	4	7.29	6.29	5.41
LP	6816	ULP1	-	0	0	0	0
LP	6816	ULP2	-	0	0	0	0
LP	6817	ULP1	-	0	0	0	0
LP	6817	ULP2	-	0	0	0	0
LP	6817	ULM1	Brothwell	2	11.37	9.92	7.1
LP	6817	ULC	Smith	1	7.68	7.88	10.55
LP	6817	URdI2		0	0	0	0
LP	6817	ULM2	Brothwell	1	11.42	9.06	6.47
LP	6817	URM2	Brothwell	1	11.36	9.08	7.03
LP	6817	ULdM1	-	0	0	0	0
LP	6818	ULC	-	0	0	0	0
LP	6836	LRdC	-	0	0	0	0
LP	6836	Incisor	Smith	5+	0	0	0
LP	6836	ULM3	Brothwell	1	10.2	9.14	8.49
LP	6836	ULC	Smith	1	6.36	7.62	0
LP	6836	LRP1	Smith	2	7.81	7.47	0
LP	6836	LRP2	Smith	2	6.52	7.28	0
LP	6905	URP2	Smith	5	0	0	0
LP	6935	Premolar	-	0	0	0	0
LP	6935	Fragments	-	0	0	0	0
LP	6943	Fragments	-	0	0	0	0
LP	6951	ULC	Smith	3	0	0	0
LP	6953	ULI1	-	0	0	0	0
LP	6953	RdC	-	0	0	0	0
LP	6961	Fragments	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	7013	LLM1	Brothwell	2	0	0	0
LP	7013	ULM1	Brothwell	1	0	0	0
LP	7013	URM1	Brothwell	2	0	0	0
LP	7013	LLM2	Brothwell	2	8.46	6.28	6
LP	7013	LLM1	Brothwell	1	0	0	0
LP	7014	Molar	-	0	6.38	7.01	10.3
LP	7016	URP2	-	0	0	0	0
LP	7016	ULdC	-	0	0	0	0
LP	7056	ULM1	Brothwell	1	0	0	0
LP	7070	URM2	Brothwell	4	11.23	12.26	0
LP	7070	Molar	-	0	10.38	11.32	5.9
LP	7070	URC	Smith	1	10.76	10.25	0
LP	7121	URM2	Brothwell	3	11.08	9.8	0
LP	7121	LLM3	Brothwell	2	9.77	11.49	0
LP	7121	ULM2	Brothwell	3	0	0	0
LP	7121	ULI1	Smith	5	0	0	0
LP	7121	LRM3	Brothwell	2	0	0	0
LP	7121	Molar	-	0	10.34	9.75	0
LP	7121	Molar	-	0	10.16	9.85	5.85
LP	7121	URM3	Brothwell	2	0	0	0
LP	7121	Fragment	-	0	6.76	7.4	9.83
LP	7122	Fragments	-	0	11.39	9.23	6.82
LP	7122	LRM2	Brothwell	4	10.18	10.67	0
LP	7122	LRM2	Brothwell	3	11.2	9.26	0
LP	7122	LLM3	Brothwell	2+	6.46	8.1	0
LP	7122	MOLAR	-	0	10.01	10.43	0
LP	7122	LRP2	Smith	2	0	0	0
LP	7123	LRP1	Smith	1	10.48	9.39	6.24
LP	7123	LRM2	Brothwell	1	9.57	11.3	6.05
LP	7123	LRP2	Smith	1	8.23	7.19	6.98
LP	7123	URM1	Brothwell	1	0	0	0
LP	7123	URC	Smith	5	0	0	0
LP	7123	ULI2	Smith	1	0	0	0
LP	7123	Fragments	-	0	0	0	0
LP	7123	URdM1	-	0	10.86	11.35	5.83
LP	7123	URdC	-	0	10.24	10.99	0
LP	7129	LRP2	Smith	3	0	0	0
LP	7200	LLC	Smith	3	6.22	7.84	9.18
LP	7200	URC	Smith	2	8.64	7.92	12.08
LP	7200	URI1	Smith	4	6.09	9.94	10.97
LP	7200	ULM1	Brothwell	1	10.15	10.21	0
LP	7200	LRM3	Brothwell	2+	10.41	11.49	0
LP	7200	URM2	Brothwell	3	11.21	9.67	0
LP	7201	LLdM2	-	0	0	0	0
LP	7201	ULdI1	-	0	11.33	10.72	0
LP	7201	LLC	Smith	3	4.91	6.75	5.46
LP	7201	LRdM2	-	0	0	0	0
LP	7201	ULdM1	-	0	0	0	0
LP	7201	LLM1	Brothwell	1	10.14	11.13	0
LP	7201	LLI2	Smith	4	3.36	5.28	8.14
LP	7201	ULdI2	-	0	0	0	0
LP	7201	Fragments	-	0	0	0	0
LP	7201	Fragments	-	0	0	0	0
LP	7201	Premolar	-	0	0	0	0
LP	7201	URdC	-	0	0	0	0
LP	7201	ULdC	-	0	0	0	0
LP	7234	ULP2	Smith	2	8.35	5.79	7.67
LP	7234	ULM2	Brothwell	2+	11.2	10.89	6.81
LP	7234	ULM1	Brothwell	3	10.58	10.63	7.16

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	7234	ULP1	Smith	3	7.98	6.88	8.47
LP	7237	LRM1	Brothwell	1	9.83	10.77	0
LP	7237	LLM1	Brothwell	1	9.8	11.02	0
LP	7238	LRM2	Brothwell	2+	9.34	10.65	6.02
LP	7238	LLM2	Brothwell	2	10.07	10.74	0
LP	7238	LLM1	Brothwell	4	10.67	11.58	0
LP	7238	LLI2	Smith	1	2.93	5.1	8.99
LP	7238	LRI2	-	0	3.96	5.38	9.76
LP	7268	Molar	-	0	0	0	0
LP	7268	Fragments	-	0	0	0	0
LP	7270	URI2	Smith	1	0	0	0
LP	7270	ULdM1	-	0	0	0	0
LP	7270	URP1	Smith	2	9.55	6.87	0
LP	7270	ULP1	Smith	2	9.21	7.02	0
LP	7270	URM3	Brothwell	2	11.15	8.82	0
LP	7270	ULM1	Brothwell	2+	10.93	9.94	6.93
LP	7270	ULM3	Brothwell	2	11.46	8.78	0
LP	7270	URdM1	-	0	0	0	0
LP	7270	Root	-	0	0	0	0
LP	7273	Fragment	-	0	0	0	0
LP	7273	LLP1	Smith	1	8.38	6.92	7.56
LP	7273	LLM3	Brothwell	1	10.35	10.97	0
LP	7273	LRM1	Brothwell	2	10.34	10.75	6.68
LP	7273	LLP2	Smith	1	7.25	6.06	0
LP	7273	LLM1	Brothwell	2	9.48	11.14	0
LP	7273	LLM1	Brothwell	2	9.36	11.21	0
LP	7273	LLdC	-	0	0	0	0
LP	7273	MOLAR	-	0	0	0	0
LP	7281	Fragment	-	0	0	0	0
LP	7298	URP1	Smith	5	8.2	6.55	4.26
LP	7301	ULC	Smith	1	0	0	0
LP	7301	URM1	Brothwell	1	10.71	10.34	7.44
LP	7301	ULM1	Brothwell	1	10.78	10.32	7.39
LP	7301	ULdM2	-	0	0	0	0
LP	7301	ULdM1	-	0	0	0	0
LP	7301	Fragment	-	0	0	0	0
LP	7301	URP2			0	0	0
LP	7301	URM3	Brothwell	2	10.46	8.45	7.18
LP	7301	URC	Smith	2	7.35	7.6	10.76
LP	7301	URdM1	-	0	0	0	0
LP	7301	URdM1	-	0	0	0	0
LP	7301	URdM1	-	0	0	0	0
LP	7301	URP1	Smith	1	8.21	7.16	8.21
LP	7301	ULM2	Brothwell	2	10.79	8.23	8.01
LP	7302	URM2	-	0	0	0	0
LP	7302	LLI2	Smith	3	0	6.22	0
LP	7302	URP1	Smith	5	7.76	6.54	0
LP	7311	URM1	Brothwell	4	10.56	10.29	0
LP	7311	MOLAR	-	0	0	0	0
LP	7315	ULM2	-	0	0	0	0
LP	7328	LRP1	Smith	3	8.25	7.49	7.13
LP	7328	LLP1	Smith	3	7.31	7.23	7.62
LP	7328	URM1	Smith	3	9.52	10.57	5.36
LP	7328	LLM2	Brothwell		10.4	10.01	5.68
LP	7328	LLM1	Brothwell	3	10.58	10.97	5.72
LP	7328	LRM1	Brothwell	4	10.42	11.13	5.71
LP	7328	LRM2	Brothwell	3	10.14	9.84	5.05
LP	7328	LRM3	Brothwell	2	10.21	10.11	6.15
LP	7355	LLP2	Smith	3	7.57	6.67	5.66

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	7355	Upper	-	0	0	0	0
LP	7355	Fragments	-	0	0	0	0
LP	7355	LLI1	Smith	3	4.09	5.05	0
LP	7355	LLC	Smith	3	6.98	5.98	8.48
LP	7355	LLM2	Brothwell	4	9.45	9.48	4.41
LP	7355	LRI2	Smith	3	5.89	5.45	7.9
LP	7355	MOLAR	-	0	0	0	0
LP	7355	LRI1	Smith	3	4.08	4.65	6.45
LP	7355	LLI2	Smith	3	5.19	5.48	8.33
LP	7355	ULC	Smith	3	6.93	5.88	8.64
LP	7355	LRM2	Brothwell	4+	0	10.07	4.5
LP	7355	LRP1	Smith	4	7.1	6.76	6.56
LP	7356	MOLAR	-	0	0	0	0
LP	7362	LRM1	Brothwell	1	10.49	11.58	0
LP	7362	RdC	-	0	0	0	0
LP	7378	ULI2	Smith	2	3.86	6.4	8.61
LP	7378	URM2	Brothwell	4	10.88	10.38	6.37
LP	7378	URP2	Smith	3	8.45	7.13	0
LP	7378	ULM3	Brothwell	1	9.98	8.72	0
LP	7378	ULM2	Brothwell	4	11.88	10.32	5.83
LP	7378	ULM3	Brothwell	1	10.49	9	0
LP	7378	URP1	Smith	3	8.58	7.27	0
LP	7378	URM3	Brothwell	2	10.14	8.68	0
LP	7378	ULP2	Smith	3	8.65	6.54	0
LP	7378	ULP1	Smith	4	8.68	6.35	0
LP	7378	ULC	Smith	3	7.8	7.48	0
LP	7378	LLI2	Smith	2	4.83	4.99	0
LP	7378	Fragments	-	0	0	0	0
LP	7381	URI1	Smith	4	6.31	8.39	8.41
LP	7395	ULM1	-	0	0	0	0
LP	7409	ULM1	Brothwell	1	11.12	10.14	7.12
LP	7433	LRP2	Smith	2	7.57	6.61	0
LP	7433	LLM2	Brothwell	3	10.83	10.75	6.62
LP	7451	URM2	Brothwell	1	10.62	10.63	0
LP	7451	ULM2	-	0	0	0	0
LP	7451	LLI2	-	0	0	0	0
LP	7451	ULM1	Brothwell	2	10.41	9.84	6.87
LP	7451	LRM1	Brothwell	1	10.62	11.83	0
LP	7451	URdM1	-	0	0	0	0
LP	7451	ULI2	-	0	0	0	0
LP	7451	ULdC	-	0	0	0	0
LP	7451	ULdI1	-	0	0	0	0
LP	7451	ULdI1	-	0	0	0	0
LP	7451	ULM2	Brothwell	1	11.7	10.2	0
LP	7451	ULdC	-	0	0	0	0
LP	7451	Fragments	-	0	0	0	0
LP	7451	URdC	-	0	0	0	0
LP	7451	LLdC	-	0	0	0	0
LP	7451	ULI2	-	0	0	0	0
LP	7461	Fragment	-	0	0	0	0
LP	7471	Fragment	-	0	0	0	0
LP	7493	LRI1	Smith	4	4.37	4.66	5.78
LP	7493	ULM2	Brothwell	2	10.88	9.34	7.1
LP	7525	Fragments	-	0	0	0	0
LP	7547	URP2	Smith	1	10.24	7.37	8.15
LP	7547	ULM1	Brothwell	1	11.87	10.77	7.42
LP	7547	URM3	Brothwell	1	12.03	9.72	7.89
LP	7547	LRM2	Brothwell	3+	10.92	10.88	5.44
LP	7547	URM1	Brothwell	3	11.98	11.05	7.97

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	7547	URC	Smith	1	7.31	7.14	11.96
LP	7547	LRM2	Brothwell	3+	10.91	10.62	5.57
LP	7547	ULM3	Brothwell	1	12.43	9.18	8.75
LP	7547	ULP1	Smith	1	9.69	6.84	9.53
LP	7578	URP2	Smith	1	9.72	7.14	8.92
LP	7578	LRP1	Smith	1	7.32	7.77	7.68
LP	7578	URP1	Smith	1	9.51	6.96	7.56
LP	7606	URM3	Brothwell	3	10.37	9.64	5.96
LP	7606	LLM2	Brothwell	3+	8.55	9.9	0
LP	7606	LLM2	Brothwell	3+	9.19	10.1	0
LP	7606	LRdM2	-	0	0	0	0
LP	7606	LRM3	Brothwell	2	9.24	10.05	4.94
LP	7606	LLdM2	-	0	0	0	0
LP	7606	LRM1	Brothwell	4	10.12	10.42	5.02
LP	7606	URI1	Smith	4	5.63	9.18	11.39
LP	7606	LRM2	Brothwell	3	9.75	10.73	6.61
LP	7606	ULM1	Brothwell	1	9.73	9.23	5.64
LP	7606	LLM1	Brothwell	1	10.16	0	0
LP	7606	ULdI1	-	0	0	0	0
LP	7606	LLP1	Smith	3	8.19	6.92	5.56
LP	7606	LLM3	Brothwell	1	9.53	10.13	0
LP	7606	ULM2	Brothwell	4	11.83	10.04	7.04
LP	7606	LLP1	Smith	3	0	7.25	0
LP	7606	ULdI2	-	0	0	0	0
LP	7606	ULC	Smith	5	8.36	7.24	0
LP	7606	ULdC	-	0	0	0	0
LP	7606	URdI2	-	0	0	0	0
LP	7606	ULM2	Brothwell	4	11.35	8.34	5.79
LP	7606	URC	Smith	3	6.36	6.67	10.5
LP	7611	LRI2	Smith	4	5.22	5.35	7.16
LP	7611	LRM1	Brothwell	2	9.89	11.87	5.9
LP	7611	Molar	-	0	0	0	0
LP	7611	LLM3	Brothwell	1	8.9	10.29	0
LP	7611	LRM1	Brothwell	2	10.11	11.39	0
LP	7611	LLM2	Brothwell	2	9.18	11.5	0
LP	7611	LRI1	Smith	4	4.73	3.95	6.95
LP	7611	LRC	Smith	4+	6.62	6.4	8.81
LP	7611	LRM2	Brothwell	3	9.7	9.93	0
LP	7611	LLP1	Smith	4+	6.89	6.2	0
LP	7611	URP1	Smith	2	8.82	6.45	6.42
LP	7611	LRP2	Smith	4	8.11	6.71	0
LP	7611	Incisor	-	0	0	0	0
LP	7611	ULC	Smith	5	6.8	6.45	0
LP	7611	LRdC	-	0	0	0	0
LP	7611	Molar	-	0	0	0	0
LP	7611	ULdI1	-	0	0	0	0
LP	7611	ULM1	Brothwell	4	8.98	9.83	4.58
LP	7611	LLP1	Smith	4	6.61	8.83	4.64
LP	7611	URM3	Brothwell	4+	12.16	8.49	5.65
LP	7611	Premolar	-	0	0	0	0
LP	7611	URM2	Brothwell	2+	9.76	9.51	0
LP	7611	LLM1	Brothwell	1	10.54	11.72	0
LP	7611	ULP2	Smith	4	8.28	6.55	5.94
LP	7611	LRM2	Brothwell	4	9.23	10.13	4.95
LP	7611	URC	Smith	4+	7.09	7.25	0
LP	7611	LLI2	Smith	4	5.09	5.24	0
LP	7631	LLM1	Brothwell	1	0	0	0
LP	7631	LRM1	Brothwell	1	9.7	10.67	0
LP	7631	URM1	Brothwell	1	10.03	12.41	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	7631	URM2	Brothwell	1	0	0	0
LP	7631	URC	Smith	3	6.46	7.54	0
LP	7647	Molar	-	0	0	0	0
LP	7651	Root	-	0	0	0	0
LP	7661	Molar	Brothwell	5++	0	0	0
LP	7661	ULI1	-	0	0	0	0
LP	7661	ULI1	-	0	0	0	0
LP	7661	Fragments	-	0	0	0	0
LP	7661	URM3	Brothwell	3	10.76	9.32	4.54
LP	7661	ULM2	Brothwell	2	10.79	10.16	6.93
LP	7661	ULC	Smith	2+	5.64	5.68	11.69
LP	7661	ULM3	Brothwell	1	0	0	0
LP	7661	ULP1	Smith	1	0	0	0
LP	7661	ULM1	Brothwell	1	0	0	0
LP	7661	LLP2	Smith	5	8.74	7.5	0
LP	7661	ULM3	Brothwell	1	0	0	0
LP	7661	URM1	Brothwell	1	11.32	11.05	6.65
LP	7661	URM1	Brothwell	2	11.28	10.11	7.15
LP	7661	URM2	Brothwell	1	10.45	9.8	6.96
LP	7661	URM3	Brothwell	2	9.29	9.31	0
LP	7661	URP2	-	0	0	0	0
LP	7661	ULM1	Brothwell	2+	1060	10.3	6.82
LP	7661	ULM1	Brothwell	2+	11.5	10.46	7.22
LP	7661	URM2	Brothwell	2+	10.68	10.94	7.32
LP	7661	URdM1	-	0	0	0	0
LP	7661	ULdM1	-	0	0	0	0
LP	7661	Premolar	Smith	5+	0	0	0
LP	7708	Molar	-	0	0	0	0
LP	7708	URdM1	-	0	0	0	0
LP	7778	Fragments	-		0	0	0
LP	7846	Molar	-	0	0	0	0
LP	7846	LRI1	Smith	4	4.14	4.34	6.43
LP	7846	LRI2	Smith	5	5.33	4.87	0
LP	7846	LLdI1	-	0	0	0	0
LP	7846	LLC	Smith	4	5.21	6.44	0
LP	7846	LLI2	Smith	4	4.14	5.43	8.44
LP	7846	LLI1	Smith	4	5.21	0	0
LP	7846	Fragments	-	0	0	0	0
LP	7850	LLI2	Smith	1	4.32	5.45	0
LP	7850	URM2	Brothwell	4	10.71	9.36	6.71
LP	7850	Fragments	-	0	0	0	0
LP	7854	Fragments	-	0	0	0	0
LP	7858	Fragment	-	0	0	0	0
LP	7858	LRM2	Brothwell	2	9.36	10.76	5.6
LP	7858	URP2	Smith	2	8.83	7.03	0
LP	7904	LLdI1	-	0	0	0	0
LP	7904	URdI2	-	0	0	0	0
LP	7904	ULdC	-	0	0	0	0
LP	7904	LLM2	Brothwell	2	9.96	11.02	5.87
LP	7904	URdI1	-	0	0	0	0
LP	7904	LRM2	Brothwell	3	9.96	11.03	0
LP	7904	LLM1	Brothwell	3+	10.67	11.38	6.03
LP	7904	LRM1	Brothwell	3	10.77	11.18	5.71
LP	7904	LRdC	-	0	0	0	0
LP	7904	URdM2	-	0	0	0	0
LP	7904	LLI1	Smith	4	5.43	5.22	6.87
LP	7904	LLdI1	-	0	0	0	0
LP	7904	URdM1	-	0	0	0	0
LP	7904	URdC	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	7904	LRdM2	-	0	0	0	0
LP	7904	ULdM2	-	0	0	0	0
LP	7904	LRdM2	-	0	0	0	0
LP	7904	Fragments	Smith	3	8.4	7.02	5.74
LP	7904	Fragments	-	0	0	0	0
LP	7904	LLdM2	-	0	0	0	0
LP	7904	LRM1	Brothwell	1	10.38	11.48	0
LP	7904	LLdM2	-	0	0	0	0
LP	7904	LLM2	Brothwell	2+	9.74	11.19	5.11
LP	7925	ULdM1	-	0	0	0	0
LP	7941	Fragments	-	0	0	0	0
LP	7941	Fragments	-	0	0	0	0
LP	7969	Fragments	-	0	0	0	0
LP	7991	Root	-	0	0	0	0
LP	8020	ULI1	-	0	0	0	0
LP	8020	Molar	-	0	0	0	0
LP	8093	ULI2	Smith	5++	0	0	0
LP	8093	URI2	Smith	5++	0	0	0
LP	8093	ULP1	Smith	5++	0	0	0
LP	8093	URP1	Smith	5++	0	0	0
LP	8107	Fragments	-	0	0	0	0
LP	8107	URI1	Smith	2	4.29	8.14	10.1
LP	8107	URM2	Brothwell	2+	11.49	9.1	0
LP	8107	URM3	Brothwell	2	11.51	9.76	0
LP	8108	URM1	Brothwell	2	10.65	9.6	0
LP	8108	LRC	Smith	3	7.21	7.92	8.04
LP	8108	Molar	-	0	0	0	0
LP	8108	URM3	Brothwell	4+	9.92	8.18	5.8
LP	8108	Molar	-	0	0	0	0
LP	8108	ULM3	Brothwell	1	9.32	11.68	0
LP	8108	ULM2	Brothwell	3	10.62	8.52	0
LP	8108	LRM2	Brothwell	3	10.68	11.54	0
LP	8108	Fragments	-	0	0	0	0
LP	8108	URM2	Brothwell	1	10.62	9.54	0
LP	8110	LLP2	Smith	2	8.59	7.1	7.4
LP	8110	Fragments	-	0	0	0	0
LP	8110	LRP2	Smith	2	7.29	7.23	0
LP	8110	ULC	Smith	4	7.06	6.83	0
LP	8110	ULC	Smith	3	5.86	6.67	0
LP	8111	URM2	Brothwell	1	9.08	10.04	6.35
LP	8111	ULI2	Smith	2	4.92	5.33	8.87
LP	8111	URM1	Brothwell	1	10.97	10.95	0
LP	8111	URI1	Smith	1	6.31	7.99	10.76
LP	8111	ULI1	Smith	2	6.07	7.87	10.57
LP	8111	ULdC	-	0	0	0	0
LP	8111	Fragments	-	0	0	0	0
LP	8111	ULI2	Smith	2	4.89	5.42	9.63
LP	8116	ULP1	Smith	2	9.94	7.26	6.45
LP	8116	URC	Smith	4	8.04	7.91	0
LP	8116	ULC	Smith	4	8.46	7.93	0
LP	8116	URI1	Smith	5	5.34	0	0
LP	8116	LRP2	Brothwell	2	7.64	6.88	0
LP	8116	Fragments	-	0	0	0	0
LP	8116	LRM1	Smith	2	0	11.96	0
LP	8119	Molar	-	0	0	0	0
LP	8119	Lower	-	0	0	0	0
LP	8119	Premolar	-	0	0	0	0
LP	8119	ULC	Smith	4	6.66	6.8	0
LP	8119	Molar	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	8119	Molar	-	0	0	0	0
LP	8119	Molar	-	0	0	0	0
LP	8130	LLP2	Smith	3	7.71	6.99	5.9
LP	8130	LRM1	Brothwell	4	10.8	11.02	5.82
LP	8130	LLM2	Brothwell	2	10.19	11.27	0
LP	8130	URM2	Brothwell	3	10.77	9.36	0
LP	8130	ULM1	Brothwell	2	11	12	0
LP	8130	LRM2	Brothwell	2	10.95	10.95	0
LP	8130	Premolar	-	0	0	0	0
LP	8130	LRM1	Brothwell	3	10.58	11.91	0
LP	8130	LLdM2	-	0	0	0	0
LP	8130	LLdI1	-	0	0	0	0
LP	8130	Fragments	-	0	0	0	0
LP	8135	LRM1	Brothwell	2	9.58	11.27	0
LP	8135	ULM3	Brothwell	2	10.89	8.9	0
LP	8135	ULdM1	-	0	0	0	0
LP	8135	ULdM2	-	0	0	0	0
LP	8135	Fragments	-	0	0	0	0
LP	8135	LRM2	Brothwell	3	10.18	11.32	6.03
LP	8135	ULM1	Brothwell	1	10.87	10.19	7.11
LP	8135	URI2	Smith	4	5.73	6.46	8.17
LP	8135	ULdI2	-	0	0	0	0
LP	8146	LRM3	Brothwell	2+	11.25	9.86	5.83
LP	8146	URM1	Brothwell	3+	11.59	10.94	5.18
LP	8146	ULM3	Brothwell	3	11.98	10.38	0
LP	8146	LLM1	Brothwell	3	11.08	11.73	7.46
LP	8146	URM2	Brothwell	2+	8.79	12.23	0
LP	8146	URM3	Brothwell	3	9.36	12.31	6.35
LP	8146	LRP2	Smith	2	8.96	7.37	0
LP	8146	LLP1	Smith	3	7.74	7.04	0
LP	8146	URP1	Smith	4	9.49	6.8	0
LP	8146	Fragments	-	0	0	0	0
LP	8159	LLM2	-	0	0	0	0
LP	8159	LLM3	Brothwell	2+	9.44	10.56	0
LP	8167	Fragment	-	0	0	0	0
LP	8181	Lower Incisor	Smith	5++	0	0	0
LP	8181	Incisor	Smith	5++	0	0	0
LP	8181	LLC	Smith	5++	0	0	0
LP	8181	ULC	Smith	5++	0	0	0
LP	8181	Premolar	Smith	5	0	0	0
LP	8181	Canine	Smith	6	0	0	0
LP	8181	Incisor	Smith	5++	0	0	0
LP	8182	ULdI2	-	0	0	0	0
LP	8182	ULdI1	-	0	0	0	0
LP	8185	ULC	Smith	3	6.06	6.45	9.73
LP	8185	URM2	Brothwell	3	10.08	8.52	5.4
LP	8185	ULM1	Brothwell	3+	12.13	10.54	0
LP	8185	URI2	Smith	3+	5.07	6.33	10.42
LP	8185	URI1	Smith	3+	6.18	9.74	12.68
LP	8185	URC	Smith	2+	6.53	7.54	10.17
LP	8185	URM3	Brothwell	2+	12.35	8.37	6.81
LP	8185	LLM1	Brothwell	3	10.67	11.91	0
LP	8185	Incisor	-	0	0	0	0
LP	8200	URM1	Brothwell	3	10.4	10.86	7.46
LP	8200	URM3	Brothwell	2	9.58	9.29	6.77
LP	8200	ULP2	Smith	3	8.55	5.94	6.83
LP	8200	ULP1	Smith	5+	0	0	0
LP	8200	URM2	Brothwell	3	10.97	8.57	6.29
LP	8200	URI2	Smith	2	4.37	5.77	8.92

