Martin Bartelheim, Primitiva Bueno Ramírez
and Michael Kunst (Eds.)

KEY RESOURCES AND SOCIO-CULTURAL DEVELOPMENTS IN THE IBERIAN CHALCOLITHIC

RessourcenKulturen Band 6

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View from the ore-rich Cerro de San Cristóbal in Logrosán (Cáceres) towards the dry lands of the Dehesa landscape in the Spanish Extremadura symbolising the abundance of mineral resources and the scarcity of water on the Iberian peninsula. Photo: Martin Bartelheim.

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Resource Use and Sociocultural Dynamics in the Chalcolithic of the Iberian Peninsula

An Introduction and Synthesis

Keywords: Chalcolithic, Iberian Peninsula, ResourceCultures, social dynamics, raw materials, imports, agriculture

Abstract

The marked geographic and climatic differences between the southwest and the interior of the Iberian Peninsula have traditionally been made responsible for the seemingly diverging social and cultural development in both regions observable during the Chalcolithic (3rd mill. BC). Studies into the specific available resources and ways of use in various landscapes of the southern half of the Iberian Peninsula reveal that the picture is much more complex with many regional peculiarities. Studying the ResourceCultures of the respective societies helps to shed light on what was considered to be the base for a society, how it was valuated and what were the specific relations between those resources and the sociocultural dynamics that can be detected in the archaeological record. This synthesis of a number of case studies presented here shows the suitability of the Iberian Peninsula for the successful application of the resource concept for the description of these processes.

1. Starting Points

In antiquity the Iberian Peninsula was considered one of the areas richest in resources and most agriculturally favourable in the Mediterranean (especially in Strabo III,2; Scymnus Chius 161–164; Avienus, Ora Maritima 286–297). However, these reports about opulent raw materials and natural products were mainly indicating coastal areas, standing in striking contrast to the arid interior. On the peninsula areas suffering of a lack of water and tough climatic conditions are alternated by favourable landscapes accommodating agrarian and other organic raw materials. Historically, and especially in the agrarian sector, this has led to the development of a variety of local adaptations, even in small areas (Bartelheim/Montero 2009).

In prehistoric research of the 70s of the 20th cent. environmental determinism dominated any explanations about the relationship between the development of culture and society and the given economic circumstances. However, as of the 80s this started to change drastically (Chapman 1990; Díaz Andreu 2002). The basis for the description of sociocultural dynamics was formed by models influenced by Anglosaxon archaeological research. Neo-Marxist approaches were common. Based on these indications for the emergence of class differences, it was assumed that steeply hierarchically organised societies with a coercive nature existed since the Chalcolithic and continued into the Bronze Age (especially Lull 1983; Lull/Risch 1995; Lull et al. 2010; Chapman 1990; 2003; 2008; Arteaga 1993; 2001; Nocete 2001). A central role in this reasoning was reserved for the production and distribution of important resources, mainly agricultural products and metals, especially copper. However, its use and specific role in the development of societies has been studied and characterised only partially (see Bartelheim 2007) with some exceptions (e.g. Castro et al. 1998; Contreras 2000; García

Sanjuán et al. 2013). Therefore, simultaneously other approaches exist, based on the same facts supporting the idea of considerably flatter hierarchies in smaller societies (e.g. Gilman/Thornes 1985; Gilman 1987; 2001; Montero-Ruiz 1994; 1998; Díaz Andreu/Montero-Ruiz 2000; Cruz Berrocal et al. 2013). The mechanisms that were active in how changes in the use of resources influenced sociocultural development are only partially understood. Especially analyses of what was regarded and used as resources are rare.

The Iberian Peninsula has a longstanding history of investigation into connections between social and cultural development and the exploitation of the environment. However, these are usually strongly regionally focused. Extensive scientific (archaeo-biological, geo-archaeological, material analytic, mining-archaeological) studies (e.g. Montero-Ruiz 1994; Delibes de Castro/Montero-Ruiz 1999; Peña Chocarro 1999; Barroso Bermejo et al. 2003; Harrison 2007; Arteaga/Roos 2005; Arteaga/Barragán 2010; Contreras et al. 2010, Dambeck et al. 2010; Blasco et al. 2011) have contributed considerable quantities of relevant data regarding resources and their use. Unfortunately, systematic supra-regional comparisons, combining various research perspectives and data pools are lacking so far.

During the last decades, long-distance contacts also have played a negligible role in the models of economic, societal and cultural development during the pre-Phoenician prehistory. In the 19th and early 20th cent. colonisation from abroad was assumed for the coastal areas in the Chalcolithic (Siret 1890) in analogy to the 'Phoenician Colonisation' as it was called then. However, such considerations became obsolete after similar settlements were discovered in the inland too (Lillios 1995; Kunst 2001; Márquez Romero 2013). Also the contradictory efforts to identify autochthonous cultural and technological developments (Montero-Ruiz/Ruiz Taboada 1996) have been put into perspective during recent years. The Iberian Peninsula seems to have been placed outside of the main supra-regional trading networks for extensive periods of time, in spite of the presence of some imported goods such as ivory, ostrich eggs or amber (Schuhmacher 2011; 2012; Murillo-Barroso/Martinón-Torres 2012). Very probably the Peninsula's geographical position and topography are to blame for this. This stands in contrast to regions such as Southeast Europe, where development is closely linked with the intensive cultural exchange between Europe and the Near East and the Eurasian area.

2. Regional Diversity

The described models for socioeconomic development and their connection with the use of resources were first established based on evidence from the climatically favoured southern Mediterranean coast of the Iberian Peninsula.

Generally, this region has been better investigated and interpreted socioculturally than the inner highland (also see the contributions of Escudero et al.; García Sanjuán; Morán et al. and Valera in this volume). This can be explained by the fact that the inland does not present the same density of archaeological finds. Apart from that the unfavourable ecological situation plays a role too, as a clearly different lifestyle and economy was adopted. Only recently models were developed for the centre of the Iberian Peninsula too (e.g. Díaz-del-Río 2001; 2006; Ríos 2011; Bueno Ramírez et al. 2012c). These have mainly highlighted the small-scale character of social communities and their territories, especially in comparison with the south. Other opinions however, have pointed out the close relation between the southwest and the Iberian centre proposing more intensive studies which would contribute to level the available evidence in the scarcely investigated inland (Bueno Ramírez et al. 2002; 2005a; 2005b; 2011; 2012a; 2012b).

2.1. Iberian South and West

In the research history of the south and west of the Iberian Peninsula, reaching back to the 19th cent. (e.g. Siret 1890; Estácio da Veiga 1898), a system of settlements and graves was recognised that proved to be increasingly complex. While during the second half of the 20th cent. fortified prehistoric settlements seemed to be limited to the coasts, in the last decades the amount of known settlements of this type in the inland and their type diversity increased significantly. (Kunst 2001; Nocete 2001).

Nearly everywhere in the Iberian south and southwest fortified and unfortified settlements of various scales are known. Except for large-scale sites of up to 100ha or more – e.g. Valencina de la Concepción (García Sanjuán et al. 2013); Marroquies Bajos (Zafra de la Torre et al. 1999; 2003); La Pijotilla (Hurtado Pérez 1997); Porto Torrão (Valera/Filipe 2004) – also smaller settlements were excavated. These were possibly directly linked to the bigger ones and together with them formed part of a politically and economically structured landscape (Valera 2015). The settlement character is not always clear, mainly due to the state of research (Márquez Romero 2013). On the other hand the case of Perdigões in the Portuguese Alentejo indicates a site with an unusual settling function (Valera et al. 2014; Valera this volume). Whether all or several enclosures were used simultaneously or successively remains a question because extensive excavations are scarce.

In close vicinity to some of the bigger enclosures graves were found. These graves were elaborately built and contained rich grave goods – e.g. Valencina de la Concepción (García Sanjuán et al. 2013); La Pijotilla (Hurtado Pérez et al. 2000); Perdigões (Valera et al. 2014); Alcalar (Morán/Parreira 2004). This situation is contrasted by a large amount of simple megalithic burials (Leisner 1943; 1956–1998; several contributions in Gonçalves 2000; Jiménez Àvila/Enríquez Navasqués 2000; Fernández Eraso/Mújika Alistuza 2010) which has led to the assumption that the prominent graves housed the burials of socially significant deceased. Consequently these places were also assumed to be central points, creating a clearly vertical social differentiation as early as the 3rd mill. BC (e.g. Chapman 1990; Nocete 2001; Márquez Romero 2006; García Sanjuán/Murillo-Barroso 2013; Morán 2014). However, it is difficult to translate this into archaeological evidence, as the burials are collective and exceptional grave goods, such as in Alcalar, Gr. 3 (Leisner 1943, 238, Table 79; Brandherm 2003, 76), accompanying a specific individual are an exception. Architectonical structures within the settlements reflecting a social hierarchy are absent so far. Considerations regarding the resources that were necessary for this society have focused on the potential of agriculture or animal husbandry, the exploitation and working of metal and lithic raw materials and the distribution of quality products and exotica such as ivory, ostrich eggshells, greenstone or amber (e.g. Gilman/Thornes 1985; Chapman 1990; Nocete 2001; Risch 2011).

2.2. The Iberian Inland

The interior, with its extensive plains connected with the main rivers such as the Duero, Tagus and Guadiana Rivers and easy connections crossing the Pyrenean routes and the Ebro River, has traditionally been ignored. This marginal role can be explained by the ideas that accompanied the origin of the Neolithic and the origin of the Chalcolithic (Chapman 2008; Cruz Berrocal et al. 2013). In both cases the interior areas have been interpreted as marginal areas. From the hypothesis of the 'Cave Culture' (Bosch Gimpera 1932), which describes the interior Circle as nearly abandoned, to the work carried out well into the 90s of the last century the Meseta, and especially the South Meseta, has been evaluated similarly (Díaz-del-Río/Consuegra 1999; Díaz-del-Río 2001).

Megalithic studies shook this up, contributing the oldest chronologies of this region, though they were thought to be non-existent (Bueno Ramírez 1991; Bueno Ramírez et al. 2002; 2013). The excavations of megalithic monuments yielded the first evidence of Neolithic settlements, underneath their mounds (Bueno Ramírez et al. 1999; 2002; Delibes de Castro/Zapatero 1996). Moreover, the funerary use of dolmens provided us with long chronologies, verifying human occupation from the 4th and 3rd mill. calBC (Bueno Ramírez et al. 2000a; 2005a; 2005b; 2011). Thus, the monuments of the dead became the first evidence of a continuous human presence in the recent prehistory of the South Meseta. Nevertheless, this did not eliminate all of the problems that had been put forward in the conviction that this area was marginal. Part of these arguments was also based on the supposed lack of resources in this area, especially the lack of wheat agriculture, making the few inhabitants the protagonists of an economy defined by livestock with minimal possibilities for stable settling. This assumption justified that no pollen analyses were carried out to prove the supposed absence of these crops (Baquedano et al. 2000).

3. ResourceCultures

The varying settlement dynamics in the south/southwest and the centre of the Iberian Peninsula are analysed in the light of their ResourceCultures. The apparent contrast between the south (or west) of the Iberian Peninsula and the centre is accentuated not only in this volume, but also in one of the subprojects of Collaborative Research Centre 1070 RessourcenKulturen at Tübingen University in cooperation with the Alcalá de Henares University and the German Archaeological Institute in Madrid (DAI Madrid). The overview of the current state of research that is presented here is the result of comparable research of the earlier mentioned subproject concerning the socioeconomic implications of resources and their use in a settlement region in the southwestern and the South Meseta respectively (Escudero et al. and Schmitt this volume).

This corresponds to the research approaches of Collaborative Research Centre 1070 ResourceCultures – Sociocultural Dynamics and the Use of Resources at Tübingen University. Questions regarding how strongly different natural conditions are reflected in sociocultural development and what can be identified as the basis for social dynamics are central to the research interests. In accordance with the concept of analysis of ResourceCultures, resources can be seen as the basis or a means to create, sustain and alter social relations, units and identities within the framework of culturally defined beliefs and practices. Not only conventionally understood resources such as raw materials, energy or labour are included in this, but also intangible resources such as cultural and religious aspects or social networks. A common criterion is an essential character for the structure and dynamics of the society. Similar to modern interpretations, it is assumed that what can be considered a resource was culturally defined, and was therefore chronologically and regionally defined as well (Bartelheim et al. 2015).

What characterises the concept of ResourceCultures is the interest in the specific interaction of resources in ResourceComplexes with several interconnected components, the forms of use of resources and the sociocultural dynamics that stem from this. Therefore, it is necessary to analyse the cultural basis and the social implications of this use in order to reach a comprehensive characterisation of the development, movement and valuation of resource use. The analysis of ResourceCultures is useful to highlight the many facets of human societies and acknowledge the versatility of social processes. Additionally, it appears that the base for a functional society is its own specific ResourceCulture (Bartelheim et al. 2015).

The application of the concept of ResourceCultures on the Chalcolithic evidence from the southern, western and central Iberian Peninsula was at the heart of the conference held from 9th to 11th of April 2015 at Alcalá University and the German Archaeological Institute in Madrid (DAI). The following core questions were central to the contributions to this conference, on which the results in this volume are based:

a) What were resources and how were they used?
b) Which technological and logistical conditions are necessary for the use of resources and which ResourceComplexes can be recognised?
c) What connection between the use of resources and sociocultural dynamics can be recognised in the regions of the case studies?
d) Do these connections explain the claimed differences between the sociocultural development in the southern and central Iberian Peninsula?

4. The Economy of the Central Iberian Chalcolithic

The introduction of systematic analyses for the reconstruction of the palaeo-environment, agriculture or husbandry is recent and is still in need of improvement in order to be able to make solid claims regarding chronologies, cultivation types or common husbandry. One of the challenges for research in the second half of the 20th cent. was to prove that these societies were familiar with agriculture. The research team of UAH focused on pollen analyses, anthracology, carpology and phytolithic studies of handmills and residues in pottery.

In this way we started to gather evidence that could help assess the use of wheat flours in combination with acorn flours. This combination is well known from other areas in the Iberian Peninsula. The westernmost sites of the Tagus were studied similarly, permitting us to recognise the agricultural activities of people in recent prehistory along the entire catchment area of the river, highlighting the importance of forestry, spread all across Europe (Bueno Ramírez et al. 1999; 2002; 2005a; 2005b; 2008; 2013; López Sáez et al. this volume; Bogucki/Grygiel 1993). The palaeo-diet of the deceased buried in the Azután dolmen or the Huecas (Toledo) confirms wheat agriculture.

Husbandry, defining these people as transhumant, was proven to be of a more stable nature than has traditionally been assumed as a Neolithic habitat was found below the Castillejo tumulus in Toledo. Also other indicators, such as the age of the animals or the collected flora, indicated continuous settling, longer than is usually presumed for transhumant groups practising husbandry (Bueno Ramírez et al. 2005a). Notwithstanding, this interpretation of these mobile societies (Galán/Martin 2009) still plays an important role in Iberian research even though it has been proven that megaliths correspond to settlements with a certain demographic entity. The specialised cattle breeding strategies, adapted to the geographical circumstances, and resulting need for mobility, often connected with long-term transhumance cycles, is held responsible for the ephemeral existence of settlement architecture. A limited vertical social differentiation is maintained until the Bronze Age for these mobile societies in the centre of the Iberian Peninsula, mainly based on a followership structure (Harrison/Mederos 2000; Díaz-del-Río 2004). This is explained by the assumption that the ecological conditions, often referred to as unfavourable, cannot nurture large groups of people and thus no power can be built up by potential leaders.

Apart from exploring the development of farming the investigation into other materials like flint, copper, gold or salt played an important role to evaluate the economic potential of the interior area of the Peninsula (Barroso Bermejo et al. 2003; this volume; García/Valiente 2009; Abarquero et al. 2012).

4.1. Manifestations of Chalcolithic Social Structure in the Central Iberian Peninsula

New data seems to bring the Neolithic and Chalcolithic of the South Meseta in line with the rest of the Iberian developments. Two elements are central in the move towards new perspectives.

First of all, the documentation and characterisation of hypogeum necropolises of varying lay-outs and rich Bell-Beaker grave goods in the Valle de Huecas (Toledo). We claim that the classical burials from Ciempozuelos follow this type of structures of a collective nature, as do Yuncos, in Toledo, La Salmedina, Camino de las Yeseras and others in Madrid. Therefore, the Ciempozuelos Bell-Beaker core which has been used as an example for individual burials (Garrido Pena 2000), has started to transform into one of the main ensembles of advanced megalithic structures with depositions of Bell-Beaker ceramics on the Iberian Peninsula (Bueno Ramírez et al. 2008). The continued collectivity in the burials of the 3rd mill. calBC forces us to reflect upon the real importance of the differences between individuality and collectivity during Bell-Beaker times in the interior of the Peninsula (Bueno Ramírez et al. 2005b; Barroso Bermejo et al. 2015).

Second, the significant increase of known ditched enclosures in the Madrilian Guadarrama area (Díaz-del-Río 2003; Ríos 2011). Most of these are known thanks to rescue excavations. The supposed monotony of prehistoric pit agglomerations on the plains of the South Meseta, especially in the Madrid area, is hereby blurred as some hypogeum necropolises are thought to be linked to enclosures. As we suggested (Bueno Ramírez et al. 2000a; 2008; 2011; 2012a; 2012b), the combination of these two elements indicates archaeological records that are very similar to the ones found in the southwest. This is being gradually confirmed.

It is also necessary to mention the absence of fortified settlements on the South Meseta hitherto. This is equivalent to their relative scarcity in the central Andalusian area, while examples of this type of sites can be found both in the southeast and the southwest. Again, the contributions in this volume contribute to this discussion.

The Tagus Valley is a pioneer area in the documenting of fortified settlements in its westernmost area (Kunst 2007; Schubart/Sangmeister 1983). Therefore, the presence of hypogea that are associated to Atlantic materials, such as the perforated Trivia from some of the necklaces the deceased wear, can help to find this kind of places on the South Meseta. It works to our advantage that thorough surveying has been undertaken in this area in the sector of the Cáceres Jara (Bueno Ramírez et al. 2000b; González Cordero et al. 1988). This confirms that fortified settlements were placed in the same type of landscape as the sector which administratively pertains to Toledo. Indeed, near the Estrella dolmen indications of a possibly Chalcolithic fortification were found (Carrobles/Méndez 1991). More towards the inland the Herencias settlement (de Alvaro 1987) seemed to have some sort of wall. Though the evidence is scarce, elements of an analysis indicate a variety of elements which have already been confirmed for southwestern Portugal and Andalusia.

5. Cultural Connotations of Resources in the Iberian Chalcolithic?

The regionally variable state of research on the Iberian Peninsula is reflected in the case studies that have been included in this volume. Valencina de la Concepción (García Sanjuán this volume) has, like Zambujal (Kunst et al. forthcoming), the advantage of a long research history, which leads to a great quantity of data as a result, ready to use for the posed core questions. Nevertheless, also more recently but continuously, extensively and systematically researched sites such as Perdigões (Valera this volume) or Camino de las Yeseras (Liesau this volume) are included. These shortly but intensively researched places are complemented by some systematically analysed landscapes, such as the Tagus Valley in central Spain (Bueno Ramírez et al. this volume), the estuary area of the Portuguese Tagus (Gonçalves/Sousa this volume) or the Alentejo (Valera this volume). This adds another spatial dimension to the finds.

In all case studies agriculture holds a central position as an economical factor. Nowadays it has been proven for almost all regions, except for mountainous areas, that cereals and legumes were used (and generally also cultivated). Apart from this, also the keeping of livestock, significantly varying in form and intensity according to the region, is a central feature.

To what extent these sometimes blurry variations are reflected in the ecological circumstances remains to be defined by a closer network of regional studies. Agroforestry is a specifically Iberian use of the landscape, producing the so-called *dehesas*. On the southwestern and western Meseta it is present from the end of the 5th to the beginning of the 4th mill. (López Sáez et al. this volume). This type of cultivation is a very effective combination of animal husbandry and agriculture that has been adapted to specific ecological conditions. Future studies are to show to what extent variations in the spectrum of animal bones can indicate differences in mobility in the keeping of livestock. For example, the presence of pigs, animals not fit for transhumant economies, would indicate a more sedentary economy. Whereas the use of plants and animals can be quantified through seed and pollen spectrums and butchering remains, their sociocultural value as a resource in prehistoric times is difficult to grasp. Nevertheless, it can be assumed that it was high. An interesting insight into this topic is provided by the site of Valencina de la Concepción (García Sanjuán this volume). Pigs are thought to have held a special significance here. Firstly, because of the relatively high amount of pigs in the bone record. Secondly, because in the very richly equipped monumental Tholos of Montelírio pigs together with acorns are the only animals that have been depicted on grave goods (Fernández Flores et al. 2016). This could indicate that they held high economical (and therefore perhaps also political) significance for a significant social group, which according to the high quality of the grave goods and the elaborate architecture, were buried in this grave. This observation is even more astonishing as Valencina is located in a favourable setting in more than one way (especially the fertile soils, excellent connectivity, vicinity to the sea and copper mines). This could very probably explain its size and assumed importance (Borja 2013; Llergo et al. 2013). As no other economical factor is so strongly represented, except for exotic materials, the emphasis on pigs could indicate that they were a culturally meaningful resource.

5.1. Imported Materials

The abundant presence of non-local materials is another remarkable characteristic of Valencina. Imported materials are mainly ivory, ostrich eggshells, amber, variscite, rock crystal and cinnabar (Bueno Ramírez et al. 2005b; Odriozola Lloret/García Sanjuán 2013; Odriozola et al. this volume; Schuhmacher et al. 2013; Murillo-Barroso/García Sanjuán 2013). The role of exotica as prestige objects is confirmed in Valencina by the presence of many imported goods in the richly equipped and meticulously built graves such as Montelírio. Apart from this, many objects, partially made of special materials, were found. Their production undoubtedly required a very specialised crafting and they can therefore be characterised as status objects. This refers especially to a rock crystal dagger with ivory sheath, a piece of painstakingly decorated gold foil (Fernández Flores et al. 2016) an amber pommel for a dagger (Murillo-Barroso/García Sanjuán 2013, fig. 4–5), very finely processed rock crystal and silex arrowheads or excessively long silex blades (Murillo Díaz 2013, fig. 4; 15). It remains unclear whether imported materials and quality crafted products were only used as a resource for status representation or also played a role as an economic/religious resource. One possibility might be that they were an accessory for the social competition to express or ensure control over human resources. A similar situation can be found in Perdigões, where exogenous materials (ivory, seashells) and products (the ceramic 'horn idols' some of them decorated, the bone 'almeriense idols' or some schist decorated plaques) hold an even greater variety of meanings, for example symbolical, social, economic, moral or religious (Valera this volume). This sheds an interesting light on the question which role the exchange of goods and raw materials and the underlying networks play as a resource or ResourceComplex for the construction and maintenance of societies. Metals in contrast, and especially copper, do not seem to have held a special value in the Iberian Chalcolithic and therefore did not play a prominent role (Murillo-Barroso/Montero-Ruiz this volume). This could be explained by the ready availability and easy production possibilities of the raw material (Bartelheim 2007, 59 f.). Murillo-Barroso and Montero-Ruiz link value closely to the meaning and use of objects and reach the conclusion that 'objects with high significance symbolise central ideas and beliefs and represent an important political component' (Murillo-Barroso/Montero-Ruiz this volume). This corresponds to the concept of resources the Collaborative Research Centre 1070 maintains, according to which the value of a resource does not essentially stem from itself but is rather measured by what a society attributes to it.

Also in the 3rd mill. BC hypogea of the Iberian inland a variety of raw materials with exogenous origins could be detected (Bueno Ramírez et al. 2005b; Liesau et al. 2016) which highlights cultural similarities with the Southwest.

6. Resources and Society

The social implications of the use of resources in the Chalcolithic of the Iberian Peninsula are difficult to identify in the archaeological record. Vertical social differentiation can be identified in few places. As no clear indications for this are found in settlements, the specially built and equipped graves close to bigger enclosures and fortifications could have been used for this purpose. So far we only know this from Valencina, Alcalar and Los Millares. However, up to now the basis of this differentiation can merely be found in Valencina. Apart from here, no clearly interpretable information is available. Previously discussed findings regarding the Chalcolithic in the interior of the Iberian Peninsula show that only access to more information can remedy this shortage.

The discovery of the large-scale settlement in Azután already shows that the socioeconomic model applied to the south and southwest is also of relevance further to the north, up to the middle Tagus Valley (Bueno Ramírez et al. 2002; 2011; 2012c). So far it is not clear whether the South Meseta and the surrounding hill and mountain region could provide similar structures to those found in the Tagus Valley. As no bigger sites have been identified as of yet, it remains to be seen whether smaller settlements and a primarily mobile lifestyle were indeed preferred here (Bueno Ramírez et al. 2012c). The hitherto unknown expansion of the settling pattern in the southwest of the ample and fertile middle Tagus Valley, traditionally considered part of the dry and scarcely settled centre of the Peninsula, also indicates that differentiated regional considerations are necessary for the judgement of economic and social relationships in the Iberian Chalcolithic. Estimated regional contrasts, for example between the south and centre, definitely fall short here.

7. New Questions for Chalcolithic Research on the Iberian Peninsula

The current state of our knowledge influences the Chalcolithic discourse about both the centre and the southwestern area of the Peninsula. Specific questions should be asked to make the most of the obtained data. The interior of the Peninsula and specifically the supposedly empty areas in the Meseta during recent prehistory, are an outstanding laboratory to verify some basic questions of recent prehistory research in the Peninsula. Contrasting it with another recently investigated area, the southwest, allows for unprecedented interpretations of the perspectives that have been used in the interpretation and evaluation of Chalcolithic records in southern Europe. Here we can find the most important questions for future research:

– Where can we find the most important factors for social development?

a) In abiotic resources such as water, fertile soils, salt, silex, metal, which are all closely connected to subsistence?

b) In the accessibility of the sites, as an important point of inflection for the spreading goods and ideas, forming and maintaining social networks?

c) In cultural factors?

We should contribute maps depicting the position of habitational and funerary elements, alongside contrasted analytics that allow a discussion of the technological level of these groups, their diet, mobility, the use of local or imported silex, chronology and techniques of metal use, etc.

– How can we establish the role of tradition in the dawning of Chalcolithic occupations?

Working with diachronic perspectives is fundamental to eliminate preconceived ideas regarding the supposed absence of people as the only explanation for each of the phases of recent prehistory in the interior and southwest of the Peninsula. Funerary uses and chronologies from dolmens and funerary caves support this interpretation as does the reconstruction of interaction networks through the circulation of prestige goods and symbols appearing on and outside of monuments (Bueno Ramírez et al. 2013; this volume).

– Is there a strong difference between settlement patterns in the interior and southwest and the assumedly original ones in the southwestern area of the Iberian Peninsula? What do ^{14}C dates and the study of archaeological structures and contexts contribute?

When data is contributed to this discussion a wide panorama of occupations will be revealed, with a significant increase in the second half of the 4th mill. BC and in the 3rd mill. BC a demographic flourishing that is well documented for the rest of Europe (Parkinson/Duffy 2007).

– What role can be ascribed to these interior sectors of southern Europe in the general context of Chalcolithic occupations? Are there real chronological differences? What type of materials does this area provide for the rest of Europe: marble, gold, amber, salt, copper?

– When and why does this type of settlements, associated with rich funerary records, start to disappear until finally being replaced by a consolidated Bronze Age?

Probably part of the answer can be found in the interior of the Peninsula, where little documented chronologies in funerary records prevail, like the ones close to the second half of the 2nd mill. calBC (Balsera et al. 2015; Barroso Bermejo et al. 2014; Bueno Ramírez et al. 2005b). These chronologies are probably similar to the classical Lisbon areas (Soares 2003) where the excavations, carried out a long time ago, could not retrieve this kind of data. The synchrony, at least partially, of the Ciempozuelos Bell-Beaker culture, collective burials in hypogea or other advanced megalithic structures and the beginnings of the Bronze Age cultures (El Argar being the best known) invoke critical reflections (Bueno Ramírez et al. 2005b).

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Bibliography

Abarquero et al. 2012: F. Abarquero/E. Guerra/G. Delibes de Castro/A. L. Palomino/J. M. del Val, Arqueología de la Sal en las Lagunas de Villafáfila (Zamora). Investigaciones sobre los cocederos prehistóricos. Arqueología en Castilla y León 9 (Valladolid 2012).

de Álvaro 1987: E. de Álvaro, La Edad del Cobre en el valle del Tajo. Carpetania 1, 1987, 11–42.

Arteaga 1993: O. Arteaga, Tribalización, jerarquización y estado en el territorio de El Argar. SPAL. Revista de prehistoria y arqueología de la Universidad de Sevilla 1, 1993, 179–208.

Arteaga 2001: O. Arteaga, Fuente Álamo im Territorium von El Argar. In: H. Schubart/V. Pingel/O. Arteaga, Fuente Álamo I (Mainz 2001) 161–203.

Arteaga/Barragán 2010: O. Arteaga/D. Barragán, Investigaciones geoarqueológicas en la Rua da Barroca, Lagos. Actas do 7º Encontro de Arqueologia do Algarve, Silves 2009. Xelb. Revista de arqueologia, arte, etnologia e história 10, 2010, 87–102.

Arteaga/Roos 2005: O. Arteaga/A. M. Roos, Proyectos geoarqueológicos en las costas de Andalucía. In: J. A. López Geta/J. C. Rubio Campos/M. Martín Machuca (eds.), VI Simposio del Agua en Andalucía, Sevilla, 2005. Hidrogeología y Aguas Subterráneas 14 (Madrid 2005) 1471–1486.

Balsera et al. 2015: V. Balsera/J. Bernabeu/M. Costa/P. Díaz-del-Río/L. García Sanjuán/S. Pardo, The Radiocarbon Chronology of Southern Spain's Late Prehistory (5600–1000 cal BC). A Comparative Review. Oxford Journal of Archaeology 34, 2015, 139–156.

Baquedano et al. 2000: M. I. Baquedano/J. F. Blanco/P. Alonso/D. Álvarez, El Espinillo. Un yacimiento calcolítico y de la Edad del Bronce en las terrazas del Manzanares. Arqueología, Paleontología y Etnografía 8 (Madrid 2000).

Barroso Bermejo et al. 2003: R. Barroso Bermejo/P. Bueno Ramírez/R. de Balbín Behrmann, Primeras producciones metálicas en la cuenca interior del Tajo. Cáceres y Toledo. Estudos Pré-históricos 10/11, 2003, 87–106.

Barroso Bermejo et al. 2014: R. Barroso Bermejo/P. Bueno Ramírez/R. de Balbín Behrmann/A. Vázquez Cuesta/A. González Martin, Nekropolen des 3. Jahrtausends v. Chr. im Zentrum der Iberischen Halbinsel. Madrider Mitteilungen 55, 2014, 1–28.

Barroso Bermejo et al. 2015: R. Barroso Bermejo/P. Bueno Ramírez /A. Vázquez Cuesta/C. Odriozola Lloret/D. Uribelarrea del Val/O. López Jiménez/R. de Balbín Behrmann/L. Peña Chocarro/J. Yravedra Sainz de los Terreros, Campaniforme no funerario en la provincia de Toledo. El yacimiento de Las Vegas. De nuevo el Valle de Huecas. Trabajos de Prehistoria 72, 2015, 145–157.

Bartelheim 2007: M. Bartelheim, Die Rolle der Metallurgie in vorgeschichtlichen Gesellschaften. Sozioökonomische und kulturhistorische Aspekte der Ressourcennutzung. Ein Vergleich zwischen Andalusien, Zypern und dem Nordalpenraum. Forschungen zur Archäometrie und Altertumswissenschaft 2 (Rahden/Westf. 2007).

Bartelheim et al. 2015: M. Bartelheim/R. Hardenberg/T. Knopf/A. Scholz/J. Staecker, 'ResourceCultures'. A Concept for Investigating the Use of Resources in Different Societies. In: A. Danielisová/M. Fernández Götz (eds.), Persistent Economic Ways of Living. Production, Distribution, and Consumption in Late Prehistory and Early History (Budapest 2015) 39–50.

Bartelheim/Montero 2009: M. Bartelheim/I. Montero, Many Ores and Little Water. The Use of Resources on the Iberian Peninsula During the Bronze Age. In: M. Bartelheim/H. Stäuble (eds.), Die wirtschaftlichen Grundlagen der Bronzezeit Europas. Forschungen zur Archäometrie und Altertumswissenschaft 4 (Rahden/Westf. 2009) 5–22.

Blasco et al. 2011: C. Blasco/C. Liesau/P. Ríos (eds.), Yacimientos Calcolíticos con Campaniforme de la Región de Madrid. Nuevos estudios. Patrimonio Arqueológico de Madrid 6 (Madrid 2011).

Bogucki/Grygiel 1993: P. Bogucki/R. Grygiel, The First Farmers of Central Europe. A Survey Article. Journal of Field Archaeology 20, 1993, 399–426.

Borja 2013: F. Borja Barrera, La desembocadura del Guadalquivir en la segunda mitad del Holoceno. Síntesis paleogeográfica. In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/T. Ruíz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción (Sevilla). Investigación y Tutela en el 150 Aniversario del Descubrimiento de La Pastora (Sevilla 2013) 93–112.

Bosch Gimpera 1932: P. Bosch Gimpera, Etnología de la Península Ibérica (Barcelona 1932).

Brandherm 2003: D. Brandherm, Die Dolche und Stabdolche der Steinkupfer- und der älteren Bronzezeit auf der Iberischen Halbinsel. Prähistorische Bronzefunde 6.12 (Stuttgart 2003).

Bueno Ramírez 1991: P. Bueno Ramírez, Megalitos en la Meseta Sur. Los dólmenes de Azután y La Estrella (Toledo). Excavaciones Arqueológicas en España 159 (Madrid 1991).

Bueno Ramírez et al. 1999: P. Bueno Ramírez/R. de Balbín Behrmann/R. Barroso Bermejo/J. M. Rojas/R. Villa/R. Félix/S. Rovira, Neolítico y Calcolítico en término de Huecas (Toledo). Trabajos de Prehistoria 56, 1999, 141–160.

Bueno Ramírez et al. 2000a: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Valle de las Higueras (Huecas, Toledo, España). Una necrópolis Ciempozuelos con cuevas artificiales al interior de la Península. Estudos Pré-históricos 8, 2000, 49–80.

Bueno Ramírez et al. 2000b: P. Bueno Ramírez/A. González Cordero/S. Rovira Llorens, Areas de habitación y sepulturas de falsa cúpula en la cuenca extremeña del Tajo. Acerca del poblado con necrópolis del Canchal, en Jaraiz de la Vera (Cáceres). In: J. Jiménez Ávila/J. J. Enríquez Navascués (eds.), El megalitismo en Extremadura (homenaje a Elías Díeguez Luengo). Extremadura Arqueológica 8 (Mérida 2000) 211–244.

Bueno Ramírez et al. 2002: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann/M. Campo/F. Etxeberría/L. Herrasti/J. Juan/P. López/J. A. López/B. Sánchez, Áreas habitacionales y funerarias en el neolítico de la cuenca interior del Tajo. La provincia de Toledo. Trabajos de Prehistoria 56, 2002, 65–79.

Bueno Ramírez et al. 2005a: P. Bueno Ramírez/R. de Balbín Behrmann/R. Barroso Bermejo, El dolmen de Azután (Toledo) Áreas de habitación y áreas funerarias en la cuenca interior del Tajo. Monografías 2 (Alcalá 2005).

Bueno Ramírez et al. 2005b: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Ritual campaniforme, ritual colectivo. La necrópolis de cuevas artificiales del Valle de las Higueras, Huecas, Toledo. Trabajos de Prehistoria 62, 2005, 67–90.

Bueno Ramírez et al. 2008: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Campaniforme en las construcciones hipogeas del megalitismo reciente al interior de la Península Ibérica. Veleia 24/25, 2007/2008, 771–790.

Bueno Ramírez et al. 2011: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Entre lo visible y lo invisible. Registros funerarios de la Prehistoria reciente de la Meseta Sur. Arqueología, Sociedad, territorio y paisaje. Biblioteca Praehistórica Hispana 28 (Madrid 2011) 53–73.

Bueno Ramírez et al. 2012a: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, 5000 años atrás. Primeros agricultores y metalúrgicos del valle de Huecas (Huecas, Toledo) (Toledo 2012).

Bueno Ramírez et al. 2012b: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Les grottes artificielles et le Campaniforme à l'intérieur de la péninsule ibérique: la nécropole de Valle de las Higueras. Sépultures collectives et mobiliers funéraires de la fin du Néolithique en Europe occidentale. Archives d'Écologie Préhistorique (Toulouse 2012) 359–381.

Bueno Ramírez et al. 2012c: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Meseta Sur. In: M. Rojo Guerra/R. Garrido Pena/I. García Martinez de Lagrán (eds.), El Neolítico en la Península Ibérica y su contexto europeo (Madrid 2012) 508–542.

Bueno Ramírez et al. 2013: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Interior Regions and Places of Collective Memory. The Megalithism of the Interior Basin of the Tagus, Iberian Peninsula. A Reflection After Reading the Tara Project. In: M. O'Sullivan/C. Scarre/M. Doyle (eds.), Tara. From the Past to the Future. Towards a New Research Agenda (Dublin 2013) 484–502.

Carrobles/Méndez 1991: J. Carrobles Santos/V. M. Méndez Cabeza, Introducción al estudio del Calcolítico en la Jara toledana. Anales Toledanos 28, 1991, 7–24.

Castro et al. 1998: P. Castro/R. Chapman/S. Gili/V. Lull/R. Micó/C. Rihuete/R. Risch/M. E. Sanahuja Yll (eds.), Aguas Project. Palaeoclimatic Reconstruction and the Dynamics of Human Settlement and Land-Use in the Area of the Middle Aguas, Almería, of the South-East of the Iberian Peninsula (Luxemburg 1998).

Chapman 1990: R. Chapman, Emerging Complexity. The Later Prehistory of South-East Spain, Iberia and the West Mediterranean (Cambridge 1990).

Chapman 2003: R. Chapman, Archaeologies of Complexity (London 2003).

Chapman 2008: R. Chapman, Producing Inequalities. Regional Sequences in Later Prehistoric Southern Spain. Journal of World Prehistory 21.3/4, 2008, 195–260.

Contreras 2000: F. Contreras Cortés (ed.), Proyecto Peñalosa. Análisis histórico de las comunidades de la Edad del Bronce del piedemonte meridional de Sierra Morena y depresión Linares-Bailén. Arqueología, Monografías 10 (Sevilla 2000).

Contreras et al. 2010: F. Contreras Cortés /A. Moreno Onorato/J. A. Cámara Serrano, Los inicios de la minería. La explotación del mineral de cobre. In: F. Contreras Cortés/J. Dueñas Molina (eds.), La minería y la metalurgia en el Alto Guadalquivir desde sus orígenes hasta nuestros días (Jaén 2010) 43–121.

Cruz Berrocal et al. 2013: M. Cruz Berrocal/L. García Sanjuán/A. Gilman (eds.), The Prehistory of Iberia. Debating Early Social Stratification and the State (New York 2013).

Dambeck et al. 2010: R. Dambeck/H. Thiemeyer/N. Herrmann/A. J. Kalis/M. Kunst/A. Lord/ H. Rittweger/H.-P. Stika/A. Stobbe, Holozäne Talentwicklung und Landschaftswandel am Rio Sizandro. Geoarchäologische Beiträge zum Projekt 'Sizandro – Alcabrichel', Torres Vedras, Portugal. Madrider Mitteilungen 51, 2010, 9–41.

Delibes de Castro/Montero-Ruiz 1999: G. Delibes de Castro/I. Montero-Ruiz (eds.), Las primeras etapas metalúrgicas en la península Iberica II. Estudios regionales (Madrid 1999).

Delibes de Castro/Zapatero 1996: G. Delibes de Castro/P. Zapatero, De lugar de habitación a sepulcro monumental: una reflexión sobre el yacimiento de la Velilla, en Osorno (Palencia). Rubricatum 1 (Gavá 1996) 337–348.

Díaz Andreu 2002: M. Díaz Andreu, Historia de la arqueología en España (Madrid 2002).

Díaz Andreu/Montero-Ruiz 2000: M. Díaz Andreu/I. Montero-Ruiz, Metallurgy and Social Dynamics in the Later Prehistory of Mediterranean Spain. In: C. F. E. Pare (ed.), Metals Make the World Go Round (Oxford 2000) 116–132.

Díaz-del-Río 2003: P. Díaz-del-Río, Recintos y fosos del III milenio AC en la Meseta peninsular. Trabajos de Prehistoria 60, 2003, 61—78.

Díaz-del-Río/Consuegra 1999: P. Díaz-del-Río/S. Consuegra, Primeras evidencias de estructuras de habitación y almacenaje neolíticas en el entorno de la Campiña madrileña: el yacimiento de "La Deseada" (Rivas-Vaciamadrid)". In: II Congrés del Neolitic a la Península Ibérica. Saguntum, PLAV. Extra 2, 1999, 252–257.

Díaz-del-Río 2001: P. Díaz-del-Río, La formación del paisaje agrario. Madrid en el III y II milenios BC. Arqueología, Paleontología y Etnografía 9 (Madrid 2001).

Díaz-del-Río 2004: P. Díaz-del-Río, III Millennium BC Ditch Enclosures in Central Iberia. Oxford Journal of Archaeology 23, 2004, 107–121.

Díaz-del-Río 2006: P. Díaz-del-Río, An Appraisal of Social Inequalities in Central Iberia, c. 5300–1600 cal BC. In: P. Díaz-del-Río/L. García Sanjuán (eds.), Social Inequality in Iberian Late Prehistory. British Archaeological Reports. International Series S1525 (Oxford 2006) 67–79.

Estacio da Veiga 1889: S. P. M. Estacio da Veiga, Antiguidades Monumentães do Algarve. Tempos Prehistoricos (Lisbon 1889).

Fernández Eraso/Mújika Alistuza 2010: J. Fernández Eraso/J. A. Mújika Alistuza, Actas del Congreso Internacional sobre Megalitismo y otras manifestaciones funerarias contemporáneas en su contexto social, económico y cultural. Munibe. Suplemento 32 (San Sebastián 2010).

Fernández Flores et al. 2016: A. Fernández Flores/L. García Sanjuán/M. Díaz Zorita Bonilla, Montelirio (Castilleja de Guzmán, Sevilla). Un Gran Monumento Megalítico de la Edad del Cobre (Sevilla 2016).

Galán Domingo/Martín Bravo 2009: E. Galán Domingo/A. Martín Bravo, Megalitismo y zonas de paso en la cuenca extremeña del Tajo. Zephyrvs 44, 2009, 193–204.

García/Valiente 2009: R. García/S. Valiente, Estudio de las muestras cerámicas documentadas en Salinas de Espartinas y de las tierras de su entorno. In: Sociedad española de Historia de la Arqueología (ed.), La explotación histórica de la sal. Investigación y puesta en valor (Ciempozuelos 2009) 193–206.

García Sanjuán et al. 2013: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/T. Ruíz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción (Sevilla). Investigación y Tutela en el 150 Aniversario del Descubrimiento de La Pastora (Sevilla 2013).

García Sanjuán/Murillo-Barroso 2013: L. García Sanjuán/M. Murillo-Barroso, Social Complexity in Copper Age Southern Iberia (c. 3200–2200 cal BC). Reviewing the 'State' Hypothesis at Valencina de la Concepción (Seville, Spain). In: M. Cruz Berrocal/L. García Sanjuán/A. Gilman (eds.), The Prehistory of Iberia. Debating Early Social Stratification and the State (New York 2013) 119–140.

Garrido Pena 2000: R. Garrido Pena, El campaniforme en la Meseta Central de la Península Ibérica (c. 2500–2000 AC). British Archaeological Reports. International Series 892 (Oxford 2000).

Gilman 1987: A. Gilman, El análisis de clase en la prehistoria del sureste. Trabajos de Prehistoria 44, 1987, 27–34.

Gilman 2001: A. Gilman, Assessing Political Development in Copper and Bronze Age Southeast Spain. In: J. Haas (ed.), From Leaders to Rulers (New York 2001) 59–81.

Gilman/Thornes 1985: A. Gilman/J. B. Thornes, Land-Use and Prehistory in Southeast Spain (London 1985).

Gonçalves 2000: V. S. Gonçalves (ed.), Muitas antas, pouca gente? Actas do I Colóquio Internacional sobre Megalitismo (Reguengos de Monsaraz, outubro de 1996). Trabalhos de Arqueologia 16 (Lisbona 2000).

González Cordero et al. 1988: A. González Cordero/M. de Alvarado Gonzalo/L. Municio González/F. Piñón Varela, El poblado de El Cerro de la Horca (Plasenzuela, Cáceres). Datos para la secuencia del Neolítico Tardío y la Edad del Cobre en la Alta Extremadura. Trabajos de Prehistoria 45, 1988, 87–102.

Harrison 2007: R. Harrison, Majaladares (Spain). Internationale Archäologie 107 (Rahden/Westf. 2007).

Harrison/Mederos 2000: R. J. Harrison/A. Mederos Martin, Patronage and Clientship. A Model for the Atlantic Final Bronze Age in the Iberian Peninsula. In: C. F. E. Pare (ed.), Metals Make the World Go Round (Oxford 2000) 133–150.

Hurtado Pérez 1997: V. Hurtado Pérez, The Dynamics of the Occupation of the Middle Basin of the River Guadiana Between the Fourth and Second Millennia BC. In: M. Díaz Andreu (ed.), Archaeology of Iberia (Madrid 1997) 98–121.

Hurtado Pérez et al. 2000: V. Hurtado Pérez/P. Mondéjar Fernández de Quincoces/J. C. Pecero Espín, Excavaciones en la tumba 3 de La Pijotilla. In: J. Jiménez Àvila/J. J. Enríquez Navasqués, El Megalitismo en Extremadura. Extremadura Arqueológica 8 (Homenaje a Elías Diéguez Luengo) (Mérida 2000) 249–266.

Jiménez Àvila/Enríquez Navasqués 2000: J. Jiménez Àvila/J. J. Enríquez Navasqués, El Megalitismo en Extremadura. Extremadura Arqueológica 8 (Homenaje a Elías Diéguez Luengo) (Mérida 2000).

Kunst 2001: M. Kunst, Die Kupferzeit der Iberischen Halbinsel. In: M. Blech/M. Koch/M. Kunst (eds.), Denkmäler der Frühzeit. Hispania Antiqua (Mainz 2001) 67–100.

Kunst 2007: M. Kunst, Zambujal and the Enclosures of the Iberian Peninsula (Sheffield 2007).

Kunst et al. forthcoming: M. Kunst/G. de Carvalho Amaro/P. Jordão, El poblado fortificado de Zambujal (III/II mil. a. C.) y sus recursos de materias primas. In: M. Kunst (ed.), Zambujal. Die Grabungen und Prospektionen von 1994 bis 2017. Madrider Beiträge (forthcoming).

Leisner 1943: G. Leisner/V. Leisner, Die Megalithgräber der Iberischen Halbinsel, 1. Der Süden. Römisch-Germanische Forschungen 17 (Berlin 1943).

Leisner 1956–1998: G. Leisner/V. Leisner, Die Megalithgräber der Iberischen Halbinsel, 2. Der Westen. Madrider Forschungen 1 (Berlin 1956–1998).

Liesau et al. 2016: C. Liesau/E. Guerra/G. Delibes de Castro/C. Blasco/P. Ríos, Copper Weapons, Gold and Ivory. Long Distance Exchanges and Emulations among the Atlantic Beaker Groups. Musaica Archaeologica 1, 2016, 11–20.

Lillios 1995: K. Lillios (ed.), The Origins of Complex Societies in Late Prehistoric Iberia. International Monographs in Prehistory. Archaeological Series 8 (Ann Arbor 1995).

Llergo et al. 2013: Y. Llergo/M. Royo/C. Granados/A. Fernández/F. Borja/J. L. Ubera, El entorno vegetal de Valencina de la Concepción (Sevilla) en el III milenio AC. Una aproximación palinológica. In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/T. Ruíz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción (Sevilla). Investigación y Tutela en el 150 Aniversario del Descubrimiento de La Pastora (Sevilla 2013) 409–420.

Lull 1983: V. Lull, La cultura de El Argar (Madrid 1983).

Lull et al. 2010: V. Lull/R. Micó/C. Rihuete/R. Risch, Metal and Social Relations of Production in the 3rd and 2nd Millennia BCE in the Southeast of the Iberian Peninsula. Trabajos de Prehistoria 67, 2010, 323–347.

Lull/Risch 1995: V. Lull/R. Risch, El estado argárico. Verdolay 7, 1995, 97–109.

Márquez Romero 2006: J. E. Márquez Romero, Neolithic and Copper Age Ditched Enclosures and Social Inequality in the South of the Iberian Peninsula (IV–III Millennia cal. BC). In: P. Díaz-del-Río/L. García Sanjuán (eds.), Social Inequality in Late Iberian Prehistory. British Archaeological Reports. International Series 1525 (Oxford 2006) 171–184.

Márquez Romero 2013: J. E. Márquez Romero, Yacimientos prehistóricos de fosos. Una lectura alternativa a un problema histórico ya clásico. In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/M. T. Ruiz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción. Investigación y Tutela en el 150 Aniversario del descubrimiento de La Pastora (Sevilla 2013) 77–92.

Montero-Ruiz 1994: I. Montero-Ruiz, El origen de la metalurgia en el sudeste de la Península Ibérica (Almería 1994).

Montero-Ruiz 1998: I. Montero-Ruiz, Interpretación cultural en la investigación arqueometalúrgica. La Edad del Bronce. In: J. Fernández Manzano/F. J. Sarabia Herrero (eds.), Arqueometalurgía del bronce. Introducción a la metodología de trabajo. Studia Archaeologica 86 (Valladolid 1998) 99–108.

Montero-Ruiz/Ruiz Taboada 1996: I. Montero-Ruiz/A. Ruiz Taboada, Enterramiento colectivo y metalurgia en el yacimiento neolítico de Cerro Virtud, Cuevas del Almanzora, Almería. Trabajos de Prehistoria 53, 1996, 55–75.

Morán 2014: E. Morán, El Asentamiento Prehistórico de Alcalar (Portimão, Portugal), La Organización del Território y el Proceso de Formación de un Estado Prístino en el Tercer Milénio a.n.e. (PhD-Thesis Universidad de Sevilla 2014).

Morán/Parreira 2004: E. Morán/R. Parreira, Alcalar 7. Estudo e Reabilitação de un Monumento Megalítico. Cadernos 6 (Lissabon 2004).

Murillo-Barroso/García Sanjuán 2013: M. Murillo-Barroso/L. García Sanjuán, El pomo de ámbar de la Estructura 10.042–10.049 del Sector PP4-Montelirio del asentamiento de Valencina de la Concepción (Sevilla). In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/T. Ruíz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción (Sevilla). Investigación y Tutela en el 150 Aniversario del Descubrimiento de La Pastora (Sevilla 2013) 511–520.

Murillo-Barroso/Martinón-Torres 2012: M. Murillo-Barroso/M. Martinón-Torres, Amber Sources and Trade in the Prehistory of the Iberian Peninsula. European Journal of Archaeology 15, 2012, 187–216.

Murillo Díaz 2013: T. Murillo Díaz, La manufactura de artefactos líticos de la Edad del Cobre en el territorio de Valencina de la Concepción (Sevilla). In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/T. Ruíz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción (Sevilla) Investigación y Tutela en el 150 Aniversario del Descubrimiento de La Pastora (Sevilla 2013) 469–484.

Nocete 2001: F. Nocete, Tercer milenio antes de nuestra era. Relaciones y contradicciones centro/perifería en el Valle del Guadalquivir (Barcelona 2001).

Odriozola Lloret/García Sanjuán 2013: C. P. Odriozola Lloret/L. García Sanjuán, Las cuentas de collar de piedra verde de Matarrubilla (Valencina de la Concepción, Sevilla). In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/T. Ruíz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción (Sevilla). Investigación y Tutela en el 150 Aniversario del Descubrimiento de La Pastora (Sevilla 2013) 485–494.

Parkinson/Duffy 2007: W. A. Parkinson/P. R. Duffy, Fortifications and Enclosures in European Prehistory. Journal of Archeological Research 15, 2007, 97–141.

Peña Chocarro 1999: L. Peña Chocarro, Prehistoric Agriculture in Southern Spain during the Neolithic and the Bronze Age. The Application of Ethnographic Models. British Archaeological Reports. International Series 818 (Oxford 1999).

Ríos 2011: P. Ríos, Territorio y sociedad en la región de Madrid durante el III milenio a.C. El referente del yacimiento de Camino de las Yeseras. Patrimonio Arqueológico de Madrid 7 (Madrid 2011).

Risch 2011: R. Risch, Social and Economic Organization of Stone Axe Production and Distribution in the Western Mediterranean. In: V. Davis/ M. Edmonds (eds.), Stone Axe Studies, III (Oxford 2011) 99–118.

Schubart/Sangmeister 1983: H. Schubart/E. Sangmeister, A cronologia absoluta (datações C14) de Zambujal. Clio Arqueologia 1, 1983, 31–40.

Schuhmacher 2011: T. X. Schuhmacher, Elfenbein des Chalkolithikums und der Frühen Bronzezeit auf der Iberischen Halbinsel. Ergebnisse eines interdisziplinären Forschungsprojekts. In: A. Banerjee/C. Eckmann (eds.), Elfenbein und Archäologie, INCENTIVS-Tagungsbeiträge 2004–2007. Römisch-Germanisches Zentralmuseum, Tagungen 7 (Mainz 2011) 91–122.

Schuhmacher 2012: T. X. Schuhmacher, Die Elfenbeinobjekte des Chalkolithikums und der Frühen Bronzezeit auf der Iberischen Halbinsel. Interdisziplinäre Studien zu Herkunft, Austausch, Verarbeitung und sozialer Bedeutung von Elfenbein. Iberia Archaeologica 16.2 (Darmstadt 2012).

Schuhmacher et al. 2013: T. X. Schuhmacher/A. Banerjee/W. Dindorf/F. Nocete Calvo/J. M. Vargas Jiménez, Los marfiles del yacimiento de Valencina de la Concepción (Sevilla) en el contexto del Calcolítico del suroeste peninsular. In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/T. Ruíz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción (Sevilla) Investigación y Tutela en el 150 Aniversario del Descubrimiento de La Pastora (Sevilla 2013) 495–510.

Siret 1890: E. L. Siret, Las primeras edades del metal en el Sudeste de España (Barcelona 1890).

Soares 2003: J. Soares, Os hipogeus pré-históricos da Quinta do Anjo (Palmela) e as economías do simbólico (Setúbal 2003).

Valera 2015: A. C. Valera, Social Change in the Late 3rd Millennium BC in Portugal. The Twilight of Enclosures. In: H. Meller/R. Risch/R. Jung/H. W. Arz (eds.), 2200 BC. Ein Klimasturz als Ursache für den Zerfall der Alten Welt? 7. Mitteldeutscher Archäologentag vom 23. bis 26. Oktober 2014 in Halle (Saale). Tagungen des Landesmuseums für Vorgeschichte Halle 13.1/2 (Halle 2015) 409–428.

Valera et al. 2014: A. C. Valera/A. M. Silva/C. Cunha/L. Evangelista, Funerary Practices and Body Manipulations at Neolithic and Chalcolithic Perdigões Ditched Enclosures (South Portugal). In: A. C. Valera (ed.) Recent Prehistoric Enclosures and Funerary Practices, Oxford. British Archaeological Reports. International Series 2676 (Lisbon 2014) 37–57.

Valera/Filipe 2004: A. C. Valera/I. Filipe, O povoado do Porto Torrão (Ferreira do Alentejo) novos dados e novas problemáticas no contexto da calcolitização do Sudoeste peninsular. Era Arqueologia 6 (Lisboa 2004) 28–61.

Zafra de la Torre et al. 1999: N. Zafra de la Torre/F. Hornos Mata/M. Castro López, Una macro-aldea en el origen del modo de vida campesino. Marroquíes Bajos (Jaén) c. 2500–2000 cal. ANE. Trabajos de Prehistoria 56, 1999, 77–102.

Zafra de la Torre et al. 2003: N. Zafra de la Torre/F. Hornos Mata/M. Castro López, Sucesión y simultaneidad en un gran asentamiento. La cronología de la macro-aldea de Marroquíes Bajos, Jaén. c. 2500–2000 cal ANE. Trabajos de Prehistoria 60, 2003, 79–90.

PRIMITIVA BUENO RAMÍREZ, ROSA BARROSO BERMEJO AND RODRIGO DE BALBÍN BEHRMANN

Ancestors' Images as Marks of the Past
The Dolmen of Azután, Toledo (Spain)

Keywords: Megalithic, Neolithic, Chalcolithic, ideology, ancestors, megalithic art

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Abstract

Ditched enclosures, walled enclosures and megaliths are the three types of monumental structures derived from forms of social cohesion within European Neolithic societies, which is the most convincing hypothesis to explain the relationship between these types of sites. This text proposes that the position of megalithic cemeteries is excellent evidence to develop methods of surveying and territorial studies offering a more varied and richer image. In addition to generally accepted views, it might be added that the memory of the ancestors materialised in the megaliths is a social tool, which helps to support the ideological construction of sites of all kinds.

The position of the Azután dolmen on the old terrace of the Tagus and its conspicuousness over the valley always suggested the role of this monument as a visible element of the location of Neolithic groups in the west of Toledo province. During the late 1990s and even more so during the twenty-first century two ideas proved to be the most convincing to understand the relationship between dolmens and human settlements. One was the value of the past, vindicated by the display of large stone tombs dedicated to ancestors; the other the relationship between the monuments and such abiotic resources as water, good farmland, grazing and easy access, all factors favouring human settlement and therefore convincing support for proposals about the close relationship between the habitat and dolmens.

Another factor increases the interest in using the position of megaliths as the starting point for research projects on settlement patterns in recent prehistory. This is the evidence of long sequences of use of the monuments, which is an indicator of the permanence of the sites. The functionality of the megaliths, as receptacles of ancestors, adds an ideological component that cannot be ignored when analysing the arguments about the way the territory was used by groups practising farming or metallurgy.

The occurrence of all these factors in the case of Azután dolmen was the empirical base to begin intensive surveying together with the use of geophysical techniques. This has led to the discovery of one of the largest groups of ditched enclosures on the southern Spanish Plateau an area where they were completely unknown (Schmitt et al. in print).

An examination of some of these hypotheses – together with settlement patterns of later European prehistory – may contribute reasonable evidence of interaction. Characterising grave goods and prestige goods circulated during the time megalithic monuments were in use throughout the European plains.

Azután: Dolmens on the South Meseta

In the interior of the Iberian Peninsula a close quantitative relation between megaliths and Early

Neolithic settlements is evident. Most of the early Neolithic on the Meseta is known through the megalithic tombs beneath mounds (Zapatero 1991; Bueno Ramírez et al. 2002; 2006; 2013; 2016a). The excavation of some of the best-known monuments probably explains this relationship as they were excavated in dated manner. The digging of trenches through the mounds has occurred in other parts of Iberia (Fábregas/Vilaseco 2013).

The functionality of the first phases of every dolmen needs to be considered. First, the above-mentioned evidence of population. Second, the sites are usually associated with menhirs, of which there is evidence within the southern Iberian Peninsula (García Sanjuán et al. 2003). Finally, there are previous tombs beneath what we see today (Lecornec 1994). These three facts are repeated in relation with one another or separately in much of the Atlantic Megalithism. They must be accounted for as well as the changes, rebuilding and maintenance visible in the monuments. Thus we face a very significant diachrony (Bueno Ramírez et al. 2013; Barroso Bermejo et al. 2007; 2012; García Sanjuán 2005; Laporte 2010).

Megalithic monuments therefore played a major role in materialising the past of the places where these constructions were built. In this respect, they represent a clear opportunity to establish strategies enabling the collection of verifiable data. These strategies should take into account the possibility of documenting sequences in the monument itself, by excavating the mound and the levels below, by dating the human remains or other organic objects and certainly by documenting the decoration on the stones, their form, technique and carving. These objectives guided the different studies carried out by our team in the Azután dolmen and at least some of them were achieved. The study of its relationship with the surrounding terrain, although it had already been started, was recently intensified.

Azután is one of the largest monuments in the Iberian Peninsula and certainly the biggest in the centre of the peninsula. Its large volume poses some questions about the level of social relations that is required to build such a tomb. It is also decorated, mostly with engravings, but also with some remains of paint that confirm the relationship of its builders with the ideological framework that sustained megalithic art in Europe (Bueno Ramírez/de Balbín Behrmann 2002). The representations include forms of Schematic Art in, for example, the schematic anthropomorphic representation in the area of the head of the tomb (Bueno Ramírez et al. 2005a, 91) together with classic elements of the Atlantic area: trapezoids and spirals. Many of the stones in the dolmen are shaped like stelae, especially those on the south side of the tomb, where a reserved area is also located, presided by a small menhir. The unusual form of one of the stones on the north side decorated with feet in relief, suggest it is part of a re-used capstone, as documented in the megalith of Saint-Piat, in the centre-west of France (Jagu 2003).

The degree of ritual elaboration of the tomb is considerable and matches references in Beira in Portugal (Gomes et al. 1998), coinciding in the type of construction and size of the chamber. This is further evidence to connect Azután with other monuments in the Tagus Basin, which makes sense according to the location of the dolmen. Indeed it has been argued that inland megalithism covers a large area, including both North and South Meseta, the Beira Baixa and the western part of the Tagus Valley. That is to say all the inland plains with easy possibilities for transit. The accessibility of this large area towards the megalithic areas in the south-west especially Alentejo and Algarve, to the Guadiana and Guadalquivir in the west and to the inland Tagus, eastern Guadiana Valley and the Ebro Valley complete its privileged position (Bueno Ramírez et al. 2010). A position on traditional routes (Bueno Ramírez 1991; Bueno Ramírez et al. 2005a; 2005b; Galán/Martín Bravo 2009; Wheatley et al. 2010) is one of the most noteworthy traits of the location of this type of monument. Azután corresponds to that image of tombs built with large stones in areas of easy transit. A more diverse picture of paleoeconomic subsistence is recognisable by the choice of good farming land, contradicting the classic view of herding and transhumance as only economic factors. Likewise the appearance of grassland near water-courses indicates more complex ideas of what constitutes favourable conditions than usually conceded (*fig. 1*).

The prolonged use of the monument, corroborated by radiocarbon dates, demonstrates that the Azután dolmen was still being used, when

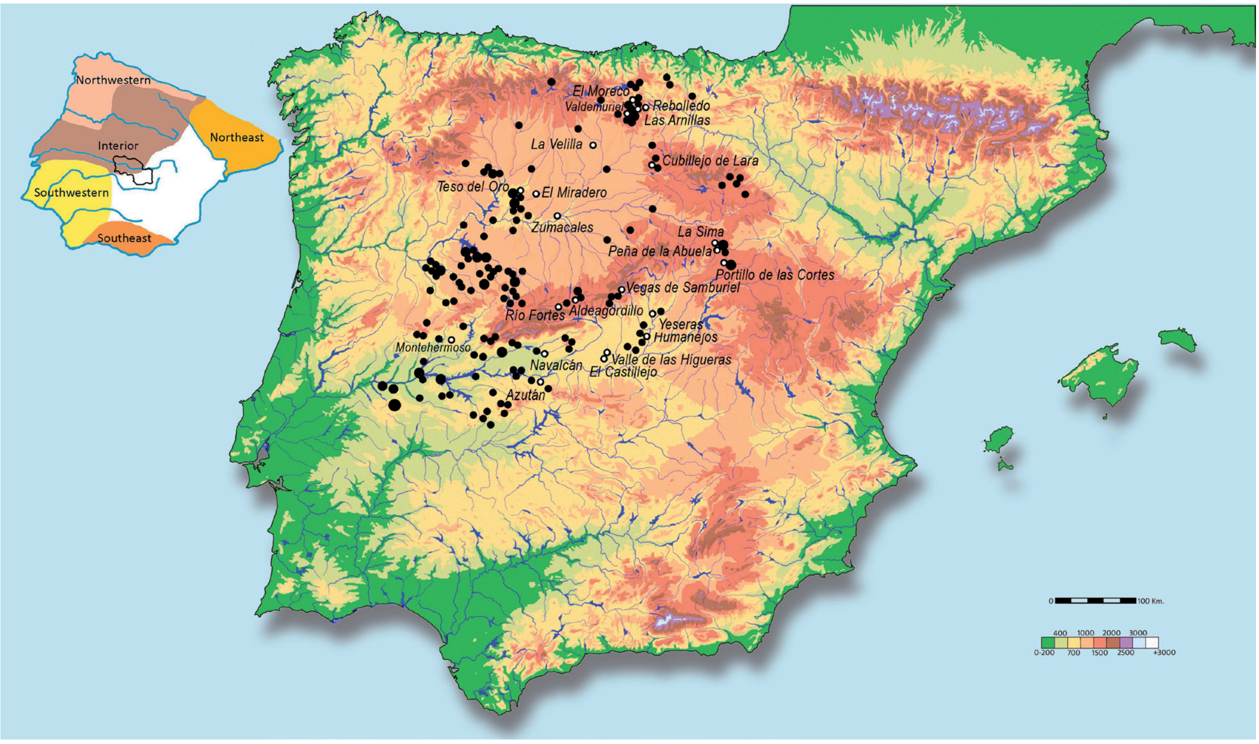

Fig. 1. Main megalithic areas in the Iberian Peninsula (after: Bueno Ramírez et al. 2005a), and location of the megalithic monuments in the interior of the Iberian Peninsula (after: Bueno Ramírez et al. 2016a).

the Castillejo tumulus and a little afterwards the Higueras Valley necropolis further inland in the Tagus Valley were fully in use. This contemporaneous use of different constructions is not unique to Toledo province. Similar evidence is found in the area of Madrid where the Entretérminos dolmen, which is very similar to Azután, the hypogean tombs of Camino de las Yeseras and others reflect a compact group of occupations in the area in later prehistory. Research in Toledo has contributed an exhaustive chronology obtained in burial sites and occupation areas, in addition to studies on funerary rituals and the sex and age of the inhumed individuals (Barroso Bermejo et al. 2014; 2015a; 2015b; Bueno Ramírez et al. 2000; 2004; 2012; 2016a; Liesau et al. 2008).

The development of a recent megalithism in this sector should be connected with systems of the use of territory that are well known in the whole of south-west Iberia. The more than likely presence of ditched and walled enclosures completes a picture of the inland Chalcolithic that has changed radically since the identification of hypogean tombs in Huecas, where Bell Beaker pottery has been found in collective funerary deposits (Bueno Ramírez et al. 2007; 2011) (*fig. 2*).

Fig. 2. Grave goods with carinated bowl, Bell Beaker and associated plain pottery. Cave 5 of Higueras Valley Necropolis, Toledo, Spain (Photo: R. de Balbín Behrmann).

Azután is one of the few sites that has yielded Maritime Bell Beaker ware, which enriches the list of items that connect these prestige products accompanying 3rd mill. calBC burials with western sectors, especially the area around Lisbon, like other objects found in the Higueras Valley Necropolis, such as adornments made from *Trivia arctica* shells.

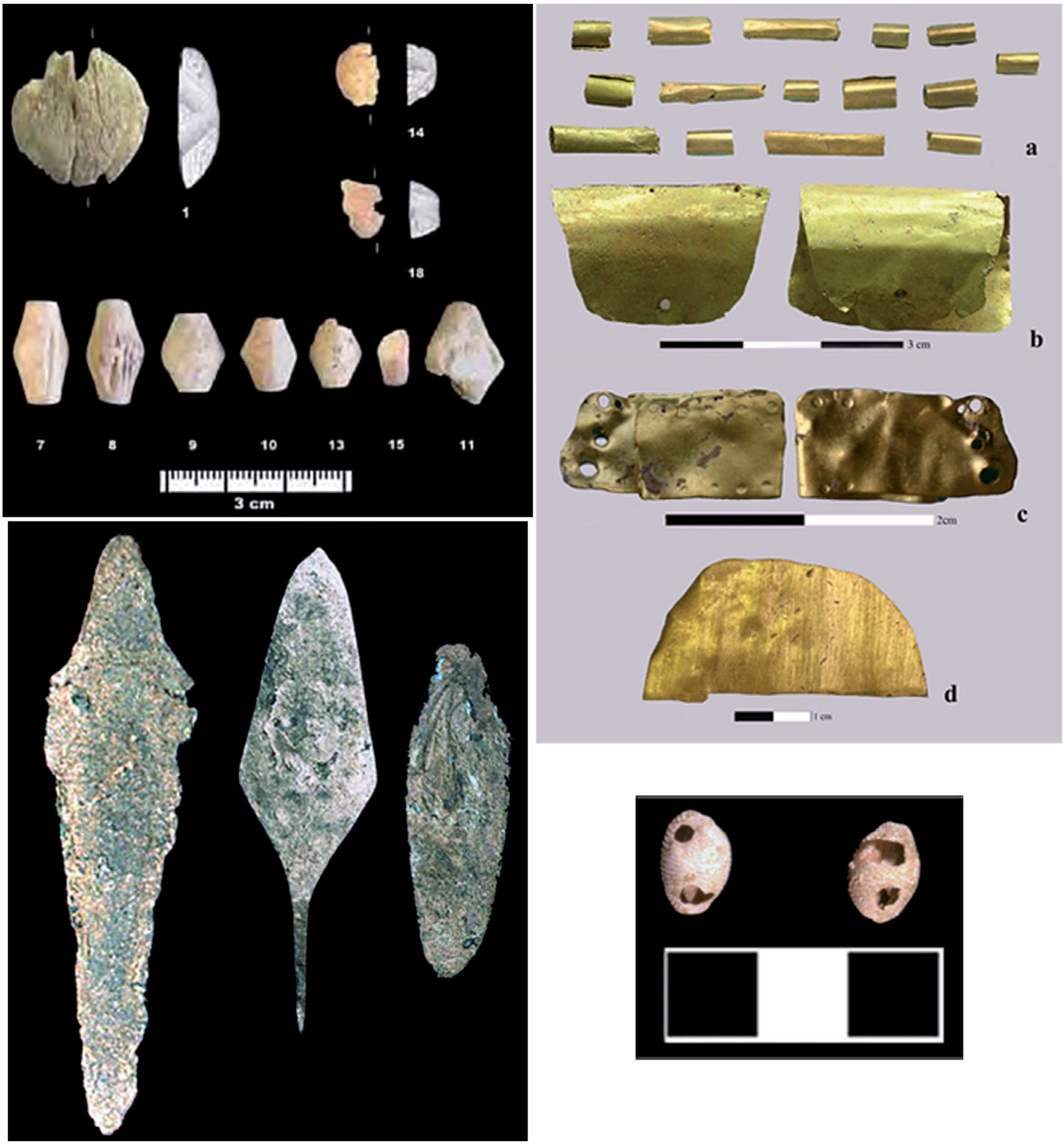

Fig. 3. Elements of prestige in the hypogeum necropolis at the interior of the Iberian Peninsula. On top: ivory and gold ornaments of Camino de las Yeseras, Madrid (after: Blasco et al. 2014, Fig. 13b; Rovira et al. 2011, Fig. 7). Below: Dagger and Palmela points of cave 1 and Trivia shells of the cave 3 at Higueras Valley Necropolis, Toledo, Spain.

Gold, probably from the Tagus (Barroso Bermejo et al. 2003; Murillo-Barroso et al. 2015), ivory from Africa or even the Orient (Schuhmacher/Banerjee 2012; Valera 2010) and amber (Murillo-Barroso/Martinón 2012), which appear to have circulated in the south of the Iberian Peninsula, constitute some of the evidence of long-distance trade networks. In exchange, they may have been traded for variscite from Zamora and Huelva, cinnabar from Almadén and fibrolite and flint from locations in inland Iberia that still need to be determined (Bueno Ramírez et al. 2016b). All these raw materials were devoted to display in the realm of death and in this way the Spanish Meseta was in an advantageous position to profit from this type of exchange between Iberian communities and groups in the rest of Europe in the 3rd mill. calBC (*fig. 3*).

Under the Ground we Tread

Small hearths and a possible hut, together with lithic objects, pottery and faunal remains, associated with the radiocarbon date of 5250±40 BP attest the presence of Neolithic farmers on the site. The documentation of a recipient containing honey associated with that date is today the oldest known example in all of Europe (Bueno Ramírez et al. 2002; Roffet Salque et al. 2015). This site could not be delimited over its whole surface area or dated except beneath the tumulus, but it is undoubtedly a solid floor to confirm a time before the dolmen was built. It therefore provides a *post quem* date for the monument.

By the careful cleaning of the area of the chamber and passage during the excavation it was determined that no hearths or remains of huts existed there. This is probably because of the necessary preparation and excavation for the foundations of the large uprights, which would involve digging up the whole area and removing any previous remains. Despite intrusions and the Civil War trench, the human remains in areas nearest to the uprights were still in an acceptable state of preservation and radiocarbon samples were taken. These were dated in several laboratories and determined the span of time in which the monument was in use. The date given above, associated with the oldest hut, provided a rare opportunity in European megaliths to establish the probable time for the construction of the monument, between 5250 and 5000 BP or, with a high degree of probability, to between 4222 and 3973 calBC. This chronology closely fits the oldest known constructions on the South Meseta.

It is not usual in Iberian chronologies, and certainly not at Atlantic sites, to find such a close fit as the one provided by the two dates, as it is commonly debated whether the oldest date for an individual buried at any site is necessarily the date when the monument was built. In fact, at Azután one of the human remains that have been dated is older than the above dates and this might be interpreted as an error. However, this is not the only case either at inland Iberian megaliths or at Atlantic monuments. We believe that this type of result, earlier than what is thought to be the time of the construction of the tomb, should be regarded as archaeological evidence of the oldest times of the ideological construction of the megaliths: fragments of bones from older monuments or burials (Jones 2005), retrieved from earlier uses like some of the decorated stones (Mohen/Scarre 2002; Bueno Ramírez et al. 2014; 2015a; Laporte 2015).

The archaeological context of the Azután dolmen is an ineluctable point of reference to fix the time of the building of the monuments with large stones, chamber and passage on the Atlantic façade of Europe (Furholt/Müller 2011). It demonstrates that it had been built by the late 5th or early 4th mill. and therefore old megalithic monuments existed in inland Iberian with large-sized architecture at that time. Chronologies obtained on both South and North Meseta (Bueno Ramírez et al. 2005a; 2013; 2016a; Rojo et al. 2005; Villalobos 2015) confirm that tumuli with no interior stone architecture were also being built at the same time. This antiquity has recently been ratified at other sites on the inland plains of Iberia. One example is the El Portillo dolmen which, together with the Ambrona tumuli of the same chronology (Bueno Ramírez et al. 2016b), shows the need to reappraise the role of this group of megalithic monuments in the context of the southern European plains, underscoring the multiple forms and specialisation in the structures in inland Iberian from the first constructions.

The early phase identified at Azután is supported by evidence from other tombs in the region. The free-standing stone at the entrance of the Estrella dolmen, also decorated, may be evidence of the re-use of older material. At the nearby Navalcán dolmen (Bueno Ramírez et al. 1999), the decorated menhirs in the chamber attest the re-use of stones. These data support the importance of older architectures in Inland Iberia to build megaltihs, indicating the ancient roots of megalithism in the region.

The three monuments pose a question that remains unanswered: the absence of other funerary evidence in their surroundings, which has always appeared to be a problem that might be solved by fieldwork considering the possibility of non-visible burials. The results of geomagnetic surveying in the area around Azután will contribute interesting information about this possibility (Schmitt et al. in print).

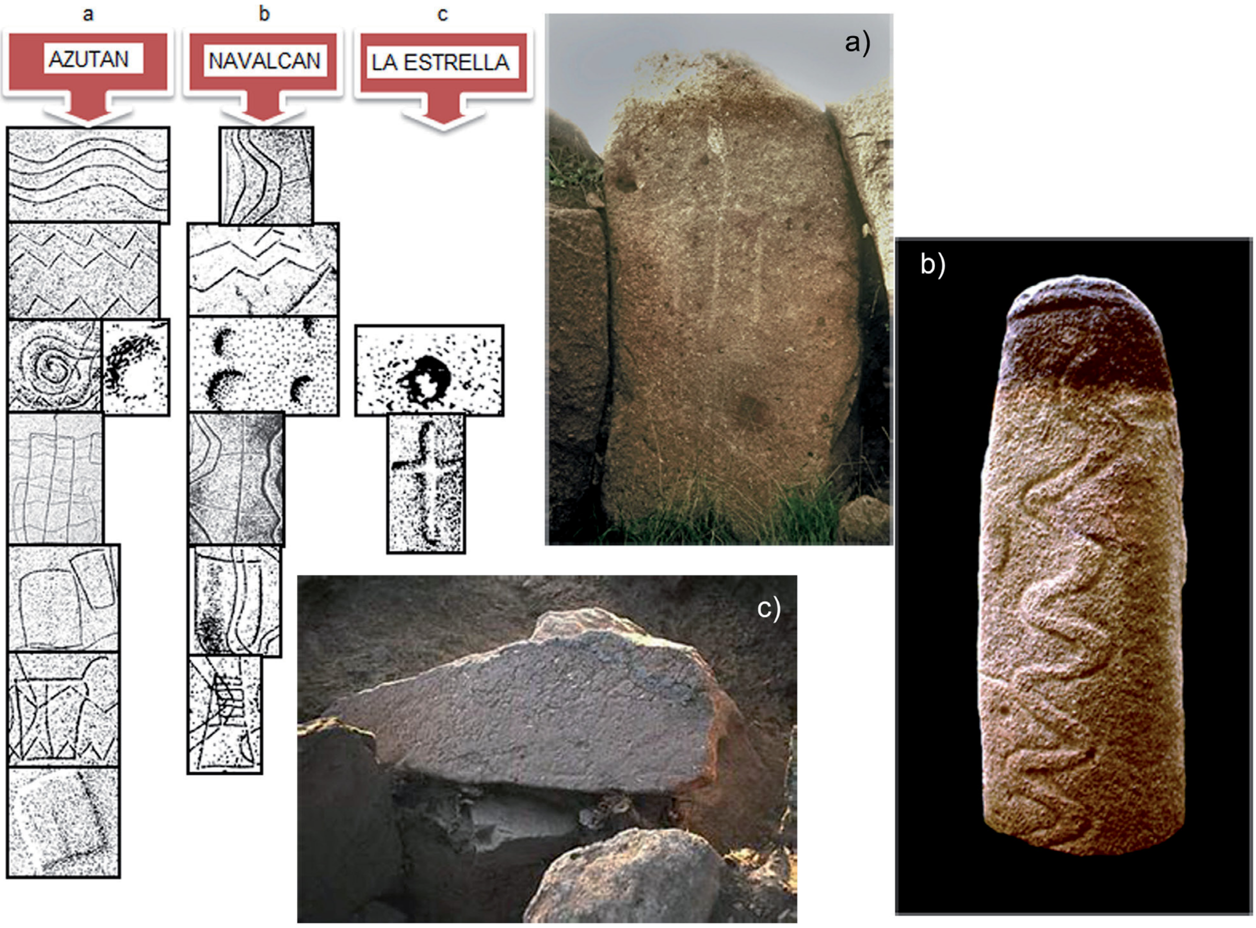

Fig. 4. Engraved decorations of Azután, Navalcan and La Estrella monuments (Toledo, Spain).

The oldest phases in the Azután and Navalcán dolmens are characterised by medium-sized and large stones decorated with engravings and remains of red paint. The hut beneath the Azután mound has yielded a date in the late 5th mill. calBC that may represent a context for these stones, although their origin may be older. In both cases, it is likely that the demolition of a group of decorated stones that would not have been too far from the current position of both dolmens was the origin of the constructions that have reached the present time (*fig. 4*).

Another point the two sites have in common is that the decoration on their stones resembles the familiar repertoire on the Atlantic seaboard. Some motifs are very similar to those in dolmens in the north of Portugal, others to those on menhirs in the Algarve and, in general, the use of the stones, the main motifs and their position in the panels is plainly similar to the graphic ensembles repeated in European decorated dolmens. This suggests a line of research on the capacity of interaction of the Neolithic groups in inland Iberia in the 5th mill. calBC, of the utmost interest in the current state of our knowledge. The ideology underlying the symbology expressed on the megaliths is evidence little used to appraise widespread formulas in European megalithism, the origin of which must lie in times associated with the first agrarian groups.

Enclosures and Megaliths

The old discussion on the distance of the tombs from areas of activity or settlements has fortunately been resolved. On the South Meseta it was precisely the work at Azután and its surroundings that began to define a Neolithic population, later confirmed in the whole basin (Cerrillo 2005; Díaz-del-Río/Consuegra 1999; Rojas/Villa 1996; Jiménez et al. 2008).

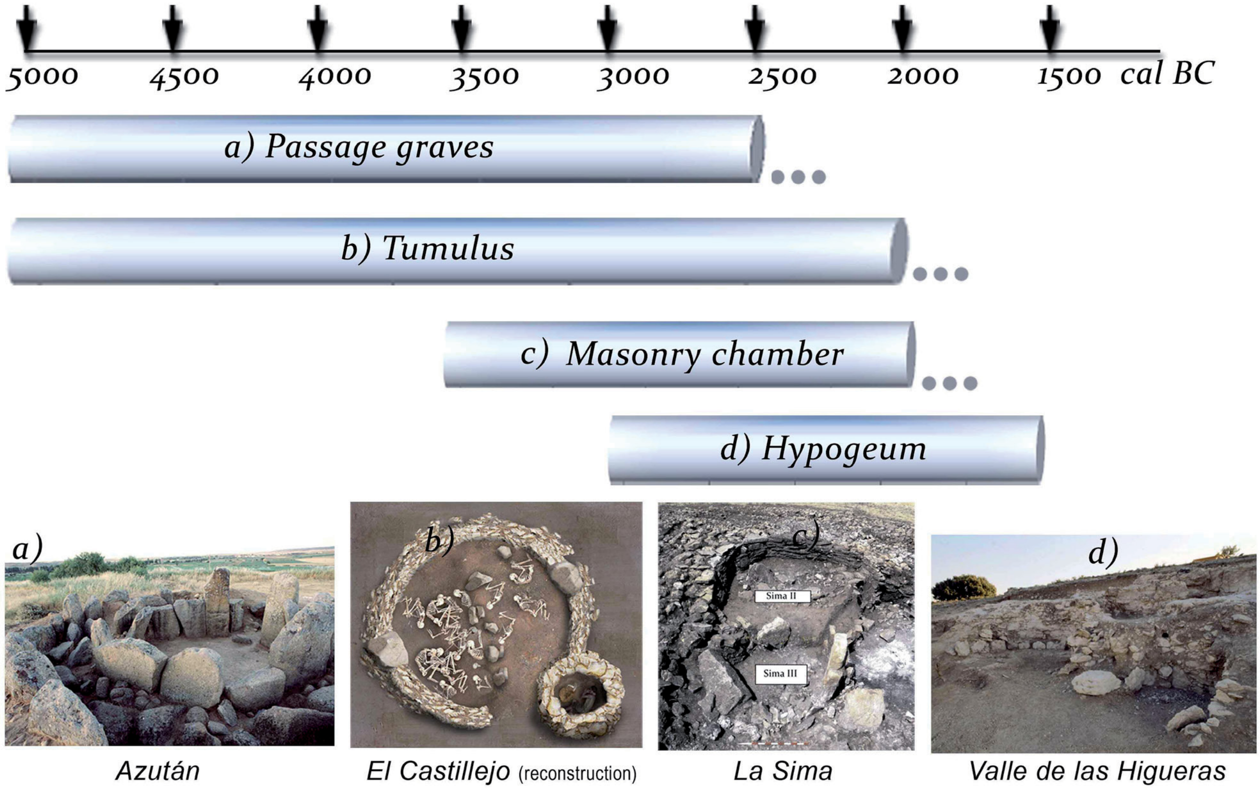

Fig. 5. Typologies and chronologies of collective burials in Central Iberia (after: Bueno Ramírez et al. 2016). The information of each sample is published from the Azután team in the bibliography selected of that paper.

In the rest of Europe, ever since the first work at Sarup (Andersen 2011), the relationship between megaliths and ditched enclosures and between megaliths and activity areas has begun to be accepted and a link has been defined and supported on the Iberian Peninsula by such sites as Perdigões (Valera et al. 2014a).

The chronology of the enclosures has reached a consensus in our historiography, with the oldest examples dated in the late 4th mill. calBC (Balsera et al. 2015, 149; Chapman 2008) and a duration that increasingly extends into the Bronze Age (Valera et al. 2014b). The oldest enclosures must have played a wider-ranging role than documented to date (Bernabeu et al. 2003; Rojo et al. 2005), in the same way as re-cutting excavations are prolonging the chronologies that had been accepted until five years ago (Jiménez 2015).

These dates partly coincide with the dates of walled settlements. Thus, determining the relationship between both types of enclosures and the megalithic tombs of different types is necessary in the current state of research. In addition, the chronologies of megalithism (*grosso modo*) coincide fully with the periods of both types of enclosures. The presence of tombs with orthostats and stonework in the classic walled sites such as Los Millares should not blind us to the fact that ditched enclosures are also found in areas with the same kinds of graves. In the same way, associated with both walled settlements and ditched enclosures, hypogea are equally important as well as other less visible funerary records (Barroso Bermejo et al. 2014; Valera et al. 2014b) (*fig. 5*).

The association of enclosure and hypogea represented so clearly by Camino de las Yeseras in the inland Tagus Basin is equally seen at Perdigões, to choose one of the best known examples in the south-west. The exhaustive chronology at Higueras Valley lies within key phases of the use of this type of site, which confirms the number of possibilities for the study of Chalcolithic sites in the area.

The supposed differences between constructions with stone or with earth have their nuances within the enclosures themselves (Díaz-del-Río/Consuegra 1999), through earth-stone sequences and in the areas of access. This latter position has

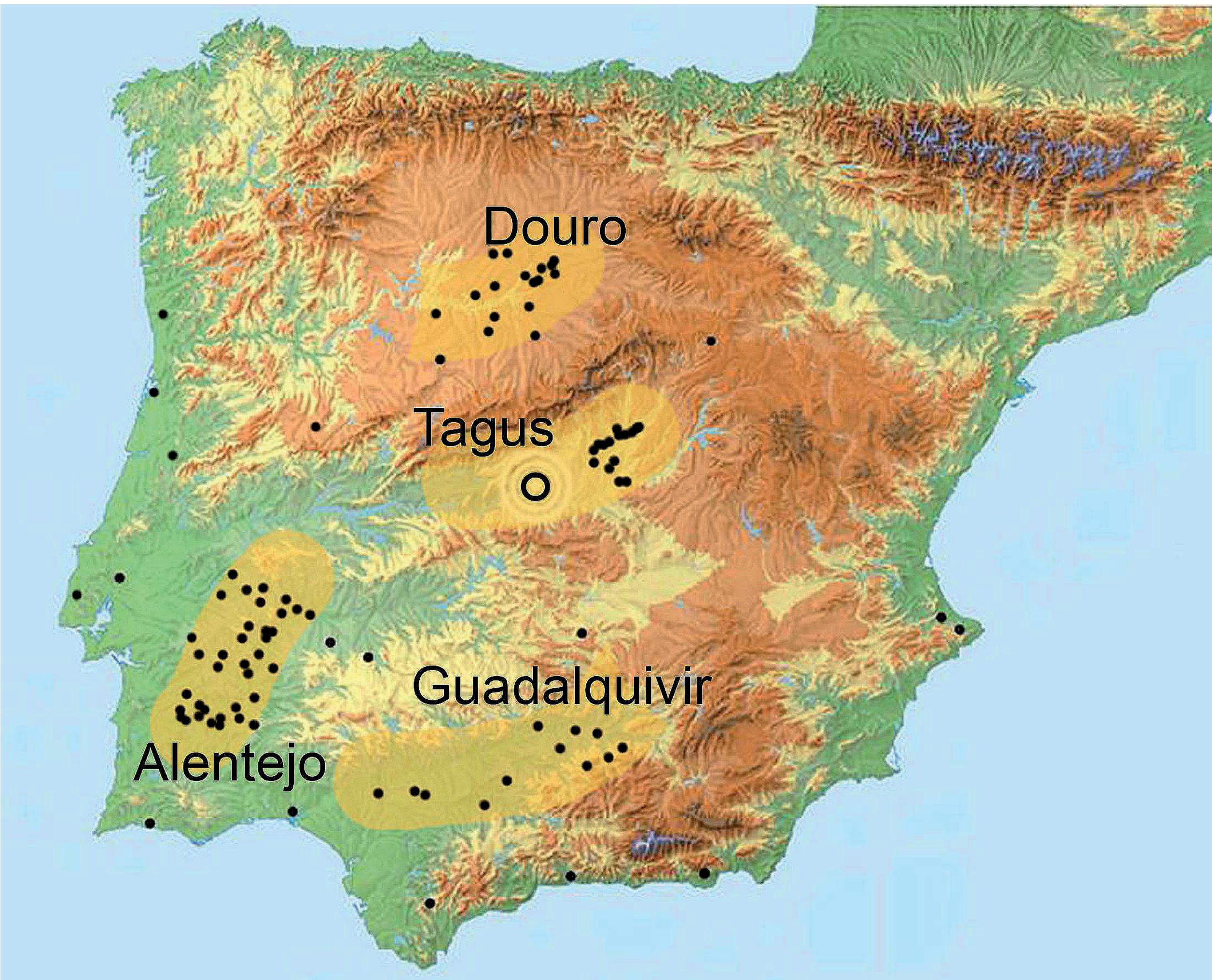

Fig. 6. Image of starting point about topographic position of ditched enclosure in Iberian Later Prehistory (after: Delibes de Castro et al. 2014; Jiménez 2015; Rios Mendoza 2011; Valera 2013). See the connection with the megalithic position in the centre of the Iberian Peninsula developed in fig. 1.

recently been documented in the access to Perdigões which, as occurs in other European enclosures (Laporte et al. 2014), includes stones in marking the entry to the monument. The stones at the entrance to Perdigões are three large stelae, forming an organised ensemble. Thus, at some time, the use of the entrance visibly represented the relationship with the ancestors that the common stelae in the cromlechs, alignments and dolmens in the Reguengos de Monsaraz group, which includes Perdigões, also represented (Bueno Ramírez et al. 2015b).

The relationships between ditched enclosures and clay constructions are deeper and include some megalithic sites like the area around the dolmen at Llano de la Belleza in Huelva (García Sanjuán et al. 2003), where geophysical surveying revealed part of an enclosure together with menhirs (Bueno Ramírez et al. 2014) and Neolithic sites like the enclosure with menhirs at Estanys in Catalonia (Tarrús 2002), in which the menhirs are found in a semi-circular ditch.

All this evidence, together with the development in the understanding of our area of study in recent years, increases the likelihood of finding ditched enclosures in the surroundings of Azután. The proximity between the Estrella dolmen and the walled enclosure of El Castrejón (Carrobles/Méndez 1991), whose chronology is still pending archaeological confirmation, will contribute firm evidence for the debate on this variety of contexts in identical territories (*fig. 6*).

Conclusions

The value of the past seen in megaliths of all types in the area of Atlantic Europe possesses one of its most powerful arguments in the movement of stones. Our hypothesis here aims to add this evidence to its close relationship with large-scale collective constructions, such as ditched and walled enclosures. The sequences in the megalithic graves themselves often coincide with those in the enclosures, demanding a more combined interpretation in which the three forms of sites would correspond to more closely connected ideological and social structures than has been thought until now.

The ideological and social construct of megalithic territories is inseparable from the modes of occupation of the first farmers. The archaeological evidence in the interior of the Iberian Peninsula supports well-demonstrated data in other parts of Europe (Cassen et al. 2009; Ghesquière/Marcigny 2011; Schulting et al. 2011; Gebauer 2015, 130). In many places, the Early-Middle and Late Neolithic sequences are located in the same areas, with megaliths as the most visible evidence of their presence. Ditched enclosures, walled enclosures and megaliths form the monumental trilogy derived from formulas of social cohesion enshrined in European Neolithic societies and this is the most convincing hypothesis to explain the relationships between these types of archaeological sites.

We have proposed here that the position of the megalithic graves constitutes a good start for the application of methodologies involving surveying and territorial analysis, which contribute towards this more varied and diverse picture. In addition to more widely accepted reasons, the memory of the ancestors materialised in the megalithic monuments is one of the social tools to take into account to support the ideological construct of all kinds of enclosures.

Their history has more in common than might be thought: built in many places in the 4th mill. calBC following antecedents in the 5th mill. or even earlier; a notable increase in exchange networks involving prestige goods in the first half of the 3rd mill.; and occupations prolonged until the 2nd mill., equally describe the three forms of monuments in the recent prehistory of Europe.

In fact, they share many traits of their construction: use of more or less complex circular areas; the repetition of lines for the outline of the tumuli or as the boundaries of the ditched or walled enclosures; the openings on the east or east-south-east sides; and the use of 'crab-like' structures in the areas of access to some enclosures (Bueno Ramírez et al. 2008). These reflect tradition and learning within the same background of technical knowledge. If we truly accept that these sites are the social and ideological result of specific ways to conceive the use of the territory (Díaz-del-Río 2003), we should attempt to establish more wide-ranging hypotheses so that these different forms of monuments are not studied separately from each other.

The opening of interpretations should run in parallel with the development of multi-disciplinary strategies aimed at characterising the role of the inland plains in southern Europe. These appear to have played a major role in the exchange networks that characterise the important period in the 4th and 3rd mill. calBC, in the framework of occupations rooted in the establishment of the first farming societies.

The *floruit* of these networks coincides with the building of different kinds of enclosures and megalithic architecture, at a time when Bell Beaker pottery was found across all Europe. The results of stable isotope analysis may provide significant information for the hypothesis of the movements of populations to explain this process, but we believe that the archaeological evidence supports the importance of territorial roots rather than outside influences. It is more likely that these were the result of an exchange system for ceremonial purposes, which must have originated with the first farmers, expanded greatly during the 5th and 4th mill. and continued in the 3rd mill. calBC, incorporating Bell Beaker ware as part of the ceremonies dedicated to ancestors.