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	8221	Fragments	-	0	0	0	0
LP	8221	LRM2	Brothwell	5+	9.89	10.36	0
LP	8221	URM2	Brothwell	1	0	0	0
LP	8226	Fragments	-	0	0	0	0
LP	8251	LLM2	Brothwell	5+	10.03	10.52	0
LP	8251	LLM1	Brothwell	5+	10.75	11.03	0
LP	8251	LRP1	Smith	5	0	0	0
LP	8251	LRP2	Smith	5	0	0	0
LP	8251	LRM1	Brothwell	5+	10.17	10.39	0
LP	8254	URC	Smith	3	5.56	6.66	9.1
LP	8254	LRI2	Smith	3	4.4	5.42	8.16
LP	8254	URM2	Brothwell	1	10.83	10.43	0
LP	8254	LRM1	Brothwell	4	10.28	10.72	5.47
LP	8254	LRP2	Smith	3	7.95	6.92	7.84
LP	8254	LRP2	Smith	2+	7.77	7.31	0
LP	8254	Fragments	-	0	0	0	0
LP	8254	URP2	Smith	4	8.68	6.8	6.77
LP	8254	LRC	Smith	3	6.15	6.49	0
LP	8254	ULM1	Brothwell	3	10.98	11.96	0
LP	8254	LLP1	Smith	4	4.31	4.82	7.03
LP	8254	LLM2	Brothwell	2+	9.48	11.23	5.36
LP	8254	LLM1	Brothwell	4	10.04	10.85	0
LP	8254	LLP1	Smith	2+	7.47	7.16	7.29
LP	8254	ULP2	Smith	2+	8.1	7.78	6.32
LP	8254	Fragments	-	0	0	0	0
LP	8254	ULC	Smith	4	6.23	6.32	0
LP	8262	LLM1	Smith	1	9.77	11.48	0
LP	8262	Molar	-	0	0	0	0
LP	8262	LRP2	Smith	1	7.95	7.72	0
LP	8262	LRP1	Smith	1	7.02	7.48	0
LP	8262	LRM1	Brothwell	1	9.49	11.22	0
LP	8272	ULM2	Brothwell	1	0	0	0
LP	8272	URM3	-	0	0	0	0
LP	8272	URP2	-	0	0	0	0
LP	8272	Molar	-	0	0	0	0
LP	8272	Molar	-	0	0	0	0
LP	8272	Molar	-	0	0	0	0
LP	8272	ULdM1	-	0	0	0	0
LP	8272	Fragments	-	0	0	0	0
LP	8272	Premolar	-	0	0	0	0
LP	8272	LRM1	-	0	0	0	0
LP	8272	LRC	Smith	2+	4.22	6.62	0
LP	8272	URI2	Smith	2	4.9	6.39	0
LP	8272	Upper	-	0	0	0	0
LP	8272	LLC	Smith	2	7.19	7.77	0
LP	8272	LLM1	Brothwell	4+	10.08	10.9	5.3
LP	8272	LLM2	Brothwell	2	10.22	10.9	0
LP	8272	ULP2	Smith	2	9.37	6.94	0
LP	8272	LRC	-	0	0	0	0
LP	8272	LLP1	Smith	3	8.63	7.73	0
LP	8274	ROOT			0	0	0
LP	8309	LRM1	Brothwell	3+	10.5	11.11	6.66
LP	8309	LRP2	Smith	2+	8.25	6.89	7.3
LP	8312	Fragment	-	0	0	0	0
LP	8318	LLC	Smith	5	6.44	6.26	0
LP	8323	LRM2	Brothwell	3	9.33	10.47	5.5
LP	8323	LLM1	Brothwell	4	10.07	11.04	0
LP	8323	LLM2	Brothwell	2	9.72	10.52	6.21
LP	8323	LRM2	Brothwell	3	9.75	10.45	5.25

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	8323	Molar	-	0	0	0	0
LP	8323	Fragments	-	0	0	0	0
LP	8335	Fragments	-	0	0	0	0
LP	8368	Molar	Brothwell	5++	0	0	0
LP	8388	ULC	Brothwell	4+	6.27	6.22	7.79
LP	8388	URC	Smith	4	6.21	6.62	9.18
LP	8388	LRI1	Smith	4	3.57	5.55	6.04
LP	8388	URM3	Brothwell	3+	11.29	8.95	6.43
LP	8388	ULI2	Smith	2	6.23	6.38	11.19
LP	8388	ULM1	Brothwell	1	0	0	0
LP	8388	LRM1	Brothwell	3	9.57	10.21	5.92
LP	8388	URI2	Smith	4	6.25	6.47	8.1
LP	8388	ULI1	Smith	4+	6.37	8.41	0
LP	8388	LLI1	Smith	4	5.25	5.52	8.28
LP	8388	URP1	Smith	2	9.11	7.24	9.66
LP	8388	Premolar	-	0	0	0	0
LP	8388	ULdM1	-	0	0	0	0
LP	8388	Lower incisor	-	0	0	0	0
LP	8388	ULM2	Brothwell	3	9.49	9.3	6.36
LP	8388	ULP2	Smith	3	8.58	5.97	5.72
LP	8388	Molar	-	0	0	0	0
LP	8388	URdM1	-	0	0	0	0
LP	8388	ULI2	Smith	2	4.68	5.11	9.27
LP	8388	LRI2	Smith	3	6.47	6.31	8
LP	8388	LRP2	Smith	2	7.31	6.8	7.57
LP	8388	ULdI2	-	0	0	0	0
LP	8388	LLP1	Smith	3	7.39	7.28	9.4
LP	8388	ULdM1			0	0	0
LP	8388	LRI1	Smith	3	3.88	5.08	5.71
LP	8388	Fragments	-	0	0	0	0
LP	8388	LLI1	Smith	5	5.68	5.01	0
LP	8388	LLI2	Smith	3	3.97	5.6	7.23
LP	8388	LRP1	Smith	2	6.89	6.97	8.33
LP	8388	ULdM1	-	0	0	0	0
LP	8388	URP2	Smith	2	7.61	7.29	0
LP	8388	URI2	Smith	3	4.9	7.82	11.54
LP	8388	GERMEN	-	0	0	0	0
LP	8388	ULI1	Smith	4	6.42	9.63	12.09
LP	8388	ULI2	Smith	4+	5.4	8.21	10.69
LP	8388	URI2	Brothwell	2+	9.34	10.23	6.23
LP	8388	ULI2	Smith	2	3.36	7.24	7.19
LP	8388	LLM1	Brothwell	4	8.66	10.2	4.2
LP	8388	URP1	Smith	2	8.86	6.76	7.82
LP	8388	ULI2	Smith	3	4.78	6.03	9.15
LP	8388	ULP1	Smith	5	8.85	6.68	0
LP	8388	URP1	Smith	2	8.72	6.9	8.7
LP	8388	LRM1	Brothwell	2	10.64	11.46	7.14
LP	8388	ULM3	Brothwell	3	11.09	9.45	7.12
LP	8388	ULC	Smith	4	7.1	7.71	8.28
LP	8388	LLM1	Brothwell	1	8.89	10.49	7.17
LP	8388	ULM2	Brothwell	2	11.18	9.42	6.62
LP	8388	URP2	Smith	4	8.35	6.46	5.56
LP	8388	ULM1	Brothwell	2	10.01	10.73	6.42
LP	8388	Premolar	-	0	0	0	0
LP	8388	ULI1	Smith	5	6.41	8.22	0
LP	8388	ULI2	Smith	2	5.12	6.37	11.14
LP	8388	LLdC	-	0	0	0	0
LP	8388	URI1	Smith	4	6.88	8.43	8.01
LP	8388	ULI1	Smith	3	4.76	7.92	11.67

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	8388	LLM1	Brothwell	2	10.49	11.44	6.34
LP	8388	ULP1	Smith	2	9.17	7.5	9.61
LP	8388	URP2	Smith	3	8.82	6.93	6.64
LP	8388	ULI2	Smith	1	5.06	8.83	12.94
LP	8447	Fragments	-	0	0	0	0
LP	8488	ULC	Smith	2	4.96	5.88	0
LP	8488	LLM1	-	0	0	0	0
LP	8488	LRM1	-	0	0	0	0
LP	8488	ULC	Smith	2	7.02	6.62	0
LP	8488	Molar	-	0	0	0	0
LP	8488	Premolar	-	0	0	0	0
LP	8488	Lower	-	0	0	0	0
LP	8488	Fragments	-	0	0	0	0
LP	8488	ULM1	Brothwell	2+	10.34	10.3	0
LP	8488	LLP2	Smith	2	7.9	7.33	0
LP	8488	LLI1	Smith	4	0	0	0
LP	8488	LLM1	Brothwell	3+	10.01	11.22	0
LP	8488	LLP1	Smith	4	7.65	7.23	7.84
LP	8488	LRM1	Brothwell	2	9.73	10.67	6.85
LP	8491	Fragments	-	0	0	0	0
LP	8491	Fragments	-	0	0	0	0
LP	8491	LLI2	Smith	4	5.91	6.18	0
LP	8491	URM3	Brothwell	3	12.4	10.7	0
LP	8491	ULI1	Smith	2	5.24	8.51	0
LP	8491	Molar	-	0	0	0	0
LP	8501	LLM1	Brothwell	3	9.55	10.36	6.94
LP	8502	Molar	-	0	0	0	0
LP	8563	LRP1	Smith	2+	8.45	7.54	8.89
LP	8563	URM3	Brothwell	3	11.46	9.08	8.84
LP	8600	LRdC	-	0	0	0	0
LP	8715	Fragments	-	0	0	0	0
LP	8740	ULM1	Brothwell	4+	11.23	10.88	6.38
LP	8740	Fragment	-	0	0	0	0
LP	8776	LRM2	Brothwell	4+	9.56	10.84	6.48
LP	8787	LRM1	-	0	0	0	0
LP	8787	LLdM2	-	0	0	0	0
LP	8787	LLM1	-	0	0	0	0
LP	8789	LLM1	-	0	0	0	0
LP	8789	LRM2	-	0	0	0	0
LP	8789	LRM1	Brothwell	2	10.31	10.89	0
LP	8789	LRdM2	-	0	0	0	0
LP	8789	ULC	Smith	5	7.15	6.62	8.32
LP	8789	LRM1	Brothwell	3	11.11	11.76	6.5
LP	8789	LLdI2	-	0	0	0	0
LP	8789	Fragments	-	0	0	0	0
LP	8792	LRC	-	0	0	0	0
LP	8792	Premolar	-	0	0	0	0
LP	8792	LLdI1	-	0	0	0	0
LP	8792	LLdM1	-	0	0	0	0
LP	8793	Fragments	-	0	0	0	0
LP	8796	Fragments	-	0	0	0	0
LP	8796	URdM1	-	0	0	0	0
LP	8806	LRdM2	-	0	0	0	0
LP	8806	LLdM1	-	0	0	0	0
LP	8806	LRdM1	-	0	0	0	0
LP	8806	LLM2	Brothwell	4	10.43	11.1	4.95
LP	8806	LLM2	Brothwell	3	9.65	11.18	6.32
LP	8806	LRM1	Brothwell	3	9.71	10.71	5.88
LP	8806	LRM2	Brothwell	3+	10.27	10.89	5.37

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	8806	LRM3	Brothwell	3	9.88	10.96	6.61
LP	8806	LLM3	Brothwell	3	10.01	11.01	5.19
LP	8806	LLP2	Smith	2	7.63	6.93	7.49
LP	8806	LRP1	Smith	2	7.47	6.64	7.5
LP	8806	LLP2	Smith	3	7.89	6.82	5.67
LP	9023	LRP1	Smith	3	7.48	6.88	7.22
LP	9023	URM1	Brothwell	5	10.32	10.28	0
LP	9023	URM2	Brothwell	4+	10.41	10.27	0
LP	9023	URC	Smith	4	7.47	7.43	8.19
LP	9023	URP1	Smith	4	8.56	6.4	5.91
LP	9023	ULM1	Brothwell	5	11.35	9.6	0
LP	9023	URM3	Brothwell	4	10.99	9.15	5.2
LP	9024	ULC	Smith	5	7.75	7.31	8.12
LP	9024	ULI1	-	0	0	0	0
LP	9024	LLC	Smith	5	6.22	6.51	8.76
LP	9024	LLP1	Smith	4	4.76	5.1	5.35
LP	9024	LLM2	Smith	5	10.01	10.42	0
LP	9024	LRC	Smith	4	5.53	6.62	9.15
LP	9024	Lower	-	0	0	0	0
LP	9024	ULI1	Smith	4	5.44	8.72	8.78
LP	9024	URI1	Smith	4	5.91	8.41	8.01
LP	9024	LRM3	Brothwell	3+	9.95	10.72	5.08
LP	9024	ULP2	Smith	4	8.67	6.2	4.94
LP	9024	LLP1	Smith	4	7.23	7.12	4.52
LP	9024	ULI2	Smith	3	4.9	6.27	7.73
LP	9024	LLI1	Smith	4	5.07	4.92	0
LP	9024	LLC	Smith	5	4.29	5.49	0
LP	9024	URI2	Smith	3	4.43	5.87	8.15
LP	9024	Fragments	-	0	0	0	0
LP	9046	LLM2	Brothwell	4	9.6	10.98	3.83
LP	9046	LRM1	Brothwell	5	10.07	10.91	0
LP	9048	ULdM1	-	0	0	0	0
LP	9048	LLM3	Brothwell	3	9.67	9.26	4.33
LP	9048	URM3	Brothwell	4	10.7	8.12	5.59
LP	9048	LLI2	Smith	2	3.58	5.18	9.87
LP	9048	LRC	Smith	4	6.71	7.48	8.18
LP	9048	ULM2	Brothwell	4	11.65	10.87	6.12
LP	9048	Upper central	-	0	0	0	0
LP	9048	ULdI2	-	0	0	0	0
LP	9048	LLP2	Smith	2	7.73	7.14	7
LP	9048	ULI2	Smith	2	3.48	5.83	0
LP	9048	URP2	Smith	2	8.14	6.28	0
LP	9048	URI2	Smith	2	5.54	6.07	0
LP	9048	LRP1	Smith	2	7.28	7.18	0
LP	9048	ULM1	Brothwell	2	10.72	0	0
LP	9048	Fragments	-	0	0	0	0
LP	9048	Fragments	-	0	0	0	0
LP	9048	LRdC	-	0	0	0	0
LP	9048	ULI1	Smith	4	6.39	8.26	8.22
LP	9048	URM1	Brothwell	2	10.07	0	0
LP	9048	URP1	Smith	2	8.78	6.98	0
LP	9048	URC	Smith	6	8	8.39	0
LP	9048	ULP1	Smith	2	8.07	6.28	6.18
LP	9048	URM1	Brothwell	3	11.39	10.69	5.97
LP	9048	LRP2	Smith	3	8.07	6.71	6.44
LP	9048	LRdM2	-	0	0	0	0
LP	9048	ULP1	Smith	3	8.45	7.28	4.1
LP	9048	LRM2	Brothwell	3	9.76	11.2	5.12
LP	9048	LRM1	Brothwell	4	11.13	11.24	6.76

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	9048	LLM2	Brothwell	3	9.52	10.69	7.14
LP	9048	ULI2	Smith	2	4.2	6.23	11.67
LP	9048	ULI1	Smith	4	4.58	8.11	11
LP	9048	ULP2	Smith	5	9.51	6.4	0
LP	9048	URP2	Smith	5	9.37	6.57	0
LP	9048	URM1	Brothwell	4	11.65	10.51	6.25
LP	9048	URP2	Smith	2	8.42	6.81	0
LP	9048	LLI2	Smith	3	3.9	6.32	7.92
LP	9084	LLdM1	-	0	0	0	0
LP	9084	LLdM2	-	0	0	0	0
LP	9084	LLdM1	-	0	0	0	0
LP	9092	LRM1	-	0	0	0	0
LP	9092	LRdM2	-	0	0	0	0
LP	9107	LLdC	-	0	0	0	0
LP	9125	LRM2	Brothwell	3	10.29	11.89	0
LP	9125	LLP1	-	0	0	0	0
LP	9125	LLdI2	-	0	0	0	0
LP	9125	LLI2	Smith	2	3.95	5.45	0
LP	9125	ULM1	Brothwell	2	9.81	9.25	0
LP	9125	Molar	-	0	0	0	0
LP	9125	ULdI1	-	0	0	0	0
LP	9125	LLdC	-	0	0	0	0
LP	9125	URM2	Brothwell	4	9.56	9.98	5.05
LP	9125	LLC	Smith	2	4.09	7.02	0
LP	9125	LRdC	-	0	0	0	0
LP	9125	LLI1	Smith	3	3.27	5.19	0
LP	9125	LRC	Smith	3	5.91	7.21	0
LP	9125	LLC	Smith	2	6.81	7.91	0
LP	9125	LLP2	Smith	2	8.67	7.77	0
LP	9125	URI2	Smith	2	3.5	6.19	10.63
LP	9125	LRM1	Brothwell	3	10.18	11.33	6.01
LP	9125	LLdC	-	0	0	0	0
LP	9125	URM1	-	0	0	0	0
LP	9125	LRM1	-	0	0	0	0
LP	9125	LRdM2	-	0	0	0	0
LP	9125	LRdM2	-	0	0	0	0
LP	9125	LRdC	-	0	0	0	0
LP	9125	LLdM2	-	0	0	0	0
LP	9125	LLdM2	-	0	0	0	0
LP	9125	Molar	Brothwell	5++	0	0	0
LP	9125	Molar	Brothwell	5+	0	0	0
LP	9125	URdM1	-	0	0	0	0
LP	9125	Molar	Brothwell	5++	0	0	0
LP	9125	URdM1	-	0	0	0	0
LP	9125	LRM2	-	0	0	0	0
LP	9125	Upper Incisor	-	0	0	0	0
LP	9125	Lower	-	0	0	0	0
LP	9125	LRdM2	-	0	0	0	0
LP	9125	URM1	Brothwell	3	11.88	11.18	8.12
LP	9125	ULdM1	-	0	0	0	0
LP	9125	LRdM2	-	0	0	0	0
LP	9125	LRdC	-	0	0	0	0
LP	9125	ULdI1	-	0	0	0	0
LP	9125	URM2	-	0	0	0	0
LP	9125	LRdC	-	0	0	0	0
LP	9125	LRdM2	-	0	0	0	0
LP	9125	LLI1	Smith	5	4.59	4.52	0
LP	9125	LRM3	Brothwell	5	10.26	10.38	0
LP	9125	LLI1	Smith	4	4.2	5.32	6.22