One of the clearest consequences of this hypothesis would be to break down the notable historiographic barriers between research on the Neolithic and the Bell Beaker Period. Megaliths and other contemporary types of graves, together with ditched and walled enclosures, form a specific mode of occupation throughout the whole of recent prehistory. Other sites, such as areas where raw materials were obtained and the open-air rock art, are indicators of the intensity of these occupations.

The unexpectedly important role of these records in the organisation of prehistoric societies in inland Iberia has been identified at the same time as new approaches have been developed in a field of research that had been largely resolved with premises taken for granted without any archaeological evidence to support them (Bartelheim/ Bueno Ramírez this volume). The changes that have occurred in the last ten years still contain memories of a historicist past, according to which small groups of transhumant herders were the only occupants of the interior of the Iberian Peninsula.

Tradition and some of its most visible materialisations (Azután dolmen, among others) are convincing arguments of the value of the past that the tombs of ancestors brought to the social and ideological construct of the places occupied in southern Europe in recent prehistory.

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Bibliography

Andersen 2011: N. Andersen, Causeway Enclosures and Megalithic Monuments as Media for Shaping Neolithic Identities. In: M. Furholt/F. Lüth/J. Müller (eds.), Megaliths and Identities (Bonn 2011) 143–154.

Balsera et al. 2015: V. Balsera/J. Bernabeu/M. Costa/P. Díaz del Rio/L. García Sanjuán/S. Pardo, The Radiocarbon Chronology of Southern Spain's Late Prehistory (5600–1000 CALBC). A Comparative Review. Oxford Journal of Archaeology 34.2, 2015, 135–156.

Barroso Bermejo et al. 2003: R. Barroso Bermejo/P. Bueno Ramírez/R. de Balbín Behrmann 2003, Primeras producciones metálicas en la cuenca interior del Tajo. Cáceres y Toledo. Estudos Pré-históricos 10, 87–107.

Barroso Bermejo et al. 2007: R. Barroso Bermejo/P. Bueno Ramírez/J. Camino/R. de Balbín Behrmann, Fuentenegroso (Asturias), un enterramiento del Bronce Final – Hierro en el marco de las comunidades atlánticas peninsulares. Pyrenae 38.2, 2007, 7–32.

Barroso Bermejo et al. 2012: R. Barroso Bermejo/P. Bueno Ramírez/R. de Balbín Behrmann/A. Vázquez/A. González, Agregaciones protohistóricas a megalitos prehistóricos. El dolmen de Lagunita I, Santiago de Alcántara (Cáceres). In: Actas V Encontro Arqueología do Sudoeste Peninsular (Almodovar 2012) 99–111.

Barroso Bermejo et al. 2014: R. Barroso Bermejo/P. Bueno Ramírez/R. de Balbín Behrmann/A. Vazquez/A. González, Nekropolen des 3. Jahrtausends v. Chr. im Zentrum der Iberischen Halbinsel. Madrider Mitteilungen 55, 2014, 1–28.

Barroso Bermejo et al. 2015a: R. Barroso Bermejo/P. Bueno Ramírez/A. Vazquez/A. González/L. Peña, Enterramientos individuales y enterramientos colectivos en necrópolis del megalitismo avanzado del interior. La cueva 9 de Valle de las Higueras. Toledo. In: L. Rocha/P. Bueno Ramírez Ramirez/G. Branco (eds.), Death as Archaeology of Transition. Thoughts and Materials. Papers from the II International Conference of Transition Archaeology. Death Archaeology. 29th April–1st Mai 2013, British Archaeological Reports. International Series 2078 (Oxford 2015) 165–176.

Barroso Bermejo et al. 2015b: R. Barroso Bermejo/P. Bueno Ramírez/A. Vázquez/C. Odriozola/D. Uribelarrea/O. López/R. de Balbín Behrmann/L. Peña/J. Yravedra, Campaniforme no funerario en la provincia de Toledo. El yacimiento de Las Vegas. De nuevo el Valle de Huecas. Trabajos de Prehistoria 72.1, 2015, 145–157.

Bernabeu et al. 2003: J. Bernabeu/T. Orozco/A. Díez/M. Gómez/F. J. Molina, Mas d'Is (Penáguila. Alicante). Aldeas y recintos monumentales del Neolítico inicial en el valle del Serpis. Trabajos de Prehistoria, 60.2, 2003, 39–60.

Blasco et al. 2014: C. Blasco/C. Liesau/P. Ríos, El Horizonte campaniforme en la Región de Madrid a la luz de las nuevas actuaciones. In: Actas de las novenas jornadas de Patrimonio Arqueológico en la Comunidad de Madrid – Museo Arqueológico Regional de la Comunidad de Madrid. 15–16 de noviembre de 2012 (Madrid 2014) 105–126.

Bueno Ramírez 1991: P. Bueno Ramírez, Megalitos en la Meseta Sur. Los dólmenes de Azután y La Estrella (Toledo). Excavaciones Arqueológicas en España 159. Ministerio de Cultura (Madrid 1991).

Bueno Ramírez/de Balbín Behrmann 2002: P. Bueno Ramírez/R. de Balbín Behrmann, L'art mégalithique péninsulaire et l'art mégalithique de la façade atlantique. Un modèle de capillarité appliqué à l'art postpaléolithique ibérique. L'Anthropologie 106, 2002, 603–646.

Bueno Ramírez et al. 1999: P. Bueno Ramírez/R. de Balbín Behrmann/R. Barroso Bermejo/J. Alcolea/R. Villa/A. Moraleda, El dolmen de Navalcán. El poblamiento megalítico en el Guadyerbas. Servicio de Arqueología de la Diputación de Toledo (Toledo 1999).

Bueno Ramírez et al. 2000: P. Bueno Ramírez/R. de Balbín Behrmann/R. Barroso Bermejo, 2000. Valle de las Higueras (Huecas, Toledo, España). Una necrópolis Ciempozuelos con cuevas artificiales al interior de la Península. Estudos Pré-históricos 8, 49–80.

Bueno Ramírez et al. 2002: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann/M. Campo/F. Etxeberría/A. González/L. Herrasti/J. Juan/P. López/J. A. López/J. C. Matamala/B. Sánchez, Áreas habitacionales y funerarias en el Neolítico de la cuenca interior del Tajo. La provincia de Toledo. Trabajos de Prehistoria 59.2, 2002, 65–79.

Bueno Ramírez et al. 2004: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Construcciones megalíticas avanzadas de la cuenca interior del Tajo. El núcleo cacereño. SPAL 13, 2004, 83–112.

Bueno Ramírez et al 2005a: P. Bueno Ramírez/ R. de Balbín Behrmann/R. Barroso Bermejo, El dolmen de Azután (Toledo) Áreas de habitación y áreas funerarias en la cuenca interior del Tajo. Universidad de Alcalá – Diputación de Toledo. Monografías 2 (Toledo 2005).

Bueno Ramírez et al. 2005b: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Ritual campaniforme, ritual colectivo. La necrópolis de cuevas artificiales del Valle de las Higueras, Huecas, Toledo. Trabajos de Prehistoria 62.2, 2005, 67–90.

Bueno Ramírez et al. 2006: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Les mégalithes du centre de la Péninsule Ibérique. Une perspectiva d'analyse à partir de la Meseta Sud, In: R. Joussaume/L. Laporte/C. Scarre (eds.), Origine et développement du mégalithisme de l' Ouest de l' Europe, I (Bougon 2006) 435–450.

Bueno Ramírez et al. 2007: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Campaniforme en las construcciones hipogeas del megalitismo reciente al interior de la Península Ibérica (Veleia 2007) 24–25.

Bueno Ramírez et al. 2008: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, The Necropolis of Era de la Laguna, Santiago de Alcántara, Cáceres, in the Context of the Megalithism of the Central Region of the International Tagus. In: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann (eds.), Graphical Markers and Megalith Builders in the International Tagus, Iberian Peninsula. British Archaeological Reports. International Series 1765 (Oxford 2008) 41–59.

Bueno Ramírez et al. 2010: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Megalitos en la cuenca interior del Tajo. Munibe suplemento 32, 2010, 152–184.

Bueno Ramírez et al. 2011: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Entre lo visible y lo invisible. Registros funerarios de la Prehistoria reciente de la Meseta Sur. Arqueología, sociedad, territorio y paisaje. Biblioteca Praehistórica Hispana 28, 2011, 53–73.

Bueno Ramírez et al. 2012: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Les grottes artificielles et le Campaniforme à l'intérieur de la péninsule ibérique. La nécropole de Valle de las Higueras. Sépultures collectives et mobiliers funéraires de la fin du Néolithique en Europe occidentale. Archives d'Écologie Préhistorique (Toulouse 2012) 359–381.

Bueno Ramírez et al. 2013: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Interior Regions and Places of Collective Memory. The Megalithism of the Interior Basin of the Tagus, Iberian Peninsula. A Reflection after Reading the Tara Project. In: M. O'Sullivan/C. Scarre/M. Doyle (eds.), Tara. From the Past to the Future. Towards a New Research Agenda (Dublin 2013) 484–502.

Bueno Ramírez et al. 2014: P. Bueno Ramírez/R. de Balbín Behrmann/R. Barroso Bermejo, Custodian Stones. Human Images in the Megalithism of the Southern Iberian Peninsula. In: A. Cruz/E. Cerrillo Cuenca/P. Bueno Ramírez/J. Caninas/C. Batata (eds.), Rendering Death. Ideological and Archaeological Narratives from Recent Prehistory (Iberia). British Archaeological Reports 2648 (Oxford 2014) 3–12.

Bueno Ramírez et al. 2015a: P. Bueno Ramírez/R. de Balbín Behrmann/R. Barroso Bermejo, Human Images, Images of Ancestors, Identity Images. The South of the Iberian Peninsula. Statues-menhir et pierres levées du Néolithique à aujourd'hui (Saint-Pons de Thomières 2015) 443–455.

Bueno Ramírez et al. 2015b: P. Bueno Ramírez/R. de Balbín Behrmann/L. Rocha/J. Oliveira, Anthropomorphic Images as Origins of Ancestor's "Caves". The Stele-Menhir of Anta do Telhal, Arraiolos, Evora. Portugal. In: L. Rocha/P. Bueno Ramírez/G. Branco: Death as Archeology of Transition. Thoughts and Materials. Papers from the II International Conference of Transition Archaeology. Death Archaeology. 29th April–1st May 2013, British Archaeological Reports. International Series 2078 (Oxford 2015) 83–94.

Bueno Ramírez et al. 2016a: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Between East and West. Megaliths in the Centre of the Iberian Peninsula. In: L. Laporte/C. Scarre (eds.), The Megalithic Architectures of Europe (Oxford 2016) 157–166.

Bueno Ramírez et al. 2016b: P. Bueno Ramírez/R. Barroso Bermejo Bermejo/R. de Balbín Behrmann/A. González Martín/O. Cambra Moo/O. García Gil/C. Odriozola Lloret/M. A. Lancharro/Oscar López, Pasados releídos. El dolmen del Portillo de las Cortes, Guadalajara/MAN. Boletín del Museo Arqueológico Nacional 34, 2016, 9–28.

Carrobles/Méndez 1991: J. Carrobles/V. M. Méndez, Introducción al estudio del Calcolítico en La Jara toledana. Anales Toledanos, 1991, 7–24.

Cassen et al. 2009: S. Cassen/P. Lanos/P. Dufresne/C. Oberlin/E. Delqué Kolic/M. Goffic, Datations sur site (Tables de Marchands, alignement du Grand Menhir, Er Grah) et modelisation chronologique du néolithique morbihannais. In: S. Cassen (ed.), Autour de la Table, explorations archéologiques et discours savants sur une architecture restaurée à Locmariaquer, Morbihan (Table des Marchands et Grand Menhir), 2009, 737–768.

Cerrillo 2005: E. Cerrillo, Los primeros grupos neolíticos de la cuenca extremeña del Tajo. British Archaeological Reports 1393 (Oxford 2005).

Chapman 2008: R. Chapman, Producing Inequalities. Regional Sequences in Later Prehistoric Southern Spain. Journal of World Prehistory 21, 2008, 195–260.

Delibes de Castro et al. 2014: G. Delibes de Castro/M.García García/J. del Olmo Martín/J. Santiago Pardo. Recintos de fosos calcolíticos del Valle medio del Duero. Arqueología aérea y espacial (Valladolid 2014).

Díaz-del-Río 2003: P. Díaz-del-Río, Recintos de fosos del III milenio AC en la meseta peninsular. Trabajos de Prehistoria 60.2, 2003, 61–78.

Díaz-del-Río/Consuegra 1999: P. Díaz-del-Río/S. Consuegra, Primeras evidencias de estructuras de habitación y almacenaje neolíticas en el entorno de la Campiña madrileña. El yacimiento de 'La Deseada' (Rivas-Vaciamadrid). In: II Congrés del Neolitic a la Península Ibérica. Saguntum, PLAV Extra 2, 1999, 252–257.

Fábregas/Vilaseco 2013: R. Fábregas/I. Vilaseco, From West to West. The Many Lives of the Galician Mounds. In: M. O'Sullivan/C. Scarre/M. Doyle (eds.), Tara. From the Past to the Future. Towards a New Research Agenda (Dublin 2013) 502–514.

Furholt/Müller 2011: M. Furholt/J. Müller, The Earliest Monuments in Europe. Architecture and Social Structures (5000–3000 calBC). In: M. Furholt/F. Lüth/J. Müller (eds.), Megaliths and Identities (Bonn 2005) 15–32.

Galán/Martín Bravo 2009: E. Galán/A. Martín Bravo, Megalitismo y zonas de paso en la cuenca extremeña del Tajo. Zephyrvs 44, 2009, 193–204.

García Sanjuán 2005: L. García Sanjuán, Las piedras de la memoria. La permanencia del megalitismo del Suroeste de la Península Ibérica en el II y I milenios a.n.e. Trabajos de Prehistoria 62.2, 2005, 85–109.

García Sanjuán et al. 2003: L. García Sanjuán/T. Rivera/D. W. Wheatley, Prospección de superficie y documentación gráfica en el dólmen del Llano de la Belleza, Aroche, Huelva. Anuario Arqueológico de Andalucía, 2003, 181–192.

Gebauer 2015: A. B. Gebauer, Location! Location! What are some of the Defining Factors in the Placement of Megalithic Tombs in the Landscape. In: K. von Hackwitz/R. Peyroteo Stjerna (eds.), Ancient Death Ways. Proceedings of the Workshop on Archaeology and Mortuary Practices (Uppsala 2015) 127–142.

Ghesquière/Marcigny 2011: E. Ghesquière/C. Marcigny, Cairon, un hábitat puis un mégalithe du Néolithique moyen (Rennes 2011).

Gomes et al. 1998: L. F. C. Gomes/P. S. Carvalho/J. M. A. Perpetuo/C. Marrafa, O dolmen de Areita (S. Joao de Pesqueira,Viseu). A Pré-historia da Beira interior. Estudos Pré-históricos 6, 1998, 33–93.

Jagu 2003: D. Jagu, Une double condamnation à Changé, Saint-Piat (Eure et Loir). Révue Archéologique de Picardie 2, 2003, 147–155.

Jiménez et al. 2008: J. Jiménez/J. M. Rojas/G. Garrido/J. Perera, El yacimiento del Neolítico inicial de la Paleta (Numancia de la Sagra, Toledo). In: M. Hernández/J. Soler/J. A. López (eds.), IV Congreso del Neolítico peninsular 1, 27–30 de noviembre de 2006 (Alicante 2008) 126–136.

Jiménez 2015: V. Jiménez, The Unsuspected Circles. On the Late Recognition of Southern Iberian Neolithic and Chalcolithic Ditched Enclosures. Proceedings of the Prehistoric Society 81, 2015, 1–20.

Jones 2005: A. Jones, Lives in Fragments? Personhood and the European Neolithic. Journal of Social Archaeology 5.2, 2005, 193–217.

Laporte 2010: L. Laporte, Restauration, reconstruction, appropriation. Évolution des architectures mégalithiques dans l'Ouest de la France, entre passé et présent. In: J. Fernández Eraso/J. A. Mujika Alustiza (eds.), Actas del Congreso Internacional sobre Megalitismo y otras manifestaciones funerarias, contemporáneas en su contexto social, económico y cultural. Munibe Suplemento 32, 2010, 120–150.

Laporte et al. 2014: L. Laporte/C. Bizien Jaglin/J. N. Guyodo, Enceintes néolithiques de l'Ouest de la France une archéologie des fossés. In: R. Joussaume/J. M. Large/S. Corson/N. le Meur/J. P. Tortuyaux (eds.), Enceintes néolithiques de l'Ouest de la France. Actes du Colloque CrabeNeo. Association de Publication Chauvinois (Chauvigny 2014) 455–487.

Laporte 2015: L. Laporte, Menhirs et dolmens. Deux facettes complémentaires du mégalithisme atlantique? In: G. Rodriguez/H. Marchesi (eds.), Statues-menhir et pierres levées du Néolithique à aujourd'hui (Saint-Pons de Thomières 2015) 175–191.

Lecornec 1994: J. Lecornec, Le Petit Mont. Arzon-Morbihan (Rennes 1994).

Liesau et al. 2008: C. Liesau/C. Blasco/P. Ríos/J. Vega/R. Menduiña/F. F. Blanco/J. Baena/T. Herrera/A. Petri/J. L. Gómez, Un espacio compartido por vivos y muertos. El poblado calcolítico de fosos de Camino de las Yeseras (San Fernando de Henares, Madrid). Complutum 19.1, 2008, 87–120.

Mohen/Scarre 2002: J. P. Mohen/C. Scarre, Les tumulus de Bougon. Complex mégalithique du V as III millénaire (Paris 2002).

Murillo-Barroso et al. 2015: M. Murillo-Barroso/M. E. Costa/M. Díaz Guardamino/L. García Sanjuán/C. Mora, A Reappraisal of Iberian Copper Age Goldwork. Craftmanship, Symbolism and Art in a Non-Funerary Gold Sheet from Valencina de la Concepción. Cambridge Archaeological Journal 25.3, 2015, 565–596.

Murillo-Barroso/Martinón 2012: M. Murillo-Barroso/M. Martinón, Amber Sources and Trade in the Prehistory of the Iberian Peninsula. European Journal of Archaeology 15.2, 2012, 187–216.

Rios Mendoza 2011: P. Rios Mendoza, Territorio y sociedad en la región de Madrid durante el III milenio A.C. El referente del yacimiento de Camino de las Yeseras. Patrimonio arqueológico de Madrid 7 (Madrid 2011).

Roffet Salque et al. 2015: M. Roffet Salque/M. Regert/R. P. Evershed/A. Outram/L. Cramp/O. Decavallas/M. Pääkkönen, Widespread Exploitation of the Honeybee by Early Neolithic Farmers. Nature 527.7577, 2015, 226–230.

Rojas/Villa 1996: J. M Rojas/R. Villa, Una inhumación individual de época neolítica en Villarmayor de Calatrava (Ciudad Real). In: I Congrés de Neolitic a la Península Ibérica, 1.2. Revista del Museu de Gavà, Rubricatum 1.2 (Barcelona 1996) 509–518.

Rojo et al. 2005: M. Rojo/M. Kunst/R. Garrido/I. García/G. Morán, Un desafío a la eternidad. Tumbas monumentales del Valle de Ambrona. Arqueología en Castilla y León 14 (Valladolid 2005).

Rovira et al. 2011: S. Rovira/C. Blasco/P. Ríos/I. Montero/J. Chamón, La Arqueometalurgia. In: C. Blasco/C. Liesau/P. Ríos (eds.), Yacimientos calcolíticos con campaniforme de la región de Madrid. Nuevos estudios. Patrimonio Arqueológico de Madrid 6 (Madrid 2011) 291–309.

Schmitt et al. in print: F. Schmitt/P. Bueno Ramírez/M. Bartelheim, Just Passing By? Investigating in the Territory of the Megalith Builders of the Southern European Plains. The Case of Azután, Toledo. In: Megaliths. Societies. Landscapes. Early Monumentality and Social Differentiation in Neolithic Europe (Kiel in print).

Schuhmacher/Banerjee 2012: T. Schuhmacher/A. Banerjee, Procedencia e intercambio de marfil en el calcolítico de la Península Ibérica. In: M. Borrell/F. Borrell/J. Bosch/X. Clop/M. Molist (eds.), Xarxes al Neolític. Circulació i intercanvi de matèries, productes i idees a la Mediterrània occidental (VII–III millenni aC). Actes del Congrés Internacional Xarxes al Neolític. Revista del Museu de Gavà, Rubricatum 5 (Barcelona 2012) 289–298.

Schulting et al. 2011: R. J. Schulting/E. Murphy/C. Jones/G. Warren, New Dates from the North and a Proposed Chronology from Irish Court Tombs. Proceedings for the Royal Irish Academy 112C, 2011, 1–60.

Tarrús 2002: J. Tarrús, Poblats, dólmens i menhirs. Els grups megalitics de l'Alberra, serra de Rodas i cap de Creus (Girona 2002).

Valera 2010: A. C. Valera, Marfim no recinto calcolítico dos Perdigoes, 1. Lúnulas, fragmentaçao e ontologia dos artefactos. Apontamentos de Arqueologia e Património 5, 2010, 31–42.

Valera 2013: A. C. Valera, Recintos de Fossos da Pré-História Recente em Portugal. Almadán 2.18, 2013, 93–110.

Valera et al. 2014a: A. C. Valera/A. M. Silva/C. Cunha/L. Evangelista, Funerary Practices and Body Manipulation at Neolithic and Chalcolithic Perdigôes Ditched Enclosures (South of Portugal). In: A. C. Valera (ed.), Recent Prehistoric Enclosures and Funerary Practices in Europe. British Archaeological Reports. International Series 2676 (Oxford.2014) 37–57.

Valera et al. 2014b: A. C. Valera/A. M. Silva/J. E. Marquez Romero, The Temporality of Perdigôes. Absolute Chronology of the Structures and Social Practices. SPAL 23, 2014, 11–26.

Villalobos 2015: R. Villalobos, The Megalithic Tombs of the Spanish Northern Meseta. Material, Political and Ideological Ties Between the Neolithic People and Their Territory. Préhistoires Méditerranéennes (online), last update 10.10.2015, http://pm.revues.org/1047 (last access 30.10.2016).

Wheatley et al. 2010: D. Wheatley/L. García Sanjuán/P. Murrieta Flores/J. Márquez, Approaching the Landscape Dimension of the Megalithic Phenomenon in Southern Spain. Oxford Journal of Archaeology 29.4, 2010, 387–405.

Zapatero 1991: P. Zapatero, Sobre las relaciones entre neolítico interior y megalitismo. Boletín del Seminario de Estudios Arte y Arqueología de Valladolid 57, 1991, 53–61.

FELICITAS SCHMITT

Enclose Where the River Flows
New Investigations on the Southern Meseta and the Ditched Enclosures of Azután (Toledo)

Keywords: southern Meseta, ditched enclosures, settlement conditions, landscape, connection and communication

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Abstract

Since the end of 2013 a new research project within the SFB 1070 ResourceCultures is investigating the Iberian Copper Age. The main focus is on the available resources and their influence on societies, i.e. the socio-cultural dynamics during that period. The two case studies in the south-west and in the centre of the peninsula will serve to contrast the dynamics of these areas. New insights can be gained by including the published results of former projects and new fieldwork of both the studies.

This contribution concentrates on the work undertaken on the southern Meseta during the years 2014 and 2015. The surroundings of the municipality of Azután in the west of the province of Toledo revealed two small ditched enclosures and a huge double-ditched enclosure, detected via archaeological and geomagnetic surveys. With the initial assumption of the project these results were outstanding as only small sites were expected at first. Especially regarding the size of the double-ditched enclosure as well as its constructional elements, the closest comparable sites are within 220 to 320km distance south-west in Badajoz and the Alentejo. A comparison with other Iberian enclosures will help to integrate Azután into the bigger picture. In addition, the resources of the micro region will be identified to emphasize the favourable location of the site.

1. Introduction

During the last 30 years research on Late Prehistory increased in the centre of the Iberian Peninsula but still the archaeological record differs in its amount when compared with the south-west (Chapman 2008; Balsera et al. 2015). Though the Chalcolithic material culture from the Spanish Central Plateau is very similar to the one in the south (Bueno Ramírez et al. 2016) still some site types were absent; for instance, the large ditched or walled enclosures. While in south Portugal or south-west Spain spaces of tens of hectares (Valera 2013; Márquez/Jiménez 2010) were enclosed the highland plains showed sites with sizes of four and less hectares (Díaz-del-Río 2003; Delibes de Castro et al. 2014). Therefore, the working hypothesis was that a different economic base of society, more egalitarian social structures and a lower population density did not have the potential to concentrate enough manpower for the construction of large monuments. Because of the seemingly heterogeneous social and cultural development in different regions two case studies with similar cultural appearance, but very different local preconditions are undertaken since October 2013 (Bartelheim 2016). We attempt to obtain a better insight in socio-cultural dynamics through the reconstruction of the landscape, of settlement patterns and the use of resources and eventually a comparison of two case studies in regions with markedly different natural conditions: (1) The surroundings of Valencina de la Concepción (see Escudero et al. this volume) and (2) the surroundings of Azután in the west of the province of Toledo.

To accomplish the objectives of the project the resources revealed in other excavations in the province of Toledo and in the test trenches of the case study were identified and their availability in the micro-region of Azután was mapped. The following questions have to be considered:

1. Are there potential resources available that were not used? And if so, what might be the reason?
2. Are certain resources cultural connoted, do they fulfil a purpose that is not important for subsistence?
3. What can be said about the role resources played in socio-cultural dynamics in differing natural environments?

For the investigation of the social and cultural development during the Late Neolithic and the Copper Age a reconstruction of the settlement pattern is aimed at, as well as an evaluation of mobility and communication across the Spanish Central Plateau (henceforth referred to as Mesetas), including the question for the means of control of the landscape and the use of trade or communication routes. The detection of the main resource complex of the society in each case study is of mayor significance for the reconstruction of societies in order to eventually compare both studies. Since not all of these questions can be answered extensively in this paper, the focus is put on the fieldwork and the landscape of the micro-region. Therefore, initially the research area of case study 2 Azután will be characterised to afterwards describe the results of the fieldwork within their natural conditions.

Azután: Research Area and Chronology

Together with the Central System and the Montes de Toledo the northern and southern Mesetas form the centre of the Iberian Peninsula. The southern Meseta is the lower part of the highlands; still it has an average altitude of 600m. The main rivers of the southern tablelands are the Tagus and the Guadiana, which together with their tributaries form an important system of waterways, both rivers draining into the Atlantic Ocean. Mountain ranges separate the southern Meseta from Andalucía to the south (Sierra Morena) and Valencia and the Mediterranean coast (Baetic and the Iberian Mountains) to the east (Chapman 2008, 222 f.). The case study is situated in the surroundings of Azután, a municipality in the westernmost part of the province of Toledo (Castilla-La Mancha). It is located in the Middle Tagus Basin on the southern terraces of the river in the rural district called 'La Campana de Oropesa'. Azután has been known for long because of the megalithic burial of the same name, excavated in several campaigns (Bueno Ramírez 1991; Bueno Ramírez et al. 2005a), which has served as a perfect starting point for further investigation. In the valley where it is located, between the Gredos Mountains (a part of the Spanish Central System) in the north and the western foothills of the Montes de Toledo in the south, the mountains form a bell-mouthed east-west corridor through Central Iberia and into the landscape of the Extremadura. From there on no further natural barriers block the way towards the Atlantic Coast. Moreover, Azután lies along one of the traditional herd drive paths from north to south and at one of the rare natural fords of the Tagus (Bueno Ramírez 2005a, 21, fig. 5; Bueno Ramírez et al. 2010).

A physical and geographical factor is the climate as it influences and shapes the landscape of the Iberian Peninsula both, during the dry summers and the wet winters. Warm and frequent dry conditions are characteristic on the southern Meseta often accompanied by insufficient rainfall. Extreme changes of temperatures – seasonally and daily – also occur (Chapman 2008, 223; ENADISMA 1972, 3). In the region around Talavera de la Reina, which includes Azután and its surroundings, maximum temperatures range between 35 and 40°C and minimum temperatures between 0 and -5°C. Average annual precipitations are of ca. 400mm in the east and 500mm in the west of the Meseta (ENADISMA 1972, 3). Thus, the climate can be described as subtropical with seasonal rainfalls in winter – rain-fed agriculture without extra irrigation is still possible (Andreae 1977, 42).

Geography, geology and climate have played an important part in the formation of the Iberian relief. However, at least since the Early Neolithic farmers and settlers had a strong impact on their environment as well. At the end of the Neolithic and during the Chalcolithic, this is especially visible in the construction of the ditched or walled enclosures and the megalithic burial mounds as well as in pollen samples from that period (Bueno Ramírez et al. 2005b; López et al. 2009).

As this whole volume deals mostly with the Chalcolithic the slightly different structured chronologies and the extreme variability of the intensity of investigation and availability of archaeological data across the Iberian Peninsula will not be discussed in detail.[1] I will only briefly state the basics of investigation intensity and chronology of the southern Meseta for a better understanding of the context of this paper. For example, the spatial distribution of the examined ^{14}C dates by Balsera et al. (2015) reveals a geographical concentrated pattern of dates. This does not only reflect the number of samples taken during an excavation but also a possible higher or lower number of actual excavations undertaken in an area, which has been stressed by Chapman (2008) as well. On the one hand because of different heritage policies and the major urban development in the Mediterranean coastal areas and around Madrid the majority of radiocarbon dates is concentrated in these parts of southern Spain. On the other hand, a large part of the central zone and the middle Guadalquivir Valley yielded almost no dates. To make matters even more complicated, the percentage of dates for each period differs as well within the regions. This situation developed because of the interest of several research groups in one prehistoric period focussing on one region (Balsera et al. 2015, 141; Chapman 2008, 246).

Archaeological tradition on the southern Meseta shows a clear tendency for the western part, where investigations mainly focussed on the 5th to 3rd mill. BC, whereas the eastern part with La Mancha received more attention in the Bronze Age research. All in all, not an optimal situation for the whole of the southern Meseta but the chronology for the Copper Age established by Hurtado Pérez and Hunt (1999) can be applied to the research currently undertaken in the west of the province of Toledo. In general, the chronology of the 4th and 3rd mill. BC of the Iberian Peninsula varies from region to region (Chapman 2008). While the Copper Age in Andalucía is divided into three phases from 3200 to 2300 BC (Castro et al. 1996), the Copper Age of the southern Meseta has been classified into four phases, beginning with the transition from the Final Neolithic (mid to end of 4th mill. BC) to the Initial Copper Age (around 3500–2800 BC). This is the most problematic period as the transition is rather indistinct than marked by a clear difference as also visible in the chronological overlapping of the end of the Neolithic and the start of the Chalcolithic. The second phase is defined as fully developed Copper Age (ca. 2800–2400 BC) followed by the Beaker Copper Age (ca. 2400–2200 BC) and leading to the Bronze Age transition (ca. 2300/2200–2000 BC) at the end of the 3rd mill. BC (Hurtado Pérez/Hunt 1999; Chapman 2008, 223). In summary: according Hurtado Pérez and Hunt (1999) the Chalcolithic period of the southern Meseta has an approximate duration of 1500 years and includes the second half of the 4th mill. and the whole of the 3rd mill. BC.

1 This has already been investigated and published in an admirably detailed manner by Chapman (2008) and Balsera et al. (2015) for the south of Spain. For a summary of these informations with focus on the southern Meseta see Schmitt et al. (in print).

In the last few years new studies about the Mesetas demonstrated the immanent potential of the 4th and 3rd mill. BC (e.g. Barroso Bermejo et al. 2014; Bueno Ramírez et al. 2016; 2013; 2011; 2009; 2005c; Delibes de Castro et al. 2014). Projects along the Mediterranean and Atlantic coast in the southwest of Spain and Portugal have shown that settlement sites and ditched enclosures often are linked to megalithic monuments in their surroundings. This connection between different types of sites has been assumed by Bueno Ramírez et al. (2005c; 2011; 2012; and in this volume) for the central plains as an indicator for the area of the living as well. Hence, the dolmen of Azután would be a visible marker of the human activity that took place in its vicinity, and therefore represents an ideal initial point of departure to conduct further studies on the settlement patterns within the same chronology. Fieldwork was necessary to test this hypothesis on the megalithic burial of Azután.

Archive Studies and Fieldwork: 2013–2015

After having outlined the geographical and chronological framework of the case study, the following part will describe the investigations and fieldwork carried out since the start of the project. The foundation for the fieldwork was already set at the end of 2013 and included a full review of publications and reports held in the archives of the Consejería de Cultura, Educación y Deportes of the Junta de Comunidades de Castilla-La Mancha (henceforth referred to as JCCM) in Toledo. This consisted mostly of the revision of the *carta arqueológica* – containing site information of mainly unpublished archaeological surveys – and the collection of late prehistoric data for the province of Toledo to enable the creation of a combined map. Two years of fieldwork in three separate seasons followed: archaeological and geomagnetic surveys in the spring and autumn of 2014 and the excavation (opening of small test trenches) in late autumn of 2015.

The study of the documents of the JCCM revealed an enormous potential of sites. All accessible information deriving from the municipalities of Toledo was revised and searched for prehistoric sites, the majority of which were only known by surface finds. A list including each project relevant site with a Neolithic, Chalcolithic and/or simply Prehistoric (without further determination) chronology, together with its geographical location, was established. This led to 397 recorded sites (*fig. 1a*). Taking the published ones[2] into account that have not been mentioned in the *carta arqueológica* around 450 potentially Neolithic/Chalcolithic places in the province of Toledo may exist according to the current state of knowledge. The map with the location of the sites shows several agglomerations. Those areas of accumulation were visualised by creating a heatmap in QGIS to show objective clusters of sites (*fig. 1b*). For instance, close to the autonomous community of Madrid in the north-east of the province of Toledo the larger number of sites within a 10km radius can be explained due to the intensive construction activities in the wider surroundings of the Spanish capital (Balsera et al. 2015, 141) e.g. in Seseña or Ocaña and Yepes. Other sites cluster because of scientific research projects, which is the case for Huecas and its neighbour Barcience (Benítez et al. 2009). Accumulation along the rivers mainly can be explained by a better accessibility and visibility in these areas as it is the case in Azután and Alcolea de Tajo in the west of the province where cereal, corn and alfalfa fields were concentrated on the fertile terraces of the Tagus River. After the harvest the vegetation cover is down to a minimum or the fields are even ploughed. Though ploughing slowly destroys the archaeological structures, it also unearths finds as site indicators. Hence, blank spots on the map do not exclusively correlate with an absence of finds in a certain region but can also reflect a dense vegetation cover, difficult to access properties or a lack of survey activity. Taking into account the approximately 450 sites only in the province of Toledo, distributed almost all over the province, at least parts of the central highlands do not seem very empty anymore. However, it has to be considered that the documents of the *carta arqueológica* do not clarify the amount of prehistoric surface finds nor the extension[3] of each site. Still, the

2 'Published' does not necessarily mean that the site has been excavated. A lot of the information derives from archaeological surveys or simple observations.

3 The sizes of archaeological sites were mentioned in the reports about the surveys but for all periods detected in that area. In the cases were finds scattered from the Neolithic/Chalcolithic over Bronze Age to Roman times no information of extension for each individual period was given.

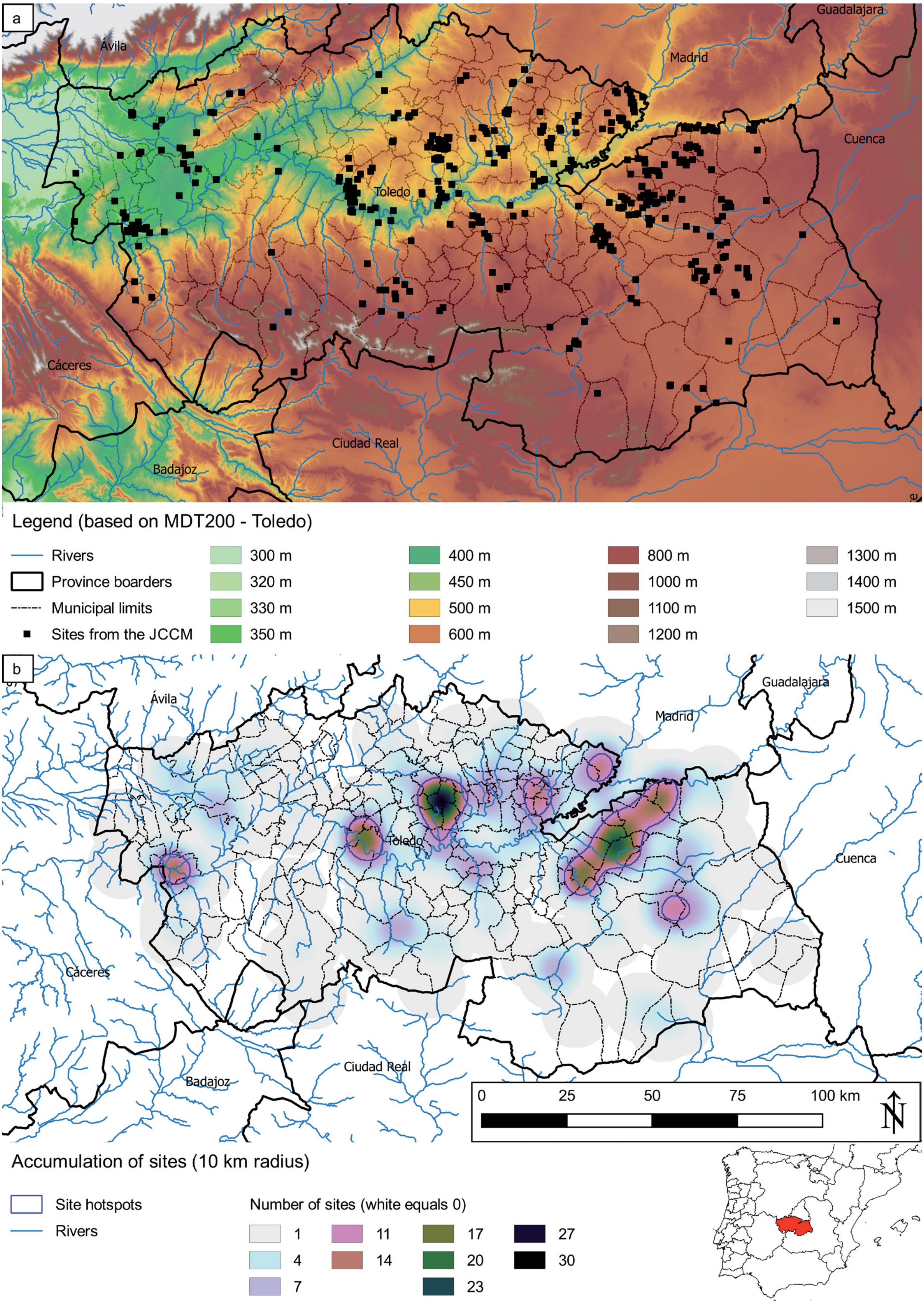

Fig. 1. Map a) squares indicating the prehistoric sites and the archaeological potential of the province of Toledo. Site information deriving from the JCCM (based on MDT200); Map b) Accumulation of prehistoric sites from the JCCM showing the hotspot areas mentioned in the paper, from 1 to 30 sites in a 10km radius/20km diameter (© Instituto Geográfico Nacional, maps modified).

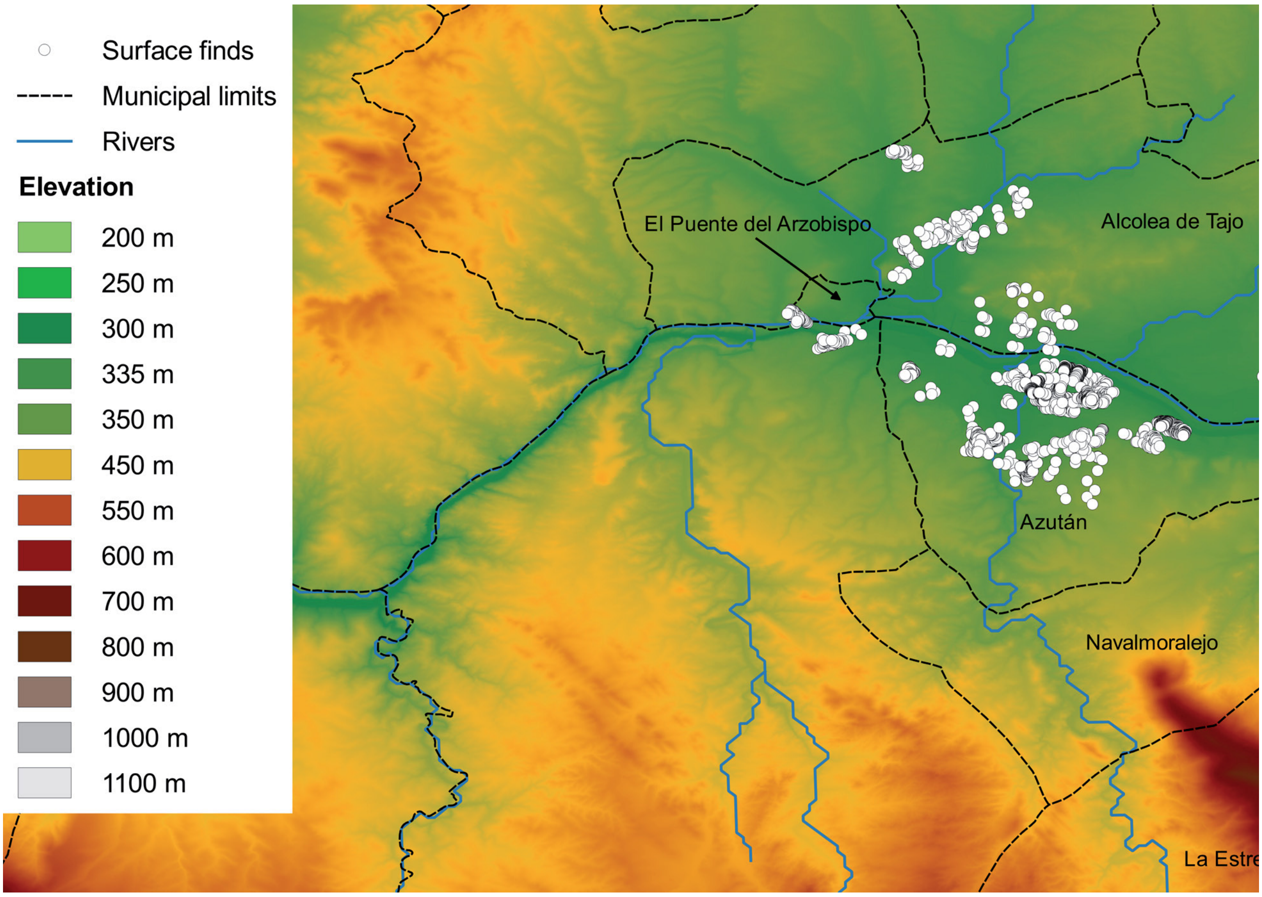

Fig. 2. The map illustrates the municipalities of interest for the archaeological survey. The agglomeration of dots shows the cluster of finds on the southern bank of the Tagus (© Instituto Geográfico Nacional, MDT05, maps modified).

initial investigations already reflect the potential of the interior of the peninsula.

On account of the unknown size as well as the amount of finds of the prehistoric sites mentioned in the *carta arqueológica* a smaller part of the province of Toledo should be reinvestigated. In order to verify or falsify the results of former survey works a couple of municipalities in the west of the province were selected. The surroundings of Azután and La Estrella were chosen for their excellent initial situation since excavations of both megalithic burials already revealed a chronology of the 4th and 3rd mill. BC (Bueno Ramírez 1991; Bueno Ramírez et al. 2005a). The approach was to start with the parcels of the municipalities that were already known for prehistoric finds and from there on the area was extended as far as possible. Due to reasons of visibility and accessibility because of agricultural activities the archaeological survey had to be restricted almost exclusively to El Puente del Arzobispo, Alcolea de Tajo and Azután. The dense vegetation cover and the denied access in Navalmoralejo, La Estrella and Aldeanueva de San Bartolomé restrained our survey work. Hence, only the site of El Castrejón (Aldeanueva de San Bartolomé) could be reviewed there. Out of more than 89 parcels surveyed during the fieldwork campaigns 54 were situated in Azután. This situation is reflected in the map, which includes the location of the measured surface finds as well as the limits of the municipalities mentioned in the text (*fig. 2*). It is beyond question that the finds cluster on the terraces of the Tagus River in Azután.

During the survey activities mainly in spring and some additional survey during the campaign in autumn of 2014 all potentially Neolithic/Chalcolithic artefacts were measured individually with a handheld GPS and collected. Diagnostic items of other periods from the Palaeolithic until Medieval times were dealt with in the same way. Non-diagnostic wheel-made ceramic, iron objects etc. were counted and left on the field. This procedure and the focus on Azután allowed an insight into the areas settlement history. The oldest finds derive from the south-west of the modern village of Azután on a terrain undulation where an Acheulean biface and a Levallois core were found. In Neolithic and Chalcolithic times, the area around the dolmen and the terraces of the Tagus south-west and west of the village were in the focus of interest, while Bronze Age and Iron Age finds concentrate on the terraces to the east of Azután. Furthermore, material evidence from Roman, Visigoth and Al-Andalus periods were found in different areas of the municipality. By far the most important areas for the objectives of the case study were the southern terraces of the Tagus to the west of Azután. Here the very high amount of surface finds of the spring campaign of 2014 surpassed the initial expectations. Though mixed with other archaeological periods 75% of approximately 4783 recorded artefacts pointed to the 4th and 3rd mill. BC. This already indicated a bigger settlement size than 1 to 4ha, as the stray finds were scattered over an area of at least 40ha. With the cultivated fields impossible to investigate because of their vegetation density but located between the surveyed parcels an area of almost 90ha became the centre of interest.

With the help of the aerial images offered by the Spanish National Geographical Institute (Instituto Geográfico Nacional) and other web browsers two ditched enclosures were detected. They are located in the vicinity of the dolmen of Azután where little surface finds were made despite the fact that this part of the municipality has been the most intensively surveyed area during the last decades. The sites are situated to the south-west and south-east of the megalithic burial, both less than 500m distant. In contrast, the area of dense surface finds did not show any crop marks that would indicate an archaeological site. Because of the visible structures in the aerial images and the quantity of finds, those three areas were selected for further detailed investigations. Therefore, in October 2014 geomagnetic surveys were undertaken both in the parcel with possible enclosures near the dolmen and in the area west of the village with the accumulation of chronological relevant finds. A little less than 30ha were measured, 17ha alone on the river terraces. The geomagnetic survey close to the Tagus revealed an outstanding image with numerous structures. Of special importance, besides several ditches, is the double-ditched enclosure with measurements and architectural features never recorded in central Spain previous to 2014. The Spanish Central Plateau was mainly known for ditched enclosures of 0.5 to 4ha size (Delibes de Castro et al. 2014; Díaz-del-Río 2003) but the site El Prado in Azután by far surpasses those dimensions. If this construction has been a semicircle, then El Prado enclosed around 50ha, if it crossed the river and formed a circle its size would have been around 100ha. For both types there are comparisons in 200 to 300km distance in the province of Badajoz and the Portuguese Alentejo but not on the Mesetas. Furthermore, what four years ago seemed to be a characteristic of the South-West, the sinuous construction elements (Valera 2012a), is now present at the site of El Prado.

In order to verify the structures visible in the geomagnetic image an excavation was carried out in late autumn of 2015. Two trenches – each 5x5m – were opened in two different areas, 16m apart and probably related to each other: one examined the inner ditch of the double-ditched enclosure and the other a part of the accumulation of pits in the interior of the enclosure. In this western trench four pits of different composition were uncovered, three of which could be investigated. In the eastern trench the approximately 1.8m deep and V-shaped ditch started ca. 40cm below the modern soil and was cut by a younger pit. Three ^{14}C dates are available so far: for two pits (structure west and east) and the ditch (*tab. 1*).

These dates show that the El Prado enclosure revealed a longer site continuity starting before the Chalcolithic and reaching the beginning of the 5th mill. BC. Also the connection of the accumulation of circular structures in the interior of the site with the ditched construction can be assumed, both show similar dating. With El Prado the Initial Copper Age of the southern Meseta has been recorded. As the excavated materials and the plans are currently under study and more samples for carbon

Structure	Dated material	Uncalibrated date	Calibrated date, 2 σ
W	Mandible (ovicapridae): middle of the structure	6051±32 BP	5035–4848 calBC
E	Ulna (suidae), femur (ovicapridae): top and middle of the structure	4381±30 BP	3090–2914 calBC
Inner ditch	Carbon: 80cm above the bottom of the ditch	4560±31 BP	3487–3105 calBC

Tab. 1. Uncalibrated and calibrated 2 σ dates deriving from three different archaeological structures of the site El Prado (Azután). Samples analysed by the CNA University of Sevilla. Radiocarbon calibration programme used: Calib 7.0 © M. Stuiver and P. J. Reimer 2013 (Reimer et al. 2013).

dating under analysis the results for the complete ^{14}C-sequence will be discussed elsewhere.

The Enclosures of Azután: Description and Comparison

After the detailed description of the fieldwork, the Azután sites can be discussed within a broader Iberian context. Hence, the three enclosures detected in 2014 will be described and compared with similar constructions, starting with the small ones in the vicinity of the dolmen and closing with the impressive double-ditched enclosure on the terraces of the Tagus. Their architectural features are present at other sites as well but the archaeological structures recently revealed in Azután add some more information to the data base of Iberian enclosures and the distribution of certain types. The names of the sites were chosen after the name of the district they were located in. Therefore, the three enclosures are called Los Pedazos (south-west of the dolmen), Los Viñones (south-east of the dolmen) and El Prado (on the Tagus terraces).

Los Pedazos

Los Pedazos (*fig. 3*) is the only one of the three enclosures whose outline has to be discussed on the basis of the aerial image only (PNOA from 2013) because the geomagnetic measurements barely reached the inner ditch. The enclosure is situated approximately 110m to the south-west of the dolmen on a terrain undulation. The structure visible in the orthophoto shows an ellipsoidal plan, which differs from most of the Neolithic and Chalcolithic enclosures of Iberia. In total three ditches can be identified, though the part north of the track is drawn clearer than the part south of it. All three ditches do not overlap and therefore they could have been contemporaneous. The inner ditch seems to be the broadest of all three with a width ranging between 12 and 16m. In its western part a clear interruption of approximately 26m becomes apparent. The other two ditches as well show interruptions almost at the same location though they are not very distinct. Right in front of the probable entrance of the inner ditch a semi-circular construction in its western part might be interpreted as part of a gate. In about 18m distance from the inner ditch a second one was detected, which is slightly smaller with a width between 9 to 11m. Another 12m away from the middle ditch the outer ditch defines the dimensions of the enclosure as a whole. It has approximately the same width as the middle ditch and encloses an area of 12ha altogether. At their nearest point the enclosures of Los Pedazos and Los Viñones are only 270m away from each other.

Sites with a similar plan as the enclosure of Los Pedazos are rare on the Iberian Peninsula and only one comparable site can be mentioned here: La Redonda (Ampudia, Palencia). The enclosure of La Redonda was first mentioned in 2011 (García 2011, 163) and a plan published in 2015 by García (2015, 168). It is a segmented (causewayed) enclosure with four ditches known from archaeological survey and aerial images. La Redonda consists of an outer ditch with a circular and the three inner ditches with an ellipsoidal outline (*fig. 4a*). No definite entrance can be identified for La Redonda. All together the four ditches enclose an area of 1.7ha.

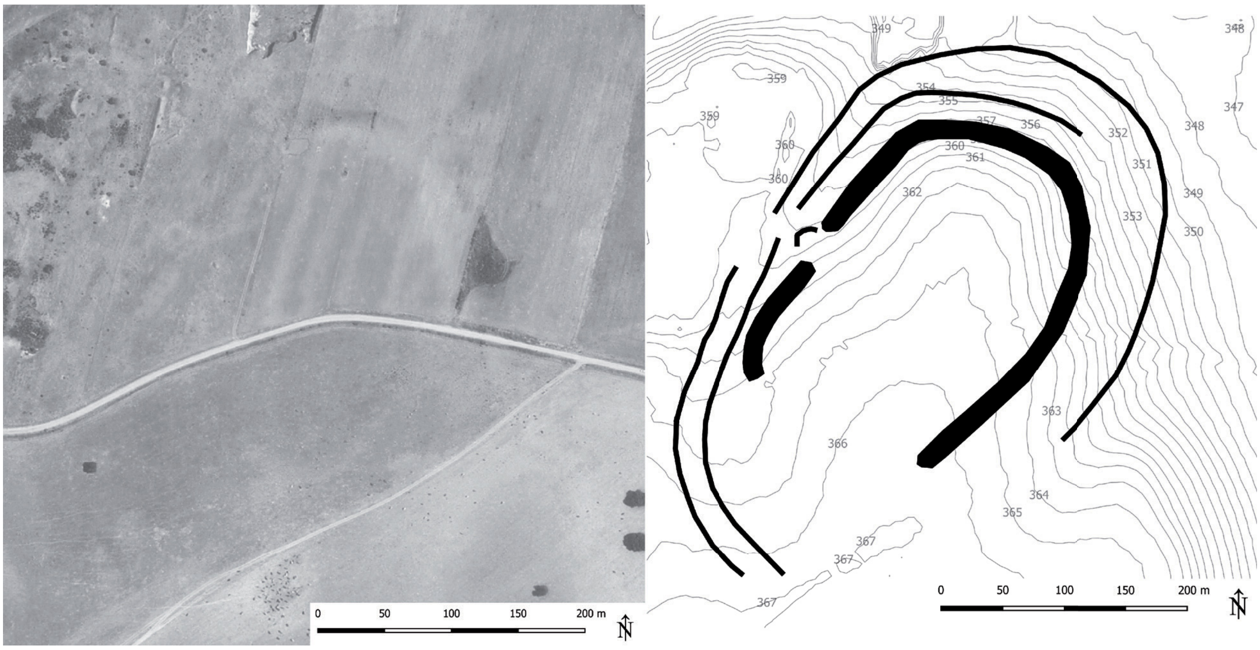

Fig. 3. Enclosure Los Pedazos in the south-west of the dolmen of Azután. Left: aerial image; right: sketch based on the aerial image with isolines of 1m distance (© Instituto Geográfico Nacional, PNOA 2013, maps modified).

Unfortunately, besides the ellipsoidal construction of three of the four ditches and the Chalcolithic sequence no further parallels can be drawn to the enclosure of Los Pedazos.

Los Viñones

The second enclosure in the vicinity of the dolmen is Los Viñones (*fig. 5*), located 230m south-east of the megalithic burial in the lowlands and west of the Anguilucha Creek. The sketch of the site was based on the geomagnetic image; hence it can be regarded as a more accurate depiction of the site. Only the western half of the small enclosure was visible in the aerial images were it seemed to have rounded parts interrupting the ditch. This could not be verified by the geomagnetic measurements. The enclosure consists of one ditch with an oval outline that has a 30m wide opening to the north. In the geomagnetic image the ditch appears to be between 6 to 12m wide and encloses an area of 1.4ha.

With regard to its oval plan Los Viñones is best compared to La Serna (Pedraza de Campos, Palencia), which is known through archaeological survey and aerial images (García 2011, 163; 2015, 167–169). La Serna is a segmented enclosure (*fig. 4b*) like many of the sites of the northern Meseta but its size of 0.08ha is a lot smaller than Los Viñones. A better comparison is the site of Los Melonares-Zofraga (Rueda, Valladolid) that encircles 0.79ha and also belongs to the type of segmented enclosures (*fig. 4c*; Delibes de Castro et al. 2014, 69–72). Although it is an almost circular construction, the size is closer to the one of Los Viñones and the possible entrance also points northwards. Other comparable ditched enclosures with only one ditch are not known to date.

El Prado

The double-ditched enclosure of El Prado is at the lowest location of the three enclosures discussed here. It is situated on the southern bank of the Tagus River and the maximum distance from its most southern part to the modern river bed is around 590m. With regard to El Prado the sketch was based on the geomagnetic image only (*fig. 6*) as the aerial images showed no sign of large archaeological structures though the surface finds indicated it. El Prado is the most intensively investigated enclosure in the municipality of Azután. Besides archaeological survey, geomagnetic measurements were carried out and the inner ditch of the enclosure was partly excavated.

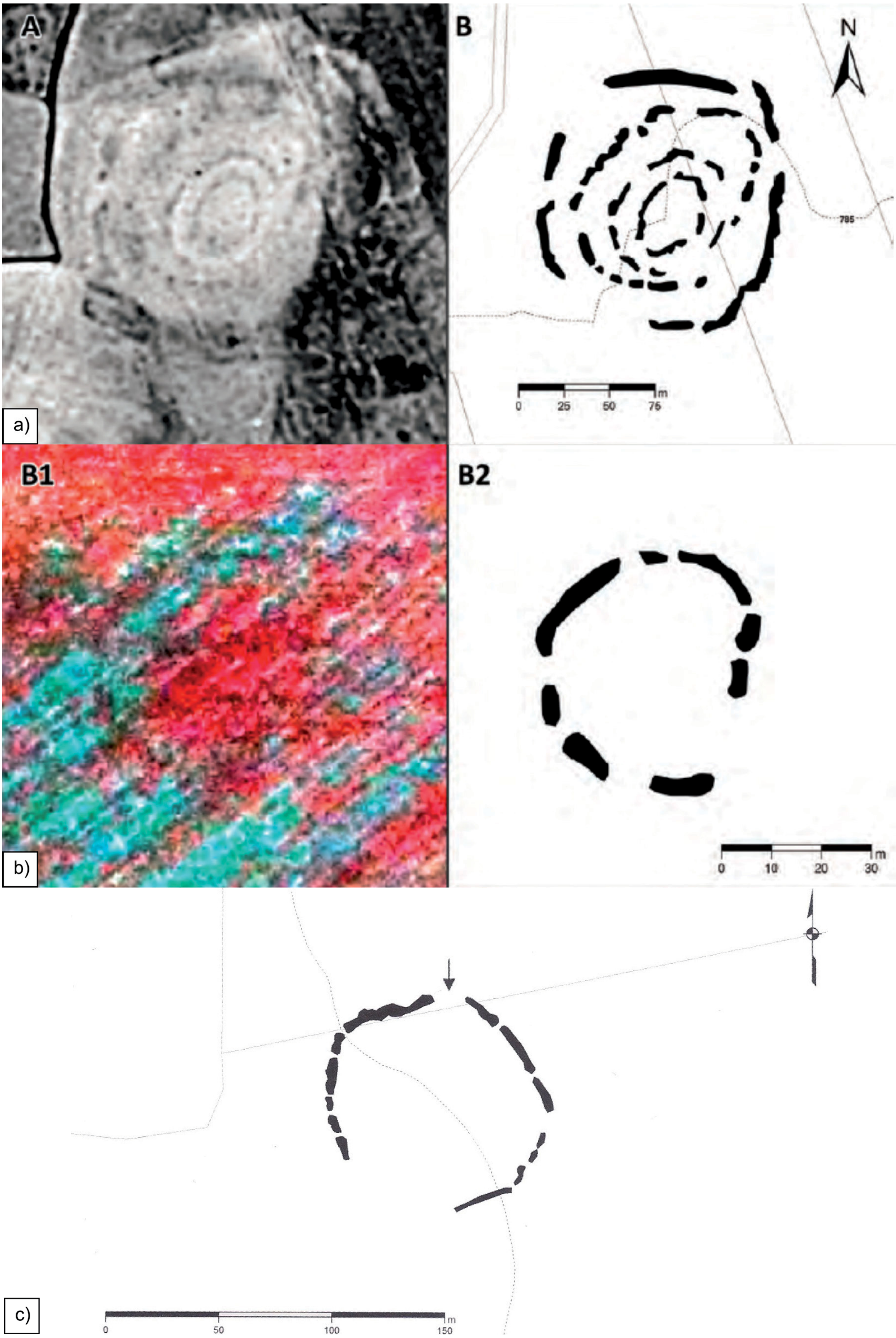

Fig. 4. Comparative sites for Los Pedazos a) La Redonda (Ampudia; García 2015, 168, fig. 48) and for Los Viñones b) La Serna (Pedraza de Campos; García 2015, 167, fig. 47), c) Los Melonares-Zofraga (Rueda; Delibes de Castro et al. 2014, 71, fig. 42).

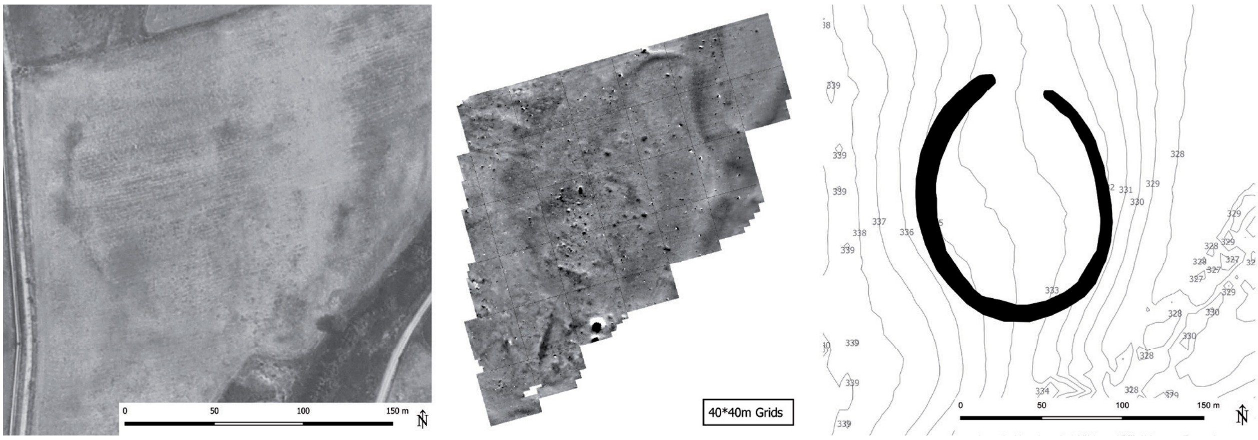

Fig. 5. Enclosure Los Viñones in the south-east of the dolmen of Azután. Left: aerial image; middle: sketch based on the magnetogram with isolines of 1m distance; right: magnetogram (© Instituto Geográfico Nacional, PNOA 2013, maps modified. Geophysical image by © Becker Archaeological Prospection).

As mentioned above the double-ditched enclosure surrounded an area of 50ha at least but may have been even bigger with a surface of 100ha in its interior. It surpasses by far the sizes of the known enclosures of the Mesetas and also the constructional elements have been absent in the centre of the Iberian Peninsula until the detection of El Prado. Both ditches of the site are between 2 and 3m wide. While the outer ditch does not show any sinuous constructional elements, the inner ditch consists of wavy and straight parts. Those sinuous construction parts have, until five years ago, only been known from the South-West (Valera 2012a, 27) and up to their detection in 2014 unknown at the centre of the Iberian Peninsula. Each ditch has a clearly visible interruption. In the outer ditch it is situated in the northern third accompanied by unclear interruptions of the sinuous part of the inner ditch. The interruption of the inner ditch is recognizable in the southern third of the geomagnetic image and right at the location of one of the two visible interconnecting ditches. Those are 2m wide, 6m long and interconnecting both circular ditches of the double-ditched enclosure (for further measurements see Schmitt et al. in print). Excavations of a part of the inner ditch revealed a V-shaped profile and, below the 40cm thick humus layer, a depth of ca. 1.8m.

The best comparisons for the architectural features of El Prado are found in the Alentejo region in the south of Portugal with the double-ditched enclosures of Moreiros 2 (Arronches) and Perdigões (Reguengos de Monsaraz). In the case of Moreiros 2 (*fig. 7a*), which covers a surface of ca. 2.5ha, the inner and outer ditches show interruptions. Additionally, the outer ditch has no sinuous elements while the inner one predominantly was constructed with a wavy plan. These two elements are present in El Prado as well but in Moreiros 2 interconnecting ditches between the inner and outer one could not be detected (Valera et al. 2013). On the one hand the double-ditched enclosure of Perdigões (*fig. 7b*) that surrounds ca. 20ha shows these interruptions or entrance situations as well as the interconnecting ditches. On the other hand, the sinuous constructional elements are missing (only referring to the biggest enclosure of Perdigões), which leads to the conclusion that El Prado includes elements of both sites used for comparison. An interesting point is that according to our present knowledge the double-ditched enclosure of Azután is older than the one of Perdigões. In Perdigões ditch 5, 6 and 12 date to approximately the same period (ca. 3365–2918 calBC) like the inner ditch of El Prado but not the ditches of the double-ditched enclosure (Valera et al. 2014). The dates available from Moreiros 2 derive from ditch 1 and 3 of the small enclosure within the double-ditched one and date to the second half of the 4th mill. BC; 3310–2901 calBC (Valera et al. 2013, 43). Hitherto, El Prado seems to be not only the biggest enclosure of this construction type but also the oldest one.

Two further comparisons for El Prado are mentioned because of their location and topography. Both will be described just briefly, because their construction is differing. As it is not certain

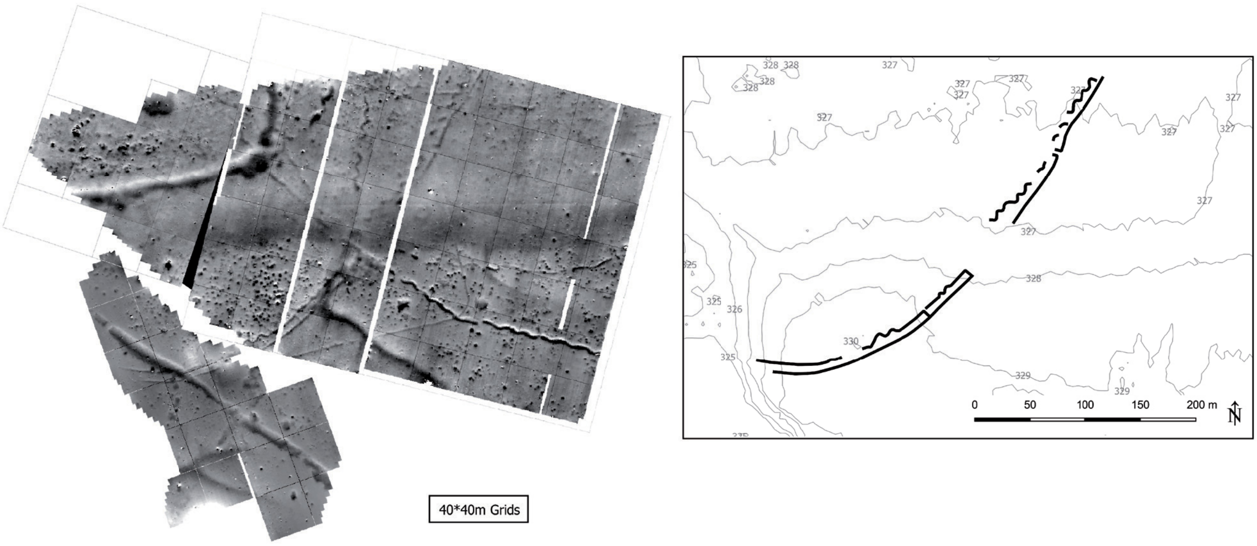

Fig. 6. Enclosure El Prado on the terraces of the Tagus 1km east of the dolmen of Azután. Left: magnetogram; right: sketch based on the magnetogram with isolines of 1m distance (Schmitt in print, fig. 2. Geophysical image by © Becker Archaeological Prospection).

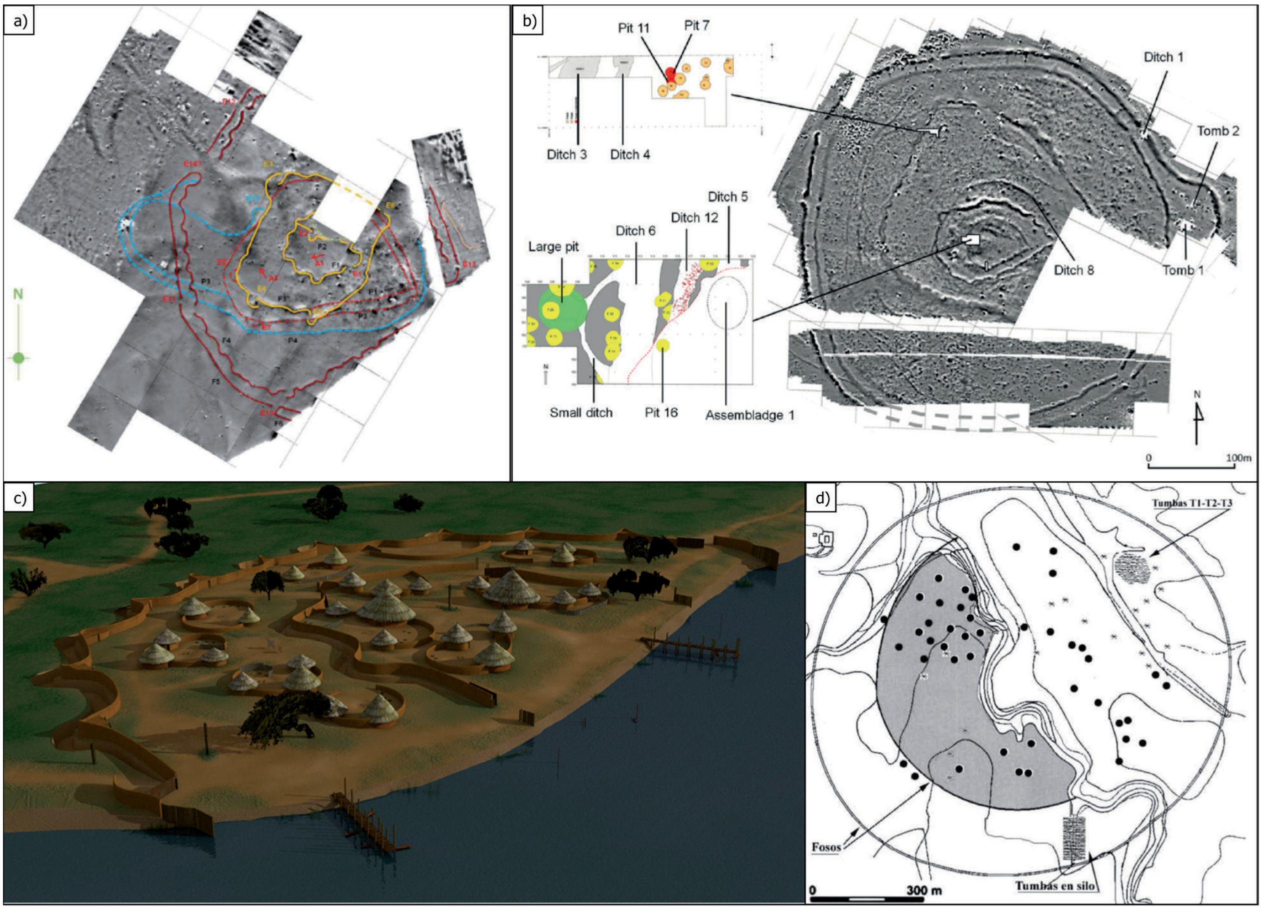

Fig. 7. Comparative sites for El Prado a) Moreiros 2 (Arronches; Valera et al. 2013, 38, fig. 4), b) Perdigões (Reguengos de Monsaraz; Valera et al. 2014, 17, fig. 13), c) Águas Frias (Alandroal; Calado 2007 in: http://megasettlements.blogspot.de/2007/01/re-creating-past_24.html) and d) La Pijotilla (Solana de los Barros; Hurtado Pérez 1999, 76, fig. 4).

whether the site had a semi-circle design stopping at the river bank or whether it described a full circle and crossed the river the two examples discussed here are Águas Frias (Alandroal, Alentejo) and La Pijotilla (Solana de los Barros, Badajoz). Águas Frias (*fig. 7c*) is located on the left bank of the Lucefecit River, which flows into the Guadiana River. The enclosure was dated to the second half of the 4th mill. BC. Three semi-circular ditches with a sinuous construction seemed to have started and ended at the river bank though it could not be conclusively clarified whether the construction really was limited to one side of the river (Calado/Rocha 2007, 35–40, Valera 2012b). The rescue excavation has not been published completely but according to the calculation of Márquez and Jiménez (2010, 102) the site covered an area of approximately 1ha. For La Pijotilla (*fig. 7d*) information about a ca. 80ha area enclosed by two concentric ditches can be found in publications (Hurtado Pérez 1995, 62; Odriozola et al. 2008, 213). However, in this case the focus of investigations and publications was rather put on the related burials and material analyses than on the enclosure itself. Unfortunately, information about the excavation of the ditches is rare to find because it is barely published (Hurtado Pérez 1991). The site – including the enclosure and the burials – covers the 3rd to the beginning of the 2nd mill. BC; from the Chalcolithic Period to the Early Bronze Age. The backfill of the outer ditch could be dated to 2460–2200 calBC 1 σ. Located in the valley, at least the outer ditch is said to run on both sides of the eponymous Pijotilla Creek, a tributary of the Guadajira River. The inner ditch apparently formed a semi-circle (Polvorinos et al. 2002, 1; Hurtado Pérez 2008, 186–190; Márquez/Jiménez 2010, 198).

The double-ditched enclosure of Azután is surrounded by numerous different structures (described in detail in Schmitt et al. in print). Some of them might have been contemporaneous, others not as they cut the ditches of the enclosure. Especially the combination of many pit-like structures accompanying the ditched enclosure occurs often on the Iberian Peninsula (Delibes de Castro et al. 2014; Valera 2013). Hopefully, future projects will be able to clarify the chronological sequence within the structures on the terraces of the Tagus and among the three enclosures of Azután. But especially the comparison of the El Prado enclosure demonstrates how well the site can be embedded in the picture of the south-western enclosures of Iberia.

Which circumstances might have been the crucial factors for the emergence of a site of this type and size on the Spanish Mesetas? A closer look on the environmental conditions of the micro-region of Azután including the availability of resource and the integration of the sites in the landscape is necessary.

Resources and Site Location

After the description of the enclosures of Azután an approximation at the reasons behind the selection of this area by the Late Neolithic and Copper Age settlers will be aimed at. Therefore, the available resources of the surroundings of Azután as well as their actual appearance in the archaeological record of the 4th and 3rd mill. BC of the region will be investigated. This requires consideration of the geographical location and its integration into the network of communication.

A bit of everything is probably important for a society to found a settlement or a highly frequented site but resources to fulfil the fundamental needs should be sufficiently available. Probably the agricultural potential of the soil and the existence of raw material for the production of the basic tools as well as resources for the development of the site were in the vicinity of the chosen place. Since the Neolithisation clay is an essential material for the production of pottery of different character and all kinds of use (metal production, food preparation, ritual purposes etc.). The middle basin of the Tagus River is dominated by granite and fertile ground as parent material. While the foothills of the Montes de Toledo reveal a slate-rich composition, the Tagus lowlands have been filled by tertiary sediment. On each side of the river soil layers are composed by quartz, quartzite and clay (*fig. 8*). Especially the clay layers become more massive the closer they are to the banks of the Tagus (ENADISMA 1972, 5–7). In the area of Talavera de la Reina westwards to Puente del Arzobispo so-called *rañas* (alluvial fans) shape the land along the river. As a result, the alluvial deposits consist of sandy, silty

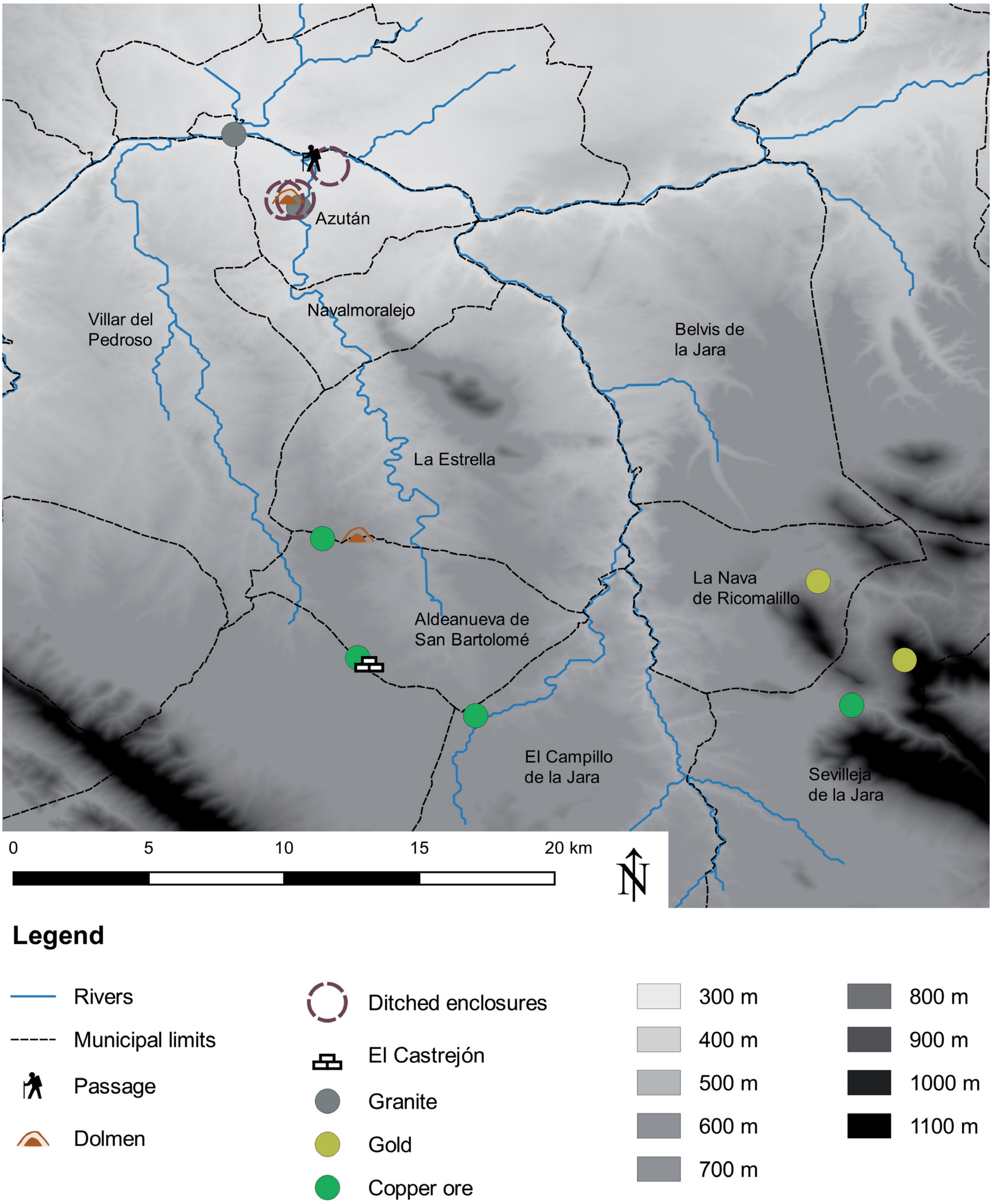

Fig. 8. Resources in the vicinity of the municipality of Azután indicating the locations mentioned in the paper (© Instituto Geográfico Nacional, MDT05, maps modified).

soil with strongly rounded pebbles. Nevertheless, layers of clay with an excellent consistency can be found in the alluvial soils. Until today towns famous for their pottery can be found in the west of the province of Toledo as e.g. the two mentioned above (ENADISMA 1972, 11).

Also granite and quartzite as well as quartz contribute to the favourable location of Azután.

Both of these coarser grained stones were used for the production of grinding stones or net weights as well as for the construction of megalithic tombs and stelae as reflected in the sites of Azután (Bueno Ramírez 1991; Bueno Ramírez et al. 2005a). Flint and quartz can be found in the form of arrowheads or other cutting tools. However, quartz in its purest form as rock crystal seems to have been used preferably in burial context as valuable good, which may have had a ritual meaning (Costa et al. 2011, 259–263). This is reflected by the prism and the nucleus found in the excavation of the dolmen of Azután or the artefacts detected in the megalithic monuments of Valencia de Alcántara (Bueno Ramírez 1988; 1991, fig. 42, fig. 61, 101).

Copper is the resource that gave the name to the period of interest even though it is rarely represented in the archaeological record of the first half of the Chalcolithic. As earlier studies already showed the Iberian Peninsula, and especially its western half, is rich in metal ores (Delibes de Castro/Montero-Ruiz 1999; Bartelheim/Montero-Ruiz 2009, 9 f.). Unfortunately, many of the copper mines have been reused in later times like the Roman period. This often destroyed the earlier layers of extraction, therefore prehistoric mining traces are difficult to detect. An approximation to their use in prehistory can be made through isotopic analyses of copper artefacts and comparison of the isotopic fingerprint of the site it is supposed to derive from. Surface finds related to mining activities or the processing of ores (hammers, pestles, melting pots etc.) also may indicate prehistoric activities. The western foothills of the Montes de Toledo also contain copper ore veins some near the surface others even on the surface (Montero-Ruiz et al. 1990; Barroso Bermejo et al. 2003). They can be found for example in Aldeanueva de San Bartolomé where in the site of El Castrejón the ore veins are within the granite rock and the green ore is associated with milk quartz. Surface surveys before 1991 (Carrobles/Méndez Cabeza 1991, 7 f.), around 2007 (Pacheco/Pérez 2007) and again within our project in 2014 revealed potentially prehistoric finds. The project survey mainly found very fragmented ceramic sherds and a mortar made of sandstone that might have served to separate the ore from the quartz. On the top of the hill walls are enclosing approximately 1ha of El Castrejón and were interpreted as possibly Chalcolithic (Carrobles/Méndez Cabeza 1991, 8), which would define the site as a walled enclosure. Inside these walls some rectangular shallow pits (trenches) were detected that may indicate mining activities following the ore veins on the surface to a certain extent into the hill. The site combines indicators for mining and processing the copper ore at a distance of only 18km south of Azután. I. Montero-Ruiz et al. (1990, 15) mentioned another location in Aldeanueva 1km distant to the west of the dolmen of La Estrella. Trenches could be detected that served to exploit malachite and azurite and were dated to Roman times but so far no prehistoric mining traces were detected. Hence, in less than 20km distance from Azután copper mining was possible (*fig. 8*).

There are other abundant copper sources in the rural district of La Jara 20 to 40km away from the sites of Azután, although without evidence for prehistoric copper exploitation. Known for copper mining is the municipality of El Campillo de la Jara. Especially rich in several ores, amongst others copper and gold, is the municipality of Sevilleja de la Jara. Gold mining was also practiced in recent times in La Nava de Ricomalillo in between Campillo and Sevilleja (*fig. 8*; Montero-Ruiz et al. 1990, 16–22). Besides the use of stream gold an exploitation of the gold deposits in the western Montes de Toledo might have taken place but up until now this remains pure speculation.

The Tagus Basin can surely be mentioned as one of the important resources. Its perfectly central position has been emphasised several times by Bueno Ramírez et al. (e.g. Bueno Ramírez et al. 2005a; 2010; 2016). As mentioned at the beginning, the valley of the middle Tagus Basin where Azután is situated forms a natural corridor from east to west. The north and the south are framed by mountain ranges but can be crossed through passes. More specifically the Tagus in the heart of the peninsula facilitates as well the connection with other watercourses. In combination with the old drover ways (*cañadas*) the contact to the Duero Basin in the north or the Guadiana Valley in the south was certainly possible. The central position and the ability to connect different geographical areas made the Tagus an important intersection in all directions (Bueno Ramírez et al. 2010, 154).

Several studies have investigated the locations of megalithic sites with regard to the *cañadas*, revealing a close spatial connection. Therefore, it can be argued that these historic transhumance tracks reach back far more than the Middle Ages and the sites indicate their use in the times of the megalithic builders (Galán/Martín 2009; Murrieta-Flores 2012). The megalithic burials and stelae probably have served as visual markers describing the course of a *cañada*. This can be observed for several areas along the Tagus (Bueno Ramírez et al. 2004; 2010) and for the research area of the case study as well (Bueno Ramírez 1991; Bueno Ramírez et al. 2005a). Two megalithic burials can be found situated along the route nowadays known as *Cañada Real Leonesa Oriental,* which leads from Puerto de San Vicente to Ávila. Hence, it is the connecting line for the northern and the southern Meseta and links the Tagus with the Guadiana basin. The location of the walled enclosure El Castrejón in Aldeanueva de San Bartolomé and the latest discoveries of the ditched enclosures in Azután strengthen the argument for the importance of the communication route and the significance of the archaeological landscape in the surroundings of Azután. Since the Tagus is a perennial river and sometimes even cuts canyon-like into the ground, as it is the case in Toledo or from El Puente del Arzobispo to the west, it is difficult to cross and natural fords are rare. But Azután is situated at one of these rare river crossings adding another advantage to the favourable location. It can be assumed that the double-ditched enclosure El Prado may even have surrounded the passage, controlling and protecting the place.

In the river valley fertile soil facilitated agriculture and the analyses undertaken in the archaeological sites of Azután (dolmen) and in the north of the province (Huecas) suggest the cultivation of cereals (Bueno Ramírez et al. 2005a; 2005b; 2009; 2010). The archaeological record of Azután verifies the use of wheat already in the 5th mill. BC, which suggests that wheat cultivation in Central Iberia may have taken place right from the beginning of agriculture. Evidence of wheat agriculture of the mid-5th mill. BC was not restricted to the southern half of the Meseta but is present in the site of La Atalaya (Muñopepe, Ávila) on the northern Meseta as well (Guerra et al. 2012; 2015). But even older proof for the cultivation of wheat was documented on the southern Meseta in the site of Los Barruecos (Malpartida de Cáceres, Cáceres), which dates to the late 6th mill. BC (Cerrillo 2005). This is in contradiction with earlier assumptions that this branch of economy slowly derived from the Mediterranean coastal areas several centuries after the start of the Neolithic. Apparently, agriculture and forestry played an important role from the beginning of the Neolithic onward. This is reflected in the use of acorns all over the Iberian Peninsula, including the sites of Azután and Castillejo, where they were ground into flour and mixed with other food (Bueno Ramírez et al. 2002; 2010, 157 f.).

The results of the analyses of phytoliths and residues in ceramic vessels are supported by palynological data, too. The analysed samples from the dolmen of Azután and the burials of Huecas point to landscape clearance and expanding agriculture. Both cereal (*Cerealia*) pollen and the spurs of coprophilic funguses point to the availability of grassland for cattle feeding and breeding and enough open spaces for the cultivation of wheat (López et al. 2009, 95–97). Additionally, palynological analyses of the time period between 4000 and 2500 BC show clear evidence pointing to deforestation. The once dense holm oak (*Quercus ilex*) forest cover is transformed to a landscape described as *dehesa*-like. The holm oaks ranges at not more than approximately 15% of all vegetation (López et al. 2009, 94 f.). The growing number of juniper and oak pollen as well as the presence of acorns in archaeological contexts illustrates the beginning of the *dehesa* economy (Bueno Ramírez et al. 2005b, 86–88; 2005c, 84–86). Also the increase of pollen of shrubs and bushes together with domesticated animals is evidence for a rather sedentary farming, cattle-breeding economy and the *dehesa* landscape (Liesau 2009; López et al. 2009, 96 f.; Bueno Ramírez et al. 2009, 54 f.; López/López 2000).

The land use in the form of agriculture, cattle breeding and forestry forms the most important resource complex of the Neolithic and Chalcolithic period. Thus, together with communication/mobility and connection Azután was fully integrated in the community of the 4th and 3rd mill. BC. New analyses of phytoliths and residues from the excavation of 2015 will surely confirm the results mentioned above.

Conclusion

As stated above the archaeological landscape of Azután reveals impressive new evidence for the Later Prehistory of Central Iberia. Areas that were regarded as almost 'deserted' in the 4th and 3rd mill. BC can now be filled with history. It is obvious that earlier theories were based on patchy and limited research and do not reflect the prehistoric reality as shown by the systematic fieldwork presented here. The architectural variability, the chronology, the types of ritual and the quantity of hypogea in the Valle de las Higueras (Huecas, Toledo) already pointed to social structures of similar dimensions as those found in Andalucía and the south-west (Bueno Ramírez et al. 2016). El Prado is the only large ditched enclosure so far known in Central Iberia and also shows similarities with sites located more than 200km to the south-west. As discussed above, a certain degree of landscape organisation can be seen (Schmitt et al. in print). It seems that the Anguilucha Creek separated the valley of the municipality of Azután into an area of the living and an area of the dead. To the east where the sun rises the monument of El Prado with its diverse negative structures defines a regularly visited place (numerous pits) where people gathered, communicated and may have exchanged goods, maybe even over long distances. To the west of the creek where the sun sets the enclosures Los Viñones, Los Pedazos and the dolmen may have created spaces connected to the funerary ritual. Maybe this division can be found in other sites of the same period but further studies in Azután will be needed to strengthen or weaken this first idea.

An interaction between the valley and the western part of the Montes de Toledo can be assumed. Along the *Cañada Real Leonesa Oriental* – from south to north – copper mining sites can be found in the hills, the places of the ancestors in the hills and the foothills have to be passed to enter the *dehesa*-like landscape of the valley. The contemporaneity of these sites can only be assumed but fertile soil, water supply, abundant copper and gold resources as well as clay, stone and silex sources covered the basic needs of the settlement. Megalithic burials, as known from the Extremadura, and enclosures, as known from the Alentejo, point to supra-regional contacts.

The next step will be the comparison of the results of the field campaigns of Azután with other archaeological landscapes of the Iberian Peninsula as far as possible within the limited size of and time for the excavation. Clearly, the west of the province of Toledo has such potential for prehistoric research that cannot be covered by a PhD study alone. Sustained projects would be desirable to gain more insight into this impressive landscape.

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Bibliography

Andreae 1977: B. Andreae, Agrargeographie. Strukturzonen und Betriebsformen in der Weltlandwirtschaft (Berlin 1977).

Balsera et al. 2015: V. Balsera/J. Bernabeu/M. Costa/P. Díaz-del-Rio/L. García Sanjuán/S. Pardo, The Radiocarbon Chronology of Southern Spain's Late Prehistory (5600–1000 cal BC). A Comparative Review. Oxford Journal of Archaeology 34.2, 2015, 135–156.

Barroso Bermejo et al. 2003: R. Barroso Bermejo/P. Bueno Ramírez/R. de Balbín Behrmann, Primeras producciones metálicas en la cuenca interior del Tajo. Cáceres y Toledo. Estudos Pré-históricos 10, 2003, 87–107.

Barroso Bermejo et al. 2014: R. Barroso Bermejo/P. Bueno Ramírez/R. de Balbín Behrmann/A. Vazquez/A. González, Nekropolen des 3. Jahrtausends v. Chr. Im Zentrum der Iberischen Halbinsel. Madrider Mitteilungen 55, 2014, 1–28.

Bartelheim 2016: M. Bartelheim, A 02. Many Ores and Little Water. Sociocultural Change in Connection with the Use of Resources in the Later Prehistory of the Iberian Peninsula, last updated 05.05.2016, <http://www.uni-tuebingen.de/en/research/core-research/collaborative-research-centers/sfb-1070/projects/project-division-a-developments/project-a-02.html> (last access 06.07.2016).

Bartelheim/Montero-Ruiz 2009: M. Bartelheim/I. Montero-Ruiz, Many Ores and Little Water. The Use of Resources on the Iberian Peninsula During the Bronze Age. In: M. Bartelheim/H. Stäuble (eds.), The Economic Foundations of the European Bronze Age. Forschungen zur Archäometrie und Altertumswissenschaft 4 (Rhaden/Westf. 2009) 5–22.

Benítez et al. 2009: L. Benítez/P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann/J. A. López (eds.), Arqueología, Medio Ambiente y Obras Públicas. El Valle de Huecas (Huecas, Toledo) (Ciudad Real 2009).

Bueno Ramírez 1988: P. Bueno Ramírez, Los Dólmenes de Valencia de Alcántara. Excavaciones Arqueológicas en España 155 (Madrid 1988).

Bueno Ramírez 1991: P. Bueno Ramírez, Megalitos en la Meseta Sur. Los Dolmenes de Azután y La Estrella (Toledo). Excavaciones Arqueológicas en España 159 (Madrid 1991).

Bueno Ramírez et al. 2002: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann/M. Campo/F. Etxeberría/A. González/L. Herraste/J. Juan/P. López/J. A. López/B. Sánchez, Áreas habitacionales y funerarias en el Neolítico de lacuenca interior del Tajo. La provincia de Toledo. Trabajos de Prehistoria 59.2, 2002, 65–79.

Bueno Ramírez et al. 2004: P. Bueno Ramírez/R. de Balbín Behrmann/R. Barroso Bermejo, Application d'une méthode d'analyse du territoire à partir de la situation des marqueurs graphiques à l'intérieur de la Péninsule Ibérique. Le Tage International. L'anthropologie 108, 2004, 653–710.

Bueno Ramírez et al. 2005a: P. Bueno Ramírez/R. de Balbín Behrmann/R. Barroso Bermejo, El dolmen de Azután (Toledo). Áreas de habitación y áreas funerarias en la cuenca interior del Tajo (Alcalá de Henares 2005).

Bueno Ramírez et al. 2005b: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann/M. Campo/A. González/F. Etxeberria/L. Herrasti/V. Galván/J. Juan Tresserras/J. A. López/P. López/J. C. Matamala/J. J. Millos/B. Robledo/G. Trancho/B. Sánchez, Alimentación y economía en contextos habitacionales y funerarios del Neolítico meseteño. In: R. Ontañón Peredo/C. García Moncó Piñeiro/P. Arias Cabal (eds.), Actas del III Congreso del Neolítico en la Península Ibérica. Santander, 5 a 8 de octubre de 2003 (Santander 2005) 83–92.

Bueno Ramírez et al. 2005c: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Ritual campaniforme, ritual colectivo. La necrópolis de cuevas artificiales del Valle de las Higueras, Huecas, Toledo. Trabajos de Prehistoria 62.2, 2005, 67–90.