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	9125	ULdI1	-	0	0	0	0
LP	9125	ULM1	Brothwell	3	10.83	10.43	0
LP	9125	LLdI2	-	0	0	0	0
LP	9125	ULI2	Smith	2	2.95	6.29	0
LP	9125	LLdC	-	0	0	0	0
LP	9125	LLdI1	-	0	0	0	0
LP	9125	LRI1	Smith	3	4.27	5.01	0
LP	9125	LLdC	-	0	0	0	0
LP	9125	LLM2	-	0	0	0	0
LP	9125	LLP2	-	0	0	0	0
LP	9125	ULdI2	-	0	0	0	0
LP	9125	LRdM2	-	0	0	0	0
LP	9125	Lower d	-	0	0	0	0
LP	9125	ULP2	-	0	0	0	0
LP	9125	LLP2	Smith	4	8.66	7.49	4.44
LP	9125	LLP2	-	0	0	0	0
LP	9125	ULM2	-	0	0	0	0
LP	9125	LRC	Smith	1	4.67	6.4	0
LP	9125	ULI1	Smith	2	4.28	9.11	12.96
LP	9125	ULdI2	-	0	0	0	0
LP	9125	LRM1	Brothwell	3	10.04	11.51	0
LP	9125	Molar	-	0	0	0	0
LP	9125	Lower	-	0	0	0	0
LP	9126	URdM1	-	0	0	0	0
LP	9128	LLM2	Brothwell	4+	10.13	10.37	3.78
LP	9128	LLM1	Brothwell	4	10.03	11.2	5.22
LP	9128	ULC	Smith	3	5.97	6.82	10.31
LP	9128	Fragments	-	0	0	0	0
LP	9128	Incisor	-	0	0	0	0
LP	9128	LRI2	Smith	5	4.15	5.12	0
LP	9128	LRM2	Brothwell	4+	0	10.75	0
LP	9128	LLC	Smith	5	5.89	6.42	0
LP	9128	ULI1	Smith	5	5.23	0	0
LP	9128	LLP1	Smith	4	7.96	6.95	5.91
LP	9136	Fragment	-	0	0	0	0
LP	9141	LLM2	-	0	0	0	0
LP	9141	URM2	-	0	0	0	0
LP	9141	ULI2	Smith	2	4.93	6.82	9.36
LP	9141	LRM3	-	0	0	0	0
LP	9141	URC	Smith	2	6.73	8.12	0
LP	9141	URM1	Brothwell	3	11.37	11.11	0
LP	9141	LLM1	Brothwell	3	10.96	8.87	0
LP	9141	LRdM1	-	0	0	0	0
LP	9141	ULC	Smith	3	5.4	7.45	10.16
LP	9141	ULM2	-	0	0	0	0
LP	9141	URI1	Smith	4	5.79	8.85	10.92
LP	9141	LRdM1	-	0	0	0	0
LP	9141	ULI1	-	0	0	0	0
LP	9141	URM2	-	0	0	0	0
LP	9141	ULI1	Smith	5	7.35	8.62	0
LP	9141	LRdM2	-	0	0	0	0
LP	9141	LLM1	-	0	0	0	0
LP	9141	ULI1	Smith	3	4.61	8.98	11.17
LP	9141	ULdM1	-	0	0	0	0
LP	9141	URdM2	-	0	0	0	0
LP	9141	MOLAR	-	0	0	0	0
LP	9141	LRdM2	-	0	0	0	0
LP	9141	ULM1	Brothwell	2	12.58	11.35	0
LP	9141	URI1	Smith	3	3.49	8.44	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	9141	LLM2	-	0	0	0	0
LP	9141	URdM1	-	0	0	0	0
LP	9141	ULM1	Brothwell	3	11.33	10.56	0
LP	9141	URdM1	-	0	0	0	0
LP	9141	LRM1	Brothwell	2	10.44	11.94	0
LP	9141	ULdM1	-	0	0	0	0
LP	9141	LLdM1	-	0	0	0	0
LP	9141	URM2	Brothwell	2	9.95	10.41	6.04
LP	9141	URI1	Smith	4+	7.41	8.79	0
LP	9141	LRM3	Brothwell	3+	9.59	9.36	4.5
LP	9141	LRM1	Brothwell	2	10.97	11.87	0
LP	9141	ULdM1	-	0	0	0	0
LP	9141	URdM1	-	0	0	0	0
LP	9141	ULdM1	-	0	0	0	0
LP	9141	ULM1	Brothwell	3	11.56	9.79	6.69
LP	9141	LRdC	-	0	0	0	0
LP	9141	LRdM2	-	0	0	0	0
LP	9141	LRdM2	-	0	0	0	0
LP	9141	LRdM2	-	0	0	0	0
LP	9141	LRdC	-	0	0	0	0
LP	9141	ULI1	-	0	0	0	0
LP	9141	URdM2	-	0	0	0	0
LP	9141	ULdM1	-	0	0	0	0
LP	9141	ULdM2	-	0	0	0	0
LP	9141	ULM1	-	0	0	0	0
LP	9141	Molar	-	0	0	0	0
LP	9141	LRdM2	-	0	0	0	0
LP	9141	Molar	-	0	0	0	0
LP	9141	URM2	Brothwell	2	9.18	10.12	6.39
LP	9141	LLM1	-	0	0	0	0
LP	9141	URM1	-	0	0	0	0
LP	9141	ULM2	-	0	0	0	0
LP	9141	Lower	-	0	0	0	0
LP	9141	URdI2	-	0	0	0	0
LP	9141	ULdI2	-	0	0	0	0
LP	9141	LRdM2	-	0	0	0	0
LP	9141	URdM1	-	0	0	0	0
LP	9141	URdI2	-	0	0	0	0
LP	9141	LRdM2	-	0	0	0	0
LP	9141	ULP2	-	0	0	0	0
LP	9141	LLC	Smith	5	6.3	5.39	0
LP	9141	URM1	-	0	0	0	0
LP	9141	ULdM1	-	0	0	0	0
LP	9141	URI1	-	0	0	0	0
LP	9141	ULdI2	-	0	0	0	0
LP	9141	ULdC	-	0	0	0	0
LP	9141	LRdC	-	0	0	0	0
LP	9141	LRdM2	-	0	0	0	0
LP	9141	LRdM1	-	0	0	0	0
LP	9141	LRM1	-	0	0	0	0
LP	9141	Lower	-	0	0	0	0
LP	9141	LLdI2	-	0	0	0	0
LP	9141	LLdI2	-	0	0	0	0
LP	9141	LRM1	-	0	0	0	0
LP	9141	Lower	-	0	0	0	0
LP	9141	URC	-	0	0	0	0
LP	9141	URM3	Brothwell	2	8.6	8.25	0
LP	9141	URdM1	-	0	0	0	0
LP	9141	LRdM2	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	9141	Lower	-	0	0	0	0
LP	9141	URI2	-	0	0	0	0
LP	9141	ULI2	-	0	0	0	0
LP	9141	Lower	-	0	0	0	0
LP	9141	URP1	-	0	0	0	0
LP	9141	URdC	-	0	0	0	0
LP	9141	Lower	-	0	0	0	0
LP	9141	ULI2	-	0	0	0	0
LP	9141	URdC	-	0	0	0	0
LP	9141	URI2	-	0	0	0	0
LP	9141	URM2	-	0	0	0	0
LP	9141	URI1	-	0	0	0	0
LP	9141	LRdM2	-	0	0	0	0
LP	9141	LLdM1	-	0	0	0	0
LP	9141	Lower incisor	-	0	0	0	0
LP	9141	URdM1	-	0	0	0	0
LP	9141	ULdM2	-	0	0	0	0
LP	9141	ULdM1	-	0	0	0	0
LP	9141	URdM2	-	0	0	0	0
LP	9141	Upper incisor	-	0	0	0	0
LP	9141	ULM2	-	0	0	0	0
LP	9141	URdM1	-	0	0	0	0
LP	9141	ULM1	-	0	0	0	0
LP	9141	URM1	-	0	0	0	0
LP	9141	URM1	Brothwell	2	11.11	11.4	7.94
LP	9141	LRdM2	-	0	0	0	0
LP	9141	LLdM2	-	0	0	0	0
LP	9141	LRM1	Brothwell	2	10.86	11.78	0
LP	9141	LRM1	-	0	0	0	0
LP	9141	URM2	-	0	0	0	0
LP	9141	LLM3	Brothwell	4	10.43	0	4.93
LP	9141	URP2	Smith	2	8.22	6.42	0
LP	9141	URdM1	-	0	0	0	0
LP	9141	ULM1	-	0	0	0	0
LP	9141	LRdM2	-	0	0	0	0
LP	9141	LRM2	Brothwell	4	10.07	10.36	6
LP	9141	ULC	Smith	3	6.22	7.86	0
LP	9141	URP2	Smith	3	7.75	6.51	0
LP	9141	LRdM2	-	0	0	0	0
LP	9141	ULdI2	-	0	0	0	0
LP	9141	LRdC	-	0	0	0	0
LP	9141	LRM3	-	0	0	0	0
LP	9141	ULdM1	-	0	0	0	0
LP	9141	LRdM2	-	0	0	0	0
LP	9141	URdC	-	0	0	0	0
LP	9141	ULdC	-	0	0	0	0
LP	9141	LLI1	-	0	0	0	0
LP	9141	ULdI2	-	0	0	0	0
LP	9141	URdI2	-	0	0	0	0
LP	9141	LLdC	-	0	0	0	0
LP	9141	LLdI1	-	0	0	0	0
LP	9141	ULdC	-	0	0	0	0
LP	9141	LLdC	-	0	0	0	0
LP	9141	ULdI2	-	0	0	0	0
LP	9141	ULdI2	-	0	0	0	0
LP	9141	ULI2	-	0	0	0	0
LP	9141	LLdI1	-	0	0	0	0
LP	9141	URdC	-	0	0	0	0
LP	9141	URI1	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	9141	LRdC	-	0	0	0	0
LP	9141	LLI2	-	0	0	0	0
LP	9141	URdC	-	0	0	0	0
LP	9141	URdI2	-	0	0	0	0
LP	9141	LRM1	-	0	0	0	0
LP	9141	LRdI1	-	0	0	0	0
LP	9141	URI1	-	0	0	0	0
LP	9141	URdC	-	0	0	0	0
LP	9141	ULI1	-	0	0	0	0
LP	9141	ULC	-	0	0	0	0
LP	9141	LRI1	-	0	0	0	0
LP	9141	ULdI1	-	0	0	0	0
LP	9141	ULI1	-	0	0	0	0
LP	9141	LRdM1	-	0	0	0	0
LP	9141	ULdI2	-	0	0	0	0
LP	9141	Lower	-	0	0	0	0
LP	9141	URI2	-	0	0	0	0
LP	9141	ULI1	-	0	0	0	0
LP	9141	LLI2	-	0	0	0	0
LP	9141	LLI2	-	0	0	0	0
LP	9141	Lower	-	0	0	0	0
LP	9141	URC	-	0	0	0	0
LP	9141	ULdC	-	0	0	0	0
LP	9141	URC	-	0	0	0	0
LP	9141	URdI2	-	0	0	0	0
LP	9149	canine?	-	0	0	0	0
LP	9149	ULI2	Smith	4	5.04	6.31	6.61
LP	9149	LLI1	Smith	4	4.35	5.17	6.83
LP	9149	Molar	-	0	0	0	0
LP	9149	URM1	-	0	0	0	0
LP	9149	LLM1	-	0	0	0	0
LP	9149	URM2	-	0	0	0	0
LP	9149	URM3	-	0	0	0	0
LP	9149	ULI1	-	0	0	0	0
LP	9149	URP2	-	0	0	0	0
LP	9149	Molar	-	0	0	0	0
LP	9149	ULdC	-	0	0	0	0
LP	9149	ULdI1	-	0	0	0	0
LP	9149	URdC	-	0	0	0	0
LP	9149	LLdM2	-	0	0	0	0
LP	9149	URdM1	-	0	0	0	0
LP	9149	LLM1	-	0	0	0	0
LP	9149	LLdC	-	0	0	0	0
LP	9149	URdM1	-	0	0	0	0
LP	9149	ULdC	-	0	0	0	0
LP	9149	ULdC	-	0	0	0	0
LP	9149	MOLAR	-	0	0	0	0
LP	9149	LLP2	Smith	5	7.34	7.2	0
LP	9149	LLdC	-	0	0	0	0
LP	9149	ULC	Smith	5+	5.5	6.24	0
LP	9149	ULdI1	-	0	0	0	0
LP	9149	LRdM1	-	0	0	0	0
LP	9149	LLdM2	-	0	0	0	0
LP	9149	LRM2	-	0	0	0	0
LP	9149	URM1	-	0	0	0	0
LP	9149	ULC	Smith	4	5.48	6.26	9.39
LP	9149	LRM2	-	0	0	0	0
LP	9149	ULdM1	-	0	0	0	0
LP	9149	URP1	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	9149	URM1	Brothwell	2	10.81	11.43	7.36
LP	9149	LRdI1	-	0	0	0	0
LP	9149	LRI2	-	0	0	0	0
LP	9149	LLP2	-	0	0	0	0
LP	9149	URI2	-	0	0	0	0
LP	9149	LLI2	Smith	4	4.55	5.16	0
LP	9149	ULI1	-	0	0	0	0
LP	9149	LRdC	-	0	0	0	0
LP	9149	LRdI1	-	0	0	0	0
LP	9149	LLdI1	-	0	0	0	0
LP	9149	LRI1	-	0	0	0	0
LP	9149	LLI1	-	0	0	0	0
LP	9149	LRI2	Smith	4	4.09	5.29	8.24
LP	9149	Lower	-	0	0	0	0
LP	9149	ULI1	-	0	0	0	0
LP	9149	LRP2	-	0	0	0	0
LP	9149	ULP1	Smith	3	8.96	6.88	0
LP	9149	ULI2	Smith	2	4.13	6.2	10.67
LP	9149	LLP2	Smith	4	5.64	7.51	5.93
LP	9149	ULI2	Smith	2	3.83	6.52	10.17
LP	9149	ULI1	Smith	3	4.75	9.41	11.59
LP	9149	ULM1	-	0	0	0	0
LP	9149	LLM2	Brothwell	4	10.62	10.69	4.93
LP	9149	URI1	-	0	0	0	0
LP	9149	URI1	-	0	0	0	0
LP	9149	URdM1	-	0	0	0	0
LP	9149	Premolar	-	0	0	0	0
LP	9149	ULI2	Smith	2	4.3	6.68	11.5
LP	9149	MOLAR	-	0	0	0	0
LP	9149	LLdC	-	0	0	0	0
LP	9149	URdM1	-	0	0	0	0
LP	9149	ULI1	-	0	0	0	0
LP	9149	LLDc	-	0	0	0	0
LP	9149	LLdC	-	0	0	0	0
LP	9149	ULM1	-	0	0	0	0
LP	9149	LRdI1	-	0	0	0	0
LP	9149	ULdC	-	0	0	0	0
LP	9149	PrEMOLAR	-	0	0	0	0
LP	9149	ULdM1	-	0	0	0	0
LP	9149	LOWER	-	0	0	0	0
LP	9149	UPPER	-	0	0	0	0
LP	9149	LLdI1	-	0	0	0	0
LP	9149	ULdI2	-	0	0	0	0
LP	9149	ULI2	-	0	0	0	0
LP	9149	ULI2	-	0	0	0	0
LP	9149	LRdC	-	0	0	0	0
LP	9149	ULI2	-	0	0	0	0
LP	9149	ULdC	-	0	0	0	0
LP	9149	LRdC	-	0	0	0	0
LP	9149	LOWER	-	0	0	0	0
LP	9149	MOLAR	-	0	0	0	0
LP	9149	URI2	-	0	0	0	0
LP	9149	URdC	-	0	0	0	0
LP	9149	ULdI1	-	0	0	0	0
LP	9149	ULI1	-	0	0	0	0
LP	9149	LRdM2	-	0	0	0	0
LP	9149	ULdI1	-	0	0	0	0
LP	9149	LLM1	-	0	0	0	0
LP	9149	LLdC	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	9149	LOWER	-	0	0	0	0
LP	9149	PrEMOLAR	-	0	0	0	0
LP	9149	LLP1	-	0	0	0	0
LP	9149	URI2	-	0	0	0	0
LP	9149	URI2	Smith	3	3.36	7.44	0
LP	9149	LOWER	-	0	0	0	0
LP	9149	ULdI2	-	0	0	0	0
LP	9149	ULdC	-	0	0	0	0
LP	9149	URdM1	-	0	0	0	0
LP	9149	ULdM1	-	0	0	0	0
LP	9149	ULdM1	-	0	0	0	0
LP	9149	LRM1	-	0	0	0	0
LP	9149	LRM1	-	0	0	0	0
LP	9149	Lower		0	0	0	0
LP	9149	ULI1	Smith	5	6.44	8.57	0
LP	9149	ULM1	-	0	0	0	0
LP	9149	URM1	-	0	0	0	0
LP	9149	URdM1	-	0	0	0	0
LP	9149	URdI1	-	0	0	0	0
LP	9149	MOLAR	-	0	0	0	0
LP	9149	LRdM2	-	0	0	0	0
LP	9149	LRdM2	-	0	0	0	0
LP	9149	URI1	-	0	0	0	0
LP	9150	Fragments	-	0	0	0	0
LP	9167	URdI1	-	0	0	0	0
LP	9167	ULI2	-	0	0	0	0
LP	9167	LLI1	-	0	0	0	0
LP	9167	LRdM1	-	0	0	0	0
LP	9181	Fragment	-	0	0	0	0
LP	9203	LOWER	-	0	0	0	0
LP	9203	URC	Smith	4	7.07	6.19	8.62
LP	9203	LLM2	Brothwell	4+	11.12	12.08	5.47
LP	9203	ULP2	Smith	4+	9.03	6.23	5.01
LP	9203	MOLAR	-	0	0	0	0
LP	9203	ULP1	Smith	4	9.22	6.82	0
LP	9203	LRM2	Brothwell	4	10.24	11.31	0
LP	9203	LLM1	Smith	4+	10.81	11.68	5.23
LP	9203	LLP2	Smith	4	7.58	7.07	6.48
LP	9203	ULM2	Brothwell	4+	11.33	9.09	0
LP	9223	URdM1	-	0	0	0	0
LP	9223	URdM2	-	0	0	0	0
LP	9227	LLI1	Smith	3	3.65	5.64	0
LP	9262	URM1	-	0	0	0	0
LP	9311	URP1	Smith	3	9.29	7.23	6.49
LP	9311	URM3	Brothwell	3+	10.25	9.34	5.94
LP	9318	LRM3	-	0	0	0	0
LP	9318	LLM2	-	0	0	0	0
LP	9318	URM1	-	0	0	0	0
LP	9318	URdC	-	0	0	0	0
LP	9318	LLP2	Smith	2	7.53	6.99	0
LP	9318	LLI2	Smith	2	3.33	5.58	0
LP	9318	URdM1	-	0	0	0	0
LP	9318	URM3	Brothwell	3	12.3	10.27	7.48
LP	9318	LLP2	Smith	3	7.43	6.38	6.06
LP	9318	LLdM2	-	0	0	0	0
LP	9318	Lower Molar	Brothwell	5+	0	0	0
LP	9318	LRdM2	-	0	0	0	0
LP	9318	Premolar	-	0	0	0	0
LP	9318	LLdC	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	9318	LLM2	Brothwell	3+	10.54	9.85	0
LP	9318	Molar	-	0	0	0	0
LP	9318	LLI2	Smith	4	5.85	5.39	7.8
LP	9318	ULdI2	-	0	0	0	0
LP	9318	LRdC	-	0	0	0	0
LP	9318	LLC	Smith	2	5.6	6.48	10.98
LP	9318	LLI1	Smith	4	5.38	6.27	6.61
LP	9318	Lower	-	0	0	0	0
LP	9318	LLM3	-	0	0	0	0
LP	9318	LRM2	Brothwell	5	9.61	10.55	0
LP	9318	LLM1	Brothwell	3	10.13	1153	0
LP	9318	ULM2	Brothwell	3	0	0	0
LP	9318	LRM1	-	0	0	0	0
LP	9318	URM1	-	0	0	0	0
LP	9318	LRdM2	-	0	0	0	0
LP	9318	ULI2	Smith	2	3.39	5.87	0
LP	9318	LLdC	-	0	0	0	0
LP	9318	ULI2	Smith	2	4.6	6.26	0
LP	9318	LRM1	Brothwell	2	10.16	11.59	0
LP	9318	LRM1	-	0	0	0	0
LP	9318	LRP2	Smith	3	6.84	6.54	0
LP	9322	LLC	Smith	4	5.8	6.8	9.7
LP	9322	LLM2	Brothwell	5	9.72	10.13	0
LP	9322	Fragments	-	0	0	0	0
LP	9336	LRM1	Brothwell	5+	10.14	0	0
LP	9336	LRP2	Smith	4	8.55	6.91	3.16
LP	9336	LLM3	Brothwell	5	11.11	12.25	0
LP	9336	LLM2	Brothwell	5	10.75	10.86	0
LP	9336	LLM1	Brothwell	5	10.4	11.08	0
LP	9367	URI1	Smith	5	6.76	7.45	0
LP	9367	Fragments	-	0	0	0	0
LP	9367	LRM1	-	0	0	0	0
LP	9367	Upper incisor	-	0	0	0	0
LP	9367	URC	Smith	4	8.7	7.79	9.17
LP	9367	MOLAR	-	0	0	0	0
LP	9367	URM3	-	0	0	0	0
LP	9367	Lower	-	0	0	0	0
LP	9367	ULM2	-	0	0	0	0
LP	9367	URP2	Smith	4	8.47	6.3	0
LP	9367	ULM3	-	0	0	0	0
LP	9367	LLM3	-	0	0	0	0
LP	9367	LRM3	-	0	0	0	0
LP	9367	ULC	Smith	4	9.33	8.32	0
LP	9367	ULI1	Smith	5	6.75	8.25	0
LP	9367	ULI2	Smith	2	3.98	5.87	0
LP	9367	LLI2	Smith	6	0	0	0
LP	9367	URM3	Brothwell	4	10.84	8.63	0
LP	9367	lower	Smith	7	0	0	0
LP	9367	URC	Smith	3	8.17	6.91	0
LP	9370	Lower incisor	-	0	0	0	0
LP	9370	ULI1	Smith	6	0	0	0
LP	9370	Molar	-	0	0	0	0
LP	9370	Lower	-	0	0	0	0
LP	9370	LLM2	Brothwell	5++	10.05	10.08	0
LP	9370	Lower	-	0	0	0	0
LP	9370	LRM2	Brothwell	4	9.89	10.84	0
LP	9370	ULI1	Smith	5	7.53	9.45	0
LP	9370	ULI1	Smith	4	5.98	7.68	8.58
LP	9441	LLP2	Smith	4	8.26	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	9441	LRP1	Smith	3	8.09	6.67	7.87
LP	9441	LLP1	Smith	3	7.83	6.55	6.65
LP	9460	URM2	Brothwell	3	11.5	10.95	7.22
LP	9460	LRM1	Brothwell	2	10.58	11.91	7
LP	9460	LLM1	Brothwell	3	10.49	11.5	6.77
LP	9460	LLM2	Brothwell	2	9.82	10.45	8.64
LP	9466	LLdM1	-	0	0	0	0
LP	9466	LLdM2	-	0	0	0	0
LP	9467	ULM1	Brothwell	1	11.11	10.49	7.49
LP	9467	ULM2	Brothwell	2	10.31	10.02	0
LP	9611	LLP2	-	0	0	0	0
LP	9611	Fragments	-	0	0	0	0
LP	9618	ULC	-	0	0	0	0
LP	9618	ULI2	Smith	3	5.58	7.23	0
LP	9618	URP1	-	0	0	0	0
LP	9618	ULM1	Brothwell	1	12.43	12.45	0
LP	9618	Lower	-	0	0	0	0
LP	9618	LRM3	Brothwell	3	8.88	0	0
LP	9618	Fragments	-	0	0	0	0
LP	9618	molar	-	0	0	0	0
LP	9618	LLM3	Brothwell	3	9.06	9.92	0
LP	9618	URM3	Brothwell	3	12.48	10.43	0
LP	9618	URM1	Brothwell	2	11.86	11.63	0
LP	9633	LRI1	Smith	4	4.93	5.46	7.28
LP	9633	URI1	Brothwell	2	5.09	6.63	7.97
LP	9633	LRI1	Smith	2	4.48	7.78	9.19
LP	9633	URdI1	-	0	0	0	0
LP	9633	ULM3	-	0	0	0	0
LP	9633	LLdC	-	0	0	0	0
LP	9633	LLP2	-	0	0	0	0
LP	9633	Molar	-	0	0	0	0
LP	9633	URI1	-	0	0	0	0
LP	9633	Lower	-	0	0	0	0
LP	9633	LRI1	Smith	2	3.56	5.79	9.49
LP	9633	ULI1	Smith	5	6.15	7.39	0
LP	9633	URP1	Smith	3	6.28	6.96	0
LP	9633	URP2	-	0	0	0	0
LP	9633	ULI2	-	0	0	0	0
LP	9633	LLI1	Smith	3	3.44	4.94	8.46
LP	9633	ULI2	-	0	0	0	0
LP	9633	URdI1	-	0	0	0	0
LP	9633	LRC	Smith	3	7.67	7.48	0
LP	9633	URP2	Smith	8,66	8.78	6.7	7.97
LP	9633	LLdM2	-	0	0	0	0
LP	9633	LLP1	Smith	2	8.48	7.43	7.79
LP	9633	ULM2	Brothwell	5	10.88	8.43	0
LP	9633	LLM2	-	0	0	0	0
LP	9633	Upper incisor	-	0	0	0	0
LP	9633	LRM1	-	0	0	0	0
LP	9633	LRdM2	-	0	0	0	0
LP	9633	ULdI2	-	0	0	0	0
LP	9633	LLM1	-	0	0	0	0
LP	9633	LLdM2	-	0	0	0	0
LP	9633	ULM2	-	0	0	0	0
LP	9633	LRM2	-	0	0	0	0
LP	9633	root	-	0	0	0	0
LP	9633	Fragments	-	0	0	0	0
LP	9633	LLM2	-	0	0	0	0
LP	9633	ULdM1	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	9633	ULdI1	-	0	0	0	0
LP	9633	Upper incisor	-	0	0	0	0
LP	9633	ULM2	-	0	0	0	0
LP	9633	ULdI1	-	0	0	0	0
LP	9633	LRP2	-	0	0	0	0
LP	9633	LLdC	-	0	0	0	0
LP	9633	ULdI2	-	0	0	0	0
LP	9633	ULdI1	-	0	0	0	0
LP	9633	ULdI2	-	0	0	0	0
LP	9633	ULdI2	-	0	0	0	0
LP	9633	LLM1	-	0	0	0	0
LP	9633	ULI1	Smith	2	3.35	7.77	11.56
LP	9633	LLM1	Brothwell	3	9.8	10.78	6.2
LP	9633	URI1	Smith	3	6.82	8.2	10.5
LP	9633	ULC	Smith	5	8.54	6.3	0
LP	9633	ULP1	-	0	0	0	0
LP	9636	LLM1	-	0	0	0	0
LP	9636	LLM3	Brothwell	6	0	0	0
LP	9636	LLM2	Brothwell	6	0	0	0
LP	9694	Fragments	-	0	0	0	0
LP	9694	URI2	-	0	0	0	0
LP	9695	ULM1	-	0	0	0	0
LP	9695	LRM2	-	0	0	0	0
LP	9706	LRM2	-	0	0	0	0
LP	9707	ULM2	Brothwell	3	11.01	9.7	0
LP	9735	LRdM2	-	0	0	0	0
LP	9735	LRdM2	-	0	0	0	0
LP	9735	URM2	-	0	0	0	0
LP	9735	URdM1	-	0	0	0	0
LP	9735	LLdM2	-	0	0	0	0
LP	9735	ULM3	Brothwell	4+	1195	9.49	6.28
LP	9735	LRdM2	-	0	0	0	0
LP	9735	ULdI1	-	0	0	0	0
LP	9735	LLI1	Smith	2	4.46	5.79	9.76
LP	9735	LLdI2	-	0	0	0	0
LP	9735	LRdM2	-	0	0	0	0
LP	9735	URM2	-	0	0	0	0
LP	9735	URP1	Smith	3	8.44	6.02	6.54
LP	9735	LRdI1	-	0	0	0	0
LP	9735	ULdI1	-	0	0	0	0
LP	9735	URdM1	-	0	0	0	0
LP	9735	LRdM2	-	0	0	0	0
LP	9735	ULdI2	-	0	0	0	0
LP	9735	LRI1	-	0	0	0	0
LP	9735	ULdM1	-	0	0	0	0
LP	9735	LLM2	-	0	0	0	0
LP	9735	URdI2	-	0	0	0	0
LP	9735	LRM1	-	0	0	0	0
LP	9735	ULdI1	-	0	0	0	0
LP	9735	ULdM1	-	0	0	0	0
LP	9735	ULC	-	0	0	0	0
LP	9735	LRM1	-	0	0	0	0
LP	9735	ULdI1	-	0	0	0	0
LP	9735	URdI2	-	0	0	0	0
LP	9735	URdM1	-	0	0	0	0
LP	9735	LRdC	-	0	0	0	0
LP	9735	ULdI2		0	0	0	0
LP	9735	ULM2	-	0	0	0	0
LP	9735	LLdC	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	9735	ULdM1	-	0	0	0	0
LP	9735	LLP1	Smith	2	7.27	7.2	9.5
LP	9735	Fragments	-	0	0	0	0
LP	9735	LRdC	-	0	0	0	0
LP	9735	URdM1	-	0	0	0	0
LP	9735	URI1	-	0	0	0	0
LP	9735	LLdC	-	0	0	0	0
LP	9735	LRdI1	-	0	0	0	0
LP	9739	LRC	Smith	2	3.89	6.09	7.31
LP	9739	URI2	Smith	3	3.89	6.25	10.14
LP	9739	URC	Smith	3	8.13	7.54	8.27
LP	9739	ULP1	Smith	4	9.91	7.14	0
LP	9739	ULI2	-	0	0	0	0
LP	9739	ULC	-	0	7.02	6.48	9.12
LP	9739	Fragments	-	0	0	0	0
LP	9854	LLI2	-	0	0	0	0
LP	9854	LRM1	-	0	0	0	0
LP	9854	Molar	-	0	0	0	0
LP	9854	LRdM2	-	0	0	0	0
LP	9854	LLM1	-	0	0	0	0
LP	9854	LRP1	-	0	0	0	0
LP	9854	LRdC	-	0	0	0	0
LP	9854	ULC	-	0	0	0	0
LP	9854	ULM2	-	0	0	0	0
LP	9854	URM2	Brothwell	4+	9.83	10.51	4.32
LP	9854	URC	Smith	3	8.15	7.32	8.56
LP	9854	LRdC	-	0	0	0	0
LP	9854	ULdI2	-	0	0	0	0
LP	9854	ULdM1	-	0	0	0	0
LP	9854	LLI1	Smith	3	3.17	5.42	8.12
LP	9854	LLdM2	-	0	0	0	0
LP	9854	URdM1	-	0	0	0	0
LP	9854	ULdI1	-	0	0	0	0
LP	9854	LLdM2	-	0	0	0	0
LP	9854	LLP1	-	0	0	0	0
LP	9854	LRdI1	-	0	0	0	0
LP	9854	LRdC	-	0	0	0	0
LP	9854	LRdM1	-	0	0	0	0
LP	9854	LRdC	-	0	0	0	0
LP	9854	ULdC	-	0	0	0	0
LP	9854	ULdM2	-	0	0	0	0
LP	9854	URdM1	-	0	0	0	0
LP	9854	ULdM2	-	0	0	0	0
LP	9854	ULdM1	-	0	0	0	0
LP	9854	LRdM1	-	0	0	0	0
LP	9854	URP1	-	0	0	0	0
LP	9854	LRM1	Brothwell	3	11.15	11.55	7.98
LP	9854	Upper	-	0	0	0	0
LP	9854	LLI1	Smith	3	3.49	5.43	10.33
LP	9854	LLI1	Smith	2	3.4	5.58	10.22
LP	9854	LRdM2	-	0	0	0	0
LP	9854	LRI2	Smith	2	4.21	6.26	10.43
LP	9854	LLI1	Smith	4	5.1	0	7.36
LP	9854	LLI1	Smith	2	3.23	5.02	9.37
LP	9854	Fragment	-	0	0	0	0
LP	9854	LLdM2	-	0	0	0	0
LP	9854	ULdM1	-	0	0	0	0
LP	9854	LRdM2	-	0	0	0	0
LP	9854	ULdM1	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	9854	ULM1	Brothwell	3	9.96	9.28	6.53
LP	9854	LLM2	Brothwell	4	9.93	10.66	4.72
LP	9854	LLM2	-	0	0	0	0
LP	9854	LRM1	-	0	0	0	0
LP	9866	Root	-	0	0	0	0
LP	9867	ULC	Smith	2	5.57	6.78	10.86
LP	9867	LLI1	Smith	4	4.25	5.63	6.85
LP	9867	LLM2	-	0	0	0	0
LP	9867	ULM3	Brothwell	5	0	0	0
LP	9867	LLP2	Smith	3	7.45	6.77	5.89
LP	9867	URP1	Smith	3	9.05	7.14	6.77
LP	9867	LRM3	-	0	0	0	0
LP	9867	LLI1	-	0	0	0	0
LP	9867	LRC	-	0	0	0	0
LP	9867	LLP2	-	0	0	0	0
LP	9867	LLI1	-	0	0	0	0
LP	9867	URdC	-	0	0	0	0
LP	9867	LLC	Smith	4	6.47	6.32	0
LP	9867	LRI1	Smith	3	4.53	5	7
LP	9867	Lower M2	Brothwell	5	0	0	0
LP	9867	LRM1	-	0	0	0	0
LP	9867	Molar	-	0	0	0	0
LP	9867	LLdC	-	0	0	0	0
LP	9867	LLM1	-	0	0	0	0
LP	9867	URP1	Smith	5	9.18	6.67	0
LP	9867	ULI2	-	0	0	0	0
LP	9867	LRP2	-	0	0	0	0
LP	9867	Fragments	-	0	0	0	0
LP	9867	ULdM1	-	0	0	0	0
LP	9867	LRM1	-	0	0	0	0
LP	9867	ULM1	-	0	0	0	0
LP	9867	LRdM2	-	0	0	0	0
LP	9867	URM2	-	0	0	0	0
LP	9867	Upper incisor	-	0	0	0	0
LP	9867	Lower	-	0	0	0	0
LP	9867	LLM2	-	0	0	0	0
LP	9867	ULI2	-	0	0	0	0
LP	9867	LRI1	Smith	4	3.86	4.99	0
LP	9867	LLM1	-	0	0	0	0
LP	9867	LLP2	-	0	0	0	0
LP	9867	LLM2	-	0	0	0	0
LP	9867	LRP2	-	0	0	0	0
LP	9867	LLP2	-	0	0	0	0
LP	9867	LRM2	-	0	0	0	0
LP	9878	LRI1	Smith	4	5.39	4.81	6.19
LP	9904	LLI1	Smith	3	4.5	5.58	6.84
LP	9904	ULI1	-	0	0	0	0
LP	9916	Lower	-	0	0	0	0
LP	9916	ULI1	Smith	3	4.18	6.82	8.05
LP	9916	LRC	Smith	3	4.16	6.3	9.07
LP	9916	LRC	Smith	2	7.55	6.98	7.8
LP	9916	LRM2	-	0	0	0	0
LP	9916	URM3	Brothwell	2	11.09	9.92	0
LP	9916	ULM3	Brothwell	2	10.2	8.91	6.49
LP	9916	ULI2	Smith	2	3.37	5.57	8.42
LP	9916	LLM3	Brothwell	2	9.87	10.31	5.59
LP	9916	LLM2	Brothwell	2	9.95	11.11	6.37
LP	9916	URM3	Brothwell	2	10.44	8.55	0
LP	9916	URM1	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	9916	URC	Smith	3	8.54	8.43	11.95
LP	9916	LRI1	Smith	4	5.35	5.08	5.39
LP	9916	URC	Smith	2	6.23	7.58	13.02
LP	9916	ULM3	Brothwell	3+	11.78	8.75	0
LP	9916	LLI2	-	0	0	0	0
LP	9916	ULP1	-	0	0	0	0
LP	9916	ULC	-	0	0	0	0
LP	9916	LRI1	Smith	4	0	0	0
LP	9916	LRM3	Brothwell	2+	9.51	10.08	4.79
LP	9916	Lower	-	0	0	0	0
LP	9916	Upper	Smith	6	0	0	0
LP	9916	Fragments	-	0	0	0	0
LP	9976	LRdM1	-	0	0	0	0
LP	9977	LRM2	Brothwell	4+	10.61	10.75	5.39
LP	9977		-	0	0	0	0
LP	9977	URI1	Smith	2	6.24	5.61	7.93
LP	9977	URI2	Smith	3	5.02	5.1	6.45
LP	9977	LRM3	Brothwell	4+	10.94	12.34	4.11
LP	10025	LRdM2	-	0	0	0	0
LP	10041	MOLAR	-	0	0	0	0
LP	10072	LLM2	Brothwell	5+	0	0	0
LP	10072	LRP2	Smith	5	7.66	6.61	0
LP	10072	LRM1	Brothwell	5+	10.13	10.43	0
LP	10072	LRM2	Brothwell	5+	9.55	11.96	0
LP	10072	LLP2	Smith	5	7.5	7.01	0
LP	10072	LLM1	Brothwell	5+	10.35	11.11	0
LP	10074	LLI1	Smith	2	2.98	5.21	9.39
LP	10249	URM1	Brothwell	2	10.15	9.44	6.82
LP	10249	URC	Smith	2	7.21	7.53	8.87
LP	10249	URI2	Smith	2	3.4	5.99	8.49
LP	10249	URI1	Smith	3	4.65	8.21	10.81
LP	10249	URdM2	-	0	0	0	0
LP	10249	URdM1	-	0	0	0	0
LP	10254	Fragments	-	0	0	0	0
LP	10289	Fragment	-	0	0	0	0
LP	10299	ULdI2	-	0	0	0	0
LP	10321	Fragments	-	0	0	0	0
LP	10344	URM3	Brothwell	3	9.52	8.78	5.84
LP	10344	LRdM2	-	0	0	0	0
LP	10344	ULdI1	-	0	0	0	0
LP	10345	URC	Smith	4	6.22	7.25	9.62
LP	10345	URdM1	-	0	0	0	0
LP	10345	URdI2	-	0	0	0	0
LP	10345	LRdC	-	0	0	0	0
LP	10345	LRdM2	-	0	0	0	0
LP	10345	Incisor	-	0	0	0	0
LP	10345	URdM1	-	0	0	0	0
LP	10345	ULP1	Smith	5	0	0	0
LP	10345	URI1	Smith	5	6.82	8.08	9.45
LP	10345	LLdC	-	0	0	0	0
LP	10346	LLI2	Smith	4	3.77	5.89	8.45
LP	10346	LLP2	Smith	4	8.23	6.72	7.43
LP	10346	LLM1	Brothwell	4	10.26	11.23	6.8
LP	10346	URC	Smith	4	6.51	6.62	8.54
LP	10346	LLM2	Brothwell	3	9.38	10.61	7.86
LP	10346	ULM3	-	0	0	0	0
LP	10346	LLM1	Brothwell	4	0	0	0
LP	10346	LLI2	Smith	4	3.77	5.89	8.45
LP	10346	LLM1	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	10346	LLI2	Smith	3	3.94	5.86	9.92
LP	10346	ULM1	-	0	0	0	0
LP	10346	ULI1	Smith	4	6.25	8.08	9.34
LP	10346	URM3	-	0	0	0	0
LP	10346	ULdM1	-	0	0	0	0
LP	10346	LRM2	Brothwell	3	10.23	10.73	5.98
LP	10346	LRC	Smith	3	7.7	6.75	8.25
LP	10346	LRM1	Brothwell	3	9.16	10.72	7.01
LP	10347	ULI2	Smith	4	5.26	5.78	0
LP	10347	URC	Smith	5	8.46	7.42	0
LP	10347	LLM2	Brothwell	4	9.98	10.17	6.01
LP	10347	ULP1	Smith	3	8.08	6.36	4.02
LP	10347	LRM3	Brothwell	5	0	0	0
LP	10347	URC	Smith	4	6.67	6.47	7.76
LP	10347	MOLAR	-	0	0	0	0
LP	10347	ULP2	Smith	4	8.58	6.59	5.29
LP	10347	URC	Smith	4	8.26	7.6	8.17
LP	10347	ULM3	Brothwell	3+	10.9	8.72	5.56
LP	10347	LRM2	Brothwell	4	9.73	10.05	4.99
LP	10347	LLP1	Smith	3	7.3	6.48	6.22
LP	10347	URI1	Smith	5+	5.98	7.54	0
LP	10347	LLI1	Smith	5+	0	0	0
LP	10347	LLC	Smith	4	6.38	6.89	9.43
LP	10347	Fragments	-	0	0	0	0
LP	10348	LLI2	Smith	3	3.66	5.17	6.3
LP	10348	ULI2	Smith	4	4.37	6.18	0
LP	10348	Fragments	-	0	0	0	0
LP	10348	URdI1	-	0	0	0	0
LP	10348	Upper incisor	Smith	6	0	0	0
LP	10348	ULdI2	-	0	0	0	0
LP	10348	LLI1	-	0	0	0	0
LP	10348	LRM3	Brothwell	4+	9.66	10.65	4.29
LP	10348	ULdC	-	0	0	0	0
LP	10348	LRdM2	-	0	0	0	0
LP	10348	ULdM1	-	0	0	0	0
LP	10348	URdC	-	0	0	0	0
LP	10348	LLM1	-	0	0	0	0
LP	10348	ULM2	-	0	0	0	0
LP	10348	LLM1	-	0	0	0	0
LP	10348	ULM3	-	0	0	0	0
LP	10348	LRdC	-	0	0	0	0
LP	10348	LLdC	-	0	0	0	0
LP	10348	LLP1	-	0	0	0	0
LP	10348	ULI1	-	0	0	0	0
LP	10348	LRdM2	-	0	0	0	0
LP	10348	URdC	-	0	0	0	0
LP	10348	LRP1	-	0	0	0	0
LP	10348	LRP2	-	0	0	0	0
LP	10348	LLP1	-	0	0	0	0
LP	10348	LLdI1	-	0	0	0	0
LP	10348	LLP1	-	0	0	0	0
LP	10348	LLI1	Smith	4	3.35	5.2	8.07
LP	10348	LRM2	-	0	0	0	0
LP	10348	Upper	-	0	0	0	0
LP	10348	LRM2	-	0	0	0	0
LP	10348	LRM1	-	0	0	0	0
LP	10348	ULdC	-	0	0	0	0
LP	10348	URdI1			0	0	0
LP	10348	LRdI1	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	10348	LLdI1	-	0	0	0	0
LP	10348	ULdI2	-	0	0	0	0
LP	10348	LLdI1	-	0	0	0	0
LP	10348	LRdI1			0	0	0
LP	10348	URI2	-	0	0	0	0
LP	10349	ULI2	Smith	3	4.16	7.44	9.24
LP	10349	URdC	-	0	0	0	0
LP	10349	URdM1	-	0	0	0	0
LP	10349	ULM2	-	0	0	0	0
LP	10349	LRM2	Brothwell	4+	9.54	10.04	5.62
LP	10349	LRM2	Brothwell	5	0	0	0
LP	10349	URdM1	-	0	0	0	0
LP	10349	ULdC	-	0	0	0	0
LP	10349	URdI1	-	0	0	0	0
LP	10349	LLM1	-	0	0	0	0
LP	10349	LRdM2	-	0	0	0	0
LP	10349	URP1	-	0	0	0	0
LP	10349	ULdM2	-	0	0	0	0
LP	10349	ULP2	Smith	4	8.55	7.58	4.89
LP	10349	URM1	-	0	0	0	0
LP	10349	Fragments	-	0	0	0	0
LP	10349	deciduos	-	0	0	0	0
LP	10349	ULI1	-	0	0	0	0
LP	10349	URI2	Smith	4	5.32	6.42	6.31
LP	10349	Lower	-	0	0	0	0
LP	10350	URM2	Brothwell	4+	10.45	9.14	6.38
LP	10350	URI2	Smith	4	6.06	6.41	7.62
LP	10350	ULI1	Smith	3	3.88	9.17	10.48
LP	10350	URI1	-	0	0	0	0
LP	10350	LRP1	-	0	0	0	0
LP	10350	LLP1	Smith	3	7.91	6.94	5.42
LP	10350	URI2	-	0	0	0	0
LP	10350	LRP1	-	0	0	0	0
LP	10350	URdM2	-	0	0	0	0
LP	10350	LRdI2	-	0	0	0	0
LP	10350	ULdM2	-	0	0	0	0
LP	10350	ULdM1	-	0	0	0	0
LP	10350	URI2	-	0	0	0	0
LP	10350	LRP1	Smith	2	8.78	6.32	0
LP	10350	LLP2	Smith	2	8.14	7.69	0
LP	10350	URI2	-	0	0	0	0
LP	10350	LLP2	-	0	0	0	0
LP	10350	ULI2	-	0	0	0	0
LP	10350	LRdC	-	0	0	0	0
LP	10350	URC	-	0	0	0	0
LP	10350	URP2	-	0	0	0	0
LP	10350	LRI1	-	0	0	0	0
LP	10350	LLI1	-	0	0	0	0
LP	10350	ULM1	Brothwell	4	11.78	10.86	7.39
LP	10350	LLM1	-	0	0	0	0
LP	10350	LRM2	-	0	0	0	0
LP	10350	LLdC	-	0	0	0	0
LP	10350	LRP2	-	0	0	0	0
LP	10350	LRP1	-	0	0	0	0
LP	10350	URM3	-	0	0	0	0
LP	10350	ULP2	Smith	4	8.13	7.28	3.28
LP	10350	URP2	Smith	5	9.3	7.15	5.08
LP	10350	URC	Smith	2	4.7	5.06	9.77
LP	10350	LRI1	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	10350	ULI1	Smith	4	4.85	9.63	12.39
LP	10350	LLM2	-	0	0	0	0
LP	10350	LRM1	Brothwell	LRM1	10	11.8	7.43
LP	10350	URP1	Smith	3	9	7.05	6.91
LP	10350	LRP1	Smith	2	8.27	7.28	9.4
LP	10350	ULM2	Brothwell	3	11.92	9.28	7.96
LP	10350	URM3	-	0	0	0	0
LP	10350	ULI2	-	0	0	0	0
LP	10350	LLI1	-	0	0	0	0
LP	10350	LRdM2	-	0	0	0	0
LP	10350	URdC	-	0	0	0	0
LP	10350	LLP2	Smith	3	7.3	7.16	9.85
LP	10350	LRdM2	-	0	0	0	0
LP	10350	Premolar	Smith	5	0	0	0
LP	10350	Fragments	-	0	0	0	0
LP	10350	LLdM2	-	0	0	0	0
LP	10350	ULdM1	-	0	0	0	0
LP	10350	LLI1	Smith	4	5.04	5.65	6.88
LP	10350	ULdM1	-	0	0	0	0
LP	10350	MOLAR	-	0	0	0	0
LP	10350	LRdM2	-	0	0	0	0
LP	10350	LLdI2	-	0	0	0	0
LP	10350	LRM2	-	0	0	0	0
LP	10350	LRdM1	-	0	0	0	0
LP	10350	URP2	-	0	0	0	0
LP	10350	ULdC	-	0	0	0	0
LP	10350	ULdC	-	0	0	0	0
LP	10350	URdM1	-	0	0	0	0
LP	10350	LLdI1	-	0	0	0	0
LP	10350	URI1	-	0	0	0	0
LP	10350	URdI1	-	0	0	0	0
LP	10350	URP1	Smith	2	8.84	6.16	0
LP	10350	ULdM1	-	0	0	0	0
LP	10350	LLI1	-	0	0	0	0
LP	10350	Lower	-	0	0	0	0
LP	10350	LLI2	-	0	0	0	0
LP	10350	Lower	-	0	0	0	0
LP	10350	LLI1	-	0	0	0	0
LP	10350	URdI2	-	0	0	0	0
LP	10350	ULdI2	-	0	0	0	0
LP	10350	Lower	-	0	0	0	0
LP	10350	URC	-	0	0	0	0
LP	10350	ULI1	-	0	0	0	0
LP	10350	LLdC	-	0	0	0	0
LP	10350	LRdI2	-	0	0	0	0
LP	10350	ULP2	-	0	0	0	0
LP	10350	URP2	Smith	3	8.68	6.92	9.47
LP	10350	URP2	-	0	0	0	0
LP	10350	ULM2	-	0	0	0	0
LP	10350	URI2	Smith	3	4.07	7.28	12.34
LP	10350	ULM2	-	0	0	0	0
LP	10350	LRdC	-	0	0	0	0
LP	10350	URC	-	0	0	0	0
LP	10350	LRM2	Brothwell	4	9.06	10.66	4.96
LP	10350	ULdI2	-	0	0	0	0
LP	10350	URdI1	-	0	0	0	0
LP	10350	LRC	Smith	4	7.21	6.88	9.94
LP	10350	URP1	Smith	2	8.36	6.79	7.44
LP	10350	LLId1	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	10350	URdI2	-	0	0	0	0
LP	10350	ULP2	Smith	4	8.86	6.86	4.76
LP	10350	MOLAR	-	0	0	0	0
LP	10350	ULdI2	-	0	0	0	0
LP	10350	URM2	Brothwell	3	11.72	9.6	9.47
LP	10350	LLdM2	-	0	0	0	0
LP	10350	ULdI1	-	0	0	0	0
LP	10350	URC	-	0	0	0	0
LP	10351	Fragments	-	0	0	0	0
LP	10352	Fragments	-	0	0	0	0
LP	10353	Fragments	-	0	0	0	0
LP	10354	Fragments	-	0	0	0	0
LP	10355	Fragments	-	0	0	0	0
LP	10356	Fragments	-	0	0	0	0
LP	10357	Fragments	-	0	0	0	0
LP	10358	Fragments	-	0	0	0	0
LP	10359	Fragments	-	0	0	0	0
LP	10360	Fragments	-	0	0	0	0
LP	10361	Fragments	-	0	0	0	0
LP	10363	Fragments	-	0	0	0	0
LP	10364	Fragments	-	0	0	0	0
LP	10365	Fragments	-	0	0	0	0
LP	10366	Fragments	-	0	0	0	0
LP	10367	Fragments	-	0	0	0	0
LP	10368	Fragments	-	0	0	0	0
LP	10369	Fragments	-	0	0	0	0
LP	10370	Fragments	-	0	0	0	0
LP	10371	Fragments	-	0	0	0	0
LP	10372	Fragments	-	0	0	0	0
LP	10373	LRM1	Brothwell	1	9.76	10.59	6.55
LP	10374	Fragments	-	0	0	0	0
LP	10375	Fragments	-	0	0	0	0
LP	10376	Fragments	-	0	0	0	0
LP	10378	Fragments	-	0	0	0	0
LP	10379	Fragments	-	0	0	0	0
LP	10380	Fragments	-	0	0	0	0
LP	10381	Fragments	-	0	0	0	0
LP	10382	ULI1	Smith	5+	5.74	8.41	0
LP	10383	Fragments	-	0	0	0	0
LP	10384	Fragments	-	0	0	0	0
LP	10385	Fragments	-	0	0	0	0
LP	10386	URM1	-	0	11.54	10.08	6.86
LP	10387	Fragments	-	0	0	0	0
LP	10388	Fragments	-	0	0	0	0
LP	10389	LLM1	Brothwell	4	10.36	10.88	5.45
LP	10390	Fragments	-	0	0	0	0
LP	10391	Fragments	-	0	0	0	0
LP	10392	Fragments	-	0	0	0	0
LP	10393	Fragments	-	0	0	0	0
LP	10394	Fragments	-	0	0	0	0
LP	10395	URM2	Brothwell	2	11.22	10.55	7.15
LP	10396	Fragments	-	0	0	0	0
LP	10397	Fragments	-	0	0	0	0
LP	10398	Fragments	-	0	0	0	0
LP	10399	Fragments	-	0	0	0	0
LP	10400	Fragments	-	0	0	0	0
LP	10401	Fragments	-	0	0	0	0
LP	10402	Fragments	-	0	0	0	0
LP	10403	Fragments	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	10404	Fragments	-	0	0	0	0
LP	10405	Fragments	-	0	0	0	0
LP	10406	Fragments	-	0	0	0	0
LP	10407	Fragments	-	0	0	0	0
LP	10409	Fragments	-	0	0	0	0
LP	10410	Fragments	-	0	0	0	0
LP	10413	Fragments	-	0	0	0	0
LP	10414	Fragments	-	0	0	0	0
LP	10415	Fragments	-	0	0	0	0
LP	10416	Fragments	-	0	0	0	0
LP	10418	Fragments	-	0	0	0	0
LP	10419	Fragments	-	0	0	0	0
LP	10421	Fragments	-	0	0	0	0
LP	10422	Fragments	-	0	0	0	0
LP	10423	Fragments	-	0	0	0	0
LP	10424	Fragments	-	0	0	0	0
LP	10425	Fragments	-	0	0	0	0
LP	10426	Fragments	-	0	0	0	0
LP	10427	Fragments	-	0	0	0	0
LP	10428	Fragments	-	0	0	0	0
LP	10430	Fragments	-	0	0	0	0
LP	10431	Fragments	-	0	0	0	0
LP	10432	Fragments	-	0	0	0	0
LP	10433	Fragments	-	0	0	0	0
LP	10433	Fragments	-	0	0	0	0
LP	10434	Fragments	-	0	0	0	0
LP	10435	Fragments	-	0	0	0	0
LP	10437	Fragments	-	0	0	0	0
LP	10438	Fragments	-	0	0	0	0
LP	10439	Fragments	-	0	0	0	0
LP	10440	Fragments	-	0	0	0	0
LP	10441	Fragments	-	0	0	0	0
LP	10442	Fragments	-	0	0	0	0
LP	10443	Fragments	-	0	0	0	0
LP	10444	Fragments	-	0	0	0	0
LP	10445	Fragments	-	0	0	0	0
LP	10446	Fragments	-	0	0	0	0
LP	10447	Fragments	-	0	0	0	0
LP	10450	Fragments	-	0	0	0	0
LP	10451	Fragments	-	0	0	0	0
LP	10452	Fragments	-	0	0	0	0
LP	10453	Fragments	-	0	0	0	0
LP	10454	URI1	Smith	3	4.51	8.08	11.24
LP	10455	Fragments	-	0	0	0	0
LP	10457	Fragments	-	0	0	0	0
LP	10458	Fragments	-	0	0	0	0
LP	10460	Fragments	-	0	0	0	0
LP	10461	Fragments	-	0	0	0	0
LP	10462	Fragments	-	0	0	0	0
LP	10463	Fragments	-	0	0	0	0
LP	10464	Fragments	-	0	0	0	0
LP	10465	Fragments	-	0	0	0	0
LP	10466	Fragments	-	0	0	0	0
LP	10467	Fragments	-	0	0	0	0
LP	10468	Fragments	-	0	0	0	0
LP	10469	Fragments	-	0	0	0	0
LP	10470	Fragments	-	0	0	0	0
LP	10471	Fragments	-	0	0	0	0
LP	10472	Fragments	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	10473	Fragments	-	0	0	0	0
LP	10474	Fragments	-	0	0	0	0
LP	10475	Fragments	-	0	0	0	0
LP	10476	Fragments	-	0	0	0	0
LP	10477	Fragments	-	0	0	0	0
LP	10478	Fragments	-	0	0	0	0
LP	10479	Fragments	-	0	0	0	0
LP	10480	Fragments	-	0	0	0	0
LP	10481	Fragments	-	0	0	0	0
LP	10482	Fragments	-	0	0	0	0
LP	10483	Fragments	-	0	0	0	0
LP	10484	Fragments	-	0	0	0	0
LP	10485	Fragments	-	0	0	0	0
LP	10486	Fragments	-	0	0	0	0
LP	10487	Fragments	-	0	0	0	0
LP	10488	Fragments	-	0	0	0	0
LP	10489	Fragments	-	0	0	0	0
LP	10490	Root	-	0	0	0	0
LP	10491	Fragments	-	0	0	0	0
LP	10492	Fragments	-	0	0	0	0
LP	10493	Fragments	-	0	0	0	0
LP	10494	Fragments	-	0	0	0	0
LP	10495	Fragments	-	0	0	0	0
LP	10496	Fragments	-	0	0	0	0
LP	10497	Fragments	-	0	0	0	0
LP	10498	Fragments	-	0	0	0	0
LP	10499	Fragments	-	0	0	0	0
LP	10500	Fragments	-	0	0	0	0
LP	10501	Fragments	-	0	0	0	0
LP	10502	LRM2	Brothwell	3	10.34	10.86	5.16
LP	10503	Fragments	-	0	0	0	0
LP	10504	Fragments	-	0	0	0	0
LP	10505	Fragments	-	0	0	0	0
LP	10506	Fragments	-	0	0	0	0
LP	10507	Fragments	-	0	0	0	0
LP	10508	Fragments	-	0	0	0	0
LP	10509	Fragments	-	0	0	0	0
LP	10510	Fragments	-	0	0	0	0
LP	10511	Fragments	-	0	0	0	0
LP	10512	Molar	-	0	0	0	0
LP	10513	Fragments	-	0	0	0	0
LP	10514	Fragments	-	0	0	0	0
LP	10515	Fragments	-	0	0	0	0
LP	10516	Fragments	-	0	0	0	0
LP	10517	Fragments	-	0	0	0	0
LP	10518	Fragments	-	0	0	0	0
LP	10519	Fragments	-	0	0	0	0
LP	10520	Fragments	-	0	0	0	0
LP	10521	Fragments	-	0	0	0	0
LP	10522	Fragments	-	0	0	0	0
LP	10523	Fragments	-	0	0	0	0
LP	10524	Fragments	-	0	0	0	0
LP	10525	Fragments	-	0	0	0	0
LP	10526	Fragments	-	0	0	0	0
LP	10527	Fragments	-	0	0	0	0
LP	10528	Fragments	-	0	0	0	0
LP	10529	Fragments	-	0	0	0	0
LP	10530	Fragments	-	0	0	0	0
LP	10531	Fragments	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	10532	Fragments	-	0	0	0	0
LP	10533	Fragments	-	0	0	0	0
LP	10534	Fragments	-	0	0	0	0
LP	10535	Fragments	-	0	0	0	0
LP	10536	Fragments	-	0	0	0	0
LP	10537	Fragments	-	0	0	0	0
LP	10538	Fragments	-	0	0	0	0
LP	10539	Fragments	-	0	0	0	0
LP	10540	Fragments	-	0	0	0	0
LP	10541	Fragments	-	0	0	0	0
LP	10542	Fragments	-	0	0	0	0
LP	10543	Fragments	-	0	0	0	0
LP	10544	Fragments	-	0	0	0	0
LP	10545	Fragments	-	0	0	0	0
LP	10546	Fragments	-	0	0	0	0
LP	10547	Fragments	-	0	0	0	0
LP	10548	Fragments	-	0	0	0	0
LP	10549	Fragments	-	0	0	0	0
LP	10550	Fragments	-	0	0	0	0
LP	10551	Fragments	-	0	0	0	0
LP	10552	Fragments	-	0	0	0	0
LP	10553	Fragments	-	0	0	0	0
LP	10554	Fragments	-	0	0	0	0
LP	10555	Fragments	-	0	0	0	0
LP	10556	Fragments	-	0	0	0	0
LP	10557	Fragments	-	0	0	0	0
LP	10558	Fragments	-	0	0	0	0
LP	10559	Fragments	-	0	0	0	0
LP	10560	Fragments	-	0	0	0	0
LP	10561	Fragments	-	0	0	0	0
LP	10562	Fragments	-	0	0	0	0
LP	10563	Fragments	-	0	0	0	0
LP	10564	Fragments	-	0	0	0	0
LP	10565	Fragments	-	0	0	0	0
LP	10566	Fragments	-	0	0	0	0
LP	10567	Fragments	-	0	0	0	0
LP	10568	URM1	Brothwell	5+	0	0	0
LP	10569	Fragments	-	0	0	0	0
LP	10570	Fragments	-	0	0	0	0
LP	10571	Fragments	-	0	0	0	0
LP	10572	Root	-	0	0	0	0
LP	10574	Fragments	-	0	0	0	0
LP	10575	Fragments	-	0	0	0	0
LP	10576	Fragments	-	0	0	0	0
LP	10577	Fragments	-	0	0	0	0
LP	10578	Fragments	-	0	0	0	0
LP	10579	Fragments	-	0	0	0	0
LP	10580	Fragments	-	0	0	0	0
LP	10581	Fragments	-	0	0	0	0
LP	10582	Fragments	-	0	0	0	0
LP	10583	URM1	-	0	0	0	0
LP	10584	Fragments	-	0	0	0	0
LP	10585	Fragments	-	0	0	0	0
LP	10586	Fragments	-	0	0	0	0
LP	10587	ULM2	-	0	0	0	0
LP	10588	Fragments	-	0	0	0	0
LP	10589	Fragments	-	0	0	0	0
LP	10590	Fragments	-	0	0	0	0
LP	10591	Fragments	-	0	0	0	0