Bueno Ramírez et al. 2009: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Agricultores y metalúrgicos en el Valle de Huecas (Toledo). In: L. Benítez/P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann/J. A. López (eds.), Arqueología, Medio Ambiente y Obras Públicas. El Valle de Huecas (Huecas, Toledo) (Ciudad Real 2009) 33–72.

Bueno Ramírez et al. 2010: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Megalitos en la cuenca interior del Tajo. MUNIBE 32, 2010, 152–187.

Bueno Ramírez et al. 2011: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Entre lo visible y lo invisible. Registros funerarios de la Prehistoria reciente de la Meseta Sur. In: P. Bueno Ramírez/A. Gilman/C. Martín/F. J. Sánchez (eds.), Arqueología, sociedad, territorio y paisaje. Estudios sobre prehistoria reciente, protohistoria y transición al mundo romano en homenaje a Mª Dolores Fernández Posse. Biblioteca Praehistórica hispana 28 (Madrid 2011) 53–73.

Bueno Ramírez et al. 2012: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Les grottes artificielles et le Campaniformes à l'intérieur de la péninsule ibérique. La nécropole de Valle de las Higueras. In: M. Sohn/J. Vaquer (eds.), Sépultures collectives et mobiliers funéraires de la fin du Néolithique en Europe occidentale. Archives d'Écologie Préhistorique (Toulouse 2012) 359–381.

Bueno Ramírez et al. 2013: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Interior Regions and Places of Collective Memory. The Megalithism of the Interior Basin of the Tagus, Iberian Peninsula. A Reflection After Reading the Tara Project. In: M. O'Sullivan/C. Scarre/M. Doyle (eds.), Tara – From the Past to the Future. Towards a New Research Agenda (Dublin 2013) 484–502.

Bueno Ramírez et al. 2016: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Between East and West. Megaliths in the Centre of the Iberian Peninsula. In: L. Laporte/C. Scarre (eds.), The Megalithic Architectures of Europe (Oxford 2016) 157–166.

Calado 2007: M. Calado, Re-Creating the Past, last updated 24.01.2007, <http://megasettlements.blogspot.de/2007/01/re-creating-past_24.html> (last access 22.08.2016).

Calado/Rocha 2007: M. Calado/L. Rocha, As primeiras sociedades camponesas no Alentejo Central. A evoluçao do povoamento. In: E. Cerillo/J. Valadés (eds.), Los primeros campesinos de La Raya. Aportaciones recientes al conocimiento del neolítico y calcolítico en Extremadura y Alentejo. Actas de las Jornadas de Arqueología del Museo de Cáceres. Memorias 6 (Cáceres 2007) 29–46.

Carrobles/Méndez Cabeza 1991: J. Carrobles/M. Méndez Cabeza, Introducción al estudio del Calcolítico en la Jara toledana. Anales toledanos 28, 1991, 7–23.

Castro et al. 1996: P. V. Castro/V. Lull/R. Mico, Cronología de la prehistoria reciente de la Península Ibérica y Baleares (c. 2800–900 cal ANE). British Archaeological Reports. International Series 652 (Oxford 1996).

Cerrillo 2005: E. Cerrillo, Los primeros grupos neolíticos de la cuenca extremeña del Tajo. British Archaeological Reports. International Series 1393 (Oxford 2005).

Chapman 2008: R. Chapman, Producing Inequalities. Regional Sequences in Later Prehistoric Southern Spain. Journal of World Prehistory 21, 2008, 195–260.

Costa et al. 2011: M. E. Costa/L. García/M. Murillo Barroso/R. Parrilla/D. W. Wheatley, Artefactos elaborados en rocas raras en los contextos funerarios del IV–II milenios cal ANE en el sur de España. Una revisión. Menga. Revista de Prehistoria de Andalucía 1, 2011, 253–293.

Delibes de Castro/Montero-Ruiz 1999: G. Delibes de Castro/I. Montero-Ruiz (eds.), Las primeras etapas metalúrgicas en la Península Ibérica. 2. Estudios regionales (Madrid 1999).

Delibes de Castro et al. 2014: G. Delibes de Castro/M. García/J. del Olmo/J. Santiago (eds.), Recintos de fosos calcolíticos del Valle Medio del Duero. Arqueología aérea y espacial. Studia Archaeologica 100 (Valladolid 2014).

Díaz-del-Río 2003: P. Díaz-del-Río, Recintos de fosos del III milenio AC en la Meseta Peninsular. Trabajos de Prehistoria 60.2, 2003, 61–78.

ENADISMA 1972: ENADISMA, Instituto Geológico y Minero de España, Mapas de rocas industriales, E. 1:200.000. Talavera de la Reina. Hoja 4–7 y memoria 52 (Madrid 1972).

Galán/Martín 2009: E. Galán/A. M. Martín, Megalitismo y zonas de paso en la cuenca extremeña del Tajo. Zephyrus 44, 2009, 193–205.

García 2011: M. García, La Ocupación del Valle del Duero en la prehistoria reciente. Los recintos de fosos. In: V. Mayoral/S. Celestino (eds.), Tecnologías de información geográfica y análisis arqueológico del territorio. Actas del V Simposio Internacional de Arqueología de Mérida. Anejos de Archivo Español de Arqueología LIX (Mérida 2011) 161–166.

García 2015: M. García, Poblamiento y sociedad en el valle medio del Duero durante la Edad de los Metales (ca. 2800–450 cal. ANE). Un estudio de arqueología del paisaje (Valladolid 2015).

Guerra et al. 2012: E. Guerra/P. J. Cruz/J. F. Fabían/P. Zapatero/S. López, El marco cronológico de la neolitización en el sector suroccidental de la submeseta norte española. Dataciones absolutas del yacimiento de La Atalaya (Muñopepe, Ávila). In: M. Borrell/F. Borrell/J. Bosch/X. Clop/M. Molist (eds.), Redes en el Neolítico. Circulación e Intercambio de Materias, Productos e Ideas en el Mediterráneo Occidental (VII–III milenio aC) (Gavá, Bellaterra, 2–4 de Febrero de 2011) (Gava 2012) 517–523.

Guerra et al. 2015: E. Guerra/P. J. Cruz/J. F. Fabían/P. Zapatero/S. López, Reflexiones sobre los inicios del Neolítico en el SO de la Submeseta Norte española a partir de los documentos de La Atalaya (Muñopepe, Ávila). In: V. Gonçalves/M. Diniz/A. N. Sousa (eds.), Actas do 5 Congresso do Neolítico Peninsular (Universidade de Lisboa, 7–9 Abril 2011) (Lisboa 2015) 323–331.

Hurtado Pérez 1991: V. Hurtado Pérez, Informe de las excavaciones de urgencia en "La Pijotilla". Campaña de 1990. Extremadura Arqueológica 2, 1991, 45–67.

Hurtado Pérez 1995: V. Hurtado Pérez, Interpretación sobre la dinámica cultural en la cuenca media del Guadiana (IV–II milenios A.N.E). Extremadura Arqueológica 5, 1995, 53–80.

Hurtado Pérez 1999: V. Hurtado Pérez, Los inicios de la complejización social y el campaniforme en Extremadura. SPAL 8, 1999, 47–83.

Hurtado Pérez 2008: V. Hurtado Pérez, Los recintos con fosos en la Cuenca Media del Guadiana. ERA-Arqueologia 8, 2008, 182–197.

Hurtado Pérez/Hunt 1999: V. Hurtado Pérez/M. Hunt, Extremadura. In: G. Delibes de Castro/I. Montero-Ruiz (eds.), Las primeras etapas metalúrgicas en la Península Ibérica. II estudios regionales (Madrid 1999) 241–274.

Liesau 2009: C. Liesau, Ganadería y caza entre los primeros habitantes del Valle de Huecas. In: L. Benítez/P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann/J. A. López (eds.), Arqueología, Medio Ambiente y Obras Públicas. El Valle de Huecas (Huecas, Toledo) (Ciudad Real 2009) 109–116.

López/López 2000: P. López/J. A. López, Análisis polínico del Dolmen de Azután. Revista Española de Micropaleontología 32.1, 2000, 107–114.

López et al. 2009: J. A. López/L. López/S. Pérez, Historia de la vegetación y paleoambiente del Valle de Huecas. In: L. Benítez/P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann/J. A. López (eds.), Arqueología, Medio Ambiente y Obras Públicas. El Valle de Huecas (Huecas, Toledo) (Ciudad Real 2009) 89–108.

Márquez/Jiménez 2010: J. E. Márquez/V. Jiménez, Recintos de Fosos. Genealogía y significado de una tradición en la Prehistoria suroeste de la Península Ibérica (IV–III milenios AC) (Málaga 2010).

Montero-Ruiz et al. 1990: I. Montero-Ruiz/S. Rodríguez/J. M. Rojas, Arqueometalurgia de la Provincia de Toledo. Minería y recursos minerales de cobre (Toledo 1990).

Murrieta-Flores 2012: P. Murrieta-Flores, Understanding Human Movement through Spatial Technologies. The Role of Natural Areas of Transit in the Late Prehistory of South-Western Iberia. Trabajos de Prehistoria 69.1, 2012, 103–122.

Odriozola et al. 2008: C. P. Odriozola/V. Hurtdao/M. I. Dias/M. I. Prudêncio, Datación por técnicas luminiscentes de la tumba 3 y el conjunto campaniforme de La Pijotilla (Badajoz, España). In: S. Rovira/M. García Heras/M. Gener/I. Montero-Ruiz (eds.), VII congreso ibérico de arqueometría. Madrid, 8–10 de octubre 2007 (Madrid 2008) 211–225.

Pacheco/Pérez 2007: C. Pacheco/R. Pérez, Memoria de Aldeanueva de San Bartolomé (Toledo 2007) (Unpublished).

Polvorinos et al. 2002: A. Polvorinos/V. Hurtado Pérez/M. J. Hernandez/J. Almarza,Arqueometría de cerámicas de la tumba 3 del yacimiento calcolítico de La Pijotilla (Badajoz). In: IV Congreso Nacional de Arqueometría. Valencia, del 15 al 17 de octubre 2001 (Valencia 2002) 1–8.

Reimer et al. 2013: P. J. Reimer/E. Bard/A. Bayliss/J. W. Beck/P. G. Blackwell/C. B. Ramsey/C. E. Buck/H. Cheng/R. L. Edwards/M. Friedrich/P. M. Grootes/T. P. Guilderson/H. Haflidason/I. Hajdas/C. Hatté/T. J. Heaton/D. L. Hoffmann/A. G. Hogg/K. A. Hughen/K. F. Kaiser/B. Kromer/S. W. Manning/M. Niu/R. W. Reimer/D. A. Richards/E. M. Scott/J. R. Southon/R. A. Staff/C. S. M. Turney/J. van der Plicht, IntCal13 and MARINE13 Radiocarbon Age Calibration Curves 0–50,000 years calBP. Radiocarbon 55.4, 2013, 1869–1887.

Schmitt in print: F. Schmitt, Nouvelles recherches dans la microrégion d'Azután (Tolède, Espagne) en 2014 et 2015. L'enceinte à fossé 'El Prado' dans la moyenne vallée du Tage. Deuxièmes Rencontres Nord-Sud de Préhistoire Récente Dijon 19–21 novembre 2015 «Habitations et habitat du Néolithique à l'âge du Bronze en France et ses marges» (Dijon in print).

Schmitt et al. in print: F. Schmitt/P. Bueno Ramírez/M. Bartelheim, Just Passing By? Investigating in the Territory of the Megalith Builders of the Southern European Plains. The Case of Azután, Toledo. In: Megalith. Societies. Landscapes. Early Monumentality and Social Differentiation in Neolithic Europe. Conference in Kiel, 16.–20.06.2015 (Kiel in print).

Valera 2012a: A. C. Valera, Fossos sinuosos na Pré-História Recente do Sul de Portugal. Ensaio de análise crítica. In: M. De Deus (ed.) Actas do V Encontro de Arqueologia do Sudoeste Peninsular (Almodôvar 2012) 25–38.

Valera 2012b: A. Valera, 0072 – Águas Frias Ditched Enclosure, last update 17.01.2012, <http://portugueseenclosures.blogspot.de/2012/01/0072-aguas-frias-ditched-enclosure.html> (last access 08.08.2016).

Valera 2013: A. C. Valera, Recintos de fossos da Pré-História Recente em Portugal. Investigação, discursos, salvaguarda e divulgação. Almadan Segunda Série 18, 2013, 93–110.

Valera et al. 2013: A. C. Valera/H. Becker/R. Boaventura, Moreiros 2 (Arronches, Portalegre). Geofisica e cronología dos recintos interiores. Apontamentos de Arqueologia e Património 9, 2013, 37–46.

Valera et al. 2014: A. C. Valera/A. M. Silva/J. E. Márquez, The Temporality of Perdigões Enclosures. Absolute Chronology of Structures and Social Practices. SPAL 23, 2014, 11–26.

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Late Prehistory Body Ornaments
Exchange and Social Dynamics in the Middle Tagus Basin

Keywords: variscite, bead, XRF, XRD, Madrid, Tagus

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1. Introduction

Prehistoric greenstone body ornamentation has long been a topic of research in Iberia. Nevertheless, the geographical distribution and density of such objects has remained unknown until recent years. One of the earliest published maps of their distribution (Muñoz Amilibia 1965, fig. 104) was restricted to the southwest and southeast settlements and tombs, the Basque megaliths in the north and the northeastern pit-graves.

Since then, research has intensified in most regions: the north-west (Guitián Rivera/Vázquez-Varela 1975; Fábregas Valcarce 1991, 100), North Meseta (Campano Lorenzo et al. 1985; Villalobos García/Odriozola 2016), Guadiana (Odriozola et al. 2010), Ebro (Villalba et al. 1998) and Guadalquivir Basins (Odriozola/García Sanjuán 2012) and, more recently, La Mancha (Odriozola et al. 2016b).

In this paper, stone body ornamentation in the middle Tagus Basin will be approached through the study of bead production variability at 4th to 2nd mill. BC sites. We particularly focus on the spatial variability of raw materials and their chronological and contextual patterning.

Samples were recovered from the following sites: Dolmen del Portillo de las Cortes (Aguilar de Anguita, Guadalajara), El Rebollosillo (Torrelaguna, Madrid), Humanejos (Parla, Madrid), El Espinillo (Villaverde, Madrid), El Capricho (Barajas, Madrid), and La Veredilla (Illescas, Toledo). Greenstone body ornaments have been reported in other sites in the Tagus Basin, such as Dolmen de Entretérminos (Madrid), Valle de las Higueras (Huecas, Toledo), Camino de Yeseras (San Fernando de Henares, Madrid), Soto de Henares (Torrejón de Ardoz, Madrid), Las Vegas de Samburiel (El Bolao, Madrid) and La Cueva de La Ventana (Torrelaguna, Madrid). Together, they allow a first in-depth regional approach to the quality, quantity and context of individual body ornaments in the central Tagus Basin.

1.1. Mineralogical Diversity and Chronological Ordering

To date, most papers devoted to body ornamentation continue to use 'calaite' and variscite as synonyms. However, the increase in geochemical analyses of green mineral sources has been paralleled by an increase in the number of analyses of 'calaite' beads, and thus in the knowledge of the exact minerals used in beadmaking. Beads have been found to include green mica, steatite, turquoise, talc, chlorite, etc. (Villalba et al. 2001). As the number of analysed beads increases, it is becoming apparent that Neolithic, Copper Age, and Bronze Age communities used nearly any available green mineral for beadmaking.

Jiménez Gómez (1995) analysed the evolution of variscite consumption patterns at Zambujal (Torres Vedras, Central Portugal). She concluded that the variety of greenstone raw material decreased over time, with variscite the main stone throughout the first half of the 3rd mill. BC. Villalobos García (2012) recognised a similar pattern when analysing the Spanish North Meseta.

Recently, Odriozola et al. (2016a) have proposed that the initial process of discovery, production and network exchange of variscite in Iberia occurred coevally with the widest spread of green alpine jade axes around Western Europe approx. 4500 BC (Petrequin et al. 2006). From 4500 BC onwards, mainly in the 4th and first half of the 3rd mill. BC, variscite mining increased greatly (Blasco et al. 1992; Villalobos García/Odriozola 2016) and variscite products became generalised at archaeological sites in the Iberian Peninsula (Blasco et al. 1997; Bueno Ramírez et al. 2005; Costa Caramé et al. 2011; Gonçalves/Reis 1982; Guitián Rivera/Vázquez Varela 1975; Villalobos García 2012). Therefore, the use of variscite beads became extremely popular; achieving a time of maximum distribution and use during the first half of the 3rd mill. BC, whereas the use of other green stones became rare and from approx. 2500 BC onwards variscite and greenstone use began to decline. This coincides with an increased presence of copper-based metals (Murillo-Barroso/Montero Ruiz 2012), and of artefacts made from raw materials from outside the Iberian Peninsula, such as Asian and African Ivory (Schuhmacher 2012; Schuhmacher et al. 2009) or Baltic and Sicilian amber (Murillo-Barroso/Martinón Torres 2012).

Despite the lack of systematic data, a general pattern on greenstone consumption can be drafted from the available information. It seems that a plethora of green minerals used during the Neolithic were substituted by green variscite-like minerals during the Copper Age (Jiménez Gómez 1995; Odriozola et al. 2016a; Villalobos García 2012). Therefore, raw material choice variability offers an interesting and new avenue to study interaction and the dynamics of socioeconomic change in the Neolithic-Copper Age transition.

Preliminary research suggests that green stones used for bead production changed through time, with an important variability in their quantity between sites and/or regions. Beads and pendants made out of green variscite-like minerals are more likely to be found in the Neolithic near the source, e.g. on the Catalan coast and in inland Catalonia. Green variscite-like mineral body ornaments are very likely to be found next to rivers during the Late Neolithic, when Can Tintorer was still in use (5th mill. to the third quarter of the 4th mill. BC), but other green minerals are unlikely to be found.

1.2. The Sites

The analysed sample has been mainly recovered from funerary contexts: the Entretérminos (Losada 1976) and Portillo de las Cortes (Osuna Ruiz 1975; Bueno Ramírez et al. 2016) dolmens, the collective burial of El Rebollosillo (Díaz del Rio 1996; 2001), the artificial caves of Valle de las Higueras (Bueno Ramírez et al. 2005; 2010; 2012), the pit graves of La Veredilla (unpublished) and Vegas de Samburiel (Jiménez Guijarro 2008), the burial cave of La Cueva de la Ventana (Jiménez Guijarro 2008), and burials from the sites of Camino de las Yeseras (Liesau 2008) and Humanejos (Flores 2011). The only beads from domestic contexts were recovered at El Espinillo (Baquedano et al. 2000), El Capricho (Díaz-del-Río 2001) and Soto de Henares (Galindo Sanjosé/Sánchez Sánchez-Moreno 2006) (*fig. 1*).

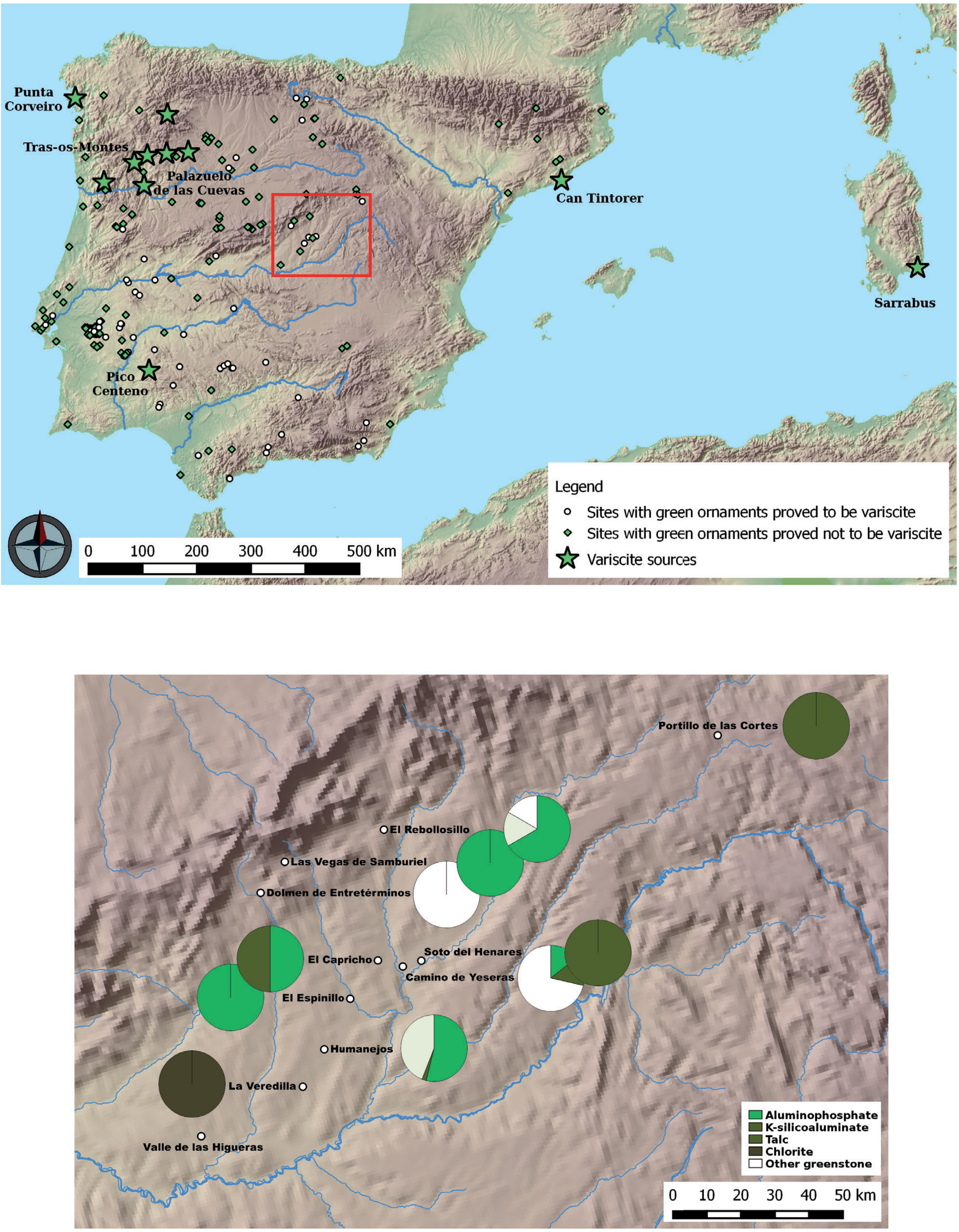

Fig. 1. Distribution map of Iberian variscite sources, studied sites and all the sites with beads demonstrated to be made out of variscite by means of XRD or XRF. Elaborated from our own database (R+D project HAR2012–34620) and published data (Domínguez Bella 2010; Domínguez Bella/Bóveda 2011; Edo i Benaiges et al. 1997; Pozo et al. 2002; Ríos Mendoza/Liesau 2011; Vijande Vila et al. 2015).

Chronologically, the only Neolithic sample comes from Portillo de las Cortes dolmen. This megalithic burial stands on the southern slope of the central mountains that link with the Iberian System. Initially excavated in the early 20th cent. by the Marqués of Cerralbo, in a process photographed by Juan Cabré, it was later re-excavated in the 1970s by Manuel Osuna Ruiz (Osuna Ruiz 1975; Delibes de Castro 2004), and more recently by Bueno Ramírez et al. (2016).

It is a classic corridor tomb, with a 3m diameter chamber and an 8m long corridor oriented southeast. A total of 35 individuals were recorded in both areas, together with characteristic Late Neolithic grave goods such as polished axes, microliths and blades.

Individual 24 stands out as having a substantially wealthier set of grave goods, including for example several polished axes and knapped flint utensils, two stone pendants (probably of a pectoral), a San Martin-El Miradero idol-type spatula, and the only green bead (40/27/PC-93) recovered throughout the excavation.

In addition to Skeleton 24's bead, in the National Archaeological Museum (MAN) in Madrid (Bueno Ramírez et al. 2016) a set of twelve beads in the Marqués of Cerralbo collection is labelled as coming from El Portillo, with no further details of their provenance (MC27300–5847 and 5842).

Marqués of Cerralbo performed several excavations in the surroundings of the El Portillo de las Cortes dolmen. It is likely that the materials from these excavations were deposited in the MAN with the Portillo de las Cortes materials and therefore labelled as pertaining to this dolmen. La Mestilla – Abadón necropolis was also excavated by Cerralbo. This site yielded Bell Beaker vessels, which makes it a plausible origin for the twelve beads labelled El Portillo, but unfortunately we cannot confirm this hypothesis.

For the Copper Age, roughly speaking the 3rd mill. BC, we have a more generous sample of body ornamentation.

El Capricho (Barajas, Madrid) has yielded materials of several chronologies from Recent Prehistory to Roman times. However, a small archaeological excavation was able to record an almost complete Copper Age dwelling (Díaz-del-Río 2001, 173–183). This was constructed as a circular dwelling bounded by a ditch, inside which storage structures and various agricultural tools and domestic implements were retrieved. The only green bead found in the excavation appeared outside the dwelling.

El Espinillo (Villaverde, Madrid) is located next to Euskalduna Factory site. Here abundant Copper and Bronze Age materials were recorded within structures such as a wide variety of pits, a probable ditch, semi-sunken dwellings and postholes (Baquedano et al. 2000; Díaz-del-Río 2001, 212–229). Only one green bead was recovered.

Humanejos (Parla, Madrid) has yielded Prehistoric, Roman and Medieval materials. Recent excavations have recorded over 1,500 Copper Age structures, including holes, dwellings, burials, ditches, etc. (Flores 2011). In terms of personal body ornamentation, two aluminosilicate beads associated with a young female have been published (Liesau/Blasco Bosqued 2011; Ríos Mendoza/Liesau 2011; Liesau/Blasco Bosqued 2015).

The contexts and materials described below are still unpublished. Despite the numerous prehistoric tombs recorded, only one of them has been dated absolutely. However, grave goods undoubtedly situate most of them in the 3rd mill. BC.

Structure 793 (1–5–6) is a pit grave of ca. 2m diameter containing 4 individuals that were buried with bone and copper awls, and eleven beads. Of these beads, nine were green, six of which were found around Individual 7931's neck (sex undetermined, 35–40 years old) and two around Individual 7935.

Structure 826 (1) is a pit grave of ca. 2m diameter with 2 individuals (no anthropological study), ceramic and metal artefacts and a total of 61 greenstones. Of these, 45 were around the neck and chest of one of the buried individuals, and the rest (16) were scattered across the rest of the grave, suggesting that they may be part of a single set.

Structure 1701 (3) is a pit grave of ca. 2.6m diameter containing a 20-year-old female adult and an undetermined young adult buried on top of a previous poorly-preserved burial and four ceramic bowls, one knife, three awls and 63 beads. Individual 1701 (2) has been radiocarbon dated to the first quarter of the 2nd mill. BC (Ua 40220: 5216±34 BP). Additionally, a piece of charcoal was radiocarbon dated to the last quarter of the 3rd mill. BC (Ua 40222: 3800±42 BP).

Structure 1075 (3) is a pit grave of ca. 2m diameter with a six or seven-year-old individual and four greenstone beads.

Structure 1166 is a pit grave of ca. 2m diameter holding four individuals (1166 [1] undetermined sex, seven years old; 1166 [2] undetermined sex, 18 months old; 1166 [3] undetermined sex, four years old; and 1166 [4] an 18 to 20-year-old female) and a total of 19 beads accompanied by pottery vessels, and metal elements. 17 beads appeared near Individual 1166 (3)'s neck and arm. This structure has been dated to the second third of the 3rd mill. BC (Gómez Pérez et al. 2011).

El Rebollosillo (Torrelaguna, Madrid) is a burial cave in Torrelaguna (Madrid), in the southern foothills of the Central System. Archaeological work recovered twenty individuals, dating to the mid-3rd mill. calBC. Among the grave goods were six beads; four green and two black (Díaz-del-Río 1996; 2001, 145 f.).

Entretérminos dolmen (Madrid). The analysed bead was unearthed from this dolmen by the Marqués de Loriana (1942) when the dolmen had already been plundered. The publication of the grave goods by Losada (1976) (Bell Beaker and copper based items) clearly dates the finds in the 3rd mill. BC.

Soto del Henares (Torrejón de Ardoz, Madrid), is a settlement in the fertile agricultural plains of the Henares River. Rescue excavations unearthed several dwellings from which a single bead was recovered and analysed (unpublished report Galindo Sanjosé/Sánchez Sánchez-Moreno 2006). During archaeological work, a pit with five individuals was found, covered by a tumulus. One of these individuals was radiocarbon dated to 4075±35BP (Blasco Bosqued et al. 2014). Although the analysed bead was recovered in the settlement area and not in the dated burial, it is consistent with that of other settlements in the area, and may likely be ascribed to the use of the settlement.

Valle de las Higueras (Huecas, Toledo), is the first artificial cave necropolis recorded in inland Iberia (Bueno Ramírez et al. 2000). The systematic work performed at this necropolis has recorded ten structures (Bueno Ramírez et al. 2011; Barroso Bermejo et al. 2014). It allowed the reconstruction of feasting and Bell Beaker rituals associated with the burials, the synchronicity between burials and Bell Beakers and non-decorated ceramics, and the different uses of these funerary spaces and the role that outstanding items, such as beads, played in social action. The necropolis has been systematically radiocarbon dated (Bueno Ramírez et al. 2005; Barroso Bermejo et al. 2014). Domínguez Bella (2010) analysed three beads from Cave 3 that were made of variscite and clinochlore. The remaining approx. 200 beads are still being studied.

La Veredilla (Illescas, Toledo) is further evidence of the intense colonisation of the agricultural plains of the Tagus Basin. Excavations have revealed several domestic structures and a burial pit where the studied beads were unearthed.

Camino de las Yeseras (San Fernando de Henares, Madrid), is a prehistoric ditched enclosure of approx. 3ha (Vega/Menduiña, 2011, 7) on a riverine terrace between the Jarama and the Henares rivers (Blasco Bosqued et al. 2007; Liesau et al. 2008). Chronologically, the site ranges between 2800/2700 BC and the Bronze Age (Ríos Mendoza 2011). Camino de las Yeseras necropolis includes tombs with and without Bell Beaker pottery, but has only yielded three green beads and a plaque. This is a small number if compared with Valle de las Higueras (Bueno Ramírez et al. 2005) or other neighbouring regions, such as the Northern Meseta (Delibes de Castro 1988; Fabián García 2006) or the Portuguese Estremadura (Odriozola et al. 2013a, 2013b).

All the three beads and the plaque from Camino de las Yeseras were recorded in the central area of the site and are associated with dates approx. in the mid 3rd mill. BC (Ríos/Liesau 2011, 264). Scanning electron microscopy (SEM), compositional analysis by inductively coupled plasma mass spectrometry (ICP-MS) and x-ray diffraction (XRD) have shown that these four items were shaped from some sort of silicoaluminate (two beads) and variscite (one bead and the plaque). Ríos Mendoza/Liesau (2011, 358–364) state that the variscite bead would be from the Pico Centeno mines and the plaque from Can Tintorer. Additionally, ten white calcium carbonate beads were also recorded (Ríos Mendoza/Liesau 2011, 358–364).

Las Vegas de Samburiel (El Bolao, Madrid) is a tumulus that has been partially excavated. Below the tumulus, a hearth and a pit were recorded. Bell Beaker pottery (international and continental styles), a bone spatula, and a green bead were found (Jiménez Guijarro 2008). SEM analysis of the bead showed it was made out of aluminophosphate (García de Miguel et al. 2005).

La Cueva de la Ventana (Torrelaguna, Madrid) has provided Prehistoric, Roman and Medieval materials. Bone and shell (*Trivia*) beads and pendants, and white and black beads were found in the Neolithic levels in the cave. *Trivia* and black and white beads were recorded in the Neolithic II level, 4300–3800 BC (Jiménez Guijarro 2010). However, no greenstone beads were recorded in the stratigraphy at the site. SEM analysis showed the beads were made out of fossil wood (black beads) and calcium carbonate (white beads) (García de Miguel et al. 2005).

2. Methodology

Beads, pendants and charms were analysed in order to approach bead mineralogical variability, spatial distribution and chronological layering within the Tagus Basin (formerly Spanish Central Plateau).

The mineralogical identifications of beads in this paper (183 samples from six different sites in the Tagus Basin) are based on the chemical composition measured by an Oxford Instrument XMET-7500[1] portable energy dispersive x-ray spectrometer (EDX) with an Rh tube, a silicon drift detector (SDD), and an automatic 5-position filter changer. Quantification was obtained with the SOILS-LE program.

The most common green stones shaped into beads in prehistoric Iberia are variscite, mica, talc-steatite, chlorite and serpentine. The mineralogical classification of beads by means of portable analytical devices is not a straightforward task and deserves a full-length paper in its own right. However, aluminophosphate identification is an almost straightforward task based on Al-to-P atomic ratios. Virtually whenever an Al-to-P atomic ratio is detected in the compositional range of variscite ([$MPO_4 \cdot 2H_2O$], where M = Al^{3+}, Fe^{3+}, Cr^{3+}, V^{3+} [Larsen 1942a], from ca. 0.8 to 1.8 [see Odriozola et al. 2010; Odriozola 2015]), x-ray diffraction confirms that the analysed sample, either geological or a bead, contains variscite as its main crystallographic phase. Thus, here we use the P-to-Al atomic ratio as an indicator to determine variscite as the raw material of beads. Nevertheless, turquoise, crandallite or aheylite may occur separately or as minor crystallographic phases together with variscite (Larsen 1942a). In these cases, Al-to-P atomic ratios together with Ca, Cu and Fe values are taken into account to differentiate between minerals.

A much more complicated task is that of differentiating green stones formed by sheet silicates (micas, talc-steatite, chlorite or serpentine). Micas have a Si-to-Al ratio that ranges from 1.2–3 depending on the type of mica: muscovite [$KAl_2[OH,F]_2AlSi_3O_{10}$], biotite [$K[Mg,Fe]_3[OH,F]_2AlSi_3O_{10}$] and phlogopite [$KMg_3[OH,F]_2AlSi_3O_{10}$]) have K and a variable amount of M^{+2} substitutions (Mg,Fe) (Deer et al. 1992; Roberts et al. 1990). Chlorites [$A_{4\text{-}6}Z_4O_{10}(OH)_8$, where A = Al, Fe^{2+}, Fe^{3+}, Li, Mg, Mn^{2+}, Ni; Z = Al, B, Fe^{3+}, Si] (Deer et al. 1992; Roberts et al. 1990), have a Si-to-Al ratio ranging from ca. 1.7–8 and a variable amount of Fe, Mg and Mn. To differentiate between these two aluminosilicates we look at the Si-to-Al atomic ratio and the amount of Fe and Mg.

Serpentine [$A_3Si_2O_5(OH)_4$, where A = Mg, Fe^{2+}, Ni] (Roberts et al. 1990), and talc [$Mg_3Si_4O_{10}(OH)_2$] (Deer et al. 1992; Roberts et al. 1990) are magnesium silicates and have no or small amounts of aluminium, thus the Si-to-Al atomic ratio should clearly differentiate these minerals from the former. However, to differentiate between them we should again look at the Si-to-Al atomic ratio because serpentines have no Al, whereas talc may

1 Measurements undertaken in the Museo Arqueológico Nacional (Madrid) were done with a Bruker Trazer IV-SD Turbo with an Rh x-ray tube, a vacuum pump and an X Flash SDD detector. The spectrometer was operated at 15kV and 55µAmp. This apparatus did not possess any quantification program based on fundamental parameters. Thus quantification was performed on secondary standards built up in our laboratories. However, we abandoned this after realising that measured element variability was large enough for quantification to become unreliable. Therefore, all measurements made with this apparatus are expressed as qualitative data.

have Al substitutions in small quantities. The quantity of Mg and Fe also contributes to differentiate between these two minerals as talc tends to have more Mg and Fe than serpentine.

By building up a ternary diagram where the vertexes are Si-to-Al, K and Fe+Mg, we could ideally differentiate between all these four minerals. Nevertheless, we have to be conservative, and we have classified beads by aluminophosphate, K-aluminosilicates, Mg-aluminosilicates, Mg-silicates and other silicates.

For the purposes of this paper, which is to identify whether the green beads were made from variscite or any other greenstone, this methodology seems to be appropriate.

Anyway, whenever it is possible to transport samples to the laboratory, x-ray diffraction (XRD) has been performed with a Panalytical X'Pert Pro θ/θ diffractometer equipped with Cu Kα source (1.5406Å) operating at 45kV and 40mA. A PixCel detector was used and the data were collected on transmission mode with a 2D detector. Patterns were obtained using a step width of 0.053º 2θ between 8º and 60º 2θ and a counting time of 35s per step at ambient temperatures. An incident beam PreFIX module with X-ray mirror for Cu radiation was used to allow non-destructive analysis.

Additionally, in the course of elemental analysis, traces of Hg were detected on some beads in the form of stains on their surface and perforation. These beads were later analysed by means of XRD and a Scanning Electron Microscope on a High-Resolution Hitachi S4800 SEM-FEG equipped with an EDX Bruker X Flash Detector 4010.

3. Results

3.1. Portillo de las Cortes Dolmen

Skeleton 24's bead proved to be made of K-silicoaluminate (most probably a muscovite green mica). The remaining beads (only ten out of twelve were green) without a specific context were found to be in nine cases some sort of phosphate (most probably a mixture of variscite [$AlPO_4{\cdot}2H_2O$], calcium and/or iron phosphate) – see fig. 2 and table 1.

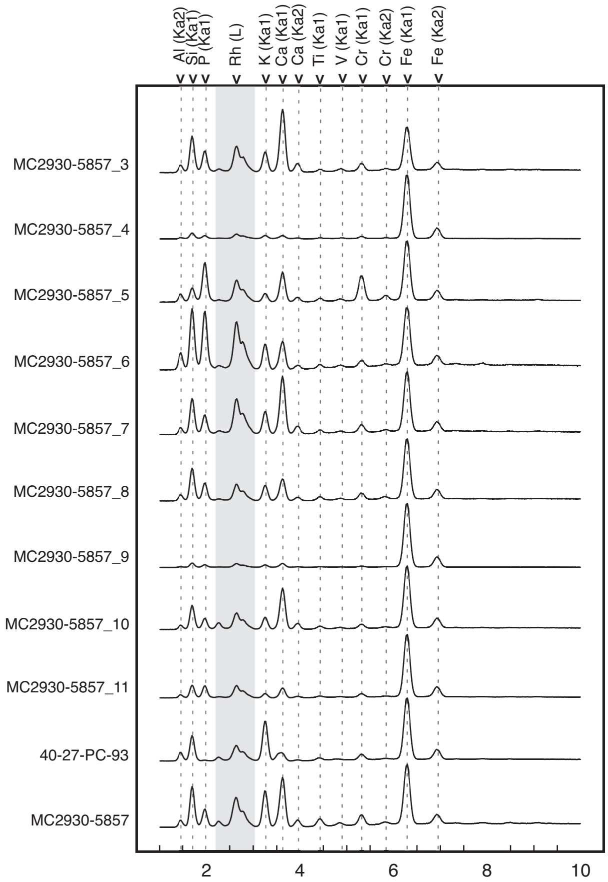

Fig. 2. EDX spectra of Portillo de las Cortes dolmen's bead and MAN's beads labelled as Portillo.

It can be observed in fig. 2 (normalised intensity) that for all the analysed samples P and Al, Fe and Ca have high intensities, and in most of the cases Si appears with a medium intensity. Although the sample data is qualitative, an origin for these phosphate beads from Portillo de las Cortes dolmen may be proposed. Based on the presence of relatively large amounts of Si and the presence of Ca together with the P and Al, their source would be the Palazuelo de las Cuevas (Zamora) variscite mines (Odriozola et al. 2016b; Villalobos García/Odriozola 2016).

3.2. El Capricho

One of the two beads recovered at this 3rd mill. BC round house is a K-silicoaluminate, most probably green mica (El Capricho-01B) (*table 2*).

ID	Context	Mineral
MC2930-5847-1	Portillo de las Cortes surroundings	$AlPO_4$ (high content Si-Ca-Fe)
MC2930-5847-10	Portillo de las Cortes surroundings	$AlPO_4$ (high content Si-Ca-Fe)
MC2930-5847-11	Portillo de las Cortes surroundings	$AlPO_4$ (high content Fe)
MC2930-5847-3	Portillo de las Cortes surroundings	$AlPO_4$ (high content Si-Ca-Fe)
MC2930-5847-4	Portillo de las Cortes surroundings	Si-Fe
MC2930-5847-5	Portillo de las Cortes surroundings	$AlPO_4$ (high content Ca-Fe)
MC2930-5847-6	Portillo de las Cortes surroundings	$AlPO_4$ (high content Ca-Fe-Si)
MC2930-5847-7	Portillo de las Cortes surroundings	$AlPO_4$ (high content Ca-Fe-Si)
MC2930-5847-8	Portillo de las Cortes surroundings	$AlPO_4$ (high content Ca-Fe-Si)
MC2930-5847-9	Portillo de las Cortes surroundings	$AlPO_4$ (high content Fe)
40-27-PC-93	Portillo de las Cortes	Si-Al-K

Tab. 1. mineralogical identification of Portillo de las Cortes dolmen's beads.

The term mica is used here to describe a group of potassium aluminosilicate minerals, usually with an admixture of iron and magnesium. Micas are characterised by a platy morphology and perfect basal cleavage, a consequence of their layered atomic structure. The main types are dark brown or black biotite ($K[Mg,Fe]_3[OH,F]_2AlSi_3O_{10}$), colourless to pale yellow muscovite ($KAl_2[OH,F]_2AlSi_3O_{10}$), coppery yellow to brown phlogopite ($KMg_3[OH,F]^2AlSi_3O_{10}$) and pink to pale purple lepidolite ($KLi_2[OH,F]_2AlSi_3O_{10}$). Muscovite is one of the most common micas, the most transparent together with phlogopite. Their Mohs hardness varies between 2 and 3 (Aston et al. 2000; Deer et al. 1992).

The second bead is mainly formed by P and Al (*table 2*). It is probably made of some sort of aluminophosphate, a variscite-like mineral. P-to-Al atomic ratios for this bead are 0.80. As the accepted values for Iberian variscite-like minerals range typically between ca. 0.8–1.8, we may therefore consider the El Capricho-01 bead to be made of a variscite-like mineral.

Additionally, the EDX analysis shows that this contains 1.47% Ca. The presence of Ca could be explained by the mineral's origin, given that along with variscite it often crystallises as crandallite [$CaAl_3(PO_4)_2(OH)_5 \cdot H_2O$], wavellite, [$Al_3(PO_4)_2(OH,F)_3 \cdot 5H_2O$] and apatite [$Ca_{10}(PO_4)_6(OH,F,Cl)_2$], among other calcium phosphates that often appear in the same phosphate deposits as variscite. This is the case for other European mines such as Pannece, Sarrabús and Can Tintorer (Camprubi et al. 1994; Fernández Turiel et al. 1990; Marini et al. 1989; Massé 1971), or the Fairfield mines (Utah, USA) (Larsen 1942a; 1942b; 1942c) and the deposits at Woodland in Australia (Willing et al. 2008).

Areas in which different phosphates appear together with variscite have been documented in the Terena Synform (Huelva), where Pico Centeno is situated, e.g. aheylite [Fe_2+$Al_6(PO_4)_4(OH)_8 \cdot 4H_2O$] and turquoise [$CuAl_6(PO_4)4(OH)_8 \cdot 4H_2O$]. Nevertheless, calcium phosphates have never been detected (Odriozola/Villalobos García 2015), even though Moro et al. (1995) defined these deposits as aluminium phosphates (Fe, Ca). Conversely, calcium phosphates (e.g. crandallite [$CaAl_3(PO_4)_2(OH)_5 \cdot (H_2O)$]) have been documented in the Alcañices Synform (Zamora).

El Capricho-01 bead has a low P-to-Al atomic ratio and moderate Fe and Ca contents, which would mean that iron and calcium phosphates could be present as minor crystalline phases or amorphous material. We have previously argued that the anomalous P-to-Al atomic ratio values found in variscite from Iberian sources were due to structural variations stemming from their paragenesis (Odriozola et al. 2010; Odriozola 2015). Thus, the P-to-Al atomic ratio is a suitable method for distinguishing between sources due to the particular paragenesis of each source. Bearing this in mind, it would appear evident that the Ca values of the El Capricho samples indicate that they originate from a source in which calcium phosphates can be found alongside variscite.

ID	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Fe	Ni	Zn	As	Rb	Sr	Zr	Mo	P/Al
El Capricho-01	43.30	4.60	46.08	0.35	2.61	-	0.46	0.11	-	0.33	2.11	-	-	0.04	-	-	-	-	1.06
El Capricho-01B	0.00	26.46	49.00	17.27	0.27	1.40	2.41	1.30	0.28	0.06	0.54	1.00	-	-	0.013	-	0.001	0.001	
El Rebollosillo-01	28.6	41.49	22.84	0.24	1.7	1.89	1.47	0.27	0.07	0.57	0.85	-	-	0.010	-	-	-	-	0.8
El Rebollosillo-02	41.52	7.97	44.76	0.21	3.24	-	0.47	0.19	0.08	0.47	1.07	-	-	0.010	-	-	-	-	1.08
El Rebollosillo-03	42.66	7.27	45.7	0.54	2.57	-	0.43	0.03	0.14	0.28	0.37	-	-	0.010	-	-	-	-	1.07
El Rebollosillo-04	42.72	2.67	49.62	0.31	1.88	-	0.81	0.17	0.15	0.78	0.85	-	-	0.020	-	-	0.010	-	1.16
El Rebollosillo-05	-	-	53.12	28.34	6.79	4.43	-	3.10	-	1.57	-	1.37	0.42	0.670	-	-	0.194	-	
El Rebollosillo-06	40.53	3.58	52.97	-	0.22	1.59	-	0.15	-	-	-	0.96	-	0.002	-	-	-	-	
El Espinillo-01	30.93	32.34	27.11	0.84	1.28	2.40	3.21	0.31	0.10	0.34	1.11	-	-	0.010	-	0.002	0.004	-	0.88
Humanejos 826(1)-16	40.85	2.78	49.37	0.53	4.30	-	0.17	0.18	0.00	0.53	1.26	-	0.007	-	-	0.006	0.000	-	1.21
Humanejos 826(1)-12	43.06	3.85	48.94	-	3.00	-	0.14	0.12	0.00	0.35	0.49	0.03	0.003	-	-	0.005	0.003	-	1.14
Humanejos 826(1)-10	40.32	3.52	48.02	0.54	4.33	0.59	0.26	0.21	0.00	0.31	1.87	-	0.008	-	0.002	0.005	0.003	-	1.19
Humanejos 826(1)-08	45.46	3.55	47.39	0.10	1.47	-	0.20	0.30	0.15	0.48	0.76	0.10	0.009	-	0.002	0.004	0.000	-	1.04
Humanejos 826(1)-07	43.78	2.05	49.65	0.30	2.90	-	0.12	0.14	0.00	0.19	0.85	0.01	0.023	-	-	-	-	-	1.13
Humanejos 826(1)-13	44.36	8.27	41.23	0.36	3.25	0.78	0.22	0.19	0.00	0.21	1.11	-	0.011	-	0.002	0.002	-	-	0.93
Humanejos 826(1)-11	43.39	3.15	46.70	0.57	3.87	0.67	0.29	0.04	0.17	0.67	0.45	0.01	0.012	-	-	0.000	-	-	1.08
Humanejos 826(1)-09	36.31	9.32	43.99	0.75	5.67	1.02	0.28	0.46	0.00	0.52	1.66	-	0.009	-	0.002	0.004	-	-	1.21
Humanejos 826(1)-14	41.20	3.68	47.12	0.52	5.98	0.00	0.21	0.09	0.10	0.56	0.51	-	0.010	-	-	0.006	-	-	1.14
Humanejos 826(1)-15	39.33	3.51	48.08	0.69	6.11	0.70	0.22	0.16	0.00	0.47	0.68	-	0.012	-	-	0.019	-	0.011	1.22
Humanejos 826(1)-23	40.13	5.15	48.83	0.38	2.55	-	0.20	0.27	0.18	0.98	1.30	-	0.010	0.001	0.003	0.002	-	-	1.22
Humanejos 826(1)-21	39.82	3.70	47.62	0.52	4.79	0.85	0.30	0.23	0.13	0.62	1.37	-	0.020	-	0.002	0.006	0.004	-	1.2

ID	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Fe	Ni	Zn	As	Rb	Sr	Zr	Mo	P/Al
Humanejos 826(1)-20	39.57	3.85	45.51	0.71	6.99	0.76	0.27	0.17	0.00	0.47	1.67	-	0.009	-	0.002	0.007	-	-	1.15
Humanejos 826(1)-19	41.63	3.62	46.72	0.59	4.92	0.75	0.26	0.23	0.00	0.30	0.95	-	0.017	-	0.001	0.003	-	-	1.12
Humanejos 826(1)-18	39.17	9.93	44.32	0.56	3.64	0.71	0.24	0.16	0.13	0.47	0.66	-	0.005	-	-	0.003	-	-	1.13
Humanejos 826(1)-17	33.81	4.78	38.33	1.19	12.90	0.81	0.40	0.35	-	0.52	6.81	-	0.055	-	-	0.018	-	-	1.13
Humanejos 826(1)-42	43.90	5.12	45.89	0.47	3.32	-	0.19	0.10	0.06	0.46	0.47	-	0.007	-	0.001	0.002	-	-	1.05
Humanejos 826(1)-28	43.70	4.20	47.05	0.49	2.60	-	0.18	0.11	0.10	0.46	1.10	-	0.004	-	0.001	0.003	-	-	1.08
Humanejos 826(1)-35	41.77	4.36	46.03	0.34	3.47	-	0.13	0.42	-	0.64	2.78	-	0.036	-	-	0.005	-	-	1.1
Humanejos 826(1)-27	42.11	14.42	37.82	0.78	2.25	0.94	0.46	0.15	0.06	0.40	0.57	-	0.011	-	0.017	0.005	-	-	0.9
Humanejos 826(1)-34	44.85	5.97	45.82	0.16	2.14	-	0.20	0.08	-	0.14	0.61	-	0.014	-	-	0.001	-	-	1.02
Humanejos 826(1)-41	43.87	3.69	46.47	0.30	3.31	-	0.14	0.33	0.07	0.29	1.47	-	0.044	-	-	0.013	-	-	1.06
Humanejos 826(1)-26	45.68	5.15	45.51	0.20	1.51	-	0.16	0.19	0.07	0.29	1.21	-	0.011	-	0.002	0.010	-	-	1
Humanejos 826(1)-40	42.01	8.66	40.48	0.56	5.60	0.83	0.23	0.23	-	0.41	0.95	-	0.027	-	-	-	0.003	-	0.96
Humanejos 826(1)-33	44.23	8.42	42.72	0.20	2.20	-	0.12	0.36	-	0.53	1.20	-	0.008	-	-	0.006	-	-	0.97
Humanejos 826(1)-32	46.30	6.37	43.68	0.20	2.27	-	0.16	0.10	-	0.42	0.47	-	0.006	-	0.003	0.009	-	-	0.94
Humanejos 826(1)-25	42.07	9.49	44.56	0.17	1.63	-	0.25	0.15	0.05	0.65	0.96	-	0.015	-	0.001	0.002	-	-	1.06
Humanejos 826(1)-24	46.10	7.07	42.35	0.45	2.56	-	0.21	0.21	0.08	0.30	0.65	-	0.009	-	0.001	0.014	-	-	0.92
Humanejos 826(1)-39	45.25	3.73	40.08	1.68	6.34	1.09	0.24	0.17	-	0.42	0.97	-	0.014	-	0.006	0.006	0.003	-	0.89
Humanejos 826(1)-38	44.47	8.73	40.83	0.43	3.56	-	0.19	0.24	0.08	0.42	1.03	-	0.011	-	0.000	0.007	-	-	0.92

ID	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Fe	Ni	Zn	As	Rb	Sr	Zr	Mo	P/Al
Humanejos 826(1)-31	40.60	12.78	42.03	0.34	2.36	-	0.16	0.17	0.13	0.64	0.76	-	0.008	-	0.003	0.007	-	-	1.04
Humanejos 826(1)-23	43.98	7.09	45.05	0.41	2.01	-	0.19	0.05	0.14	0.78	0.30	-	0.004	-	0.003	0.002	-	-	1.02
Humanejos 826(1)-29	40.78	8.58	41.80	0.64	4.95	0.68	0.23	0.13	0.06	0.67	1.44	-	0.010	-	-	0.007	-	-	1.03
Humanejos 826(1)-36	41.96	6.04	45.50	0.28	2.17	-	0.15	0.15	-	0.29	3.39	0.06	0.008	0.001	-	0.007	-	-	1.08
Humanejos 826(1)-30	43.68	3.30	48.20	0.13	2.54	-	0.12	0.22	-	0.49	1.25	0.04	0.012	-	-	0.005	-	-	1.1
Humanejos 826(1)-37	42.65	6.32	43.63	0.35	3.35	0.71	0.21	0.31	-	0.63	1.80	-	0.028	-	-	0.002	-	-	1.02
Humanejos 826(1)-06	42.44	3.61	50.85	0.09	1.49	-	0.11	0.19	-	0.19	1.01	-	0.005	-	-	0.005	-	-	1.2
Humanejos 826(1)-05	41.26	3.02	51.74	0.15	2.39	-	0.14	0.19	0.05	0.18	0.88	-	0.005	-	-	0.005	-	-	1.25
Humanejos 826(1)-65	46.30	5.81	43.38	0.41	3.15	-	0.16	0.05	0.10	0.40	0.23	-	0.006	-	-	0.002	0.003	-	0.94
Humanejos 826(1)-64	45.91	3.05	46.84	0.28	2.28	-	0.17	0.20	0.07	0.30	0.87	-	0.016	-	0.003	0.007	-	-	1.02
Humanejos 826(1)-64	45.79	2.93	47.14	0.20	2.70	-	0.12	0.13	0.13	0.47	0.40	-	0.006	-	-	0.000	0.005	-	1.03
Humanejos 826(1)-62	43.67	8.08	44.22	0.42	2.34	-	0.19	0.10	0.07	0.62	0.28	-	0.003	-	-	0.002	-	-	1.01
Humanejos 826(1)-61	44.83	6.38	43.98	0.40	3.07	-	0.22	0.17	-	0.31	0.59	0.03	0.012	-	0.003	0.004	-	-	0.98
Humanejos 826(1)-60	44.67	6.66	44.96	0.28	1.92	-	0.18	0.12	0.04	0.39	0.75	-	0.011	-	0.001	0.004	-	-	1.01
Humanejos 826(1)-59	42.16	12.72	40.96	0.30	2.63	-	0.17	0.16	0.08	0.32	0.49	-	0.005	-	-	0.002	-	-	0.97
Humanejos 826(1)-58	41.35	7.04	45.19	0.59	4.16	0.72	0.21	0.06	-	0.42	0.25	-	0.008	-	-	0.004	0.003	-	1.09
Humanejos 826(1)-57	43.35	3.45	47.98	0.37	3.66	-	0.15	0.09	0.08	0.47	0.38	-	0.009	-	-	0.004	-	-	1.11
Humanejos 826(1)-56	42.53	6.23	44.98	0.70	3.77	0.68	0.19	0.11	-	0.29	0.51	-	0.011	-	-	0.004	-	-	1.06

ID	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Fe	Ni	Zn	As	Rb	Sr	Zr	Mo	P/Al
Humanejos 826(1)-55	42.04	4.61	44.19	0.81	5.38	0.85	0.32	0.25	-	0.37	1.15	0.01	0.009	-	-	0.003	-	-	1.05
Humanejos 826(1)-54	45.45	7.30	43.17	0.40	2.77	-	0.16	0.11	-	0.21	0.40	-	0.007	-	0.001	0.008	-	-	0.95
Humanejos 826(1)-53	44.70	2.70	48.67	0.28	2.21	-	0.10	0.26	0.12	0.53	0.41	-	0.005	-	-	0.011	-	-	1.09
Humanejos 826(1)-52	44.48	4.52	47.00	0.24	2.50	-	0.16	0.07	0.09	0.39	0.52	-	0.017	-	-	-	-	-	1.06
Humanejos 826(1)-51	42.46	8.62	44.33	0.48	2.36	-	0.36	0.21	-	0.45	0.72	-	0.018	-	0.003	0.001	-	-	1.04
Humanejos 826(1)-50	43.21	5.08	45.35	0.48	3.34	0.64	0.21	0.18	0.12	0.61	0.76	-	0.004	-	-	0.004	0.003	-	1.05
Humanejos 826(1)-49	40.97	5.70	48.96	0.34	2.74	-	0.22	0.11	0.12	0.43	0.40	-	0.007	-	-	0.004	-	-	1.19
Humanejos 826(1)-48	40.34	11.48	39.08	0.81	3.21	0.93	0.50	0.39	0.06	0.44	2.71	-	0.013	-	0.007	0.017	-	-	0.97
Humanejos 826(1)-47	40.89	9.25	42.43	0.43	2.68	0.77	0.25	0.15	-	0.16	2.95	-	0.028	-	-	0.003	-	-	1.04
Humanejos 826(1)-46	39.60	7.24	46.04	0.64	4.13	0.81	0.24	0.13	-	0.53	0.60	-	0.011	-	0.004	0.001	0.003	-	1.16
Humanejos 826(1)-45	43.60	4.52	46.93	0.36	2.10	-	0.16	0.15	0.13	0.41	1.62	-	0.013	-	-	0.004	-	-	1.08
Humanejos 826(1)-44	44.37	4.30	43.91	0.34	5.27	0.67	0.17	0.17	-	0.31	0.48	-	0.009	-	-	0.004	-	-	0.99
Humanejos 826(1)-43	41.92	14.01	38.09	0.58	3.06	0.85	0.24	0.12	0.10	0.44	0.58	-	0.005	-	-	0.005	-	-	0.91
Humanejos 1166(7)-02	40.37	9.76	45.53	0.19	1.93	0.73	0.29	0.11	0.07	0.58	0.42	-	0.004	-	0.001	0.005	-	-	1.13
Humanejos 1166(7)-03	29.53	31.94	33.90	0.27	1.62	-	0.43	0.30	-	0.41	1.59	-	0.009	-	0.003	0.005	-	-	1.15
Humanejos 1166(7)-05	44.19	8.93	44.03	0.11	1.60	-	0.19	0.10	0.09	0.40	0.35	-	0.005	-	-	0.001	-	-	1
Humanejos 1166(7)-09	46.39	3.78	44.33	0.52	3.52	-	0.20	0.08	-	0.43	0.65	0.07	0.011	-	0.001	0.001	-	-	0.96
Humanejos 793(6)-01	43.05	42.61	1.26	-	0.70	10.70	1.40	0.09	-	0.01	0.14	-	0.000	-	0.011	0.002	-	-	0.03

ID	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Fe	Ni	Zn	As	Rb	Sr	Zr	Mo	P/Al
Humanejos 793(5)-01	41.69	10.64	44.59	0.14	1.24	-	0.34	0.27	0.05	0.23	0.77	-	0.015	-	-	0.001	-	-	1.07
Humanejos 793(5)-02	39.83	12.77	44.03	0.23	1.33	-	0.46	0.11	0.07	0.56	0.57	-	0.022	-	-	0.001	-	-	1.11
Humanejos 793(1)-05	44.33	6.93	43.70	0.28	2.15	-	0.33	0.35	0.07	0.42	1.26	0.10	0.014	-	0.001	0.007	-	-	0.99
Humanejos 793(1)-08	39.84	13.30	42.05	0.25	1.52	-	0.53	0.17	0.09	0.49	1.69	-	0.025	-	0.004	0.001	-	-	1.06
Humanejos 793(1)-06	43.56	4.28	48.44	0.28	2.16	-	0.19	0.09	0.07	0.73	0.17	-	0.005	-	0.001	0.001	-	-	1.11
Humanejos 793(1)-04	41.50	9.67	42.19	0.51	4.48	0.67	0.34	0.06	0.08	0.28	0.22	0.01	0.000	-	-	0.000	-	-	1.02
Humanejos 793(1)-11	40.40	8.92	44.81	0.36	2.14	-	0.46	0.61	0.08	0.57	1.16	0.22	0.009	-	0.001	0.015	-	-	1.11
Humanejos 793(1)-09	37.96	13.27	42.18	0.40	1.63	-	0.27	0.16	0.04	0.21	3.85	-	0.022	-	-	0.003	-	-	1.11
Humanejos 1075(3)-07	27.74	45.02	19.72	1.04	1.15	1.96	1.91	0.33	0.05	0.46	0.58	-	0.006	-	0.003	0.004	-	-	0.71
Humanejos 1075(3)-08	32.88	34.63	27.27	0.65	0.87	1.30	1.35	0.15	0.08	0.32	0.48	-	0.009	-	0.002	0.000	-	-	0.83
Humanejos 1075(3)-09	33.01	36.04	24.68	0.77	1.19	1.33	1.86	0.16	0.00	0.30	0.62	-	0.005	-	0.004	0.003	-	-	0.75
Humanejos 1075(3)-10	29.77	49.86	12.79	1.18	1.61	1.72	1.78	0.15	0.00	0.28	0.84	-	0.011	-	0.003	0.002	-	-	0.43

Tab. 2. Chemical composition of the studied samples. Values are expressed as atomic percentage.

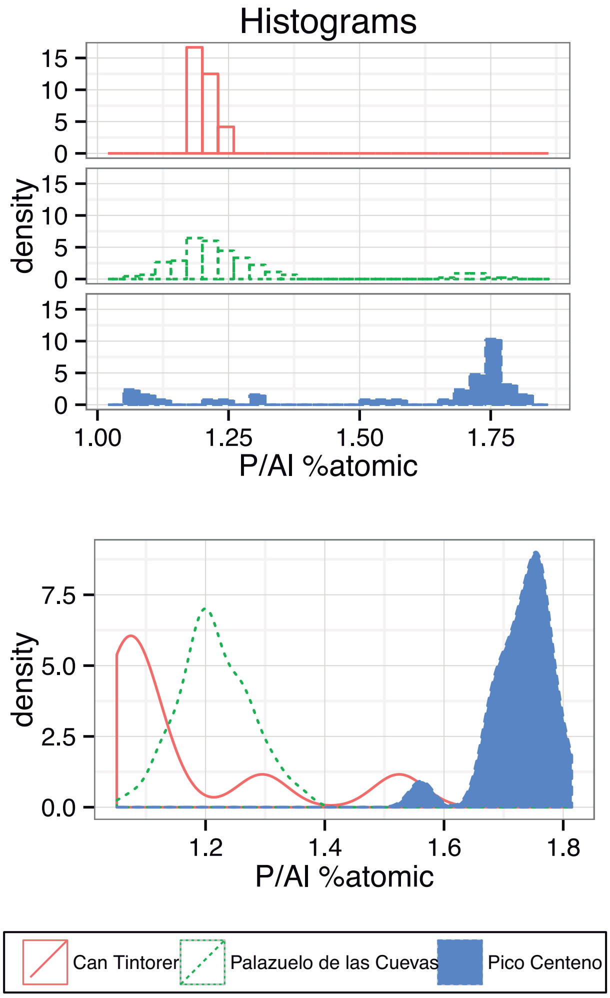

Fig. 3. P-to-Al atomic ratio histograms and non parametric density estimate for the Iberian variscite mines (data from our own database, n=204).

Comparing the P-to-Al atomic ratio values of the El Capricho-01 bead with the data available from Iberian mines, it may be proposed that the bead could be from Aliste (Zamora), although values below 1.1 could also indicate it originated in Can Tintorer (Barcelona), as can be deduced from the P-to-Al ratio distribution graph (*fig. 3*).

It is important to bear in mind that the Barcelona and Zamora mines overlap, with P-to-Al ranges close to 1 (*fig. 3*). Therefore, it could be incorrect to assume that they are of Barcelona origin; in this case, it is important to treat the results with caution. Edo i Benaiges et al. (1995) suggest the use of Si and Ca to distinguish minerals from Can Tintorer, which are more calcareous, from those of Aliste, with quartz intergrowth, while Herbaut and Querré (2004) propose the use of V, Cr and Fe. In any case, on the basis of the polycrystalline mixtures, it would seem that, although the P-to-Al atomic ratio gives us an indication of the origins of green phosphate deposits on the Iberian Peninsula, elements such as Ca and Si should also be explored in conjunction with one another, given that aluminium phosphates usually precipitate together with calcium phosphates and have quartz intergrowth in many cases. If we look at the following ternary diagram (*fig. 4*), whose vertices represent the P-to-Al atomic ratio and the Si and Ca atomic content, we can see that the separation between sources is absolute.

The non-parametric density estimation plotted in fig. 4 for each of the studied sources clearly shows that using P-to-Al atomic ratios in conjunction with silica and calcium atomic values can be a reliable argument for source differentiation, as the combined variation of these elements is smaller within than between sources. However, a small overlap does occur between Palazuelo de las Cuevas and Can Tintorer on the lower silica values.

Consequently, the P-to-Al, Si and Ca atomic values of the El Capricho bead approximately fit the Palazuelo de las Cuevas value distribution.

3.3. El Espinillo

The only bead recovered from the Copper and Bronze Age site of El Espinillo (Villaverde, Madrid) (Baquedano et al. 2000) has a chemical composition compatible with variscite-like minerals, on the basis of its P-to-Al atomic ratio, 0.88. As shown in fig. 4, the P-to-Al, Si and Ca atomic values of the El Espinillo bead roughly match the Palazuelo de las Cuevas value distribution.

3.4. Humanejos

3.4.1. Structure 793 (1-5-6)

Beads around Individual 793 (1)'s neck were made from some sort of aluminophosphate, typically a variscite-like mineral, except for bead 793 (1)-07 that was shaped from a K-silicoaluminate (*table 2*).

Like the El Capricho and El Espinillo beads, the eight beads from Humanejos Structure 793 (1-5) display a chemical composition compatible with

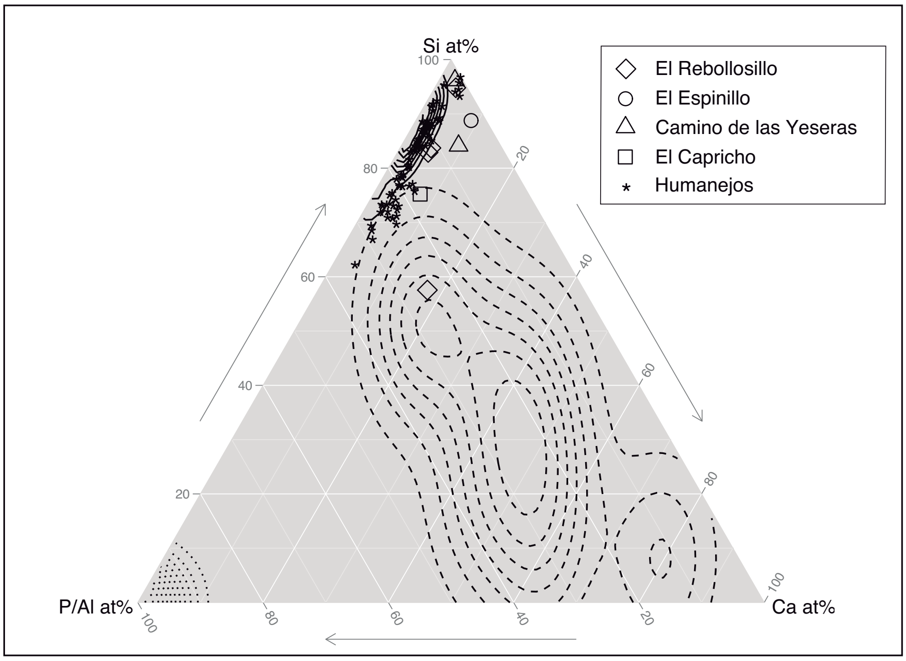

Fig. 4. P-to-Al atomic ratio, Si and Ca ternary plot of the Iberian variscite source – non-parametric density estimate – and the studied sites.

that of variscite-like minerals on the basis of their P-to-Al atomic ratio ranging between 0.91–1.15. As in the previous case, EDX analysis also shows moderate contents of Ca and Fe and a high content of Si, ca. 4–13%. If we look at the former ternary diagram (*fig. 4*), it can be observed that the P-to-Al, Si and Ca atomic values in the Humanejos 793 (1-5) beads closely fit the Palazuelo de las Cuevas value distribution.

The bead associated with individual 793 (6) proved to have been worked from a K-silicoaluminate (*table 2*).

3.4.2. Structure 826 (1)

The 61 green beads analysed were found to be made out of some sort of aluminophosphate (*table 2*).

As in the former cases, the 61 beads from Humanejos Structure 826 (1) possess a chemical composition compatible with variscite-like minerals on the basis of their P-to-Al atomic ratio ranging between 0.89–1.25.

EDX analysis continues to show the same trend in Ca, Fe and Si content as for the former cases, and fig. 3 shows that the P-to-Al, Si and Ca atomic values of the Humanejos 826 (1) beads closely match the Palazuelo de las Cuevas value distribution.

3.4.3. Structure 1701 (3)

EDX qualitative analysis revealed that the 63 beads were made out of some sort of Mg-silicoaluminate. However, it also revealed the presence of sulphur and mercury. Further visual inspection of the beads, showed they were stained with a red pigment. Therefore, it was likely that the beads and buried individual were covered with cinnabar (HgS). This possibility meant that we were granted permission to examine three beads (1701[3]-58, 1701[3]-68 and 1701[3]-67) in detail in our laboratory facilities.

XRD analysis revealed that the beads were made from clinochlore (*fig. 5*).

XRD (*fig. 5*) did not show any other pattern than clinochlore. However, by masking (2mm) the x ray beam we were able to focus x rays over the red stain on Sample 1701(3)-67 (*fig. 6a*), and therefore we were able to detect a pattern that, as expected, proved to be cinnabar (*fig. 6b*).

To ensure that this stain was of cinnabar, we performed SEM-EDS analysis over the stain. Surprisingly, the SEM-EDS qualitative analysis showed that the stain elemental constituents were S, Hg, P and Ca. P and Ca are not constituent elements of either clinochlore or cinnabar. Therefore, we took a closer look at the XRD diagram (*fig. 7*) on the ROI where the main hkl planes of the hydroxylapatite diffract. Although, XRD patterns do not have

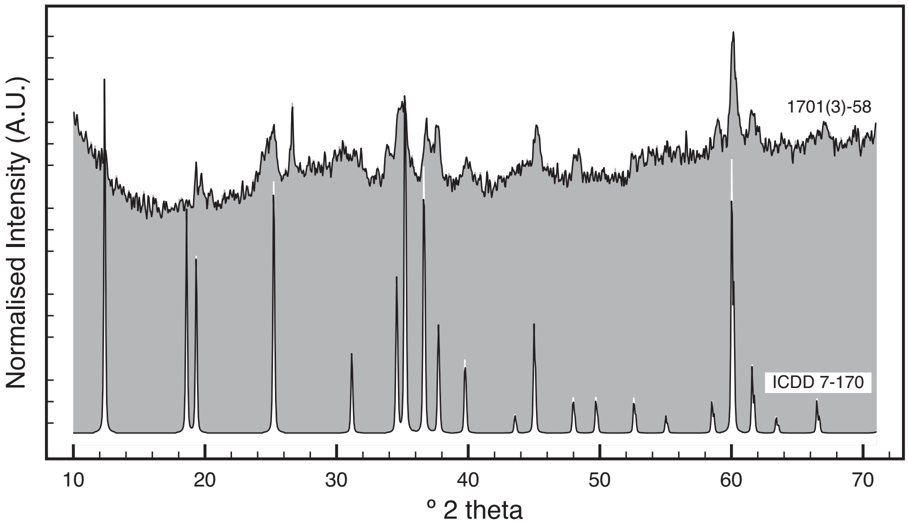

Fig. 5. XRD pattern of sample 1701 (3)-58 compared to ICDD 7-170 card.

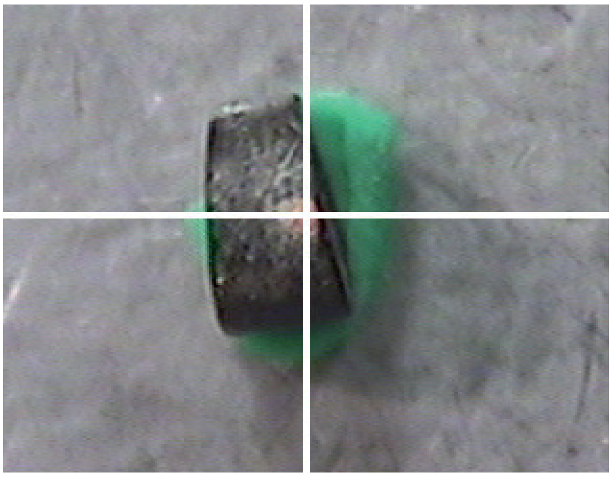

Fig. 6a. Photograph of bead 1701 (3)-67. Cross shows the X-ray bam impact area on the red stain.

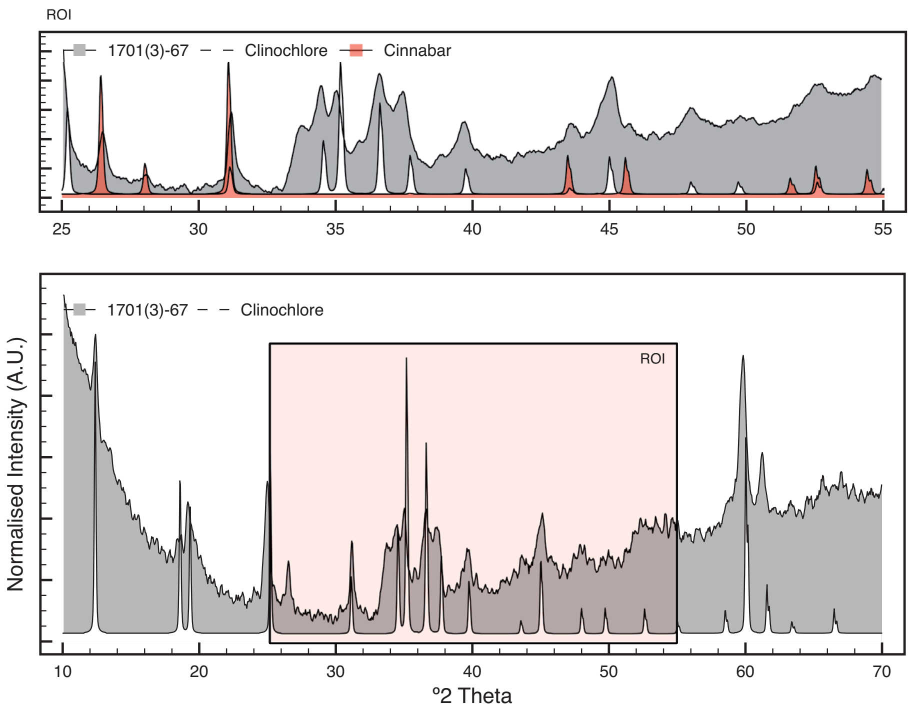

Fig. 6b. XRD pattern of sample 1701 (3)-67 compared to ICDD 25-18 card 7-160 (clinochlore). Zoom on the Region of Interest (ROI) showing XRD pattern of the sample compared to ICDD card 7-160 (clinochlore) and ICDD card 1-75-1589 (cinnabar).

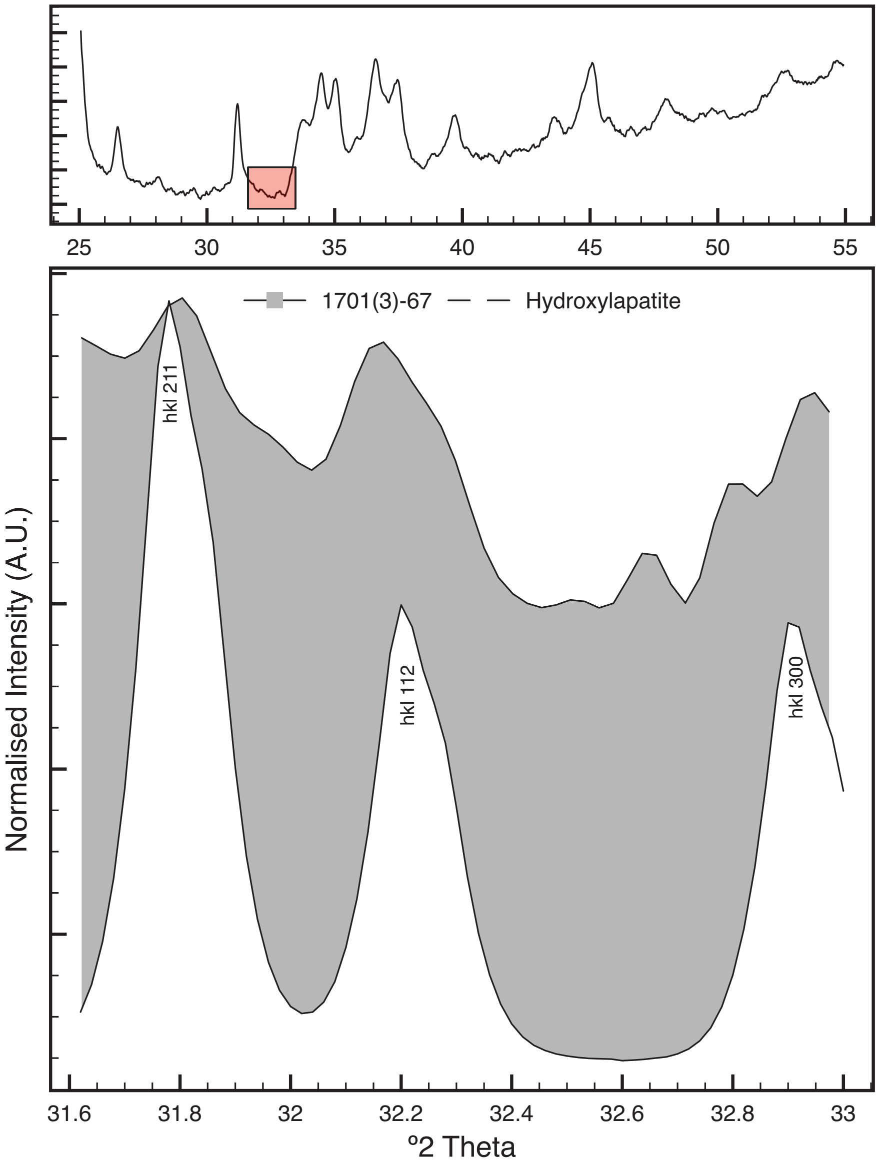

Fig. 7. XRD pattern of sample 1701 (3)-67 compared to ICDD 9-432 card (hydroxylapatite) on the ROI.

sufficient resolution to ascertain the presence of hydroxylapatite, a reasonable match can be observed between the sample (1702(3)-67) pattern and the hydroxylapatite (9-432) pattern.

Hydroxylapatite is the main inorganic constituent of bone tissue. In this case, it was used as a binder mixed with cinnabar. This proposal is consistent with the use of cinnabar mixed with other elements, such as ochre (Rogerio Candelera et al. 2013).

This is not the only case where cinnabar and bone have been recorded together as a pigment. Powdered bone has been used as a binder since the Palaeolithic (de Balbín Behrmann/Alcolea González 2003), or as an inlay in Bell Beakers (Odriozola/Hurtado Pérez 2007). Today, it is still used to paint ceramic by mixing it with inorganic pigments.

The 63 beads from structure 1701 (3) proved to be made of clinochlore, a member of the chlorite mineral group. Chlorites are a group of minerals with layered structure, which in many respects resemble the micas. They occur commonly as fine-grained scaly or massive aggregates. Cation substitution in the chlorite group has led to a proliferation of names based on differences in chemical composition: Mg-rich clinochlore, Fe-rich chamosite or Mn-rich pennantite. Clinochlore $[(Mg,Fe^{+2})_5Al(Si_3Al)O_{10}(OH)_8]$ is a silicate mineral from the chlorite family which normally appears in metamorphic or magnesian rock contexts. The beads were finally stained with an admixture of bone and cinnabar.

Clinochlore is a material which, by its very nature, is not particularly abundant, which is why it

Fig. 8. Distribution map of clinochlore beads in Iberia, studied sites and all the sites with beads demonstrated to be made out of clinochlore by means of XRD. Elaborated from our own database (R+D project HAR2012-34620) and published data (Domínguez Bella 2010; Gonçalves et al. 2011; Huet Gonçalves 2007; Odriozola et al. 2016).

could be classified as a ‚rare' or ‚exotic' rock. This factor would place it in the same high regard as other rare rocks or exotic raw materials such as variscite, amber and ivory. However, this consideration is undoubtedly due to its rarity (Taffinder 1998). In this respect, Domínguez Bella (2010) cites various places in which the material has been documented: Sierra de Guadarrama (Torrelodones, Colmenarejo, Galapagar), the province of Guadalajara (in the Hiendelaencina-Alcorlo area), Serranía de Ronda, Sierra Morena, Badajoz (Burguillos del Cerro), Barcelona, Biscay, Almería and Asturias. Its natural distribution seems slightly wider than that of variscite, but even so it is restricted enough to be considered an exotic material.

The use of this mineral for body ornaments has been known for a relatively short time. Until now, it had only been documented in the Bronze Age cist necropolis of Carapinhais (Sobral da Adiça, Moura) (Gonçalves et al. 2011; Huet Gonçalves 2007), the fortified Late Bronze Age settlement of Castro dos Ratinhos (Moura) (Gonçalves et al. 2011), in the artificial cave necropolis of Valle de las Higueras (Huecas, Toledo) (Domínguez Bella 2010), and in the burial site of Cerro Ortega (Villanueva de la Fuente, Ciudad Real) (Odriozola et al. 2016b). Domínguez Bella (2010) states that he has analysed clinochlore beads in the Basque Country, but he does not specify the site or number.

The studies that we are conducting as part of the HAR2012-34620 R+D project can be added to these cases. The use of this type of mineral has been documented at Cova da Moura (Torres Vedras), Las Cabezas II (Alburquerque, Badajoz), in a pit grave on Dinamarca Street in Valencina de la Concepción (Valencina de la Concepción, Seville) and in La Sima – Cueva de Don Juan (Cazalla de la Sierra, Seville) (*fig. 8*).

The available data situates its use in a time frame ranging from the 5th to 4th mill. BC in Cova da Moura to the 2nd mill. BC in Carapinhais and Castro dos Ratinhos, including the late 4th mill. BC in Cerro Ortega, and second half of the 3rd mill. BC in Humanejos, Valencina de la Concepción, Valle de las Higueras, Las Cabezas II and La Sima. Therefore, based on the available data there is no clear pattern of use. What does seem certain, bearing in mind the sheer volume of beads, is that more clinochlore would have been used during the second half of the 3rd mill. calBC. This conclusion can be drawn considering that Humanejos, Dinamarca Street, Las Cabezas II and La Sima contained a total of 238 beads compared with two from Cerro Ortega (Late Neolithic), 17 from Carapinhais (Early Bronze Age) and the single bead at Castro dos Ratinhos (Late Bronze Age). Two clinochlore beads were recorded at Cova da Moura, dating back to between the 5th mill. BC and the early 3rd mill. BC.

3.4.4. Structure 1075 (3)

EDX analysis of the 4 beads around the six or seven year-old individual showed their elemental composition was compatible with that of aluminophosphate, on the basis of their P-to-Al atomic ratio between 0.71-0.83.[2] However, it contained a moderate content of calcium and higher silica values than that of the former Humanejos variscite beads (*table 2, fig. 4*).

EDX analysis revealed higher Ca and Si content than in the former cases. However, it can be observed in fig. 3 that the P-to-Al, Si and Ca atomic values in Humanejos 1075 (3)'s beads roughly fit the Palazuelo de las Cuevas value distribution.

2 Sample 1075 (3)-10 has an extremely low value, 0.43, that raises doubts about its mineralogical identification.

3.4.5. Structure 1166 (3)

The 17 beads associated with Individual 1166 (3) were analysed by EDX. The analysis of the 13 white beads showed that in eleven of them the elemental composition is compatible with that of bone/ivory (P and Ca are the main constituients), while the remaining two white beads are compatible with the elemental composition of (K, Ca)-silicoaluminate.

EDX analysis of the four green beads shows that the elemental composition is compatible with that of aluminophosphate, on the basis of their P-to-Al atomic ratio ranging between 0.96 and 1.16 (*table 2*).

The P-to-Al, Si and Ca atomic values of Humanejos 1166's beads closely match the Palazuelo de las Cuevas value distribution (*fig. 4*).

3.5. El Rebollosillo

The chemical composition of four out of the six analysed cases from this collective burial are, according to their P-to-Al atomic ratio (0.80 to 1.13), compatible with variscite-like minerals (*table 2*). Two of them have P-to-Al, Si and Ca atomic values similar to the Humanejos beads and closely fit the Palazuelo de las Cuevas value distribution (*fig. 4*). Rebollosillo-01 falls into the Can Tintorer value distribution due to the combination of a low silica value and P-to-Al ratio of ca. 1.1. Rebollosillo-04 approximately fits Palazuelo de las Cuevas values, clustering with samples from Humanejos Structure 1075 (3) due to its high silica content and its P-to-Al ratio below unity (*table 2*, *fig. 4*). EDX analysis shows that sample Rebollosillo-06's chemical composition is compatible with that of steatite-talc [$Mg_3Si_4O_{10}(OH)_2$] (Deer et al. 1992; Roberts et al. 1990). Steatite is a rock composed primarily of the mineral talc in which the talc flakes are oriented randomly, resulting in a massive, homogeneous texture. When the talc flakes are aligned in layers, the rock is called schist. Talc is a hydrated magnesium silicate characterised by extreme softness and a soapy feel. Steatite is generally grey, greenish grey or brown in colour. The surface has a dull waxy lustre, often with many scratches as a consequence of the extreme softness of the stone (Aston et al. 2000; Deer et al. 1992).

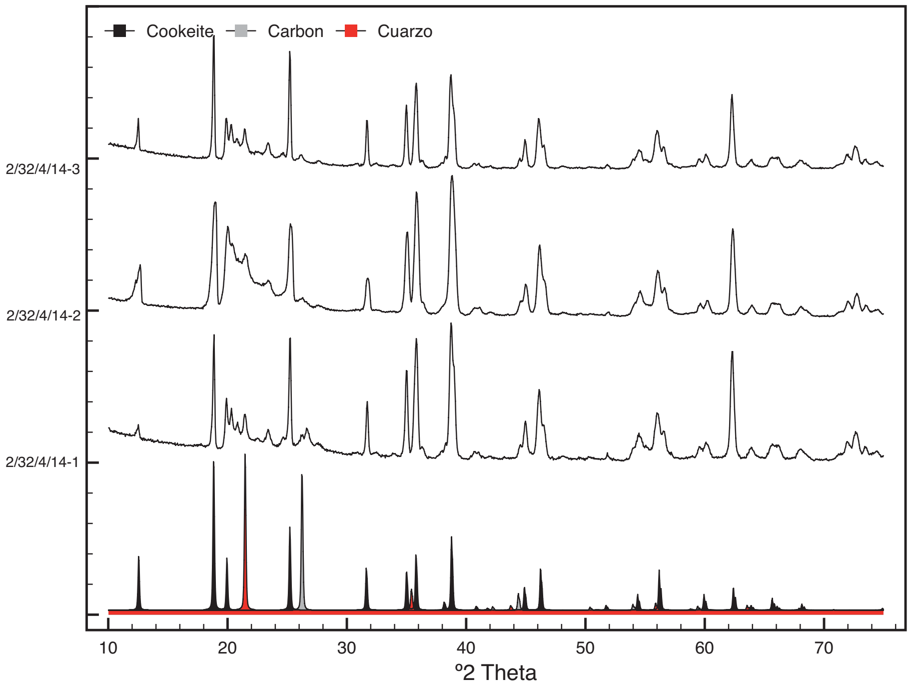

Fig. 9. XRD pattern of sample La Veredilla beads compared to ICDD 1-87-2016 card (cookeite), card 1-75-1621 (carbon) and card 1-76-0933 (quartz).

Talc, like muscovite, has a dioctahedrical-layered structure in which a sheet of octahedrally coordinated ions of Mg is sandwiched between two layers of SiO_4 tetrahedra. The absence of interlayer cations and very weak interlayer bonding results in very low hardness and the prevalence of stacking faults.

In contrast, Rebollosillo-05 does not fit any of the aforementioned rock-forming minerals. EDX analysis shows that its chemical composition is compatible with that of some sort of (Ca, Al) silicate with a high chlorine content.

Both Rebollosillo-05 and Rebollosillo-06 samples are thought to have a local origin.

3.6. Entretérminos Dolmen

The analysis performed by García de Miguel suggests that the published bead is made out of microcline (K-feldespar) (Jiménez Guijarro 2010), although detailed results are yet to be reported.

3.7. La Veredilla

XRD analysis of the three beads from La Veredilla concluded they are made out of cookite, a mineral belonging to the chlorite group (*table 2, fig. 9*).

4. Provenance, Distribution and Chronological Sequencing

The use of green ornaments in Iberian Prehistory starts with the Neolithic, although not at its very beginning and neither as a global phenomenon. During its initial stage of use, bone, shells and minerals other than greenstone were abundant (Rubio de Miguel 1993; Alday Ruiz 1995; Pascual Benito 1999; Utrilla Miranda et al. 2008; Martínez Sevilla/ Salmerón Juan 2014; Villalobos García in press). Green stones are barely documented during this initial stage, although they have been recorded in several sites. Paternanbidea Burial 1 (Ibero, Navarre) is one of the early sites where greenstone beads have been found. It has yielded several individuals and hundreds of personal ornaments made from shells and a few shaped out of greenstone. It is dated between 5200–4800 BC (García Gazólaz 2007). Besides this, sites coeval with the former, such as Gruta do Caldeirão (Tomar, Santarém) (Real 1992), Cueva del Moro (Olvena, Huesca) and Cueva de Chaves (Bastaras, Huesca) (Baldellou et al. 2012) have provided beads worked out of green stones, in some cases variscite.

We do not yet possess an accurate chronological framework for this initial stage of use or for greenstone mining activity. However, the few absolute dates for use and production contexts allow us to propose a synchronic start in the use of greenstone beads and the mining of green minerals, particularly variscite-like minerals (Odriozola et al. 2016a). After this time, it was not until the latest stages of the Neolithic when the use of greenstone personal ornaments became generalised. They have been recorded at almost every 4th mill. BC megalithic burial across Iberia (Fábregas Valcarce 1991, 100; Campano Lorenzo et al. 1985; Bueno Ramírez et al. 2005, fig. 9; Costa Caramé et al. 2011), as well as in the Catalan '*sepulcros de fosa*' (Muñoz Amilibia 1965) or the Levantine Neolithic IIB (Pascual Benito 1999).

After this initial stage of use, a time of increasing greenstone personal ornament consumption begins. It is during this time when Can Tintorer (Barcelona) (Villalba et al. 1986) starts to be mined, and very probably also the Aliste (Zamora) region aluminophosphate deposits (Villalobos García/Odriozola 2016). However, sites from approx. the 4th mill. BC have yielded beads worked out of minerals other than variscite-like minerals, e.g. talc, muscovite, malachite etc. (Villalba et al. 2001). These non-variscite minerals have a much higher natural occurrence than variscite.

The only site that chronologically can be ascribed to this period is the Portillo de las Cortes dolmen. The bead from Portillo de las Cortes dolmen is a K-silicoaluminate, whose elemental composition is compatible with that of the green micas (muscovite). Muscovite is known to outcrop in different places in the Palaeozoic formations of the Iberian Central System (Valle González/González Cesteros 1992). Although we lack a proper size sample, this suggests that in the Tagus Basin the consumption of local green-mineral resources may have predominated. The situation was similar in the North Meseta (Villalobos García 2012).

The remaining sites studied in this paper are Copper Age sites belonging roughly to the 3rd mill. BC. Except for La Veredilla (three cookite beads) and for Entretérminos dolmen (one K-silicoaluminate bead) all the green beads studied here are made from variscite-like minerals. El Espinillo is the only site where all the beads are shaped out of aluminophosphate. The remaining sites have documented different proportions of green stones, including variscite-like minerals (*table 2* and *fig. 1*).

Site	Beads
Camino de las Yeseras	10 $CaCO_3$
Camino de las Yeseras	2 silicoaluminate
Camino de las Yeseras	2 variscite
Cueva de la Ventana	2 fossil wood
Cueva de la Ventana	1 $CaCO_3$
Soto del Henares	?
Las Vegas de Samburiel	1 varsicite

Tab. 3. Beads' analytical results already published.

The provenance analysis of variscite-like minerals studied in this paper points to Palazuelo de las Cuevas (Zamora) as the origin of all the beads except for a bead from El Rebollosillo.

In addition to the sites studied here, some beads have been published from Camino de las Yeseras (Ríos Mendoza/Liesau 2011, 358–364), Vegas de Samburiel (García de Miguel et al. 2005), Cueva de la Ventana (García de Miguel et al. 2005) and Soto de Henares (Galindo Sanjosé/Sánchez Sánchez-Moreno 2006) (*table 3*).

The origin of the Camino de las Yeseras variscite beads has been located in Can Tintorer and Encinasola on the basis of the P-to-Al atomic ratio (Ríos Mendoza/Liesau 2011). However, a re-evaluation of these data situates the origin of these beads in the Aliste region if the silica and calcium content is taken into account, as shown in fig. 4. Ríos Mendoza and Liesau (2011) indicate that the chemical composition of variscite-like beads differs in the mercury content. This is an extremely rare element in variscite-like minerals, unless this mercury comes from cinnabar (HgS), which was actually used in the same context as the bead and the plaque (Ríos Mendoza/Liesau 2011).
Consequently, green stones used for beads in the 3rd mill. BC are mainly Palazuelo de las Cuevas variscite-like minerals. However, there are some exceptions to this rule as already mentioned.

Variscite-like minerals seem to be preferred to other types in the 3rd mill. BC, with 48.7% of the total (94/193), followed by clinochlore with 32.4% (63/193), bone with 5.7% (11/193), calcium carbonate with 5.7% (11/193), K-silicoaluminate with 2.1% (4/193), cookite with 1.5% (3/193), talc with 0.5% (1/193), and others with 3.1% (6/193) (*fig. 10*).