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
LP	10592	Fragments	-	0	0	0	0
LP	10593	Fragments	-	0	0	0	0
LP	10594	Fragments	-	0	0	0	0
LP	10595	Fragments	-	0	0	0	0
LP	10596	Fragments	-	0	0	0	0
LP	10597	Fragments	-	0	0	0	0
LP	10598	Fragments	-	0	0	0	0
LP	10599	Fragments	-	0	0	0	0
LP	10600	Fragments	-	0	0	0	0
LP	10601	Fragments	-	0	0	0	0
LP	10602	Fragments	-	0	0	0	0
LP	10603	Fragments	-	0	0	0	0
LP	10604	Fragments	-	0	0	0	0
LP	10605	Fragments	-	0	0	0	0
LP	10606	Fragments	-	0	0	0	0
LP	10607	Fragments	-	0	0	0	0
LP	10608	Fragments	-	0	0	0	0
LP	10609	Fragments	-	0	0	0	0
LP	10610	Fragments	-	0	0	0	0
LP	10611	Fragments	-	0	0	0	0
LP	10612	Fragments	-	0	0	0	0
LP	10613	Fragments	-	0	0	0	0
LP	10614	Fragments	-	0	0	0	0
LP	10615	Fragments	-	0	0	0	0
LP	10616	Root	-	0	0	0	0
LP	10617	Fragments	-	0	0	0	0
LP	10618	Fragments	-	0	0	0	0
LP	10619	Fragments	-	0	0	0	0
LP	10620	Fragments	-	0	0	0	0
LP	10621	Fragments	-	0	0	0	0
LP	10622	Fragments	-	0	0	0	0
LP	10623	Fragments	-	0	0	0	0
LP	10624	Fragments	-	0	0	0	0
LP	10625	Fragments	-	0	0	0	0
LP	10626	Fragments	-	0	0	0	0
LP	10627	Fragments	-	0	0	0	0
LP	10628	Fragments	-	0	0	0	0
LP	10629	Fragments	-	0	0	0	0
LP	10630	Fragments	-	0	0	0	0
LP	10631	Fragments	-	0	0	0	0
LP	10632	Fragments	-	0	0	0	0
LP	10633	Fragments	-	0	0	0	0
LP	10634	Fragments	-	0	0	0	0
LP	10635	Fragments	-	0	0	0	0
LP	10636	Fragments	-	0	0	0	0
LP	10637	Fragments	-	0	0	0	0
VC	C-1	URI1	Smith	6	6.48	7.46	-
VC	C-1	URI2	Smith	5+	6.36	6.22	-
VC	C-1	URC	Smith	5+	7.64	7.23	-
VC	C-1	URP1	Smith	5	7.98	6.14	-
VC	C-1	URP2	Smith	5	8.81	6.39	-
VC	C-1	ULI1	Smith	5+	-	-	-
VC	C-1	ULI2	Smith	5+	5.90	6.49	-
VC	C-1	ULC	Smith	5	7.35	7.50	-
VC	C-1	ULP1	Smith	3	-	6.24	5.97
VC	C-1	ULP2	Smith	4	8.8	6.62	5.67
VC	C-1	URM2	Brothwell	3+	10.64	10.009	5.39
VC	C-1	URM1	Brothwell	4+	11.68	10.52	4.52
VC	C-1	ULM1	Brothwell	5	11.24	9.75	-

APPENDIX 2.2 DENTAL MEASUREMENTS

SITE	ID	TEETH	WEAR	WEAR VALUES	BL	MD	CH
VC	C-1	LRI1	Smith	6	4.77	3.99	-
VC	C-1	LRI2	Smith	6	5.71	5.68	-
VC	G-1	URI1	Smith	6	7.40	7.16	-
VC	G-1	ULM2	Brothwell	6	11.20	7.63	-
VC	G-1	ULI2	Smith	5	6.51	5.76	-

Key to table:L= lower; R= right; I= incisor; C= canine; P= premolar; M= Molar; U= upper; BL= bucco-lingual; MD= mesio-distal; CH= crown height.

Table A.2.2.i.- Dental measurements of La Pijotilla and Valencina-Castilleja.

APPENDIX 2.3.- RESULTS OF INDICES

ID	TYPE OF BONE	ELEMENT	SIDE	MEASUREMENT	N	MEASUREMENT	N	RESULT
2770	Femur	M 1/3	Right	AP MID	30.82	ML MID	26.25	117.40
2804	Femur	M 1/3	Right	AP MID	29.93	ML MID	27.36	109.39
2843	Femur	M 1/3	Right	AP MID	21	ML MID	24.85	84.50
2900	Femur	M 1/3	U	AP MID	32.65	ML MID	27.98	116.69
2913	Femur	M 1/3	Right	AP MID	27.7	ML MID	33.26	83.28
2961	Femur	M 1/3	Right	AP MID	29.07	ML MID	26.27	110.65
3007	Femur	M 1/3	Right	AP MID	23.41	ML MID	20.19	115.94
4197	Femur	M 1/3	U	AP MID	30.26	ML MID	22.9	132.13
4372	Femur	M 1/3	Left	AP MID	30.88	ML MID	24.15	127.86
4439	Femur	M 1/3	Left	AP MID	27.14	ML MID	23.12	117.38
4517	Femur	M 1/3	Right	AP MID	34.42	ML MID	25.98	132.48
4556	Femur	M 1/3	Left	AP MID	27.68	ML MID	31.59	87.62
4655	Femur	M 1/3	Left	AP MID	27.11	ML MID	30.04	90.24
4737	Femur	M 1/3	Left	AP MID	26.31	ML MID	25.9	101.58
4799	Femur	M 1/3	Left	AP MID	26.65	ML MID	26.97	98.81
4943	Femur	M 1/3	Right	AP MID	28.16	ML MID	27.9	100.93
5054	Femur	M 1/3	Right	AP MID	16.31	ML MID	17.13	95.21
5059	Femur	M 1/3	Left	AP MID	25.01	ML MID	25.65	97.50
5364	Femur	P 1/3	Left	AP MID	9.57	ML MID	12.37	77.36
5562	Femur	M 1/3	Right	AP MID	19.05	ML MID	19.13	99.58
5616	Femur	M 1/3	Right	AP MID	25.42	ML MID	21.42	118.67
5765	Femur	M 1/3	Right	AP MID	22.92	ML MID	22.22	103.15
6058	Femur	M 1/3	Right	AP MID	23.98	ML MID	20.05	119.60
6161	Femur	M 1/3	Left	AP MID	24.24	ML MID	21.81	111.14
6715	Femur	M 1/3	Left	AP MID	22.35	ML MID	25.06	89.18
6756	Femur	M 1/3	Right	AP MID	33.82	ML MID	24.99	135.33
6838	Femur	M 1/3	Left	AP MID	30.57	ML MID	25.21	121.26
6914	Femur	M 1/3	Right	AP MID	28.5	ML MID	25.09	113.59
6917	Femur	M 1/3	Left	AP MID	25.61	ML MID	23.78	107.69
7019	Femur	M 1/3	Right	AP MID	31.2	ML MID	24.31	128.34
7054	Femur	M 1/3	Right	AP MID	20.72	ML MID	19.24	107.69
7239	Femur	M 1/3	Right	AP MID	23.35	ML MID	23.49	99.40
7500	Femur	M 1/3	Left	AP MID	22.84	ML MID	23.23	98.32
7540	Femur	M 1/3	Right	AP MID	30.99	ML MID	29.15	106.31
7540	Femur	P 1/3	Right	AP MID	26.05	ML MID	30.69	84.88
7732	Femur	M 1/3	Left	AP MID	28.42	ML MID	26.76	106.20
7826	Femur	M 1/3	Right	AP MID	34.55	ML MID	25.51	135.43
7857	Femur	M 1/3	Right	AP MID	28.35	ML MID	24.76	114.49
8443	Femur	M 1/3	Left	AP MID	26.34	ML MID	25.37	103.82
8869	Femur	M 1/3	Left	AP MID	32.48	ML MID	24.87	130.59
9651	Femur	M 1/3	Right	AP MID	27.26	ML MID	27.14	100.44

Key to table: AP= antero-posterior; ML= medio-lateral; MID= midshaft; U= undetermined.

Table A.2.3.i- Results of Platymeric index (La Pijotilla)

APPENDIX 2.3.- RESULTS OF INDICES

ID	TYPE OF BONE	ELEMENT	SIDE	MEASUREMENT	N	MEASUREMENT	N	RESULT
2811	Tibia	M 1/3	Right	AP MID	28.33	ML MID	19.77	69.78
2910	Tibia	M 1/3	Right	AP MID	33.45	ML MID	21.32	63.73
3000	Tibia	M 1/3	Right	AP MID	38.15	ML MID	24.26	63.59
3970	Tibia	M 1/3	Right	AP MID	28.36	ML MID	22.45	79.16
4463	Tibia	M 1/3	Right	AP MID	37.55	ML MID	22.7	60.45
4867	Tibia	M 1/3	Right	AP MID	27.57	ML MID	21.9	79.43
4912	Tibia	M 1/3	Right	AP MID	33.51	ML MID	21.98	65.59
4933	Tibia	M 1/3	Left	AP MID	27.86	ML MID	19.9	71.42
5526	Tibia	M 1/3	Right	AP MID	25.32	ML MID	15.62	61.69
5763	Tibia	M 1/3	Left	AP MID	42.61	ML MID	28.75	67.47
5862	Tibia	M 1/3	Left	AP MID	33.5	ML MID	15.52	46.32
6121	Tibia	M 1/3	Left	AP MID	28.25	ML MID	19.92	70.51
6949	Tibia	M 1/3	Left	AP MID	31.56	ML MID	22.59	71.57
8695	Tibia	M 1/3	Right	AP MID	32.56	ML MID	20.35	62.5
9991	Tibia	M 1/3	Right	AP MID	31.02	ML MID	19.93	64.24

Key to table: AP= antero-posterior; ML= medio-lateral; MID= midshaft; U= undetermined.

Table A.2.3.ii- Results of Platyenemic index (La Pijotilla)

APPENDIX 3.1 OSTEOLOGICAL DATA FROM SOUTH-WEST SPANISH COPPER AGE SITES USED FOR COMPARATIVE ANALYSIS

N	BAG	SITE	SECTOR	BONE	ELEMENT	SIDE	AGE	SEX	NON METRIC	REFERENCE
1	-	LM	LM	Skull	Malar	-	-	-	Zygomatico-facial foramen present	Guijo and Lacalle, 2010
2	-	LM	LM	Skull	Malar	-	-	-	Zygomatico-facial foramen present	Guijo and Lacalle, 2010
3	1	LM	LM	Femur	Femur	-	33-46	F	3rd Trochanter	Guijo and Lacalle, 2010
4	-	LM	LM	Femur	Femur	R			3rd Trochanter	Guijo and Lacalle, 2010
5	-	LM	LM	Femur	Femur	-			3rd Trochanter	Guijo and Lacalle, 2010
6	-	LM	LM	Feet	Talus	R	-	-	Double facet	Guijo and Lacalle, 2010
7	-	LM	LM	Feet	Talus	R	-	-	Double facet	Guijo and Lacalle, 2010
8	-	LM	LM	Feet	Talus	R	-	-	Double facet	Guijo and Lacalle, 2010
9	-	LM	LM	Feet	Talus	R	-	-	Double facet	Guijo and Lacalle, 2010
10	-	LM	LM	Feet	Talus	R	-	-	Double facet	Guijo and Lacalle, 2010
11	-	LM	LM	Feet	Talus	R	-	-	Double facet	Guijo and Lacalle, 2010
12	-	LM	LM	Feet	Talus	L	-	-	Double facet	Guijo and Lacalle, 2010
13	-	LM	LM	Feet	Talus	L	-	-	Double facet	Guijo and Lacalle, 2010
14	-	LM	LM	Feet	Talus	L	-	-	Double facet	Guijo and Lacalle, 2010
15	-	LM	LM	Patella	Patella	-	-	-	Emarginate patella	Guijo and Lacalle, 2010
16	94	VC	NDA	Feet	1st MT	-	18	F	Sesamoids	López Flores, 2004
17	640	VC	PP4-M	Humerus	Distal end	R	-	-	Septal aperture	Robles Carrasco, 2011
18	648	VC	PP4-M	Patella	Patella	R	A	-	Vastus notch	Robles Carrasco, 2011

Key to table: R=right; L=left; P= proximal; A=adult; S= subadult; I2= 7-12; AO= 13-17; MT= metatarsal; M= male; F= female; VC= Valencina-Castilleja; LM=La Molina; NDA= Nuevo Depósito de Aguas; PP4-M= PP4-Montelirio.