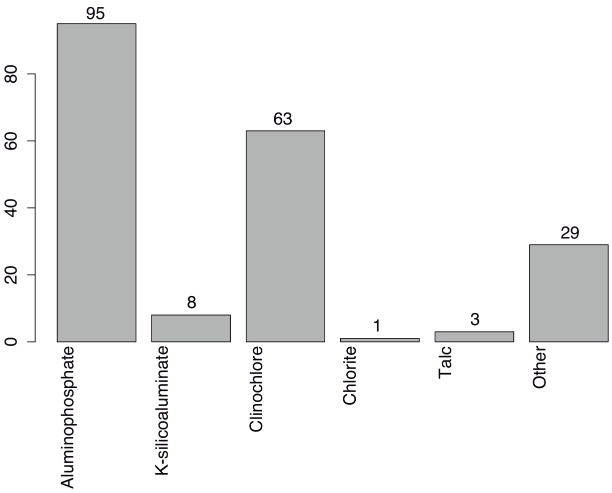

Fig. 10. Mineral frequency for Copper Age sites studied here.

This is in good agreement with the apogee of variscite production and consumption in inland and western Iberia during the first half of the 3rd mill. BC (Odriozola et al. 2013a; 2013b; Villalobos García 2012) and the appearance of the intensive production *locii* of Las Peñas and Los Arenales (Quiruelas de Vidriales, Zamora) (Villalobos García/Odriozola 2016).

5. Concluding Remarks

Perhaps the most striking aspect of 4th to 2nd mill. BC body ornamentation in the Tagus Basin is the remarkable range of materials used in their production. At least eight different mineral groups were used in stone beadmaking. This pattern is consistent with what is known for the rest of Iberia.

The contribution of science-based archaeology in recent decades has enabled a better understanding of the scale of interaction between late prehistoric groups. Individual and collective identities are frequently expressed through body ornamentation, and their public exhibition, especially in burial practices, seems to be somehow linked to strategies aimed at reinforcing connections of affinity, perhaps in the context of ancestor worship.

Central Iberia has been traditionally considered peripheral to the multiple interaction spheres operating in Europe throughout Late Prehistory. This idea, outdated for several decades now, has been overturned by the long-term systematic research agenda developed by several academic teams. As other papers in this volume highlight, Central Iberia has emerged as a key region in understanding broad-scale social interactions in the Peninsula.

Therefore, we have chosen this area to start a detailed study on the real capacity of personal body ornamentation exchange networks, their territorial and social projection, and the highlights of their chronology. For this, we have used the archaeological record at megalithic monuments, especially Portillo and Entretérminos, and tumuli without megalithic architecture like Vegas de Samburiel, as well as other well-contrasted sets of evidence of the use of natural caves coeval to that of collective burials, such as Rebollosillo, and the added novelty of hypogea necropolis in the interior of the Iberian Peninsula.

The number of green beads recovered from settlements such as Camino de las Yeseras, el Espinillo and El Capricho supports our previous knowledge: these items are quantitatively scarce in such contexts.

The diversity of burial contexts shows a development of rituality very similar to the classic areas of SW Iberia. The recently obtained AMS-radiocarbon chronology for the Portillo de las Cortes dolmen (Bueno Ramírez et al. in press), 3943–3674 BC,[3] confirms once again the known chronologies for the megaliths of inland Iberia (Bueno Ramírez et al. 2013). Consequently, the Entretérminos dolmen may have been built at the same time, given its tremendous similarity with other inland Iberian monuments of the same size. Pending a detailed publication of the tomb at Vegas de Samburiel in Madrid, we can only assume that the materials described could respond to old and newer uses, like the tomb of Castillejo in Huecas, Toledo (Bueno Ramírez et al. 2005).

The necropolis of Valle de las Higueras, Humanejos, and Camino de las Yeseras provide a repertoire of personal body ornamentation associated with contexts including Bell Beaker pottery. This association opens a new window on the social and group consideration of a set of burial items

3 5000±30 BP (Beta.334952), 2 sigma calibration using calib 7.1 and IntCal13, see http://calib.qub.ac.uk/calib/ (last access 20.03.2017).

traditionally considered to be exclusive of individual burials. Moreover, these necropolises are providing a set of radiocarbon chronologies (Bueno Ramírez et al. 2005; Barroso Bermejo et al. 2014) from the 3rd mill. BC. The earliest dates for these structures are within the Late Neolithic. However, the evidence of use and continued construction of these structures in the second half of the 3rd mill. BC, constitutes a line of work that opens necessary reflections on Bronze Age funerary rituals.

The ongoing study in Valle de las Higueras will contribute more precise associations between beads and individuals' age and sex, and a closer look at their distribution patterns. Furthermore, it will allow a more precise inspection of the association of green beads and certain items in the so-called Bell Beaker package, especially the lavishly decorated pots, metal, armbands, v-perforated buttons, etc. The Humanejos assemblage represents the best-studied context in this sense to date. Beads are associated with individuals with no clear preference for gender or age. Beads form part of children's funerary ritual in Structures 1075 and 1066 and in some cases of women's. If the number of beads can be an indication of inequality, in two structures, two individuals monopolise all the beads, but one outnumbers the other. The most obvious case is that of the difference in the number of beads among individuals in Structure 826.

These differences in the display of prestige items is not exclusive to a late stage in the megalithic phenomenon, but an intrinsic part of the ritual idiosyncrasy of ancestor worship (Bueno Ramírez et al. 2005). The record associated with Portillo de las Cortes Individual 24 is a good example.

The provenance of the vast majority of the beads studied here is probably in the Palazuelo de las Cuevas region (Northern Plateau). This would support previous hypotheses derived from the study of megaliths in the South Iberian Plateau (Bueno Ramírez 1999, Bueno Ramírez et al. 2006), proposing a connection between the North and South Plateaux, which are very similar areas from the cultural point of view.

The role played by green ornaments in European Late Prehistory funerary rituals increases during the Copper Age. However, a turning point occurs around the second quarter of the 3rd mill. BC, when the use of green ornaments reaches its apogee and starts to decline in favour of other display items such as amber, gold, metal or decorated Bell Beakers. There is, however, a period when green ornaments coexist with these new display items, until their total replacement. All this is convincing evidence that the maximum development of ostentation and display mechanisms, within the framework of collective burials, occurred in the mid 3rd mill. BC. In the light of these and other recent data (Bueno Ramírez et al. 2005), we must therefore rethink the role of individual burials.

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Bibliography

Alday Ruiz 1995: A. Alday Ruiz, Los elementos de adorno personal de la cueva del Moro de Olvena y sus derivaciones cronológico-culturales. Bolskan 12, 1995, 193–214.

Aston et al. 2000: B. G. Aston/J. A. Harrell/I. Shaw, Stone. In: P. T. Nicholson/I. Shaw (eds.), Ancient Egyptian Materials and Technology (Cambridge 2000) 5–78.

de Balbín Behrmann/Alcolea González 2003: R. de Balbín Behrmann/J. J. Alcolea González, El macizo de Ardines, Ribadesella, España. Un lugar mayor del arte paleolítico europeo. In: R. de Balbín Behrmann (ed.), Primer Symposium Internacional de Arte Prehistórico de Ribadesella (Ribadesella 2003) 91–151.

Baldellou et al. 2012: V. Baldellou/P. Utrilla Miranda/J. García Gazólaz, Variscita de Can Tintorer en el Neolítico Antiguo del Valle Medio del Ebro. In: M. Borrell/F. Borrell/J. Bosch/X. Clop/M. Molist (eds.), Xarxes al Neolític. Circulació i intercanvi de matèries, productes i idees a la Mediterrània occidental (VII–III mil·lenni aC). Actes del Congrés Internacional Xarxes al Neolític. Revista del Museu de Gavà, Rubricatum 5 (Barcelona 2012) 307–314.

Baquedano et al. 2000: M. I. Baquedano/J. F. Blanco/P. Alonso/D. Álvarez. El Espinillo. Un yacimiento calcolítico y de la edad del bronce en las terrazas del Manzanares. Arqueología, Paleontología y Etnografía 8 (Madrid 2000).

Barroso Bermejo et al. 2014: R. Barroso Bermejo/P. Bueno Ramírez/R. de Balbín Behrmann/A. Vázquez Cuesta/A. González Martín, Nekropolen des 3. Jahrtausends v. Chr. Im Zentrum der Iberischen Halbinsel. Madrider Mitteilungen 55, 2014, 1–28.

Blasco Bosqued et al. 2007: C. Blasco Bosqued/G. Delibes de Castro/G. Baena Preysler/C. Liesau/P. Ríos, Mendoza. El poblado calcolítico de Camino de las Yeseras (San Fernando de Henares, Madrid). Un escenario favorable para el estudio de la incidencia campaniforme en el interior peninsular. Trabajos de Prehistoria 64, 2007, 151–163.

Blasco Bosqued et al. 2014: C. Blasco Bosqued/C. Liesau/P. Ríos Mendoza/J. L.Gómez/R. Flores, Un enterramiento múltiple del yacimiento calcolítico de Humanejos (Parla, Madrid) desde una perspectiva tafonómica. Agrupando y reagrupando familia. Cuadernos de Prehistoria de la Universidad Autónoma de Madrid 40, 2014, 11–29.

Bueno Ramírez 1999: P. Bueno Ramírez, Megalitos en la Meseta Sur. Los dólmenes de Azután y La Estrella (Toledo). Excavaciones Arqueológicas en España 159 (Madrid 1999).

Bueno Ramírez et al. 2000: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Valle de las Higueras (Huecas, Toledo, España). Una necrópolis Ciempozuelos con cuevas artificiales al interior de la Península Ibérica. Estudos Pré-históricos 8, 2000, 49–80.

Bueno Ramírez et al. 2005: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Ritual campaniforme, ritual colectivo: la necrópolis de cuevas artificiales del Valle de las Higueras, Huecas, Toledo. Trabajos de Prehistoria 62, 2005, 67–90.

Bueno Ramírez et al. 2006: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Les mégalithes du centre de la Péninsule Ibérique. Une perspectiva d' analyse à partir de la Meseta Sud. In: R. Joussaume/L. Laporte/C. Scarre (eds.), Origine et développement du mégalithisme de l' Oueste de l' Europe. Volume I: Monuments funéraires. Actes du colloque international, 26–30 octobre 2002, Bougon (France) (Bougon 2006) 435–450.

Bueno Ramírez et al. 2010: P. Bueno Ramírez/R. Barroso Bermejo/R de Balbín Behrmann, Megalitos en la cuenca interior del Tajo. Munibe Suplemento 32, 2010, 152–184.

Bueno Ramírez et al. 2011: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Campaniforme en las construcciones hipogeas del Megalitismo reciente al interior de la Península Ibérica. Veleia 24/25, 2011, 771–790.

Bueno Ramírez et al. 2012: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, 5.000 años atrás. Primeros agricultores y metalúrgicos del Valle de Huecas (Huecas, Toledo) (Madrid 2012).

Bueno Ramírez et al. 2013: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Interior Regions and Places of Collective Memory. The Megalithism of the Interior Basin of the Tagus, Iberian Peninsula. A Reflection after Reading of the Tara Project. In: M. O'Sullivan/C. Scarre/M. Doyle (eds.), Tara. From the Past to the Future (Dublin 2013) 484–501.

Bueno Ramírez et al 2016: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann/A. González Martín/O. Cambra Moo/O. García Gil/C. Odriozola LLoret/M. A. Lancharro/O. López/S. Escalante, Pasados releídos. El dolmen del Portillo de las Cortes, Guadalajara. Boletín del Museo Arqueológico Nacional 34, 2016, 9–28.

Bueno Ramirez et al. in press: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Between East and West. Megaliths in the Centre of the Iberian Peninsula (Oxford).

Campano Lorenzo et al. 1985: A. Campano Lorenzo/J. A. Rodriguez Marcos/C. Sanz Mínguez, Apuntes para una primera valoración de la explotación y comercio de la variscita en la Meseta Norte. Anuario del Instituto de Estudios Zamoranos Florián de Ocampo, 1985, 13–22.

Camprubi et al. 1994: A. Camprubi/F. Costa/J. C. Melgarejo, Mineralizaciones de fosfátos férricos-alumínicos de GAVÀ (Catalunya). Tipología. Boletín Geológico y Minero 105, 1994, 444–453.

Costa Caramé et al. 2011: M. E. Costa Caramé/L. García Sanjuán/M. Murillo-Barroso/R. Parrilla Giráldez/D. W. Wheatley, Artefactos elaborados en rocas raras en los contextos funerarios del IV–II milenios cal ANE en el sur de España: Una revisión. Menga Revista de prehistoria de Andalucía 1, 2011, 253–294.

Deer et al. 1992: W. A. Deer/R. A. Howie/J. Zussman, An Introduction to the Rock Forming Minerals (Harlow 1992).

Delibes de Castro 1988: G. Delibes de Castro, Enterramiento calcolítico en fosa de «El Ollar», Donhierro (Segovia). Espacio, Tiempo y Forma Serie Prehistoria y Arqueología 1, 1988, 227–238.

Delibes de Castro 2004: G. Delibes de Castro, Dolmen del Portillo de Las Cortes (Aguilar de Anguita, Guadalajara). In: J. Blánquez/B. Rodríguez (eds.), El Arqueólogo Juan Cabré (1882–1947). La Fotografía Como Técnica Documental (Madrid 2004) 331–335.

Díaz-del-Río 1996: P. Díaz-del-Rio, El enterramiento colectivo de El Rebollosillo (Torrelaguna). In: Reunión de Arqueología Madrileña. Celebrada en el Consejo Superior de Investigaciones Científicas, Madrid, 25–26 de enero de 1996 (Madrid 1996) 198–200.

Díaz-del-Río 2001: P. Díaz-del-Rio, La formación del paisaje agrario. Madrid en el III y II milenios AC. Arqueología, Paleontología y Etnografía 9 (Madrid 2001).

Domínguez Bella 2010: S. Domínguez Bella, Objetos ornamentales en el Calcolítico del centro de la Península Ibérica. Estudio analítico de las cuentas de collar de los enterramientos prehistóricos del Valle de las higueras (Toledo). In: S. Domínguez Bella/J. Ramos Muñoz/M. Pérez Rodríguez (eds.), Minerales y Rocas en las Sociedades de la Prehistoria (Cádiz 2010) 275–284.

Domínguez Bella/Bóveda 2011: S. Domínguez Bella/M. J. Bóveda, Variscita y ámbar en el Neolítico gallego. Análisis arqueométrico del collar del túmulo 1 de Chousa Nova, Silleda (Pontevedra, España). Trabajos de Prehistoria 68, 2011, 369–380.

Edo i Benaiges et al. 1995: M. Edo i Benaiges/A. Blasco/M. J. Villalba/D. Gimeno/J. L. Fernández Turiel/F. Plana, La caracterización de la variscita del complejo minero de Can Tintorer, una experiencia aplicada al conocimiento del sistema de bienes de prestigio durante el neolítico. In: J Bernabeu/T. Orozco Köhler/X. Terradas (eds.), Los Recursos Abióticos en la Prehistoria. Caracterización, Aprovisionamiento E Intercambio (Valencia 1995) 83–110.

Edo i Benaiges/Fernández Turiel 1997: M. Edo i Benaiges/J. L. Fernández Turiel, Las cuentas de collar de calaita del dolmen del Prado de las Cruces. Bernuy-Salinero (Ávila). In: J. F. Fabián García (ed.), El Dolmen Del Prado de Las Cruces. Bernuy-Salinero (Ávila) (Valladolid 1997) 135–144.

Fabián García 2006: J. F. Fabián García, El IV y III milenio AC en el Valle Amblés (Ávila). Arqueología en Castilla y León 5 (Valladolid 2006).

Fábregas Valcarce 1991: R. Fábregas Valcarce, Megalitismo del Noroeste de la Península Ibérica. Tipología y secuencia de los materiales líticos (Madrid 1991).

Fernández Turiel et al. 1990: J. L. Fernández Turiel/D. Gimeno/F. Plana/A. Blasco/M. Edo i Benaiges/M. J. Villalba/L. Gordo, Estudio de las mineralizaciones fofáticas del complejo minero neolítico de Can Tintorer (Gavá, Barcelona) y comparación con las cuentas procedentes de ajuares arqueológicos. Boletín de la Sociedad Española de Mineralogía 13, 1990, 86–87.

Flores 2011: R. Flores, El yacimiento de Humanejos (Parla, Madrid). In: M. C. Blasco Bosqued/C. Liesau/P. Ríos (eds.), Yacimientos Calcolíticos Con Campaniforme de La Región de Madrid. Nuevos Estudios (Madrid 2011) 9–16.

Galindo Sanjosé/Sánchez Sánchez-Moreno 2006: L. Galindo Sanjosé/V. M. Sánchez Sánchez-Moreno, Informe preliminar de intervención arqueológica en el yacimiento Soto del Henares, dentro del Plan Parcial Soto del Henares (Torrejón de Ardoz). Fase II de excavación. Parcela T4 (Madrid 2006).

García Gazólaz 2007: J. García Gazólaz, Los enterramientos neolíticos del yacimiento de Paternanbidea (Ibero). In: Museo de Navarra (ed.), La Tierra te sea leve. Arqueología de la Muerte en Navarra (Pamplona 2007) 59–65.

García de Miguel et al. 2005: J. M. García de Miguel/I. Paniagua/J. Jiménez Guijarro, Útiles y adornos del Neolítico y Calcolítico madrileños. Caracterización petrológica y áreas de captación. In: O. Puche Riart/M. Ayarzagüena Sanz (eds.), Minería y metalurgia históricas en el Sudoeste europeo (Madrid 2005) 79–86.

Gómez Pérez et al. 2011: J. L. Gómez Pérez/M. C. Blasco Bosqued/G. Trancho/P. Ríos/I. Grueso/M. S. Martínez, Los protagonistas. In: M. C. Blasco Bosqued/C. Liesau/P. Ríos (eds.), Yacimientos Calcolíticos Con Campaniforme de La Región de Madrid. Nuevos Estudios (Madrid 2011) 101–132.

Gonçalves/Reis 1982: A. A. B. Gonçalves/M. L. Reis, Estudo mineralógico de elementos de adorno de cor verde provenientes de estações arqueológicas portuguesas. Portugalia Nova Série 2–3, 1982, 153–166.

Gonçalves et al. 2011: A. P. Gonçalves/A. M. M. Soares/A. C. Silva/L. Berrocal Rangel, Stone Beads from Late Bronze Age and Early Iron Age Settlements from South-Western Portugal. Analyses by X-Ray Diffraction. In: I. Turbanti Memmi (ed.), Proceedings of the 37th International Symposium on Archaeometry (Heidelberg 2011) 227–231.

Guitián Rivera/Vázquez Varela 1975: F. Guitián Rivera/J. M. Vázquez Varela, Análisis radiográfico de cuentas de calaíta gallegas. Boletín de la Comisión de Monumentos de Lugo 9, 1975, 187–188.

Herbaut/Querré 2004: F. Herbaut/G. Querré, La parure néolithique en variscite dans le sud de l'Armorique. Bulletin de la Société Préhistorique Française 101, 2004, 497–520.

Huet Gonçalves 2007: A. A. Huet Gonçalves, Identificação mineralógica de uma conta da Necrópole dos Carapinhais (Sobral da Adiça, Moura). Vipasca Arqueologia e História 2, 2007, 191–193.

Jiménez Gómez 1995: M. C. Jiménez Gómez, Zambujal. Los amuletos de las campañas 1964 hasta 1973. In: E. Sangmeister/M. C. Jiménez Gómez (eds.), Zambujal. Kupferfunde aus den Grabungen 1964 bis 1973 (Mainz am Rhein 1995) 155–238.

Jiménez Guijarro 2008: J. Jiménez Guijarro, El concepto no neolítico del fenómeno megalítico madrileño. Entretérminos y Las Vegas de Samburiel. In: M. S. Hernández Pérez/J. A. Soler Díaz/J. A. López Padilla (eds.), IV Congreso del Neolítico Peninsular 27–30 de noviembre de 2006, Volume 2. Museo Arqueológico de Alicante (Alicante) 55–63.

Jiménez Guijarro 2010: J. Jiménez Guijarro, Cazadores y campesinos. La neolitización del interior de la Península Ibérica (Madrid 2010).

Larsen 1942a: E. S. Larsen, The Mineralogy and Paragenesis of the Variscite Nodules from Near Fairfield, Utah. Part 1. American Mineralogist 27, 1942, 281–300.

Larsen 1942b: E. S. Larsen, The Mineralogy and Paragenesis of the Variscite Nodules from Near Fairfield, Utah. Part 2. American Mineralogist 27, 1942, 350–372.

Larsen 1942c: E. S. Larsen, The Mineralogy and Paragenesis of the Variscite Nodules from Near Fairfield, Utah. Part 3. American Mineralogist 27, 1942, 441–451.

Liesau et al. 2008: C. Liesau/C. Blasco Bosqued/P. Rios Mendoza/J. Vega/R. Menduiña/J. F. Blanco/J. Baena Preysler/T. Herrera/A. Petri/J. L. Gómez, Un espacio compartido por vivos y muertos. El poblado calcolítico de fosos de Camino de las Yeseras (San Fernando de Henares, Madrid) Complutum 19, 2008, 97–120.

Liesau/Blasco Bosqued 2011: C. Liesau/C. Blasco Bosqued, Materias primas y objetos de prestigio en ajuares funerarios como testimonios de redes de intercambio en el Horizonte campaniforme. Cuadernos de Prehistoria y Arqueología de la Universidad Autónoma de Madrid 37/38, 2011, 209–222.

Liesau/Blasco Bosqued 2015: C. Liesau/C. Blasco Bosqued, La diversidad campaniforme en el mundo funerario. Algunos ejemplos de la cuenca media/alta del Tajo en el interior peninsular. Arpi 3, 2015, 1–15.

Loriana 1942: M. Loriana, Nuevos hallazgos del vaso campaniforme en la provincia de Madrid (dolmen de Entretérminos). Archivo Español de Arqueología 47, 1942, 161–167.

Losada 1976: H. Losada, El dolmen de Entretérminos. Trabajos de Prehistoria 33, 1976, 209–226.

Marini et al. 1989: C. Marini/D. Gimeno/G. Sistu, Le mineralizzazioni a variscite del Sarrabus. Bollettino della Società Geografica Italiana 108, 1989, 357–367.

Martínez Sevilla/Salmerón Juan 2014: F. Martínez Sevilla/J. Salmerón Juan, La artesanía de los brazaletes líticos de la cueva-sima de La Serreta (Cieza, Murcia). Tecnología, útiles y funcionalidad del sitio. Zephyrus 74, 2014, 65–87.

Massé 1971: R. Massé, Découvert de minyulite, wavellite et variscite dans les phtanites de Pannecé. Bulletin de la Société Sciences naturelles Ouest de la France 69, 1971, 12–15.

Muñoz Amilibia 1965: A. M. Muñoz Amilibia, La Cultura neolítica catalana de los "Sepulcros de fosa" (Barcelona 1965).

Murillo-Barroso/Martinón Torres 2012: M. Murillo-Barroso/M. Martinón Torres, Amber Sources and Trade in the Prehistory of the Iberian Peninsula. European Journal of Archaeology 15, 2012, 187–216.

Murillo-Barroso/Montero Ruiz 2012: M. Murillo-Barroso/I. Montero Ruiz, Copper Ornaments in the Iberian Chalcolithic. Technology versus Social Demand. Journal of Mediterranean Archaeology 25.1, 2012, 53–73.

Odriozola 2015: C. P. Odriozola, A New Approach to Determine the Geological Provenance of Variscite Artifacts Using the P/Al Atomic Ratios. Archaeological and Anthropological Sciences 7.3, 2015, 329–350.

Odriozola/García Sanjuán 2012: C. P. Odriozola/L. García Sanjuán, Las cuentas de collar de piedra verde de Matarrubilla (Valencina de la Concepción, Sevilla). In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/T. Ruíz Moreno/R. Cruz Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de La Concepción (Sevilla). Investigación y Tutela en el 150 Aniversario del Descubrimiento de La Pastora (Sevilla 2012) 485–494.

Odriozola/Hurtado Pérez 2007: C. P. Odriozola/V. Hurtado Pérez, The Manufacturing Process of 3rd Millennium BC Bone Based Incrusted Pottery Decoration from the Middle Guadiana River Basin (Badajoz, Spain). Journal of Archaeological Science 34, 2007, 1794–1803.

Odriozola/Villalobos García 2015: C. P. Odriozola/R. Villalobos García, La explotación de variscita en el Sinforme de Terena. El complejo minero de Pico Centeno (Encinasola, Huelva). Trabajos de Prehistoria 72, 2015, 335–345.

Odriozola et al. 2010: C. P. Odriozola/J. A. Linares Catela/V. Hurtado Pérez, Variscite Source and Source Analysis. Testing Assumptions at Pico Centeno (Encinasola, Spain). Journal of Archaeological Science 37, 2010, 3146–3157.

Odriozola et al. 2013a: C. P. Odriozola/A. C. Sousa/R. Boaventura/R. Villalobos García, Componentes de adornos de pedra verde de Vila Nova de São Pedro (Azambuja). Estudo de proveniências e redes de troca no 3o milénio a.n.e. no actual território portugués. In: J. M Arnaud/A. Martins/C. Neves (eds.), Arqueologia Em Portugal. 150 Anos. Associaçaão dos Arqueólogos Portugueses (Lisboa 2013) 457–462.

Odriozola et al 2013b: C. P. Odriozola/R. Villalobos García/R. Boaventura/A. C. Sousa/J. M. Martínez Blanes/J. L. Cardoso, Las producciones de adorno personal en rocas verdes del SW peninsular. Los casos de Leceia, Moita da Ladra y Penha Verde. Estudos Arqueológicos de Oeiras 20, 2013, 605–622.

Odriozola et al. 2016a: C. P. Odriozola/R. Villalobos García/C. I. Burbidge/R. Boaventura/A. C. Sousa/O. Rodríguez Ariza/R. Parrilla Giráldez/M. I. Prudêncio/M. I. Dias, Distribution and Chronological Framework for Iberian Variscite Mining 2 and Consumption at Pico Centeno, Encinasola, Spain. Quaternary Research 85.1, 2016, 159–176.

Odriozola et al. 2016b: C. P. Odriozola/L. Benítez de Lugo Enrich/R. Villalobos García/J. M. Martínez Blanes/M. A. Avilés/N. Palomares Zumajo/M. Benito Sánchez, Personal Body Ornamentation on the Southern Iberian Meseta. An Archaeomineralogical Study. Journal of Archaeological Science. Reports 5, 2016, 156–167.

Osuna Ruiz 1975: M. Osuna Ruiz, El dolmen del Portillo de las Cortes (Aguilar de Anguita, Guadalajara). Noticiario Arqueológico Hispánico Prehistoria 3, 1975, 239–309.

Pascual Benito 1999: J. L. Pascual Benito, Utillaje óseo, adornos e ídolos neolíticos valencianos (Valencia 1999).

Pétrequin et al. 2006: P. Pétrequin/M. Errera/A. M. Pétrequin/P. Allard, The Neolithic Quarries of Mont Viso, Piedmont, Italy. Initial Radiocarbon Dates. European Journal of Archaeology 9, 2006, 7–30.

Pozo et al. 2002: M. Pozo/J. Casas/J. A. Medina, Estudio mineralógico de componentes ornamentales pétreos procedentes de un yacimiento de la Cultura del Argar (Fuente Álamo, Almería). Boletín Geológico y Minero 113, 2002, 131–142.

Real 1992: F. Real, Estudo mineralógico de adornos de cor verde do Neolítico Antigo da Gruta do Caldeirão. In: J. Zilhão (ed.), Gruta Do Caldeirão O Neolítico Antigo. Trabalhos de Arqueología 6 (Lisboa 1992) 315–319.

Ríos Mendoza 2011: P. Ríos Mendoza, Nuevas fechas para el Calcolítico de la región de Madrid. Aproximación cronocultural a los primeros poblados estables. In: M. C. Blasco Bosqued/C. Liesau/P. Ríos (eds.), Yacimientos Calcolíticos Con Campaniforme de La Región de Madrid.Nuevos Estudios (Madrid 2011) 73–86.

Ríos Mendoza/Liesau 2011: P. Ríos Mendoza/C. Liesau, Elementos de adorno, simbólicos y colorantes en contextos funerarios y singulares. In: M. C. Blasco Bosqued/C. Liesau/P. Ríos (eds.), Yacimientos Calcolíticos Con Campaniforme de La Región de Madrid. Nuevos Estudios (Madrid 2011) 357–370.

Roberts et al. 1990: W. L. Roberts/T. J. Campbell/G. R. Rapp, Encyclopedia of Minerals (New York 1990).

Rogerio Candelera et al. 2013: M. A. Rogerio Candelera/L. K. Herrera/A. Z. Miller/L. García Sanjuán/C. Mora Molina/D. W. Wheatley/A. Justo/C. Saiz Jimenez, Allochthonous Red Pigments Used in Burial Practices at the Copper Age Site of Valencina de la Concepción (Sevilla, Spain). Characterisation and Social Dimension. Journal of Archaeological Science 40, 2013, 279–290.

Rubio de Miguel 1993: I. Rubio de Miguel, La función social del adorno personal en el Neolítico de la Península Ibérica. Cuadernos de Prehistoria y Arqueología Universidad Autónoma de Madrid 20, 1993, 27–58.

Schuhmacher 2012: T. X. Schuhmacher, Elfenbeinobjekte des Chalkolithikums und der Frühen Bronzezeit auf der Iberischen Halbinsel. Studien zu Herkunft, Austausch, Verarbeitung und sozialer Bedeutung von Elfenbein (Darmstadt 2012).

Schuhmacher et al. 2009: T. X. Schuhmacher/J. L. Cardoso/A. Banerjee, Sourcing African Ivory in Chalcolithic Portugal. Antiquity 83, 2009, 983–997.

Taffinder 1998: J. Taffinder, The Allure of the Exotic. The Social Use of Non-Local Raw Materials during the Stone Age in Sweden (Uppsala 1998).

Utrilla Miranda et al. 2008: P. Utrilla Miranda/I. Lorenzo Lizalde/V. Baldellou/M. C. Sopena/P. Ayuso, Enterramiento masculino en fosa, cubierto de cantos rodados, en el Neolítico Antiguo de la Cueva de Chaves. In: M. S. Hernández Pérez/J. A. Soler Díaz/J. A. López Padilla (eds.), IV Congreso del Neolítico Peninsular. Volume 2 (Alicante 2008) 131–140.

Valle González/González Cesteros 1992: A. Valle González/V. González Cesteros, Guía de Minerales de España. Tomo IV. Silicatos y Apéndices (Valladolid 1992).

Vega/Menduiña 2011: J. Vega/R. Menduiña, El Yacimiento de Camino de las Yeseras (San Fernando de Henares, Madrid). In: M. C. Blasco Bosqued/C. Liesau/P. Ríos (eds.), Yacimientos Calcolíticos Con Campaniforme de La Región de Madrid. Nuevos Estudios (Madrid 2011) 5–8.

Villalba et al. 1986: M. J. Villalba/L. Bañolas/J. Arenas/M. Alonso, Les mines neolítiques de Can Tintorer, Gavà. Excavacions 1978–1980 (Barcelona 1986).

Villalba et al. 1998: M. J. Villalba/M. Edo i Benaiges/A. Blasco, Explotación, manufactura, distribución y uso como bien de prestigio de la calaita en el Neolítico. El ejemplo del complejo de Can Tintorer. In: G. Delibes de Castro (ed.), Minerales y metales en la Prehistoria Reciente. Algunos testimonios de su explotación y laboreo en la península ibérica (Valladolid 1998) 41–70.

Villalba et al. 2001: M. J. Villalba/M. Edo i Benaiges/A. Blasco, La callaïs en Europe du Sud-Ouest. État de la question. In: C.-T. Le Roux (ed.), Du monde des chasseurs à celui des métallurgistes. Revue Archéologique de l'Ouest Suppléments (Rennes 2001) 267–276.

Villalobos García 2012: R. Villalobos García, Adornos exóticos en los sepulcros tardoneolíticos de la Submeseta Norte Española. El ejemplo de Las Tuerces como nodo de una red descentralizada de intercambios. In: M. Borrell/F. Borrell/J. Bosch/X. Clop/M. Molist (eds.), Xarxes al Neolític. Circulació i intercanvi de matèries, productes i idees a la Mediterrània occidental (VII–III millenni aC). Actes del Congrés Internacional Xarxes al Neolític. Revista del Museu de Gavà, Rubricatum 5 (Barcelona 2012) 265–271.

Villalobos García in press: R. Villalobos García, Evolución de los sistemas de artefactos sociotécnicos empleados en la Meseta Norte Española durante el Neolítico y Calcolítico. In A. Cruz/E. Cerrillo (eds), Tráfego de Objetos Tráfego Tecnológico. Síntomas das ideologias dominantes na Ibéria (Oxford in press).

Villalobos García/Odriozola 2016: R. Villalobos García/C. P. Odriozola, First Approach to the Organisation of Variscite Body Ornament Production During Late Prehistory in the Iberian Peninsula. The Mines of Aliste and Production Loci of Quiruelas de Vidriales (Zamora, Spain). European Journal of Archaeology 19.4, 2016, 631–651.

Willing et al. 2008: M. Willing/S. Stöcklmayer/S. Wells, Ornamental Variscite. A New Gemstone Resource from Western Australia. The Journal of Gemmology 31, 2008, 111–124.

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Production and Consumption of Salt in the Inland Tagus Valley in Prehistory (Spain)

Keywords: salt, Iberian Peninsula, Tagus Basin, Copper Age, Bronze Age

Abstract

Three different types of archaeological sites related to the production and consumption of salt in the inland Tagus valley have been identified: sites with the direct evidence of salt production, indirect evidence of its production through archaeological surveying and sites where analyses have identified the prehistoric consumption of salt in a domestic context. All together, they enable an updated assessment of the prehistoric use of salt in the inland Tagus Valley as cyclical, domestic and inserted, like so many other productions, in the characteristic population patterns in the region.

1. Introduction

Salt was used for numerous applications in prehistory. They included the preparation and conservation of meat and vegetables, livestock-farming, tanning and dyeing hides, metal-working (Delibes de Castro et al. 1998; Juan/Matamala 2002) and even a symbolic role (Abarquero et al. 2012, 325). Even bearing in mind its simple production depending on the natural resources and its possibilities for storage and trade, it is easy to understand its high value.

Documentation of the use of salt on the Iberian Peninsula in prehistory has increased since production was identified at La Marismilla, in the Guadalquiver estuary (Escacena/Rodríguez 1988). By the end of the twentieth century sea salt factories were known in the Lower Tagus (Soares 2000) and by inland lakes (Delibes de Castro et al. 1988), as well as rock salt mines (Weller 2002). Sites like Espartinas in Madrid (Valiente et al. 2002) and Monte da Quinta 2 in Portugal (Valera et al. 2006) enrich a panorama that has recently been extended to the Andalusian highlands at Fuente Camacho (Teran/Morgado 2011) and Añana in the Basque Country (Weller 2015, Fig. 6) (*fig. 1*).

All the sites prioritise in their settlement pattern proximity to different kinds of saline resources and direct evidence of their involvement in salt production: such as ovens, layers of ashes, large accumulations of pottery, clay supports and digging tools in the case of mines (Figuls et al. 2010, 60). These are all elements connected with different parts of the salt production process (Harding 2013, 115). They are found *in situ* or around the original sites of the preparation, boiling and drying of the salt. Another form of direct evidence is the physical-chemical analysis of the characteristic salt residue on pottery at several Iberian sites (Juan/Matamala 2002, 738), as in other studies in Europe (Cassen/Weller 2013, 276).

However, direct evidence is still scarce considering that this is a peninsula with a large perimeter with access to sea salt, as well as deposits of rock salt and natural brine, where our warm climate brings the salt to the surface. Therefore, some uses presumably do not leave a visible archaeological record. This is a natural 'invisible' soluble resource, except where elements connected with its production and consumption are left.

Fig. 1. Iberian Peninsula. Sites with evidence of salt production mentioned in the text.

All this justifies that salt has always been valued in every prosperous prehistoric community from the north to the south of the Iberian Peninsula (Martín et al. 2007; García Sanjuán 2013, 50) especially when allochthonous products (variscite, amber, cinnabar, etc.) imply the existence of exchange networks of which salt may also have formed part. A good example is found in Catalonia in the Neolithic with the salt production at Cardona and varisicite of the Gavá mines. Salt is included among the goods being traded (Figuls et al. 2010).

The use of indirect evidence for its production and consumption is equally justified. These obviously include place-names (*salado*, *salinillas*, *salobral*, etc.) given to numerous rivers and streams, as well as the cartographic analysis of the sites grouped in the proximity of sources of salt on the coast or inland around wells, springs and salt-marshes, often exploited during long historical periods. A good example of the confluence of this evidence is found around the Bay of Cádiz and the south of Seville. In both areas the suggestive place-names and potential salt resources are surrounded by a large number of occupations dated from the Neolithic to the Bronze Age (Ramos et al. 2013, 102 f.). The shape of certain recipients, with a wide base and straight walls and the repeated finds of twin silos, each one dug on a different height (Cassen et al. 2008, 188–190) are regarded as proof of salt production in the area. Shells of marine molluscs at inland sites (Soares 2013) would also indicate fluid exchange networks that might include salt.

The record in the inland Tagus Basin will be examined here. The area of study covers, from east to west, the Provinces of Guadalajara, Madrid and Toledo. These administrative boundaries are operative in this case, as much of the region is inside the salt-rich area (*fig. 2*) and both direct and indirect proof of its prehistoric production and consumption has been documented (*fig. 3*).

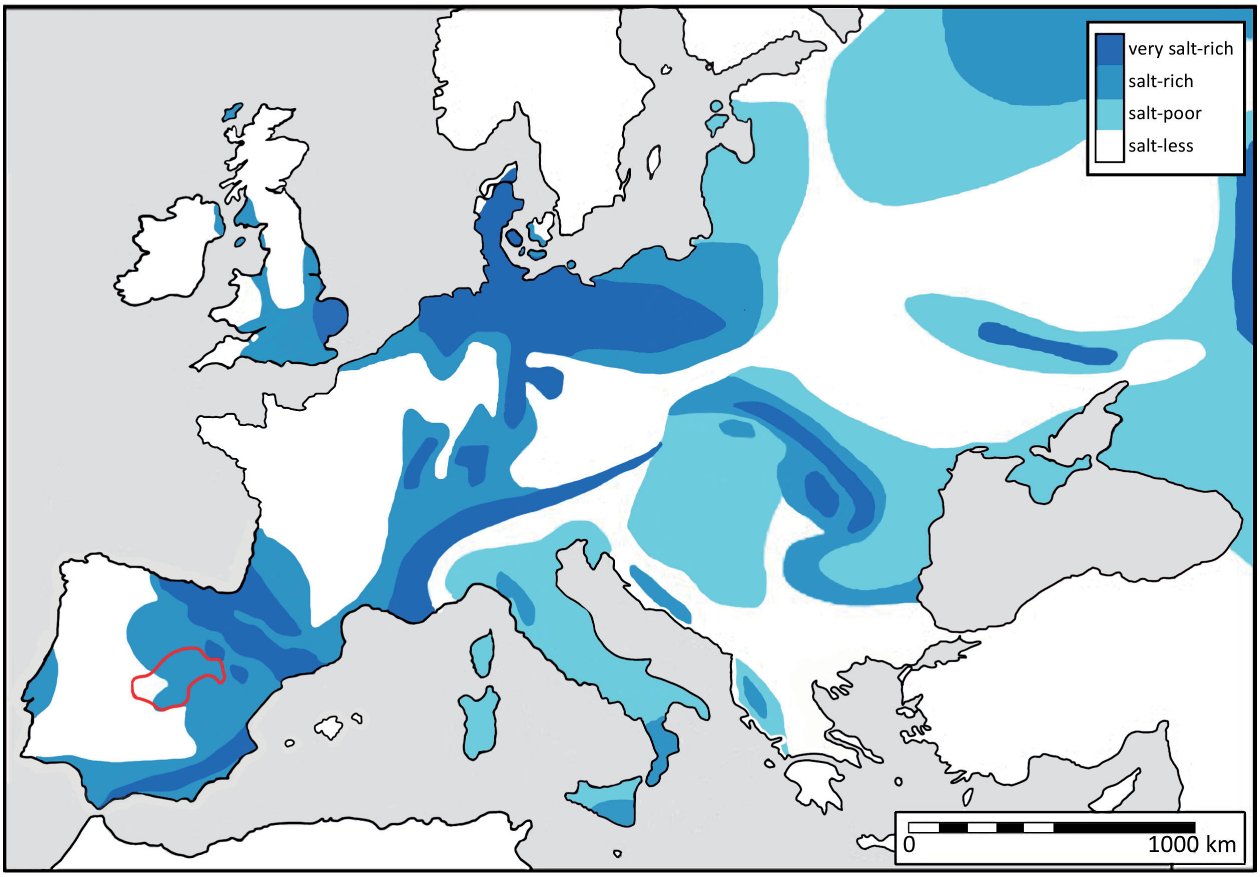

Fig. 2. Map of salt sources in Europe with the location of the study area (after: Harding 2013, Fig. 7.1).

2. Salt as a Potential Resource in the Inland Tagus Valley in Prehistory

Salt is regarded as one of the potential resources determining the characteristic prehistoric settlement pattern in the Tagus Basin. Place-names, vegetation, hydrology, lithology and above all, *salinas* and deposits define these 'landscapes of salt' whose origin may date back to Prehistory. In the Province of Guadalajara several studies of this type of site have been conducted. Two of them will be described here (*fig. 3*).

The first study was carried out in the valley of the Salado River in Sigüenza, in the north of the province (Malpica et al. 2008; 2011). The area contains more than ten *salinas*, some of them emblematic like Imón, as well as a wide range of brackish sites, including halophilic meadows, springs, wells and ponds. Two systematic surveying programmes have located Chalcolithic and Bronze Age settlements around the saline springs and endorheic ponds, although they were usually located on high land rather than in the valley (*fig. 4:A*). A temporary use of the salt mainly for livestock has been interpreted in connection with a relatively mobile population (Malpica et al. 2011, 266). The absence of *briquetage* leads the authors to suppose that the salt was used directly through its precipitation on the land around the saline resurgences (Malpica et al. 2008, 57).

A similar methodology and approach was employed at the head of the Tagus on the River Bullones, where several *salinas* have been exploited since the twelfth century. The authors (Arenas/Martínez Naranjo 1999) detect in the Early Iron Age a valley population located near salt sources. During the Late Iron Age strategic settlements, as well as the main centres of agrarian population, appear to control the salt and optimise the production. Documentation on proto-historic salt in the area of Molina de Aragón also includes some fragments of flat pottery recipients interpreted as salt moulds (Arenas/Martínez Naranjo 1999, 211) (*fig. 4b:B*. At one of the sites where they were found

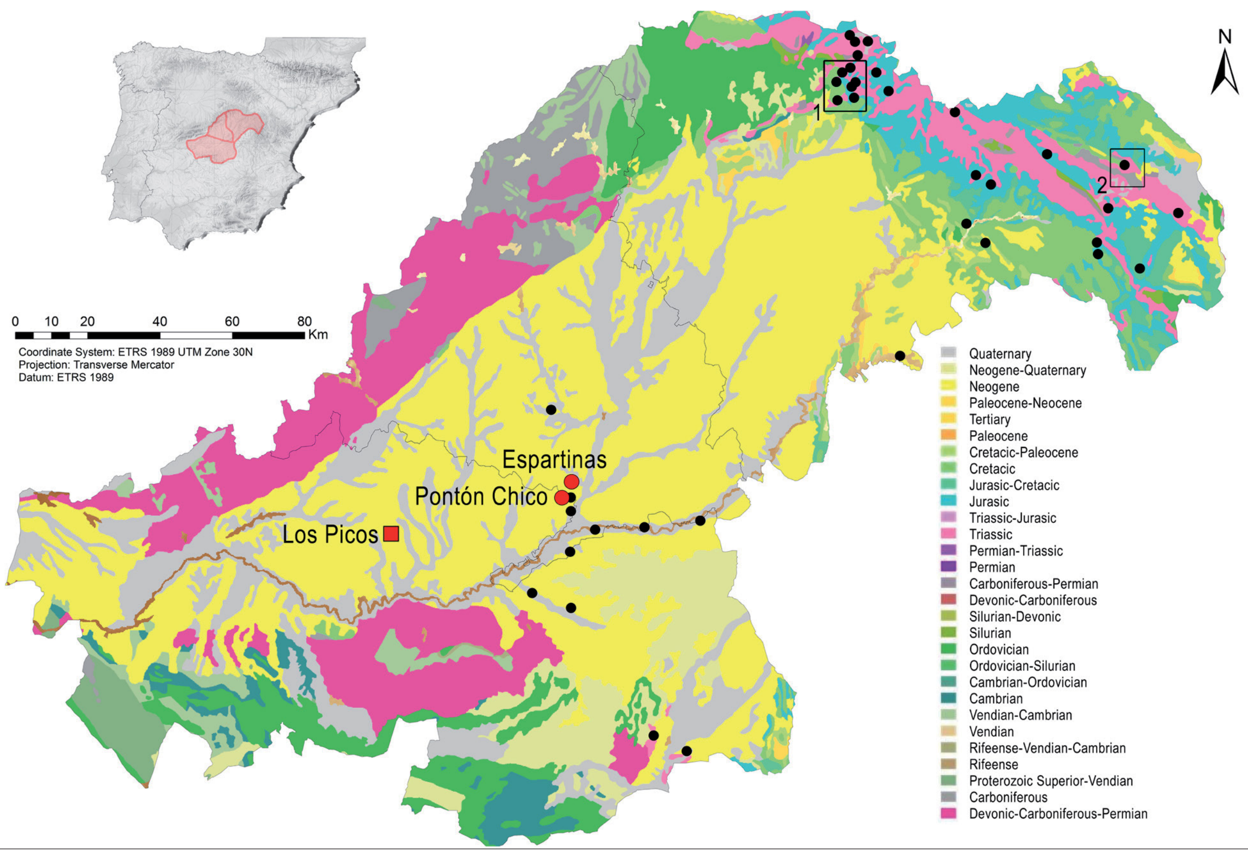

Fig. 3. Study area and details of geology. Location of the salinas (black points), areas with indirect evidence of ancient salt production (rectangles) and prehistoric sites with direct archaeological evidence of consumption and production of salt (red marks). Map by M. Lancharro from Geological map of Spain (Scale) 1:1.000.000. UTM_30 (WGS84).

(El Palomar de Aragoncillo), they coincide with the interpretation of meat products stored in one of the dwellings in the settlement (Arenas 1999, 304 f.). The enormous volume of fauna found in the house and the selection of limbs, although without anatomical connections, are the arguments used to propose the preparation of salted products. Such products have also been proposed for prehistoric sites. Structure F-274 at the Chalcolithic site of Camino de las Yeseras (Madrid), large in size and with evidence of combustion, contained several hind-quarters, possibly articulated. It was suggested, among other options, that this was an area for smoking and/or salting meat (Liesau 2011, 182).

A possible relationship with megalithic monuments, as at El Portillo de las Cortes (Guadalajara), has a point of reference in the *salinas* at Torremocha, Anguita that needs to be confirmed. However, it is suggestive as many of the installations on the Plateau have yielded a Neolithic–Bronze Age sequence, as may be suspected in the valley with the famous monument.

3. Prehistoric Salt Production in the Inland Tagus Valley

The archaeological record in the inland Tagus valley is clustered on the Miocene formations in the river basin, to the south of Madrid and north of the Province of Toledo. Here, evaporitic sediments like gypsum, marls and salts are drained by small streams and springs that form extensive saline soils with resurgences of water bearing large quantities of chloride and sodium sulphates. The geomorphology consists of a series of valleys and ravines cut in the Tertiary materials. Small plateaus and hills attest the significant erosional processes. A large number of *salinas* exploited even today (Puche et al. 2009, 107) show the potential of the area.

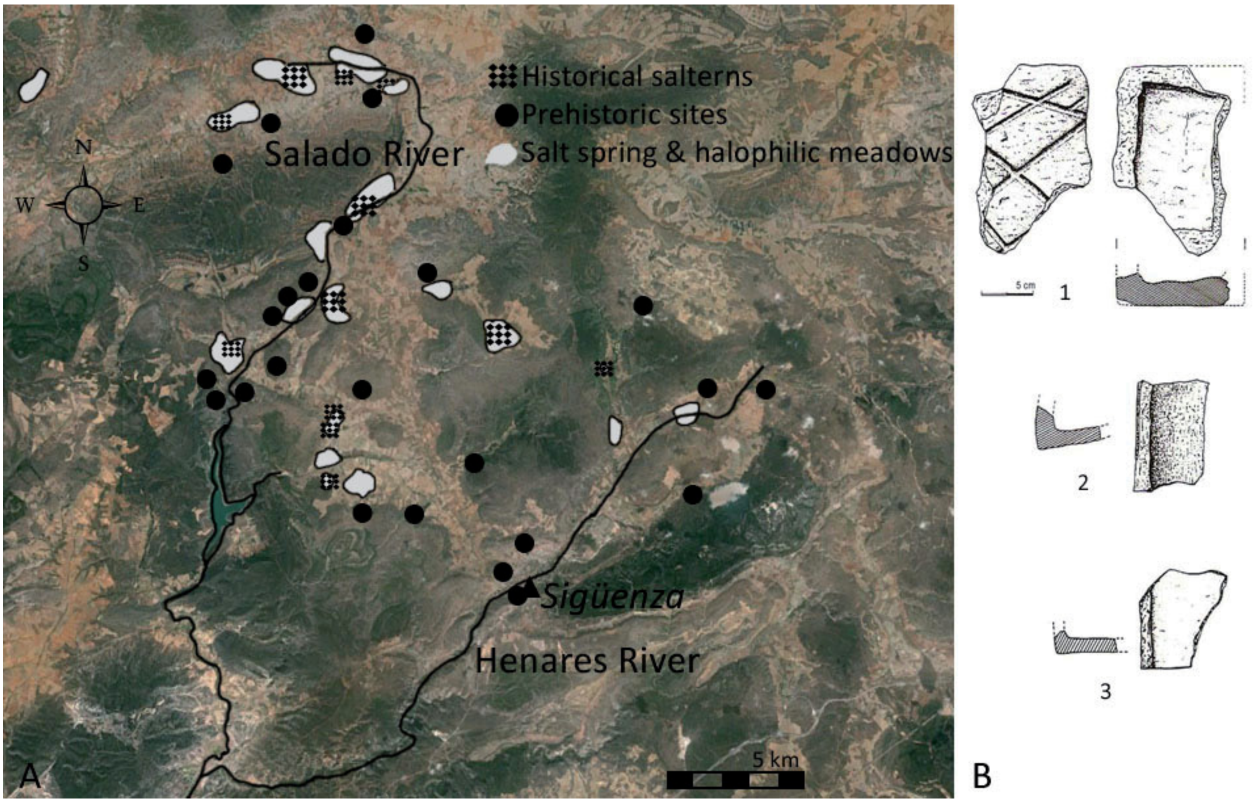

Fig. 4. (A) Location of the prehistoric sites and salt sources at River Salado (Sigüenza, Guadalajara). Aerial of Agricultural Plots Geographic Information System (SIGPAC) of the Ministry of Agriculture, Food and Environment (Spain) with information by Malpica et al. 2011, Map 1, 2; (B) Sherds of possible proto-historic moulds of salt (after: Arenas/Martínez Naranjo 1999, Fig. 3).

3.1. Espartinas (Ciempozuelos, Madrid)

The first documentation of prehistoric salt production comes from the Salinas de Espartinas. The site is located on the right bank of the Jarama River before its confluence with the Tagus. It forms part of a landscape of ravines and escarpments today seriously altered by historical processes of different kinds, such as quarrying for salt from the twelfth century onwards (Carvajal et al. 2002).

The 2001 archaeological excavation focused on a mound about 200m^2 in size formed by the waste left by the exploitation of salt by heating (Valiente et al. 2002). Most information came from Section 3C-E. The excavation only removed 6m of the 10m depth that the geophysical surveying indicated for the stratigraphy to the water-table (Valiente et al. 2009, 187). The first layers in the sequence were affected by recent activities unlike the lower levels, where possible combustion structures were documented together with abundant material remains, pieces of clay and whitish ashes resulting from the combustion of straw and other plants (Valiente et al. 2002). A small oval clay structure, 60x90x10cm in size, was also located (Valiente/Ramos 2009, 174). The upper layer contained, away from their original position, numerous reddish clay supports, used in the salt solidification process and a large number of stones (Valiente et al. 2002, 43). These may have been used to break the recipients or as platforms to hold the vessels over the embers, as proposed at Molino Sanchón II (Abarquero et al. 2012, 221).

Absences are as important to interpret the site as the presences. It is significant that whereas lithic knapping or polishing debris and faunal remains are missing (Valiente et al. 2002, 40), cylindrical reddish clay supports and badly fragmented pottery recipients have been documented. The largest ones may have been used to heat the viscous water with a high salt concentration from which the brine was obtained and then poured into moulds

Fig. 5. Location of the prehistoric sites with evidence of salt production over aerial photo of Agricultural Plots Geographic Information System (SIGPAC) of the Ministry of Agriculture, Food and Environment (Spain). On top left the different areas of Ponton Chico; on the right, view of salt in Espartinas surface.

(Ayarzagüena/Carnaval 2005). From the morphological point of view, large coarse truncated-conical recipients (mouth diameter 40–50cm) with fingermarks on the rims are differentiated from the undecorated pots and bowls (10–25cm) with more carefully finished surfaces (Valiente/Ayarzagüena 2005, 63 f.). Analyses showed they were local products fired at temperatures below 550°C (García/Valiente 2009, 204). Some sherds display internal saline concretions and the marks of fingers and basketry left when these rapidly-made vessels for boiling brine were dried on esparto mats (Valiente et al. 2003). About twenty decorated Ciempozuelos and Dornajos Bell Beaker sherds were also found. Together with a date of CSIC-1879: 3731±32BP (2206–2031 calBC) for charcoal in Section 3C-E these situate the deposit in the late Chalcolithic, although an earlier beginning may be proposed (Valiente et al. 2007, 153).

Palynological samples describe an environment with open holm oak woodland and a few riparian species further away from the *salinas*. It was an anthropised landscape, affected by deforestation and fires, which are interpreted within the typical activity of salt production (Valiente et al. 2007, 151 f.).

Surveying around Espartinas located several sites attributable to the Chalcolithic–Bronze Age. The concentration of sites is repeated further south, towards Aranjuez and the proximate town of Seseña (Valiente/Ramos 2009, 176) and the remains of *briquetage* have even been identified in Valle Grande (Valiente et al. 2007, 154). This sector connects Espartinas with the next site to be described, Pontón Chico in Seseña (*fig. 5*). The archaeological record in this Toledan town includes several prehistoric sites possibly connected with salt production. To the south of the town and

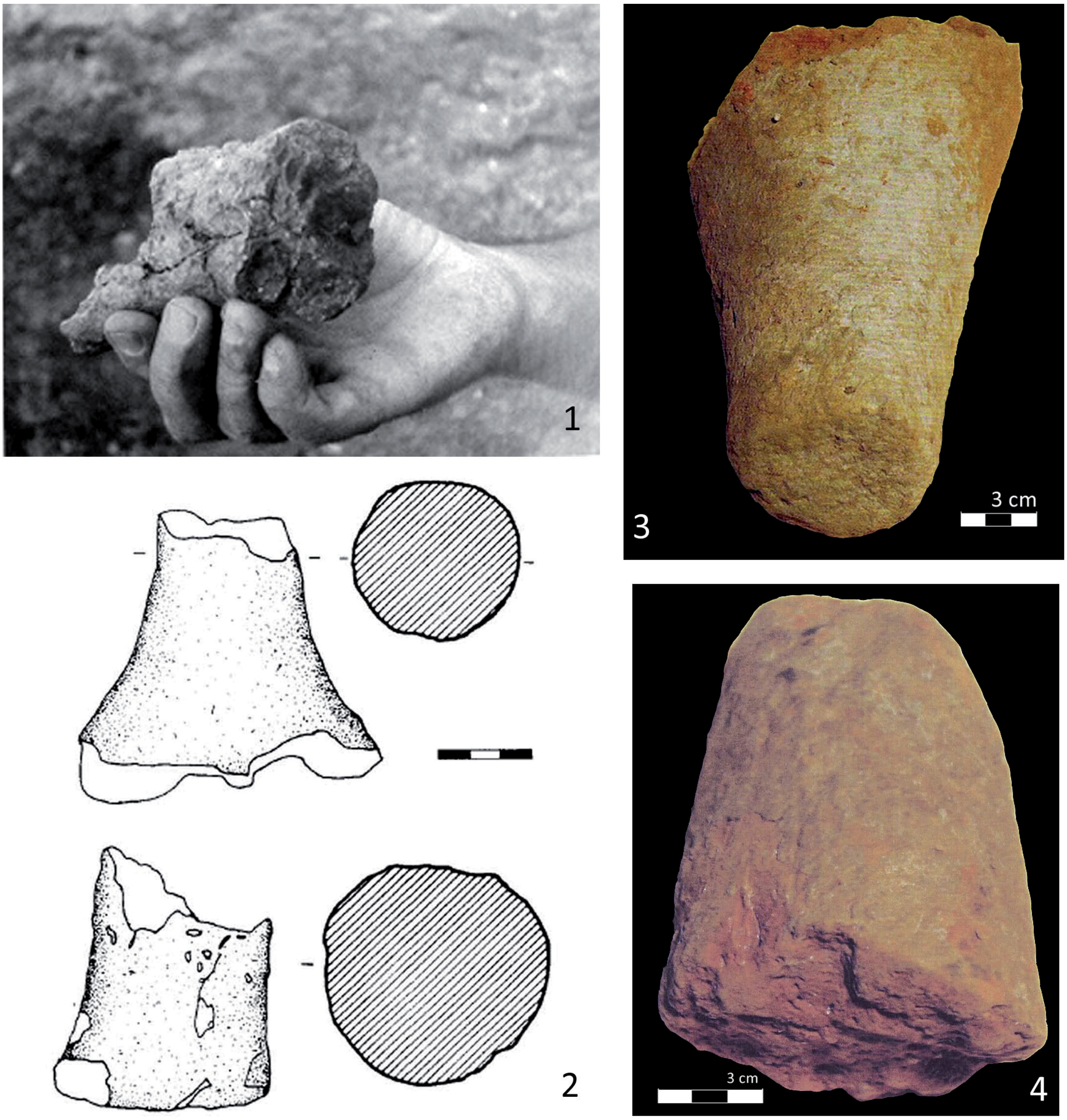

Fig. 6. Sherds of clay supports: (1) Espartinas (after Valiente et al. 2002, 44); (2) Camino Quinto D. Eduardo; Cantera Conejo (Borox). (Drawings after Muñoz 1998, Figs. 3.25 nº 10, 3.32 nº 15) (3–4) Pontón Chico (after: Arribas 2005b, 62, 63 Fig. 26 and 27).

the next municipality of Borox, Chalcolithic and Bronze Age sites are located next to *salinas* and remains of clay supports have been found on the surface (Muñoz 1998, 116) (*fig. 6:2*). Therefore, abundant evidence of salt production of different kinds is found on this side of the Jarama, where it may have become a common resource for the population.

3.2. Pontón Chico, Seseña (Toledo)

The site forms part of the same gypsum environment and has been described as a centre controlling the salt production at Espartinas (Arribas 2010, 90). It was excavated in 2002/2003 in three different sectors (A, B and C-SAU 34, 33 and 32) that apparently belong to the same site cut through by the N-IV road. It occupies a terrace of the Jarama in a high position overlooking the valley. Some 1.2ha were excavated, although Sector C (1,180m^2) was only examined superficially. Over 200 underground structures were located and about 90 of them were excavated. Most of them had been cut through and were incomplete due to the ground-levelling carried out before the archaeological excavation. Remains from the late Iron Age, the Visigothic period and even Spanish Civil War trenches were found, but most of the excavated ensemble belonged to the prehistoric period.

From the publication (Arribas 2010) and the excavation reports (Arribas 2005a; 2005b; 2005c) especially of Sector A several points can be inferred:

a) The stratigraphy in the sites consists of a surface organic layer and a layer of gypsum in which the structures were dug. They are of two types: pits and a smaller number of habitation structures.
   The bases are circular or oval structures whose section and fill allows two types to be differentiated: (I) silos finally used as waste pits whose fill is compact with no charcoal and little pottery and (II) structures with a bell-shaped cross-section interpreted as hearths for boiling salt. They are filled with ash, large amounts of pottery and fragments of clay supports (Arribas 2010, 80 f.). Clear examples are found in Sector B, between 60 and 75cm in size. They lack artefacts but contain large amounts of ash, charcoal and a baked clay plaque (Arribas 2010, 82).
   The dwellings mostly possess an oval floorplan. They can be established by their size (up to 6m long and 4m wide) and the potsherds, baked clay fragments, lithic debris and remains of vertebrates and malacofauna that had been consumed (Arribas 2010, 81). No structural elements or hearths were described in them except for E-76, which was not excavated completely (Arribas 2010, 85 f.).
b) According to the complete stratigraphy in two structures (Silos A and B), cut through in the profiles of Sector A and the others described (Arribas 2005c), it is clear that the site displays complex deposition sequences. Layers of grey ash and charcoal are common, which suggest combustion processes repeated more than is usual at this type of site (*fig. 7:1*).
   In particular, in Silo A as many as a dozen layers were differentiated for three phases of use of the structure. The first with potsherds, lithic debris, bone tools and faunal remains that would have been the last fill of the pit initially used as a silo. The second abandonment phase is characterised by the levelling of the deposits, while the third with ash and no other material than large sherds, is interpreted as connected with 'activities related to salt production' (Arribas 2010, 80). Apparently, it cannot be known whether this stratigraphy is representative of the life of the site, as the structures are presumably not coetaneous.
c) Sectors A and C comprise the central area of the settlement and Sector B its periphery specialising in salt and lithic production (Arribas 2010, 90). Indeed, some of the structures in Sector B differ from the others. For example its Structure 3, described as a dwelling, may have been used previously as a lithic workshop. Structure 10 with an irregular floor plan contained a large hearth with a semi-oval earthenware plaque and accumulated a large volume of remains of combustion in pits (Arribas 2010, 82 f.) (*fig. 7:2*).
d) The pottery recipients are poor-quality local products fired in irregular reducing conditions. The most common pieces are hemi-spherical, truncated-conical, globular and ovoid bowls, as well as some carinated vessels. They are mostly undecorated, as many as 98% in Sector A (Arribas 2005c, 95–99). Only a few fragments with lugs and simple incised and impressed decoration have been found. The predominant lithic material is debris, while few tools (blades and points) have been documented. The record also includes a green necklace bead, bone awls and a potsherd with copper adherences (Arribas 2010, 77, 89 f.).
   The most interesting elements are the supports made from baked clay and with a conical cross-section (*fig. 6:3–4*). They range in size from 20cm long to 10cm wide, although most of them are fragmented. They appear 'normally in the structures interpreted as hearths'

Fig. 7. Ponton Chico: (1) Pit with accumulations of charcoal and ashes; (2) Combustion structure 10 (Photos after: Arribas 2005b, 37, Fig. 6; 2005c, 30, Fig.10).

(Arribas 2005b, 63). Over 70% of them come from Sector A.

e) In the absence of an absolute date, the pottery can be used to situate the site in the Early–Middle Bronze Age (Arribas 2010, 88).[1]

4. Prehistoric Consumption of Salt: The Site of Los Picos, Huecas

Research in the Huecas Valley, to the north-east of Toledo, has focused on prehistoric funerary and habitation sites (Bueno Ramírez et al. 2012; Barroso Bermejo et al. 2015), located around a valley occupied by a central wetland (*fig. 8*).

This is a perennial stream supplied by several aquifers. The retention and decantation of silt and clay and its shallow depth favour the flooding of the land around it. Here, the high salinity leads to the formation of saline efflorescences. Their analysis indicates 21% of sodium salts, with 33% halite and the rest of thenardite (Uribelarrea et al. 2009, 126).

The settlement of Los Picos, where part of a dwelling and several silos were documented, is located on the right-hand side of the valley. Three very similar radiocarbon dates situate it in the first half of the 3rd mill. BC (Bueno Ramírez et al. 2012).

The level ground and the proximity of Los Picos to water suggest this was an agrarian community and the carpological and palynological results support this (López Sáez et al. 2009). The open vegetation was dotted with crops of cereals and legumes, as well as hygrophilous meadows for the livestock.

In this context salt was another resource additional to the agricultural and forestry produce. Less than 100m from Los Picos salt crystals can be seen forming small crusts that are much more visible in summer. They support a halonitrophile flora and the saline plantain *Plantago maritima*, which also appear in the pollen record at Los Picos together with *Artemisia* and Chenopodiaceae/Amaranthaceae, corresponding to a dry climate (López Sáez et al. 2009).

This evidence supports the existence and visibility of salt crystals near the settlement of Los Picos when it was occupied and they may have been used for consumption by simply collecting the crystals and brine. No evidence has been found attesting their systematic exploitation, but their use has been shown by the residue on a small, almost whole, undecorated recipient (P/8/10: diameter of the mouth 7.5cm) from E8. SEM/EDS analysis determined the presence of typical taxa in saline endorheic ponds. Chloride, sodium and traces of magnesium and sulphates, regarded as indicators of salts and gypsum, as well as diatoms of the genera *Navicula*, *Cymbella*, *Amphorara sp*. and other indeterminate fragments were identified (Juan Treserras/Matamala in print). Thus, the last use of the recipient was to hold salt. It is unlikely that salt formed part of the clay fabric. This can be ruled out by the analysis of other recipients in the valley (Barroso Bermejo et al. 2015) as well as by the clay fabric analyses of other Iberian recipients where salt has been detected in the residue (Martín et al. 2007, 183).

As well as being consumed directly, salt may have been used to preserve meat. The faunal study at Los Picos highlighted the young age at which the animals were slaughtered and the importance of pork, as swine were the most abundant animals at the site. These are patterns that may be associated with salting meat when the livestock was reduced in autumn to obtain provisions for the whole year (Daire 2003, 117).

5. Updated Interpretation of Prehistoric Salt in the Inland Tagus Valley

Three sites connected with prehistoric salt are known in the inland Tagus Valley. Two of the excavated sites attest its production and the third, the settlement of Los Picos in Huecas, its consumption. The small size of the recipient and its provenance together with the rest of the domestic recipients mean that its last use can only have been to hold the salt that was habitually consumed with the other food.

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1 Only small fragments of supports and several pieces of clay recipients possibly corresponding to moulds are found among the materials deposited in the Museum of Santa Cruz in Toledo. They are badly fragmented with impressions and a manufacture, quality and colour clearly unlike the rest of the pottery.

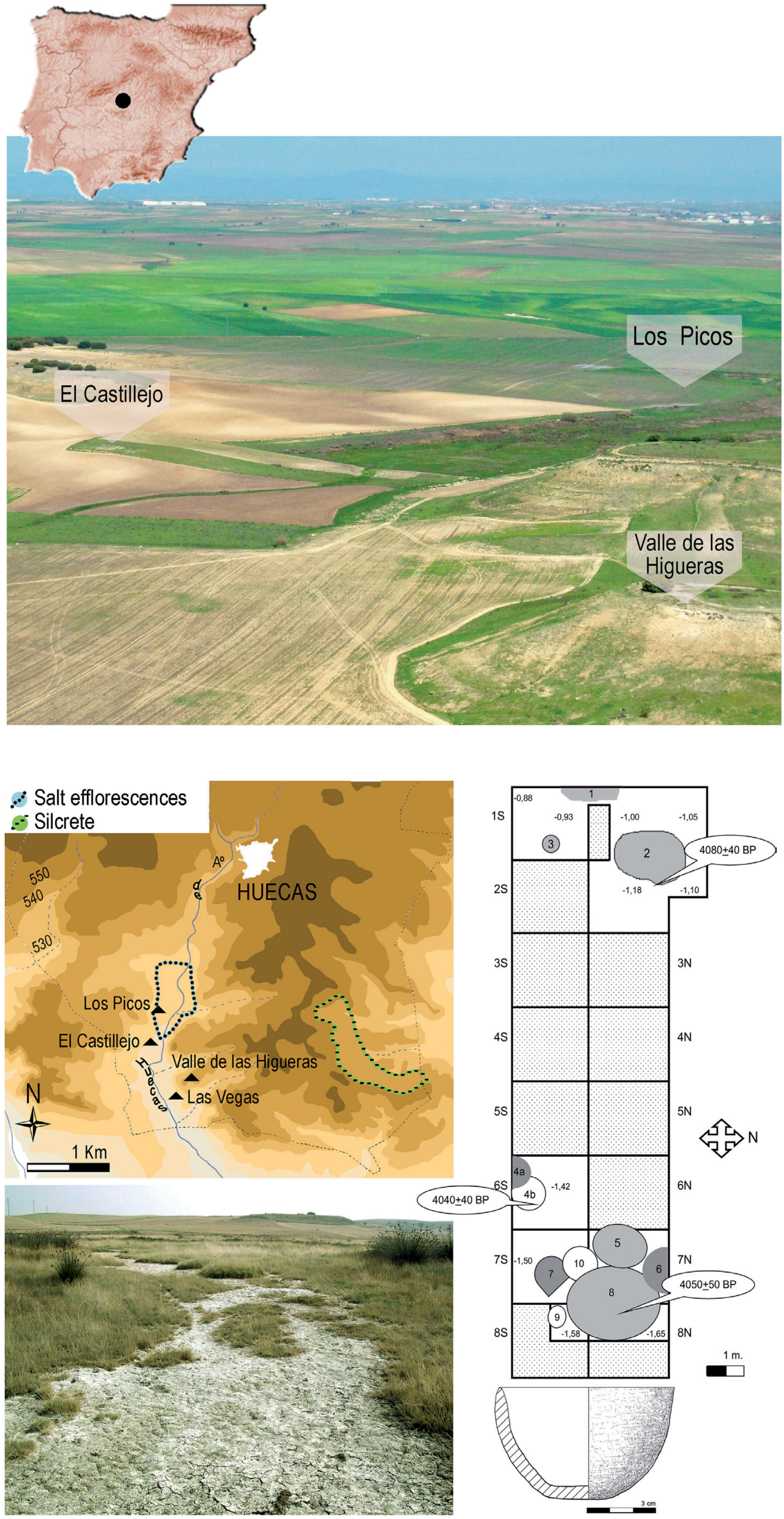

Fig. 8. Aerial photo and map of the Huecas Valley in Toledo with the location of the prehistoric sites. Photo of salt efflorescences in the Valley. Schematic drawing of Los Picos excavated area and its chronological results; below: plain hemispheric bowl of Los Picos with analysis of residues (Photos and drawings by the authors).

Several other studies in the Guadalajara area approach the use and production of salt in prehistory indirectly through archaeological surveying. They are undeniably of interest, but convincing material evidence such as large amounts of pottery and waste is lacking even on the surface. All of them are based on landscapes structured by salt, either potentially usable or with recent *salinas*. However, they may be isolated from other resources like water and the lithological or agrarian potential of the same terrain and simplistic deductions are often reached, which were partly implicit in the original hypotheses. This lack of evidence enables interpretations of mobility in areas such as the Salado River in Guadalajara, as described above, which in our opinion are premature. What these landscapes show most evidently is clear continuity until historical times. The occasional and/or seasonal use of certain products does not automatically signify mobility but a range of resources guaranteeing long-term sustainability. Therefore, hypothetical deductions based on human population patterns and the saline potential of the area are to date of limited use in the prehistory of the inland Tagus Valley. Salt should be considered in combination with other resources.

The two sites with direct evidence of salt production, Espartinas and Pontón Chico, are very near each other as they are scarcely two kilometres apart. In this distance, several sites have been related to salt through surveying. These may be different places of production that were coetaneous or near to one another in time, distributed around the saline resources to the south of Madrid and north of Toledo. This would therefore be a panorama analogous to the situation around the pond of Villafáfila (Abarquero et al. 2012). In the Tagus Basin the date of the late second half of the 3rd mill. BC at Espartinas associated with Bell-Beaker ware, would be continued by the Bronze Age levels at Pontón Chico. However, it should be recalled that salt was being 'gathered' and consumed from at least the early 3rd mill. at Los Picos. Although the Beaker–salt association is well established on the Iberian Peninsula, it is not a common pattern in Europe, whereas it is usual to find a proliferation of sites in the Bronze Age (Harding 2013, 58, 88) as seen in the Tagus Valley.

In Iberia, prehistoric salt production is generally associated with factories and not domestic sites. This is the case at Molino Sanchón II and Santioste (Abarquero et al. 2012, 254) where ritual elements like deposits of fauna and a burial are also known. The same interpretation is made of the places where salt was extracted at Espartinas (Valiente et al. 2007, 162), although really it was a waste tip that was excavated. In this respect, Pontón Chico is a new type of site as it displays elements connected with salt production within the dynamics of a settlement. It contains structures related one way or another with salt production, silos and dwellings, as well as remains of consumption and of lithic and metal working. It is true that the physical and temporal extension of the site is not known and it cannot be determined whether the stratigraphy of Silo A, which suggests an intensification of productive activity over domestic life, can be extended to the rest of the site. However, its location in farmland now used for unirrigated crops and its position on high ground overlooking the valley means the context is very different from a mere collection of workshops. This is a settled population working in the salt production in the valley and it may even have held some type of control over the different points of extraction in the surrounding area.

The salt must have been obtained through the direct use of halite, the 'gathered' salt, not only at Los Picos but in the whole inland Tagus Valley, depending on the size of the seasonal outcrops. Gypsum mine workings are known in the area (Blázquez et al. 2010, 103, 107) and perhaps flint quarrying was interspersed among them. Salt production would form part of similar activities.

Gathering salt may have been combined with production by heating over a fire as the archaeological remains show in some ways. This method of exposure to fire can take numerous forms and therefore its complete reconstruction in the Tagus is still difficult. Diagnostic archaeological remains are needed. At Espartinas it has been proposed that water with a high salt content was exposed to fire in recipients until the brine was obtained. This would be poured into smaller clay moulds that were placed on supports and exposed to the heat of the embers until the salt crystallised fully.

The salt loaves would be removed by breaking the moulds (Valiente et al. 2002). However, the system to saturate the salt water extracted at Espartinas may have been even simpler as recently proposed for the production at Villafáfila. At Molino Sanchón II and the oldest phase at Santioste the absence of furnaces, the abundance of large recipients and the scarcity of moulds suggest treatments in which the saline sediments were filtered and decanted until they were reduced over fire until the brine was completely crystallised (Abarquero et al. 2012, 220 f.). It should be recalled that numerous large recipients were found in the lower level at Espartinas while the clay supports were located in a layer of waste above the level with the furnaces. These were described as semi-open spaces with a low temperature (Valiente et al. 2002, 42 f.) similar to the ones identified at Passadeira (Soares 2013). Perhaps some of the structures described as hearths at Pontón Chico (Arribas 2010, 82) should be interpreted in the same way. In any case, the pottery assemblage at this site does not include such large recipients as at Espartinas, clay supports are common and at least Structure 10 in Sector B (Arribas 2010, 83) with clay plaques and the remains of supports suggests an area for boiling or drying salt over embers.

As A. Harding notes (2013, 113), salt production really involves several processes, such as making the clay objects, recipients, supports and moulds, which also imply processes to select, prepare and fire them. In this respect, in the Tagus Valley the ceramic products are not very standardised, although it should be admitted that the pottery really involved in the salt production process cannot always be discriminated. Even so, this does not signify an occasional use of salt and population mobility. Espartinas attests the local production of *briquetage* deliberately for salt production as the basketry marks and pieces of unbaked clay indicate the rapid manufacture of many of the recipients. The variability would be the consequence of the objectives, needs and natural state of the salt not always being the same. Documentation at Villafáfila (Abarquero et al. 2012, 312) reveals numerous changes in salt production methods, in its acquisition, filtering and boiling that cannot be explained solely as technological improvements.

Other aspects no less difficult to elucidate are the stability and level of production. On one hand, apart from the radiocarbon determination and the long continuity of the stratigraphy at Espartinas, we cannot establish the duration of the prehistoric salt production in the inland Tagus Valley. At this site it has been proposed that seasonal springs were exploited (Valiente/Ramos 2009, 170), that the stratigraphy includes levels of abandonment and also that at the same time as salt was produced, clay was extracted to make pottery for other uses (Valiente 2009, 226). Thus, diverse productive activities were in operation as proposed at Pontón Chico for lithic production (Arribas 2010, 82). Therefore, these were probably cyclical productions in summer, when the salt was more visible and when the population had less work in the fields.

On the other hand, in addition to this seasonality, it is necessary to determine the scale of production, either domestic or industrial, to cover the settlements‘ own needs or to generate a surplus that might be exchanged. This is not possible with the available information, but the seasonality and low material standardisation indicate a domestic scale of production. Continuity and seasonality can be compatible in the case of a population totally settled in an area.

The insignificant environmental impact seen in the record supports this hypothesis. Intensive production with furnaces would require large amounts of firewood (Soares 2103, 172). However, pollen studies at Espartinas (Valiente et al. 2007, 151) do not reflect such intensification, in a similar way to results at other sites around Madrid. Probably gathering small branches in the holm oak woodland and the use of straw would suffice, without the need for deforestation.

The occasional exchange of salt cannot be ruled out. Indeed, the relationship between Bell Beaker pottery and exotic products like variscite, amber and marine shells (Bueno Ramírez et al. 2012) from remote areas of the Iberian Peninsula is well known, while there is little information about the goods that inland communities traded in exchange. However, the opposite interpretation seems more probable. The salt would be traded on a regional scale, as it was equally available to coastal communities. The intensification in production coincides mostly with the discontinuities between the Chalcolithic and the Bronze Age. At that time, exchange networks broke down and communities turned towards their own resources.

One of these resources was salt used to season and preserve, among other purposes, to ensure the longer life of some primary and secondary animal products, such as meat and cheese. The use of salt to preserve food should not be ignored, however difficult archaeological proof may be. Some of the accumulations of faunal remains that in recent years have been perceived as the left-overs of a feast or banquet may be interpreted alternatively as preserved salted products.

The information, although limited, indicates that salt was produced in the inland Tagus Valley without any specialisation or control, in which the latter is understood as the result of competition. These settlements were not established for the sole reason of the salt, but formed part of the characteristic population on the terraces and valleys of the Tagus Basin in the 3rd and 2nd mill. BC, where they had access to a combination of annual and seasonal resources that they made use of.

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Bibliography

Abarquero et al. 2012: F. Abarquero/E. Guerra/G. Delibes de Castro/A. L. Palomino/J. M. del Val, Arqueología de la sal en las lagunas de Villafáfila (Zamora). Investigaciones sobre los cocederos prehistóricos. Arqueología en Castilla y León 9 (Valladolid 2012).

Arenas 1999: J. Arenas, Comercio protohistórico.Líneas de contacto entre levante y el sistema ibérico. In: F. Burillo Mozota (ed.), IV Simposium sobre los Celtíberos. Economía (Zaragoza 1999) 301–309.

Arenas/Martínez Naranjo 1999: J. Arenas/J. Martínez Naranjo, La explotación de la sal durante la Edad del Hierro en el Sistema Ibérico. In: F. Burillo Mozota (ed.), IV Simposium sobre los Celtíberos. Economía (Zaragoza 1999) 209–212.

Arribas 2005a: R. Arribas, Informe de la intervención arqueológica (movimiento de tierras) realizada en el SAU 32, Seseña, Toledo (Junta de Comunidades de Castilla) (La Mancha 2005).

Arribas 2005b: R. Arribas, Memoria final de la intervención arqueológica previa a la declaración del impacto ambiental del programa de actuación urbanizadora del SAU 33, Seseña, Toledo (Junta de Comunidades de Castilla) (La Mancha 2005).

Arribas 2005c: R. Arribas, Memoria final de las intervenciones arqueológicas realizadas en el SAU 34 de las normas subsidiarias de Seseña, Toledo (Junta de Comunidades de Castilla) (La Mancha 2005).

Arribas 2010: R. Arribas, El yacimiento de Pontón Chico, Seseña (Toledo). In: A. M. Belinchón/M. R. Perlines Benito (eds.), Actas de las II Jornadas de arqueología de Castilla. La Mancha (Toledo 2010) 72–100.

Ayarzagüena/Carnaval 2005: M. Ayarzagüena/D. Carnaval, Sistemas de explotación de la sal en las Salinas de Espartinas. In: O. Puche/D. Carvajal (eds.), Minería y metalurgia históricas en el Sudoeste europeo (Madrid 2005) 71–78.

Barroso Bermejo et al. 2015: R. Barroso Bermejo/P. Bueno Ramírez/A. Vázquez/C. Odriozola/D. Uribelarrea/O. López/R. de Balbín Behrmann/L. Peña/J. Yravedra, Campaniforme no funerario en la provincia de Toledo. El yacimiento de Las Vegas. De nuevo el Valle de Huecas. Trabajos de Prehistoria 72.1, 2015, 145–157.

Blázquez et al. 2010: O. Blázquez/D. González/B. Jiménez, Excavaciones arqueológicas en el yacimiento Reina. Seseña Nuevo (Toledo). In: A. M. Belinchón/M. R. Perlines Benito (eds.), Actas de las II Jornadas de arqueología de Castilla. La Mancha (Toledo 2010) 100–114.

Bueno Ramírez et al. 2012: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, 5.000 años atrás. Primeros agricultores y metalúrgicos del valle de Huecas (Huecas, Toledo) (Madrid 2012).

Carvajal et al. 2002: D. Carvajal/F. G.Tostón/S. Valiente, Las salinas espartinas (Ciempozuelos, Madrid). Un ámbito de explotación de la sal desde la Prehistoria. In: 1er Simposio Latino sobre Minería, Metalurgia y Patrimonio Minero en el Mediterráneo Occidental (Bellmunt del Priorat 2002) 53–62.

Cassen et al. 2008: S. Cassen/P. A. de Labriffe/L. Ménanteau, Washing and Heating on the Neolithic Shores of Western Europe. An Archaeological Hypothesis on the Production of Sea Salt. In: O. Weller/A. Dufraisse/P. Petrequin (eds.), Sel, eau et forêt D'hier à aujourd'hui. Homme et Environnement 1 (Besançon 2008) 175–203.

Cassen/Weller 2013: S. Cassen/O. Weller, Idées et faits relatifs à la production des sels marins et terrestres en Europe, du VIe au IIIe millénaire. In: J. Soares (ed.), Prehistory of Wetlands. Landscapes of Salt. Setúbal Arqueológica 14 (Setúbal 2013) 255–304.

Daire 2003: M. Y. Daire, Le sel des galois (Paris 2003).

Delibes de Castro et al. 1998: G. Delibes de Castro/A. Viñé/M. Salvador, Santioste, una factoría salinera de los inicios de la Edad del Bronce en Otero de Sariegos (Zamora). In: G. Delibes de Castro (ed.), Minerales y metales en la prehistoria reciente. Algunos testimonios de su explotación y laboreo. Studia Archaeologica, Secretariado de Publicaciones de la Universidad de Valladolid (Valladolid 1998) 155–197.

Escacena/Rodriguez 1988: J. L. Escacena/M. Rodriguez de Zuloaga, La Marismilla. ¿Una Salina Neolítica en el Bajo Guadalquivir? Revista de arqueología 89, 1988, 14–24.

Fíguls et al. 2010: A. Fíguls/O. Weller/F. Grandía, La "Vall Salina" de Cardona. Los orígenes de la minería de la sal gema y las transformaciones socioeconómicas en las comunidades del neolítico medio catalán. In: F. Abarquero/E. Guerra (eds.), Los yacimientos de Villafáfila (Zamora) en el marco de las explotaciones salineras de la prehistoria europea. Actas de la VII Bienal de la Restauración y Gestión del Patrimonio (Valladolid 2010) 49–84.

García Sanjuán 2013: L. García Sanjuán, El asentamiento de la edad del Cobre de Valencina de la Concepción. Estado actual de la investigación, debates y perspectivas. In: L. García Sanjuán/J. M. Vargas/V. Hurtado Pérez/T. Ruiz/R. Cruz Auñón (eds.), El asentamiento prehistórico de Valencina de la Concepción (Sevilla). Investigación y tutela en el 150 aniversario del descubrimiento de la Pastora (Sevilla 2013) 21–59.

García/Valiente 2009: R. García/S. Valiente, Estudio de las muestras cerámicas documentadas en Salinas de Espartinas y de las tierras de su entorno. In: Sociedad española de Historia de la Arqueología (ed.), La explotación histórica de la sal. Investigación y puesta en valor (Ciempozuelos 2009) 193–206.

Harding 2013: A. Harding, Salt in Prehistoric Europe (Leiden 2013).

Juan/Matamala 2002: J. Juan/J. C. Matamala, Salar i fermentar. Caracterització de dues estratègies de conservació de productes a la fi del neolític i a l'edat del bronze a Catalunya. In: XII Coloquio Internacional de Arqueologia de Puigcerdà (Puigcerdà 2002) 735–742.

Juan Tresserras/Matamala in print: J. Juan Tresserras/J. C. Matamala, Yacimientos arqueológicos de Valle de las Higueras, Los Picos y El Castillejo (Valle del Concejo, Huecas, Toledo) y Azután (Azután, Toledo). Estudio de contenidos de recipientes arqueológicos y de posibles moldes (in print).

Liesau 2011: C. Liesau, Los restos de mamíferos del ámbito doméstico y funerario. In: C. Blasco/C.Liesau/P. Ríos (eds.), Yacimientos calcolíticos con Campaniforme de la región de Madrid. Nuevos estudios. Patrimonio arqueológico de Madrid 6 (Madrid 2011) 171–189.

López Sáez et al. 2009: J. A. López Sáez/L. López Merino/S. Pérez, Historia de la vegetación y paleoambiente del Valle de Huecas. In: L. B. de Lugo Enrich (ed.), Arqueología medio ambiente y obras públicas. El valle de Huecas (Huecas, Toledo) (Ciudad Real 2009) 91–107.

Malpica et al. 2008: A. Malpica/N. Morère/A. Fábregas/J. Jiménez, Organización del territorio y explotación de la sal en el área del Río Salado (Sigüenza, Guadalajara, España). Antigüedad y Edad Media. Resultados de la I Campaña 2008. In: Actas del XI Encuentro de Historiadores del Valle del Henares (Guadalajara 2008) 49–62.

Malpica et al. 2011: A. Malpica/N. Morère/J. Jiménez/G. García- Contreras, Paisajes de la sal en la Meseta castellana desde la Prehistoria la Edad Media. El valle del Salado (Guadalajara). In: M. J. Puertas/G. García Contreras Ruiz (eds.), Paisajes históricos y arqueología medieval (Granada 2011) 233–276.

Martín et al. 2007: A. Martín/J. Juan/J. Martín/P. Villalba, Indicios de sal en el yacimiento neolítico de Ca l'Oliaire (Berga, Barcelona). In: A. Fíguls/O. Weller (ed.), Trobada Internacional d'arqueología envers l'explotació de la sal a la prehistòria i protohistòria, Cardona 2003. Archæologia cardonensis 1 (Cardona 2007) 175–198.

Muñoz 1998: K. Muñoz, El poblamiento desde el Neolítico Final a la Primera Edad del Hierro en la en la cuenca media del río Tajo (PhD-Thesis Universidad Complutense de Madrid 1998).

Puche et al. 2009: O. Puche/M. Ayarzagüena/L. F. Mazadiego, Patrimonio salinero español. In: Sociedad española de Historia de la Arqueología (ed.), La explotación histórica de la sal. Investigación y puesta en valor. Sociedad española de Historia de la Arqueología (Madrid 2009) 103–120.

Ramos et al. 2013: J. Ramos/S. Domínguez Bella/J. J. Cantillo/E. Vijande/M. Pérez, Novedades en el conocimiento de las sociedades tribales neolíticas en la banda atlántica de Cádiz. Explotación de recursos marinos e hipótesis del uso de la sal. In: J. Soares (ed.), Prehistory of Wetlands. Landscapes of Salt. Setúbal Arqueológica 14 (Setúbal 2013) 85–112.

Soares 2000: J. Soares, A Ponta da Passadeira e a diversidade do registo arqueológico dos IV/III milenios A. C. In: Actas das 1ªs Jornadas Arqueológicas e do Património da Corda Ribeirinha Sul, Câmara Municipal do Barreiro (Barreiro 2000) 88–109.

Soares 2013: J. Soares, Sal e conchas na Pré-História portuguesa. O povoado da Ponta da Passadeira (estuário do Tejo). In: J. Soares (ed.), Prehistory of Wetlands. Landscapes of Salt. Setúbal Arqueológica 14 (Setúbal 2013) 171–196.

Terán/Morgado 2011: J. Terán/J. Morgado, El aprovechamiento prehistórico de sal en la Alta Andalucía. El caso de Fuente Camacho (Loja, Granada). Cuadernos de Prehistoria de la Universidad de Granada 21, 2011, 221–249.

Uribelarrea et al. 2009: D. Uribelarrea/O. López/V. Martínez, Geoarqueología del valle de Huecas. In: L. B. de Lugo Enrich (ed.), Arqueología medio ambiente y obras públicas. El valle de Huecas (Huecas, Toledo) (Ciudad Real 2009) 119–135.

Valera et al. 2006: A. C. Valera/J. P. Tereso/J. Rebuge, O Monte da quinta 2 (Benavente) e a produçao de sal no Neolítico Final/Calcolítico do estuário do Tejo. In: N. Ferreira Bicho/H. Verissimo (eds.), Do Epipaleolítico ao Calcolítico na Península Ibérica. IV Congresso de arqueología peninsular, Faro, 14 a 19 de setembro 2004 (Faro 2006) 291–305.

Valiente 2009: S. Valiente, Estudio de las cerámicas a mano decoradas de las Salinas de Espartinas-Ciempozuelos, Madrid. In: Sociedad española de Historia de la Arqueología (ed.), La explotación histórica de la sal. Investigación y puesta en valor (Ciempozuelos 2009) 207–236.

Valiente/Ayarzagüena 2005: S. Valiente/M. Ayarzagüena, Cerámicas a mano utilizadas en la producción de la sal en las Salinas de Espartinas (Ciempozuelos, Madrid). In: O. Puche/D. Carvajal (eds.), Minería y metalurgia históricas en el Sudoeste europeo (Madrid 2005) 61–70.

Valiente/Ramos 2009: S. Valiente/P. Ramos, Las salinas de Espartinas. Un enclave prehistórico dedicado a la explotación de la sal. In: Sociedad Española de Historia de la Arqueología (ed.), La explotación histórica de la sal. Investigación y puesta en valor (Ciempozuelos 2009) 167–182.

Valiente et al. 2002: S. Valiente/M. Ayarzagüena/C. Monco/D. Carvajal, Excavaciones arqueológicas en las Salinas de Espartinas (Címpozuelos) y prospecciones en su entorno. Revista Archaia 2.3, 2002, 33–45.

Valiente et al. 2003: S. Valiente/A. Gea/J. F. López Cidad/M. Ayarzagüeña, Algunos datos sobre cestería y fibras vegetales aplicadas a vasijas en barro de la Edad del Bronce en las "Salinas de Espartinas" (Ciempozuelos, Madrid). Pátina 12, 2003, 101–108.

Valiente et al. 2007: S. Valiente/F. López Cidad/A. Senderos/J. A. López Saéz, Aproximación al estudio de las explotaciones de sal en los valles de los ríos Jarama y Tajo, durante la Prehistoria. In: A. Fíguls/O. Weller (ed.), Trobada Internacional d'arqueología envers l'explotació de la sal a la prehistòria i protohistòria, Cardona 2003. Archæologia cardonensis 1 (Cardona 2007) 145–174.

Valiente et al. 2009: S. Valiente/A. Rubinos/J. A. López Sáez, Resultados de varios estudios analíticos de Salinas de Espartinas en la Prehistoria. In: Sociedad española de Historia de la Arqueología (ed.), La explotación histórica de la sal. Investigación y puesta en valor (Ciempozuelos 2009) 183–192.

Weller 2002: O. Weller, The Earliest Rock Salt Exploitation in Europe. A Salt Moutain in Spanish Neolithic. Antiquity 76.1, 2002, 317–318.

Weller 2015: O. Weller, First Salt Making in Europe. A Global Overview from Neolithic Times. In: R. Brigand/O. Weller (eds.), Archaeology of Salt. Approaching an Invisible Past (Leiden 2015) 67–82.

CORINA LIESAU

Fauna in Living and Funerary Contexts of the 3rd Millennium BC in Central Iberia

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Abstract

This paper discusses the different problems faced when studying Chalcolithic archaeozoological assemblages, many of which arise as a result of the excavation strategies used. The ditched enclosure of Camino de las Yeseras in Madrid is used here as a case study to compare the data on livestock management, animal waste and hunting derived from the study of different structures and areas at the site. Earlier studies have shown that fauna and its taphonomic history can be helpful when trying to establish what uses were made of these structures. The palaeoeconomic reconstruction of Chalcolithic communities, including their subsistence and industrial activities, requires thorough archaeozoological studies, which also take into account those activities tied to the symbolic sphere, present in both domestic as well as in strategic areas linked to the ditches and relevant pits. The great taxonomic diversity documented within a single site requires extensive sampling in order to better understand how its spaces were used. Structured depositions with sequences comprising a variety of wild and domestic fauna, in which not only bovines, dogs and suids have a special role, but also their specific elements. Crania, mandibles and articulated limbs are of particular importance as they are key elements for the understanding of the spatial and social concepts behind ditched enclosures, such as those found at Camino de las Yeseras.

1. Introduction

Conducting a review study on the current state of research on livestock management and hunting activities of Peninsular Chalcolithic communities is a difficult task as a result of these sites' characteristics. The first challenge to overcome has to do with these sites' huge extensions, up to several dozen hectares, both in the case of those with positive structures as wall enclosures and those with negative structures (pit settlements with causewayed or ditched enclosures). As a result, the study of Chalcolithic sites such as Camino de las Yeseras requires large-scale excavation projects and long research timeframes.