Table A.3.1.i. Non metric traits identified in south-west Spain

APPENDIX 3.1 OSTEOLOGICAL DATA FROM SOUTH-WEST SPANISH COPPER AGE SITES USED FOR COMPARATIVE ANALYSIS

N	SITE	SECTOR	BAG ID	ELEMENT	AGE	SEX	NON METRIC	REFERENCE
1	LM	LM	Ind. 3	URM3	24-30	M	Extra cusps	Guijo and Lacalle, 2010
2	LM	LM	Ind. 3	ULM3	24-30	M	Extra cusps	Guijo and Lacalle, 2010
3	LM	LM	Ind. 3	M1 or M2	24-30	M	Carabelli	Guijo and Lacalle, 2010
4	LM	LM	Ind. 3	dM2	24-30	M	Carabelli	Guijo and Lacalle, 2010
5	VC	DP	T1	-	-	-	Groove on the cingulum	Lacalle et al, 2000
6	VC	DP	T1	-	-	-	Groove on the cingulum	Lacalle et al, 2000
7	VC	DP	T3	-	-	-	Groove on the cingulum	Lacalle et al, 2000
8	VC	DP	T3	-	-	-	Groove on the cingulum	Lacalle et al, 2000
9	VC	DP	T3	-	-	-	Groove on the cingulum	Lacalle et al, 2000
10	VC	DP	T5	-	-	-	Groove on the cingulum	Lacalle et al, 2000
11	VC	DP	T5	-	-	-	Groove on the cingulum	Lacalle et al, 2000
12	VC	DP	T5	-	-	-	Groove on the cingulum	Lacalle et al, 2000
13	VC	DP	T5	-	-	-	Groove on the cingulum	Lacalle et al, 2000
14	VC	DP	T5	-	-	-	Groove on the cingulum	Lacalle et al, 2000
15	VC	DP	T3	-	-	-	Shovelling	Lacalle et al, 2000
16	VC	DP	T3	-	-	-	Shovelling	Lacalle et al, 2000
17	VC	DP	T5	-	-	-	Shovelling	Lacalle et al, 2000
18	VC	DP	T5	-	-	-	Shovelling	Lacalle et al, 2000
19	VC	DP	T5	-	-	-	Shovelling	Lacalle et al, 2000
20	VC	DP	T3	-	-	-	Taurodontism	Lacalle et al, 2000
21	VC	DP	T3	-	-	-	Taurodontism	Lacalle et al, 2000
22	VC	DP	T5	-	-	-	Taurodontism	Lacalle et al, 2000
23	VC	DP	T5	-	-	-	Taurodontism	Lacalle et al, 2000
24	VC	DP	T5	-	-	-	Taurodontism	Lacalle et al, 2000
25	VC	DP	-	-	-	-	Enamel pearl	Lacalle et al, 2000
26	CU	Cueva de la Mora	-	-	-	-	Shovelling	Gujio, 1999
27	CU	Cueva de la Mora	-	-	-	-	Groove on the cingulum	Gujio, 1999
28	CU	Cueva de la Mora	-	-	-	-	Carabelli	Gujio, 1999
29	PP	Puerto Palmera	E3	Incisor	YA	M	Shovelling	Romero Bomba, 2005
30	PP	Puerto Palmera	E3	Incisor	YA	M	Shovelling	Romero Bomba, 2005
31	VC	PP4-Montelirio	615/15	URI1	A	-	Shovelling	Robles Carrasco, 2011
32	VC	PP4-Montelirio	640/2	URI1	A	-	Groove on the cingulum	Robles Carrasco, 2011
33	VC	PP4-Montelirio	Ind.1 667/14	LRM2	A	-	Dental foramen	Robles Carrasco, 2011
34	VC	PP4-Montelirio	Ind. 1 453/1	ULI1	A	-	Shovelling	Robles Carrasco, 2011
35	VC	PP4-Montelirio	Ind. 1 453/1	ULI1	A	-	Groove on the cingulum	Robles Carrasco, 2011

APPENDIX 3.1 OSTEOLOGICAL DATA FROM SOUTH-WEST SPANISH COPPER AGE SITES USED FOR COMPARATIVE ANALYSIS

N	SITE	SECTOR	BAG ID	ELEMENT	AGE	SEX	NON METRIC	REFERENCE
36	VC	PP4-Montelirio	Ind. 2 453/14	ULI2	A	-	Groove on the cingulum	Robles Carrasco, 2011
37	VC	PP4-Montelirio	Ind. 2 453/11	URP1	A	-	Dental foramen	Robles Carrasco, 2011
38	VC	PP4-Montelirio	Ind. 2 453/3.2	ULM1	A	-	Dental foramen	Robles Carrasco, 2011
39	VC	PP4-Montelirio	Ind. 2 453/8	ULM2	A	-	Extra cusps	Robles Carrasco, 2011
40	VC	PP4-Montelirio	Ind. 2 453/7	URM3	A	-	Extra cusps	Robles Carrasco, 2011
41	VC	PP4-Montelirio	Ind. 2 453/4	ULM3	A	-	Extra cusps	Robles Carrasco, 2011
42	VC	PP4-Montelirio	Ind. 2 453/13	URM1	A	-	Dental foramen	Robles Carrasco, 2011

Key to table: L= lower; R: right; L= left; C= canine; P= premolar; I= incisor; d=deciduos; M= molar; A= adult; I2= 7-12 years old; Ind= individual; VC: Valencina-Castilleja; LP= La Pijotilla; DP= Divina Pastora; LM= La Molina; CU= Cueva de la Mora; PP= Puerto de la Palmera

Table A.3.1.ii. List of dental non-metric traits in south-west Spain

APPENDIX 3.2. DATA FROM SOUTH-WEST SPANISH COPPER AGE SITES USED FOR COMPARATIVE ANALYSIS: PALEOPATHOLOGY

N	SITE	SECTOR	BAG ID	TOOTH	TYPE	REFRENCE
1	VC	PP4-Montelirio	211/1	ULC	1	Robles Carrasco, 2011
2	VC	PP4-Montelirio	211/2	UC	1	Robles Carrasco, 2011
3	VC	PP4-Montelirio	211/3	URP2	2	Robles Carrasco, 2011
4	VC	PP4-Montelirio	211/4	URP2	1	Robles Carrasco, 2011
5	VC	PP4-Montelirio	211/5	ULM3	1	Robles Carrasco, 2011
6	VC	PP4-Montelirio	211/6	URP2	1	Robles Carrasco, 2011
7	VC	PP4-Montelirio	211/7	ULC	1	Robles Carrasco, 2011
8	VC	PP4-Montelirio	211/10	LLM3	2	Robles Carrasco, 2011
9	VC	PP4-Montelirio	211/11	LRI2	1	Robles Carrasco, 2011
10	VC	PP4-Montelirio	211/12	LLC	1	Robles Carrasco, 2011
11	VC	PP4-Montelirio	211/13	LLC	1	Robles Carrasco, 2011
12	VC	PP4-Montelirio	211/14	LRP1	1	Robles Carrasco, 2011
13	VC	PP4-Montelirio	211/15	LLI2	1	Robles Carrasco, 2011
14	VC	PP4-Montelirio	211/9.2	LLP2	1	Robles Carrasco, 2011
15	VC	PP4-Montelirio	615/11	ULC	1	Robles Carrasco, 2011
16	VC	PP4-Montelirio	615/16	ULM3	1	Robles Carrasco, 2011
17	VC	PP4-Montelirio	615/4	LLI1	1	Robles Carrasco, 2011
18	VC	PP4-Montelirio	615/6	LLP1	1	Robles Carrasco, 2011
19	VC	PP4-Montelirio	640/1	URI2	1	Robles Carrasco, 2011
20	VC	PP4-Montelirio	640/2	URI1	1	Robles Carrasco, 2011
21	VC	PP4-Montelirio	640/5	ULM3	1	Robles Carrasco, 2011
22	VC	PP4-Montelirio	640/4.1	URI2	1	Robles Carrasco, 2011
23	VC	PP4-Montelirio	640/4.2	URC	1	Robles Carrasco, 2011
24	VC	PP4-Montelirio	640/10	LRP1	1	Robles Carrasco, 2011
25	VC	PP4-Montelirio	648/3	ULP2	1	Robles Carrasco, 2011
26	VC	PP4-Montelirio	648/5	URC	1	Robles Carrasco, 2011
27	VC	PP4-Montelirio	648/1	LLI2	1	Robles Carrasco, 2011
28	VC	PP4-Montelirio	648/4	LLC	1	Robles Carrasco, 2011
29	VC	PP4-Montelirio	Ind. 1/ 667	LRM3	1	Robles Carrasco, 2011
30	VC	PP4-Montelirio	Ind. 1/ 667	LRM2	1	Robles Carrasco, 2011
31	VC	PP4-Montelirio	Ind. 1/ 667	LRM1	1	Robles Carrasco, 2011
32	VC	PP4-Montelirio	Ind. 1/ 667	LRP2	1	Robles Carrasco, 2011
33	VC	PP4-Montelirio	Ind. 1/ 667	LRP1	1	Robles Carrasco, 2011
34	VC	PP4-Montelirio	Ind. 1/ 667	LLM2	1	Robles Carrasco, 2011
35	VC	PP4-Montelirio	Ind. 1/ 667	LLM1	1	Robles Carrasco, 2011
36	VC	PP4-Montelirio	Ind. 1/ 667	LLP2	1	Robles Carrasco, 2011
37	VC	PP4-Montelirio	Ind. 1/ 667	LLP1	1	Robles Carrasco, 2011
38	VC	PP4-Montelirio	Ind. 1/ 667	LLC	1	Robles Carrasco, 2011
39	VC	PP4-Montelirio	Ind. 1/ 667	LLI2	1	Robles Carrasco, 2011
40	VC	PP4-Montelirio	Ind. 1/ 667	ULI1	1	Robles Carrasco, 2011
41	VC	PP4-Montelirio	Ind. 1/ 667	URC	1	Robles Carrasco, 2011
42	VC	PP4-Montelirio	Ind. 1/ 667	URM3	1	Robles Carrasco, 2011
43	VC	PP4-Montelirio	Ind. 1/ 667	URM2	1	Robles Carrasco, 2011
44	VC	PP4-Montelirio	Ind. 1/ 667	URP1	1	Robles Carrasco, 2011
45	VC	PP4-Montelirio	Ind. 1/ 667	URP2	1	Robles Carrasco, 2011
46	VC	PP4-Montelirio	Ind. 1/ 667	URI1	1	Robles Carrasco, 2011
47	VC	PP4-Montelirio	Ind. 1/ 667	ULM3	1	Robles Carrasco, 2011
48	VC	PP4-Montelirio	Ind. 1/ 667	ULM2	1	Robles Carrasco, 2011
49	VC	PP4-Montelirio	Ind. 1/ 667	ULM1	1	Robles Carrasco, 2011
50	VC	PP4-Montelirio	Ind. 1/ 667	ULP2	1	Robles Carrasco, 2011
51	VC	PP4-Montelirio	Ind. 1/ 667	ULP1	1	Robles Carrasco, 2011
52	VC	PP4-Montelirio	499/4	ULC	1	Robles Carrasco, 2011
53	VC	PP4-Montelirio	499/11	LLC	1	Robles Carrasco, 2011
54	VC	PP4-Montelirio	Ind. 1/ 453/4	ULM3	1	Robles Carrasco, 2011
55	VC	PP4-Montelirio	Ind. 1/ 453/29	ULP1	1	Robles Carrasco, 2011
56	VC	PP4-Montelirio	Ind. 1/ 453/28	ULC	1	Robles Carrasco, 2011
57	VC	PP4-Montelirio	Ind. 1/ 453/32	URI2	1	Robles Carrasco, 2011
58	VC	PP4-Montelirio	Ind. 1/ 453/17	ULI2	1	Robles Carrasco, 2011

APPENDIX 3.2. DATA FROM SOUTH-WEST SPANISH COPPER AGE SITES USED FOR COMPARATIVE ANALYSIS: PALEOPATHOLOGY

N	SITE	SECTOR	BAG ID	TOOTH	TYPE	REFRENCE
59	VC	PP4-Montelirio	Ind. 1/ 453/19	LLP2	1	Robles Carrasco, 2011
60	VC	PP4-Montelirio	Ind. 1/ 453/21	LRP2	1	Robles Carrasco, 2011
61	VC	PP4-Montelirio	Ind. 1/ 453/15	LLP1	1	Robles Carrasco, 2011
62	VC	PP4-Montelirio	Ind. 1/ 453/27	LRP1	1	Robles Carrasco, 2011
63	VC	PP4-Montelirio	Ind. 1/ 453/26	LLC	1	Robles Carrasco, 2011
64	VC	PP4-Montelirio	Ind. 1/ 453/16	LRC	1	Robles Carrasco, 2011
65	VC	PP4-Montelirio	Ind. 1/ 453/22	LRI2	1	Robles Carrasco, 2011
66	VC	PP4-Montelirio	Ind. 1/ 453/23	LRI1	1	Robles Carrasco, 2011
67	VC	PP4-Montelirio	Ind. 1/ 453/31	LLI1	1	Robles Carrasco, 2011
68	VC	PP4-Montelirio	Ind. 1/ 453/12	LRM1	1	Robles Carrasco, 2011
69	VC	PP4-Montelirio	Ind. 1/ 453/10	LLM3	1	Robles Carrasco, 2011
70	VC	PP4-Montelirio	Ind. 2/ 453/1.1	LLM1	1	Robles Carrasco, 2011
71	VC	PP4-Montelirio	Ind. 2/ 453/1.4	LLC	1	Robles Carrasco, 2011
72	VC	PP4-Montelirio	Ind. 2/ 453/1.5	LLI2	1	Robles Carrasco, 2011
73	VC	PP4-Montelirio	Ind. 2/ 453/1.6	LLI1	1	Robles Carrasco, 2011
74	VC	PP4-Montelirio	Ind. 2/ 453/1.8	LRI2	1	Robles Carrasco, 2011
75	VC	PP4-Montelirio	Ind. 2/ 453/1.9	LRC	1	Robles Carrasco, 2011
76	VC	PP4-Montelirio	Ind. 2/ 453/1.10	LRP1	1	Robles Carrasco, 2011
77	VC	PP4-Montelirio	Ind. 2/ 453/1.11	LRP2	1	Robles Carrasco, 2011
78	VC	PP4-Montelirio	Ind. 2/ 453/1.15	LRM3	1	Robles Carrasco, 2011
79	VC	PP4-Montelirio	Ind. 2/ 453/1.16	LLM3	1	Robles Carrasco, 2011
80	VC	PP4-Montelirio	Ind. 2/ 453/10	URC	1	Robles Carrasco, 2011
81	VC	PP4-Montelirio	Ind. 2/ 453/9	ULC	1	Robles Carrasco, 2011
82	VC	PP4-Montelirio	Ind. 2/ 453/11	URP1	1	Robles Carrasco, 2011
83	VC	PP4-Montelirio	Ind. 2/ 453/6	URP2	1	Robles Carrasco, 2011
84	VC	PP4-Montelirio	Ind. 2/ 453/3.2	ULP2	1	Robles Carrasco, 2011
85	VC	PP4-Montelirio	Ind. 2/ 453/2	URM2	1	Robles Carrasco, 2011
86	VC	PP4-Montelirio	Ind. 2/ 453/8	ULM2	1	Robles Carrasco, 2011
87	VC	PP4-Montelirio	Ind. 2/ 453/7	URM3	1	Robles Carrasco, 2011
88	VC	PP4-Montelirio	Ind. 2/ 453/4	ULM3	1	Robles Carrasco, 2011
89	VC	PP4-Montelirio	Ind. 2/ 453/13	URM1	1	Robles Carrasco, 2011

Key to table: MD= mesio-distal diameter; BL= bucco-lingual diameter; CH= crown height; W= wear; S= score; LP= La Pijotilla;; L= lower; U=upper; R: right; L= left; C= canine; P= premolar; I= incisor; M= molar; CEJ= cemento enamel junction; Year=year in the life of the tooth when LEH occurred

Table A.3.2.i. List of teeth affected by calculus in south-west Spain

APPENDIX 3.2. DATA FROM SOUTH-WEST SPANISH COPPER AGE SITES USED FOR COMPARATIVE ANALYSIS: PALEOPATHOLOGY

N	SITE	ID	TOOTH	MD	BL	CH	M	YEAR	REFERENCE
1	CU	-	LC	-	-	-	-	3-4	Guijo. 1999
2	CU	-	URP1	-	-	-	-	4.5-5	Guijo. 1999
3	CU	-	ULP2	-	-	-	-	4	Guijo. 1999
4	CU	-	LLP2	-	-	-	-	5	Guijo. 1999
5	CU	-	ULM2	-	-	-	-	-	Guijo. 1999
6	CM	-	ULC	-	-	-	-	3	Guijo et al, 2000
7	CM	-	URC	-	-	-	-	3	Guijo et al, 2000
8	PMB	E4	-	-	-	-	-	3-5	Lazarich, 2007:19
9	VC	DP-1	-	-	-	-	-	2-2.5	Guijo et al, 2000
10	VC	DP-4	-	-	-	-	-	2.5-3	Guijo et al, 2000
11	TP	PIII/29-4	ULC	-	-	-	1	-	Díaz-Zorita and Waterman, in press
12	TP	PIII/34-1	LLC	6	6	-	1	2,7 a 4,9 años	Díaz-Zorita and Waterman, in press
13	TP	PIII/43-1	ULI2	-	-	-	1	2,7 a 4,6 años	Díaz-Zorita and Waterman, in press
14	TP	PIII/48-4	URC	-	-	-	1	3,4 a 4,8 años	Díaz-Zorita and Waterman, in press
15	TP	PIII/51-4	ULM1	10	10	-	1	4 a 7 años	Díaz-Zorita and Waterman, in press
16	TP	PIII/55-7	LRC	-	-	-	1	3 a 4,9 años	Díaz-Zorita and Waterman, in press
17	TP	PIII/60-1	URC	-	-	-	3	2,6 a 5,6 años	Díaz-Zorita and Waterman, in press
18	TP	PIII/63-2	URC	-	-	-	1	3 a 4,8 años	Díaz-Zorita and Waterman, in press
19	TP	PIII/64-5	ULC	-	-	-	1	3 a 5,3 años	Díaz-Zorita and Waterman, in press
20	TP	PIII/64-10	ULI2	-	-	-	1	2,7 a 5,1 años	Díaz-Zorita and Waterman, in press
21	TP	PIII/V40/4-1	LRI1	-	-	-	1	2,6 a 3,4 años	Díaz-Zorita and Waterman, in press
22	VC	PP4-M	UC	-	-	-	1	-	Robles Carrasco, 2011
23	VC	PP4-M	ULC	-	-	-	1	-	Robles Carrasco, 2011
24	VC	PP4-M	LRI2	-	-	-	1	-	Robles Carrasco, 2011
25	VC	PP4-M	LLC	-	-	-	1	-	Robles Carrasco, 2011
26	VC	PP4-M	ULC	-	-	-	1	-	Robles Carrasco, 2011
27	VC	PP4-M	LLI1	-	-	-	1	-	Robles Carrasco, 2011
28	VC	PP4-M	URI1	-	-	-	1	-	Robles Carrasco, 2011
29	VC	PP4-M	URI2	-	-	-	1	-	Robles Carrasco, 2011
30	VC	PP4-M	URC	-	-	-	1	-	Robles Carrasco, 2011
31	VC	PP4-M	ULP2	-	-	-	1	-	Robles Carrasco, 2011
32	VC	PP4-M	LLI2	-	-	-	1	-	Robles Carrasco, 2011
33	VC	PP4-M	LLC	-	-	-	1	-	Robles Carrasco, 2011
34	VC	PP4-M	URC	-	-	-	1	-	Robles Carrasco, 2011
35	VC	PP4-M	ULP2	-	-	-	1	-	Robles Carrasco, 2011
36	VC	PP4-M	ULP1	-	-	-	1	-	Robles Carrasco, 2011
37	VC	PP4-M	ULC	-	-	-	1	-	Robles Carrasco, 2011
38	VC	PP4-M	LLC	-	-	-	1	-	Robles Carrasco, 2011
39	VC	PP4-M	LLC	-	-	-	1	-	Robles Carrasco, 2011
40	VC	PP4-M	LRI2	-	-	-	1	-	Robles Carrasco, 2011
41	VC	PP4-M	LRC	-	-	-	1	-	Robles Carrasco, 2011
42	VC	PP4-M	LRP1	-	-	-	1	-	Robles Carrasco, 2011
43	VC	PP4-M	LRP2	-	-	-	1	-	Robles Carrasco, 2011
44	VC	PP4-M	URC	-	-	-	1	-	Robles Carrasco, 2011
45	VC	PP4-M	ULC	-	-	-	1	-	Robles Carrasco, 2011
46	VC	PP4-M	URP1	-	-	-	1	-	Robles Carrasco, 2011

APPENDIX 3.2. DATA FROM SOUTH-WEST SPANISH COPPER AGE SITES USED FOR COMPARATIVE ANALYSIS: PALEOPATHOLOGY

N	SITE	ID	TOOTH	MD	BL	CH	M	YEAR	REFERENCE
47	VC	PP4-M	URP2	-	-	-	1	-	Robles Carrasco, 2011
48	VC	PP4-M	ULP2	-	-	-	1	-	Robles Carrasco, 2011
49	VC	PP4-M	URM2	-	-	-	1	-	Robles Carrasco, 2011
50	VC	PP4-M	ULM2	-	-	-	1	-	Robles Carrasco, 2011
51	VC	PP4-M	ULM3	-	-	-	1	-	Robles Carrasco, 2011

Key to table: MD= mesio-distal diameter; BL= bucco-lingual diameter; CH= crown height; W= wear; S= score LP= La Pijotilla; CU: Cueva de la Mora de la Umbría; CM: Cueva de la Mora; PMB= Paraje de Monte Bajo; TP= Tholos Palacio III; L= lower; U=upper; R: right; L= left; C= canine; P= premolar; I= incisor; M= molar; CEJ= cemento enamel junction; Year=year in the life of the tooth when LEH occurred.

Table A.3.2.ii. List of teeth affected by LEH in south-west Spain

N	SITE	ID	TOOTH	MD	BL	CH	LOCATION	N	REFERENCE
1	CU	-	URM1	-	-	-	Oclusal	-	Guijo, 1999
2	TP	PIII/29-1	LRM1	10	9	-	Oclusal	Type 1	Díaz-Zorita and Waterman, in press
3	TP	PIII/29-2	URM2	13	9	-	Occlusal	Type 1	Díaz-Zorita and Waterman, in press
4	TP	PIII/60-3	LLM1	11	10	-	Occlusal	Type 1	Díaz-Zorita and Waterman, in press
5	TP	PIII/68-6	ULP1	-	-	-	Occlusal	Type 1	Díaz-Zorita and Waterman, in press
6	VC	Divina	-	-	-	-	-	-	Guijo et al, 2000
7	J	Ind. 1	-	-	-	-	-	-	Bueno Sánchez, 2003

Key to table= MD= mesio-distal diameter; BL= bucco-lingual diameter; CH= crown height; W= wear; S= score ; LP= La Pijotilla; CU= Cueva de la Mora de la Umbría;TP= *Tholos* Palacio III; L= lower; U=upper; R: right; L= left; C= canine; P= premolar; I= incisor; M= molar; CEJ= cemento enamel junction.