Another difficulty encountered when studying Peninsular Chalcolithic sites is that of defining the synchronic use of spaces, especially the pit settlements, where the occurrence of concentric, eccentric, interspersed, segmented, etc., ditches and pits can be linked to successive occupations as well as to section filling or remodelling episodes, with hundreds of smaller contemporaneous (or not) structures sandwiched in between. As a result of this lack of well-defined vertical stratigraphies, coupled with the morphology of the ditches, pits, silos, hut-type structures and possible pens, which do not change throughout the extensive prehistoric and historic occupations noted within them, mean large numbers of (costly) radiocarbon dates are required from these sites for meaningful analyses to be carried out. The artefacts themselves, on many occasions, do not allow for reliable chronocultural assignations to be made and the same is true for the faunal remains, so having radiocarbon dates available is crucial in many cases.

Whereas research on Chalcolithic sites in the south and west of the Peninsula has been taking place for quite some time, in terms of its interior areas there was, for a number of years, a general lack of knowledge, except for some isolated Bell Beaker finds and results derived from one-off/small-scale archaeological campaigns in pit settlements. Thanks to rescue archaeology in particular, as well as other survey methods, there has been a dramatic increase in the number of known Chalcolithic sites with pit settlements and ditched enclosures in this area. Many of these kind of sites were already well-known from southern, eastern and western Iberia as well as from other parts of Europe from the Neolithic onwards (Díaz-del-Río 2001; 2003; Bernabeu et al. 2003; Galindo et al. 2009; Vega et al. 2009; Orozco 2009; Ríos 2011; Ríos et al. 2014; Delibes de Castro et al. 2009; 2014).

Despite these difficulties, what we know for sure is that from the Early Chalcolithic onwards, large pit settlements emerge in the Peninsula's interior. These were important population aggregation centres representing the consolidation of peasant life following an earlier and more discrete Neolithic presence in a number of these population nuclei (Díaz-del-Río 2001; 2003; Galindo et al. 2009; Ríos 2011). These sites are favourably located, in close proximity to rivers, timber resources, pastures, farmland, natural pathways, etc. This allowed for long-term occupations to take place, which remained unaffected by climatic fluctuations or human environmental over-exploitation.

All of the above have influenced our archaeozoological knowledge of most of the Chalcolithic sites of Central Iberia, dug following not strategic archaeological criteria, but specifications imposed by urban developers or by the paths of motorways. Despite this, knowledge of these sites with enclosures has been renewed substantially in recent decades. Most studies concerning these Chalcolithic sites' animal remains, however, are still underway or unpublished, although this is not surprising given the large amounts recovered, the interpretation of which requires extensive team work and effort.

No less important are those studies concerning the filling processes of structures usually identified as hut structures or pits with different features, which sometimes present filling sequences that do not represent mere 'rubbish' accumulations, 'rubbish' being a difficult concept to define in terms of prehistoric societies based on our modern mindsets. As the management of food waste throughout the Chalcolithic has yet to be studied in depth, it is important to approach the study of materials together to understand the use of space in large ditched enclosures through time.

Up to now little attention has been paid to the faunal remains found in the tombs. In the past these remains were simply described in generic datasets that did not contain detailed information on where the specimens had been found nor how they were spatially related to the burials. Modern excavations of these sites, however, require the identification and recording of possible faunal offerings to be carried out *in situ*, as well as their comprehensive taphonomic study, aimed at distinguishing between either the intentional or intrusive character of the animal bones within the tombs.

The Chalcolithic is also shown as a transitional phase in terms of domestication processes, especially with regard to equids, with different debates concerning the existence of an Iberian refugium after the Pleistocene, and the wild or domestic status of the horses in the 3rd mill. BC (Uerpmann 1990; 1995; Benecke 1994; Levine 2003; Liesau 2005; Sommer et al. 2011). It is generally assumed that Peninsular Chalcolithic horses are an agriotype and even genetically show an isolation phenomenon (bottleneck) until the Bronze Age, when there began to be greater variability, thus showing that they were not domesticated in the Iberian Peninsula (Cieslak et al. 2010). A recent DNA study has shown that domestic asses were present at the Portuguese Chalcolithic site of Leceia (Cardoso et al. 2013), a discovery that has further complicated our understanding of equids in the Iberian Peninsula and the extinction process of the wild ass (Geigl/Grange 2012). Until its publication it was thought that the domestic ass has not been present in the Iberian Peninsula prior to the Phoenician colonising phenomenon (von den Driesch 1972). Given that the samples that we are dealing with here basically correspond to the first half of the 3rd mill. BC at Camino de las Yeseras (especially the central and eastern areas), with a wider chronological span for the southern area, we will assume, until proven otherwise by archaeozoological and genetic studies, that we are here dealing with wild horses (first half of the 3rd mill. BC).

The purpose of this work is to highlight and briefly discuss those studies concerning this Chalcolithic ditched enclosure on which we have been working on for a decade. This will open up a debate on the issue of representativeness of test excavations at large sites and the complex spatial perception Chalcolithic societies had of the animal world and its resources.

2. Some Methodological Considerations with Regard to the Study of Archaeozoological Remains in Enclosures

Sieving and flotation are very time consuming tasks, especially at large sites such as Camino de las Yeseras, which comprises thousands of documented and excavated structures. Although rescue archaeology has provided us with a good spatial overview of these sites, it also presents an information bias when time constraints are in place, which greatly affects the recovery of different body parts of both large- and medium-sized animals and their fragmentation rates, but especially that of small vertebrates and invertebrates and other organic remains (Payne 1972; Clason/Prummel 1977; Morales/Moreno 1992). Intact contexts, structured deposits or graves, however, deserve to be studied thoroughly.

I use the term ‘structured deposits’ to refer to contexts in which mostly complete animal skeletons have been recovered, as well as their articulated portions (axial, fore and hind limbs or jaws) which do not represent mere disposals of waste, but the careful placing of animal bodies or certain parts of these. There has been much debate with regard to this issue with different terms used to describe them such as ‘rituals’, ‘special deposits’, ‘structured deposits’ or more aseptic terms such as ‘articulated’ or ‘associated animal bone groups’ (ABGs) (Hill 1995; Márquez 2001; 2006; Bradley 2005; Márquez/Jiménez 2010; Díaz-del-Río 2010; Morris 2011; 2012; Anderson-Whymark/Thomas 2012). I consider that ‘structured deposits’ is the most suitable term for a sequence of articulated animal remains and other artefacts or ecofacts such as fractured pottery, lithic implements, charcoal remains that was intentionally sealed up down to the base of the occupation level and which reveals the intentional filling of this structure (Liesau 2011a; 2011b; 2012). In this regard it is also necessary to classify and quantify the faunal remains into categories or independent taphonomic groups, especially in the case of the structured deposits, with the aim, in terms of the overall assemblage, of not over-representing certain taxa or complete or partially articulated skeletons so that **consumption and refuse, worked bone and complete animal deposits** can be properly quantified and understood (Gautier 1987).

In terms of the use of different archaeozoological estimation and quantification methods such as MNI (minimum number of individuals), NISP (number of identified remains) and WISP (weight of the identified specimens) I would first like to make several observations in relation to their use in the study of pit settlements with ditched enclosures.

Given that pit settlements generally represent successive occupation displacements, finding intact geological subsoils where undisturbed negative structures can be dug out, makes estimating the population numbers living within them, difficult. The magnitude of their huts and other nearby features are also difficult to define in terms of the contemporaneous use of these particular spaces. In these ‘horizontal occupation aggregates’, as recently defined by Delibes de Castro et al. (2014, 8), it is difficult to establish the synchronous or asynchronous nature of the animal waste accumulations in well-defined horizons.

Therefore, the estimation of the minimum number of individuals (MNI) is an unreliable parameter when applied to contiguous or closely spaced structures and will always over-represent the taxa when estimates are made for each of the features. These estimations are only useful when dealing with fauna from intact contexts or those used for short periods such as unaltered tombs or structured deposits. In addition, the various concentric enclosures neither guarantee a better spatial delimitation of the horizons between the ditches and pits, given they were repeatedly emptied or occupation took place shortly after their infilling (Ríos et al. 2014).

In this study I will be mostly using NISP and WISP, both of which can provide data on the relative importance of each of the identified taxa found at these complex sites. Although it is beyond the scope of the present study to discuss the utility of both these quantification measures in detail, it is worth noting that I follow the methodological criteria set out in Liesau (1998; 2011b). NISP quantifies the number of bones or bone fragments identified, whereas WISP allows us, albeit indirectly, to learn about the meat contributed by each taxon. This is because there is a relationship between the weight of the bone and the carcass or soft parts of the animal from which it came from. Comparing the relative values (percentages) of NISP and WISP therefore enables us to more reliably establish the real meat providers within a site were; this is where the larger contribution made by macromammals (e.g. bovines [cattle and aurochs], horse, red deer) is better assessed than by simply counting the number of their remains (NISP). Whereas NISP values tend to be very high for medium-sized mammals as sheep, goat and suids (pigs and/or wild boar) given their higher fragmentation rates, when these are combined with their WISP data, this leads to the playing down of these taxa's numerical abundance. Therefore, both quantification methods are necessary and complement each other and this is why they are shown together in fig. 2d and 5.

How much fauna should we study for it to be a representative sample of these big enclosures? This could be debated endlessly (Grayson 1973; Lyman 1994; 2008), but each site presents a different study potential and there is no doubt that large sites require quantitatively significant samples for minimally reliable information to be gained on the representativeness of the major domestic and wild taxa consumed or made use of by their inhabitants. As we are not only interested in finding out about the relevance of the main providers of primary products, but also of the secondary, I consider that between 5000 and 10,000 identified remains, depending on their state of preservation, are necessary for us to get a meaningful picture of the faunal spectrum present within a specific prehistoric horizon. It is, however, also important to carry out these studies in different areas of the site to note whether the faunal remains were used or accumulated differentially according to the taxa they pertained to or their size. Let us now therefore turn our attention to the case study of Camino de las Yeseras.

3. Camino de las Yeseras: Overview of the Results by Area

Covering an area of more than 20ha, the site of Camino de las Yeseras is strategically located on the upper terrace and near the confluence of the Jarama and Henares Rivers in the Madrid region. Following the superficial cleaning of the site, more than 8500 structures were documented and just over 1300 excavated over several campaigns carried out by the 'Gestión del Patrimonio S.L.' and 'Argea Consultores' companies as well as by our research team at the Autonomous University of Madrid (Blasco et al. 2005; 2007; 2011; Liesau et al. 2008; 2013a; 2013b; Vega et al. 2010; Ríos 2011; Ríos et al. 2014). Despite the digging limitations as a result of the construction works, it was possible to extensively excavate the southern region of the settlement (1.3ha) and to note the presence of five concentric ditched enclosures and an additional eccentric one on the surface, from which various stretches have been excavated of the third, fourth, fifth and sixth, as well as a central area of the site, with the total surface area excavated closer to 3ha (*fig. 1*).

The faunal studies are ongoing and about 20,000 remains from different areas have been studied thus far. Our research team has been analysing the remains found in numerous structures of the southern, eastern and central areas of the site. The following represent highlights from some of the published results as well as others still under study found within the three aforementioned areas.

Fig. 1. General plan of the Camino de las Yeseras site showing the areas from which archaezoological studies are available (after: Ríos 2011, fig. 337, based on drawings by Argea Consultores S.L. and Gestion del Patriminio Cultural S.L.).

3.1. Southern Area

Around 500 structures have been documented in the southern area of the settlement, of which the following are worth noting.

3.1.1. Hut-Type Structures (Hut-Like Features with Sunken Floors) (*fig. 2*)

There is a concentration of these kinds of structures in the southern area of the site and several huts have already been studied (Blasco et al. 2005; 2007; Ríos 2011; Liesau 2011b). The study of three structures with similar features from the second half of the 3rd mill. BC has proven to be very interesting in terms of material comparative studies (Blasco et al. 2007; Ríos 2011; Liesau et al. 2013b). Hut A-09 E02 (*fig. 2a*, *d*) presents a filling with an abundance of material (3000 ceramic pieces, 252 lithics, only two bone awls and more than 1000 faunal remains). The materials found indicate a habitational use, which filled the structure until its abandonment. The material from hut F-322 (*fig. 2b*, *d*) (678 ceramic pieces, 297 lithics, 12 bone artefacts and ca. 700 animal remains) suggests the undertaking of several activities in which silex, bone and antler raw materials were also processed. Finally, hut F-5 (*fig. 2c*, *d*), with two Bell Beaker graves in artificial caves excavated on the

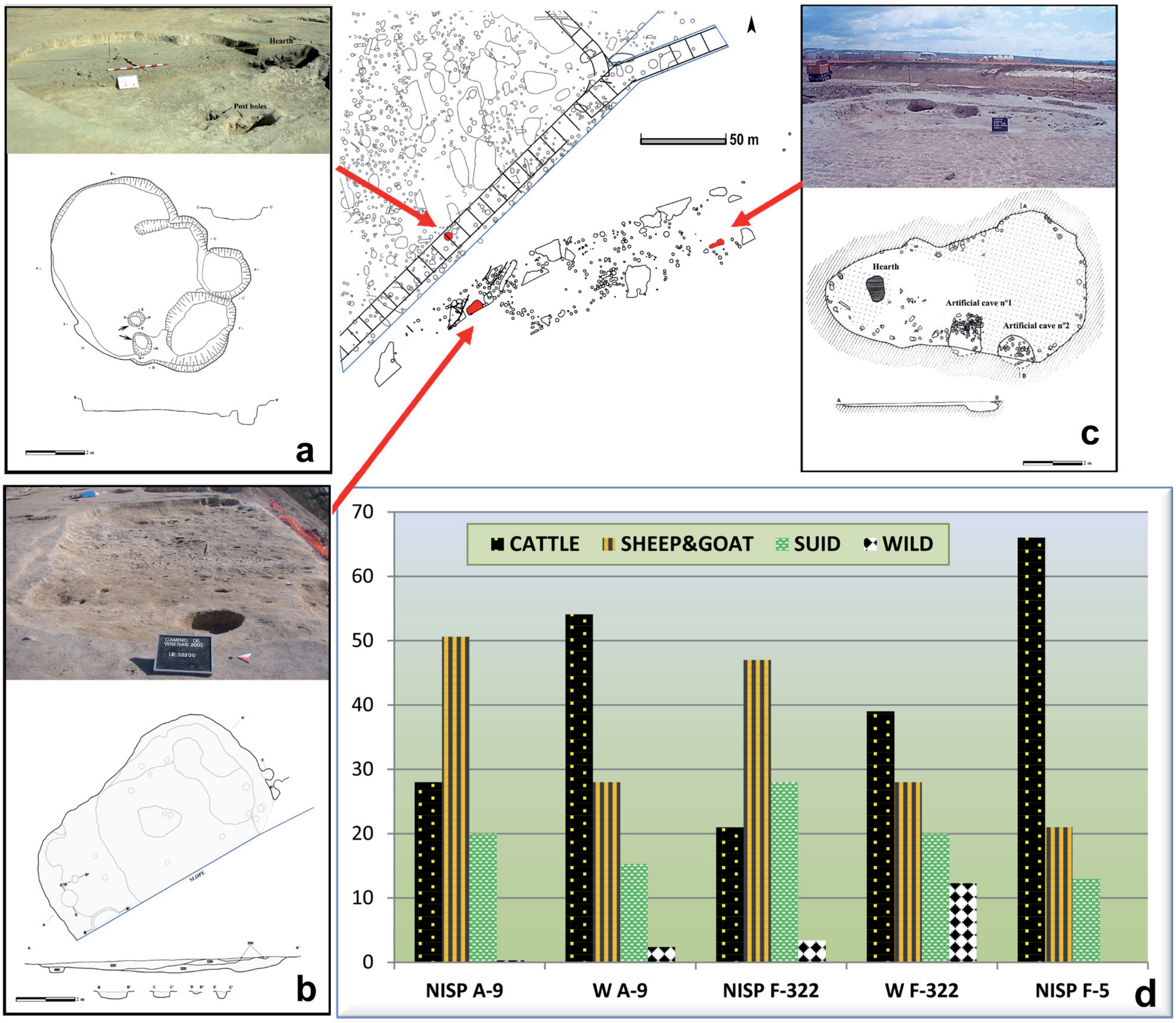

Fig. 2. Dimensioned drawing of the southern area of Camino de las Yeseras showing the huts studied (after: Ríos 2011, fig. 225): (a) Photo and plan of hut A-09 (from Argea S.L.); (b) Photo and plan of hut F-322 (after: Gestión del Patrimonio S.L., Ríos 2011 figs. 289, and 290); (c) Photo and plan of hut F-5 (after: Blasco et al. 2005, fig. 4); (d) Histogram showing relative NISP and WISP values for domestic and wild taxa found at each of the huts (WISP for hut F-5 is not available).

southern edge of the floor of the structure, only contained a few lithics and no bone artefacts, although it did have a few dozen decorated and symbolic Chalcolithic pottery pieces. A few (ca. 50) faunal remains, several articulated portions belonging only to domestic taxa, were found in the eastern portion. A second faunal assemblage, comprising mostly mandibles of cattle, suids and ovicaprines, was found next to the hearth in the western part of the structure. The small number of remains, their taphonomic alterations and the select pottery indicate that this was not a conventional living space, but rather a feature used for a short period and left undisturbed (*fig. 2c, d*).

3.1.2. Pit Features

With about 500 structures excavated, pit features are the most common at the site, albeit with a variable density depending on the area (*figs. 1; 2*). They are all from the 3rd mill. BC with the exception of a number of them from a Middle Bronze Age occupation. The sample comprises almost 6000 identified faunal remains although this number is likely to increase in the near future as research is ongoing. Domestic fauna represent 90% of NISP and weight and thus are the predominate kind, as opposed to their wild counterparts. The presence of cattle is noteworthy, which in terms of WISP represents 50% of the meat consumed. The ever-numerous ovicaprines, despite their larger NISP values, only account for around 20% of WISP, a value closer to that of the suids. In these habitat contexts of the site, wild taxa such as aurochs, red deer and wild boar represent rare resources and the presence of horse bones is also very scarce (0.2% of NISP; 0.4% of WISP) (*fig. 5a*).

3.2. Eastern Area (*figs. 1; 3*)

A study of the fauna from the fourth ditch around a pass-through area, approximately 5m wide and corresponding to the Early Chalcolithic (first half of the 3rd mill. BC) is available (Liesau et al. 2013/2014). From a taphonomic point of view it is remarkable the presence of several categories of faunal assemblages: (a) remnants of consumption and waste (ca. 1700 faunal remains recovered); (b) a major batch of slightly modified bone splinters that could be defined as bone artefacts (ca. 150); and (c) two structured deposits on both sides of the access area.

a) In the first category, the proportion of domestic fauna is 87% in terms of NISP and 74% in terms of WISP. Whereas cattle predominate in terms of weight compared to the rest of the taxa, the greater presence of suids at the expense of ovicaprids is noteworthy; the former are very numerous, but nonetheless not very significant in terms of the overall assemblage. Wild fauna make up 17% of the total NISP, whereas in terms of WISP represent 26% of the total given the presence of aurochs and red deer but especially horse, which for this time period is still considered a wild taxon (*fig. 5b*).
b) Comprising more than 150 pieces currently under study, this large accumulation of bone artefact pieces is striking. Although barely worked, they represent another category that suggests that the remains of consumed animals were probably nearby. What seems clear is that their accumulation inside the ditch was intentional. Mainly bone slinters of macromammals abound, especially the distal portions of long bones, as well as rib fragments; minor pointy bone splinters were also found and these must have been used for short periods and were later on, accumulated in the ditch (Liesau et al. 2013/2014, fig. 9).
c) The structured deposits in this context, containing skeletons of several taxa, do not represent the mere dumping of carcasses or waste, but the careful placement of their bodies in both the northern and southern sections of this access area. The articulated limbs of cattle, a complete horse metatarsal and the bones from the wing of a black stork in a pit, made in the previous filling of the ditch, were recovered in the southern section (*fig. 3*). In the northern section, in a pit excavated at the base of the ditch next to the access area, a dog was placed looking outwards, accompanied by the ribs and hind quarters of a domestic or wild boar piglet, together with the mandibles of two other dogs placed in the same context. This deposit in a pit dug out from the base of the ditch was later covered by many artefacts, pottery, bone industry, including human bones, up to the base of the feature.

Not far from this entrance, but also near to the ditch itself, other pits with faunal deposits have been found, including one containing a large and heavily weathered aurochs skull. It is thought that perhaps the skull was buried after being left out in the open for a prolonged period of time. Its exposure was maybe linked to its display as a trophy or as evidence of cultic events, the happening of which has also been noted at other pits at Camino de las Yeseras and which are currently under study (Liesau et al. 2008; 2013b). Also, preliminary studies of the mtDNA have revealed two different haplotypes of aurochs remains at the site, which is of great interest in terms of possible hybridisation episodes between the agriotype and domestic forms (Geigl et al. 2011).

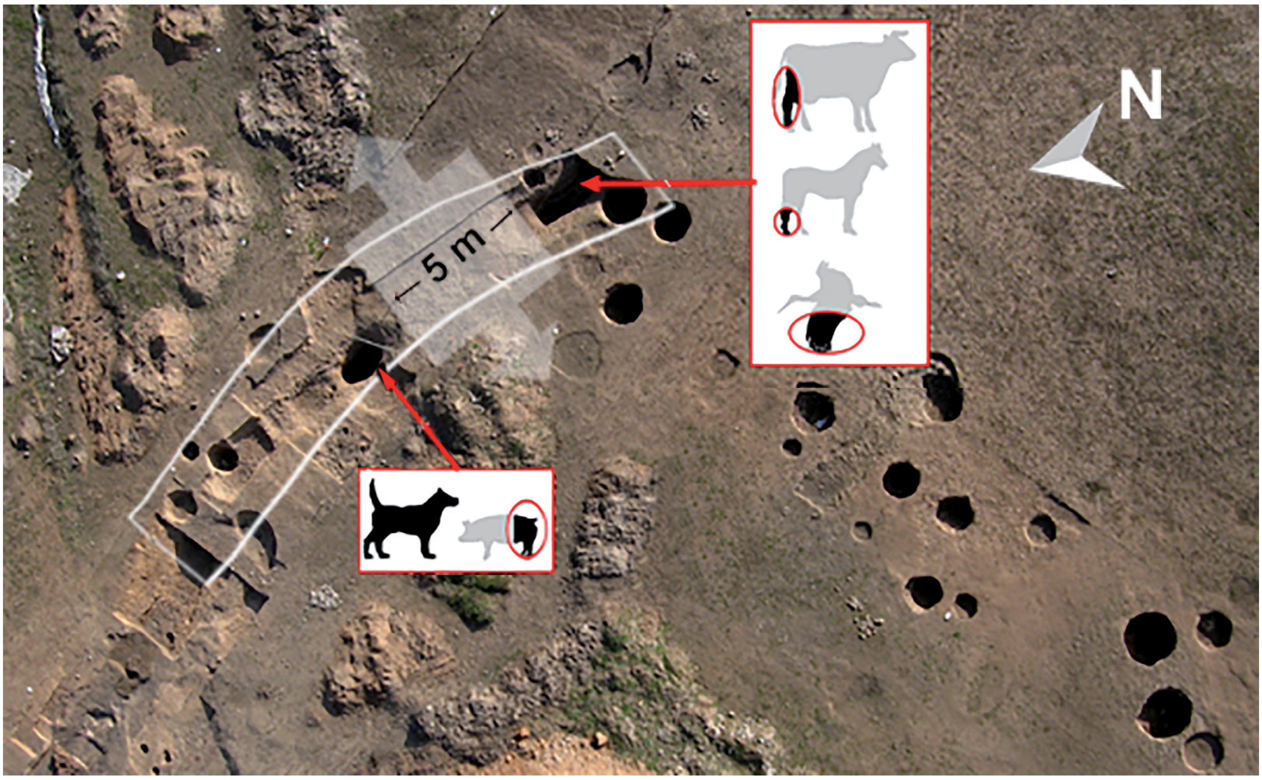

Fig. 3. Aerial photograph showing the northeastern access area and the north and south ditch stretches at Camino de las Yeseras. To the north, a foundation deposit in a hole excavated at the base of the ditch with a complete dog and a partial piglet or wild boar piglet skeletons. To the south, articulated or complete portions of bovid, horse and black stork recovered from the inside of UE 03 ditch (Aerial Photo: Argea, S.L.).

3.3. Central Area (*figs. 1, 4, 5c*)

A brief overview of the results obtained from a Chalcolithic context studied in the central area of the site, a large 600m^2 irregular feature up to 2m deep, remains to be discussed (Liesau 2008; Vega/Menduiña 2011). The faunal remains recovered here are very abundant, so much so that they represent double the amount of material recovered in terms of the rest of the site. The unit analysed (A 132 III. 02, EU 330) has a ca. 10m^2 surface area and a stratigraphy ca. 50 cm deep and chronologically corresponds to the first half of the 3rd mill. BC (*fig. 4*). This archaeological record is particularly rich given that a gold sheet, aluminium silicate green beads and a cluster of cinnabar were found within it (Ríos/Liesau 2011).

The sample comprises 1772 faunal remains, of which only 50% could be identified. The high frequency of domesticates (72% NISP) only represents 40% of WISP. It is mostly wild taxa, with horse bones predominating the assemblage (43%), followed by aurochs, red deer and wild boar remains as the main meat providers in this context (60%) (Chorro 2013) (*fig. 5c*).

4. Understanding the Archaeozoological Record of Chalcolithic Sites in Central Iberia Through the Camino de las Yeseras Case Study

After briefly reporting on the results of the different areas analysed, of which at present the eastern and central require further study, it is fair to say that the southern area presents a sufficiently representative assemblage for us to gain a significant overview of farming and hunting practices at this particular Chalcolithic community. The predominance of domestic fauna is absolute, with cattle representing the main source of meat even though ovicaprines are very numerous. The contribution made by suids is also significant, close to that of ovicaprines, depending on the context (*fig. 5*).

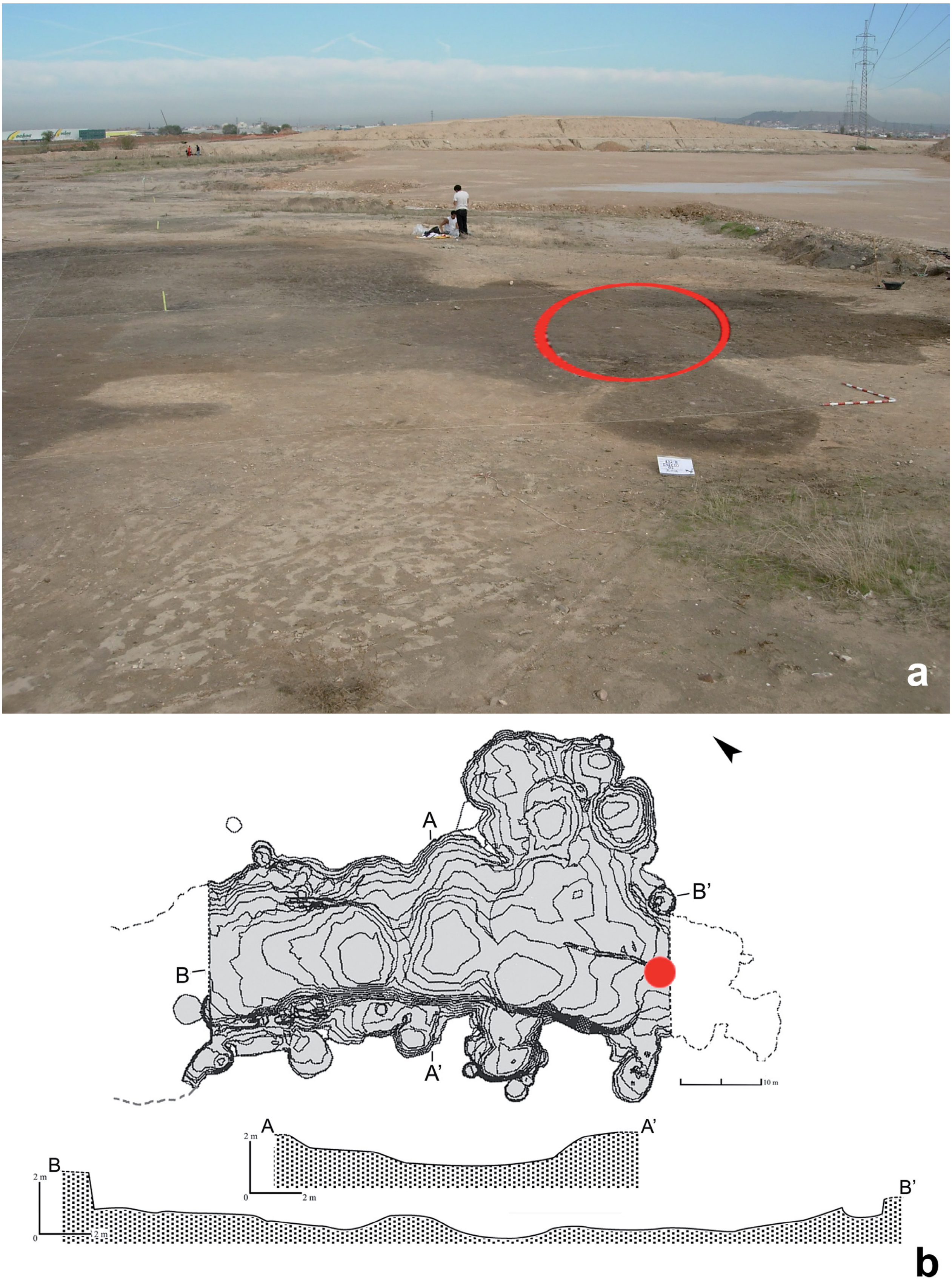

Fig. 4. Central area at Camino de las Yeseras: (a) Photo prior to the start of the excavation works (Photo: Argea, S.L.); (b) Plan and profile of the excavated area (from Ríos 2011 based on Argea S.L.).

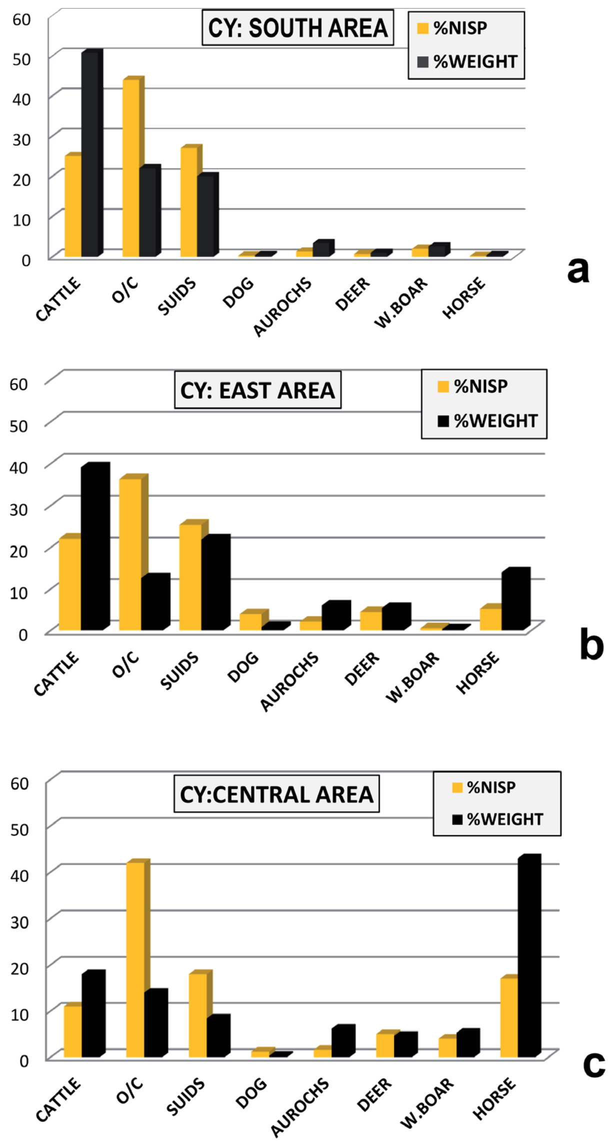

Fig. 5. Histograms comparing relative NISP (yellow) and WISP (black) values for the different taxa recovered in areas of the site: (a) Southern Area; (b) Eastern Area, access to the fourth enclosure; (c) Central Area.

Overall, the results for the southern area resemble those of many other Chalcolithic sites from the interior of the Peninsula. In the Madrid area sites such as La Loma de Chiclana, El Capricho, El Ventorro, Las Matillas, El Espinillo, Viña de la Huerta or El Juncal (Getafe) are the same in that domestic fauna is by far the most predominant, generally in the region of 90% of identified remains (NISP) and weight (WISP), but most of the faunal remains are quantitatively unrepresentative samples with the exception of that of El Ventorro (NISP ca. 1700) (Díaz-Andreu et al. 1992; Morales/Liesau 1994; Morales/Villegas 1994; Díaz-del-Río 2001; Díaz-del-Río et al. 1997; Herráez/Cerdeño 2000; Yravedra 2010; Martínez et al. 2015).

However, as we saw earlier (section 3.1.1 and *fig. 2*) the archaeofaunas also indicate functionality in relation to the structures under study, even if their size and morphology are similar, which is the case for the three huts in the southern area of the site. Hut A-09 E02 on the one hand would essentially be a living space given that the consumption refuse found within it comprises mostly domestic fauna. Hut F-322 on the other hand was most likely a communal space, where domestic and wild fauna – aurochs, red deer, rabbits and hares – were consumed. In addition, it was also used as a storage space for the keeping of some eroded Bell Beaker ceramic fragments and as a workshop for lithic knapping and bone and antler working. Lastly, the small numbers of articulated limbs found in funeral hut F-5, as well as their distribution and taphonomic history, show that this structure was designed for a special purpose. This purpose was not a residential one because the tombs, symbolic pottery and the absence of lithic and bone artefacts suggest the presence of a funerary space where some events, which have been defined as **rituals of commensality** (Liesau 2011b; Liesau et al. 2013a), took place (*fig. 2*).

In terms of the results obtained from the eastern area of the site, especially from the filling of the fourth ditch, structured deposits and worked bone pieces play a relevant role in relation to the amount of consumption refuse. In the latter, the increasing values of the wild taxa are significant (*fig. 5b*), but the structured deposits are also very interesting in relation to the symbolic importance that an access area to the centre of a ditched enclosure may have had.

In the northern part of the stretch, a foundation deposit excavated at the base of the ditch contained a young male dog looking outwards and accompanied and covered by various grave goods. This choice of species as well as the way in which it was placed looking outwards and these animals' roles as guardians could be indicating that its symbolic role was one of control over this passing or access area (Liesau et al. 2013b; 2013/2014; Daza 2015). The fact that the mandibles of two other dogs were found in the dog deposit of the northern stretch is also striking; their presence could be linked to that which has traditionally come to be defined as *pars pro toto* in certain cultic acts, where selected portions reflect standardised behaviour guidelines, which should be further studied given their frequency in the archaeological record of Peninsular Neolithic, Chalcolithic and Bronze Age sites (Valera et al. 2010; Liesau 2012, 247 f.; Valera/Costa 2013).

The other structured deposit in the south stretch of the access area is no less interesting: a pit excavated once the ditch was partially filled, the faunal spectrum of which, in contrast to the complete dog carcass and the piglet hindquarters, comprises large ungulate limbs and the wing of a large and rare bird – the black stork –, all of which emphasise the unique character of the whole assemblage (*fig. 3*).

Both deposits remind us of certain Neolithic sites, where similar associations have been found in some of the enclosures, bearing in mind the great chronological differences, but which go back to much older well-rooted traditions, as is the case of the spectacular Herxheim enclosure, including an avian wing as one of the animals deposits (Zeeb-Lanz et al. 2009; Arbogast 2009). Other taxa found in these deposits are bovines (cattle and aurochs) and ovicaprines (sheep and goat) and in particular their skulls and mandibles (Cardoso 2009; Liesau 2012). In relation to these anatomical parts, Valera and Costa pointed out 'that fragments should not be devalued for they have the potential to establish and maintain bonds, assuming relevant social roles' (Valera/Costa 2013, 273). This segmentation does not only affect animal remains but pottery, human skeletons and other artefacts, recovered from ditches, pits or funerary contexts and must be linked to previous European and also Iberian Neolithic traditions (Chapman 2000; Márquez 2006; Arbogast 2009; Jeunesse/Seidel 2010; Bedault/Hachem 2008; Höltkemeier/Hachem 2013).

Going back to the remains linked to consumption refuse, still more striking are the results obtained from the study of the central area sample, which give the impression of it being a completely separate site. The faunal accumulation is important and has nothing to do with the aforementioned assemblages from the south or east areas. Further archaeozoological analyses therefore are needed to confirm whether this unit is representative of the rest of the large structure documented there and the peculiarities noted for each of the taxa recovered in connection with other areas of the site (*fig. 5c*).

In this sense it is also worth asking how representative small assemblages excavated at large Chalcolithic sites with limited excavation areas are with regard to the use of spaces, an issue that obviously affects all archaeological materials.

The study of any kind of archaeological intervention, be it either a test or a small excavation, is very important in order to further our understanding of site settlement patterns. Archaeozoological studies provide information about the main taxa and their taphonomic history and, when possible, the stockbreeding undertaken by these past societies, providing us with an important starting point for further palaeoeconomical and environmental studies. The first results obtained from the different areas at Camino de las Yeseras however, also confirm the complex and dynamic relationships between the people and how they managed the animal bones or carcasses at different locations. These spaces were intentionally delimited by emptying the ditches and/or the embankments or by the construction of palisades or walls. Based on what can be inferred from this study the remains of consumption, the deposits and the bone artefacts all have their places too, very likely according to the specific uses and spatial conception of insolubility of what the ritual and domestic spheres are (Brück 1999; Bradley 2005).

As for the taxa recovered at most of the sites in the interior of the peninsula, ovicaprids are numerous, whereas cattle and suids are probably the most important meat resources depending on the parameters used (NISP/WISP). During the Chalcolithic, cattle presented favourable conditions for their maintenance and breeding, with the lower valley grasslands used during the hot and dry summer months. In terms of the smaller livestock, the results obtained from some sites indicate a greater preference for sheep than goats, but we are still missing comprehensive studies to better understand the composition of these herds, the ages at which they were slaughtered and the exploitation of secondary products.

Another interesting fact is the importance attained by suids during the Chalcolithic. Regardless of the difficulty in separating pig and wild boar remains, the former, as more or less stalled livestock, is further proof of stable settlements of certain importance during the 3rd mill. BC. In this sense, Camino de las Yeseras stands out because of the importance pig has within it, but also because of the abundance of its agriotype recovered in numerous structures where large-boned and large-toothed individuals have been found. Even if these pig bones include both the domestic form as well as the agriotype, given how similar they are osteomorphologically the greater consumption of suids during the Chalcolithic does not allow us to argue that this was due to specific and more sophisticated livestock management or hunting strategies, nor due to greater social complexity. Likely as a result of more favourable environmental conditions throughout the 3rd mill. BC than during the following millennium, suids were able to flourish more significantly thanks to surpluses of natural resources such as acorns or those derived from human agriculture and consumption refuse.

The available pollen, anthracological and carpological data indicate that there was an important oak tree cover during the Chalcolithic at different sites at which stockbreeding pressures can already be noted (López Sáez et al. 2009; López Sáez 2011; Peña Chocarro et al. 2011). It is very likely that throughout the 3rd mill. BC the management of pigs was already sustainable enough for pig herds to be kept around the settlements as well as for sufficient acorns to be available for humans to gather and consume. A number of studies on palaeodiets have also confirmed this kind of consumption in human populations: Huecas, El Tomillar and Camino de las Yeseras (Bueno Ramírez et al. 2005; 2009; Fabián 2009, 37; Trancho/Robledo 2011). Archaeozoological data from El Ventorro, Camino de las Yeseras, or the Chalcolithic habitation structures of Pico Fontarrón in the Huecas Valley (Toledo), but also others in the south, such as Valencina de la Concepción amongst others, as well as the Portuguese site of Perdigões show a significant consumption of pigs. These pigs could have been kept more or less in 'semi-freedom' – like the montanero pigs of the Extremadura are kept – given their abundance in sites located in the low valley of the Guadalquivir river (Morales/Villegas 1994; Morales/Liesau 1994; Bueno Ramírez et al. 2009; Liesau 2009; Costa 2010; García Sanjuán 2013; Martínez 2013, 42). Although their numbers declined towards the end of the Chalcolithic when more arid conditions are known to have prevailed.

In general, it has also been assumed that the most commonly consumed wild taxa are red deer, wild boar and some small game such as hares and rabbits. Aurochs and horse appear in much smaller numbers as shown by the results obtained from the southern area at Camino de las Yeseras (*fig. 5a*). However, the presence of these taxa changes dramatically in the eastern area, where the faunal record presents a more complex sequence, which requires a more careful reading of its contents. There the amounts supplied by hunting are no longer small nor opportunistic and become more significant as attested by the 26% of the total weight (WISP) represented by the wild taxa (*fig. 5b*). The presence of hunted wild fauna in the central area is even more dramatic with 60% of the weight coming from these taxa, of which 43% are horse remains (*fig. 5c*). The hunting, capture and killing of these large herbivores, as well as for wild boars, implies an important availability of meat at specific times and the communal consumption by various communities of a large animal cannot be ruled out, as already suggested by a number of scholars for other European sites (Whittle 1988; 2014; Bradley 2005). This differential distribution of bone remains in any case requires a more in-depth study of the management of space and the accumulation of large herbivores especially given that, up to now, the more than 100 aurochs remains from Camino de las Yeseras represent the most abundant sample of this nature for an Iberian Chalcolithic site.

In terms of Chalcolithic faunas, assessing the roles other resources played, such as shellfish or fishes amongst others, remains to be studied, although the results from a small number of palaeodietary studies indicate that the consumption of aquatic resources was more common than previously thought (Bueno Ramírez et al. 2005; 2009; Trancho/Robledo 2011) (*fig. 6*). We hope future studies will incorporate more analyses on these excellent environmental bio-indicators present throughout different occupation horizons. We also hope these will highlight other important

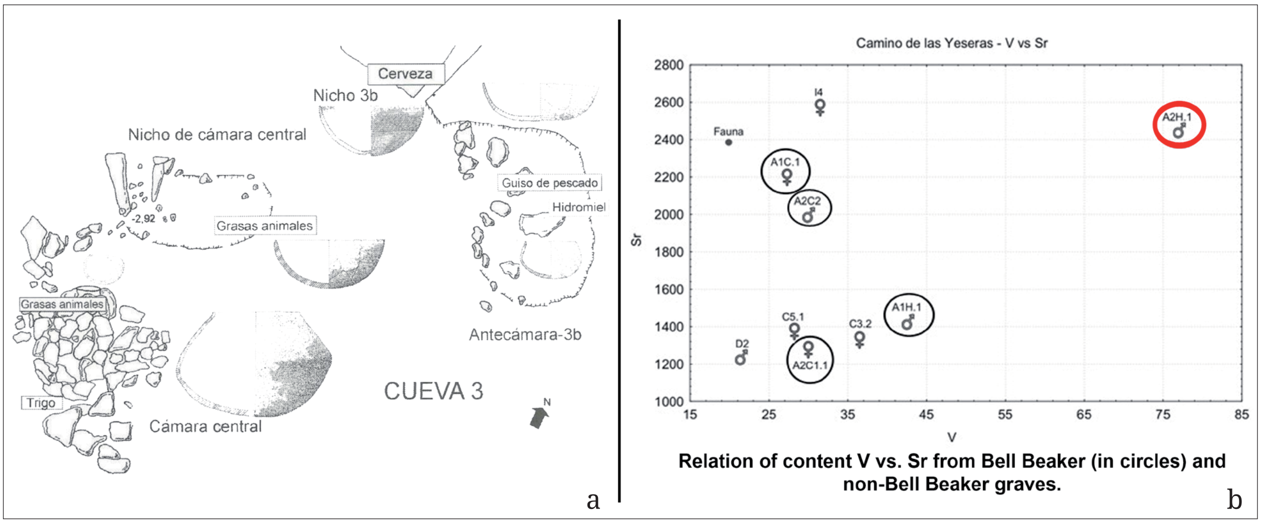

Fig. 6. Evidence of animal consumption through the analysis of: (a) The contents from Bell Beakers tomb 'cave 3' at Huecas, containing animals fats and even fish stews (after: Bueno Ramírez et al. 2005, fig. 8); (b) Study of palaeodiets carried out on different chalcolithic individuals (Bell Beaker ones in a circle) from Camino de las Yeseras (after: Trancho/Robledo 2011, fig. 4). The individual highlighted in red is worth noting as it represents a very prominent inhumation given the type of grave and its associated grave goods (gold, ivory and cinnabar). His diet shows a marked and highly frequent consumption of milk and dairy products in a relation to other individuals. Otherwise, the high value of Sr, despite of the vegetarian diet, can also indicate the consumption of molluscs, crustacean and fishes.

factors such as the differential consumption of, for example, meat or milk by special individuals, as for example the young adult documented in the richest Bell Beaker inhumation recorded at Camino de las Yeseras (*fig. 6b*).

The significant accumulations of fauna found at ditched enclosures is probably due to not only the different concept that these societies, so distant to us in time, had of food waste, as we could not find any middens at this site, but also due to the fact that many of these remains were intentionally modified to be used in a variety of tasks. Although there are more elaborate and very characteristic bone artefacts such as awls made from ovicaprine tibiae or metapodia, the most abundant artefacts are slightly modified bone splinters and these are widely distributed throughout the site during the 3rd mill. BC.

The raw materials and bone types documented at Bell Beaker funerary contexts from the second half of the 3rd mill. BC are more unique. Using different archaeometric techniques it has been possible to identify the raw materials such as ivory that were used to make buttons with V-perforations or beads (Banerjee et al. 2012). Most notable is the exploitation of fossil or sub-fossil resources – ivory from forest elephants – as well as others that imply long-distance exchange networks – African elephant and sperm whale ivory – all found at the same site, as is the case at Camino de las Yeseras (Liesau/Moreno 2012). It is not only the raw materials however, which stand out, but also the morphology of the buttons and other artefacts, which point to the circulation of very characteristic materials and designs from important Chalcolithic sites of the Tagus estuary towards the interior of the Meseta, as well as to the southeast and eastern areas of the Peninsula (Liesau 2016).

5. Funerary Fauna in Chalcolithic Tombs

Funerary fauna is still a poorly understood issue in the study of the Chalcolithic of Central Iberia. This is partly due to the limited evidence available on the burials documented so far, especially those in pit settlements and also because little attention was paid to them during older excavations, unless they had decorated or symbolic pieces amongst them. Chalcolithic studies highlighting the presence of animals or parts of identified taxa as funerary offerings within the Peninsula are relatively recent (Gonçalves 2003; Moreno 2003; Weiss Krejci 2006; Duarte et al. 2006; Cámara et al. 2008; Márquez/Jaimez 2010; Liesau 2011b; 2012).

Fig. 7. Faunal remains in Chalcolithic individual and collective graves from various sites: (a) Camino de las Yeseras: collective inhumation of two females with two children amongst whose skeletons various ovicaprine remains were found. The red circle indicates a mandible (Photo: Argea S.L.); (b) Camino de las Yeseras: individual inhumation of an adult female in whose grave 7 vertebrae of a big shad and a fore limb of a fawn were found (Photo: Gestión del Patrimonio S.L.; F-492); (c) Collective burial at El Perdido site (Torres de Alameda, Madrid). At least two dogs were found in the sealing level. Detail of a dog cranium and fore leg next to a human cranium (Photo: Trébede, Patrimonio y Cultura S.L.); (d) Individual inhumation of a male with a dog placed on its back in a pit from the Cerro de la Cabeza site (Avila) (Drawing after: Fabián 2006, 315).

Another problem also affecting the interpretation of these possible animal offerings is the frequent alterations suffered by many of the graves. Collective graves with successive or displaced inhumations or where human remains and/or grave goods have been extracted are quite common, which makes their anthropological study significantly more difficult as well as the interpretation of possible funerary practices. These alterations affect both the collective graves from the whole of the 3rd mill. BC as well as the Bell Beakers burials, particularly those containing successive inhumations (Liesau et al. 2014).

In general, in pre-Bell Beaker collective burials faunal remains are neither very common, nor do they show a general pattern in terms of the species or elements accompanying them. Occasionally the remains of small ungulates can be found, as is the case in one multiple Chalcolithic burial in a pit at Camino de las Yeseras. Two women and two children were lying close together and some bones of two ovicaprines (one a young sheep) (jaw, tibia, astragali, autopodia) were found amongst the skeletons (Gómez et al. 2011) (*fig. 7a*).

Several domestic fauna offerings were found in another burial of an adult woman in a pit (F-492), amongst which the bones of a fawn, but also several vertebrae of a large allis shad (*Alosa alosa*) were located next to the skeleton (*fig. 7b*) (Roselló 2011). The finding of this great fish, which swims upstream in order to spawn, is interesting given that the first results from the palaeodietary analysis point to a certain consumption of seafood and aquatic resources (Trancho/Robledo 2011) (*fig. 6b*). Something similar can be noted with regard to the molluscs found in the graves, within which a distinction needs to be made between those used as adornment or foreign prestige elements (Bueno Ramírez 2005, 84) and those that could be intrusive to the graves that have been filled with sediments from the occupation level (Llorente et al. 2015).

In terms of the inclusion or the acts of sealing collective or multiple inhumations dogs also take some prominence. Recent findings show that Central Iberia is no stranger to this kind of practice, well-known in the south and southeastern areas of the peninsula (García/Martínez 1997; Verdú 2004; Ramírez 2004; Márquez 2006; Lazarich 2007; Lomba et al. 2009; Márquez/Jiménez 2010), although less frequent in the interior. The presence of a dog lying on its back, possibly inside a sack or with its legs tied, next to an adult man found at Cerro de la Cabeza (Ávila) is also worth noting. A bovine mandible and an ovicaprine foreleg were also deposited in the tomb (Fabián 2006; Fabián/Blanco 2012) (*fig. 7d*).

The presence of dogs in a collective Chalcolithic grave with more than 34 individuals at the site of El Perdido in the Madrid area is also remarkable. Its sealing level presents partial skeletons of at least two dogs and these are placed between some human heads (Heras et al. 2014; Sonlleva et al. 2014; Daza 2015) (*fig. 7c*). At Camino de las Yeseras two dogs were killed by a heavy blow to their parietal and carefully placed after the closing event of a Bell Beaker collective grave (Blasco et al. 2009; Liesau 2012). This latter case is exceptional and possibly the result of earlier traditions given that the Bell Beaker funerary rituals are not particularly rich in terms of faunal offerings with bones. It is however, worth highlighting the delimitation of funerary spaces in the form of pantheons by Bell Beakers. For the first time it has been possible to note the presence of feasting practices using specific domestic animals parts within these features, as is the case of hut F-5. At other necropolises it has been possible to identify more elaborate foods: in the actual mortuary space of the Huecas necropolis, honey, animal fats and fish stews were identified amongst other foods and drinks from the inside of several pots. P. Bueno Ramírez and her team argued that these funerary practices were rooted in the Middle Neolithic (Bueno Ramírez et al. 2005, 81; 2010, 57–59) (*fig. 6a*).

In conclusion and pending further studies on the available archaeofaunal data from Chalcolithic settlements or the ditched enclosures in central Iberia there is still much to be learned, defined and characterised in relation to the different horizons of occupation and spatial use in these delimited areas with intensive productive or consumption activities. There is no doubt that the Chalcolithic is an exciting period of study entailing many research challenges, such as establishing the domestic or wild status of certain taxa, the introduction of foreign species, livestock management or interbreeding and the exchange of exotic raw materials and finished products. The faunal remains in the east area of the site are revealing all possible categories: primary and secondary deposits of animal and human remains, consumption refuse and complete or partially articulated limbs and isolated bones as recurrent anatomical items in the fillings of the ditch. But most significant is the high number of lightly modified bone artefacts often very difficult to identify as bone artefacts. As they are not frequent in domestic features their large accumulations in the ditch need to be taken into account when aiming to understand the kinds of workshop activities that took place in the enclosure areas and in the ditch fillings.

The animals themselves also reflect a complex symbolic sphere: their bones were not only used for the manufacture of votive artefacts, such as those made from herbivore phalanges or long bones with eye-engravings, but they were also depicted in rock art scenes or engraved (e.g. deer) in decorated pottery.

Selected species and their anatomical parts were involved in formalised depositions, that is to say, they symbolise a standardised pattern as a key or item to understand the spatial and social concept of characteristic features in Chalcolithic enclosures. Many of the bones placed there are not rich in meat and cannot be interpreted as food-offerings or consumption refuse, as they were present both in the pits and in the ditches as well as in the burials – horn-cores, mandibles, autopodia – all of which demonstrate that those present in Central Iberia knew and assimilated well-known concepts from other Chalcolithic peninsular communities as well as from others further afield.

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Bibliography

Anderson Whymark/Thomas 2012: H. Anderson Whymark/J. Thomas (eds.), Regional Perspectives on Neolithic Pit Deposition. Beyond the Mundane. Neolithic Studies Group Seminar Papers 12 (Oxford 2012).

Arbogast 2009: R.-M. Arbogast, Les vestiges de faune associés au site et structrures d'enceinte du site rubané de Herxheim (Rhénanie-Palatinat, Allemagne). In: A. Zeeb-Lanz (ed.), Krisen – Kulturwandel – Kontinuitäten. Zum Ende der Bandkeramik in Mitteleuropa. Beiträge der internationalen Tagung in Herxheim bei Landau (Pfalz) vom 14.–17.06.2007 (Rahden/Westf. 2009) 53–60.

Banerjee et al. 2012: A. Banerjee/J. A. López Padilla/T. X. Schuhmacher (eds.), Marfil y elefantes en la Península Ibérica y el Mediterráneo, Internationale Tagung. Iberia Archeologica 16.1 (Darmstadt 2012).

Bedault/Hachem 2008: L. Bedault/L. Hachem, Recherches sur les sociétés du Néolithique danubien à partir du Bassin parisien. Approche structurelle des données archéozoologiques. In: L. Burnez Lanotte/M. Ilett/P. Allard (eds.), Fin de traditions de dannubiennes dans le Néolithique du Basin parisien et de la Belgique (5100–4700 av.J-C.). Société Préhistorique Française. Mémoire 44 (Namur 2008) 221–243.

Benecke 1994: N. Benecke, Der Mensch und seine Haustiere (Stuttgart 1994).

Bernabeu et al. 2003: J. Bernabeu/T. Orozco/A. Díez/M. Gómez/F. J. Molina, Mas d'Is (Penàguila, Alicante). Aldeas y recintos monumentales del Neolítico inicial en el Valle del Serpis. Trabajos de Prehistoria 60.2, 2003, 39–59.

Blasco et al. 2005: C. Blasco/C. Liesau/G. Delibes de Castro/E. Baquedano/M. Rodríguez, Enterramiento campaniforme en ambiente doméstico. El yacimiento de Camino de Las Yeseras (San Fernando de Henares, Madrid). In: M. Rojo/R. Garrido/I. García (eds.), El campaniforme en la Península Ibérica y su contexto europeo, Universidad de Valladolid-Junta de Castilla y León (Valladolid 2005) 457–479.

Blasco et al. 2007: C. Blasco/G. Delibes de Castro/J. Baena/C. Liesau/P. Ríos, El poblado calcolítico de Camino de las Yeseras (San Fernando de Henares, Madrid). Un escenario favorable para el estudio de la incidencia campaniforme en el interior peninsular. Trabajos de Prehistoria 64.1, 2007, 151–163.

Blasco et al. 2009: C. Blasco/C. Liesau/P. Ríos/J. F. Blanco/R. Aliaga/E. Moreno/A. Daza, Kupferzeitliche Siedlungsbestattungen mit Glockenbecher- und Prestigebeigaben aus dem Grabenwerk von El Camino de las Yeseras (San Fernando de Henares, Prov. Madrid). Untersuchungen zur Typologie des Grabritus und zu dessen sozialer Symbolik. Madrider Mitteilungen 50, 2009, 40–70.

Blasco et al. 2011: C. Blasco/C. Liesau/P. Ríos (eds.), Yacimientos calcolíticos con campaniforme de la región de Madrid. Nuevos estudios. Patrimonio Arqueológico de Madrid 6 (Madrid 2011).

Bueno Ramírez et al. 2005: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Ritual campaniforme, ritual colectivo. De las Higueras, Huecas, Toledo. Trabajos de Prehistoria 62.2, 2005, 67–90.

Bradley 2005: R. Bradley, Ritual and Domestic Life in Prehistoric Europe (London 2005).

Brück 1999: J. Brück, Ritual and Rationality. Some Problems of Interpretation in European Archaeology. Journal of European Archaeology 2.3, 1999, 313–344.

Bueno Ramírez et al. 2009: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Agricultores y metalúrgicos en el Valle de Huecas (Toledo). In: L. Benítez de Lugo/P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann/J. A. López Sáez (eds.), Arqueología, medio ambiente y obras públicas. El Valle de Huecas (Huecas, Toledo) (Valdepeñas 2009) 33–71.

Bueno Ramírez et al. 2010: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Entre lo visible y lo invisible. Registros funerarios de la Prehistoria Reciente de la Meseta Sur. In: P. Bueno Ramírez/A. Gilman/C. Martín/F. J. Sánchez Palencia (eds.), Arqueología, Sociedad, Territorio y Paisaje. Estudios sobre Prehistoria Reciente, Protohistoria y Transición al Mundo Romano en Homenaje a Mª Dolores Fernández Posse (Madrid 2010) 53–73.

Cámara et al. 2008: J. A. Cámara/R. M. Lizcano/C. Pérez/ E. Gómez, Apropiación, sacrificio, consumo y exhibición ritual de los animales en el polideportivo de Martos. Sus implicaciones en los orígenes de la desigualdad social. Cuadernos de Prehistoria y Arqueología de la Universidad de Granada 18, 2008, 55–90.

Cardoso 2009: J. L. Cardoso, O povoado pré-histórico do Carrascal (Oeiras) e os rituais asociados a grandes bovídeos. Estudos Arqueológicos de Oeiras 17, 2009, 357–370.

Cardoso et al. 2013: J. Cardoso/J. Vilstrup/V. Eisenmann/L. Orlando, First Evidence of Equus asinus, L. in the Chalcolithic Disputes the Phoenicians as the First to Introduce Donkeys into the Iberian Peninsula. Journal of Archaeological Science 40, 2013, 4483–4490.

Chapman 2000: J. Chapman, Fragmentation in Archaeology (London 2000).

Chorro 2013: M. A. Chorro, Estudio de la fauna calcolítica del Área Central de Camino de las Yeseras (San Fernando de Henares, Madrid) (Master Thesis Universidad Autónoma de Madrid 2013).

Cieslak et al. 2010: M. Cieslak/M. Pruvost/N. Benecke/M. Hofreiter/A. Morales/M. Reissmann, Origin and History of Mitochondrial DNA Lineages in Domestic Horses. PLoS ONE 5.12, 2010, 1–13.

Clason/Prummel 1977: A. Clason/W. Prummel, Collecting, Sieving and Archaeological Research. Journal of Archaeological Science 4.3, 1977, 171–175.

Costa 2010: C. Costa, Os restos faunísticos de animais vertebrados do sector i dos Perdigões (fossas e fossos 3 e 4). Apontamentos de Arqueologia e Património 6, 2010, 53–74.

Daza 2015: A. Daza, La fauna en el Calcolítico de la Región de Madrid. Los depósitos de canes (Master Thesis Universidad Autónoma de Madrid 2015).

Delibes de Castro et al. 2009: G. Delibes de Castro/M. Crespo/J. Fernández Manzano/J. I. Herrán/J. A. Rodríguez Marcos, Un recinto de fosos calcolítico en el valle medio del Duero. El Casetón de la Era (Villalba de los Alcores, Valladolid). Cuartas Jornadas de Patrimonio Arqueológico en la Comunidad de Madrid. Museo Arqueológico Regional 12–14 de noviembre 2007 (Alcalá de Henares 2009) 241–249.

Delibes de Castro et al. 2014: G. Delibes de Castro/M. García/J. del Olmo/J. Santiago, Recintos de fosos calcolíticos del valle medio del Duero. Arqueología aérea y espacial. Studia Archaeologica 100 (Valladolid 2014).

Díaz-Andreu et al. 1992: M. Díaz-Andreu/C. Liesau/A. Castaño, El poblado calcolítico de La Loma de Chiclana (Vallecas, Madrid). Excavaciones de urgencia realizadas en 1987. Paleontología y Etnografía, Arqueología 3, 1992, 31–116.

Díaz-del-Río 2001: P. Díaz-del-Río, La formación del paisaje agrario. Madrid en el III y II Milenio BC. Arqueología, Paleontología y Etnografía 9 (Madrid 2001).

Díaz-del-Río 2003: P. Díaz-del-Río. Recintos de fosos del III milenio AC en la Meseta Peninsular. Trabajos de Prehistoria 60.2, 2003, 61–78.

Díaz-del-Río 2010: P. Díaz-del-Río, Scaling the Social Context of Copper Age Aggregations in Iberia. In: A. C. Valera/L. Evangelista (eds.), The Idea of Enclosure in Recent Iberian Prehistory. Proceedings of the XV World Congress UISPP (Lisbon, 4–9 September 2006). British Archaeological Reports. International Series 2124 (Oxford 2010) 169–175.

Díaz-del-Río et al. 1997: P. Díaz-del-Río/S. Consuegra/L. Peña Chocarro/B. Márquez/C. Sampedro/R. Moreno/D. Albertini/P. Pino, Paisajes agrarios prehistóricos en la Meseta peninsular. El caso de Las Matillas (Alcalá de Henares). Trabajos de Prehistoria 52.2, 1997, 93–111.

Driesch 1972: A. von den Driesch, Osteoarchäologische Untersuchungen auf der Iberischen Halbinsel. Studien über frühe Tierknochenfunde von der Iberischen Halbinsel 3 (München 1972).

Duarte et al. 2006: C. Duarte/L. Evangelista/M. Lago/M. J. Valente/A. C. Valera, Animal Remains in Chalcolithic Funerary Context in Portugal. The Case of Perdigões. In: N. Ferreira Bicho (ed.), Animais na Pré-história e arqueologia da Península Ibérica. IV Congresso de Arqueología Peninsular (Faro, 14 a 19 de Setembro de 2004). Promontoria Monográfica 3 (Faro 2006) 47–55.

Fabián 2006: F. J. Fabián, El IV y III Milenio AC en el Valle Amblés (Ávila). Arqueología en Castilla y León Monografías 5 (Salamanca 2006).

Fabián 2009: F. J. Fabián, Hace 4.600 Años en El Tomillar (Bercial de Zapardiel, Ávila). Institución Gran Duque de Alba (Ávila 2009).

Fabián/Blanco 2012: F. J. Fabián/A. Blanco, Cuatro enterramientos calcolíticos en hoyo del Cerro de la Cabeza. Complutum 23.1, 2012, 99–120.

Galindo et al 2009: L. Galindo/V. Marcos/M. Llorente, Soto del Henares. Aproximación a un poblado de recintos. In: Dirección General de Patrimonio Histórico (ed.), Actas de las cuartas Jornadas de Patrimonio Arqueológico en la Comunidad de Madrid (Madrid 2009) 263–271.

García/Martínez 1997: L. A. García/C. Martínez, Intervención Arqueológica en Casa Noguera (Archivel, Caravaca de la Cruz). Memorias de Arqueología 12, 1997, 235–252.

García Sanjuán 2013: L. García Sanjuán, El Asentamiento de la Edad del Cobre de Valencina de la Concepción. Estado actual de la investigación, debates y perspectivas. In: L. García Sanjuán/J. M. Vargas/V. Hurtado Pérez/T. Ruiz/R. Cruz Auñon/R. García (eds.), El asentamiento prehistórico de Valencina de la Concepción (Sevilla). Investigación y tutela en el 150 aniversario del descubrimiento de La Pastora (Sevilla 2013) 21–59.

Gautier 1987: A. Gautier, Taphonomic Groups. How and Why? Archaeozoologia 1.2, 1987, 47–51.

Geigl et al. 2011: E. M. Geigl/S. Guimaraes/C. Liesau, Palaeogenetic Analysis of Bovine Remains from Camino de las Yeseras and Humanejos. In: C. Blasco/C. Liesau/P. Ríos (eds.), Yacimientos Calcolíticos con Campaniforme de la región de Madrid. Nuevos estudios. Patrimonio Arqueológico de Madrid 6 (Madrid 2011) 171–189.

Geigl/Grange 2012: E. M. Geigl/T. Grange, Eurasian Wild Asses in Time and Space. Morphological Versus Genetic Diversity. Annals of Antomy 194, 2012, 88–102.

Gómez et al. 2011: J. L. Gómez/C. Blasco/G. Trancho/I. Grueso/P. Ríos/M. Martínez Ávila, Los protagonistas. In: C. Blasco/C. Liesau/P. Ríos (eds.), Yacimientos calcolíticos con Campaniforme de la región de Madrid. Nuevos estudios. Patrimonio Arqueológico de Madrid 6 (Madrid 2011) 101–132.

Gonçalves 2003: V. S. Gonçalves, STAM-3, a Anta 3 da Herdade de Santa Margarida (Reguengos de Monsaraz). Trabalhos de Arqueologia 32, 2003, 432–439.

Grayson 1973: D. K. Grayson, On the Methodology of Faunal Analysis. American Antiquity 39.4, 1973, 432–439.

Heras et al. 2014: C. Heras/A. Bastida/V. Galera, Vida y muerte en el poblado calcolítico de "El Perdido" (Torres de Alameda, Madrid). Primeras aportaciones. In: Dirección General de Patrimonio Histórico (ed.), Actas de las IX Jornadas de Patrimonio Arqueológico de la Comunidad de Madrid (Madrid 2014) 199–211.

Herráez/Cerdeño 2000: E. Herráez/E. Cerdeño, Estudio de la fauna del yacimiento del Espinillo (Villaverde, Madrid) In: M. I. Baquedano/J. F. Blanco/P. Alonso/D. Álvarez (eds.), El Espinillo. Un yacimiento calcolítico y de la Edad del Bronce en las terrazas del Manzanares. Arqueología, Paleontología y Etnografía 8, 2000, 141–149.

Hill 1995: J. D. Hill, Ritual and Rubbish in the Iron Age of Wessex. British Archaeological Reports. British Series 242 (Oxford 1995).

Höltkemeier/Hachem 2013: S. Höltkemeier/L. Hachem, Les dépôts de faune dans les enceintes néolithiques Michelsberg dans le Nord de la France et en Allemagne. Les dépôts d'ossements d'animaux en France. Actes de la table ronde de Bibracte, 15–17 octobre 2012. Archéologie des Plantes et des Animaux 4, 2013, 177–189.

Jeunesse/Seidel 2010: C. Jeunesse/U. Seidel, Die Erdwerke. In: Badisches Landesmuseum Karlsruhe (ed.), Jungsteinzeit im Umbruch. Die „Michelsberger Kultur" und Mitteleuropa vor 6000 Jahren. Katalog zur Ausstellung im Badischen Landesmuseum, Schloss Karlsruhe, 20.11.2010–15.5.2011 (Karlsruhe 2010) 58–69.

Lazarich 2007: M. Lazarich, La necrópolis de Paraje de Monte Bajo (Alcalá de los Gazules, Cádiz). Un acercamiento al conocimiento de las prácticas funerarias prehistóricas (Cádiz 2007).

Levine 2003: M. Levine, Focusing on Central Eurasian Archaeology. East Meets West. In: M. Levine/C. Renfrew/K. Boyle (eds.), Prehistoric Steppe Adaptation and the Horse (Cambridge 2003) 1–7.

Liesau 1998: C. Liesau, El Soto de Medinilla. Faunas de mamíferos de la Edad del Hierro en el valle Medio del Duero (Valladolid, España). Archaeofauna 7, 1998, 11–210.

Liesau 2005: C. Liesau, Arqueozoología del caballo en la Antigua Iberia. Gladius 25, 2005, 187–206.

Liesau 2009: C. Liesau, Los animales en la economía del Valle de Huecas desde sus más antiguos asentameintos. In: L. Benítez de Lugo/P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann/J. A. López Sáez (eds.), Arqueología, Medio Ambiente y Obras Públicas. El valle de Huecas (Huecas, Toledo) (Valdepeñas 2009) 111–115.

Liesau 2011a: C. Liesau, La Arqueozoología, un elemento clave en la concepción espacial de Camino de las Yeseras. Los restos de mamíferos del ámbito doméstico y funerario. In: C. Blasco/C. Liesau/P. Ríos (eds.), Yacimientos calcolíticos con Campaniforme de la región de Madrid. Nuevos estudios. Patrimonio Arqueológico de Madrid 6 (Madrid 2011) 167–170.

Liesau 2011b: C. Liesau, Los restos de mamíferos del ámbito doméstico y funerario. In: C. Blasco/C. Liesau/P. Ríos (eds.), Yacimientos calcolíticos con Campaniforme de la región de Madrid. Nuevos estudios. Patrimonio Arqueológico de Madrid 6 (Madrid 2011) 171–189.

Liesau 2012: C. Liesau, Depósitos con ofrendas de animales en yacimientos Cogotas I. Antecedentes y características. In: J. A. Rodríguez Marcos/J. Fernández Manzano (eds.), Cogotas. Volume 1. Una cultura de la Edad del Bronce en la Península Ibérica. Homenajes a Mª Dolores Fernández-Posse (Valladolid 2012) 219–257.

Liesau 2016: C. Liesau, Some Prestige Goods as Evidence of Interregional Interactions in the Funerary Practices of the Bell Beaker Groups of Central Iberia. In: E. Guerra Doce/C. Liesau (eds.), Analysis of the Economic Foundations Supporting the Social Supremacy of the Beaker Groups. Proceedings of the XVII UISPP World Congress (1–7 September 2014) (Oxford 2016) 69–93.

Liesau et al. 2008: C. Liesau/C. Blasco/P. Ríos/J. Vega/R. Menduiña/J. F. Blanco/J. Baena/T. Herrera/A. Petri/J. L. Gómez, Un espacio compartido por vivos y muertos. El poblado calcolítico de fosos de Camino de las Yeseras. Complutum 19.1, 2008, 97–120.

Liesau/Moreno 2012: C. Liesau/E. Moreno, Marfiles campaniformes de El Camino de las Yeseras (San Fernando de Henares, Madrid). In: A. Banerjee/J. A. López Padilla/T. X. Schuhmacher (eds.), Marfil y elefantes en la Península Ibérica y el Mediterráneo, Internationale Tagung. Iberia Archeologica 16.1 (Darmstadt 2012) 83–94.

Liesau et al. 2013a: C. Liesau/P. Ríos/R. Aliaga/A. Daza/L. Llorete/C. Blasco, Hut Structures from the Bell Beaker Horizon. Housing, Communal or Funerary Use in the Camino de las Yeseras Site (Madrid). In: M. P. Prieto Martínez/L. Salanova (eds.), Current Researchers on Bell Beakers. 5th–9th May 2011, Poio (Pontevedra, Galicia, Spain). Galician ArchaeoPots, Proceedings of the 15th International Bell Beaker Conference. From Atlantic to Ural (Santiago de Compostela 2013) 139–151.

Liesau et al. 2013b: C. Liesau/A. Daza/L. Llorente/A. Morales, More Questions than Answers. The Singular Animal Deposits from Camino de las Yeseras (Chalcolithic, Madrid, Spain). Anthropozoologica 42.2, 2013, 5–14.

Liesau et al. 2013/2014: C. Liesau/J. Vega/A .Daxa/P. Ríos/R. Menduiña/C. Blasco, Manifestaciones simbólicas en el acceso Noreste del Recinto 4 de Foso en Camino de las Yeseras (San Fernando de Henares, Madrid). Saldvie 13/14, 2013/2014, 53–69.

Liesau et al. 2014: C. Liesau/P. Ríos/J. Vega/R. Menduiña/C. Blasco, Buscando los ancestros. La manipulación de los restos de las tumbas campaniformes en Camino de las Yeseras (San Fernando de Henares, Madrid). In: Dirección General de Patrimonio Histórico (ed.), Actas de las IX Jornadas de Patrimonio Arqueológico de la Comunidad de Madrid (Madrid 2014) 137–148.

Llorente et al. 2015: L. Llorente/E. Roselló/A. Morales/C. Liesau/A. Daza/R. Araujo, Las Náyades (Mollusca, Unionoida) del Calcolítico de Camino de las Yeseras (San Fernando de Henares, Madrid). In: I. Gutiérrez/D. Cuenca/M. González (eds.), La Investigación Arqueomalacológica en la Península Ibérica. Nuevas Aportaciones. Actas de la IV Reunión de Arqueomalacología de la Península Ibérica (Santander 2015) 125–134.

Lomba et al. 2009: J. Lomba/M. López/F. Ramos/A. Avilés, El enterramiento múltiple, calcolítico, de Camino del Molino (Caravaca, Murcia). Metodología y primeros resultados de un yacimiento excepcional. Trabajos de Prehistoria 66.2, 2009, 143–159.

López Sáez et al. 2009: J. A. López Sáez/L. López Merino/S. Pérez Díaz, Historia de la vegetación y paleoambiente del Valle de Huecas. In: L. Benítez de Lugo/P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann/J. A. López Sáez (eds.), Arqueología, Medio Ambiente y Obras Públicas. El valle de Huecas (Huecas, Toledo) (Valdepeñas 2009) 83–101.

López Sáez 2011: J. A. López Sáez, Análisis palinológicos en el poblado calcolítico de Camino de las Yeseras (San Fernando de Henares, Madrid). In: C. Blasco/C. Liesau/P. Ríos (eds.), Yacimientos calcolíticos con Campaniforme de la región de Madrid. Nuevos estudios (Madrid 2011) 251–259.

Lyman 1994: R. L. Lyman, Quantitative Units and Terminology in Zooarchaeology. American Antiquity 59.1, 1994, 36–71.

Lyman 2008: R. L. Lyman, Quantitative Paleozoology. Cambridge Manuals in Archaeology (Cambridge 2008).

Martínez 2013: R. Martínez, Cerdos, caprinos y náyades. Aproximación a la explotación ganadera y fluvial en el Guadalquivir entre el Neolítico y la Edad del Cobre (3500–2200 a.n.e.). Revista de Prehistoria y Arqueología de la Universidad de Sevilla 22, 2013, 29–46.

Martínez et al. 2015: V. Martínez/E. Moreno/C. Gallego/O. López, El yacimiento inédito de El Juncal (Getafe). Primera aproximación. In: Administrador de Infraestructuras Ferroviarias-Alta Velocidad (ed.), La Arqueología en el trazado ferroviario del sur de la Comunidad de Madrid. Una aventura fascinante (Madrid 2015) 243–280.

Márquez 2001: J. E. Márquez, De los campos de silos a los agujeros negros. Sobre pozos, depósitos y zanjas en la Prehistoria Reciente del Sur de la Península Ibérica. Revista de Prehistoria y Arqueología de la Universidad de Sevilla 10. Homenaje al Profesor Pellicer 1, 2001, 207–220.

Márquez 2006: J. E. Márquez, Sobre los depósitos estructurados de animales en yacimientos con fosos del sur de la Península Ibérica In: N. Ferreira Bicho (ed.), Animais na Pré-história e arqueologia da Península Ibérica. IV Congresso de Arqueología Peninsular (Faro, 14 a 19 de Setembro de 2004). Promontoria Monográfica 3 (Faro 2006) 15–25.

Márquez/Jiménez 2010: J. Márquez/V. Jiménez, Recintos de fosos. Genealogía y significado de una tradición en la Prehistoria del suroeste de la Península Ibérica (IV–III milenios AC) (Málaga 2010).

Morales/Liesau 1994: A. Morales/C. Liesau, Arqueozoología del Calcolítico en Madrid. Ensayo crítico de síntesis. In: C. Blasco (ed.), El Horizonte Campaniforme de la región de Madrid en el centenario de Ciempozuelos. Patrimonio Arqueológico del Bajo Manzanares 2 (Madrid 1994) 227–247.

Morales/Moreno 1992: A. Morales/R. Moreno, Peña Negra (Alicante). Efectos de la selección apriorística de muestras en Arqueozoología. Archaeofauna 1, 1992, 1–10.

Morales/Villegas 1994: A. Morales/C. Villegas, La fauna de mamíferos del yacimiento de “El Ventorro”. Síntesis osteológica de la campaña de 1981. Estudios de Prehistoria y Arqueología Madrileñas 9, 1994, 35–56.

Moreno 2003: M. Moreno, Estudo dos restos faunísticos da Anta 3 da Herdade de Santa Margarida (Reguengos de Monsaraz). In: V. S. Gonçalves (ed.), STAM-3, a Anta 3 da Herdade de Santa Margarida (Reguengos de Monsaraz). Trabalhos de Arqueología 32 (Lisboa 2003) 432–439.

Morris 2011: J. Morris, Investigating Animal Burials. Ritual, Mundane and Beyond. British Archaeological Reports. British Series 535 (Oxford 2011).

Morris 2012: J. Morris, Animal “Ritual” Killing. From Remains to Meanings. In: A. Pluskowski (ed.), The Ritual Killing and Burial of Animals. European Perspectives (Oxford 2012) 8–21.

Orozco 2009: T. Orozco, Recintos prehistóricos. Panorama Europeo. In: Actas de las Cuartas Jornadas de Patrimonio Arqueológico en la Comunidad de Madrid. Dirección general de Patrimonio Histórico y Museo Arqueológico Regional de Madrid (Madrid 2009) 221–231.

Payne 1972: S. Payne, Partial Recovery and Sample Bias. The Result of Sieving Experiments. In: E. S. Higgs (ed.), Papers in Economic Prehistory (London 1971) 49–64.

Peña Chocarro et al. 2011: L. Peña Chocarro/M. Ruiz Alonso/D. Sabato, Los macrorrestos vegetales. In: C. Blasco/C. Liesau/P. Ríos (eds.), Yacimientos calcolíticos con Campaniforme de la región de Madrid. Nuevos estudios. Patrimonio Arqueológico de Madrid 6 (Madrid 2011) 261–276.

Ramírez 2004: J. A. Ramírez Águila, Excavaciones en calle Corredera 46 y 47 de Lorca. In: Servicio de Patrimonio Histórico/Dirección general de Cultura/Consejería de Educación y Cultura (eds.), XV Jornadas de Patrimonio Histórico y Arqueología de la Región de Murcia. Murcia del 24 de noviembre al 2 de diciembre de 2004 (Murcia 2004) 115–119.

Ríos 2011: P. Ríos, Territorio y sociedad en la Región de Madrid durante el III milenio a.C. El referente del yacimiento de Camino de las Yeseras. Patrimonio Arqueológico de Madrid 7 (Madrid 2011).

Ríos/Liesau 2011: P. Ríos/C. Liesau, Elementos de adorno, simbólicos y colorantes en contextos funerarios y singulares. In: C. Blasco/C. Liesau/P. Ríos (eds.), Yacimientos calcolíticos con Campaniforme de la región de Madrid. Nuevos estudios. Patrimonio Arqueológico de Madrid 6 (Madrid 2011) 357–370.

Ríos et al. 2014: P. Ríos/C. Liesau/C. Blasco, Funerary Practices in the Ditched Enclosures of Camino de las Yeseras. Ritual, Temporal and Spatial Diversity. In: A. C. Valera (ed.), Recent Prehistoric Enclosures and Funerary Practices in Europe. Proceedings of the International Meeting Held at the Gulbenkian Foundation (Lisbon, Portugal, November 2012). British Archaeological Reports. International Series 2676 (Oxford 2014) 139–147.

Roselló 2011: E. Roselló, Los peces. In: C. Blasco/C. Liesau/P. Ríos (eds.), Yacimientos calcolíticos con Campaniforme de la región de Madrid. Nuevos estudios. Patrimonio Arqueológico de Madrid 6 (Madrid 2011) 235–236.

Sommer et al. 2011: R. S. Sommer/N. Benecke/L. Lõugas/O. Nelle/U. Schmölke, Holocene Survival of the Wild Horse in Europe. A Matter of Open Landscape? Journal of Quaternary Science 26.8, 2011, 805–812.

Sonlleva et al. 2014: D. Sonlleva/V. Galera/C. Heras, El enterramiento colectivo de época calcolítica del yacimiento de “El Perdido” (Torres de la Alameda). Una visión desde la antropología físisca. In: Dirección General de Patrimonio Histórico (ed.), Actas de las IX Jornadas de Patrimonio Arqueológico de la Comunidad de Madrid (Madrid 2014) 175–186.

Trancho/Robledo 2011: G. Trancho/B. Robledo, Reconstrucción paleonutricional de la población del Camino de las Yeseras (San Fernando de Henares, Madrid). In: C. Blasco/C. Liesau/P. Ríos (eds.), Yacimientos calcolíticos con Campaniforme de la región de Madrid. Nuevos estudios. Patrimonio Arqueológico de Madrid 6 (Madrid 2011) 133–153.

Uerpmann 1990: H.-P. Uerpmann, Die Domestikation des Pferdes im Chalkolithikum West- und Mitteleuropas. Madrider Mitteilungen 31, 1990, 109–153.

Uerpmann 1995: H.-P. Uerpmann, Domestication of the Horse. When, Where and Why? In: L. Bodson (ed.), Le cheval et les autres équidés. Aspects de l’Histoire de leur insertion dans les activités humaines. Colloques d’Histoire des Connaissances Zoologiques 6 (Liège 1995) 15–29.

Valera et al. 2010: A. C. Valera/T. Nunes/C. Costa, Enterramentos de canídeos no Neolítico. A Foso 5 de Corça 1 (Brinches, Serpa). Apontamentos de Arqueología e Patrimonio 5, 2010, 7–17.

Valera/Costa 2013: A. C. Valera/C. Costa, Animal Limbs in Funerary Contexts in Southern Portugal and the Question of Segmentation. Anthropozoologica 48.2, 2013, 263–275.

Vega et al. 2009: J. Vega/C. Blasco/R. Menduiña/P. Ríos/A. Petri/T. Herrera, El recinto de foso de Camino de las Yeseras (San Fernando de Henares, Madrid). In: Dirección General de Patrimonio Histórico (ed.), Actas de las cuartas Jornadas de Patrimonio arqueológico en la Comunidad de Madrid. Celebradas en el Museo Arqueológico Regional de Alcalá de Henares los días 21, 22 y 23 de noviembre de 2007 (Madrid 2009) 251–261.

Vega et al. 2010: J. Vega/C. Blasco/C. Liesau/P. Ríos/J. F. Blanco/R. Menduiña/R. Aliaga/E. Moreno/T. Herrera/A. Petri/J. L.Gómez, La singular dualidad de enterramientos en el poblado de silos Calcolítico de Camino de las Yeseras (San Fernando de Henares, Madrid). In: J. Fernández Eraso/J. A. Mujika Alustiza (eds.), Actas del Congreso Internacional sobre Megalitismo y otras manifestaciones funerarias contemporáneas en su contexto social, económico y cultural. Munibe Suplemento 32 (Donostia 2010) 648–662.

Vega/Menduiña 2011: J. Vega/R. Menduiña, El yacimiento de Camino de las Yeseras (San Fernando de Henares, Madrid). In: C. Blasco/C. Liesau/P. Ríos (eds.), Yacimientos calcolíticos con Campaniforme de la región de Madrid. Nuevos estudios. Patrimonio Arqueológico de Madrid 6 (Madrid 2011) 5–8.

Verdú 2004: J. C. Verdú, Excavación "Marianela", Lorca. In: Servicio de Patrimonio Histórico/Dirección general de Cultura/Consejería de Educación y Cultura (eds.), XV Jornadas de Patrimonio Histórico y Arqueología de la Región de Murcia. Murcia del 24 de noviembre al 2 de diciembre de 2004 (Murcia 2004) 31–33.

Weiss Krejci 2006: E. Weiss Krejci, Animals in Mortuary Contexts of Neolithic and Chalcolithic Iberia. In: N. Ferreira Bicho (ed.), Animais na Pré-história e arqueologia da Península Ibérica. IV Congresso de Arqueología Peninsular (Faro, 14 a 19 de Setembro de 2004). Promontoria Monográfica 3 (Faro 2006) 35–45.

Whittle 1988: A. Whittle, Problems in Neolithic Archaeology. New Studies in Archaeology (Cambridge 1988).

Whittle 2014: A. Whittle, The Times and Timing of Enclosures. In: A. C. Valera (ed.), Recent Prehistoric Enclosures and Funerary Practices in Europe. Proceedings of the International Meeting held at the Gulbenkian Foundation (Lisbon, Portugal, November 2012). British Archaeological Reports. International Series 2676 (Oxford 2014) 1–12.

Yravedra 2010: J. Yravedra, Estudio Arqueozoológico. In: G. López/J. Morín/I. Rus (eds.), Recuperando el pasado. Volume 2. La Prehistoria reciente en la depresión Prados-Guatén (Comunidad de Madrid) (Madrid 2010) 209–216.

Zeeb-Lanz et al. 2009: A. Zeeb-Lanz/R. M. Arbogast/F. Haack/M. N. Haidle/C. Jeunesse/J. Orschiedt/D. Schimmelpfennig/S. van Willigen, The LBK Settlement with Pit Enclosure at Herxheim near Landau (Palatinate). First Results. In: D. Hofmann/P. Bickle (eds.), Creating Communities. New Advances in Central European Neolithic Research (Oxford 2009) 202–219.

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Landscapes, Human Activities and Climate Dynamics in the South Meseta of the Iberian Peninsula during the 3rd and 2nd Millennia calBC

Keywords: Chalcolithic, Early Bronze Age, palynology, climate change, South Meseta, Spain

Abstract

Palaeoenvironmental and archaeological data from several regions around the world show evidence of a multi-centennial climatic change event occurring ca. 4200 years ago. Whereas the so-called 4.2 ka calBP event and its local impact has been successfully traced in certain North European regions, this has yet to be fully assessed in the Iberian Peninsula. This paper presents a compilation of palynological data from archaeological sites and peat-bogs, aimed to search for landscape changes and climate fluctuations during the transition between the 3rd and 2nd mill. calBC in the Iberian South Meseta, also known as the Copper-to-Bronze transition. Pollen records are evidence for agriculture and livestock grazing as the first human activities with an impact on these landscapes. Both palaeoenvironmental and archaeological data provide mounting proofs of increasing aridification in the area starting in the Late Copper Age (ca. 2200 calBC). This chapter concludes relating the onset of the Early Bronze Age with an abrupt climate disruption, the 4.2 ka calBP event.

Introduction

Climate change in the past has been an important contributor to the development of human society throughout the Holocene (de Menocal 2001; Magny 2004). Because of current social development, it is very unlikely for climate change today to produce comparable impacts as those that occurred in the past. Nonetheless, tackling such historical cases can improve our understanding of the nature of human-climate-ecosystem interactions, as well as the vulnerability and sustainability of small-scale societies in the context of climate change (López Sáez et al. 2014a). This paper results from a research project investigating the spatiotemporal aspects of resilience in complex social systems.[1] The chapter aims to develop a conceptual model of the dynamics that drove the trajectories of regional socioenvironmental systems by examining one case study: the South Meseta of the Iberian Peninsula during the transition from 3rd to 2nd mill. calBC. Following Berger et al. (2007), we will consider the following principles:

I. The dynamics of socioenvironmental systems oscillate between chance and necessity, so their continued existence depends on the

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adequacy of the interaction between their societal and environmental dynamics, which varies through time with the development of both these domains;

II. Sometimes, socioenvironmental systems are so vulnerable that any perturbation, large or small, can cause an irreparable loss of coherence;

III. At other times, the socioenvironmental system survives by adapting (resilient state), although the resilience varies with the connectivity between the system's societal and environmental dynamics.

How societies respond to major climate events in addition with contemporary developments in other aspects, determines societal success or collapse (López Sáez et al. 2009b; Butzer 2012; Wiener 2014).

In the last decades, the Iberian Copper Age or Chalcolithic (ca. 3200–2200 calBC), as well as its transition to the Bronze Age (ca. 2200–2000 calBC) has probably been the period that has generated most scientific controversy within Iberian later prehistory (e.g. Cruz Berrocal et al. 2013). Later prehistoric research on the Iberian Peninsula has focused heavily on its southern half, whereas the inner and northernmost areas have only recently attracted interest and research effort. Up to the 1970s the inland Iberian plateau or Meseta was envisaged as a 'no man's land', whose isolated prehistoric inhabitants developed regressive lifestyles and engaged with a poor material culture. This picture changed markedly thanks to research projects and systematic fieldwork undertaken from the early 1980s. These led to the discovery of numerous habitats and megaliths from the 3rd mill. calBC and even earlier (Bueno Ramírez et al. 2005a; 2006; 2008a; 2008b), with and without Bell Beaker pottery, indicating the existence of a remarkable Chalcolithic population hub, which was interpreted within the classical pre- and Beaker sequences (Álvaro 1987). In any case, it has been the Beaker phenomenon which has starred the most symbolic and social discourse in this territory (Garrido Pena 1997; 2000). This has been so despite the weakness of settlement archaeology in the region and regardless of the preliminary status of the available accounts, which need diachronic perspectives in order to underpin social patterns (Bueno Ramírez et al. 2005b; 2008c). Actually, in the South Meseta, the earlier half of the 3rd mill. calBC is regarded as the outcome of socioeconomic trajectories which started in the course of the Neolithic, particularly in the most fertile areas of the alluvial plains of the Tagus (Bueno Ramírez et al. 2004) and Guadiana (Benítez de Lugo 2011) Rivers and their streams. The overall distribution of nearly two hundred Beaker sites in the South Meseta shows a clear clustering around the middle Tagus basin (Madrid and Toledo provinces) (Garrido Pena 1997). This image contrasts with other areas such as La Mancha in the southern half of the study area (Ciudad Real and Albacete provinces), where proofs of permanent prehistoric settlement do not occur for earlier periods than the Middle Bronze Age (Garrido Pena 1997; Benítez de Lugo 2011; Brodsky et al. 2013). The success of Early Bronze Age (EBA) societies was closely related to settings featuring favourable agrological and hydrological resources (Díaz Andreu 1994). Considering the possible relationship between environmental and cultural changes, the emergence, persistence and/or subsequent collapse of Copper and Bronze Age societies offer important insights into human-environment interactions (Carrión et al. 2010).

Several theoretical and empirical approaches have been proposed to address such themes, but there is no coherent account integrating a detailed reconstruction of climatic conditions, the particular histories of vegetation and subsistence practices. To identify the processes of landscape change related to the socioenvironmental systems we have chosen as indicators the variation in structure and composition of vegetation through time and the strategies (agriculture, forestry, grazing) in which the landscapes were exploited by prehistoric inhabitants (López Sáez 2007). Such an approach will reside on both available palynological and archaeological data in the study area during the referred time span. This essay highlights the prospects of pollen analysis as a crucial method to identify human impact on the vegetation through time (López Sáez et al. 2003a). Our methodological, taphonomic and statistical procedures on the use of pollen data and their interpretation have been published and discussed elsewhere (López Sáez/López Merino 2005; 2007; López Sáez et al. 2006; 2013).

Consolidation of the Productive Economy: Middle Neolithic to Copper Age

During the Middle to the Late Neolithic (ca. 4200–3500 calBC) a *dehesa* landscape (López Sáez et al. 2010a) took form in the South Meseta. The *dehesa* system represents a cultural landscape shaped by combined human and livestock pressure, i.e. an anthropozoogenous landscape resulting fromfarming and grazing activities into the oak forests (*Quercus ilex* and *Q. suber*). This historical product was linked to new concepts of landscape organisation held by the earliest megalithic-building communities (Bueno Ramírez et al. 2002; López Sáez et al. 2007). Areas with greater agricultural resources, such as those of the Tagus Valley, were increasingly populated from the Middle Neolithic onwards and these settings would be colonised in the Chalcolithic period (Bueno Ramírez et al. 2005a).

In the province of Toledo (*fig. 1*), the pollen records from the Azután megalith and the El Castillejo barrow (López García/López Sáez 2000; Bueno Ramírez et al. 2002; 2005c; López Sáez/López García 2005; López Sáez et al. 2009a) show a Middle–Late Neolithic *dehesa* landscape (*Quercus ilex* ~15%) accompanied by a dense macchia of *Olea europaea* with meadows and ruderal communities. These provide evidence of the increasing human pressure ca. 4200–3650 calBC, mainly by grazing activities (high values of coprophilous fungi) with traces of crop cultivation (*Cerealia* and *Vicia faba* pollen). One of the most important environmental changes for this period is shown ca. 3650–3500 calBC, when *Quercus ilex*/*Olea europaea* forests declined and a rapid expansion of heathlands (*Cistus ladanifer*, *Erica arborea*) took place (*fig. 2*). This could be explained by: (I) forest clearance by humans (anthropogenic pollen indicators are abundant); (II) recurrent wild and human induced fires promoting fire-tolerant communities; and (III) a climatic trend to drier conditions. A similar tendency is documented in other parts of central Spain (Fabián et al. 2006; López Sáez/López García 2006; López Sáez 2007; 2012; López Sáez et al. 2014a). Some authors (Harrison 1995) have proposed that *dehesa* landscapes originated from the introduction of pigs and sheep during the 3rd mill. in a wooded environment. However, the foregoing data suggest an earlier origin, dating back to the Middle Neolithic (between the 5th and the 4th mill. calBC) and most probably due to the anthropogenic use of fire as a deforester element to get cleared areas in evergreen forests (López Sáez et al. 2005a; 2007).