Table A.3.2.iii. List of teeth affected by caries in south-west Spain

APPENDIX 3.2. DATA FROM SOUTH-WEST SPANISH COPPER AGE SITES USED FOR COMPARATIVE ANALYSIS: PALEOPATHOLOGY

N	SITE	S	BAG ID	BONE	ELEMENT	SIDE	SEX	AGE	OBSERVATION	REFERENCE
1	VC	CC	7	Mandible	Mandibular condyle	L	-	A	OA at condyle	Unpublished
2	VC	PP4-M	Ind. 1 667	Vertebra	Body	-	-	A	Osteophyte	Robles Carrasco, 2011

Key to table: VC= Valencina-Castilleja; S= sector; R= right; L=left; A= adult; PE= proximal end; M= medial; DE= distal end; YA= 18-25; OA= osteoarthritis. D=distal

Table A.3.2.iv. List of joint disease in the south-west of Spain

N	SITE	SECTOR	BAG	BONE	ELEMENT	SIDE	SEX	AGE	TYPE	REFERENCE
1	CCA	T7	CR2	Skull	Parietal	L	-	Adult	Impact	Martínez et al, 1991
2	VC	LC	2	Mandible	Mandible	R	-	YA	Healed fracture	Guijo et a, 1996

Key to table: L= left; R= right; MT= metatarsal; LP= La Pijotilla; CCA= Cerro de la Casería

Table A.3.2.v. List of bone fragments with evidence of trauma from south-west Spain

N	SITE	SECTOR	BAG	BONE	ELEMENT	SIDE	AGE	SEX	OBSERVATION	REFERENCE
1	LM	LM	2	Patella	Patella	-	A	M	Patellar tendon enthesophyte	Guijo and Lacalle, 2000
2	VC	PP4-M	648	Tibia	Distal end	R	A	-	Squatting facets	Robles Carrasco, 2011

Key to table: R: right; L= left; A= adult; AO= 13-17. M= male; F= female; M?= possible male; MC= metacarpal; U= undetermined; P= proximal; OA= osteoarthritis; P=proximal; LM= La Molina; VC= Valencina-Castilleja; PP4-M= PP4-Montelirio.

Table A.3.2.vi. List of enthesophytes in south-west of Spain

Figure A.4.1.1. Osteoarthritis at plantar surface (left) of an articular facet of a first distal foot phalanx (ID 3425)

Figure A.4.1.2. Lumbar vertebrar with spondylosis on the body surface (ID 3510)

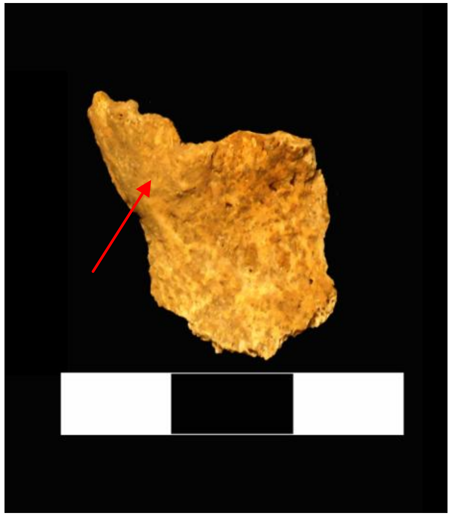

Figure A.4.1.3. Osteophytosis at the border of a lumbar vertebra (ID 3577)

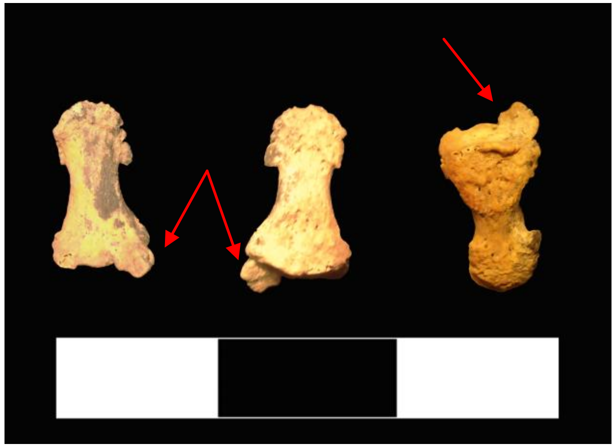

Figure A.4.1.4. Osteophyte on superior (left) surface at proximal end of a third distal phalanx (ID 3824). Inferior view (centre and right)

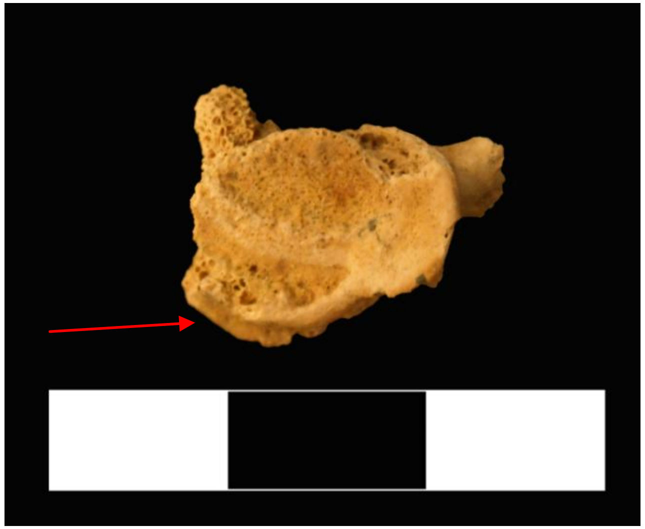

Figure A.4.1.5. Spondylosis on the body surface of a cervical vertebra (ID 4189)

Figure A.4.1.6. Osteoarthritis at plantar surface of an articular facet on the third medial foot phalanx (ID 4277)

Figure A.4.1.7. Osteoarthritis at plantar surface of an articular facet at a foot medial phalanx (ID 4416)

Figure A.4.1.8. Osteoarthritis at plantar surface of an articular facet on a first distal foot phalanx (ID 5086)

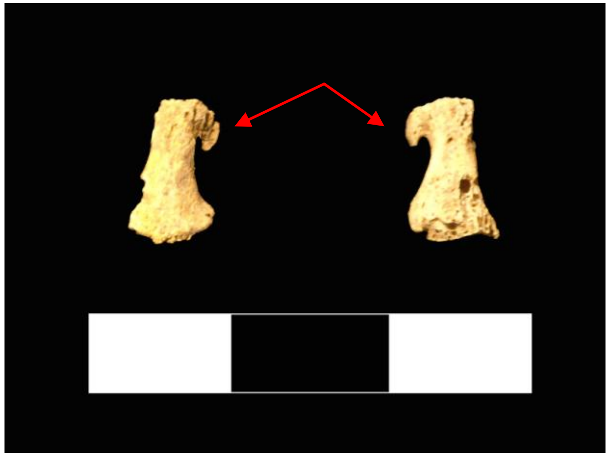

Figure A.4.1.9. Osteoarthritis at palmar surface at distal end on a first distal foot phalanx (ID 5288). Superior (left) and inferior view (right)

Figure A.4.1.10. Osteoarthritis at plantar surface of an articular facet on a first right metatarsal (ID 5553)

Figure A.4.1.11. Osteoarthritis at the first right metacapal at palmar surface of an articular facet at the distal end (ID 7120). Inferior (left) and dorsal (right) view.

Figure A.4.1.12. Osteoarthritis at palmar surface of an articular facet at the distal end of a first left metacarpal (ID 9966). Inferior (left) and superior (right) view.

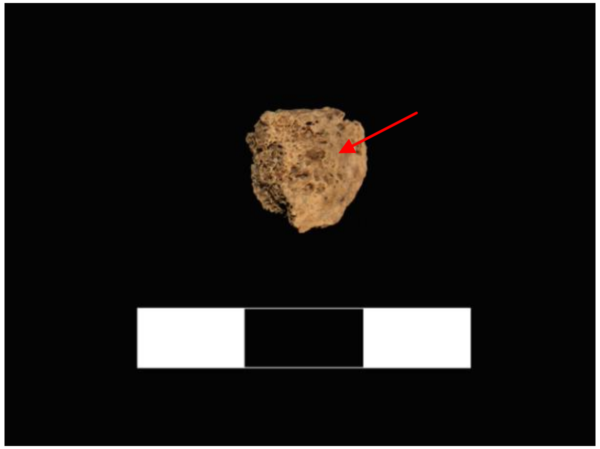

Figure A.4.1.13. Spondylosis on the body surface of a thoracic vertebra (ID 10069).

Figure A.4.1.14 Flattened body and Spondylosis on the body surface of a 5th lumbar vertebra (ID 7140)

Figure A.4.1.15 Osteoarthritis at distal end on medial surface of a distal end of a fibula (ID 8873). Medial (left) and lateral (right) view.

Figure A.4.1.16 Osteoarthritis at anterior side of the patella (ID 9863)

Figure A.4.1.17 Osteoarthritis at plantar surface of an articular facet on a first distal foot phalanx (ID 10118). Superior (left) and inferior (right) view.

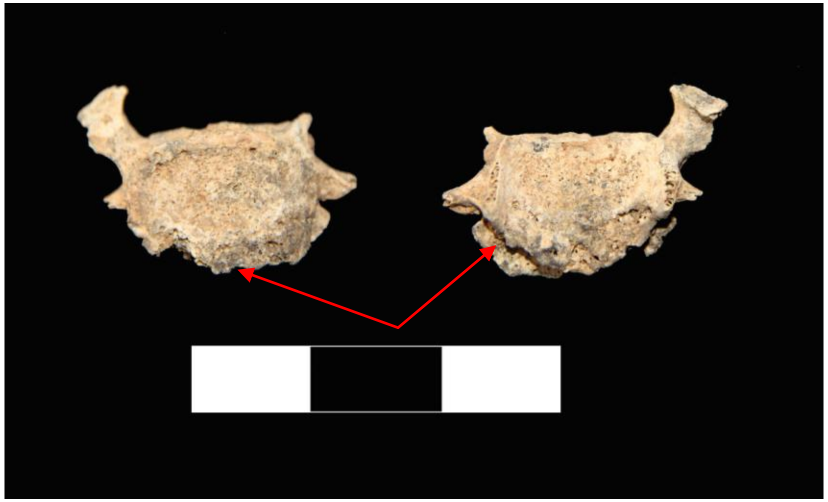

Figure A.4.1.18 Spondylosis on the body surface on a second cervical vertebra (ID 10221). Inferior (left) and superior (right) view.

APPENDIX 4.2 ABNORMAL VARIATION: DENTAL PALEOPATHOLOGY

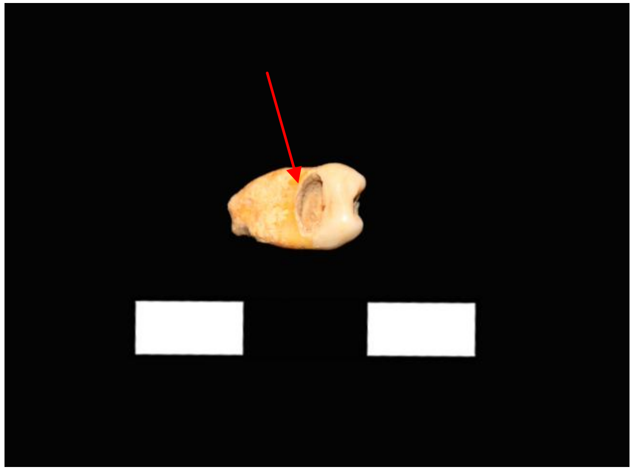

Figure A.4.2.1 Dental caries on mesial surface at CEJ on URM3 (ID 8388)

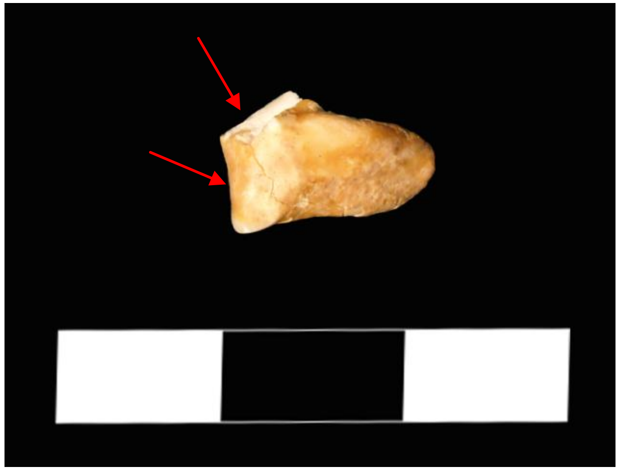

Figure A.4.2.2. Severe dental attrition on a molar (6261)

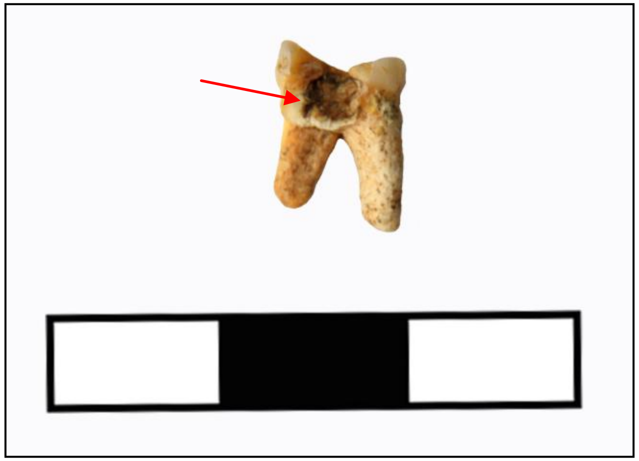

Figure A.4.2.3. Cervical caries on a molar at lingual surface (ID 9125)

Figure A.4.2.4. Cervical caries on a URM1 and calculus at labial (ID 10587)

Figure A.4.2.5. Calculus at LLP2 (ID 9441)

Figure A.4.2.6. Cervical caries on lower molar at buccal surface (ID 10403)

Figure A.4.2.7. Example of dental erupting

Figure A.4.3.1. Cremated remains (ID 5520)

Figure A.4.3.2. Cremated remains (ID 7199)

APPENDIX 5.1 MULTIPLE OBSERVATIONS

SITE	ID	SEX	AGE	STATURE	NMT	PALEOPATHOLOGY	$\delta^{13}C_{(av)}$	$\delta^{15}N_{(av)}$	$^{87}Sr/^{86}Sr$
LP	2093	U	A	-	-	-	-19.4	9.2	-
LP	16	U	36-45	-	-	-	-	-	0.71136
LP	171	U	26-35	-	-	-	-	-	0.71340
LP	421	U	18-25	-	-	-	-	-	0.71353
LP	422	U	18-25	-	-	-	-	-	0.71482
LP	716	U	18-25	-	-	-	-	-	0.71343
LP	719	U	26-35	-	-	-	-	-	0.71168
LP	1392	U	Adult	-	-	-	-	-	0.70972
LP	1393	U	18-25	-	-	-	-	-	0.71335
LP	1411	U	18-25	-	-	-	-	-	0.71612
LP	1412	U	26-35	-	-	-	-	-	0.71279
LP	1415	U	26-35	-	-	-	-	-	0.71307
LP	1420	U	26-35	-	-	-	-	-	0.71371
LP	2415	U	26-35	-	-	-	-	-	0.71059
LP	2495	U	26-35	-	-	-	-	-	0.71319
LP	2499	U	26-35	-	-	-	-	-	0.71425
LP	4640	U	26-35	-	-	-	-	-	0.71390
LP	10373	U	18-25						0.71278
LP	4170	M?	19-20	-	-	-	-	-	-
LP	4493	M	20-21	-	-	-	-	-	-
LP	4597	M	30-35	-	-	-	-	-	-
VC	ALG-1	M?	18-25	-	-	-	-	-	0.70906
VC	ALG-2	M?	18-25	-	-	Cribra orbitalia	-	-	0.71296
VC	ALG-3	U	18-25	-	-	-	-	-	-
VC	ALG-4	U	18-25	-	-	-	-	-	-
VC	ALG-5	F?	26-35	1.69 ±4.30	-	-	-	-	-
VC	ALG-6	M?	A	-	-	-	-	-	-
VC	ALG-7	M?	18-25	-	-	-	-	-	0.70902
VC	ALG-8	M?	A	-	-	-	-	-	-
VC	ALG-9	U	A	-	-	-	-	-	-
VC	ALG-10	M?	26-35	-	-	Dental calculus	-	-	0.70948
VC	ALG-11	M?	18-25	-	-	-	-	-	0.70837
VC	ALG-12	F?	26-35	-	-	-	-	-	0.71217
VC	ALG-13	F	26-35	-	-	-	-18.8	8.7	0.71450
VC	ALG-14	U	A	-	-	-	-	-	-

APPENDIX 5.1 MULTIPLE OBSERVATIONS

SITE	ID	SEX	AGE	STATURE	NMT	PALEOPATHOLOGY	$\delta^{13}C_{(av)}$	$\delta^{15}N_{(av)}$	$^{87}Sr/^{86}Sr$
VC	ALG-15	M?	26-35	-	-	-	-	-	-
VC	ALG-16	U	26-35	-	-	-	-	-	0.70885
VC	ALG-17	U	26-35	-	-	-	-	-	0.70898
VC	ALG-18	U	A	-	-	-	-	-	-
VC	ALG-19	U	A	-	-	-	-	-	-
VC	A-1	F	26-35	-	-	Dental calculus, LEH, AMTL	-19.0	9.0	0.70905
VC	A-2	M	30-34	-	-	-	-	-	0.71291
VC	A-3	U	A	-	-	-	-	-	-
VC	A-4	U	A	-	-	-	-18.8	8.7	-
VC	A-5	U	A	-	-	-	-	-	-
VC	A-6	U	A	-	-	-	-	-	-
VC	A-7	S	0-6	-	-	-	-	-	-
VC	C-1	F	18-25	-	Vastus notch, groove on the cingulum, shoveling, septal aperture	Cribra orbitalia,	-	-	0.71149
VC	C-2	S	7-12	-	-	-	-	-	-
VC	G-1	F	>45	-	Parietal foramen	-	-	-	0.70961
VC	G-2	S	7-12	-	Fronto-temporal articulation, auditory torus	-	-	-	-
VC	CC-1	F?	18-25	-	-	Cribra orbitalia	-18.9	7.5	-
VC	CC-2	U	18-25	-	-	-	-	-	-
VC	CC-3	F	18-25	-	-	-	-	-	-
VC	CC-4	F?	18-25	-	-	-	-	-	-
VC	189.1	U	YA	-	-	-	-	-	0.70906
VC	444.1	U	AO-	-	-	-	-	-	0.70914
VC	484.1	U	YA	-	-	-	-	-	0.71341
VC	446.3.1	U	AO-	-	-	-	-	-	0.70900
VC	446.2	U	YA	-	-	-	-	-	0.70901
VC	360.1	U	YA	-	-	-	-	-	0.70903
VC	360.2	U	YA	-	-	-	-	-	0.70909
VC	447.1	U	AO-	-	-	-	-	-	0.70907
VC	446.3	U	AO-	-	-	-	-	-	0.71883
VC	730.1	U	A	-	-	-	-	-	0.70995
VC	505.1	U	A	-	-	-	-	-	0.71323
VC	453.1	M	25-35	-	-	-	-	-	0.71341
VC	453.2	F?	18-25	-	-	-	-	-	0.71216

APPENDIX 5.1 MULTIPLE OBSERVATIONS

SITE	ID	SEX	AGE	STATURE	NMT	PALEOPATHOLOGY	δ¹³C(av)	δ¹⁵N(av)	⁸⁷Sr/⁸⁶Sr
VC	453.3	U	INF II	-	-	-	-	-	0.71170
VC	449.1	M?	18-25	-	-	-	-	-	0.71028
VC	449.3	U	25-35	-	-	-	-	-	0.70907
VC	449.4	M	25-35	-	-	-	-	-	0.70970
VC	449.6	M	25-35	-	-	-	-	-	0.70917
VC	449.7	U	25-35	-	-	-	-	-	0.70912
VC	CC-6	U	A	-	-	Cribra orbitalia	-	-	-
VC	10.049/ 667.1	M	18-25	-	Dental foramen	Osteophytes, dental calculus, LEH	18-25	-19.1	0.70929
LS	PP8- 7055- 186	-	A	-	-	-	-19.1	8.7	-
LS	PP8- 1336-81	-	A	-	-	-	-19.0	7.8	-

Key to table: LP= La Pijotilla; VC= Valencina-Castilleja; ALG= El Algarrobillo; A= La Alcazaba; C= La Cima; G= La Gallega; CC= Cerro de la Cabeza; NMT= non-metric traits; LEH= linear enamel hypoplasia; AMTL= ante mortem tooth loss.

Table A.5.1. Multiple observations by skeleton/bone fragments