The landscapes of the South Meseta are still characterised by open evergreen oak forests ca. 2900–2000 calBC. At this time, an increase in farming activities occurs led by pastoralism (*fig. 2*). Pollen records from eleven archaeological sites (*fig. 1*) dated to the Chalcolithic period (El Castillejo, Los Picos-Fontarrón, Valle de las Higueras, Mejorada I and Camino de Yepes-Valdegato in Toledo province; Salinas de Espartinas, Gózquez, Villaverde 91, Fuente de la Mora, El Ventorro and Camino de las Yeseras in Madrid province) show the occurrence of *Cerealia*-type pollen (>3%) and high values (>15%) of anthropozoogenous taxa (*Plantago lanceolata*, *Urtica dioica*), carbonicolous and coprophilous fungal ascospores (*Chaetomium*, *Sordaria*, *Cercophora*, *Sporormiella*), setting up an agropastoral landscape where the tree cover was relatively low (*Quercus ilex* <10%) due to the use of fire to clear the original Neolithic *dehesa*-type landscapes (Macías et al. 1996; Martín et al. 2001; López Sáez et al. 2009a; 2010b; 2015; Valiente et al. 2007; 2009; López Sáez 2011). During the Copper Age (ca. 2900–2000 calBC) crop farming seems to have played a major role in the activities close to settlements. In this sense, we must understand the Chalcolithic landscapes as the historical products of long-lasting anthropogenic activities dating back to the first agricultural societies in these settings.

The existence of a *dehesa*-type landscape in the South Meseta, from the Middle Neolithic to the end of the Copper Age (ca. 4200–2000 calBC) was the outcome of a set of customs to exploit agroforestry resources under a management rationale which resulted sustainable in the long-term. This required a year-round permanence in the area and therefore involved the progressive sedentarisation of the population, especially during the Copper Age (Díaz-del-Río 2001; Bueno Ramírez et al. 2008c). It is also noteworthy that open-air copper ores exploitation, a woodland-consuming activity, was practiced on a small scale (Barroso Bermejo et al. 2003) allowing the conservation of these landscapes. During most of the 3rd mill. calBC climate was dry as reflected by

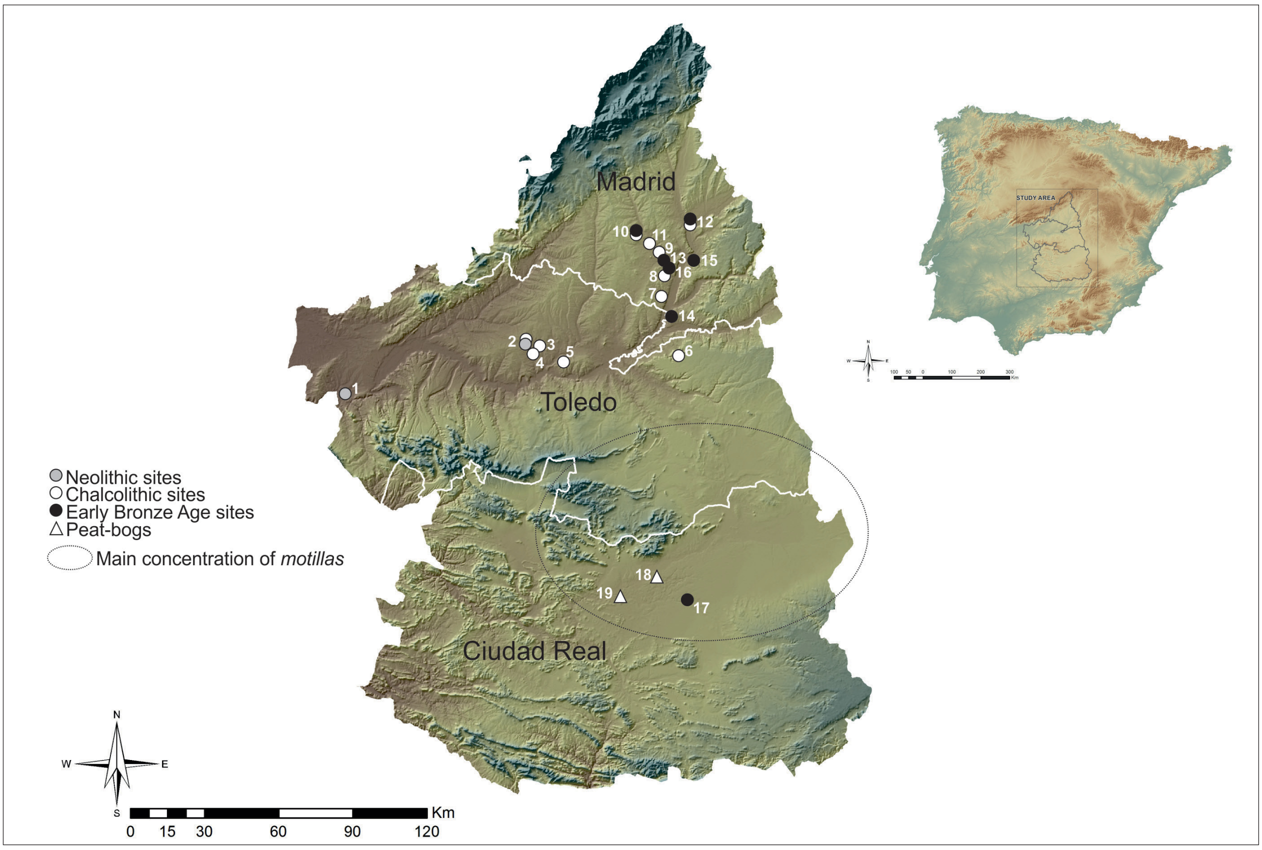

Fig. 1. Location of pollen records mentioned in the text. 1. Azután; 2. El Castillejo; 3. Los Picos-Fontarrón; 4. Valle de las Higueras; 5. Mejorada I; 6. Camino de Yepes-Valdegato; 7. Salinas de Espartinas; 8. Gózquez; 9. Villaverde 91; 10. Fuente de la Mora; 11. El Ventorro; 12. Camino de las Yeseras; 13. Caserío de Perales; 14. Cantera de la Flamenca; 15. Valdelázaro; 16. Fábrica de Ladrillos; 17. Azuer; 18. DTP; 19. Castillo de Calatrava.

the substantial presence of xerophytic taxa (*Olea europaea*, *Chenopodiaceae*, *Helianthemum*, *Artemisia*, *Reseda lutea*, *Ephedra*, etc.) in pollen records from the above mentioned Chalcolithic sites. The continental character of the climate favoured the development of semi-steppe vegetation very similar to present-day one.

In short, the Chalcolithic period (ca. 2900–2000 calBC) on the South Meseta of the Iberian Peninsula was the climax of a process of demographic growth. This was favoured by subsistence strategies based on surplus accumulation practiced since the Neolithic period. In the northern sedimentary lowlands of both the Tagus (Toledo province) and the Guadarrama Basins (Madrid province) (*fig. 1*), a fully agrarian character of the landscapes (*dehesa*-type) has been demonstrated by pollen data at least since the end of the 4th mill. calBC (*fig. 2*). A larger number of prehistoric settlements is observed during the Chalcolithic period, indicating a substantial increase in population (Ruiz Taboada 1998; Muñoz 2000; Benítez de Lugo 2011). This demographic trend was combined with a more prolonged nature of the settlements and the investment of some staple surplus in agricultural infrastructure and social strategies of political economy, denoted by the occurrence of prestige items and funerary constructions (Muñoz 2000; Díaz-del-Río 2001; 2003; Bueno Ramírez et al. 2002; 2005c). A comparative review of more than one thousand radiocarbon dates from the later prehistory of southern Spain (Balsera et al. 2015) shows a sharp increase of activity ca. 3200–2200 calBC, possibly reflecting large-scale patterns resulting from major economic and social processes: demographic growth and increase of agro-pastoral activities (López Sáez et al. 2003b; López Sáez/López García 2004).

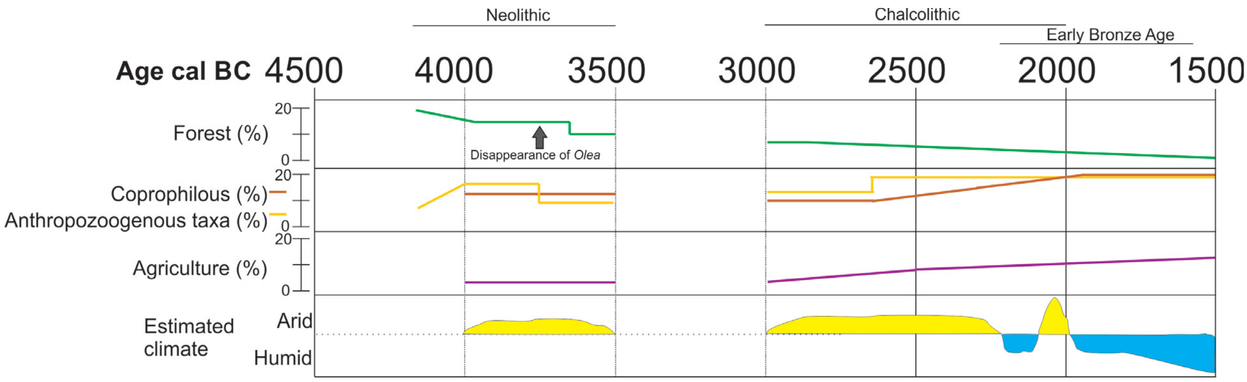

Fig. 2. Temporal variation of major landscape patterns and processes on the South Meseta of the Iberian Peninsula. Estimated climate is inferred from the relationship between xerophytic versus hydro-hygrophytic taxa.

A Climatic Change at the Time of the Chalcolithic–Early Bronze Age Transition

The transition from the Chalcolithic (Iberian Copper Age) to the Early Bronze Age on the Iberian Peninsula (ca. 2200–2000 calBC) has received considerable archaeological attention, because of the apparent concurrence of: (I) aridification; (II) reorganisation of settlements; and (III) the end of the Neolithic-Copper Age lifestyles around 2000 calBC (Díaz-del-Río 2001; Fabián et al. 2006; Lull et al. 2010; Lillios 2015; Pérez Díaz/López Sáez 2015). Collectively, these phenomena are known as the late 3rd mill. collapse of civilisations, aridity crisis, or urban crisis as well as the 4.2 ka calBP event (Wanner et al. 2008; Wiener 2014). These phenomena were first reported by Weiss et al. (1993) in northern Mesopotamia and actually the topic has generated considerable debate due to the current interest in climate change and the collapse of complex societies (e.g. McIntosh et al. 2000; de Menocal 2001; Schwartz/Nichols 2006).

The underlying nature and causes of the 4.2 ka calBP climate event are so far unclear. Some climatologists, concentrating on evidence from the Near East and the Mediterranean, believe that the moisture laden North Atlantic cyclonic westerly winds, which seasonally break into the Mediterranean and provide the winter precipitation needed for dry farming, failed for reasons still unknown and that 250 years later westerlies-borne precipitation returned to pre-aridification levels (Weiss 2012). Recent work devoted to the study of lake levels however, point to a Northern Hemisphere-wide megadrought event at 4.2 ka calBP contemporaneous with an ice sheet-fracture event in the North Atlantic (Magny et al. 2009; Giraudi et al. 2011). Others suggest a still broader event, observed at a global scale in more than 30 paleoclimate proxies, possibly involving a change in solar irradiance or a succession of major volcanic eruptions (Weiss 2013).

In the case of the Iberian Peninsula, the illustrative study of Balsera et al. (2015) insists on more regional-centred collapses of Copper Age societies than hitherto assumed, with Early Bronze Age societies emerging throughout southern and central Iberia ca. 2200–2000 calBC. Building on the economic and social transformations of the Neolithic period, the Chalcolithic and the Early Bronze Age in Iberia witnessed the emergence of social hierarchization and more integrated regional organisations, whose evolutionary level (chiefdom- or state-like polities) is open to ongoing debate (Díaz-del-Río 2001; Lull et al. 2010; Cruz Berrocal et al. 2013). Arguably, one of the most significant stages of social disruption on the South Meseta is the Copper-Early Bronze Age transition (ca. 2200–2000 calBC). Many factors contributed to the striking socio-political transformations at this time, which are visible in diverse lines of evidence: some degree of craftwork standardisation; expressions of social differentiation; and attempts at economic intensification among the agropastoral subsistence strategies. At the same time, an increasing amount of paleoenvironmental research (mainly palynological records) suggests that the climate changed significantly around the time of the Copper-Early Bronze Age transition.

During the transition from the 3rd to the 2nd mill. calBC the South Meseta was subject to the effects of a short and abrupt climate change of extreme aridity, the so-called 4.2 ka calBP (ca. 2350–1850 calBC) (Magny 2004), which has been recognised as a marked aridification phase in the Mediterranean Iberian region (Jalut et al. 2000; 2009; Carrión et al. 2010). According to Magny et al. (2009), this event is characterised in the western Mediterranean by a tripartite climatic oscillation: two phases with wetter conditions (ca. 2350–2150 and 2000–1850 calBC) bracketed a phase of drier conditions at ca. 2150–2000 calBC. Their consequences are traceable in both the archaeological and palynological records during the transitional period between the end of the Chalcolithic and the onset of the Early Bronze Age on the South Meseta of the Iberian Peninsula, as well as in other regions of central Spain (López Sáez et al. 2005b; Fabián et al. 2006). Although the 4.2 ka calBP event is generally regarded as a period of rapidly shifting climatic conditions, the actual pace of such transformations is still highly debated, particularly in terms of its spatial extent, magnitude, duration and possible cultural effects. Let us examine the situation on the South Meseta from a comparative perspective and focusing on those better studied sub-regions: the northern plains of the Tagus Basin (Toledo, Madrid and Cuenca provinces) and the southern La Mancha region (encompassing the whole Ciudad Real and Albacete provinces).

During the 3rd mill. calBC Chalcolithic sites from the Tagus basin considerably increased and by the end of this period (ca. 2150–2000 calBC) xerophytic taxa were abundant. This is clearly detected in the Late Chalcolithic layers of Los Castillejos barrow and Camino de las Yeseras pollen records (López Sáez et al. 2009a; López Sáez 2011), which lead to infer a maximum of aridity (~25% of xerophytic taxa versus ~10% in the Early Chalcolithic). In the time frame of this climate event the abandonment of the traditional Chalcolithic sites located in rich alluvial valleys (Tagus and Guadarrama) occurs. Low-lying settings occupied during the Chalcolithic period continued to be inhabited. Pollen records from six Early-Middle Bronze Age sites (*fig. 1*) located at these low-altitude fertile alluvial areas in the Tagus basin (Fuente de la Mora, Camino de las Yeseras, Caserío de Perales, Cantera de la Flamenca, Valdelázaro, Fábrica de Ladrillos) indicate more humid climatic conditions, inferred from high values of hydro-hygrophilous taxa and legumes that would be referring to potential irrigated crops (Macías et al. 1996; Macías/López Sáez 2005–2007; López Sáez et al. 2010b; López Sáez 2011). But since ca. 2200 calBC the highlands in this northern area (*sierras* and *serranías*) testify to a new type of settlements of Early Bronze Age date, located on top of *mesas* and hilltops, suggesting defensive interests or perhaps looking for commanding views and the access to extensive forestry resources (Díaz-Andreu 1994; Ruiz Taboada 1998; Muñoz 2000). Unfortunately, no paleo-ecological records are available from these upland sites.

All in all, these observations might be pointing to readjustments of subsistence strategies towards irrigated agriculture in plain areas and livestock management strategies, especially in the mountain landscapes, although livestock seems to constitute the basis of subsistence everywhere, as indicated by the abundance of anthropozoogenous taxa and coprophilous fungi (*fig. 2*). Ultimately, the Chalcolithic agrarian landscapes in these zones became unsustainable ca. 2000 calBC and transformed into diversified ones, apparently more pastoralism-oriented.

Clearer evidence of the 4.2 ka calBP and its tripartite climatic oscillation proposed by Magny et al. (2009) comes from the southern part of the South Meseta, a region called La Mancha (*fig. 1*). In this subregion several types of Bronze Age sites are known (Martínez Navarrete 1988; Fernández Posse et al. 1996; Benítez de Lugo 2011; Brodsky et al. 2013): (I) pit sites in lowlands, only preliminarily investigated; (II) artificial mounds called *castillejos* or deeply stratified hilltop settlements; and (III) *morras* or *motillas,* enclosed villages located mainly in low-lying settings (marshes and river valleys) or on smooth hills.

Some proofs of the 4.2 ka calBP event are found in pollen records from the Ciudad Real province: DTD (Tablas de Daimiel wetland) and Castillo de Calatrava peat-bogs. Both cores indicate the decrease of arboreal pollen and the development of xerophytic taxa such as *Juniperus*, *Chenopodiaceae*,

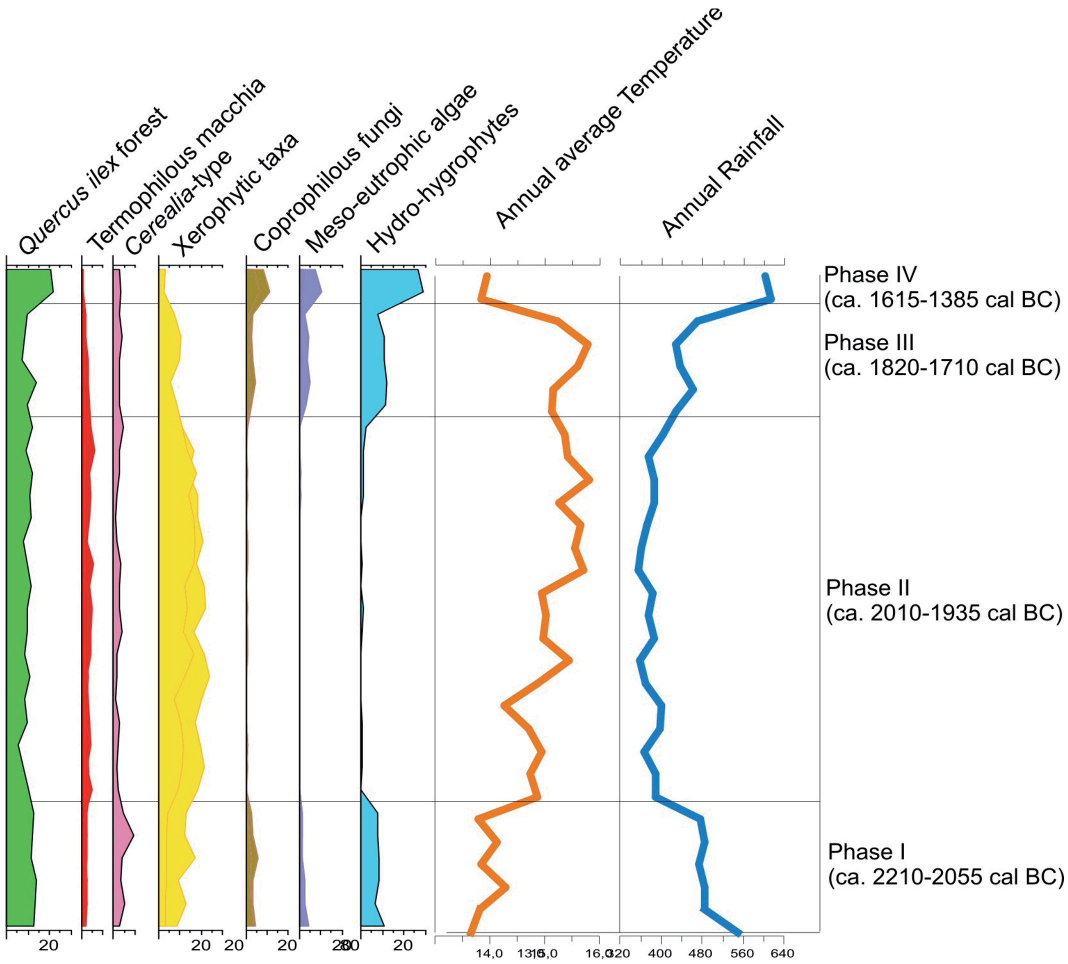

Fig. 3. Synthetic pollen diagram of Azuer's motilla. Radiocarbon data presented in López Sáez et al. (2014b) have been recalibrated with Calib 7.1. Chronological intervals of each phase correspond to median probabilities of calBC data.

Asteraceae and *Artemisia* ca. 2250–2050 calBC (García Antón et al. 1986; Ruiz Zapata et al. 2010). However, the best sequence for tracing environmental change is from one such *motilla*-type site: El Azuer in Ciudad Real province (Nájera/Molina 2004a; 2004b; Molina et al. 2005). This site was extensively excavated and is one of the most remarkable examples of such prehistoric stone-walled sites of Bronze Age date (ca. 200–1400/1350 calBC). It includes one of the oldest groundwater wells documented in the Iberian Peninsula (Molina et al. 2005). The construction of a massive concentric fortification has been related by its excavators to the exploitation of economic resources (agriculture, animal husbandry) and the control of water; meaning an environmental adaptation strategy to the peculiar ecological conditions of its location (Nájera/Molina 2004a; 2004b). The pollen record from this site will be published soon (López Sáez et al. 2014b) (*fig. 3*). Phase I (ca. 2210–2055 calBC) shows a deforested *dehesa*-type landscape under warm and sub-humid conditions (high values of termophilous macchia, hydro-hygrophytes and meso-eutrophic algae), evidence of agriculture (*Cerealia*-type >3%) and cattle raising (presence of coprophilous fungi ascospores). During this phase annual rainfall decreases gradually, which could be related to the permanent occupation of the settlement at the beginning of the Bronze Age and the construction of a central well. Phase II involved the most constructive development during the Early and Middle Bronze Age ca. 2010–1935 calBC. Its pollen record differs significantly from that of the preceding phase as hydro-hygrophytes, coprophilous fungi and algae values decrease sharply. *Cerealia*-type also decreases slightly, indicating warm and hyper-arid climate conditions (high values of xerophytic taxa) and a decreasing human impact. This phase corresponds to the minimum values of annual rainfall and the highest annual average temperature. Adverse weather conditions during this stage led to a slowdown of activities, a new organisation of the settlement and the construction of numerous ovens and pits related to storage and production activities. Phase III (ca. 820–1710 calBC, Middle Bronze Age) was the climax of population growth, related to milder weather conditions. From a climatic and economic point of view it is very similar to Phase I: increase of hydro-hygrophytes, algae and coprophilous fungi; annual rainfall also increases while annual average temperature decreases progressively. Finally, Phase IV (ca. 1615–1385 calBC, Late Bronze Age) was the last period of occupation. From a climatic point of view this phase marks the maximum moisture and highest rainfall (maximum values of hydro-hygrophytes and algae and minimum of xerophytic taxa) and a mild climate (decrease of termophilous macchia and temperature), as well as the recovery of evergreen forest, whereas both agricultural and livestock activities are confirmed.

In short, several steady socioeconomic trajectories featuring highly in the first half of the 3rd mill. broke down towards 2200 calBC. This is the case of fission dynamics of segmentary communities in the Early Bronze Age (ca. 2200–1600 calBC) which are different from Chalcolithic ones. 2nd mill. calBC habitats such as highland prominent sites in the *serranías* and the *motillas* and *castillejos* in the plains of La Mancha seem more stable and permanent than preceding Chalcolithic farmsteads (pit sites). Their number also declines, suggesting aggregation of previously dispersed households (Díaz-Andreu 1994; Ruiz Taboada 1998; Benítez de Lugo 2011; Brodsky et al 2013). The process of aridity that characterised La Mancha in the late 3rd mill. calBC may probably contribute to account for the emergence of these *motillas*. It seems that such a characteristic cultural choice had something to do with tapping groundwater aquifers in a secluded and highly inaccessible way. And conversely, increasingly humid conditions in the second third of the 2nd mill. calBC might help interpreting the abandonment of these peculiar sites, since water was now widely available and therefore they lost their original sense.

Conclusions

The ten thousand years of the Holocene and, in particular, the period since the Middle Neolithic (ca. 4200 calBC), have seen major transformations of the South Meseta of the Iberian Peninsula landscapes. Interdisciplinary studies, based on archaeological and palynological data, show that Chalcolithic societies (ca. 2900–2000 calBC) were heavily dependent on climatic conditions, which probably conditioned the size of exploitable territories in alluvial fertile soils in the Tagus and Guadarrama Basins, as well as agricultural productivity. During climatic aridification ca. 2200–2000 calBC, related to the 4.2 ka calBP event, Copper Age societies cultivating cereals were thus not very resilient and depended strongly on climate circumstances. Agropastoral societies appear better adapted to resist climatic changes, as in the case of the Early Bronze Age (ca. 2200–1600 calBC). The data presented here for the South Meseta show a significant rupture in the resilience of the agrosystems in the Late Copper Age (ca. 2200–2000 calBC). In the following centuries, during the Early Bronze Age, we see some development of irrigated agriculture and a diversification of subsistence strategies.

In most of the South Meseta, Chalcolithic settlements collapsed ca. 2200–2000 calBC at the same time that hyper-arid conditions occurred. Rejecting, of course, any standpoints based on either climatic or environmental determinism, we do have to recognise that, after all, the 4200 calBP abrupt climate event might have acted as a historical trigger or a highly important driver channeling the social collapse of Chalcolithic communities, which, ultimately, were not resilient enough. While in some sectors of the South Meseta Chalcolithic lifestyles started to disappear, in other subregions, namely the *serranías*, *sierras* and La Mancha, Bronze Age communities started to aggregate in differently organised sites ca. 2200 calBC. These new Bronze Age communities successfully adapted to aridity processes linked to the 4.2 ka calBP event. They learned to live on a more diverse spectrum of resources and exploited groundwater aquifers through deep wells, leading to the cultural phenomenon known as the *Motillas* Culture (Martínez Navarrete 1988; Fernández Posse et al.

1996). In short, they adopted new cultural and subsistence strategies and became more resilient in the long-term.

Resilience of human ecosystems can be usefully subdivided into a triad of intersecting environmental, political and cultural components (Butzer 2012). Negative feedbacks resist, dampen, or reverse change. Of course, preconditioning factors may also impose a degree of stability. In specific ecological contexts and at different spatial and temporal scales, environmental inputs mobilise certain processes, define thresholds, follow time-paths and favour outcomes that may be distinctive. However, environmentally grounded crises are culturally screened and perceived, so as to affect vulnerability, resilience and response, as well as the timescales at which underlying processes can be addressed (Gil Romera et al. 2010). Environmental elasticity may be critical in the mitigating of collapse or in the ability of a society to carry on. Perhaps little appreciated is that some environmental systems are more resilient than others in regard to anthropogenic or climatic change and their cascading feedbacks. Organisational structures on the South Meseta during the Bronze Age were less vulnerable to collapse than those implemented in arid lands or those of hydrologically sensitive areas.

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Bibliography

Álvaro 1987: E. Álvaro, La Edad del Cobre en el valle del Tajo. Carpetania 1, 1987, 11–42.

Balsera et al. 2015: V. Balsera/J. Bernabeu/M. Costa/P. Díaz-del-Río/L. García Sanjuán/S. Pardo, The Radiocarbon Chronology of Southern Spain's Late Prehistory (5600–1000 cal BC). A Comparative Review. Oxford Journal of Archaeology 34, 2015, 139–156.

Barroso Bermejo et al. 2003: R. Barroso Bermejo/P. Bueno Ramírez/R. de Balbín Behrmann, Primeras producciones metálicas en la cuenca interior del Tajo. Cáceres y Toledo. Estudos Pré-históricos 10, 2003, 87–107.

Benítez de Lugo 2011: L. Benítez de Lugo, Orígenes, desarrollo y ocaso de la cultura del Bronce de la Mancha. Nuevas aportaciones a la interpretación de los procesos de transformación y cambio en el Alto Guadiana durante la prehistoria reciente. Quaderns de Prehistòria i Arqueología de Castelló 29, 2011, 47–75.

Berger et al. 2007: J. F. Berger/L. Nuninger/S. E. van der Leeuw, Modeling the Role of Resilience in Socioenvironmental Co-Evolution. The Middle Rhône Valley Between 1000 BC and AD 1000. In: T. A. Kohler/S. E. van der Leeuw (ed.), The Model-Based Archaeology of Socionatural Systems (Santa Fe 2007) 41–59.

Brodsky et al. 2013: M. C. Brodsky/A. Gilman/C. Martín Morales, Bronze Age Political Landscapes in La Mancha. In: M. Cruz Berrocal/L. García Sanjuán/A. Gilman (eds.), The Prehistory of Iberia. Debating Early Social Stratification and the State (New York 2013) 141–169.

Bueno Ramírez et al. 2002: P. Bueno Ramírez/R. Barroso Bemejo/R. de Balbín Behrmann/M. Campo/F. Etxeberría/A. González/L. Herrasti/J. Juan/J. A. López Sáez/B. Sánchez, Áreas habitacionales y funerarias en el Neolítico de la cuenca interior del Tajo. La provincia de Toledo. Trabajos de Prehistoria 59, 2002, 65–79.

Bueno Ramírez et al. 2004: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Construcciones funerarias avanzadas en la cuenca interior del Tajo, el núcleo cacereño. SPAL. Revista de Prehistoria y Arqueología de la Universidad de Sevilla 13, 2004, 83–112.

Bueno Ramírez et al. 2005a: P. Bueno Ramírez/R. de Balbín Behrmann/R. Barroso Bermejo, El dolmen de Azután (Toledo). Áreas de habitación y áreas funerarias en la cuenca interior del Tajo (Toledo 2005).

Bueno Ramírez et al. 2005b: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Ritual campaniforme, ritual colectivo. La necrópolis de cuevas artificiales del Valle de las Higueras, Huecas, Toledo. Trabajos de Prehistoria 62, 2005, 67–90.

Bueno Ramírez et al. 2005c: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Berhmann/M. Campo/A. González/F. Etxeberría/L. Herrasti/V. Galván/J. Juan/J. A. López Sáez/P. López/J. C. Matamala/J. J. Millos/B. Robledo/G. Trancho/B. Sánchez. Alimentación y economía en contextos habitacionales y funerarios del Neolítico meseteño. In: P. Arias/R. Ontañón/C. García (eds.), III Congreso del Neolítico en la Península Ibérica (Santander 2005) 83–92.

Bueno Ramírez et al. 2006: P. Bueno Ramírez/R. de Balbín Behrmann/R. Barroso Bermejo, Mégalithes dans le centre de la Péninsule Ibérique. Une perspective d'analyse à partir de la Meseta Sud. In: R. Joussaume/L. Laporte/C. Scarre (eds.), Origine et développement du mégalithisme de l'ouest de l'Europe I (Bougon 2006) 435–450.

Bueno Ramírez et al. 2008a: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, The Necropolis of Era de la Laguna, Santiago de Alcántara, Cáceres, in the Context of the Megalithism of the Central Region of the International Tagus. In: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann (eds.), Graphical Markers and Megalith Builders in the International Tagus, Iberian Peninsula. British Archaeological Reports. International Series 1765 (Oxford 2008) 41–59.

Bueno Ramírez et al. 2008b: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Campaniforme en las construcciones hipogeas del megalitismo reciente al interior de la Península Ibérica. Veleia 24/25, 2008, 771–790.

Bueno Ramírez et al. 2008c: P. Bueno Ramírez/R. Barroso Bermejo/A. Vázquez, The Beaker Phenomenon and the Funerary Contexts of the International Tagus. In: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann (eds.), Graphical Markers and Megalith Builders in the International Tagus, Iberian Peninsula. British Archaeological Reports. International Series 1765 (Oxford 2008) 141–155.

Butzer 2012: K. W. Butzer, Collapse, Environment, and Society. Proceedings of the National Academy of Sciences USA 109, 2012, 3632–3639.

Carrión et al. 2010: J. S. Carrión/S. Fernández/P. González/G. Gil/E. Badal/Y. Carrión/L. López/J. A. López Sáez/E. Fierro/F. Burjachs, Expected Trends and Surprises in the Lateglacial and Holocene Vegetation History of the Iberian Peninsula and Balearic Islands. Review of Palaeobotany and Palynology 162, 2010, 458–475.

Cruz Berrocal et al. 2013: M. Cruz Berrocal/L. García Sanjuán/A. Gilman (eds.), The Prehistory of Iberia. Debating Early Social Stratification and the State (New York 2013).

Díaz-Andreu 1994: M. Díaz-Andreu, La Edad del Bronce en la Provincia de Cuenca. Arqueología Conquense 13. Diputación de Cuenca (Cuenca 1994).

Díaz-del-Río 2001: P. Díaz-del-Río, La formación del paisaje agrario. Madrid en el III y II milenios BC (Madrid 2001).

Díaz-del-Río 2003: P. Díaz-del-Río, Recintos y fosos del III milenio AC en la Meseta peninsular. Trabajos de Prehistoria 60, 2003, 61–78.

Fabián et al. 2006: J. Fabián/A. Blanco González/J. A. López Sáez, La transición Calcolítico-Bronce Antiguo desde una perspectiva arqueológica y ambiental. El Valle Amblés (Ávila) como referencia. Arqueología Espacial 26, 2006, 37–56.

Fernández Posse et al. 1996: M. D. Fernández Posse/A. Gilman/C. Martín, Consideraciones cronológicas sobre la Edad del Bronce en La Mancha. Complutum Extra 6, 1996, 111–137.

García Antón et al. 1986: M. García Antón/C. Morla/M. B. Ruiz Zapata, Contribución al conocimiento del paisaje vegetal holoceno en la Submeseta sur ibérica. Análisis polínico de sedimentos higroturbosos en el Campo de Calatrava (Ciudad Real, España). In: F. López Vera (ed.), Quaternary Climate in Western Mediterranean. Proceedings of the Symposium on Climatic Fluctuations during the Quaternary in Western Mediterranean Regions (Madrid 1986) 189–204.

Garrido Pena 1997: R. Garrido Pena, Bell Beakers in the Southern Meseta of the Iberian Peninsula. Socioeconomic Context and New Data. Oxford Journal of Archaeology 16, 1997, 187–206.

Garrido Pena 2000: R. Garrido Pena, El campaniforme en la Meseta Central de la Península Ibérica (c. 2500-2000 AC). British Archaeological Reports. International Series 892 (Oxford 2000).

Gil Romera et al. 2010: G. Gil Romera/L. López/J. S. Carrión/P. González/C. Martín/J. A. López Sáez/S. Fernández/M. García/V. Stefanova, Interpreting Resilience through Long-Term Ecology. Potential Insights in Western Mediterranean Landscapes. The Open Ecology Journal 3, 2010, 43–53.

Giraudi et al. 2011: C. Giraudi/M. Magny/G. Zanchetta/R. N. Drysdale, The Holocene Climatic Evolution of Mediterranean Italy. A Review of the Continental Geological Data. The Holocene 21, 2011, 105–115.

Harrison 1995: R. J. Harrison, New Aspects of the "Policultivo Ganadero" in Prehistoric Spain. Trabalhos de Arqueologia 7, 1995, 273–276.

Jalut et al. 2000: G. Jalut/A. Esteban/L. Bonnet/T. Gauquelin/M. Fontugne, Holocene Climatic Changes in the Western Mediterranean, from South-East France to South-East Spain. Palaeogeography, Palaeoclimatology, Palaeoecology 160, 2000, 255–290.

Jalut et al. 2009: G. Jalut/J. J. Dedoubat/M. Fontugne/T. Otto, Holocene Circum-Mediterranean Vegetation Changes. Climate Forcing and Human Impact. Quaternary International 200, 2009, 4–18.

Lillios 2015: K. T. Lillios, Practice, Process, and Social Change in Third Millennium BC Europe. A View from the Sizandro Valley, Portugal. European Journal of Archaeology 18, 2015, 245–258.

López García/López Sáez 2000: P. López García/J. A. López Sáez, Análisis palinológico del dolmen de Azután. Revista Española de Micropaleontología 32, 2000, 107–113.

López Sáez 2007: J. A. López Sáez, El Valle Amblés en el III milenio cal BC. Acerca del origen antropozoógeno del paisaje. Cuadernos Abulenses 36, 2007, 211–221.

López Sáez 2011: J. A. López Sáez, Análisis palinológicos en el poblado calcolítico de Camino de las Yeseras (San Fernando de Henares, Madrid). In: C. Blasco/C. Liesau/P. Ríos (eds.), Yacimientos calcolíticos con Campaniforme de la Región de Madrid. Nuevos Estudios. Patrimonio Arqueológico de Madrid 6 (Madrid 2011) 251–259.

López Sáez 2012: J. A. López Sáez, Historia de la vegetación en la comarca de Villafáfila durante el Holoceno reciente. In: F. J. Abarquero/E. Guerra/G. Delibes de Castro/A. L. Palomino/J. del Val (eds.), Arqueología de la Sal en las Lagunas de Villafáfila (Zamora). Investigaciones sobre los cocederos prehistóricos. Investigaciones Arqueológicas en Castilla y León, Monografías 9 (Valladolid 2012) 369–379.

López Sáez/López García 2004: J. A. López Sáez/P. López García, La agricultura en el Valle Amblés (Ávila, España) durante el III milenio cal BC. Consideraciones arqueopalinológicas. Trabalhos de Antropologia e Etnologia 44, 2004, 169–180.

López Sáez/López García 2005: J. A. López Sáez/P. López García, Análisis palinológicos en el dolmen de Azután (Toledo). Una aproximación a los inicios de la agricultura y la ganadería en la Meseta Sur. In: P. Bueno Ramírez/R. de Balbín Behrmann/R. Barroso Bermejo (eds.), El dolmen de Azután (Toledo), Áreas de habitación y áreas funerarias en la cuenca interior del Tajo (Toledo 2005) 225–234.

López Sáez/López García 2006: J. A. López Sáez/P. López García, Homme et milieu dans la Vallée Amblés (Massif Central, Ávila, Espagne) pendant le Chalcolithique. De la stratégie de peuplement à la paleoéconomie. In: Y. Miras/F. Surmely (eds.), Environnement et peuplement de la moyenne montagne du Tardiglaciaire à nos jours. Annales Littéraires 799. Série Environnement, sociétés et archéologie 9 (Besançon 2006) 145–155.

López Sáez/López Merino 2005: J. A. López Sáez/L. López Merino, Precisiones metodológicas acerca de los indicios paleopalinológicos de agricultura en la Prehistoria de la Península Ibérica. Portugalia 26, 2005, 53–64.

López Sáez/López Merino 2007: J. A. López Sáez/L. López Merino, Coprophilous Fungi as a Source of Information of Anthropic Activities during the Prehistory in the Amblés Valley (Ávila, Spain). The Archaeopalynological Record. Revista Española de Micropaleontología 39, 2007, 103–116.

López Sáez et al. 2003a: J. A. López Sáez/P. López/F. Burjachs, Arqueopalinología. Síntesis crítica. Polen 12, 2003, 5–35.

López Sáez et al. 2003b: J. A. López Sáez/M. Dorado/F. Burjachs/B. Ruiz/P. López/F. Fabián, Paleoambiente y paleoeconomía durante la Prehistoria en el Valle Amblés (Ávila). Polen 13, 2003, 129–141.

López Sáez et al. 2005a: J. A. López Sáez/ P. López/L. López/E. Cerrillo/A. González/A. Prada, Prehistoric Landscapes in North Extremadura Between the VI^{th} and the IV^{th} millenia cal. BC. Journal of Iberian Archaeology 7, 2005, 23–35.

López Sáez et al. 2005b: J. A. López Sáez/A. Rodríguez Marcos/P. López, Paisaje y economía durante el Bronce Antiguo en la Meseta Norte desde una perspectiva paleoambiental. Algunos casos de estudio. Boletín del Seminario de Estudios de Arte y Arqueología 71, 2005, 65–88.

López Sáez et al. 2006: J. A. López Sáez/F. Burjachs/P. López/L. López, Algunas precisiones sobre el muestreo e interpretación de los datos en Arqueopalinología. Polen 15, 2006, 17–29.

López Sáez et al. 2007: J. A. López Sáez/P. López García/L. López Merino/E. Cerrillo/A. González/A. Prada, Origen prehistórico de la dehesa en Extremadura. Una perspectiva paleoambiental. Revista de Estudios Extremeños 63, 2007, 493–509.

López Sáez et al. 2009a: J. A. López Sáez/L. López Merino/S. Pérez Díaz, Historia de la vegetación y paleoambiente del Valle de Huecas. In: L. Benítez/P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann/J. A. López Sáez (eds.), Arqueología, Medio Ambiente y Obras Públicas. El Valle de Huecas (Huecas, Toledo) (Valdepeñas 2009) 83–101.

López Sáez et al. 2009b: J. A. López Sáez/A. Blanco González/L. López/B. Ruiz/M. Dorado/S. Pérez/A. Valdeolmillos/F. Burjachs, Landscape and Climatic Changes during the End of the Late Prehistory in the Amblés Valley (Ávila, Central Spain) from 1200 to 400 cal BC. Quaternary International 200, 2009, 90–101.

López Sáez et al. 2010a: J. A. López Sáez/F. Alba/L. López/S. Pérez, Modern Pollen Analysis. A Reliable Tool for Discriminating *Quercus rotundifolia* Communities in Central Spain. Phytocoenologia 40, 2010, 57–72.

López Sáez et al. 2010b: J. A. López Sáez/F. Alba/S. Pérez/S. Manzano, Paisaje holoceno de una gran urbe. La ciudad de Madrid. Polen 20, 2010, 7–24.

López Sáez et al. 2013: J. A. López Sáez/M. J. Iriarte/F. Burjachs, Arqueopalinología. In: M. García Diez/L. Zapata (eds.), Métodos y técnicas de análisis y estudio en Arqueología Prehistórica. De lo técnico a la reconstrucción de los grupos humanos (Vitoria 2013) 273–290.

López Sáez et al. 2014a: J. A. López Sáez/D. Abel/S. Pérez/A. Blanco González/F. Alba/M. Dorado/B. Ruiz/M. J. Gil/C. Gómez/F. Franco, Vegetation History, Climate and Human Impact in the Spanish Central System over the Last 9000 Years. Quaternary International 353, 2014, 98–122.

López Sáez et al. 2014b: J. A. López Sáez/F. Alba Sánchez/T. Nájera Colino/F. Molina González/S. Pérez Díaz/S. Sabariego, Paleoambiente y sociedad en la Edad del Bronce de La Mancha. La Motilla del Azuer. Cuadernos de Prehistoria y Arqueología de la Universidad de Granada 24, 2014, 391–422.

López Sáez et al. 2015: J. A. López Sáez/E. García/F. Alba, Historia de la vegetación y los paisajes de Toledo (Toledo 2015).

Lull et al. 2010: V. Lull/R. Micó/C. Rihuete Herrada/R. Risch, Límites históricos y limitaciones del conocimiento arqueológico. La transición entre los grupos arqueológicos de Los Millares y El Argar. In: P. Bueno Ramírez/A. Gilman/C. Martín/ J. Sánchez Palencia (eds.), Arqueología, Sociedad, Territorio y Paisaje. Homenaje a María Dolores Fernández-Posse (Madrid 2010) 75–94.

Macías/López Sáez 2005–2007: R. Macías/J. A. López Sáez, Análisis polínico de la excavación de la Fábrica (Getafe, Madrid). Estudios de Prehistoria y Arqueología Madrileñas 14/15, 2005–2007, 375–376.

Macías et al. 1996: R. Macías/P. López/J. A. López Sáez, Análisis palinológicos en el sureste madrileño. Yacimientos arqueológicos y depósitos naturales. Botánica Macaronésica 23, 1996, 241–253.

Magny 2004: M. Magny, Holocene Climate Variability as Reflected by Mid-European Lake-Level Fluctuations and Its Probable Impact on Prehistoric Human Settlements. Quaternary International 113, 2004, 65–79.

Magny et al. 2009: M. Magny/B. Vannière/G. Zanchetta/E. Fouache/G. Touchais/L. Petrika/C. Coussot/A. V. Walter Simonnet/F. Arnaud, Possible Complexity of the Climatic Event around 4300–3800 cal. BP in the Central and Western Mediterranean. The Holocene 19, 2009, 823–833.

Martín et al. 2001: M. Martín/R. Macía/P. López/J. A. López Sáez/S. Consuegra/P. Díaz-del-Río, El paisaje durante el Subboreal en el entorno del yacimiento de Gózquez (Madrid). In: S. Moreno/B. Elvira/J. M. Moreno (eds.), XIII Simposio de la Asociación de Palinólogos en Lengua Española (A.P.L.E) (Cartagena 2001) 319–332.

Martínez Navarrete 1988: M. I. Martínez Navarrete, Morras, motillas y castillejos. ¿Unidad o pluralidad cultural durante la Edad del Bronce de La Mancha? In: Homenaje a Samuel de los Santos (Albacete 1988) 81–92.

de Menocal 2001: P. B. de Menocal, Cultural Responses to Climate Change during the Late Holocene. Science 292, 2001, 667–673.

McIntosh et al. 2000: R. J. McIntosh/J. A. Tainter/S. K. McIntosh, The Way the Wind Blows. Climate Change, History, and Human Action (New York 2000).

Molina et al. 2005: F. Molina/T. Nájera/G. Aranda/M. Sánchez/M. Haro, Recent Fieldwork at the Bronze Age Fortified Site of Motilla del Azuer (Daimiel, Spain). Antiquity 79, 2005, 306.

Muñoz 2000: K. Muñoz, The Tagus Middle-Basin (Iberian Peninsula) from the Neolithic to the Iron Age (V–I Millennium cal. BC). The Long Way to Social Complexity. Oxford Journal of Archaeology 19, 2000, 241–272.

Nájera/Molina 2004a: T. Nájera/F. Molina, La Edad del Bronce en La Mancha. Problemática y perspectivas de la investigación. In: L. Hernández/M. Hernández (eds.), La Edad del Bronce en tierras levantinas y limítrofes (Villena 2004) 531–540.

Nájera/Molina 2004b: T. Nájera/F. Molina, Las Motillas. Un modelo de asentamiento con fortificación central en la Llanura de La Mancha. In: M. R. García Huerta/J. Morales Hervás (eds.), La Península Ibérica en el II milenio a.C. Poblados y fortificaciones (Cuenca 2004) 173–214.

Pérez Díaz/López Sáez 2015: S. Pérez Díaz/J. A. López Sáez, Evidence of Agriculture and Livestock. The Palynological Record from the Middle Ebro Valley (Iberian Peninsula) during the 3rd and 2nd Millennia calBC. In: M. P. Prieto/L. Salanova (eds.), Current Researches on Bell Beakers. Proceedings of 15th Bell Beaker International Congress. Volume II: From Atlantic to Ural (Oxford 2015) 159–168.

Ruiz Taboada 1998: Ruiz Taboada, La Edad del Bronce en la provincia de Toledo. La Mancha y su entorno (Toledo 1998).

Ruiz Zapata et al. 2010: B. Ruiz Zapata/M. J. Gil/I. de Bustamante, Paleoenvironmental Reconstruction of Las Tablas de Daimiel and Its Evolution during the Quaternary Period. In: S. Sánche/D. G. Angeler (eds.), Ecology of Threatened Semi-Arid Wetlands. Long-Term Research in Las Tablas de Daimiel (Dordrecht 2010) 23–43.

Schwartz/Nichols 2006: G. M. Schwartz/J. J. Nichols, After Collapse. The Regeneration of Complex Societies (Tucson 2006).

Valiente et al. 2007: S. Valiente/J. F. López/A. Senderos/J. A. López Sáez, Aproximación al estudio de las explotaciones de sal en los ríos Jarama y Tajo, durante la Prehistoria. In: A. Fíguls/O. Weller (eds.), 1ª Trobada internacional d'arqueologia envers l'explotació de la sal a la prehistòria i protohistòria. Institut de recerques envers la Cultura – Archaeologia Cardonensis I (Cardona 2007) 145–174.

Valiente et al. 2009: S. Valiente/A. Rubinos/J. A. López Sáez, Resultados de varios estudios analíticos de Salinas de Espartinas en la Prehistoria. In: Sociedad Española de Historia de la Arqueología (ed.), La explotación histórica de la sal. Investigación y puesta en valor (Ciempozuelos 2009) 183–192.

Wanner et al. 2008: H. Wanner/J. Beer/J. Bütikofer/T. J. Crowley/U. Cubasch/J. Flückiger/H. Goosse/M. Grosjean/F. Joos/J. O. Kaplan/M. Küttel/S. A. Müller/I.C. Prentice/O. Solomina/T. F. Stocker/P. Tarasov/M. Wagner/M. Widmann, Mid- to Late Holocene Climate Change. An Overview. Quaternary Science Reviews 27, 2008, 1791–1828.

Weiss 2012: H. Weiss, Quantifying Collapse. The Late Third Millennium Khabur Plains. In: H. Weiss (ed.), Seven Generations Since the Fall of Akkad (Wiesbaden 2012) 1–24.

Weiss 2013: H. Weiss, The Northern Levant during the Intermediate Bronze Age. Altered Trajectories. In: A. Killebrew/M. Steiner (eds.), Oxford Handbook of the Archaeology of Levant (Oxford 2013) 367–387.

Weiss et al. 1993: H. Weiss/M. A. Courty/W. Wetterstrom/F. Guichard/L. Senior/R. Meadow/A. Curnow, The Genesis and Collapse of Third Millennium North Mesopotamian Civilization. Science 261, 1993, 995–1004.

Wiener 2014: M. H. Wiener, The Interaction of Climate Change and Agency in the Collapse of Civilizations ca. 2300–2000 BC. Radiocarbon 56, 2014, 1–16.

RUI MATALOTO, CATARINA COSTEIRA
AND DIANA NUKUSHINA

Local Shop for Local People

Resource Management During the 3rd Millennium BCE at São Pedro (Redondo, Portugal)

Are you local? This is a local shop, for local people; there's nothing for you here! (Quote from British series 'The League of Gentlemen' 1999)

Keywords: Chalcolithic; territory; local; resources; ore; weaving

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Abstract

The hill of São Pedro is located in the Alentejo Central, South Portugal, near the Serra d'Ossa. The research conducted at the site allowed to register the presence of a sequence of occupations between the end of the 4th and during all of the 3rd mill. BCE, with two fortified settlements and two of open occupation that are alternating during time.

In the present paper we intend to expose the management of the resources used throughout the history of São Pedro, revealing a deep knowledge of the territory, which allowed to create a supply network that takes full advantage of the multiple local resources: agriculture, hunting, textiles, stone – flaked and polished –, ore and others.

1. The Settlements of São Pedro: A Brief Overview

The site of São Pedro is on the eastern side of the Redondo central plain, to the south of the mountainous terrain of the Serra d'Ossa, in the south of Portugal (Calado 1995; 2001) (*fig. 1*).The occupation itself is located on a steep-sided, flat-topped hill (*fig. 4*). The site was subject to an extensive excavation program carried out between 2004 and 2009, which encompassed around two-thirds of the estimated area of the site (Mataloto et al. 2007; Mataloto 2010).

The site was in use during the late 4th and most of the 3rd mill. BCE in what seem to be five distinct occupation phases. This chronology has been supported by a series of already published radiocarbon dates (Mataloto/Boaventura 2009, 37) (*fig. 2*). An apparently open settlement dating from the late 4th and early 3rd mill. BCE seems to be the earliest phase found (phase I). This is followed by the first major stage of construction (phase II) (*fig. 3*), that features a line of walls with several thick adjoining turrets and two, apparently central, circular towers on the inside. Around the middle of the second quarter of the 3rd mill. BCE another seemingly open phase (phase III) takes place, following the abandonment and dismantling of most of the structures which characterised the previous phase. Phase IV, loosely attributable to the end of the 2nd quarter of the 3rd mill. BCE, shows a small, circular

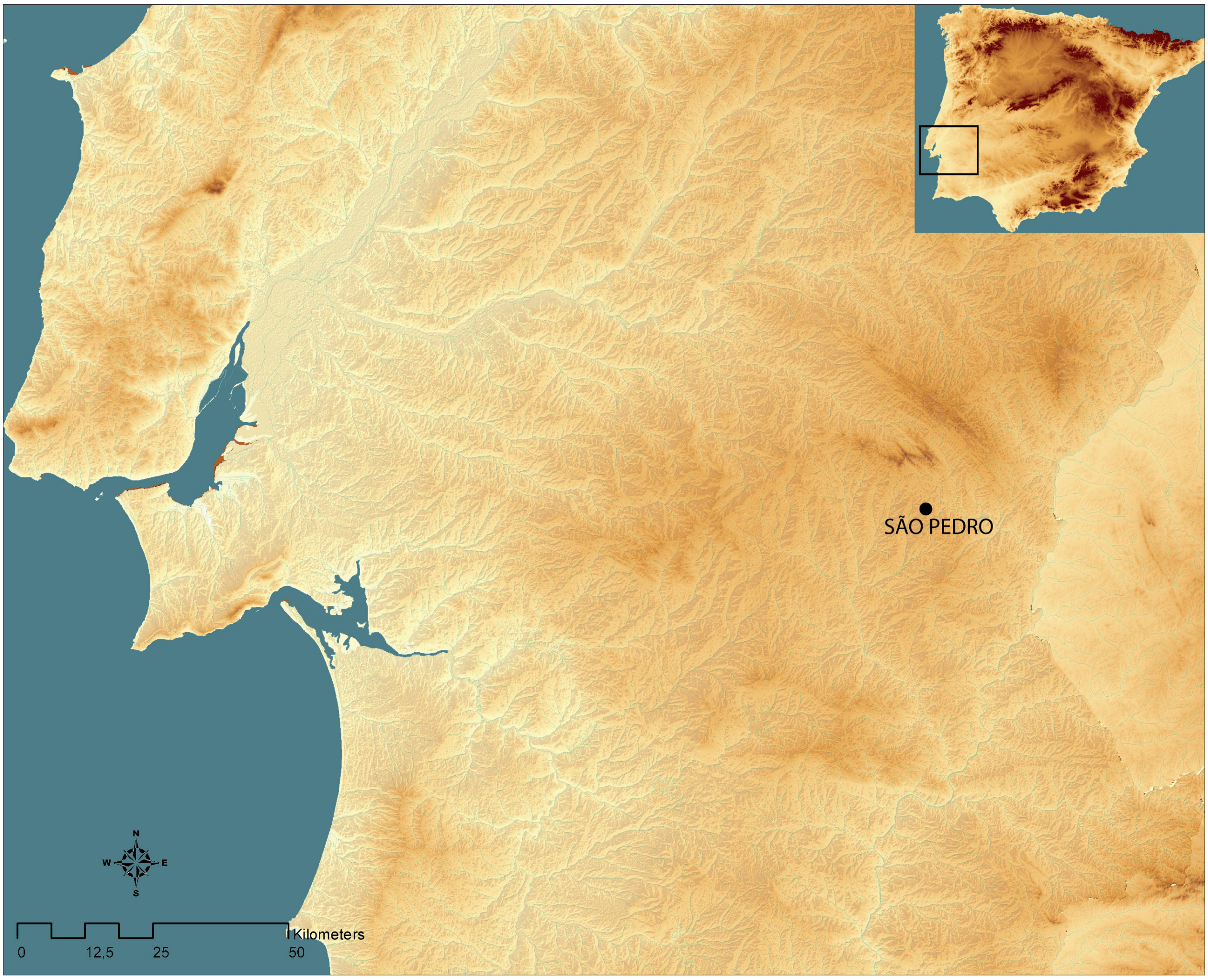

Fig. 1. Location of São Pedro in the South of Portugal and the Iberian Peninsula.

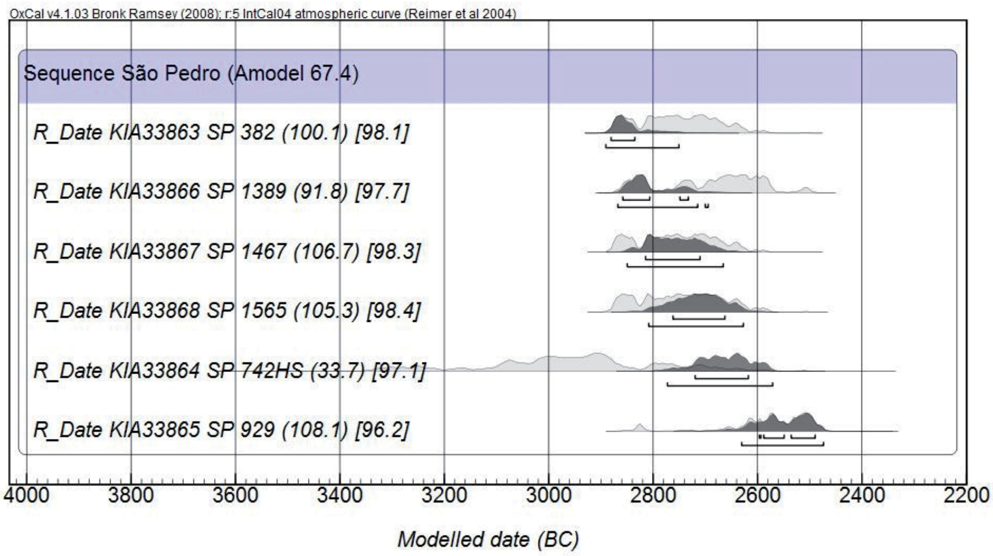

Fig. 2. Radiocarbon modelled dates of São Pedro; Phase II – SP 382; Phase III – SP 1389; Phase IV – SP 1467, SP 1565; SP 742; Phase V – SP 929.

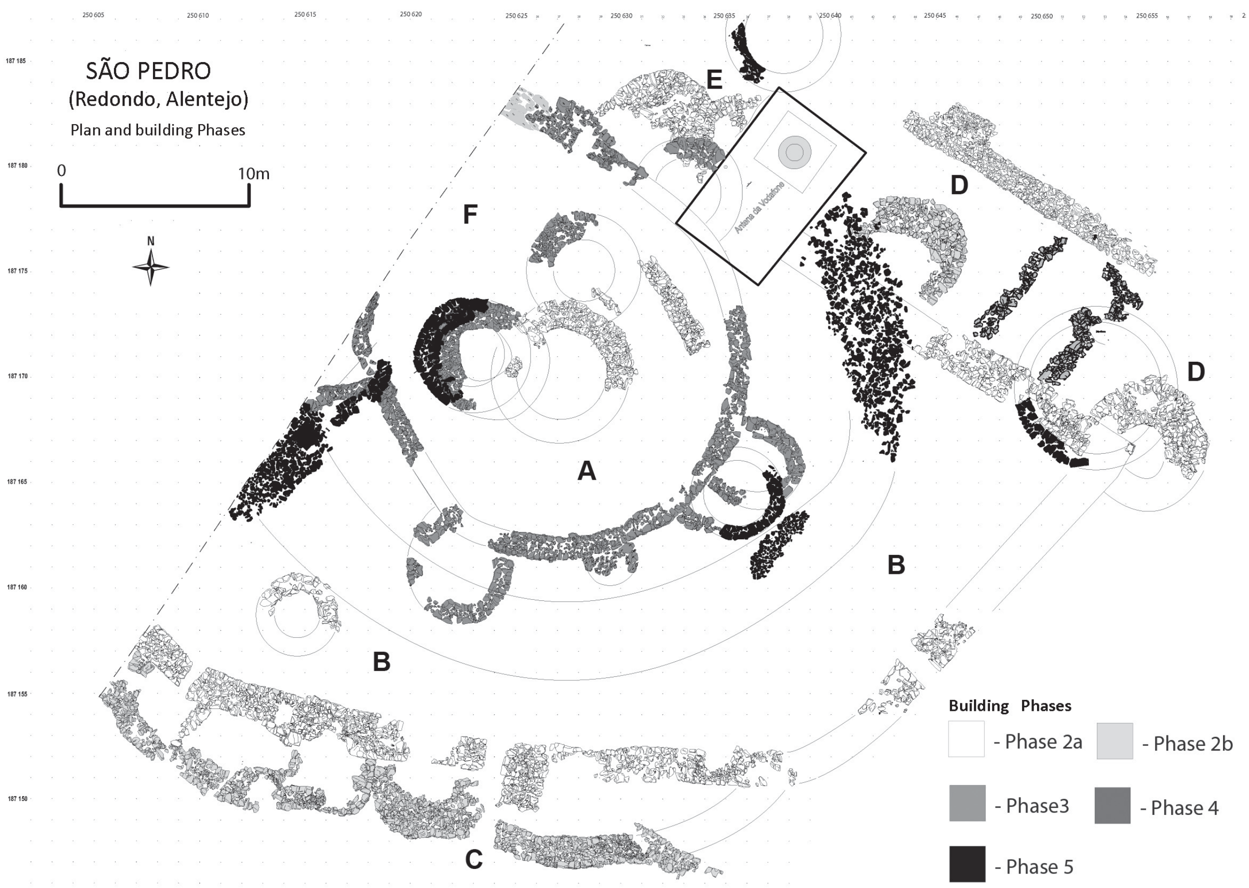

Fig. 3. General plan and building phases of São Pedro.

fortification with two hollow turrets and measuring roughly 200m². Enclosed by this structure are two additional circular towers. Numerous remains of huts constructed from perishable materials were discovered in the area outside the fortification. A new stage of the occupation once again follows the abandonment of the structures of the previous phase, probably during the 3rd quarter of the 3rd mill. BCE. This stage (phase V) is characterised for the most part by a set of stone foundations for circular huts. The end of this phase coincides with the neglect of the huts and the construction of a pavement surrounding the ruins of the fortification built in phase IV.

The complex succession of stages of occupation and complete or partial hiatuses, which takes place over several centuries, results in a very complex and dynamic stratigraphic sequence in which the strata belonging to previous stages are greatly affected by the following settlements. This makes the correlation between past actions and their resulting stratigraphy very difficult. However, a careful and rigorous analysis of the resulting data allows us to recognise trends and stratigraphic successions important to the historical process in the site.

2. The Landscape as a Resource: Plains and Mountains

The concept of resource used in the present paper must be understood in a very broad way, one which includes both material and immaterial things, essentially including the elements which provide a structure for the experience of living in a certain space. In this sense, the position of São Pedro in relation to its surroundings must be viewed as a strategic resource, shaping the course of history for the community or communities occupying the site.

From a purely natural landscape-related standpoint, the territory in São Pedro is found stretches from the southern ramparts of the mountainous

Fig. 4. General view from South to the São Pedro hills (arrow). The plains and the mountains.

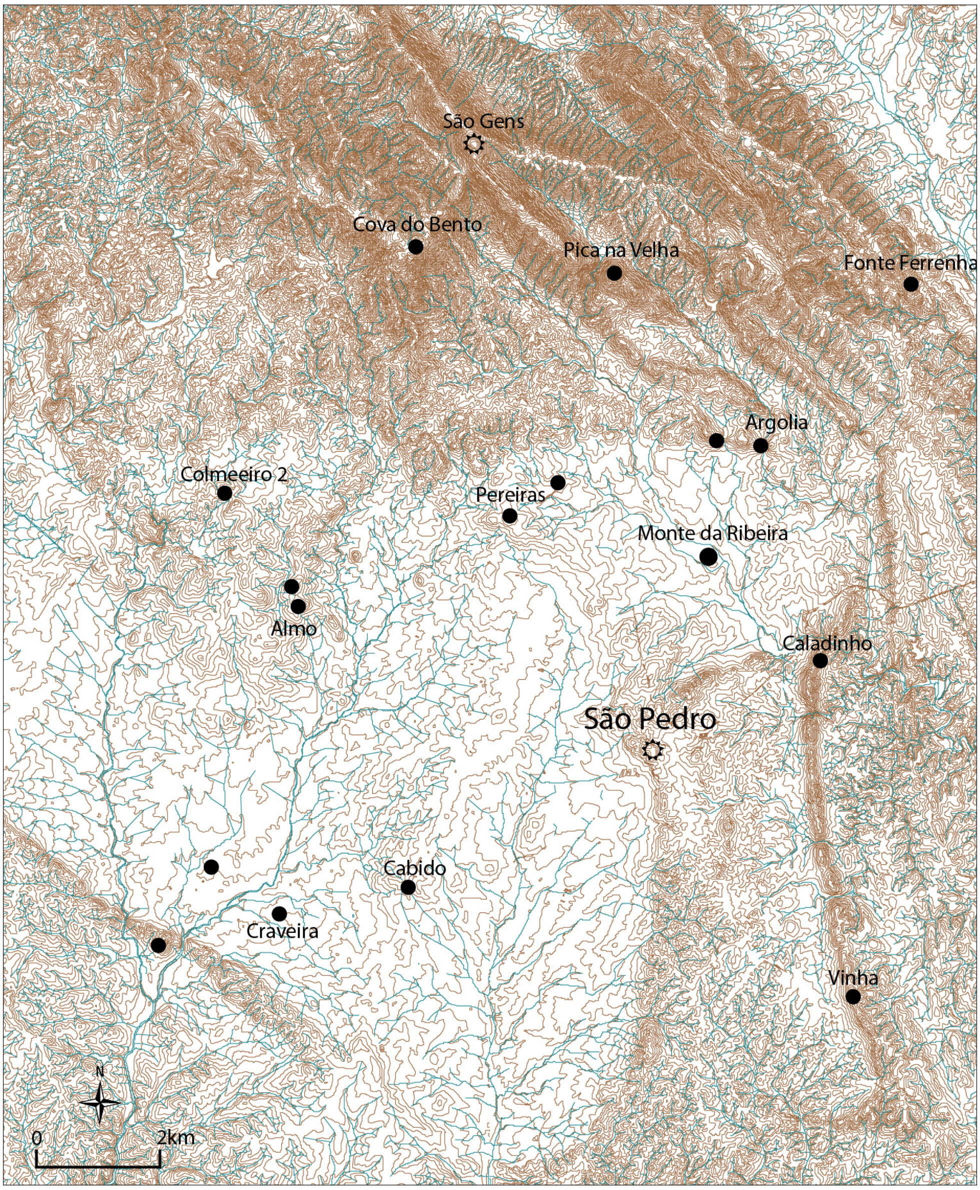

Fig. 5. Settlements in the southern area of Serra d'Ossa, end of 4th/3rd mill. BCE.

terrain of the Serra d'Ossa to the so-called 'Redondo Ridge', a line of hills running in a North-South direction, separating the fertile plains to the East from the less fertile and hilly terrain of the West (*fig. 1*). To the South the plains stretch more extensively until they meet yet another area of hilly terrain with poor soils (*fig. 4*).

São Pedro would have been integrated into a network of settlements located either on the rougher terrain of the hilly regions or on the outlying plains (*fig. 5*). This rather broad understanding places São Pedro at the heart of a territory on the south side of the Serra d'Ossa, in a position which would allow some control over the plains and the footpaths that would have crossed them in several directions. This central position must have given a certain degree of importance to the settlements at São Pedro, of special relevance in phase II. This phase seems to have been not only the most extensive stage, but also the largest and most complex fortifications, which in turn would imply a greater visual impact. A landmark such as this might even be capable of strengthening the self-identifying bonds between the people of the region.

On the high ground along the fringes of the proposed territory there are a number of fortified, or apparently fortified, settlements, such as São Gens to the north and Vinha to the east of São Pedro. The site of Monte da Ribeira, which lies in the outlying lowlands, might have been a centre for the aggregation of people who served as a structuring element for the smaller, seemingly open, settlements, which are scattered throughout the area. However, it is worth noting that these settlements network seem quite dynamic along the time, with some being founded and others abandoned and that this is reflected in the structuring of the territory, that probably would have seen significant changes during the 3rd mill. BCE, especially in its first half.

Due to the great number and apparent density of the settlements in the area, many of which are bound to have been contemporary with some of the phases of São Pedro, we believe that resource-management on the southern foothills of the Serra d'Ossa was done in a global and coordinated fashion. Resources would therefore be managed by the community, living in the area, for the entire community and not in accordance with the needs of the occupants of São Pedro. These would have to coordinate with the remaining sites, possibly through ceremonies indifferent groups would enter into some form of negotiation, taking place in a site in which regular meeting were held, possibly the site of Monte da Ribeira (Calado 2001), in view of its size (3ha) and location, in plain area, in between small rivers.

The environment where São Pedro and the other sites were set would have been an important resource in itself. The environment in which São Pedro and the other sites were set would have been an important resource in itself. Not only would there have been a wider variety of available raw materials (lithics, copper etc.) but also a greater degree of possibilities of land-use stemming from the diverse biotypes present in the area. Additionally, controlling paths crossing some of the most significant relief-systems in the area between the Tagus and the Guadiana rivers (in the south of present-day Portugal), would have proved a significant boon. Salt and flint, for instance, are resources, which cannot be found in the area and might have become more readily accessible as they made their way through the territory. Members of these communities seem to have travelled relatively frequently to the shores of the Guadiana rivers, as the presence of a large number of quartzite pebbles – found in the various phases of São Pedro and in other sites of the region – supports. The possibility that these communities played some part in distributing these goods between the two river basins is therefore quite plausible.

3. The Visible and the Invisible: Resources for Daily Life

In this paper 'local' is a key concept on resource management. However, we defend and use a broader concept of the geographical meaning of 'local' that goes way beyond the site. As 'local' we refer to an area on the southern slope of the Serra d'Ossa up to 10–15km distance from São Pedro, an area that could be crossed easily on foot within one day. Resource management is focused primarily on subsistence and daily life. An accurate approach to this subject requires significant anthracological and carpological analyses, which are regrettably still absent. We will therefore have to make recourse to indirect evidence and several studies for specific sites analysed in the region (Soares 2013) or the Guadiana Valley in general (Duque Espino 2004). Some of the paleo-environmental studies seem to reveal a more heavily wooded landscape than that currently found. The significant presence of red deer faunal remains, addressed later in this paper and a cork and holm-oak based land-cover – to which a preliminary study of charcoal samples points – seem to suggest a somewhat wetter climate. This would have been especially true for the first half of the 3rd mill. BCE, which would still be affected by the 'Bond event 5' (Bond et al. 1997) contrary to the later period which would be under the 'Bond event 3 (4.2ka)' and, therefore, have a significantly drier climate (Bond et al. 1997; Berglund 2003; Mejías Moreno et al. 2014). The charcoal analyses for the Middle Guadiana Basin also support this claim, as they coincide with the beginning of Phase II, as proposed by of David Duque Espino (2004, 756) which indicates an increasingly xeric and humanised landscape.

Pollen analyses from the site of Perdigões – which is roughly 30km away from São Pedro – have to be interpreted cautiously as the authors themselves point out. Even though the results support a more open, grazing-oriented landscape (Danielson/Mendes 2013), these analyses may reflect the immediate surroundings of a settlement and an occupied area and not a wider regional reality.

Water would have been a key component in both everyday life and agriculture, even in the absence of irrigation. Even at the present time, there are several wells, springs and small streams, which attest to the wealth of the aquifers of the area surrounding São Pedro, including those known to lie under the town of Redondo itself. The agricultural component would therefore be focused on horticultural subsistence complemented by extensive cereal production. We do not claim that São Pedro was mainly geared towards cultivation, even though there is clear evidence of agricultural activity. Grinding tools, such as querns, have been found in the site, namely some twenty millstones, generally made from granite and in relatively poor condition. Some of these are very large and were reused in structures of later building phases. However, these artefacts are not necessarily connected with cereal production and use and might have been used for grinding acorns for bread and beer, an activity attested to in pre-Roman times (Strabo, Geogr. III, 3,7).[1] As we have stated previously, seed and charcoal analyses have not been carried out. However, several cereal imprints have been found in potsherds, which indicate that grains were present in dwelling contexts where pottery would have been manufactured. This evidence, coupled with the characteristics of some of the pits found, seems to point to the storage of high volume goods, possibly grain. One pot, [1538], which is large and was deposited with a stone lid – indicating that it had something in it – might well be an example of this practice (*fig. 6*).

It is however, necessary to state that most of the thick-rimmed closed vessels (vases and pots) related to storage were found in the earlier phases of São Pedro (*fig. 7*).

Throughout the various phases of São Pedro, agriculture would have been focused primarily on the group and its subsistence. The animal remains discovered also seem to support this interpretation, as they point to a relatively modest presence of domestic animals. In fact, analysis of the animal remains of São Pedro reveals that hunting was clearly more important, as wild species are more common than domesticated ones: deer account for 36% of the remains and the bones of *Sus* species found, many of which are probably undomesticated *sus scrofa*, account for 37%. The presence of domestic animals is comparatively less significant – *bos taurus* make up only 7% of the total and *ovis/capra* 9% – which again indicates that raising domesticated animals for meat or for other products was not a very important activity. Even ceramic cheese strainers – of which 22 were found – are relatively scarce in São Pedro, in comparison with other archaeological sites, like Penedo do Lexim (in Mafra), where these artefacts are present in significantly larger numbers; this might be yet another example of the reduced importance of animal raising in São Pedro.

1 Strabo, Geographica, III, <http://www.perseus.tufts.edu/hopper/text?doc=Perseus%3Atext%3A1999.01.0239%3Abook%3D3%3Achapter%3D3%3Asection%3D7> (last access 08.02.2017).

Fig. 6. Intentional deposition of the vessel SPD [1538].

On the other hand, the intensive use of game would imply that the community of São Pedro would have travelled with some frequency to wooded areas; perhaps those of the Redondo ridge or even in the Serra d'Ossa, where other settlements were located. It seems therefore, that this situation would only be possible if there was some coordination among the communities of the area, which allowed them to hunt with relative safety and not in competition with each other.

Manufacturing pottery would have been an important aspect of the everyday life of these communities, although it is difficult to pinpoint the origin of the clay used. Notwithstanding, a macroscopic inspection of the pottery reveals a predominantly granitic matrix pointing to the use of local clays in the vast majority of cases. These matrices are identifiable in the present-day pottery production of Redondo, which uses high quality clay available in the vicinity of São Pedro.

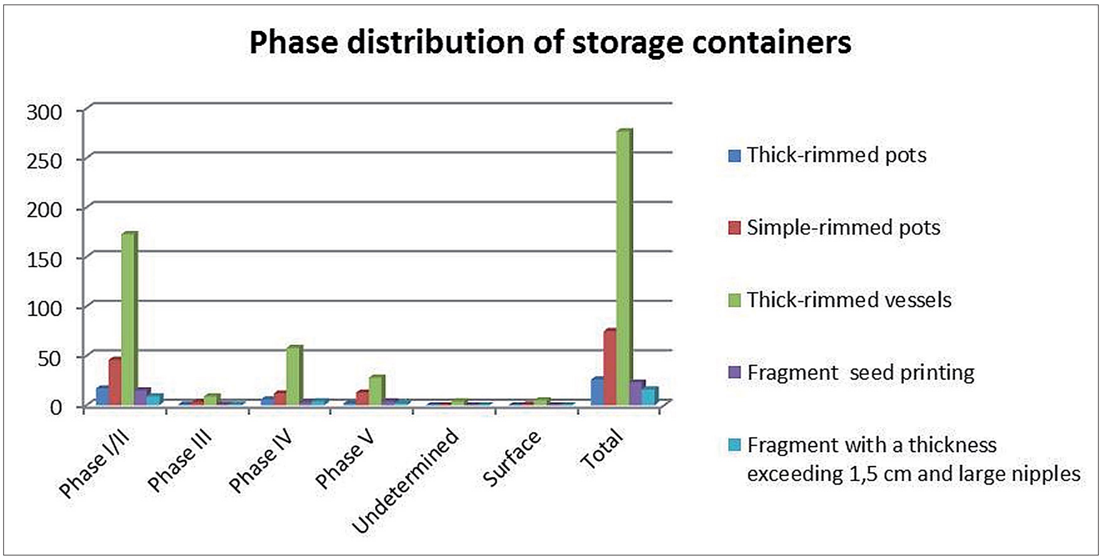

Fig. 7. Graph showing the distribution per phase of storage containers.

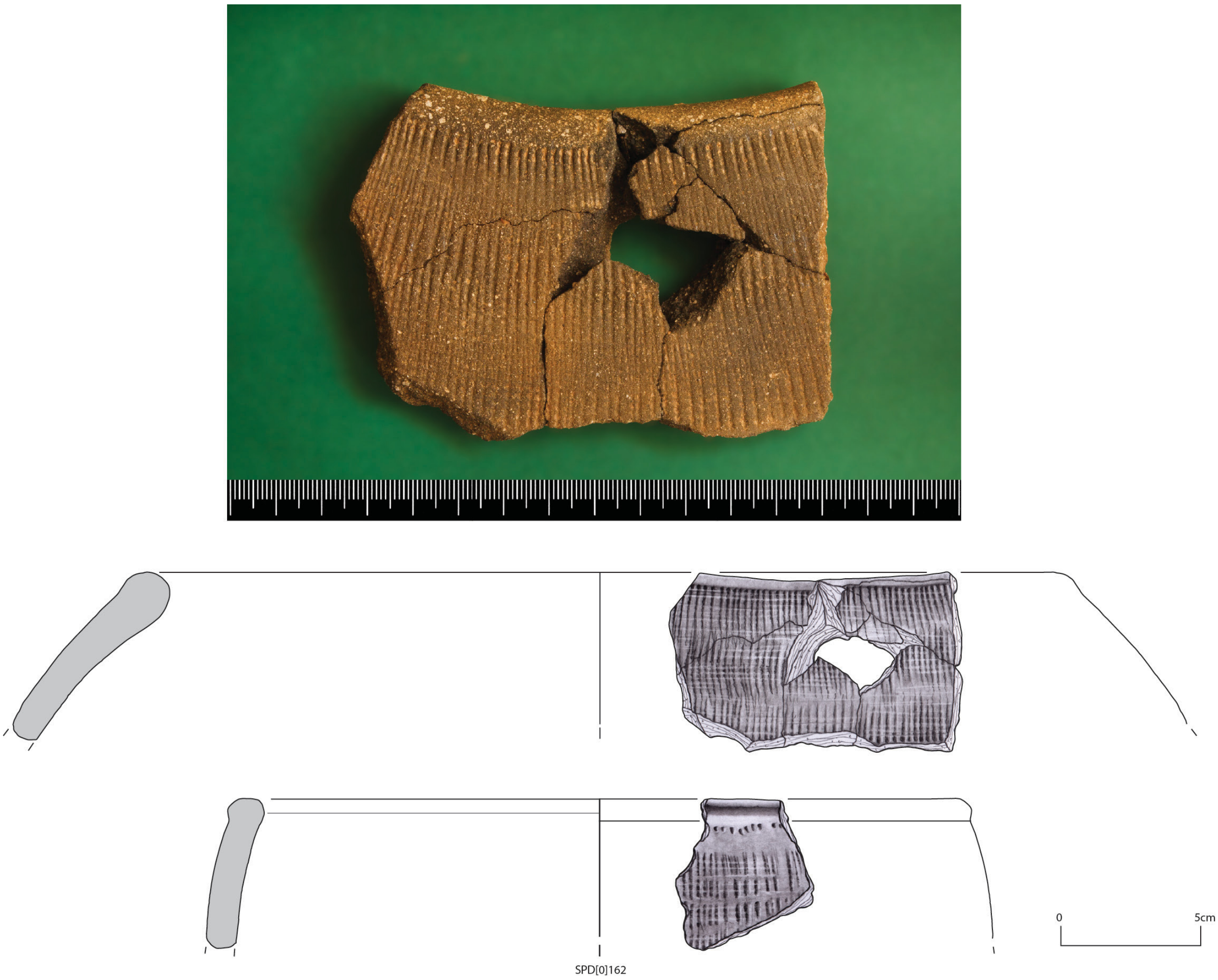

Fig. 8. Vessels SPD [2715] and SPD [0]162 with seashell impressed decorations.

The morphological study of the ceramics, which is in progress, supports the thesis that pottery was locally produced. The typological features of the most representative types of the assemblage are in keeping with the pottery tradition of the Serra d'Ossa (Calado 2001), while maintaining a few similarities with the earlier Neolithic wares, such as characteristic lugs and certain impressed decorative features, which are found in the earlier stages of occupation. The decorated pottery (its relative frequency, the technique and motif employed) also fits in perfectly with the tendencies observed in the Iberian Southwest (Costeira et al. 2013), even though some elements typical of other Iberian regions have also been found. These elements, such as the 'folha de acácia' and the grooved decorations, suggest contacts with the Portuguese Estremadura.

Additionally, shards like SPD [2715] 22 (*fig. 8*), featuring what seem to be seashell-impressed decorations, also imply some degree of contact with the coast, which might be related to frequent trips to coastal areas to obtain products like salt. Some other types of decorations, usually found in the later phases, suggest contacts with the Spanish Meseta (Mataloto et al. 2015).

Domestic activities would not have been restricted to the production of pottery, as there is evidence that weaving also took place. The loom weights themselves are a fairly numerous sample and have been the object of several papers (Costeira 2010; Costeira/Mataloto 2013). Due to the quantity of weights found, we feel that weaving and the products related to it might have played an important role in the management of local resources in the region.

In fact, the abundant loom weights allow us to know that weaving was relevant at the site, but this implies a number of additional resources and chores, ranging from the cultivation of certain crops, their harvest, the gathering or growth-management of other plants and even the treatment of the raw materials. Weaving, as a rule, is a fairly difficult practice to track in archaeological sites because for the most part, the materials associated with it are perishable. In fact, as in São Pedro, most archaeological sites on the southern Iberian Peninsula only have loomweights, especially in areas where the climate or geology make the preservation of organic materials a rare occurrence. This makes these ceramic artefacts the principal means for studying weaving in the Chalcolithic of the Iberian region. Notwithstanding, several pieces of linen cloth, esparto grass and even hemp fabrics have been found, often in association with metal artefacts in the Iberian south, for example in Tomb 3 of Cortijo Bartolo, Granada; Tombs 11 and 38 in Los Millares, Almeria (Alfaro Giner 1984, 121; Cardito Rollán 1996, 129); in tomb 1 of the megalithic necropolis of Belle France, Calda de Monchique (Soares/Ribeiro 2003); and in the burial found in the Bela Vista 5 enclosure, Beja (Valera 2014, 43 f.). Several cloth imprints on pots or baked clay have additionally been found, like the example from the Vigária site in the Serra d'Ossa region (Calado 2001, 105), thus strengthening the notion that fabrics made from plant fibres were quite widespread in the 3rd mill. BCE in the south of the Iberian Peninsula.

3706 loom weight fragments have been found most of them poorly preserved and – in keeping with the styles considered typical in the Iberian southwest at this time – plaque and crescent shaped weights (*fig. 9*). Crescent loom weights are the most common type, making up 62.7% of the total sample, while plaque shaped weights are less numerous, accounting for 36.9% of the sample (*fig. 12*). Most crescent weights feature an oval section, making up 65%, whereas others are less common, circular sectioned crescents make up 23% of this sample and sub-rectangular ones are 11%. In the plaque weight group, the rectangular plaques with rounded corners and edges are the most common type, usually exhibiting two or more perforations on each side.

The technology involved in making these loom weights has already been addressed in greater detail in a previous paper (Costeira 2010) and was mainly aimed at producing well fired weights with compact, homogenous fabrics, often including different sizes and types of flux. Most of the weights feature fairly smooth surfaces and decoration is almost completely absent.

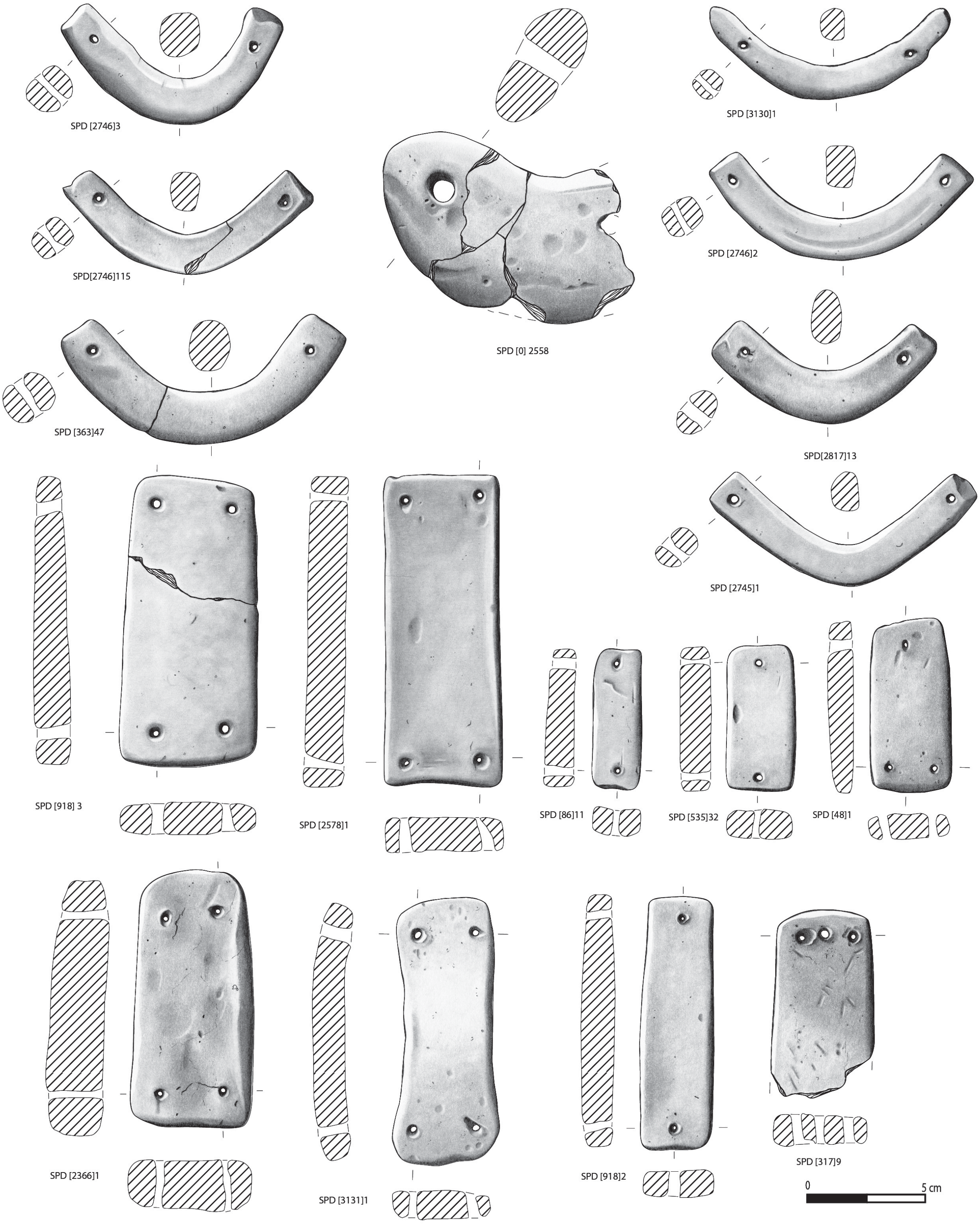

Fig. 9. Loom weights – plaques and crescents from São Pedro.

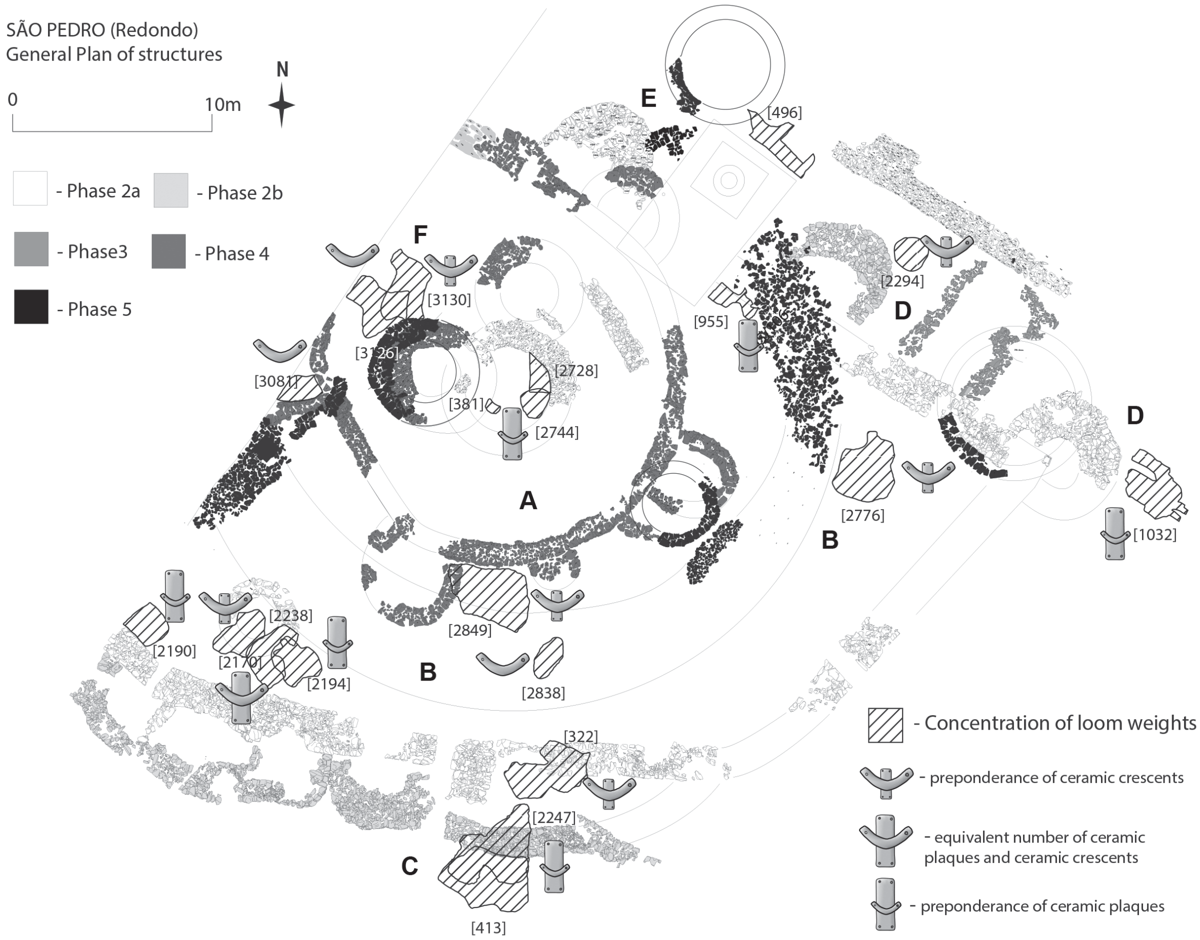

Fig. 10. General plan of São Pedro showing the loom weights concentrations. A–F excavation sectors.

The majority of the loom-weights from São Pedro were found scattered throughout different deposits and sectors, usually in small numbers. These factors seem to support the idea that most of the weights found are part of refuse contexts and that weaving was done in different households and not a specialist activity.

However, there are some interesting stratigraphic units which have yielded large amounts of weights (ranging from 10 to 50 weights) (*fig. 10*). These contexts are found for the most part in sectors B, D and F and are usually the filling of pits (*fig. 11*).

The set of 138 weights recovered in structure [1032], an elliptical irregular pit found in Sector D, is primarily composed of rectangular plaques (127 of the total number) in a relatively poor state. This makes their correlation to an event of *in situ* abandonment difficult to sustain and it seems more plausible that they are associated with the discarding of items involved in some domestic productive activity, quite possibly related to one or more households in which weaving had a greater role. Most of the concentrations of weights found in sectors B and F are also poorly preserved and therefore face the same interpretative problems. Most of these concentrations usually feature a clearly dominant type of weight. However, concentrations in which a single given type is found exclusively are very rare. Notwithstanding, in pit [2336] located in sector D, a set of 50 crescent shaped weights was recovered, mostly oval-sectioned, 14 of which were almost complete and arranged along the western side of the deposits. In this particular case, the state of the weights and their relative uniformity seem to support their interpretation as the remains of a loom discarded in a pit. Certain buildings, such as tower [345] in sector A, have also yielded fairly large numbers of

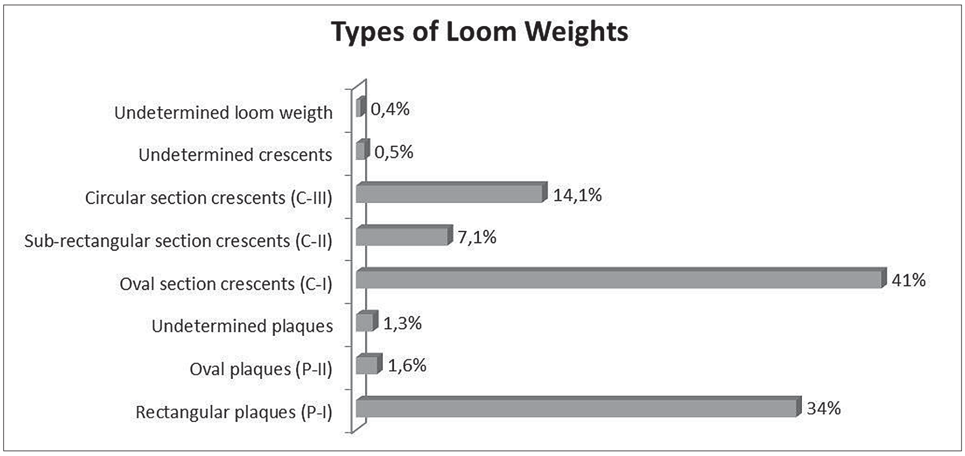

Fig. 11. Frequency of loom weight types.

loom-weights in the stratigraphy associated with them. However, the diversity and the fragmented state of the artefacts and the complex stratigraphic relations do not support a single loom interpretation of the remains located inside this tower.

The manner in which the weights were incorporated in the archaeological record in São Pedro, (especially the large amounts found together), allows us to propose the existence of areas in which weaving was more relevant; these areas were located in the midst of the living space in general, especially in Phase II. Specifically these areas include the central area in places like the tower [345] and in other peripheral areas like the south-western corner of the excavated area, adjacent to the southern wall, or the north-eastern part of the excavated area, in deposit [1032] located just outside the main wall. However, we assume that the broad distribution allows us to propose that weaving was done in multiple households and, because of that, it was not a specialised activity even if it needs special skills.

Regarding the phasing of the stratigraphic units in which the large amounts of loom weights were found, these belong mainly to the earlier stages of occupation (Phases I and II), which might suggest a greater importance of weaving in these early stages.

Loom weights have been regarded as part of the package of the secondary products revolution (Sherratt 1981) since the late 80s (Gonçalves 1989), a theoretical association based exclusively on the use of wool, seen as part of the changes brought about by animal husbandry documented in the late 4th mill. BCE. This overestimation of the importance of animal fibres in the development of weaving has been thoroughly questioned in the meantime, because all the samples found – not only on the Iberian Peninsula but also in other areas of Europe such as the French lakeside sites and sites in the Swiss plateau (Caspar et al. 2005) – have exclusively been plant fibre cloth, and because there is no undisputed evidence of wool use before the Bronze Age. Archaeozoological studies have also significantly added to these reservations. Not only have they demonstrated that sheep in this stage of domestication might not have been able to successfully bear wool (Davis 1987, 156 f.; Greenfield 2010, 35), they have also revealed a great variety in the age of slaughter of the animals, which very often is not adjusted to a situation in which wool was a main concern (Marciniak 2011). Slaughter strategies and their intended purposes are however, difficult to understand (Helmer et al. 2007).

Regarding São Pedro in particular, the sheep and goat component of the bone assemblages recovered is a very minute one (Davis/Mataloto 2012) and therefore, the existence of any particular slaughter strategy is difficult to fathom. This, coupled with the large number of loom-weights found does not lend any credibility to the hypothesis that wool use was significant. Therefore, as an alternative, we propose that weaving in this particular site and perhaps in the region where it is situated, was primarily based on agricultural plant fibres, such as linen and perhaps some other wild plant fibres.

Economically, the role played by weaving in São Pedro has to be approached in varying scales. In the Serra d'Ossa region, especially on its southern side, the presence of loom-weights in Neolithic

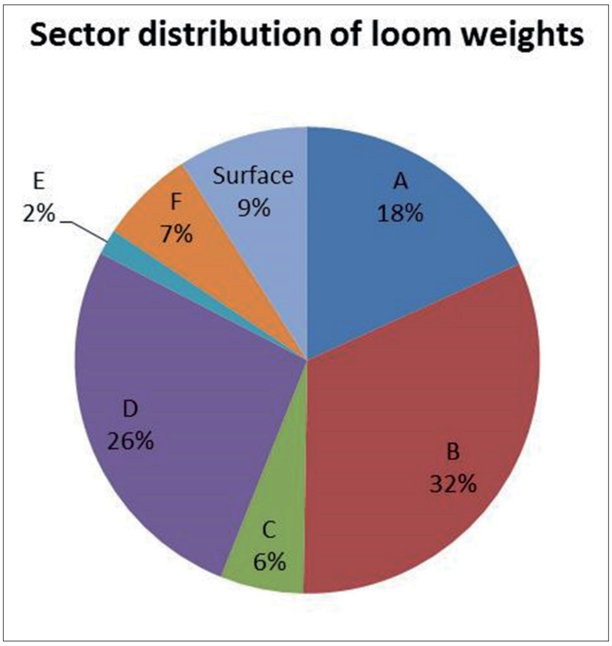

Fig. 12. Distribution of loom weights by sector.

and Chalcolithic settlements is very common. Quantifying their actual importance is often impossible, especially since most of the information comes from archaeological surveys and not from excavations. However, the great quantity of loom-weights found on the surface of sites like Monte da Ribeira (Calado 2001, 98) demonstrates very well the potential significance that weaving may have had in the region.

The *chaîne opératoire* of weaving and especially of the manufacture of linen cloth is a multi-staged and complex affair, involving a large variety of activities ranging from the raising and collecting of flax, the extraction and treatment of the fibres, the spinning of thread and weaving in itself. This wide range of chores is not necessarily connected with any single set of structures and they were probably distributed throughout several places (Martial/Médard 2007, 80). With this in mind, we do not consider São Pedro to be a site which specialised in weaving, but we find that it was probably part of a territory, in which this activity might be a relevant resource for the communities.

If we widen the scope to include the entire region of the Alentejo we find that, in general, loom-weights are very common in settlements and fairly scarce in funerary sites. The ubiquity of these artefacts has been interpreted by many authors, like Manuel Calado (2001) and Ana Catarina Sousa (2010), as evidence of the great importance that weaving would have had for these communities, contrary to what seems to be the case in other regions like the Portuguese Estremadura. Compiling and comparing quantitative data from regions like the Estremadura and Alentejo, which are archaeologically quite different, is a very complex task. With the available data, it is too risky to judge the importance of weaving in the two regions, especially as they seem to have different weaving traditions. This should not stop us from considering the production of cloth as a regional resource in Alentejo, one which might support some surplus production destined for trading on a interregional level, an economic activity which is very difficult to trace but well attested since the beginning of Roman times (Pliny the Elder, Natural History, lv.8, 191).[2]

4. Rolling Stones: A First Approach to the Lithic Resource Management

4.1. Raw Materials and Geology

During the excavation of São Pedro a large quantity of knapped stone artefacts mostly made from siliceous schists and jasper were found (*fig. 13*). The dynamic occupation of the site has greatly affected the preservation of these materials and subjected them to significant mixing, which results in a fairly fragmented and dispersed record. This is not however, a unique occurrence but rather the norm in sites occupied for a long period of time and without sudden hiatuses.

Geologically, São Pedro is a mica schist elevation located on the eastern side of the granodiorite plains, a few kilometres from the larger relief system of the Serra d'Ossa, a complex geological area, dominated by mica-schist, phyllite and grey schist bedrocks, which forms a NW-SE ridge in relation to the Terena syncline (Feio/Martins 1993; Araújo et al. 2013). These areas of siliceous schists to the north and east are, in all likelihood, the origin of the raw materials used in the production of the São Pedro lithic industry. The identification of specific

2 Pliny the Elder, Natural History, <https://ia802700.us.archive.org/12/items/naturalhistoryof02plinrich/naturalhistoryof02plinrich.pdf> (last acces 08.02.2017).

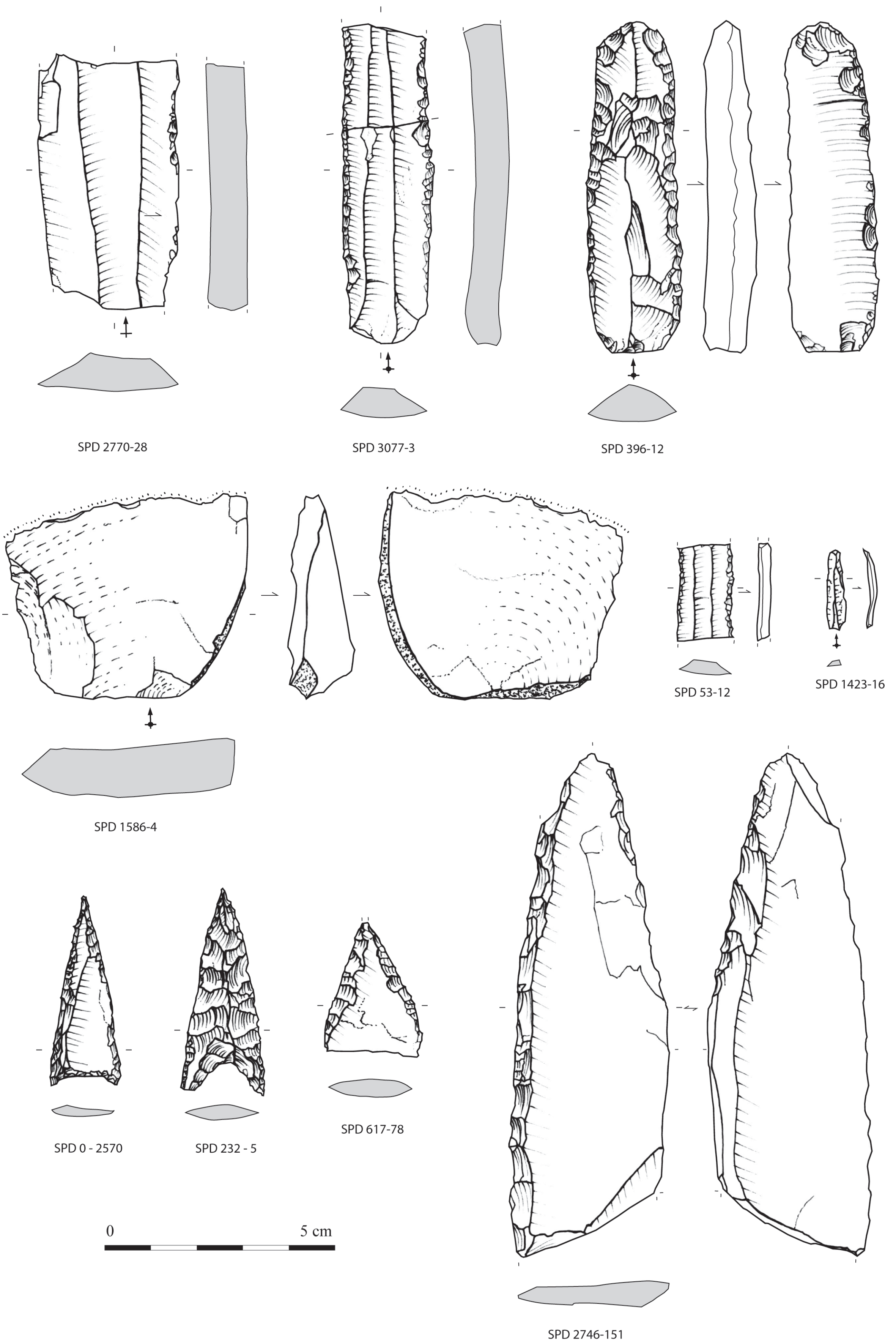

Fig. 13. Lithic industry from São Pedro – a sample of debitage products and retouched tools.

microfossils in some of the stone tools discovered has allowed us to trace the origin of the raw material to the western flank of the Terena Syncline, on the Northern area of the Serra d'Ossa, which emerges in the area of the Monte do Alfaval, some 10km northeast of São Pedro.[3] The discovery of small flint nodules in the scree areas 5km north of São Pedro and in the vicinity of the Monte da Ribeira site might be the origin of the few flint cores found in São Pedro and some of the non-blade-based flint tools. This also suggests that these communities must have had a very detailed and complete knowledge of the area, exploring its resources in a very sensible way.

Even though some stone fragments measuring a couple of millimetres were recovered, because of the status of the excavation as a salvage operation, sieving of the soil was only carried out in isolated instances. In addition to this, it is also important to mention that quartz was only collected when there were traces of knapping, which might result in the underestimating of the importance of this particular raw material. However, collecting every single fragment of quartz would have been thoroughly impractical, as quartz is found in veins in the site's bedrock.

4.2. Overview over the Knapped Stone Industry

The lithic assemblage was analysed according to the underlying theoretical and methodological concept of *chaîne opératoire* (as defined by such authors as Inizian et al. 1999). Their technological and typological characterisation follows with some adaptations the criteria used in other studies of Neolithic and Chalcolithic lithic industries carried out by authors like Carvalho (1995/1996; 2009), Forenbaher (1998; 1999), Diniz (2007) and Sousa (2010).

Generally speaking, the analysed assemblage (N=7582) is quite fragmented, which coupled with the dynamic occupation of the site and the laminar texture of the schists predominantly used seriously limits the possibilities of technological

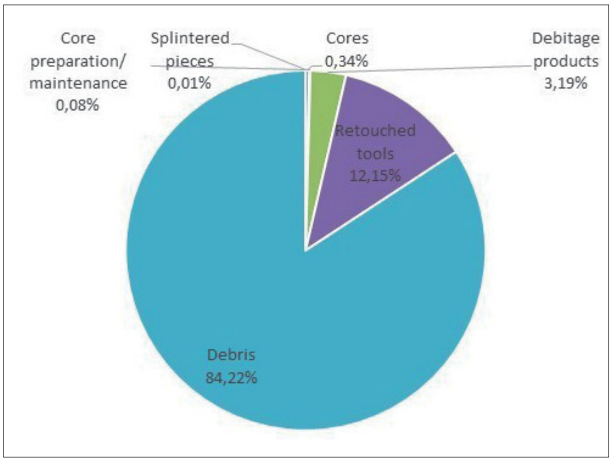

Fig. 14. Main lithic technological categories present in São Pedro site (N = 7587).

and typological characterisation (*fig. 14*). In fact, most of the analysed pieces are unclassifiable jasper and siliceous schist fragments (84%), where knapping traces are often very difficult to find. The remainder of the assemblage is for the most part retouched tools (12.2%), which were also found in a very fragmented state and unworked blanks (3.2%). The unworked debitage products are mainly flakes (75.2%), generally fairly small sized and long blanks (bladelets, mostly hyaline quartz and highly fragmented blades). Cores are noticeably scarce, accounting for a mere 0.3% of the sample.

4.3. Main Results: Raw Material Procurement and Economy

Detailed analyses of the raw materials involved will be very useful in clarifying any questions related to their origin and use. However, even in spite of their absence, it is safe to say that most of the resources used, such as the above mentioned siliceous schists and jaspers, (which are 87.2% of the assemblage), were sourced locally (*fig. 15*). Even not taking into account the chips and fragments, local raw materials are still the most common in the retouched tool category.

Knapping siliceous schist and jasper would have involved slabs of the raw material, which were then reduced to plaques and subsequently retouched in order to obtain the desired tools (Fábregas Valcarce/Rodríguez Rellán, 2008), which would explain the conspicuous scarcity of cores. These

3 Information courtesy of Profesor Luís Lopes, from the 'Laboratório de GeoCiências da Universidade de Évora', obtained for the study of the arrowheads of São Pedro carried out by Ivo Santos, to whom we extend our thanks.

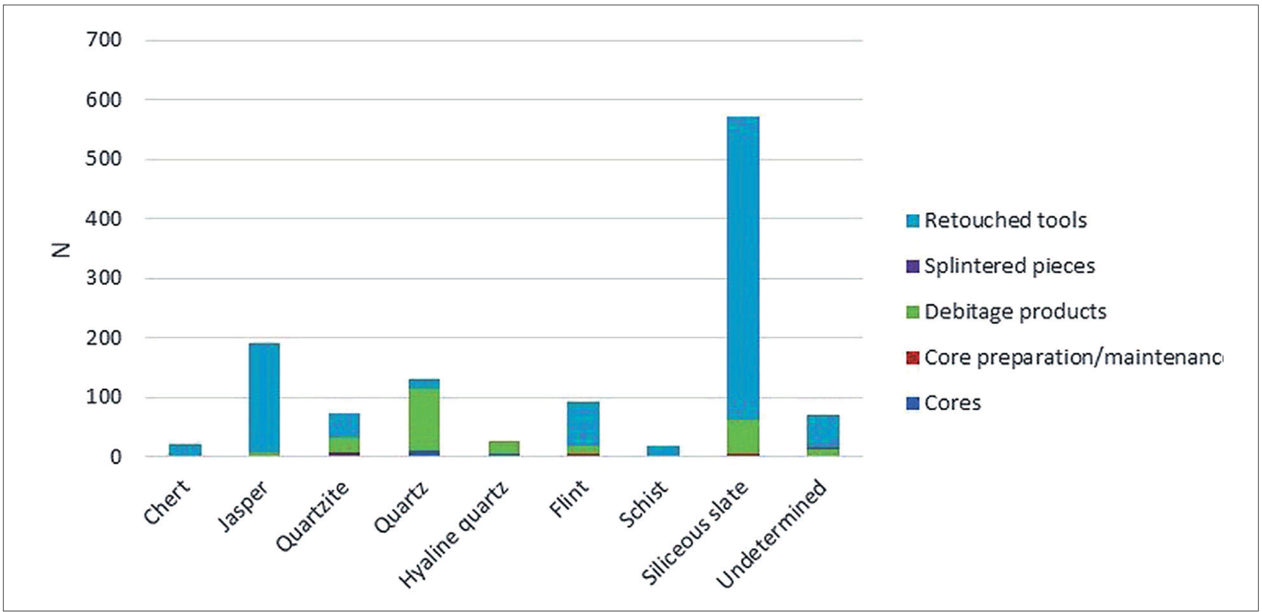

Fig. 15. Representation of the raw material types by technological category at São Pedro (excluding debris).

rocks were mainly used in the bifacial knapping of arrowheads, which are the single most common type of lithic tool found (44.3%). Additionally, arrowheads were found in different stages of production, making in situ production quite clear there. The bifacial knapping method was used in producing other artefacts, like 'ovoid bifaces' and large bifacial points. However, contrary to the situation in the Portuguese Estremadura, where fairly standard and elaborate bifacial tools can be found, these artefacts are quite irregular and might be the result of a local adaptation to the limits of the nearest raw materials available (Nukushina et al. forthcoming). Another important aspect of production is the heat treatment employed in the process of making these tools, visible in the thermal gloss and frequent potlid marks, which are probably the result of heat treatment prior to the retouch phase. It is interesting to find that heat treatment is most commonly found in areas where there are few high grade raw materials suitable for knapping (Boix Cablet 2012, 39), which is the case in the region in question. Heat treatment would make the stones easier to work, increasing their homogeneity and elasticity.

In addition to these more complex and elaborate tools, a large number of plaque fragments and flakes were found which had marginal and irregular touch. These seem to be relatively impromptu tools, possibly the result of using debris generated in producing other tools.

The sample also includes a fairly significant quartz-based component (7.7%). Even though cores are again fairly scarce, more than half of the pieces found are made from quartz and hyaline quartz (53.8%). Whereas quartz cores are usually irregular or polyhedral and aimed mostly at the debitage of relatively small flakes (averaging at 32.6mm in length), which are quite commonly found and do not evidence any degree of standardisation. Hyaline quartz cores feature for the most part scars of bladelet debitage (of which the resulting products are also found). These elements show that there must have been an operative chain, which was aimed at the local knapping of small flakes and bladelets made from different types of quartz and also the production of heavier, coarser quartzite flakes. Quartz flake production has parallels in Perdigões (Lago et al. 1998, 121) and Porto das Carretas (Soares 2013, 205). Bladelets are fairly significant in the sample (28.3%) and are mostly made from hyaline quartz, a situation which is again mirrored in Perdigões (Lago et al. 1998, 148).

Flint makes up quite a small portion of the sample (1.6%) and usually appears in the form of retouched blades or bladelets and a few arrowheads. The scarcity of flint debris and cores suggests that this particular raw material was not worked locally.

Blades in general are quite important in São Pedro. Blades with marginal retouch for instance account for 12% of the tools found, even if non retouched blanks are relatively infrequent (13.7% of the debitage products). Again, taking into account the absence of blade-cores and debris related to them, it would seem that São Pedro was a blade consumption context.

If fine-grained quartzite, which was used in some cases, was available regionally flint must have been brought from further afield. However, further analyses of the raw materials are needed to make the situation clearer.

The predominant use of siliceous schist, jasper and quartz in tool production coupled with the relative scarcity of flint products is a situation paralleled in other Chalcolithic sites of the Iberian Southwest – like Monte da Tumba in Setúbal (Silva/Soares 1987), Perdigões in Reguengos de Monsaraz (Lago et al. 1998), Perdigoa, in Alandroal (Calado 2001), Porto Torrão in Beja (even if the data is fairly preliminary) (Rodrigues 2011; Santos/Rocha 2011), or Porto das Carretas in Mourão (Soares 2013) – in stark contrast with the sites of the Portuguese Estremadura, in which a similar strategy of locally sourcing raw materials results in a very different composition of the assemblages.

4.4. Local Resources and Solutions

The analyses which were undertaken have provided evidence for the existence of two distinct stone-working operative chains in São Pedro, the most important being the process for knapping siliceous schists and jaspers and secondly, the process involved in making quartz tools. Both of these strategies seem to be intricately connected with the local and/or regional sourcing of raw materials, as seems to be the typical for the Chalcolithic settlements in the Iberian southwest. The use of siliceous schist and jasper would have been primarily aimed at producing bifacial tools, such as arrowheads. This does not, however, exclude the opportunistic use of these fairly abundant resources for simple, marginally retouched tools, which are typologically difficult to classify due to their usually highly fragmented state (which might be original or not). Even though blade blanks and retouched blades are fairly common in the assemblage, they are not part of the two local operative chains, which seem to suggest that the communities of São Pedro were not producing these tools but merely using them.

4.5. Axes, Adzes and other Tools

The study of the polished stone tools of São Pedro is still in a fairly early stage. Notwithstanding, we find it pertinent to make some observations which might shed some light on this class of artefacts, whose primary raw material, amphibolite, might have played a key role in interregional trading with regions like the Estremadura, according to the research of Cardoso and Carvalhosa (1995) and Lillios (1997).

Generally speaking, polished stone industries (axes, adzes, chisels and gouges) are distributed fairly evenly in every sector excavated. The assemblage is composed of more than 300 polished stone tools, complete or fragments (*fig. 16*). While axes and adzes are found in greater numbers other types of tools, like chisels and gouges are relatively scarce. The size of the polished stone tools varies greatly, ranging from some very sturdy implements to others which, due to their small size, gracile attributes or to the softer raw material employed, might well have had a 'ritual' use. Even though hard raw materials, mostly different kinds of amphibolite, are used in the vast majority of cases some rare instances of very soft rocks, such as schists, have been found. Although most of the assemblage features heavy use-wear, the discovery of some pristine tools makes detailed context analysis a requirement. However, these patterns are what are to be expected from a prolonged and fairly dynamic occupation. As of yet, elements which might be considered 'ingots' have not yet been found onsite. This suggests that the tools arrived at São Pedro pre-formed, probably due to the abundance of the raw materials in the surrounding areas, where small and medium-sized blocks of amphibolite can still be found to this day. Despite this fact, a considerable number of polishing stones were found in São Pedro. Polished stone tools seem again to follow a strategy of locally sourcing the

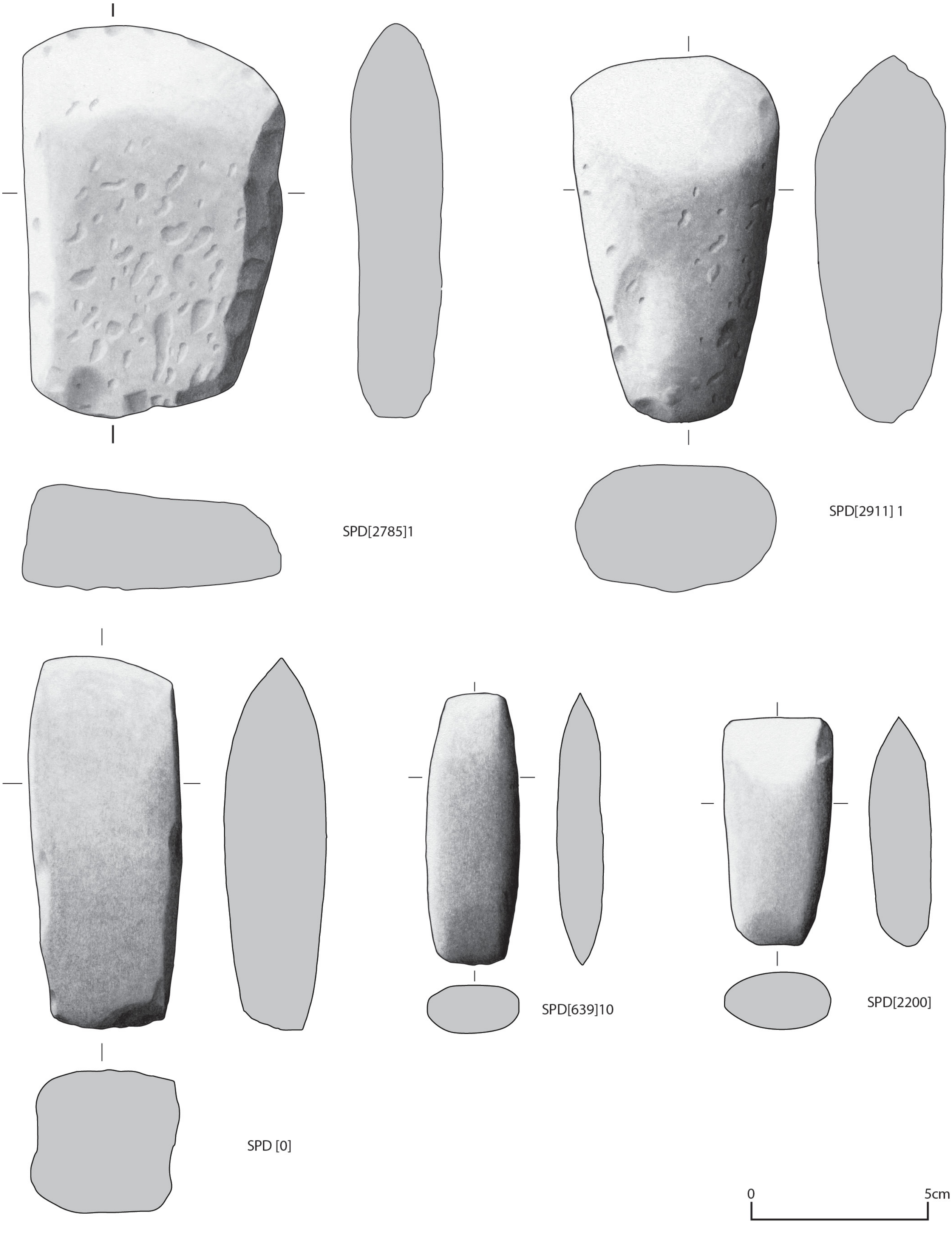

Fig. 16. Axes, adzes and chisels from São Pedro.

raw materials, which would later be worked and used within the occupied area throughout the various stages of occupation.

5. The Cycle of Metal: Raw Materials to Tools

The study of metallurgy has always played a fundamental role in understanding economic activity and trading in the communities of the 3rd mill. BCE in southern Portugal. In São Pedro, metals are the object of separate studies, which are part of larger projects, from which we have been given access to some of the early results (Gauss et al. unpublished; Orestes Vidigal et al. 2015). In this paper we intend to single out some of the most relevant aspects of metal production and its spatial and chronological contexts in São Pedro.

As can be seen in the table in fig. 17, two of the most important phases of the site coincide with the greater amount of occurrences of metallic objects, as might be expected. In the remaining phases of occupation it is difficult to be sure that the remains uncovered are not residues from earlier stages (*fig. 17*).

Phase	Crucibles (fragments)	Slag	Artefacts	Ore
II	38	5	5	6
III	4	5	2	3
IV	33	13	9	7
V	4	4	4	2
Total	78	27	20	18

Fig. 17. Metallurgical remains from São Pedro, by Phase.

In every single one of the phases of São Pedro in which metal was found (II through V), there is evidence of the entire metallurgical process, ranging from smelting to the production of artefacts (*fig. 18*). In the area surrounding São Pedro there are no known occurrences of ores. However, in the wider area there are several surface veins of copper-ores at different points in the Serra d'Ossa, even without taking into account the large vein of the Mostardeira mine, which lies on the northern side of the hills. Lead isotope analyses of samples from São Pedro and the Mostardeira mine have revealed a certain similarity, which has also been found in copper samples from the site of Zambujal and in most of the copper artefacts from the 3rd mill. BCE from the lower Estremadura (Gauss et al. unpublished). Because of this, we believe that the metal produced from the ores extracted in this region must have been an important aspect of interregional trade. However, even though metallurgy has been found in most of the phases of occupation in São Pedro and is particularly relevant in the stages where the fortifications were in use, there is no real evidence that sustains intensive trade-oriented production. The distribution of the metal finds encompasses most of the occupied area: there was no specialised production area, thus, suggesting a smaller scale activity. However, a concentration of a significant number of metal remains on the inside of pit [293], which also has very dark soils, might be an example of a single specific context of metal production, that is unfortunately is hard to date because it lies immediately under the surface strata. Curiously, most of the metal found was located in the peripheral areas of the site, what might be related to the practise of discarding debris and not with actual production areas. There is a conspicuous lack of metallurgical remains in sector A, seen in every stage of occupation, possibly a sign that these activities might not have been carried out in the central area. It is worth noticing that only two metal artefacts and two crucible fragments were found in this central area, which means that at no point of the occupation this socially differentiated area was based on metal presences. On the other hand, most of the metallic elements recovered in sector C were recovered in or underneath contexts resulting from the abandonment of the structures and as such are probably the result of the discarding and cleaning of work contexts in the adjacent sector B.

Generally speaking, in São Pedro metal is, as is usually the case in settlements of the 3rd mill. BCE in southern Portugal, essentially of a utilitarian nature. Awls are the most common tool, with ten of them found in São Pedro alongside other work tools, such as small chisels and a spatula. The presence of cutting tools, like knives and daggers, is less noticeable and these are always very poorly preserved. Finally, a strange artefact with a subcircular shape and elongated handle was found.

Recent studies have revealed that arsenical copper is frequently associated with stronger utensils, although this may be the result of using native coppers with a higher percentage of this

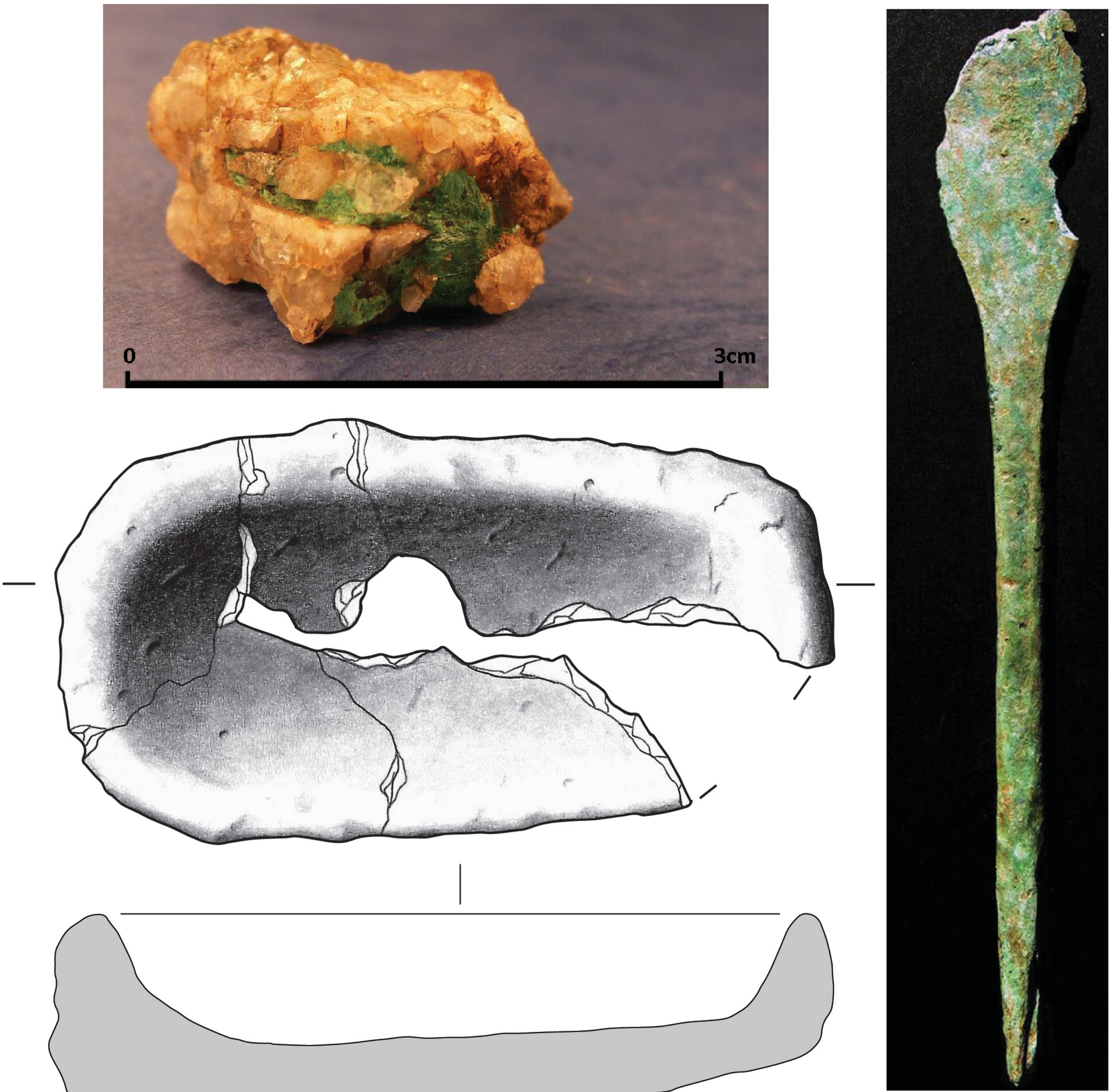

Fig. 18. Metallurgical remains from São Pedro: ore, crucible and copper artefact.

mineral (Vidigal et al. 2015) showing that metalworking was still at a very early and undeveloped stage.

To summarise, we believe that from early on, metallurgy must have played a part as another of the domestic activities carried out in São Pedro. The copper was used most certainly to trade with other communities in order to obtain non-native raw materials or products like flint or salt. Access to the ore must have been guaranteed in the context of the settlements of the southern side of the Serra d'Ossa, which would play an important role in the circulation of the surpluses from the outlying regions. A network even reaching relatively distant regions, as can be seen in the metal from this region found in Zambujal.

6. Discussion

This paper is only a first contribution towards the study of the network of interactions between the communities of São Pedro and the southern flank of the Serra d'Ossa.

We find it important to associate the different occupations of São Pedro with a settlement network, which was dynamic and highly mutable throughout the 3rd mill. BCE and through which the area's resources must have been managed and traded. A completely self-sufficient existence does not seem plausible and yet there is no clear evidence of a hierarchic, co-dependent settlement system. We therefore believe that settlements worked together, managing and negotiating their affairs as a community. Among these settlements, a synergistic system may have been created, which allowed for easier access to certain raw materials like copper, but also to local or 'imported' finished products like flint tools.

In any case, the eminently local aspect of the raw materials and activities documented at São Pedro is reflected not necessarily in a differentiated access, but maybe in a differentiated use of the materials external to central Alentejo, which seem to be concentrated in the larger sites like Perdigões. This does not necessarily imply the existence of political and/or economical elites, but might well be related to social and symbolic aspects of life, meaning that these sites were meeting places, where relationships within a community were negotiated and acted out, generating shared experiences in the process. This was probably closely related to luxury goods, like the ivory found in Perdigões (Valera et al. 2015) and their ostentation and manipulation.

Small settlements like São Pedro in its various incarnations would have played a crucial role in the production, management and local distribution of various materials. This would allow the communities living there to have access to 'imported' raw materials used in daily life, such as flint. However, this does not mean that certain local productions like cloth or metal might not have on occasion generated some surplus that might have been in turn traded for exotic goods, eventually later deposited in the larger settlements in particular events and rituals.

Still, we must make it quite clear that we do not think that there was any sort of specialised textile production in São Pedro, as the presence of large quantities of loom-weights in the most of 3rd mill. Alentejo's settlements indicates (Costeira/Mataloto 2013). In the same way, we do not propose that there was any particular activity – weaving, metalworking, or any other – specifically geared towards generating surplus. This means that if these existed, they did so as the occasion arose and they would have been used as an answer to a specific need or conjuncture, to obtain a specific product or simply as an offering. Production would therefore function at an essentially domestic level and would be aimed at the needs of the community and the family group.

In lieu of an epilogue, through the study of the data recovered at São Pedro, we understand that the management of resources would depend on a very detailed knowledge and use of the surrounding landscape, whose use would have been coordinated with the surrounding settlements, therefore allowing for a near self-sufficient economic and productive existence. Surpluses, when and if they existed, might have been traded for 'basic' external goods like flint and salt, but also for more exotic goods, which in turn were not used locally and whose final destination place was elsewhere.

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Bibliography

Alfaro Giner 1984: C. Alfaro Giner, Tejido y cestaria en la Península Ibérica. Historia de su técnica e industrias desde la Prehistoria hasta la Romanización. Biblioteca Prehistorica Hispana 21 (Madrid 1984).

Araújo et al. 2013: A. Araújo/J. Almeida/J. Borrego/J. Pedro/J. T. Oliveira, As Regiões Central e sul da Zona de Ossa Morena. In: R. Dias/A. Araújo/P. Terrinha/J. C. Kullberg (eds.), Geologia de Portugal. Volume 1: Geologia Pré-mesozóica de Portugal (Lissaboa 2013) 151–172, <http://dspace.uevora.pt/rdpc/bitstream/10174/1868/1/AS%20REGI%C3%95ES%20CENTRAL%20E%20SUL%20DA%20ZONA%20DE%20OSSA-MORENA.pdf> (last acces 08.02.0217).

Berglund 2003: B. Berglund, Human Impact and Climate Changes. Synchronous Events and a Causal Link? Quaternary International 105, 2003, 7–12.

Boix Cablet 2012: J. Boix Cablet, El tratamiento térmico en rocas silíceas, un procedimento técnico para la talla. Trabajos de Prehistoria 69.1, 2012, 37–50.

Bond et al. 1997: G. Bond/W. Shwers/M. Cheseby/R. Lotti/P. Almasi/P. Menocal/P. Priore/H. Cullen/I. Hajdas/G. Bonani, A Pervasive Millenial-Scale Cycle in North Atlantic Holocene and Glacial Climates. Science 278, 1997, 1257–1266.

Calado 1995: M. Calado, A região da Serra d'Ossa. Introdução ao estudo do povoamento neolítico e calcolítico (Lisboa 1995).

Calado 2001: M. Calado, Da Serra d'Ossa ao Guadiana. Um estudo de pré-história regional. Trabalhos de Arqueologia 19 (Lisboa 2001).

Cardoso/Carvalhosa 1995: J. L. Cardoso/A. B. Carvalhosa, Estudos petrográficos de artefactos de pedra polida do povoado pré-histórico de Leceia (Oeiras). Análises de proveniências. Estudos Arqueológicos de Oeiras 5, 1995, 123–151.

Carvalho 1995/1996: A. F. Carvalho, O talhe da pedra e a transição Neolítico-Calcolítico no Centro e Sul de Portugal. Tecnologia e aspectos da organização da produção. Trabalhos de Arqueologia da E.A.M. 3/4, 1995/1996, 41–60.

Carvalho 2009: A. F. Carvalho, O talhe da pedra na Pré-história recente de Portugal. Volume 2: O estado actual da investigação. Praxis Archaeologica 4, 2009, 67–91.

Cardito Rollán 1996: L. Cardito Rollán, Las manufacturas textiles en la prehistoria. Las placas de telar en el Calcolítico Peninsular. Zephyrus 49, 1996, 125–145.

Caspar et al. 2005: J. P. Caspar/P. Féray/E. Martial, Identification et reconstitution des traces de teillage des fibres végétales au Néolithique. Bulletin de la Société Préhistorique Française 102.4, 2005, 867–880.

Costeira 2010: C. Costeira, Os componentes de tear do povoado de S. Pedro (Redondo, Alentejo Central), 3º milénio a.n.e. 2 Volumes (PhD-Thesis Universidade de Lisboa 2010).

Costeira/Mataloto 2013: C. Costeira/R. Mataloto, Os componentes de tear do povoado de S. Pedro (Redondo, Alentejo Central). In: J. Jimenéz Ávila/M. Bustamente/M. Garcia Cabezas (eds.), Actas del VI Encuentro de Arqueologia del Suroeste Peninsular (Villafranca de los Barros 2013) 625–667.

Costeira et al. 2013: C. Costeira/R. Mataloto/C. Roque, Uma primeira abordagem à cerâmica decorada do 4º./3º. Milénio a.n.e. dos povoados de S. Pedro. (Redondo). In: J. Arnaud/A. Martins/C. Neves (eds.), Arqueologia em Portugal. 150 anos (Lisboa 2013) 397–406.

Danielson/Mendes 2013: R. Danielson/P. Mendes, Pollen Analysis of Late Neolithic Ditch Deposits from the Perdigões Archaeological Site. Apontamentos de Arqueologia e Património 9, 2013, 13–20.

Davis 1987: S. Davis, The Archaeology of Animals (London 1987).

Davis/Mataloto 2012: S. Davis/R. Mataloto, Animal Remains from Chalcolithic São Pedro (Redondo, Alentejo). Evidence for a Crisis in the Mesolithic. Revista Portuguesa de Arqueologia 5.15, 2012, 47–85.

Diniz 2007: M. Diniz, O sítio da Valada do Mato (Évora). Aspectos da neolitização no Interior/Sul de Portugal. Trabalhos de Arqueologia 48 (Lisaboa 2007).

Duque Espino 2004: D. M. Duque Espino, La gestión del paisaje vegetal en la Prehistoria reciente y Protohistoria en la Cuenca Media del Guadiana a partir de la Antracología (Cáceres 2004).

Fábregas Valcare/Rodriguez Rellán 2008: R. Fábregas Valcare/C. Rodriguez Rellán, Gestíon del cuarzo y la pizarra en el Calcolítico peninsularel „Santuario“ de El Pedroso (Trabazos de Aliste, Zamora). Trabajos de Prehistoria 65.1, 2008, 125–142.

Feio/Martins 1993: M. Feio/A. Martins, O relevo do Alto Alentejo (traços essenciais). Finisterra 28.55/56, 1993, 149–199.

Forenbaher 1998: S. Forenbaher, Production and Exchange during the Portuguese Chalcolithic. The Case of Bifacial Flaked Stone Industries. Trabajos de Prehistoria 55.2, 1998, 55–71.

Forenbaher 1999: S. Forenbaher, Production and Exchange of Bifacial Flaked Stone Artifacts during the Portuguese Chalcolithic. British Archaeological Reports. International Series 756 (Oxford 1999).

Gauss et al. unpublished: R. Gauss/R. Mataloto/M. Calado, Copper Age Metallurgy in the Upper Alentejo. Metallurgical Remains from São Pedro and Fonte Ferrenha. In: Kupferzeitliche Metallurgie in Zambujal. Estremadura, Südportugal und Südwestspanien. Vom Fertigprodukt zur Lagerstätte. Arbeitstagung Alqueva-Staudamm, 27. bis 30. Oktober 2005. Série Iberia Archaeologica. Deutsches Archäologisches Institut (unpublished paper).

Gonçalves 1989: V. S. Gonçalves, Megalitismo e metalurgia no Alto Algarve Oriental. Uma aproximação integrada. 2 Volumes (Lisboa 1989).

Greenfield 2010: H. Greenfield, The Secondary Products Revolution. The Past, the Present and the Future. World Archaeology 42.1, 2010, 29–54.

Helmer et al. 2007: D. Helmer/L. Gourichon/E. Vila, The Development of the Exploitation of Products from Capra and Ovis (Meat, Milk and Fleece) from the PPNB to the Early Bronze in the Northern Near East (8700 to 2000 BC cal.). Anthropozoologica 42.2, 2007, 41–69.

Inizian et al. 1999: M.-L. Inizian/M. Reduron Ballinger/H. Roche/J. Tixier, Technology and Terminology of Knapped Stone. Préhistoire de la Pierre Taillée 5 (Nanterre 1999).

Lago et al. 1998: M. Lago/C. Duarte/A. Valera/J. Albergaria/F. Almeida/A. Carvalho, O povoado dos Perdigões (Reguengos de Monsaraz). Dados preliminares dos trabalhos arqueológicos realizados em 1997. Revista Portuguesa de Arqueologia 1.1, 1998, 45–152.

Lillios 1997: K. Lillios, Amphibolite Tools of the Portuguese Copper Age (3000–2000 B.C.). Geoarchaeological Approach to Prehistoric Economics and Symbolism. Geoarchaeology: An International Journal 12.2, 1997, 137–163.

Marciniak 2011: A. Marciniak, The Secondary Products Revolution. Empirical Evidence and Its Current Zooarchaeological Critique. Journal of World Prehistory 24, 2011, 117–130.

Martial/Médard 2007: E. Martial/F. Médard, Acquisition et traitement des matières textiles d’origine végétale en Préhistoire. L’exemple du lin. In: V. Beugnier/P. Crombé (eds.), Plant Processing from a Prehistoric and Ethnographic Perspective. Proceedings of a Workshop at Ghent University (Belgium) November 28, 2006. British Archaeological Reports. International Series (Oxford 2007) 67–82.

Mataloto 2010: R. Mataloto, O 4.º/3.º milénio a.C. no povoado de São Pedro (Redondo, Alentejo Central). Fortificação e povoamento na planície centro alentejana. In: V. S. Gonçalves/A. C. Sousa (eds.), Transformação e mudança no Centro e Sul de Portugal no 3.º milénio a.n.e. Actas do Colóquio Internacional (Cascais 2010) 263–296.

Mataloto/Boaventura 2009: R. Mataloto/R. Boaventura, Entre vivos e mortos nos 4º e 3º milénios a.n.e. do Sul de Portugal. Um balanço relativo do povoamento com base em datações pelo radiocarbono. Revista Portuguesa de Arqueologia 12.2, 2009, 31–77.

Mataloto et al. 2015: R. Mataloto/C. Costeira/C. Roque, Torres, cabanas e memória. A fase V e a cerâmica campaniforme do povoado de São Pedro (Redondo, Alentejo Central). Revista Portuguesa de Arqueologia 18, 2015, 81–100.

Mataloto et al. 2007: R. Mataloto/S. Estrela/C. Alves, As fortificações calcolíticas de São Pedro (Redondo, Alentejo Central, Portugal). In: E. Cerrillo/J. Valadés (eds.), Los primeros campesinos de La Raya. Aportaciones recientes al conocimiento del neolitico y calcolítico en Extremadura y Alentejo. Actas de las Jornadas de Arqueología del Museu de Cáceres 1 (Cáceres 2007) 113–141.

Mejías Moreno et al. 2014: M. Mejías Moreno/L. Benítez de Lugo Enrich/J. del Pozo Tejado/J. Morelda Sierra, Los primeros aprovechamientos de aguas subterráneas en la Península Ibérica. Las motillas de Daimiel en la Edad del Bronce de La Mancha. Boletín Geológico y Minero 125.4, 2014, 455–474.

Nukushina et al. forthcoming: D. Nukushina/R. Mataloto/C. Costeira/M. A. Igreja, "Foliáceos ovóides" e "grandes pontas bifaciais" nos povoados de S. Pedro (Redondo). Actas do VIII Encontro de Arqueologia do Sudoeste Peninsular (24 a 26 de Outubro de 2014).

Orestes Vidigal et al. 2015: R. Orestes Vidigal/P. Valério/M. F. Araújo/A. M. M. Soares/R. Mataloto, Micro-EDXRF Study of Chalcolithic Copperbased Artefacts from Southern Portugal. X-ray Spectometry, last updated 27.08.2015, <http://onlinelibrary.wiley.com/doi/10.1002/xrs.2658/epdf> (last access 08.02.2017).

Rodrigues 2011: F. Rodrigues, Minimização de Impactes sobre o património cultural do sítio arqueológico do Porto Torrão. Relatório de escavação arqueológica. Crivarque (Lisboa 2011).

Santos/Rocha 2011: R. Santos/M. Rocha, Relatório final da 2ª fase de intervenção arqueológica em Porto Torrão, Ferreira do Alentejo. Sectores 1 e 2. Neoépica (Lisboa 2001).

Sherratt 1981: A. Sherratt, Plough and Pastoralism. Aspects of the Secondary Products Revolution. In: I. Hodder/G. Isaac/N. Hammond (eds.), Pattern of the Past (Cambridge 1981) 261–305.

Silva/Soares 1987: C. Tavares da Silva/J. Soares, O povoado fortificado calcolítico do Monte da Tumba. Volume 1: Escavações arqueológicas de 1982–1986 (resultados preliminares). Setúbal Arqueológica. Setúbal 8, 1987, 29–79.

Soares 2013: J. Soares, Transformações sociais durante o III milénio AC no Sul de Portugal. O povoado do Porto das Carretas (Lisboa 2013).

Soares/Ribeiro 2003: A. M. Soares/M. Ribeiro, Identificação, análise e datação de um tecido pintado proveniente de um monumento megalítico da necrópole de Belle France (Monchique, Algarve, Portugal). In: V Congresso Ibérico de Arqueometría, Grupo de investigatión SCEM, Libro de Resumenes de Actas (Cádiz 2003) 155–156.

Sousa 2010: A. C. Sousa, O Penedo do Lexim e a sequência do Neolítico Final e Calcolítico da Península de Lisboa (PhD-Thesis Universidade de Lisboa 2010).

Valera 2014: A. Valera, Bela Vista 5 – Um recinto do final do 3º milénio a.n.e. (Vidigueira, Beja). Era monográfica 2 (Lisboa 2014).

VICTOR S. GONÇALVES AND ANA CATARINA SOUSA

The Shadows of the Rivers and the Colours of Copper

Some Reflections on the Chalcolithic Farm of Cabeço do Pé da Erra (Coruche, Portugal) and Its Resources

Keywords: Portuguese Chalcolithic, 3rd mill. BCE, key resources, Lower Tagus River, Sorraia River

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Abstract

This article presents some thoughts on the nature of the resources of the Chalcolithic farm of Cabeço do Pé da Erra (Coruche, Portugal), an archaeological site first identified and excavated in the 80s of the 20th cent. and intensively investigated between 2012 and 2015. On the right bank of the Sorraia River near the Tagus River the Chalcolithic farm of Cabeço do Pé da Erra (CPE) was an island deeply affected by the Flandrian Transgression, currently an area with *Quercus suber*. The site is bounded by a ditch with U configuration – corresponding to two construction phases – in partial overlap. In the inner area surrounded by the ditch domestic contexts have been identified highlighting the presence of a set of at least nine huts with bedrock and clay walls. Cooking areas were identified as well as knapping activity of schist and flint, cheese production, weaving and grinding activities. Absolute dating and stratigraphical analysis show three phases of occupation: Phase 1 (2817–2665 calBCE 2 σ), with sparse occupation and the presence of a workshop, producing engraved schist plaques. Phase 2 (2633–2474 calBCE 2 σ), with the construction of the ditch and the huts. Phase 3 (2382–2139 calBCE 2 σ) is the time of abandonment, in which we found traces of a violent fire.

A detailed reconstruction of the ditch of Cabeço do Pé da Erra is unfortunately limited by the bad conditions for the preservation of organic matter on the site. Resources related to the construction of domestic structures (wood, sandstone, clay) could be raised in the near vicinity (5km). Most of the lithic resources (schist, jaspoide schist, granite) could be exploited at regional level at distances of about 20km. Clearly the raw materials of extra-regional origin are represented in small numbers in the archaeological record of CPE: flint, variscite and copper. Most likely exchange networks in the 3rd mill. also reflect social and symbolic aspects. Set in a passing zone, CPE is located between two areas with a marked cultural identity: the Portuguese Estremadura and the Peninsular Southwest.

Resumo

Este trabalho apresenta leituras sobre a natureza dos recursos da quinta calcolítica do Cabeço do Pé da Erra (Coruche, Portugal), sítio arqueológico inicialmente identificado e escavado nos anos 80 do século 20 e extensamente intervencionado entre

2012 e 2015. Situada na margem esquerda do Baixo Tejo, junto ao Rio Sorraia, a quinta calcolítica do Cabeço do Pé da Erra (CPE) encontrava-se numa ilha profundamente afectada pela transgressão flandriana, actualmente numa área de montado, e regista um excepcional estado de conservação. O sítio está delimitado por um fosso com configuração em U, correspondendo a duas fases construtivas, em sobreposição parcial. Na área interna delimitada pelo fosso, foram identificados contextos domésticos, destacando-se a presença de um conjunto de um mínimo de 9 cabanas com base de pedra e paredes de argila. Identificaram-se áreas de cozinha, actividade de talhe da pedra, produção de queijo, tecelagem, moagem. As datações absolutas e a leitura estratigráfica permitem identificar três fases de ocupação: a fase 1 (2817–2665 cal a.n.e. 2 σ), com ocupação esparsa e a presença de um atelier de produção de placas de xisto; fase 2 (2633–2474 cal a.n.e. 2 σ), com construção de um fosso defensivo e das cabanas; a fase 3 (2382–2139 cal a.n.e. 2 σ) corresponde ao momento de abandono, o qual teria sido rápido e com sinais de combustão violenta. A reconstituição alargada dos recursos do Cabeço do Pé da Erra está infelizmente limitada pelas más condições de preservação da matéria orgânica registadas no sítio. Os recursos relacionados com a construção das estruturas domésticas (madeira, arenito, argila) poderiam ser captados no entorno próximo (5km). A maior parte dos recursos líticos (xisto, xisto jaspóide, granito), poderia ser explorada a nível regional, em distâncias de até 20km. As matérias-primas claramente de origem extrarregional encontram-se representadas em reduzido número no registo arqueológico de CPE: sílex, variscite e cobre. As prováveis redes de trocas em curso no 3º milénio traduzem também opções sociais e simbólicas. Situado numa área de passagem, CPE localiza-se entre duas regiões com uma identidade cultural bem marcada: a Estremadura portuguesa e o Sudoeste Peninsular. E traduz também essa situação.

1. Introduction

This article focuses on the study of the resources of the Chalcolithic site of Cabeço do Pé da Erra (Coruche, Santarém, Portugal). The site was identified in 1980 following a fortuitous discovery and one of us (Victor S. Gonçalves) directed excavations at Cabeço do Pé da Erra (CPE) between 1983 and 1985 (Gonçalves 1983/1984). The works gave rise to the programme entitled ANSOR – Anthropisation of the Sorraia Valley (Gonçalves/Daveau 1983/1984) covering an extensive diachronic period: from the 6th to the 3rd mill. BCE. In 2010 the ANSOR project was recovered under the management of the authors of this article promoted by UNIARQ (Centre for Archaeology – University of Lisbon) with funding from the Coruche County.

Continuously, starting with the first phase of the project, a special privilege was given to the integrated study of the landscape of the Sorraia Valley: new geophysical surveys were carried out, together with studies of the materials collected in previous archaeological works (Monte da Barca/Gonçalves 2011) and in excavations at various archaeological sites from the Early Neolithic (Casas Novas) to the Chalcolithic period (CPE and Barranco do Farinheiro).

The archaeological works at CPE form the central core of the ANSOR project with four new excavation campaigns having been undertaken. The works began in 2011 with the geophysical survey, followed by excavation campaigns in 2012, 2013, 2014 and 2015, with an area of 538m^2 already having been excavated. Although this present study focuses exclusively on CPE, this site cannot be conceived of in an isolated fashion, both in terms of its landscape and the resources transported there via the Sorraia River and in diachronic or synchronic terms.

2. The Lower Tagus Basin and the Sorraia Valley: Landscape and Settlement in the 3rd Millennium BCE

The area under study is located on the left bank of the Lower Tagus River Basin. The Lower Tagus Basin is 85km long and between 5 and 10km wide, with a huge number of tributaries. The area has an unsymmetrical shape caused by the terraces on the left bank, in the Tertiary Basin. The length and width of the Tagus basin undoubtedly contributed to the complexity of the sedimentary dynamics of this watercourse, from the Last Glacial Maximum until the present day, a situation that is unparalleled in Europe (Vis et al. 2008, 1683).

Historical sources clearly show the changes that have taken place in the Tagus Basin, ranging from the descriptions of Antiquity (Strabo) to the cartography of Fernando Álvaro Secco (1560). It was with Suzanne Daveau that the studies of the Tagus were extended to include prehistory, with her seminal text 'Espaço e Tempo' (Daveau 1980). More recently, G. J. Vis undertook some new analytical studies in the Lower Tagus basin (Vis et al. 2008; Vis 2009). According to this author, at the beginning of the Late Glacial Maximum, in roughly 12,000 calBC, the Tagus was transformed into a river with just one single channel. It was then that the process of the Flandrian Transgression began, leading to rising sea levels and resulting in a change to a brackish and marshy delta complex. The highest sea levels occurred in 5,000 calBC, when extensive areas of the banks of the Lower Tagus valley were completely submerged over a length of 80km (Vis et al. 2008, 1699). The valleys of the river's tributaries were also submerged (Vis et al. 2008, 1699) reaching 15km inland. After 5,000 calBC, the transgressive tides stopped and the process of sedimentation of the valley bottoms began to accelerate. When the climatic optimum was reached in 3,000 calBC it is likely that the greater aridity and the change in the vegetation cover increased the rate of sedimentary deposition in the Lower Tagus Basin, a situation that was further exacerbated by the intensive farming of the different historical periods. This transgressive and regressive dynamics of the Lower Tagus Basin erased some archaeological sites, so that it is possible that many of them are hidden by several metres of sedimentation, as has been shown by the geotechnical soundings carried out in this valley (Vis 2009). The invisibility of the prehistoric settlements was further exacerbated by the intensive farming that took place here during different historical periods, namely the recent construction of a series of irrigation channels. These conditioning factors partly explain the absence of any information relating to the Neolithic and Chalcolithic settlements on the left bank of the Lower Tagus River Basin. There is also a shortage of research projects undertaken in this region. The known prehistoric settlements of this region were structured around rivers and small streams that were tributaries of the River Tagus, most notably the Sorraia and the Ribeira de Muge. Located in the Ribeira de Muge are the known Mesolithic shell mounds, with some occurrences of these being found at the surface, which can be integrated into the Late Neolithic and Chalcolithic periods (Andrade et al. 2015). Most of the known habitats are concentrated in the Sorraia Valley, largely corresponding to the ANSOR research project and some preventive interventions that were made downstream from Coruche (Monte da Foz/Neves 2011; Monte da Quinta/Valera et al. 2006).

The Sorraia River is the tributary of the Lower Tagus River that has the largest hydrographical basin (7,730km^2), with countless subsidiary tributaries, such as the streams of Erra, Divor, Juliano and the Almansor River. The ANSOR project is centred around the middle section of the Sorraia basin, close to the present-day town of Coruche, where according to Suzanne Daveau the former delta would have been located (Gonçalves/Daveau 1983/1884, 205). The middle section has the form of an asymmetrical valley in terms of its relief: the right bank (in the north) is short in area, with a ridge of small hills close to the river constituting a genuine 'network of gullies' (Gonçalves/Daveau 1983/1884, 205). The left bank has a flat morphology, corresponding to Quaternary deposits (Gonçalves/Daveau 1983/1884, 205). It was along this ridge of small hills that the ANSOR project detected a network of settlements from the 3rd mill.: Entre Águas, Raia 1, Barranco do Farinheiro, Cabeço do Pé da Erra, Catarroeira, Monte dos Lacraus, Gamas (*fig. 2*).

The banks of the Sorraia River in its middle section also correspond to the terminus of two quite distinct landscapes, between the Ribatejo and the Alentejo. The Ribatejo corresponds to the Tertiary Tagus Basin, the sedimentary substratum, while the Alentejo corresponds to the old massif, the granitic substratum. This location between two different landscapes affords the middle section of the Sorraia Valley a privileged position for access to different abiotic resources and also establishes contact with two regions that, 5,000 years ago, presented quite considerable cultural differences: the Estremadura and the Alentejo (*fig. 3*).

Fig. 1. On top: Cabeço do Pé da Erra (CPE), view from North. Below: Chalcolithic residential area with nine huts (CPE).

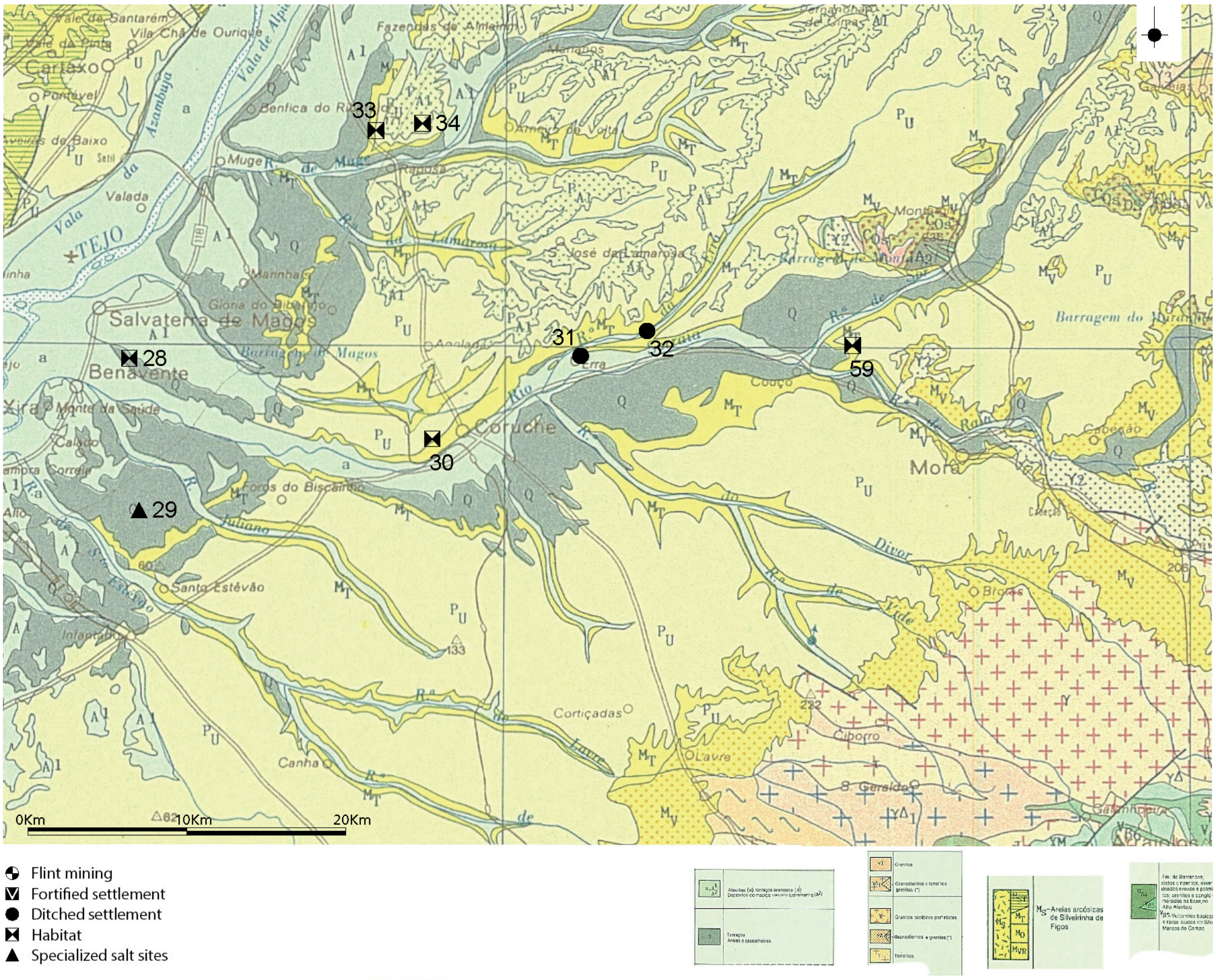

Fig. 2. Late Neolithic and Chalcolithic settlements in the banks of the Sorraia River. For sites' names see fig. 3.

3. Cabeço do Pé da Erra: Contexts and Phases

3.1. Location

The Chalcolithic settlement of Cabeço do Pé da Erra is located in the municipality of Coruche, in the district of Santarém with the coordinates WGS84 - Latitude: 38º.9899890161; longitude: -8º.46816303971. The archaeological site is situated roughly in the centre of a long elevation (54m), bordered to the north by Vale Judeu and to the south by the present-day watercourses of Ribeira da Erra and Sorraia River (*fig. 1*). In a region that was profoundly affected by the Flandrian Transgression, in the first studies undertaken by UNIARQ, one of the authors of this article (Gonçalves) and Daveau highlighted the 'insular' nature of Cabeço do Pé da Erra during the climatic optimum, saying that this island amounts to an isolated testimony to the old interfluve between the basin of the Ribeira da Erra and that of the Ribeira de Magos (Gonçalves/Daveau 1983/1984, 205).

3.2. General Morphology of the Site

The site is situated on an oblong elevation, measuring 1km in length and the prehistoric remains are concentrated in the middle. Calculating the total extent of the area's permanent occupation still remains a partly open question, even though it is likely that it was exclusively concentrated in the central area of the ridge. The habitat was

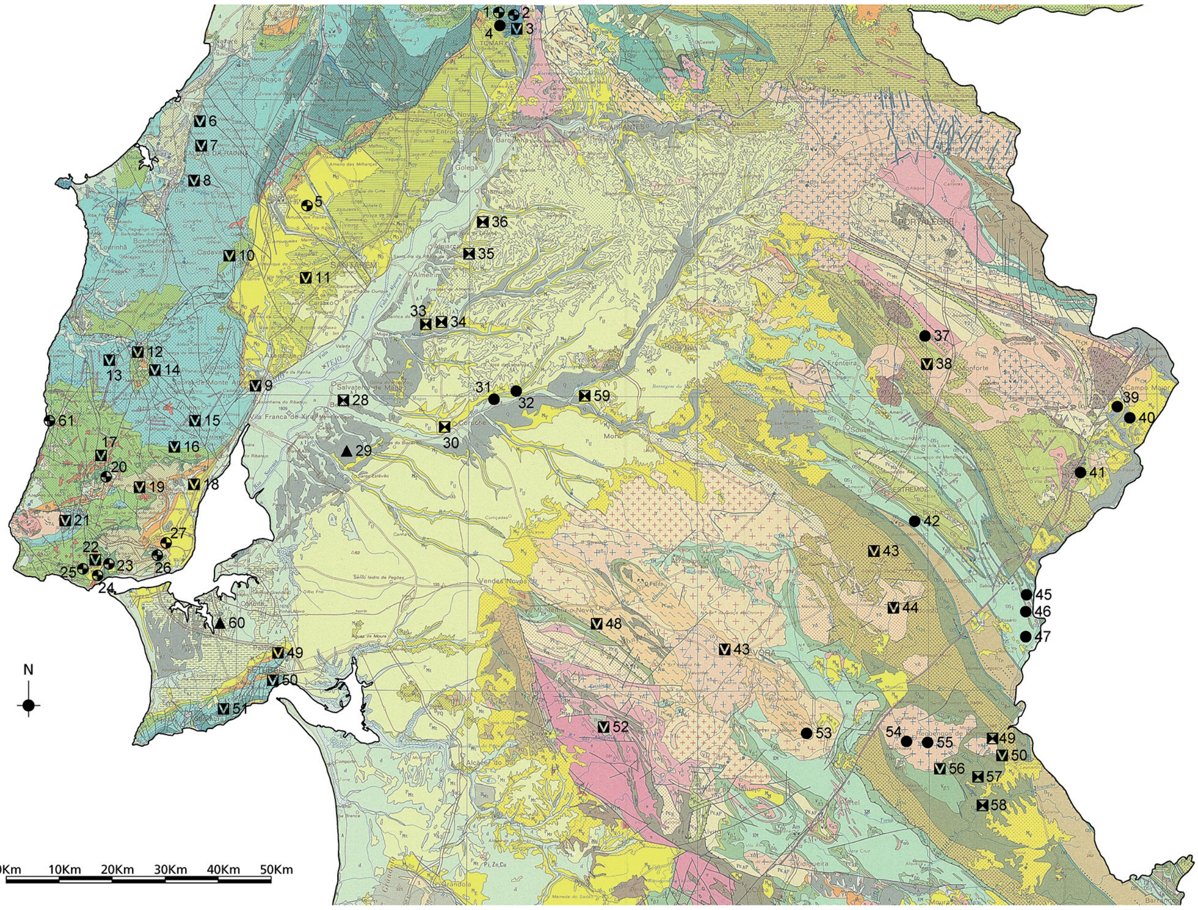

Fig. 3. Settlements in Central and South Portugal: 1. Casas de Baixo; 2. Cabeça Gorda; 3. Castelo de Ourém; 4. Fonte Quente; 5. Arruda dos Pisões (Arneiro, Passal, Cabeço dos Mouros); 6. Outeiro da Assenta; 7. Outeiro de São Mamede; 8. Columbeira; 9. Vila Nova de São Pedro; 10. Pragança; 11. Ota; 12. Fórnea; 13. Zambujal; 14. Penedo; 15. Pedra d´Ouro; 16. Castelo; 17. Penedo do Lexim; 18. Moita da Ladra; 19. Olelas; 20. Penedo da Cortegaça; 21. Penha Verde; 22. Liceia; 23. Barotas; 24. Monte do Castela; 25. Carrascal; 26. Campolide; 27. Santana; 28. Monte da Foz; 29. Monte da Quinta; 30. Monte dos Lacraus; 31. Cabeço do Pé da Erra; 32. Barranco do Farinheiro; 33. Martim Afonso; 34. Olival da Vasques; 35. Alto dos Cacos; 36. Cabeço da Bruxa; 37. Pombal; 38. Moreiros; 39. Cabeço do Cubo; 40. Santa Vitória; 41. Paraíso; 42. Salgada; 43. São Gens; 44. São Pedro; 45. Malhada das Mimosas; 46. Juromenha; 47. Águas Frias; 48. Escoural; 49. Porto das Carretas; 50. Moinho de Valadares; 51. Monte da Ponte; 52. Monte da Tumba; 53. Ponte da Azambuja; 54. Perdigões; 55. TESP 3; 56. Monte Novo dos Albardeiros; 57. Monte do Tosco; 58. Mercador; 59. Entre Águas; 60. Ponta da Passadeira; 61. Casal Barril.

built on the hillside overlooking the River Sorraia (in the south-east), corresponding to the main area of the region's occupation (Area 1). On the slope facing the former Ribeira da Erra (in the north-west), an area of secondary occupation has also been identified (Area 2). There, the total area that was excavated amounted to 536m^2. Area 1 has a total area of 800m^2 partly bordered by a ditch delimiting a subcircular space in which at least eight housing structures (huts) are located, together with functional areas and rubbish areas on the periphery.

3.2.1. The Ditches of CPE

The ditch was identified through a geophysical survey carried out in 2011 by the Eastern Atlas Company, later confirmed by the soundings undertaken in 2013 and 2014 (*fig. 4*). This structure marks out a semi-circular area. Apparently, the south-eastern and north-eastern hillsides, which slope naturally, would not have had a ditch, but the geophysical survey did not include these areas, which are covered with trees. Therefore, there may have been a strategy that involved placing the ditch in

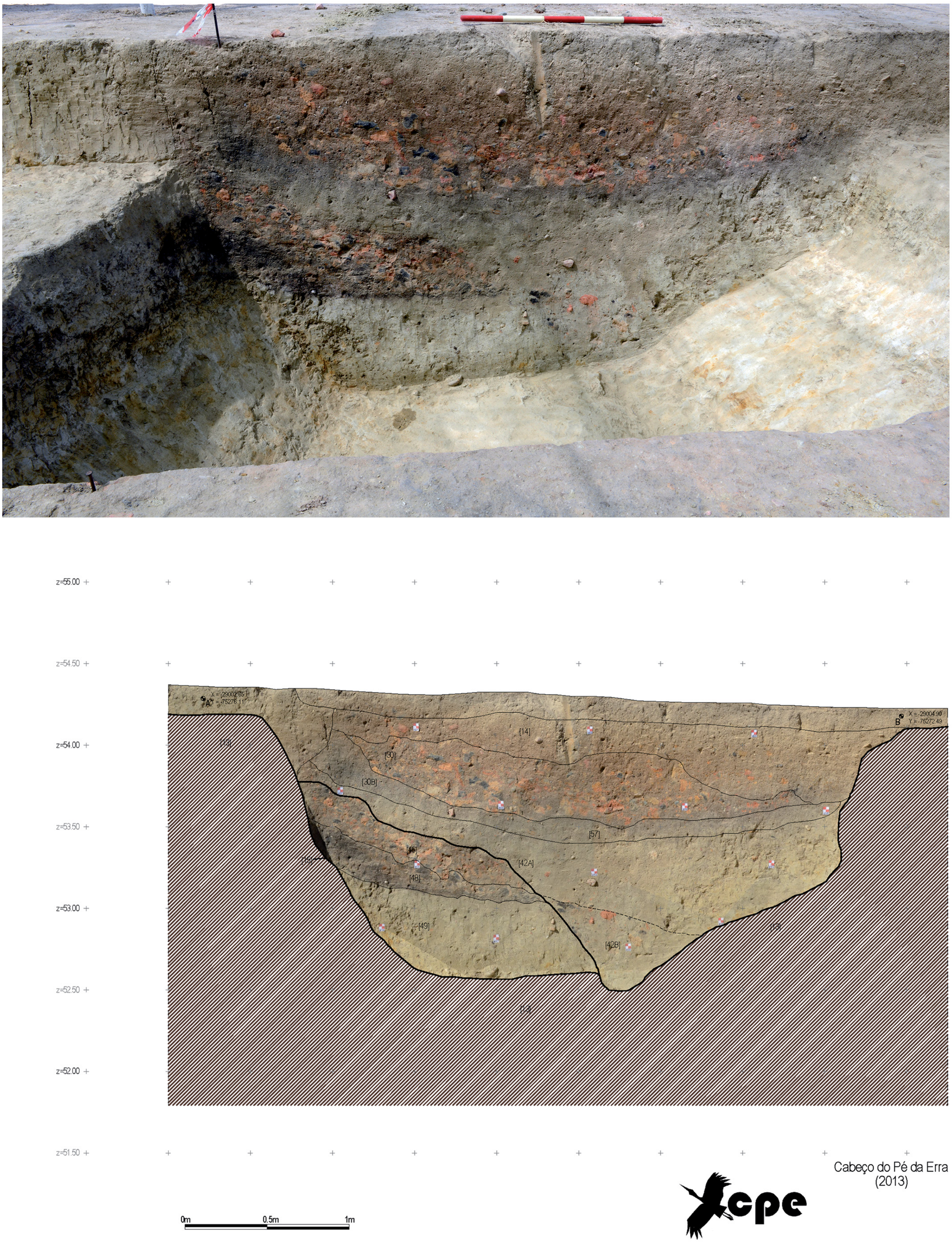

Fig. 4. On top: ditch in U shape protecting the habitational area; Below: section of the same ditch with two construction phases.

Phase	Lab. Reference	Sample	Conventional date (BP)	Calibrated date (1σ) calBC	Calibrated date (2σ) calBC
1	ICEN-587	Charcoal	4220±45	2899–2704	2911–2640
1	Beta-425879	Charcoal	4070±30	2832–2500	2851–2491
2	Beta-427670	Charcoal	4050±30	2618–2491	2832–2474
2	Beta-386916	Charcoal	4050±30	2618–2491	2832–2474
2	Beta-386915	Charcoal	4040±30	2620–2495	2834–2474
2	Beta-425878	Charcoal	4020±30	2573–2490	2619–2471
3	Beta-425880	Charcoal	3930±30	2474–2348	2550–2300
3	Beta-394160	Charcoal	3960±30	2475–2460	2565–2350
3	Beta-361778	Charcoal	3830±30	2337–2206	2456–2152
3	Beta-331682	Charcoal	3850±30	2433–2211	2458–2206
3	Beta-361777	Charcoal	3830±30	2337–2206	2456–2152
3	Beta-361776	Charcoal	3800±30	2287–2155	2338–2139

Tab. 1. Radio-carbon dating of CPE.

the area that was most unprotected in topographical terms. At both ends of the ditch, one can identify a ground plan that has the shape of a ‘crab’s pincer’, probably corresponding to distinct phases of construction. The sections excavated in 2013 and 2014 provided evidence of the existence of two completely overlapping ditches (coordinate 12) and areas where there was a partial separation of the line of the ditches with the shape of a ‘crab’s pincer’ (coordinates 15 and 2). Ditch 1, which is older, is U-shaped, while Ditch 2 is V-shaped. In the southwest area, which was excavated in 2014, it can be seen that the geological base is very irregular, with ‘gutters’ that were probably used for drainage purposes. There are also differences to be noted in terms of size: Ditch 1 is slightly shallower and narrower. Ditch 2 has a maximum depth of 2.2m. In chronological terms, the two ditches date from different periods in the site’s history: Ditch 1 dates from the 2nd quarter of the 3rd mill. (Beta-386916, Beta-386915 – *table 1*), while Ditch 2 dates from the 3rd quarter of the 3rd mill. (Beta-394160, Beta-361778 – *table 1*). An intentional deposition was identified at the bottom of Ditch 1, with remains of *Bos primigenius* (aurochs) apparently accompanied by some ceramic vessels.

The filling of the ditches reveals a complex dynamic, including phases of slow deposition, originating from erosion and phases when they were actively filled in, above all with levels of combustion and solid clay deposition. The deposition of baked clay, including thermoclasts, can also be seen to have taken place at the top of the Barranco do Farinheiro ditch and it is not yet possible to clarify whether this corresponds to a clay and fire sealing layer or whether it corresponds to the demolition of a protective embankment. Except for the already mentioned deposition of aurochs remains, the archaeological materials found in the ditch were scarce, contrary to what happened at other areas of ditches where there were funerary depositions (Valera 2012).

3.2.2. The Huts in the Residential Area

In Area 1, we find one of the most important groups of mixed structures (stone and clay) of the hut type in the whole of southern Iberia. Having first been detected during the campaigns undertaken in the 1980s, the huts at CPE have made it possible to carry out rigorous analyses of construction techniques and of the forms of occupation adopted by peasant communities in the second (agricultural and metallurgical) phase of the 3rd mill. BCE on the Iberian Peninsula.

So far, nine huts have been identified, seven of which are concentrated in the central zone of the area bordered on the outside by the ditch (*fig. 5*). We can consider the presence of two types of housing structures: semi-circular structures (Huts 1, 2, 3, 4, 5, 6, 8, 9) and circular structures (Hut 7). In

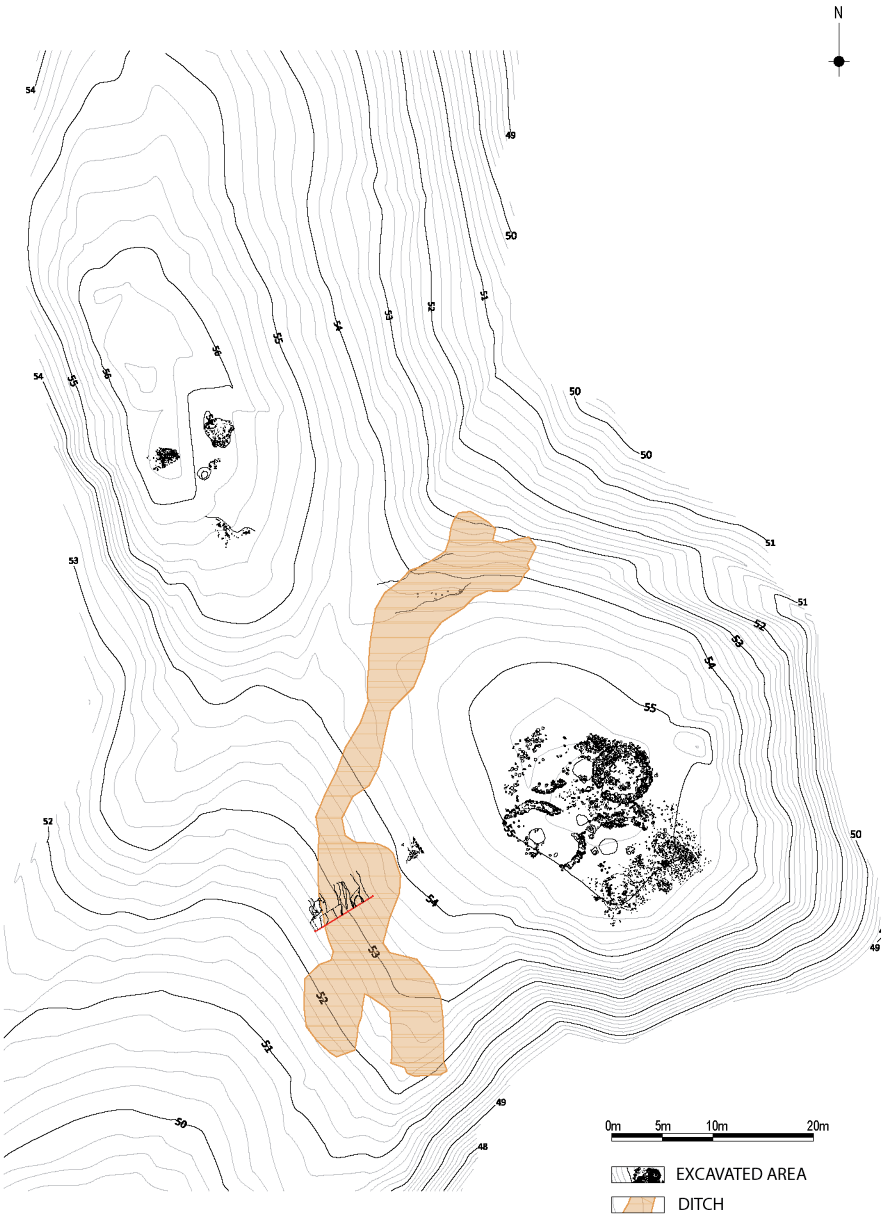

Fig. 5. Plan of Cabeço do Pé da Erra, with the layout of the ditch identified by geophysics surveys and structures identified in the 1983-2014 excavations.

both cases, the foundations are roughly 0.8m wide, with two outer stone faces filled on the inside with smaller blocks. Vertically, the walls have between one and four rows of stone. In the case of the circular structure (Hut 7) we can note the presence of a significant amount of debris from clay cladding material, which indicates that the walls were built of clay soil. In the case of the semi-circular structures there is a much smaller presence of clay, so that it is possible that the walls were built with vegetal elements (wooden posts and thatch). Closely associated with the huts is the presence of four unstructured combustion areas. The group of huts that have been identified were not occupied simultaneously highlighting the presence of two superimposed structures (Huts 4 and 6). The poor state of preservation of the organic material makes it difficult to obtain a sequence of absolute datings that will allow us to gauge the synchronic and diachronic relationships. The stratigraphic readings that have been obtained would seem to indicate that Hut 7 corresponds to a final phase of occupation, with the contexts of its occupation being completely preserved beneath the thick covering of clay debris that fell from its walls. The solution found for the construction of the two types of hut at CPE seems to correspond to the pattern found at most settlements in the south of Portugal from the 3rd mill., both in terms of building techniques (a mixed construction of stone and clay mortars) and in terms of their later evolution, with the appearance of isolated large-sized huts in the final phase of settlement.

3.2.3. Activity Areas

In the peripheral space around the nucleus of huts, in the area 'inside the ditches', we can see the presence of activity areas, with an abundant concentration of archaeological materials and the presence of expedient domestic structures. Attention is drawn to the platform on the south-eastern slope (with an area of roughly 108m^2) where a sequence of archaeological contexts was identified that were related to various domestic activities. Phase 1 corresponds to a level of occupation associated with a stone cutting area with engraved schist plaques, dating from the first quarter of the 3rd mill. This level was sealed with a large area of stone covering (measuring roughly 5 x 4m), consisting of small-sized pebbles, which possibly served as a pavement.

Phase 2 shows the profusion of expedient structures (14) composed of pebbles with some thermoclasts sometimes with clay, but without the presence of associated charcoal. These may be structures that were associated with activities that did not require the direct use of fire, such as the drying of hides or fish/meat or that were also used for salt production. There are no organic remains but some fragments of conical vessels were found. These vessels were used to boil salt water, with parallels in Monte da Quinta 2 (Benavente) and Ponta da Passadeira (Barreiro) both on the left bank of the Tagus River. These structures partly cover the stone floor and are scattered all around the platform. The whole platform presents a great density of archaeological materials, namely ceramics, frequently in the form of connecting pieces, indicating combustion activities, possibly related with the preparation of food and/or the production of salt. There is also evidence of the presence of an operational chain of jaspoid schist starting from tabular slabs. The presence of fragments of slaty schist and some preforms of engraved schist plaques seems to point to the continuity of the production of these artefacts or their remobilisation.

Interrupting these contexts in Phase 3, we note the presence of two ditches with a clear sedimentological definition and a higher density of artefacts, most notably some large connecting ceramic fragments and even some entire vessels. The lower levels of this reality are fairly compact and more blackened, possibly due to the decomposition of organic matter. In one of the ditches (U.E. 39), there was a notable concentration of fragments of a cheese strainer together with an entire vase and in the other ditch (U.E. 41) a notable density of hammerstones and grinding elements. The absolute dating obtained for one of the ditches indicates the third quarter of the 3rd mill., with the most notable feature being the presence of ceramics decorated with a broad acacia leaf, which were almost absent in Phase 3.

On the south-western slope, next to the ditch, another activity area was identified, with the detection of remains of a possible loom, with a concentration of loom weights (45). The abundance, fragmentation and diversity of archaeological materials found here would seem to indicate that this was originally a rubbish area, covered with large-sized pebbles.

3.3. Time and Phases in the Occupation of CPE

The establishment of the chronological table for the occupation of CPE represents one of the greatest challenges for the interpretation of the site. On the one hand, mention should be made of the acidity of the soils, which profoundly affected the organic matter at CPE making its conservation difficult. The rare bone that was found does not present any collagen and the charcoal does not allow for the identification of the plant species. On the other hand, the site's scarce stratigraphic power makes it difficult to obtain stratigraphic readings, presenting high levels of pedogenesis, which makes the strata homogeneous in sedimentary terms. Mention should also be made of the presence of numerous structures, so that the choice was made to preserve these for heritage purposes with only occasional necessary interventions being made in the initial phases of occupation. Despite these difficulties the site's excellent state of conservation and the painstaking care that was taken in the excavation of the contexts made it possible to establish a general and sectoral understanding of the phases, which is due to be complemented in the near future with a new battery of absolute datings that were obtained at the end of the 2015 excavation campaigns.

At CPE, generally speaking, we can identify three phases of occupation:

Phase 1: 2817–2665 calBCE 2 σ
The first phase of occupation, directly covering the sterile geological substratum, was detected at various points of the excavated area. Possibly in this phase, the ditch had not yet been constructed, so that there was only a sparse occupation of the site with perishable structures. The only dating that is available so far (ICEN 587) was obtained in the first phase of excavations at the site (Gonçalves 1983/1984), being associated with an area of excavation next to the workshop where the engraved schist plaques were produced. In stratigraphic and sedimentary terms this context is spatially associated with the stratum U.E. 68, covered with the stone paving 60. We can also identify this first level of occupation under Hut 7 (U.E. 94, 107, 106, 105) and in the peripheral area on the south-western slope (U.E. 91).

Phase 2: 2633–2474 calBCE 2 σ
In a second phase, the defensive ditch was built (Beta-386916, Beta-386915 – the first filling strata) and probably the semi-circular huts too. Questions relating to the preservation of organic matter have made the dating of this phase rather difficult, especially at Huts 1, 2, 3, 4, 7, 8 and in the activity area. In terms of relative indicators this phase presents some pottery decorated with a narrow acacia leaf with an absence of pots decorated with a broad acacia leaf, wide fluting and geometrical motifs.

Phase 3: 2382–2139 calBCE 2 σ
The final phase of occupation of CPE corresponds to the best characterisation of a period in archaeometric terms, with five datings obtained. The site was abandoned very rapidly and all of the contexts are very well preserved. In terms of occupation, there were signs of a new plan for the construction/maintenance of the ditch, maintaining roughly the same layout and a similar dynamics in terms of its filling (Beta-394160, Beta-361778). It is possible that the occupation of the 'residential' area was limited to Hut 7, which is exceptional in terms of the preservation of the contexts of its use. In the area between the huts the debris of Hut 7 covered a concentration of entire/complete vessels interpreted as being 'cooking' items with two absolute datings (Beta-331682, Beta-361777). The ditches in the activity area seem to correspond to this final phase (Beta-361776) with one of the ditches having been dated by radiocarbon and with the discovery of an abundant presence of pottery decorated with an acacia leaf.

Eventually we could talk of a 'Phase 4', corresponding to the levels of the site's abandonment and to the few materials that were found in the upper surface strata expressing the state of preservation of the underlying archaeological contexts. But in fact, this was a short and violent episode that determined the effective end of the site's settlement.

4. Estimating the Resources at CPE

An attempt to roughly estimate the resources of Cabeço do Pé da Erra is naturally limited by the poor state of preservation of the organic matter found at the site. The geological substratum inherent in the Tertiary basin of the Tagus River is very acid and thus the organic remains (fauna, charcoal and seeds) have been almost completely destroyed. Our analysis is therefore centred almost exclusively on the abiotic resources that were needed for constructions and for toolmaking. After the six excavation campaigns that have taken place (1982, 1983, 2012, 2013, 2014, 2015), we are still studying materials and undertaking archaeometric analyses and landscape studies. Although these are still at an embryonic stage, the possible reading that we can make for the resources of Cabeço do Pé da Erra allows us to propose some possible future lines of research. The analysis of the resources will centre upon three areas of analysis: the constructions, the material culture and the biotic resources.

4.1. Domestic Architectures and the Raw materials Used for Construction

Obtaining raw materials for construction purposes is usually a matter of expedient access and it is rare to find cases in which raw materials were transported over long distances. This situation is essentially related to megalithic monuments, although recent studies would seem to indicate that the predominant factor was the proximity of quarries from where the orthostats used in the dolmens of southern Portugal were extracted (Boaventura 2009; Moita 2014). Naturally there are exceptions, both at necropolises and in settlements, namely the use of limestone in fortified settlements with a geological substratum of basalt, as was the case at Penedo do Lexim (Sousa 2010) or at Moita da Ladra (Cardoso/Caninas 2010).

Situated in the middle section of the Sorraia Valley, Cabeço do Pé da Erra was implanted in an area without any materials that could be used in the building of walls, since the soils consisted of a relatively unconsolidated arenitic substratum. Very soft arenitic rock appears at only a few metres in depth. The presence of stone blocks at CPE is thus invariably an indication of the presence of anthropic structures, even if these were later dismantled. It can be seen that sandstone was used exclusively for building the stone bases of the huts, which would have been constructed upwards from this point with the use of perishable elements and clay cladding. These stone blocks could have been quarried in nearby erosive areas or even in the excavated ditch, namely on the south-western slope where the base is rocky. As far as earth constructions are concerned, although the clay that was used is not recorded on the geological map, only appearing at a distance of roughly 20km, it is possible that clay sediment from a closer location was used. At Cabeço do Pé da Erra, there is a predominance of earthen architecture, both in residential constructions and in the boundary structures – ditches. Given that '(…) the earth that is used for construction must contain clay, which functions as a binder, aggregating sands, grit and sometimes gravel' (Bruno 2010), it will naturally be important to carry out analyses of the different contexts, where the presence of baked clay has been recorded: inside the ditches, in the debris of the huts and in small perishable structures. The volume of clay used in Hut 7 (Phase 3) and in the ditch (Phase 2 and 3) is particularly relevant, since it is fairly implausible that this has such a distant origin. It should be noted that the first geological horizon in the stratigraphy of CPE, for example in the cross section below the stone paving, reveals the presence of clay that could have been used for these constructions.

The presence of ditches as a boundary structure may also suggest some ecological determinism: in an area that had no stone that could be used for building purposes, it would be very difficult to choose to build walls. There therefore seems to be a dichotomy between the two banks of the Tagus River. On the right bank, in the Portuguese Estremadura, there is an abundance of fortified settlements (18 in total, the largest such concentration in southern Portugal), while on the left bank the data identified in Coruche would seem to indicate the presence of ditches. In the Alentejo, where areas of ditches coexist with fortified settlements, the building solutions do not seem to have an ecological causality, suggesting that these had their own specific functions and meanings.

4.2. Artefacts and Tools

For the artefactual study of CPE, we consider the group of materials collected in the campaigns undertaken between 2012 and 2014, corresponding to a total number of 5,824 materials originating from Area 1, mostly ceramic vessels (64.7%), followed by flaked stone (20.2%) and knapped stone (8.3%). The remaining artefacts all record residual values of less than 3% (cheese strainers, loom weights, artefacts used for personal adornment, artefacts used for sacred purposes, polished stone, by order of their representativeness). Each of these categories of artefacts has its own distinct dynamics in terms of its reception, transformation and use.

4.2.1. Flaked stone

The flaked stone industry at CPE (*table 2*) is divided into two groups: local raw materials (85%) and non-local raw materials (15%).

Preparation	**Flint**	**Schist**	**Jaspoid schist.**	**Silic. R.**	**Quartz**	**Quart-zite**	**Total**
Core front (*flanco de núcleo*)	3			1		2	6
Tablette (*tablette*)	1						1
Debitage							
Unretouched bladelet (*lamela bruta*)	6		3	1	2		12
Unretouched blade (*lâmina bruta*)	13	1	2			3	19
Unretouched flake (*lasca bruta*)	42	14	226	26	32	41	381
Cores							
	7	4	18	1	12	17	59
Debris/knapping residues							
Chips (*esquírolas*)	9		12	3			24
Chunks (*restos de talhe*)	46	61	205	31	19	16	378
Tools							
Perforator (*furador*)	3						3
Arrowhead (*ponta de seta*)	17	8	146	3			174
Retouched blade (*lâmina retocada*)	6		5				11
Retouched flake (*lasca retocada*)	7	4	29	3	6		49
Pièce esquillée (*peça esquírolada*)	2		1		1		4
Side scraper (*raspadeira*)	6		1	1		1	9
Burin (*buril*)	3						3
Denticulated (*denticulado*)	1		2				3
Sickle element (*elemento de foice*)	2						2
Bifacial flaked stone (*foliáceo*)				1			1
Retoucher (*retocador*)					1		1
Scraper (*raspador*)	2		1			4	7
TOTAL	176	92	651	71	73	84	**1147**

Tab. 2. *Chaîne operatoire.* Portuguese names for the tools in italics.

The local raw materials correspond to schist (72%) and quartz (5%). Quartz was used as a support for expedient toolmaking, with little transformation and tenuous signs of use. Schist effectively corresponds to the main resource used for all types of artefacts with the complete stage of the *chaîne operatóire* being present at the site. Particularly important was jaspoid schist because of its particular fracture characteristics, making it better suited for cutting (*fig. 7*). In the large activity area located on the terrace overlooking the Sorraia River various concentrations of schist were identified in the working phase including the 'cores', manuports in the form of thin plaques that were used as a support for making various tools, especially arrowheads (*fig. 7*). The study of these industries, which is currently in progress, is a fairly complex matter in view of the physical and mechanical properties of schist, making it difficult to differentiate between cores and flakes, to determine the stages of the *chaîne operatóire* and to determine the point of impact and the butt (Fábregas Valcarce/Rodríguez Rellán 2008, 129).

The archaeological bibliography has centred on the study of flint and there have been few studies made of other raw materials of inferior quality that are nonetheless present locally in certain regions, such as schist (Fábregas Valcarce/Rodríguez Rellán 2008, 129). However, local materials tended to predominate in various periods and in distinct chronologies. In settlement contexts of the 3rd mill. there was clearly a local quarrying of these materials for the production of flaked lithic tools, with low percentages of imports from outside.

Fig. 6. Quartzite. On top: flake D.17-215, core J.2-32; Below: hammer B.14-252.

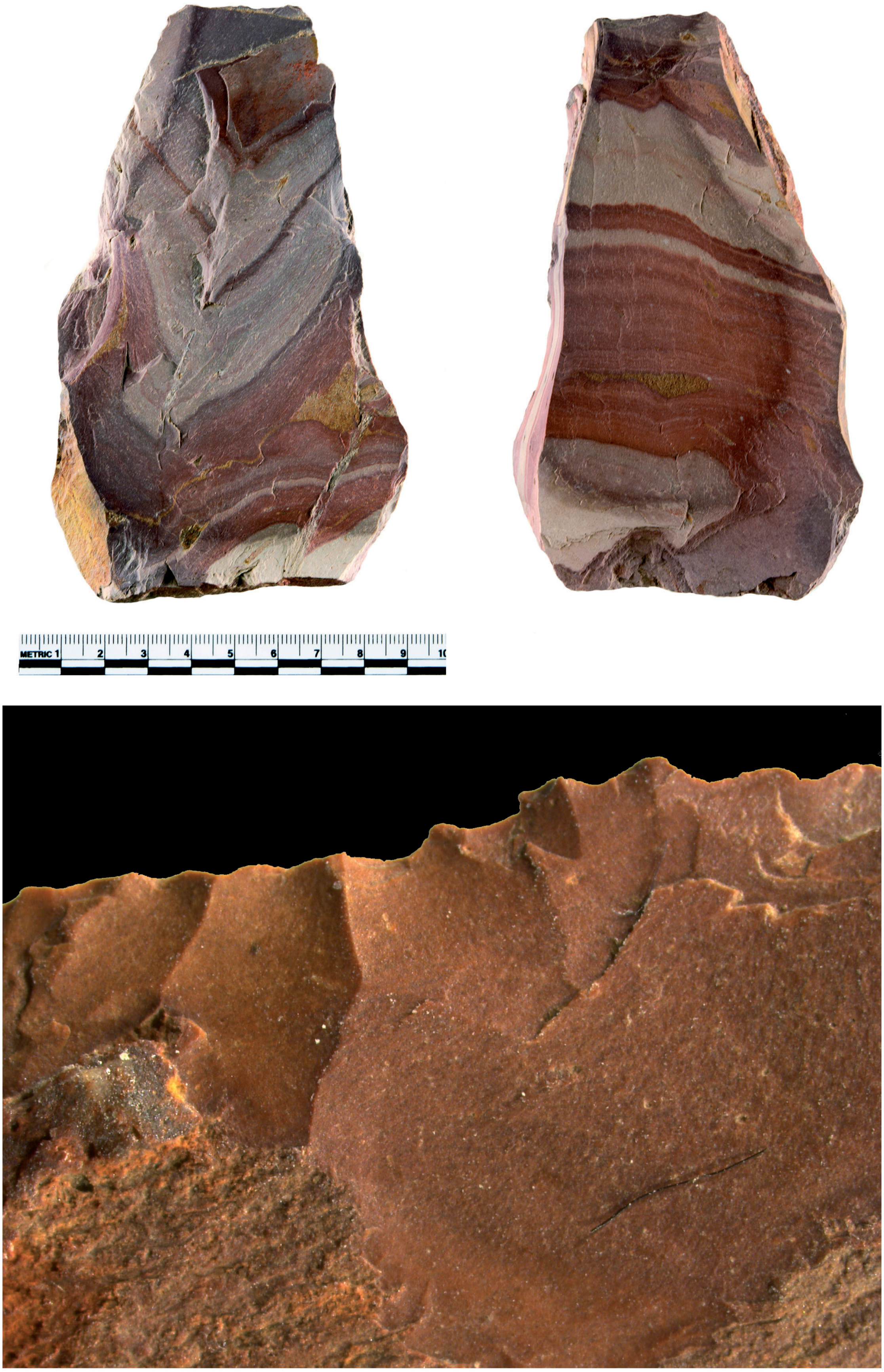

Fig. 7. Jaspoide schist. On top: raw material J.15-9; Below: detail from the arrowhead C.18-2.

Despite the scarcity of studies of the lithic industry in settlements from the 3rd mill. this tendency has been noted in different geographical contexts: in the Alentejo, at sites such as Porto das Carretas (Soares 2013) or Perdigões (Lago et al. 1998) and in the north-west of the Iberian Peninsula, in contexts such as Santuario El Pedroso (Fábregas Valcarce/Rodríguez Rellán 2008), Crasto de Palheiros (Sanchez 2008), Vinha da Soutilha, São Lourenço and Pastoria (Jorge 1986).

Flint of non-local origin corresponds to 15% of the total of flaked stones found at CPE, presenting a relatively small percentage of cores (only 6%), whereas jaspoid schist presents a percentage of 16%. It seems clear that most of the artefacts were not worked locally, despite a possible circulation of debitage namely blades, which on the whole were made of flint at CPE (*fig. 11*). Awls were also made exclusively of flint, on a support of narrow blades.

In general terms, toolmaking consisted mainly of arrowheads (60%), followed by products with retouched edges (28%), essentially flakes. In the toolmaking of the 3rd mill. there was always a preponderance of arrowheads regardless of the raw material that was used. We can verify that at the fortified settlements of the Estremadura, where there was an abundance of flint (Sousa 2010; Carvalho 1995/1996), or in the Alentejo, where schist rocks were predominantly used (Soares 2013) the situation is the same. Here, the function was more important than the material. Taking two examples located in distinct geological substrata, we can see that at Penedo do Lexim (Mafra), which is located in a flint area, arrowheads correspond to 24% of retouched tools (the pieces with retouched edges amount to 28%) and at Porto das Carretas arrowheads correspond to only 16% of toolmaking, with only nine examples found (Soares 2013, 209).

Although knapping in the 3rd mill. already presented signs of functional segmentation, with sites that specialised in mining, as well as specialised workshops outside the settlements (Sousa/Gonçalves 2011), the production of arrowheads corresponds to one of the exceptions. Since there was a recurrent presence of such tools in settlements contexts as happens for example in sites denoting a proximity to flint, such as Penedo do Lexim (Sousa 2010), Outeiro de São Mamede (Jordão 2010) or in more distant areas, such as the settlement of metallurgists of Cabezo Juré (Nocete et al. 2004). The identification of areas of arrowhead production at CPE corresponds to the first case detected in situ in Portuguese territory and the only case in which local raw materials other than flint were used.

The diachronic reading of resources throughout the phasing of CPE indicates a continuity in the raw material used for knapping, with a slight increase being recorded in the percentage of flint used in Phase 3 (third quarter of the 3rd mill.).

4.2.2. Polished Stone

	Nº	**%**
Axe (*machado*)	8	36,36
Adze (*enxó*)	3	13,63
Undetermined	8	36,36
Chisel (*formão*)	1	4,55
Hammer (*martelo*)	2	9,10
Total	**22**	**100**

Tab. 3. Polished stone (CPE 2012–2014, Area 1). Portuguese names for the tools in italics.

The number of polished stone artefacts found at CPE is relatively small, with a total of 22 artefacts being collected between 2012 and 2014 (*table 3*). We may consider that these artefacts would have had a prolonged useful life and that some of their tasks might have been performed by unworked knapped stone such as hammerstones. However, this panorama is similar to what happened in other settlements in southern Portugal, namely in the Alentejo and the Algarve. No petrographical characterisation was undertaken of the polished stones at CPE, although macroscopically we may consider such stones as amphibole schists (Cardoso et al. 1995, 149) and some adzes of altered philonian basalt. The catchment area of the amphibolic rocks might be regional (5 to 50km) in Montargil or Avis, or supra-regional in the Alto Alentejo, but a reliable classification can only be made with petrographical analyses. A study was undertaken of the region of the 'Alto Ribatejo' (Pereira 2012), with petrographical tests being conducted on polished stone originating from local settlements (Casal dos Cucos, Cabeço do Cão, Cova dos Castanheiros, Fonte Santa II, Agroal, Rexaldia) and from two necropolises located in Torres Novas (Lapa da Bugalheira and Necrópole das Lapas). After comparing these data with the supply sources mentioned by J. L. Cardoso, it can be seen that this material was most probably obtained in more distant areas, at Arronches and Évora (Cardoso et al. 1995). Although the study is still in its preliminary stages, these data seem to confirm that the resources cannot be interpreted only through a cartographical reading.

4.2.3. Knapped stone

	Nº	%
Grinding slabs (*dormente*)	104	21,86
Grinder (*movente*)	46	9,66
Undetermined grinding stone (*pedra afeiçoada, dormente ou movente*).	146	30,67
Handstone (*percutor*)	162	34,03
Polisher (*polidor*)	12	2,52
Anvil (*bigorna*)	5	1,05
Cover (*tampa*)	1	0,21
Total	**476**	**100**

Tab. 4. Grinding stones (CPE 2012–2014, Area 1). Portuguese names for the tools in italics.

a) Grinding elements

The grinding elements found, both dormant and moving, are highly fragmented amounting in total to 476 records (*table 4*). However, only nine dormant and six moving elements were found entirely intact, with most of the finds corresponding to indeterminate fragments (26.8%), which did not make it possible to classify the type of tool used with any degree of certainty. Several fragmented grinding stones were collected in situ, which it proved possible to reassemble. Currently 122 indeterminate fragments are still being reassembled. This is a fairly complex task, since many of the fractures are extremely brittle. The state of fragmentation of the moving and dormant elements reflects two quite distinct situations: the depositional conditions and the respective use. The acid soils at CPE not only affected the organic matter, but also the inorganic materials with lower levels of compactness namely ceramics, the stones used to build the huts and the grinding stones. On the other hand, those elements that were found complete or in a state which made it possible to classify them, revealed an intensive state of use expressed in their polishing and in the presence of several active surfaces, although their wear index is low (see the criteria in Gonçalves 1989). A macroscopic observation was made of the complete grinding stones and two possible supply sources were identified: gneissic granite at Furadouro and Montargil and pink coarse-grained granite at Brotas and Mora. In both cases, the supply source was situated over 10km away (*fig. 10*).

b) Hammerstones

The hammerstones found at CPE are mostly quartzite (92%), with a scant presence of quartz (8%) (*fig. 6*). The morphological diversity of the hammerstones indicates a variety of functions, with the presence being noted of elongated, spheroid and polyhedral examples, arrises and indeterminate fragments. Used on local resources, many examples present tenuous signs of wear. They are unipolar or bipolar and in some cases the percussion marks are peripheral.

Given the non-specialised nature of these artefacts few functional studies have been carried out. For the hammerstones found at the settlements of the upper eastern Algarve, Victor S. Gonçalves acknowledges that they may have been used for recuperation of the surfaces of dormant and moving elements, as well as for crushing copper ore (Gonçalves 1989). Manuel Calado also mentions the possibility of axes, as well as wedges, being used for percussion purposes (Calado 2001). At CPE, there was a concentration of hammerstones in specific contexts namely in the ditches of the activity area (U.E. 41 with 34 hammerstones and U.E. 39 with 21 hammerstones), expressing possible functional areas.

c) Polishers

The group of polishers identified shows that they probably had different functions. The smallest examples, which had an elongated shape, were produced in micaschist. The largest examples, which were rectangular in shape, have in some cases two active surfaces, using raw materials of greater compactness in the form of metamorphic rocks (see *fig. 9*).

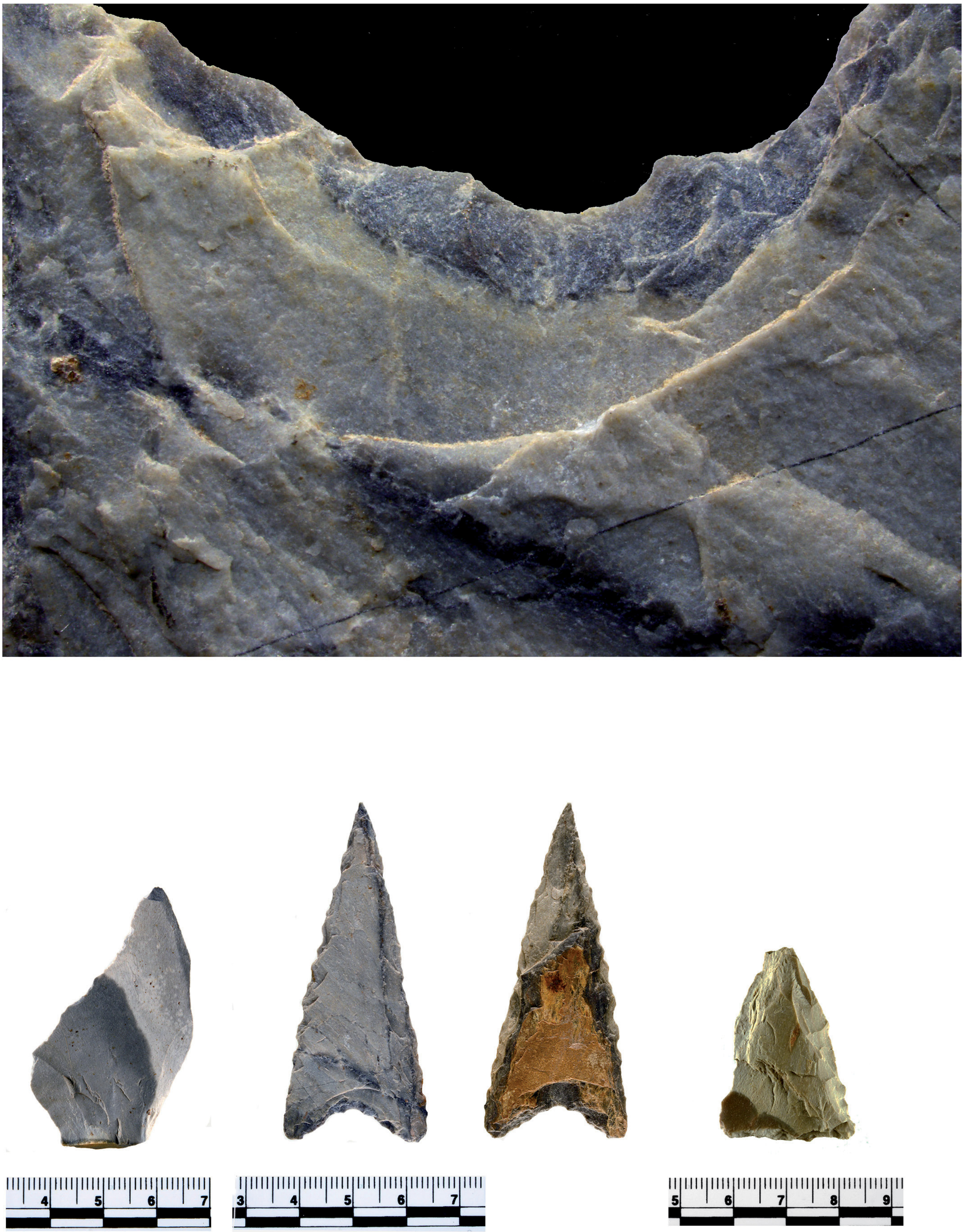

Fig. 8. Schist. Above: detail from the arrowhead F.17-19; Below: flake C.17-48, face and reverse of the arrowhead F.17-19, preform from an arrowhead (D.E 5/6-2).

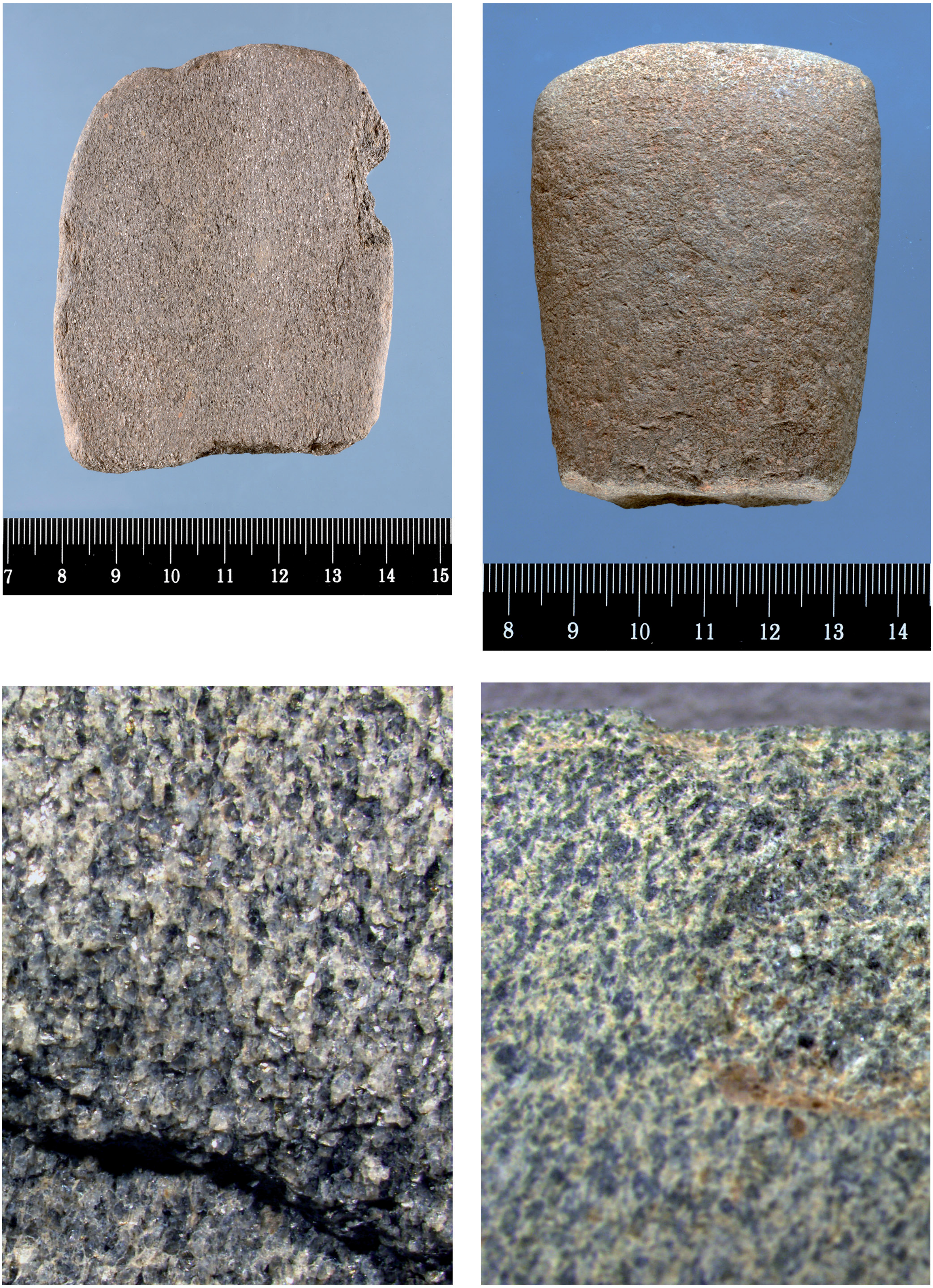

Fig. 9. On top: Mica schist polisher B.14-256; Amphibolite axe J/K.2-3; Below: details from the same artefacts.

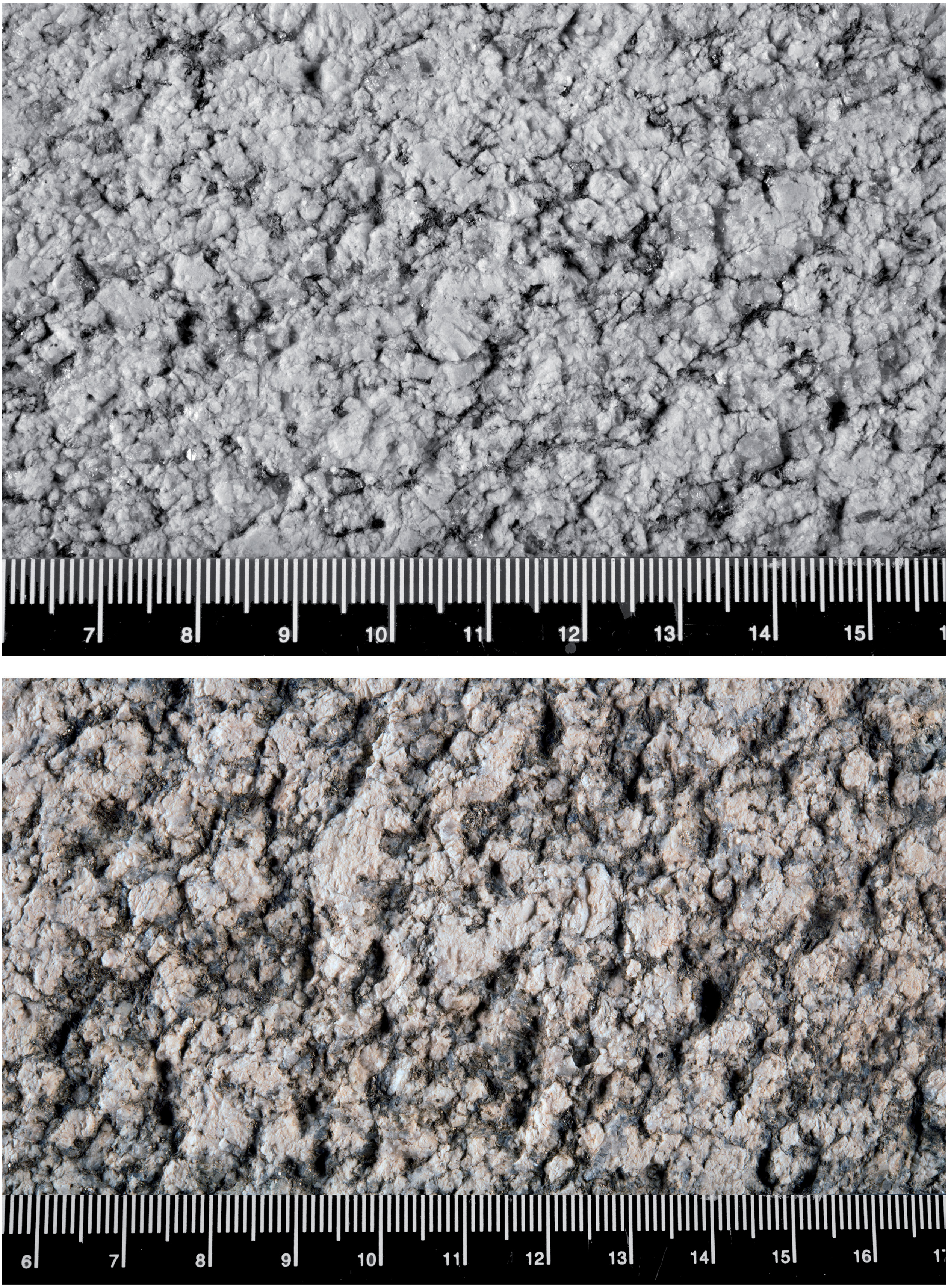

Fig. 10. On top: Granite from Montargil. Detail from a grinding slab (J.2-72); Below: granite from Mora, detail from a grinding stone (J/K.5/6-1).

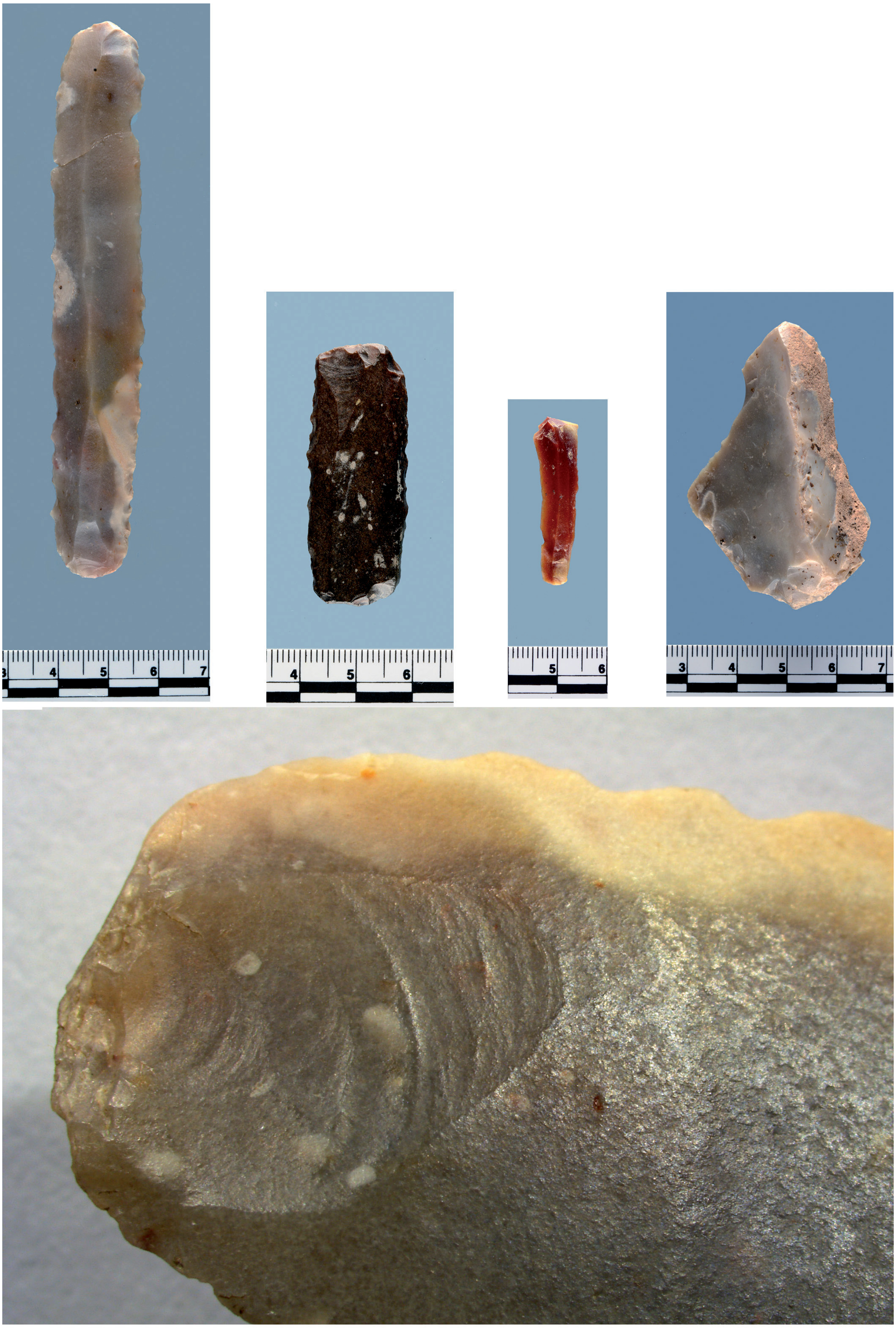

Fig. 11. Flint. On top: blade (B.15-81) raw material from Caxarias, blade H.16-87 burned flint, bladelet H.16-114, core (C.15-56); Below: detail of the blade B.15-81.

4.2.4. Artefacts of personal adornment

Tipo	Fase 1	Fase 2	Fase 3	Fase 4	Total
Beads (*componentes de colar*)	0	23	18	5	46

Tab. 5. Beads. Portuguese name for the artefacts in italics.

The group of artefacts used for personal adornment consists exclusively of necklace beads made of green stone, which were identified both in Phase 2 and Phase 3 (see *table 5*). Carlos Odriozola undertook recently some non-destructive analyses with X-ray fluorescence, having classified the material used in the manufacture of the whole group as variscite. The presence of a significant group of variscite beads is once again linked to the region of the Portuguese Estremadura. There they were found in abundance (Odriozola et al. 2013a; 2013b), contrasting with the contexts of the Alentejo where they are usually scarcer, except for special cases such as Perdigões, where the group that was found amounts to 3,000 examples (Odriozola et al. 2012). The only known supply sources are in Huelva, at Pico Centeno and in Zamora, at Palazuelo de las Cuevas (Odriozola et al. 2010), but it is quite probable that there were closer sources as Huet Bacelar Gonçalves suggests. It therefore seems clear that even small settlements, such as CPE, were integrated into the networks for the circulation of exceptional objects, such as variscite.

4.2.5 Ceramics

Ceramic items are usually the most abundant artefacts found at Neolithic and Chalcolithic sites. Besides the many ceramic vessels found at CPE, there was a significant number of fragments of cheese strainers and loom weights (*table 6*). Attention should be drawn to the presence of a large number of pots that were fully intact or that presented a complete profile. This circumstance is related with the stratigraphic preservation conditions, without any disturbances after deposition and with two clear contexts of rapid abandonment and preservation under the debris: Kitchen H.14-15 (13 pots

	Nº	%
Sherds and vessels (*cerâmicas, bordos e vasos lisos*)	3561	92
Decorated ceramic vessels (*cerâmica decorada*)	147	4
Cheese strainers (*queijeiras*)	73	2
Ceramic looms (*pesos de tear*)	93	2
Total	**3874**	**100**

Tab. 6. Ceramic artefacts (CPE 2012–2014, AREA 1). Portuguese names for the objects in italics.

that were either complete or could be reconstituted) and Hut 7 (17 pots that were either complete or could be reconstituted). There was a predominance of smooth ceramics with the presence of the morphological catalogue that commonly appears in domestic contexts from the 3rd mill. BCE (see Gonçalves, 1989; Soares/Silva 1976/1977), as well as the simple forms:

1. dishes with thickened and non-thickened rims
2. bowls
3. dome-shaped bowls
4. spherical bowls
5. pots and rare composite forms
6. truncated cones

The keel-like shapes usually associated with the Late Neolithic are absent here, with the group of pieces as a whole displaying an exclusively Chalcolithic chronology. The importance of the dishes and bowls and the absence of shapes such as bowls with a turned-out rim, shows a clear southern influence, but the presence of a significant group of ceramics decorated with acacia leaves (84 records) reflects the importance of the Portuguese Estremaduran influences at CPE. The concept of the 'Acacia Leaf Group' (Gonçalves/Sousa 2006) includes the decorations that were stamped and engraved with carved leaves, wide fluting and geometrical decoration (triangles and lozenges). There are residual traces of other decorative types, such as 'combed ceramics', an influence from the Lisbon Peninsula and symbolic ceramics, which were present in the whole of the southern Iberian Peninsula during the 3rd mill. The bell-shaped ceramics present at the site of Barranco do Farinheiro roughly 3km away are absent here, once again showing that their spread was not uniform, although this fact *per se* cannot be regarded as constituting a reliable indicator of periodisation.

There is also a crossover of influences to be noted in the loom weights: 21 plate weights of the Estremaduran type (one of which is decorated) and 72 crescent weights of the Alentejo type.

Although systematic studies of cheese strainers are rare, we can consider that the high number of fragments found at CPE is closer to the Estremaduran reality than that of the Alentejo, where such finds are usually residual.

The clay used for the production of these artefacts, pots and 'industrial' ceramics might have been collected close to CPE, although the Geological Map does not show any occurrences of clay in the arenitic substratum. Roughly 20km away areas of clay have been mapped at Montargil to the east of CPE. Archaeometric studies analysing the provenance of clays for prehistoric Peninsular contexts are rare, but the case studies that are available show that extraction from a nearby local place was a recurrent phenomenon at distances of less than five kilometres (Inácio 2015). The case of Valencina de la Concepción with clay that was collected 12km away (Inácio 2015) constitutes an exception in a context of great interpretive complexity.

4.2.6. Copper Metallurgy

	Nº	%
Tools (*utensílios*)	11	46
Rests of metallurgy (*vestígios de fundição*)	6	25
Crucibles or Smelting pots (*cadinhos e vasos para redução*)	7	29
Total	**24**	**100**

Tab. 7. Copper. Portuguese names for the objects in italics.

The number of copper tools recovered at CPE is small (*table 7*), amounting to no more than eight and corresponding to small-sized artefacts, essentially entire and fragmented awls. Nonetheless, the presence of metallurgy is to be noted throughout the site, mainly in the form of remains of metallurgical operations: copper nodules, an ingot, slag, fragment and ceramic vessels used for smelting. The small amount of copper tools may mean that the copper was reused, contrasting with the neighbouring site of Barranco do Farinheiro, where an entire axe was found weighing roughly 500g.

Most of the artefacts related with metallurgy are associated with Phase 3 (93%), only appearing residually in Phase 2 (7%). Particularly relevant is the presence of a combustion area with smelting slag and miniscule particles of copper by the side of Hut 7.

Although there is a reduced number of ceramics with slag stuck to them, no crucibles of the common southern type (with a rectangular mouth), such as known from the settlements of Andévalo, Huelva and the Upper Eastern Algarve. Nor are there any other crucibles with feet, such as found in the Portuguese Estremadura (*fig. 12*).

Regardless of the size of the group of metallic materials found in most settlements of the 3rd mill. with copper, we can still note the presence of metallurgical production (Kunst 2013), which in some way contradicts the suggestion of specialisation and elites (Nocete 2004).

4.3. Biotic Resources: Direct and Indirect Evidence

The reconstitution of subsistence biotic resources is very difficult, in view of the extremely poor state of preservation of organic matter found at the archaeological sites on the left bank of the Tagus River.

4.3.1. Hunting and Fishing

As far as hunting is concerned, the information that is currently available for the Estremadura and the Alentejo during the 3rd mill. seems to point to very distinct patterns of relative importance in relation to archaeozoological finds (Davis/Moreno Garcia 2007; Davis/Mataloto 2012; Valente/Carvalho 2014).

In the Estremadura (at Liceia, Zambujal and Penedo do Lexim) hunting played a very secondary role in the local economy (Moreno García/Sousa 2015a; Moreno García/Sousa 2015b). However, in the Alentejo, the data recently obtained for sites such as São Pedro (Davis/Mataloto 2012), Porto das Carretas (Soares 2013) or Mercador (Moreno

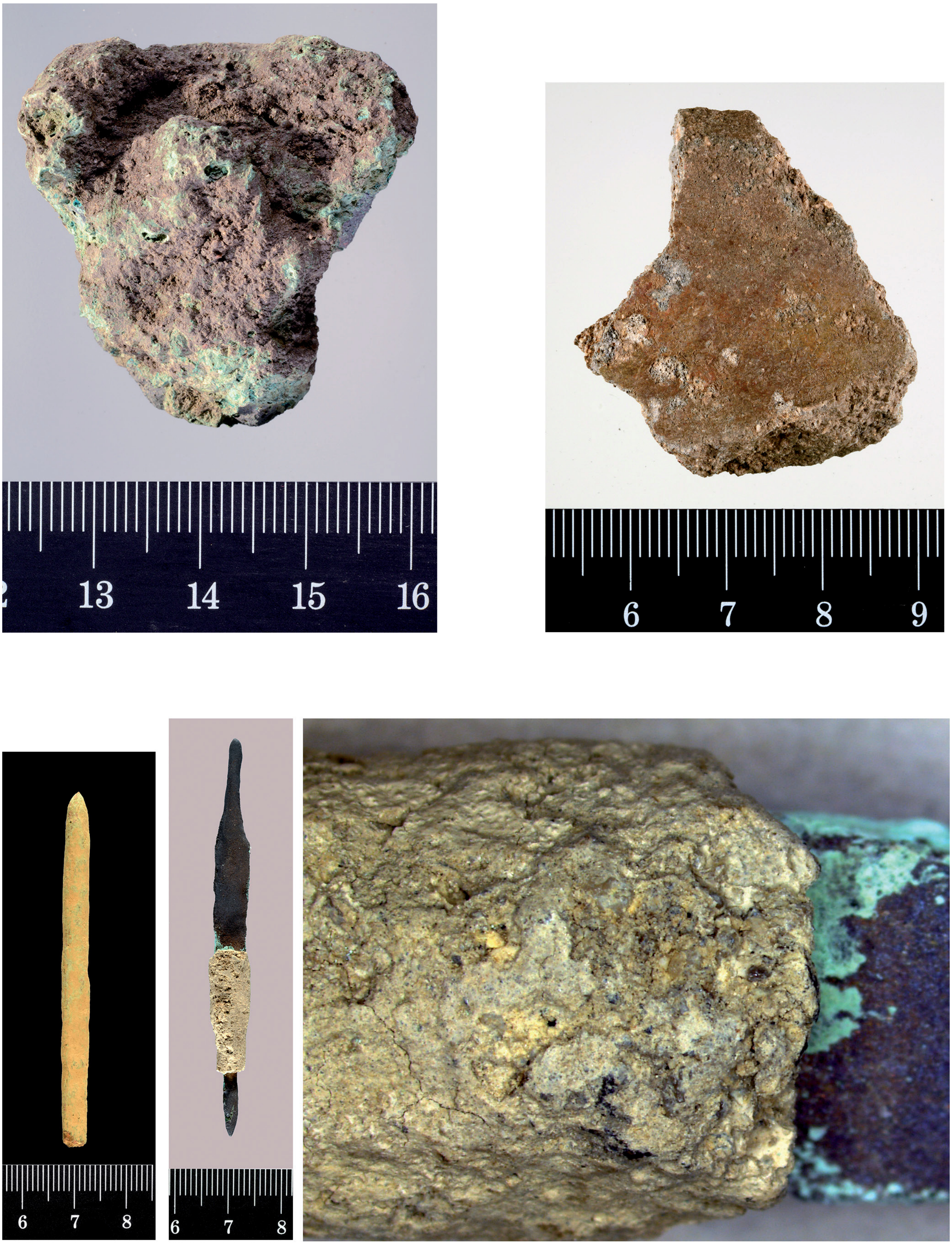

Fig. 12. Copper metallurgy. On top: ingot C.16-84, crucible V.15-8 with melted copper traces; Below: awl (B.14-1), awl with organic handle and detail (C.13-168).

García 2013) would seem to indicate the importance of hunting with a distinct model of economic exploitation and with great variability (Valente/Carvalho 2014).

For the Ribatejo, in the area where CPE is situated, the acidity of the soil does not allow us to determine the relative importance of hunting, although the high percentage of arrowheads (60% of tools) may reflect the importance of hunting in this region. The presence of an aurochs deposited in the ditch at CPE is evidence of the practice of hunting.

As the site is located between the Ribeira da Erra and the Sorraia River, water resources certainly played an important role in the subsistence strategy of these communities, but there is an absence of artefactual indicators, namely the weights of fishing nets which are present in sites close to the Guadiana River, such as Porto das Carretas and Sala nº 1. Perhaps these remained close to the course of the river, but the truth is that we do not know.

4.3.2. Production

Little is known about the production methods of the ancient peasants of the Sorraia valley.

The alluvial soils around CPE were certainly extensively used for agricultural purposes, but there is currently little evidence of agriculture. In the future a palynological study may be carried out like the one that was undertaken for the Sizandro valley (Dambeck et al. 2015) in order to assess the impact of agriculture in the Sorraia Valley. The presence of grinding elements and their intensive use may also be an indication of cereal farming.

In the case of pastoral farming, there are some direct indicators, with the occasional presence of sheep and goat bones. The presence of a significant group of cheese strainers (73 fragments collected between 2012 and 2014 one of which is 'complete') seems to indicate the secondary use of animal resources at CPE.

The analysis of ceramic residues is a very important tool for identifying milk consumption, even though the laboratory work has been a lengthy process with successive attempts being made in the last 30 years. The difficulties of this type of analysis are recurrently mentioned by the different teams that have carried out these studies: although fresh milk contains large amounts of fatty acids (C4:0 a C12:0), it is difficult for these components to survive in ceramic ware because they are susceptible to hydrolysis and are soluble in water (Copley et al. 2003, 1524). It was therefore necessary to find other biochemical indicators based on the different classes of fats (Vigne/Helmer 2007, 13).

Despite the extensive research that has been undertaken into this subject there is a shortage of analyses of contents on the Iberian Peninsula and analyses of perforated ceramics usually classified as cheese strainers have in fact never been undertaken before. However, the group of such artefacts found at CPE is currently under study, which may be an important contribution in this direction (Gonçalves et al. in print).

In the south of Portugal, despite the lack of published contexts, we can state that cheese strainers were found in practically all domestic contexts. There is also an intensification of their presence to be noted during the 3rd mill. with a further increase in the Full Chalcolithic period at sites such as Penedo do Lexim (Sousa 2010) and Liceia (Cardoso 2006). This tendency was also noted at CPE where they mainly appeared in Phase 3, including a possible area of cheese making in the activity area given the name of the 'terrace' and a complete cheese strainer found in Hut 7.

5. Near and Far – the Territories for the Exploitation of Resources Used at CPE

In order to reconstitute the territories for the exploitation of the resources that were used at CPE we sought to compare the quantitative analysis of the archaeological finds mentioned earlier with the reading of the surrounding territory.

The reading of the territory was undertaken through geological cartography (scale: 1:50,000) and surface field surveys designed to characterise the main landscape units of the territory surrounding CPE, in a systematic fashion in the immediate environment (within a radius of roughly five kilometres) and on an ad-hoc basis at a regional level (between five and thirty kilometres), selecting areas with a potential for the exploitation of resources.

Samples were collected for macroscopic comparison with the groups of artefacts found at CPE.

The study of the supply of resources at a supraregional level would require greater analytical support with general readings being made from baseline studies.

Local Collection (< 5km)

A preliminary analysis showed that the resources related with the construction of domestic structures (wood, sandstone, clay) could be obtained in the site's immediate surroundings.

In the Quaternary terraces situated upstream from CPE it was possible to obtain quartz and quartzite, which were used for the expedient manufacture of artefacts, playing a secondary role within the general context of the supply of lithic raw materials.

Occasionally, the Sorraia River might have brought materials from more distant areas to the site. In fieldworks, fragments of schist, lyddite, micaschist and even granite were found, small-sized and in a secondary position. Although there were no visible signs of areas used for the quarrying of clay, attention is drawn to the profound changes that this territory underwent after the beginning of the Flandrian Transgression. The gentle topography and the abundance of water resources probably favoured agriculture, a vocation that has continued to be practised here until the present day. Similarly, the estuary marshland context located in the adjoining area would certainly have been favourable for hunting and the consequent exploitation of the region's land and water resources.

Given the existence of other settlements in the resource catchment area close to CPE less than five kilometres away, we will have to consider the possibility of a sharing of resources. Particularly relevant here is the case of Barranco do Farinheiro, three kilometres from CPE and dated by radiocarbon as being from the same chronological period. Other small sites existed in the area immediately surrounding CPE, as confirmed in the case of Catarroeira. The question of a sharing of resources may stimulate different theoretical models, as was proposed in the case of the settlement of Andévalo (Huelva), with a possible local supply of resources being shared by various communities (Inácio 2015). We may also conceive of a hierarchized model for the settlement of the Sorraia Valley with central places. The extent of the surface dispersion and the presence of exceptional materials would seem to indicate that Barranco do Farinheiro was a central place in the Sorraia Valley. However, the samples that have been excavated are highly uneven: 536m^2 at CPE and 36m^2 at Barranco do Farinheiro.

Regional Collection (5–30km)

Most of the lithic resources could have been obtained at a regional level, at distances of roughly 20km. Three possible areas of exploitation were identified: (1) Montargil, on the left bank of the River Sor; (2) Furadouro, on the right bank of the Ribeira do Raia and (3) Mora/Brotas, on the edge of the old massif of the Alentejo. In Montargil, gneissic granite, micaschist, amphibolite, clay, siliceous schist, lyddite and quartz would have been available, granite and clay in Furadouro and Brotas. In a macroscopic analysis of the granite that was found it was possible to identify gneissic granite originating from Montargil and pink granite originating from Mora. We also know that several territories were very likely exploited. Most of the supplies of lithic materials would have been found in the regional territory: schist, jaspoid schist, lyddite and amphibolite. Knapping was mainly carried out on raw materials of local and regional origin. It is rare to find settlements in the territories where resources were probably exploited (Montargil, Furadouro and Brotas), but little archaeological research has been undertaken in these regions and what has been done has been directed towards specific themes. In the area of Furadouro and Brotas/Mora, archaeological finds have been dominated by the presence of megalithic monuments, but it is not known where the contemporary settlements in the region were located: 'many dolmens, few people?' It does not seem possible to defend the proposal that the inhabitants of CPE used these necropolises in view of their distance and above all due to the fact that these tombs were possibly much older. It is more likely that there were negative, hidden tombs, as in the case of the monument of Quinta Grande or Monte da Barca (Gonçalves 2011), an enigmatic funereal occurrence that was identified in the meadowland of the Sorraia Valley some decades ago.

Given the positioning of the settlement close to the Sorraia River, it is plausible that the essential reason for establishing communities at CPE was not its direct location next to the sources of the raw materials most commonly used for toolmaking and that there were other reasons for this, linked to the soil's capacities for use in agricultural and pastoral activities and, above all, to the control of areas of passage.

Extraregional Collection (more than 30km)
Raw materials that were clearly of an extraregional origin were found in relatively small numbers at the CPE archaeological site. While the local and regional collection of raw materials can be understood as a direct activity of the communities that lived at CPE and in the surrounding territory, the presence of materials with clearly extraregional origin would seem to indicate supracommunity interactions that implied a vast network of paths and relations with various territories. CPE and the whole of the Sorraia valley seem to have lain on the fringes of all the important supraregional resources that comprise the archaeological record of the 3rd mill.: flint, amphibolite and copper. Flint was one of the most significant extraregional resources found at CPE. Although it had only a minority share among the flaked stone of CPE (roughly 15%), it was used for specific tools such as blades and awls. In view of the geological substratum of the Estremadura, with cretaceous and Jurassic formations where there is an abundance of flint it is unquestionable that the flint at CPE would have come from the Estremadura. The quantity, accessibility, variety and quality of flint in the Estremadura is unparalleled in present-day Portuguese territory (Forenbaher 1999, 31). In a macroscopic observation of the material found at CPE, we can identify possible areas of supply: Rio Maior, Caxarias and the Lisbon Peninsula. This identification is based on a comparison between the mineralogical characteristics of the archaeological samples from CPE and those of the geological samples collected in these areas (iron oxides, microquartz and chalcedony). In recent decades, our knowledge about the collection of flint during the 4th and 3rd mill. has advanced quite considerably with the excavation of contexts that specialised in knapping and the geo-archaeological study of some groups of finds.

Generally speaking we can identify three main categories of contexts specialising in knapping in the Estremadura: mines, lithic workshops and mixed contexts. As far as mines are concerned there is a scarcity of subterranean contexts, of which the only one that is known is Campolide in Lisbon (Choffat 1907). At Casal Barril, Mafra (Sousa/Gonçalves 2011). There a mine context (or one from the primary phase of extraction in a semi-subterranean ditch) was detected dating from the first half of the 3rd mill. in the early Chalcolithic period (Beta-260629; Beta-260628: 2860–2470 calBC at 2 sigmas). Attention is also drawn to the importance of the surface mining of flint corresponding to nodules of flint in a secondary position in detrital or alluvial deposits: Pedreira do Aires, Monte das Pedras, Casal dos Matos (Andrade/Matias 2013). The lithic workshops, which resulted from a continuous and repeated activity of lithic production (Pélegrin 1995, 159), were essentially situated in the area of Rio Maior, where various workshops that specialised in foliaceous products were identified and excavated, namely at Olival do Passal (Zilhão 1995), Casas de Baixo (Zilhão 1994; Forenbaher 1999) and Cabeço dos Mouros (Andrade 2014). No workshops have yet been identified for the production of large blades in the Estremadura. Everything points to the fact that during the 3rd mill. BCE the circulation of flint outside the Estremadura region was centred on large 'prestigious' pieces – large blades and halberds, as is shown by the archaeological record of the megalithic monuments of the Alentejo. The 'amortisation' of flint, necessary for the circulation of large bifacial pointed blades (halberds, dart points) was very high, since these could be as much as 30cm in length and 500g in weight. This is the case with a piece found at Cabecinha (Figueira da Foz) which weighs 520g. In Coruche, there is a significant presence of flint daggers at the tomb of Quinta Grande or Monte da Barca, but this type of artefact is completely absent from the settlements excavated in the region. An identical situation arises in other contexts of the Alentejo, namely at Reguengos de Monsaraz, where flint is scarce in settlements such as Monte Novo dos Albardeiros or Torre do Esporão 3 appearing in exceptional large-scale pieces in the votive remains found at the tholos of Olival da Pega 2b.

When we compare the economics of the supply of lithic materials from the settlements in central and southern Portugal, we can see that there was a clear 'environmental determinism'. In contexts that were distant from the natural presence of flint, such as the Ribatejo or the Alentejo, flint is a minority element, as is shown by Cabeço do Pé da Erra on the one hand, or sites such as Porto das Carretas on the other hand. In contrast to this in the Estremadura area flint was a predominant feature of all settlements. The lesser aptitude of the local rocks was outweighed by the ease with which they could be obtained and replaced.

This reality was further accentuated in the 3rd mill. when there seems to have been a trend towards the intensive exploitation of local and regional resources in detriment to extra-regional resources. When we undertake a retrospective reading for the territory of the Sorraia River, we can see that the strategy of collecting lithic resources is substantially different at the Cardial Early Neolithic site of Casas Novas situated just one kilometre away from CPE on the Quaternary terraces surrounding the Sorraia River. Here flint is the predominant material with a share of 72% of the group of archaeological finds. The sources for the supply of flint also seem to be slightly different, since at Casas Novas there was a predominance of materials originating from the area of Tomar and Rio Maior, whereas at CPE there seems to have existed a greater variety of supply sources.

As far as the hard rocks used for the production of polished stone artefacts are concerned, the situation is substantially more complex, since no areas of direct exploitation (quarries) were detected. This lacuna is common to most of the Iberian Peninsula, possibly expressing a deficiency in the research that has been undertaken in this area or the sparse nature of actual quarrying for hard rocks. J. L. Cardoso presents a proposal for the location of amphibolitic rocks: 'the border of the Cenozoic basin of the River Tagus' (Cardoso 1999/2000, 267). He identifies several 'potential sources' (Abrantes, Ponte de Sôr, Montargil, Avis, Montemor-o-Novo, south of Grândola). We could also add to these sources Elvas in the Alto Alentejo. It might also be possible to consider the collection of such rocks at secondary deposits, as happens in the area of the Ribeira da Seda. Comparing these potential sources with the positioning of CPE we could suggest that the amphibolitic rocks were collected in the area of Montargil/Abrantes, but it will be necessary to undertake petrographical analyses since they might have an extraregional origin, as shown by the analyses undertaken by Júlio Pereira (Pereira 2012) for samples from the Alto Ribatejo region. Attention should also be drawn to the fact that no documentary record has been made of a significant presence of the manufacture of polished stone tools, a situation that is similarly found in other contexts such as Porto das Carretas (Soares 2013) or São Pedro (personal information provided by Rui Mataloto). This situation is in direct contrast to that of the Beiras, where there is a considerable group of artefacts from the operational chain: preparatory material (blocks and blanks) and remains (flakes, blades and revival plates and edges) present in large numbers at Castro de Santiago and Malhada (Valera 2007, 384).

Several authors have mentioned the question of the strategic value of polished stone for peasant communities in the 3rd mill. with hard rocks constituting a necessary material in daily life. However, in many contexts such as CPE polished stone is relatively scarce. This situation is common to many contexts in the Alentejo and the Algarve, where the number of examples found is small, as for example at Porto das Carretas (38 examples, Soares 2013, 175), Julioa 4 (12 examples, Valera 2013b, 272), Luz 20 (17 examples, Valera 2013b, 272), Moinho Valadares (15 examples, Valera 2013b, 272), Mercador (13 examples, Valera 2013b, 272), Sala nº 1 (21 examples in the excavated area) and Cerro do Castelo de Santa Justa (16 examples, Gonçalves 1989). The site of São Pedro seems to be an exception with a group of more than a hundred examples.[1] Besides the question of sampling methodology dealing with sometimes large numbers of unquantified surface examples, there may also be a different dynamic in the management of this resource. In contrast to this situation, we find the settlements of the Estremadura with a high presence of amphibolite tools at the fortified settlements, amounting to several hundred per site: 375 examples at Castro do Zambujal, 206 at Pragança and 97 at Pedra d'Ouro (Lillios 1997, 154). At Liceia, besides the 180 examples collected at the excavations undertaken by João Luís Cardo-

1 Personal information provided by Rui Mataloto.

so, there were 400 examples originating from surface collections (Cardoso 1999/2000). An identical situation was found at Penedo do Lexim with 48 examples collected at the excavations and an indeterminate number of examples originating from surface collections (Sousa 2010). It does not seem possible to defend the application of a model of an amphibolite market and an exhaustion of stocks in the late Chalcolithic period as K. Lillios suggested (1997), but there is a greater concentration of amphibolite in areas lying outside the possible areas of supply. In this case CPE fits more easily into the pattern that was found in the Alentejo, possibly with a less controlled management of a resource that was abundant at the regional level.

We also have a considerable shortage of information for the case of copper metallurgy. The Iberian Pyrite Belt, from Cercal to Huelva, is the obvious source for the supply of copper (Cardoso/Guerra 1997/1998, 74), with a group of mines having been identified that may have been exploited in the Chalcolithic period or in the Bronze Age (Müller et al. 2007). According to the chemical and isotopic analysis undertaken of the groups of artefacts from Liceia, Vila Nova de São Pedro and La Pijotilla, there was a similarity in terms of the presence of lead with the ore from the belt of Ossa Morena indicating that the sources of supply would have been common to both regions (Müller/Cardoso 2008, 84). But the reading based on the isotopic analyses of lead must however, be considered with some care, because the documentary base is very small. Cabeço do Pé da Erra presents a record of metallurgical practices especially in Phase 3 of its occupation, which corresponds to the third quarter of the 3rd mill. Just as happened in the Estremadura at Liceia or Penedo do Lexim metallurgy appeared later than it did in the areas closer to the pyrite belt.

6. Between Land and Sea – the Paths and the Cultural Traditions in the Sorraia Valley

The probable trading networks that existed towards the end of the 4th mill. and the beginning of the 3rd mill. also express social and symbolic choices so that we cannot conceive of trading mechanisms from a strictly economic point of view. For CPE and the Sorraia Valley, this circumstance is of special importance since it is situated in an area of passage at the point of transition between worlds with a clearly marked cultural identity: the Portuguese Estremadura and the southwest of the Iberian Peninsula. It is difficult to gauge which of the regions exercised more influence in these communities. As far as the sacred aspect is concerned CPE generally shows evidence of the presence of the various components of the magical and religious complex of the 3rd mill. that was characteristic for the south of the Iberian Peninsula: schist plaques with geometrical decoration and small clay statuettes of female figures. The presence of areas used for the production of schist plaques together with the various stages of the operational chain that were found here, is one of the specific features of the first occupation of CPE with similar contexts in the Alentejo being practically unknown except at Águas Frias in Alandroal. The presence of small ceramic statuettes has no evident parallel in Andalusia (Nocete 2004) and they are almost completely absent in the archaeological record of the Estremadura. Other components such as symbolic ceramics and horned idols appear throughout the Iberian Peninsula in the 3rd mill. The ceramic repertoire that expresses the everyday activities in the life of these communities records a dual influence: the catalogue of forms is similar to that of the Alentejo, but the influence of the Estremadura can be felt in the presence of a significant group of ceramics from the acacia leaf category. The concept of the Acacia leaf group (Gonçalves/Sousa 2006) must be understood here in its broadest sense, bringing together a decorative diversity and a range of morphologies: vessels with oval impressions, with herringbone patterns and decorated in lines, with deep, wide fluting, in simple association or in composite patterns. Pots, dishes and spherical bowls are practically absent from the necropolises and are preferentially associated with fortified settlements, although the acacia leaf group appears at some open sites. The region denoting the use and circulation of ceramics from the Acacia leaf group is an area centred on the Lisbon and Setúbal peninsulas, with small occurrences in the Alentejo. The duality of influences is also to be found in other areas, such as for example in the technology that was developed in weaving with the presence of the crescent loom weights that were typical of the Alentejo, as well as the robust, parallelepiped or square loom weights of the Estremadura.

Situated amid the shadows of the great River Tagus which crosses over the Iberian Peninsula CPE in the 3rd mill. showed the dynamics of a small farm, centred upon crop growing and grazing, but integrated into broader networks for the exchange of goods and ideas.

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Bibliography

Andrade/Matias 2013: M. A. Andrade/H. Matias, Lithic Raw Material Procurement and Consumption during the Late Neolithic/Early Chalcolithic. The Case of Casal dos Matos and Cabeça Gorda 1 (Vila Nova de Ourém, Estremadura, Portugal). Complutum 24.1, 2013, 91–111.

Andrade et al. 2014: M. A. Andrade/G. Lopes/C. Vilela, O sítio calcolítico de cabeço dos mouros. Identificação de uma nova oficina de talhe de pontas de seta na área de Arruda dos Pisões (Rio Maior, Portugal). Revista Portuguesa de Arqueologia 17, 2014, 113–126.

Andrade et al. 2015: M. A. Andrade/C. Neves/G. Lopes, Beyond the Mesolithic Shellmiddens. A Chrono-Cartographic Overview of the Ancient Peasant Communities in Muge. 150th Proceedings of the Conference on the 150th Anniversary of the Discovery of the Shell Middens at Muge (Cambridge 2015).

Boaventura 2009: R. Boaventura, As antas e o megalitismo da região de Lisboa (PhD-Thesis Universidad de Lisboa 2009).

Bruno 2010: P. Bruno, Arquitecturas de terra nos espaços domésticos pré-históricos do sul de Portugal. Sítios, estruturas, tecnologias e materiais (PhD-Thesis Universidad de Lisboa 2010).

Calado 2001: M. Calado, Da serra d'ossa ao Guadiana. Um estudo de pré-história regional. Trabalhos de Arqueologia 19 (Lisboa 2010).

Cardoso 1999/2000: J. L Cardoso, Os artefactos de pedra polida no povoado pré-histórico de Leceia (Oeiras). Estudos Arqueológicos de Oeiras 8, 1999/2000, 214–323.

Cardoso 2006: J. L. Cardoso, As cerâmicas decoradas pré-campaniformes do povoado pré-histórico de leceia. Suas características e distribuição estratigráfica. Estudos Arqueológicos de Oeiras 14, 2006, 9–276.

Cardoso et al. 1995: J. L. Cardoso/E. Barros/A. B. Carvalhosa, Estudos petrográficos de artefactos de pedra polida do povoado pré-histórico de Leceia (Oeiras). Análises de proveniências. Estudos Arqueológicos de Oeiras 5, 1995, 123–152.

Cardoso/Caninas 2010: J. L. Cardoso/J. C. Caninas, Moita da Ladra (Vila Franca de Xira). Resultados preliminares da escavação integral de um povoado calcolítico muralhado. In: V. S. Gonçalves/A. C. Sousa (eds.), Transformação e mudança no centro e sul de Portugal. O 4º e o 3º Milénios a.n.e. (Cascais 2010) 65–95.

Cardoso/Guerra 1997/1998: J. L. Cardoso/M. F. Guerra, Análises químicas não destrutivas do espólio metálico do povoado pré-histórico de Leceia, Oeiras e o seu significado no quadro da intensificação económica calcolítica da Estremadura. Estudos Arqueológicos de Oeiras 7, 1997/1998, 61–89.

Carvalho 1995/1996: A. F. Carvalho, O talhe da pedra e a transição neolítico – calcolítico no centro e sul de Portugal. Tecnologia e aspectos da organização da produção. Trabalhos de Arqueologia da EAM 3/4, 1995/1996, 41–60.

Choffat 1907: P. Choffat, Exploitation du silex a Campolide aux temps pré-historiques. O Archeólogo Português 12, 1907, 338.

Copley et al. 2003: M. S. Copley/R. Berstan/S. N. Dudd/G. Docherty/A. J. Mukherjee/V. Straker/S. Payne/R. P. Evershed, Direct Chemical Evidence for Widespread Dairying in Prehistoric Britain. Proceedings of the National Academy of Sciences 100.4, 2003, 1524–1529.

Dambeck et al. 2015: R. Dambeck/M. Kunst/H. Thiemeyer/A. J. Kalis/W. V. Leeuwaarden/N. Herrmann, Onde é que habitaram? Novos dados sobre a neolitização retirados do exemplo do Vale do rio Sizandro (Torres Vedras, Portugal). In: V. S. Gonçalves/M. Diniz/A. C. Sousa (eds.), Actas do 5º Congresso do Neolítico Peninsular (Lisboa 2015) 385–396.

Davis/Mataloto 2012: S. J. M. Davis/R. Mataloto, Animal Remains from Chalcolithic São Pedro (Redondo, Alentejo). Evidence for a Crisis in the Mesolithic. Revista Portuguesa de Arqueologia 15, 2012, 47–85.

Davis/Moreno García 2007: S. Davis/M. Moreno García, Of Metapodials, Measurements and Music. Eight Years of Miscellaneous Zooarchaeological Discoveries at the IPA, Lisbon. O Arqueólogo Português 4.26, 2007, 9–165.

Fábregas Valcarce/Rodríguez Rellán 2008: R. Fábregas Valcarce/C. Rodríguez Rellán, Gestión del cuarzo y la pizarra en el calcolítico Peninsular. El "Santuario" de el Pedroso (Trabazos de Aliste, Zamora). The Management of Quartz and Slate Resources in the Iberian Chalcolithic. The Case of the "Santuario" at El Pedroso (Trabazos de Aliste, Zamora). Trabajos de Prehistoria 65.1, 2008, 125–142.

Forenbaher 1999: S. Forenbaher, Production and Exchange of Bifacial Flaked Stone Artifacts during the Portuguese Chalcolithic. British Archaeological Reports. International Series 756 (Oxford 1999).

Gonçalves 1983/1984: V. S. Gonçalves, Cabeço do Pé da Erra (Coruche), Contribuição da campanha 1 (83) para o conhecimento do seu povoamento calcolítico. Clio, Arqueologia 1, 1983/1984, 69–75.

Gonçalves 1989: V. S. Gonçalves, Megalitismo e metalurgia no Alto Algarve Oriental. Uma aproximação integrada (Lisboa 1989).

Gonçalves 2011: V. S. Gonçalves, As placas de xisto gravadas (e os báculos) do sítio do Monte da Barca (Coruche) (Lisboa 2011).

Gonçalves/Daveau 1983/1984: V. S. Gonçalves/S. Daveau, Programa para o estudo da antropização do Baixo Tejo e afluentes. Projecto para o estudo da antropização do Vale do Sorraia (Ansor). Clio, Arqueologia 1, 1983/1984, 207–211.

Gonçalves/Daveau 1985: V. E. Gonçalves/S. Daveau, A evolução holocénica do Vale do Sorraia e as particularidades da sua antropização (Neolítico e Calcolítico). In: Actas da I Reunião do Quaternário Ibérico (Lisboa 1985) 187–197.

Gonçalves/Sousa 2006: V. S. Gonçalves/A. C. Sousa, Algumas breves reflexões sobre quatro datas 14C para o Castro da Rotura e o 3º milénio nas penínsulas de Lisboa e Setúbal. O Arqueólogo Português 4.24, 2007, 233–266.

Inácio 2015: N. Inácio, Alfarería y Metalurgia. Contribución del análisis arqueométrico para el estudio de los patrones de producción, distribución y consumo de cerámica en el suroeste de la Península Ibérica durante el III Milenio ANE (PhD-Thesis Universidade de Huelva 2015).

Jordão 2010: P. Jordão, Análise de proveniência de matérias-primas líticas da indústria de pedra lascada do povoado calcolítico de S. Mamede (Bombarral) (Master-Thesis Universidade de Lisboa 2010).

Jorge 1986: S. O. Jorge, Povoados da pré-história recente da região de Chaves. Vila Pouca de Aguiar (Porto 1986).

Kunst 2013: M. Kunst, The Innovation of Copper Metallurgy on the Iberian Peninsula. Its Significance for the Development of Social Complexity in the 3rd Millenium BC. In: S. Burmeister/S. Hansen/M. Kunst/N. Müller Scheeßel (eds.), Metal Matters. Innovative Technologies and Social Change in Prehistory and Antiquity (Leidorf 2013) 181–208.

Lago et al. 1998: M. Lago/C. Duarte/A. C. Valera/J. Albergaria/F. Almeida/A. F. Carvalho, Povoado dos Perdigões (Reguengos de Monsaraz). Dados preliminares dos trabalhos arqueológicos realizados em 1997. Revista Portuguesa de Arqueologia 1.1, 1998, 45–151.

Lillios 1997: K. Lillios, Amphibolite Tools of the Portuguese Copper Age (3000–2000 BC). A Geo-Archaeological Approach to Prehistoric Economics and Symbolism. Geoarchaeology 12.2, 1997, 137–163.

Moita et al. 2014: P. Moita/J. Pedro/R. Boaventura/R. Mataloto/J. Máximo/L. Almeida/P. Nogueira, Building Monument Materials during the 4th and 3rd Millennium (Portugal). In European Geosciences Union, General Assembly 2014, Vienna, Austria, 28 April – 1 May. Poster Session.

Moreno García 2013: M. Moreno García, Estudo arqueozoológico dos restos faunísticos do povoado calcolítico do Mercador (Mourão). In: A. C. Valera (ed.), As sociedades agropastoris na margem esquerda do Guadiana (2ª metade do IV aos inícios do II milénio AC) (Beja 2013) 319–349.

Moreno García/Sousa 2015a: M. Moreno García/A. C. Sousa, A exploração de recursos faunísticos no Penedo do Lexim (Mafra) no neolítico final. In: V. S. Gonçalves/M. Dinz/A. C. Sousa (eds.), Actas do 5º congresso do neolítico peninsular. Estudos and Memórias 8 (Lisboa 2015) 67–76.

Moreno García/Sousa 2015b: M. Moreno Garcia/A. C. Sousa, Para além das muralhas, uma perspectiva dos recursos faunísticos no calcolítico da Estremadura Portuguesa. O conjunto arqueofaunístico do locus 5 do Penedo do Lexim (Mafra). Revista Portuguesa de Arqueologia 18, 2015, 101–124.

Müller/Cardoso 2008: R. Müller/J. L. Cardoso, The Origin and Use of Copper at the Chalcolithic Fortification of Leceia (Oeiras, Portugal). Madrider Mitteilungen 49, 2008, 64–93.

Müller et al. 2007: R. Müller/G. Goldenberg/M. Bartelheim/M. Kunst/E. Pernicka, Zambujal and the Beginnings of Metallurgy in Southern Portugal. In: S. L. Niece/D. Hook/P. Craddock (eds.), Metal and Mines. Studies in Archaometallurgy (London 2007) 15–25.

Nocete 2004: F. Nocete, Odiel. Proyecto de investigación arqueológica para el analisis del origen de la desigualdad social en el suroeste de la Peninsula Ibérica (Sevilla 2004).

Nocete et al. 2004: F. Nocete/R. Saez/J. M. Nieto, La producción de cobre en Cabezo Juré. Estudio quimico, mineralógico y contextual de escorias. In: F. Nocete (ed.), Odiel. Proyecto de investigación arqueológica para el analisis el origen de la desigualdad social en el suroeste de la Peninsula Ibérica (Sevilla 2004) 273–295.

Odriozola et al. 2010: C. P. Odriozola/J. A. Linares Catela/V. Hurtado Pérez, Variscite Source and Source Analysis. Testing Assumptions at Pico Centeno (Encinasola, Spain). Journal of Archaeological Science 37, 2010, 3146–3157.

Odriozola et al. 2012: C. P. Odriozola/R. Mataloto/J. Moreno García/G. R. Villalobos Garcia/J. M. Martinez Blanes, Producción y circulación de rocas verdes y sus productos en el suroeste peninsular. El caso de Anta Grande do Zambujeiro. Estudos Arqueologicos de Oeiras 19, 2012, 125–142.

Odriozola et al. 2013a: C. Odrioziola/A. C. Sousa/R. Boaventura/R. Villalobos, Componentes de adornos de pedra verde de Vila Nova de São Pedro (Azambuja). Estudo de proveniências e redes de troca no 3º milénio ANE no actual território Português. In: J. Arnaud/A. Martins/C. Neves, Arqueologia em Portugal. 150 Anos (Lisboa 2013) 457–462.

Odriozola et al. 2013b: C. P. Odriozola/R. Villalobos García/R. Boaventura/A. C. Sousa/J. M. Martínez Blanes/J. L. Cardoso, Las producciones de adorno personal en rocas verde del suroeste peninsular. Los casos de Leceia, Moita da Ladra y Penha Verde. Estudos Arqueológicos de Oeiras 20, 2013, 605–622.

Pereira 2012: J. Pereira, Estudo petrográfico de algumas rochas presentes em artefactos de pedra polida do Alto Ribatejo. Comunicação apresentada ao congresso arqueológico da bacia hidrográfica do Tejo (unpublished coference paper), <https://www.academia.edu/1590212/estudo_petrogr%C3%A1fico> (last access 10.04.2017).

Silva/Soares 1976/1977: C. T. E. Silva/J. Soares, Contribuição para o conhecimento dos povoados calcolíticos do Baixo Alentejo e Algarve. Setúbal Arqueológica 2/3, 1976/1977, 179–272.

Soares 2013: J. Soares, Transformações sociais durante o III milénio AC no sul de Portugal. O povoado do Porto das Carretas (Setúbal 2013).

Sousa 2010: A. C. Sousa, O Penedo do Lexim (Mafra) na sequência do Neolítico final e Calcolítico da Península de Lisboa (PhD-Thesis Universidade de Lisboa 2010).

Sousa/Gonçalves 2011: A. C. Sousa/V. S. Gonçalves, Gathering, Stocking and Knapping Flint during the Portuguese Chalcolithic. The Casal Barril File. In: M. Capote/S. Consuegra/P. Díaz del Río/X. Terradas (eds.), Proceedings of the 2nd International Conference of the UISPP Commission on Flint Mining in Pre- and Protohistoric Times (Madrid 14–17 October 2009). British Archaeological Reports. International Series 2260 (Oxford 2011) 157–169.

Valente/Carvalho 2014: M. J. Valente/A. F. Carvalho, Zooarchaeology in the Neolithic and Chalcolithic of Southern Portugal. Environmental Archaeology 19, 2014, 226–240.

Valera 2012: A. C. Valera, Mind the Gap. Neolithic and Chalcolithic Enclosures of South Portugal. In: A. Gibson (ed.), Enclosing the Neolithic. Recent Studies in Britain and Europe. British Archaeological Reports. International Series 2440 (Oxford 2012) 165–182.

Valera 2013a: A. C. Valera, Cronologia de recintos de fossos da pré-história recente em território Português. In: J. Arnaud/A. Martins/C. Neves (eds.), Arqueologia em Portugal. 150 Anos (Lisboa 2013) 335–343.

Valera 2013b: A. C. Valera, As comunidades agropastoris na margem esquerda do Guadiana. 2ª metade do IV aos inícios do II milénio AC (Alqueva 2013).

Vigne/Helmer 2007: J.-D. Vigne/D. Helmer, Was Milk a „Secondary Product" in the Old World Neolithisation Process? Its Role in the Domestication of Cattle, Sheep and Goats. Antropozoologica 42.2, 2007, 9–40.

Vis 2009: G.-J. Vis, Fluvial and Marine Sedimentation at a Passive Continental Margin. The Late Quaternary Tagus Depositional System (PhD-Thesis Vrije Universiteit Amsterdam 2009).

Vis et al. 2008: G.-J. Vis/C. Kasse/J. Vandenberghe, Late Pleistocene and Holocene Palaeogeography of the Lower Tagus Valley (Portugal). Effects of Relative Sea Level, Valley Morphology and Sediment Supply. Quaternary Science Reviews 27, 2008, 1682–1709.

ANTÓNIO CARLOS VALERA

The 'Exogenous' at Perdigões
Approaching Interaction in the Late 4th and 3rd Millennium BC in Southwest Iberia

Keywords: exogenous materials, exchange, interaction, Southwest Iberia, Perdigões, Late Prehistory

Acknowledgments

Our research is conducted in the context of the Global Program of Research of Perdigões (INARP), coordinated by NIA-ERA Arqueologia.

Abstract

This paper addresses the presence of exogenous raw materials and finished objects at Perdigões ditched enclosures (Évora, South Portugal) during the Late Neolithic and Chalcolithic (3400–2100 BC). A list of the actual available data on exogenous items (regarding sea and estuarine products, pottery, ivory, cinnabar, flint, quartz, gold, marble, limestone and variscite) and a provisional map of the exchange network spatial coverage that these materials suggest are displayed. Also a preliminary discussion of the social role played by these items at the site (taking in consideration their categories and context) is presented and the importance of exchange for the social practices that were taking place there is stressed. The question whether Perdigões represents an intermediary link in an inter-regional exchange network or a place of consumption of exotic goods related to squander social practices in the context of emulative interaction is raised. Further discussion of this is proposed as a line inquiry for a starting research project on mobility and exchange to be developed over the site.

1. Introduction

Interaction always assumed a relevant role in the explanation of social organisation and social change. The centrality of interaction in social theory is not a peculiar circumstance though since it is a variable present at the core of life. Aristotle stated in his Nicomachean Ethics that without exchange social life simply would not exist. Living socially is interacting and in fact, there is no physical life without exchange. Interaction is fundamental to the understanding of individual and social lives and therefore, was always an indispensable variable in the discourses about the development of Neolithic and Chalcolithic communities in Iberian Recent Prehistory.

During the late 4th and the 3rd mill. BC (at least until its last quarter) Southwest Iberian societies were engaged in a social trajectory of increasing complexity. This path can be characterised (and the order is random) by the intensification of a production system based mainly in households, growing social inequalities developed in the context middle-range societies of still segmentary social relations based on kinship or already developing a social organisation of transegalitarian type (Hayden 1995; Garrido Pena 2006; Díaz-del-Río 2008),[1] demographic growth, increment of semi-specialised work, technological developments

1 Different perspectives have been advocated by approaches that argue for social systems based on coercion, initial classist stratification and hierarchic territorial division of labour organised in a core/periphery system and with a political institutionalisation of pristine state level read in the archaeological record of Southwest Iberia (Nocete 2000; 2001; Cámara Serrano/Molina González 2006; Morán/Parreira 2003; 2009).

(namely copper metallurgy and weaving), an increase and diversification of manufactured productions, a greater elaboration of the ideological frame and related forms of display (traduced in an expansion of iconographic representations) and by an increment of regional and inter regional interaction, expanding old or generating new exchange networks.

However, as occurs with many other variables the approach to Prehistoric social interaction has limitations inherent to archaeological documentation being accessible only through the material remains of the relations between individuals and groups of individuals. Those materialities, such as artefacts, raw materials, contexts and spatial locations allow us to speak about the circulation of concrete objects and raw materials, but also of abstractions such as ideas, traditions, technologic knowledge, styles or aesthetics. In addition, during the last decades the available isotopic and DNA analytic technology permitted a more concrete approach to the mobility of animals and humans. Still, it is not easy to address the routes, forms, rules, agents, meanings and the social, economic and ideological roles assumed by exchange in prehistoric communities using those materials. In other words: the nature of interaction does not become evident by the simple fact that it is inherent to social life or because it is documented by the presence of its material remains. Approaching the social role played by exchange requires strong bodies of theory as has been formulated in recent years (Sahlins 1972; Renfrew 1975; 1986; Earle/Ericson 1977; Scarre/Healy 1983; Wasserman/Faust 1994; Earle 2002; Kering/Shennan 2015 stand as examples). Also a systematic use of modern analytic methods (namely archaeometric ones) and an adequate set of diversified sites with well-preserved contexts and with solid research programs.

In Southwest Iberia during the late 4th and the 3rd mill. BC the large ditched enclosures emerge as one type of place that concentrates evidence of large and middle scale exchange, becoming important contexts to approach its dynamics in the global social trajectory. Amongst the several known, Perdigões due to the nature of its contexts, heritage situation and programmed research, provides a good documental base for this enquiry. The site is located in the inland of Alentejo, in the Portuguese middle Guadiana basin (Reguengos de Monsaraz municipality, Évora district) where a significant concentration of ditched enclosures (and few walled enclosures) has been identified (Valera 2013a). It is a large set of ditched enclosures (*fig. 1*) with an intensive research activity during the last 18 years and with a long list of publications (for more general synthesis see Lago et al. 1998; Valera et al. 2000; 2007; Márquez Romero et al. 2011; Valera et al. 2014a; 2014b).[2] The topography of the site forms a natural theatre open to the east, to the valley of Ribeira do Álamo stream, where more than a hundred megalithic monuments are located. The topographical location, the gate orientations and the visual relation established with the valley and horizon are founded in astronomic grounds related to the sun annual cycle and to the construction of a local highly symbolic and codified landscape (Valera 2010). The set of enclosures presents a long chronology starting with the Late Neolithic (around 3400–3300 BC), developing through the Chalcolithic and reaching the end of the 3rd mill. BC. The area occupied since the Neolithic is superior to 10ha reaching at least 16ha at the end of the site's life. During this time span Perdigões was increasingly integrated in an exchange network that connected it to several peripheral regions in Iberia and to areas outside the peninsula. This makes it a privileged site to approach social interaction in the region, in particular the exchange of goods and people and animal mobility.

To deal with these issues a project was recently designed designated 'Mobility and Interaction in South Portugal Recent Prehistory: the Role of Aggregation Centres', for which this paper establishes a point of departure.[3] At the present stage of research, we have to narrow the amplitude of the debate about exchange at Perdigões and present a first set of exogenous materials together with the

2 For a complete list of publications see: <http://perdresearch.blogspot.pt/p/teste-1.html> (last access 09.03.2016).

3 This project is to be developed during 2016–2018, directed by the author and financed by the Portuguese Science Foundation (ICArEHB-Algarve University, Era Arqueologia and Hércules Laboratory-Évora University are participant institutions).

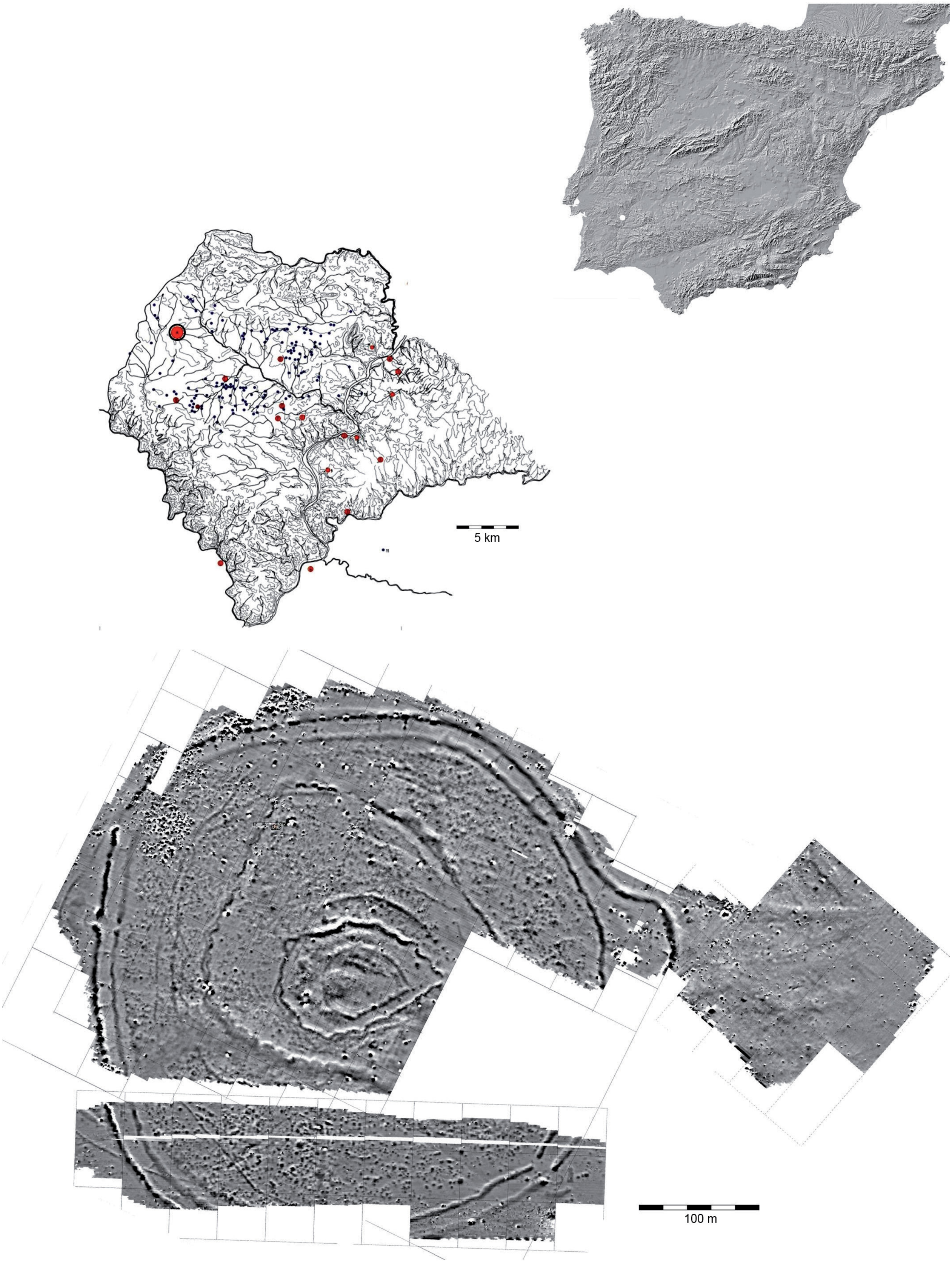

Fig. 1. Location of Perdigões in the Iberian Peninsula and in the valley of Ribeira do Álamo settlement and megalithic network. Magnetogram by Helmut Becker (Valera et al. 2014b).

nature of their contexts and the provisional spatial amplitude of the exchange network in which the site was integrated. This includes objects and raw materials mainly from funerary contexts, which indicate connections with the littoral, with the Portuguese Estremadura and the coast of Alentejo, with more northern areas of the inland Alentejo, with the Spanish Extremadura and more central areas of Iberia, with Central Andalusia and with North Africa, while the preliminary results of isotopic analyses of human remains are indicating a relevant percentage of outsiders.

2. The 'Exogenous' at Perdigões: Brief Synthesis of the Available Data

Determining what is exogenous in Perdigões (as in other sites) is not simple. Archaeology usually assumes as exogenous objects made out of locally unavailable raw materials. But it is also important to determine whether it is just the raw materials that circulate and production is local, whether the circulation of finished products occurs or both. On the other hand, objects made of locally available raw materials may also have an exogenous provenance, a situation more difficult to discriminate. We may use style or technological fingerprints to recognise them, but many may be simply impossible to identify as exogenous. Thus, when approaching the presence of exogenous materials at Perdigões we will use raw material and style as criteria and in addition also technological attributes for some categories of objects and register whether there is evidence of local production using non local raw materials. We must be aware that the range of imported objects is most probably larger than the one we are able to discriminate at the moment.

Based on these criteria, the actual list of items that indicate an exogenous provenance in Perdigões can be organised in eight main groups: sea and estuarine products, marble and limestone items, pottery, beads, cinnabar, flint, ivory, amber and 'others'. Nevertheless, it is important to take into consideration that many raw materials present at Perdigões, namely the ones used in the beads and other lithic assemblages, were not yet identified.

2.1. Sea and Estuarine Products (*fig. 2*)

Shells are the most frequent element that documents connections with the littoral areas, although always in relatively small numbers. In the first studied assemblage (from Chalcolithic Ditch 3 and Ditch 4 and some pits in Sector I of Perdigões 3) maritime and estuarine *taxa* were identified: scallop (*Pecten maximus*; *Pecten sp.*) with twelve remains, cockle (*Cerastoderma edule*) with one remain and clam (*Venerupis decussata*) with one remain (Coelho 2008). These same *taxa* have been found in several other contexts in Perdigões (still in study) with predominance of the *Pecten maximus*, three large limpet (*Patella candei*), two sea urchins (*Echinoidea sp.*) and several spotted cowrie shells (*Trivia monacha*) were recorded in funerary contexts (*tholoi* type tombs and pits with cremated remains). Apart from the shells there is a wing bone of a northern gannet (*Morus bassanus*), a marine bird that migrates from northern Europe passing through the Portuguese coast, recorded in the funerary contexts of Tomb 2 (Cabaço 2009).

The most probable area of provenance of these items is the Alentejo coast (for the sea molluscs) and the Tejo and Sado estuaries (for the *Cerastoderma edule* and *Venerupis decussate*), located 105 to 120km west/northwest of Perdigões. However, the size of the large *Patella candei* shells, measuring about 10cm, indicate the warmer southern waters of the North African Atlantic coast.

In general, the salt water molluscs do not seem to have had any role in diets in Perdigões. The focus was in the shells that were used as adornment or in practices of symbolic meaning, namely funerary ones. Two shells of *Cerastorderma edule* were perforated and transformed in pendants, while the *Echinoidea sp*. and the *Trivia monacha* shells were used as beads. It is interesting to notice that only the convex valve of the *Pecten maximus* is present, as it is usual in other inland Alentejo contexts and frequently in funerary assemblages, where also the *Patella candei* was recorded. They were probably used as small containers in ritual practices.

However, the possibility of rare and punctual consumption of some molluscs cannot be completely ruled out. Small amounts, for instance of clam or cockle, could be transported in pots with salt water and the salt itself could be another

Fig. 2. Sea and estuarine shells and bone of northern gannet (*Morus bassanus*) from Perdigões.

product to travel from littoral to more inland areas, although we still miss direct proof of its presence at Perdigões. The location of the site of Monte da Quinta 2 in the Sorraia river valley, where an area of salt production was detected (Valera et al. 2006), might support this hypothesis. There a specialised area of salt production using the *briquetage* method was recorded and, through the volumetric and quantitative study of the pottery, a production of 1293 litres was estimated just for the excavated accumulation of pottery sherds. This specialisation and amount of production indicates a production for export, namely to supply the more interior areas of north and central Alentejo easily connected to the left bank of the Flandrian Tagus estuary precisely by the Sorraia Valley.

2.2. Marble and Limestone Objects (*fig. 3*)

Contexts		Recipi-ents	*Betils*	Bracelets
Tholoi type tombs	Tomb 1	15	0	0
	Tomb 2	7	3	0
Deposi-tions of cremated remains	Pit 40	1	9	1
	Ambi-ence 1	0	5	0
Others	Pit 39	0	1	0
	Surface	1	3	0
Total		**24**	**21**	**1**

Tab. 1. Distribution of marble and lime items in Perdigões funerary contexts.

Marble and limestone artefacts are almost exclusively represented by small recipients and *betils*, the only exception might be what seems to be a fragment of a bracelet (*table 1*). With the exception of one *betil* from pit 39, three others collected at the surface and one recipient also from the surface, all the others were recorded in the funerary contexts of Tomb 1 and 2. The recipients are predominant in Tombs 1 and 2, while in the pits and area with depositions of cremated remains *betils* are predominant (see Valera et al. 2014b for a description of the referred funerary contexts).

A preliminary approach to the provenance of these items was conducted using Prompt Gamma Activation Analysis (Dias et al. 2017). A total of 14 artefacts (13 *betils* and one recipient) and eleven geological samples from three different regions (Tavira, Algarve; Estremoz-Borba-Vila Viçosa, Alentejo; Pêro Pinheiro-Moleanos, Estremadura) were analysed. The results show that seven of the analysed *betils* were made of marbles related to the Estremoz-Borba-Vila Viçosa area located some 30–40km north of Perdigões. The only analysed recipient (also the only analysed artefact from the *tholoi* type tombs) is made of limestone that is compatible with the geological samples of Estremadura, namely with the ones from Moleanos, located 160km northwest of Perdigões. The remaining five *betils* are from sources other than the sampled areas. Despite the initial stage of this research (that needs to extend the analysis to more artefacts and to geological samples of other areas and to include other methods), these preliminary results reveal different provenances with different distances for this kind of materials and suggest that they may have a diverse contextual account in the site. No evidence of local production was recorded so far.

2.3. Pottery: Style and Provenance Approaches (*fig. 4*)

Following the previous studies on this issue in the region (Cabral et al. 1988; Polvorinos et al. 2002; Odriozola 2006) a first archaeometric approach to pottery provenance of Pedigões was done comparing recipients from funerary contexts (Tomb 1 and Tomb 2) with others from interior areas of the enclosures and local weathered geological material samples (Dias et al. 2008). The results showed that, if the majority of the analysed recipients were made of clays derived from the weathered gabro-diorites where Perdigões is located, there is a specific group of pots (all from Tomb 1) made of clays from weathered schist situated at a minimum distance of 5km from the site. It should be kept in mind that Tomb 1 was used for secondary depositions, while the tomb detoriated and kept being used without reparations, suggesting a periodic use from outside people. The presence of this group of ceramics was interpreted as one more indicator of practices developed at Perdigões involving people, human remains and objects from surrounding territories. A second approach focused on Bell Beaker pottery (Odriozola et al. 2008) suggested that there might be exchange between Perdigões and Porto Torrão (Beja district), but also relations with the Spanish Extremadura region, namely with the large enclosures of San Blás and Pijotilla.

These relations with more interior areas of the Peninsula have also been stressed by stylistic analysis. The incised beaker pottery of the Portuguese middle Guadiana Basin presents patterns that may be related almost exclusively to the Ciempozuelos stylistic complex, while the incised beakers of

Fig. 3. Marble and limestone *betils* and recipients from Perdigões funerary contexts.

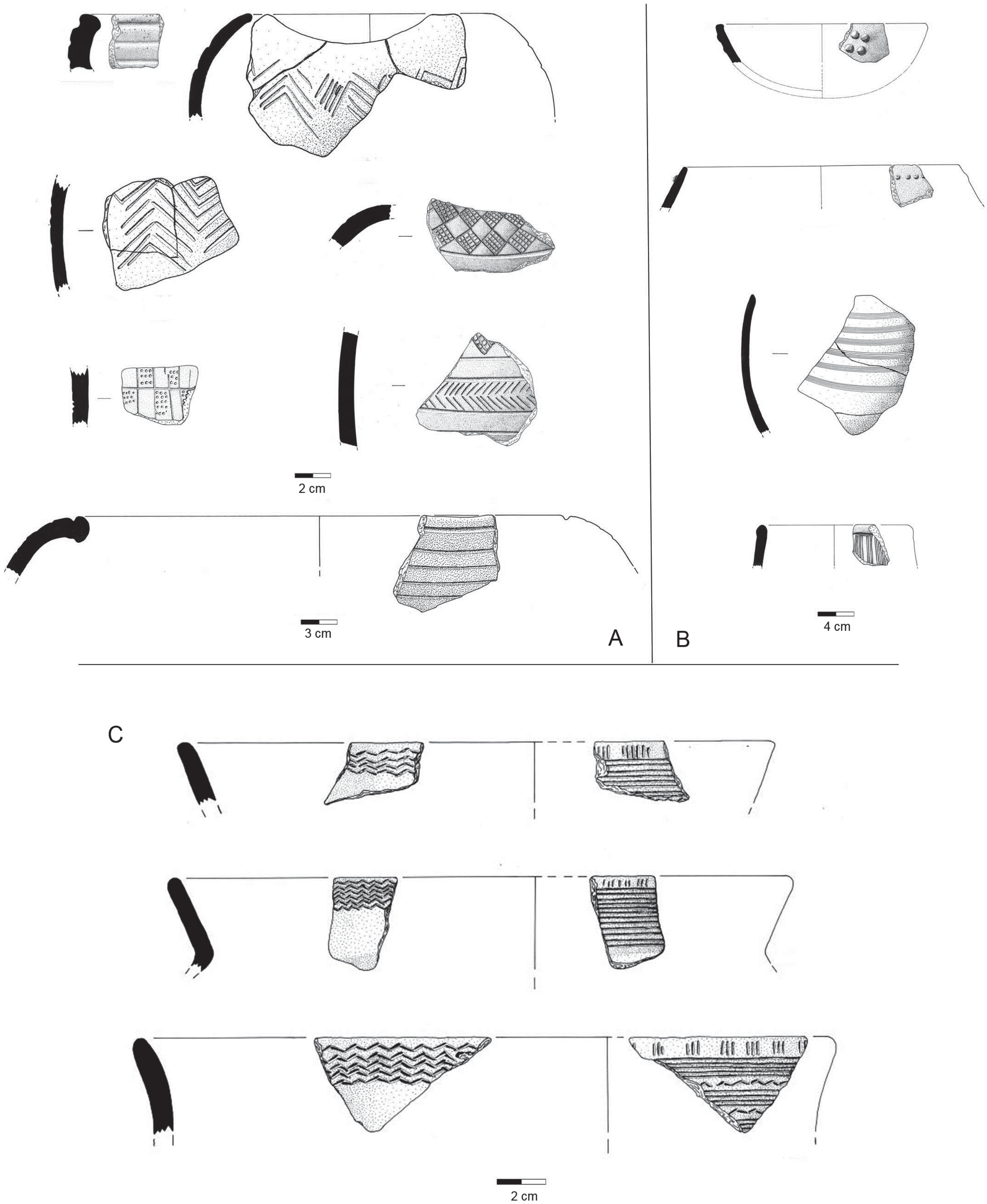

Fig. 4. Decorated pottery from Perdigões that indicates connections with peripheral areas: (A) Morphologies and decorations typical of Portuguese Estremadura; (B) Decorations typical of Tierra de Barros (Spanish Extremadura); (C) Ciempozuelos beaker patterns.

the Sado basin and Atlantic coast of Alentejo are predominantly associated to the Palmela stylistic complex (Valera/Rebuge 2011). The presence of some incised combed decorations and of ‘*pastilhas repuchadas*’ in Perdigões also indicates relations with the areas of the Tierra de Barros in Extremadura. Some large globular recipients with re-entrant rims and decorated with parallel deep incised lines, incised diamond shape motives, reticulated motives or horizontal bands of incised herringbones motives (Lago et al. 1998) are typical of the Lisbon Peninsula region, pointing to another direction.

2.4. Variscite and Muscovite Beads (*fig. 5A*)

Beads are present in great numbers in the funerary contexts of Perdigões and occasionally in other contexts (like ditches or pits). They are made of shell (as seen above) or in a variety of rocks and minerals. So far, only a part of the ‘green stone’ beads from the two excavated *tholoi* type tombs 1 and 2 were submitted to archaeometric study (Odriozola et al. 2010). Out of 42 analysed beads 38 are made of variscite and four are of muscovite (three of which are from the late reutilisation of Tomb 2). The results obtained for the variscite beads established Pico Centeno outcrops in Sierra Morena (Encinasola, Huelva) about 68km southeast of Perdigões as the source of that raw material. No presence of raw material and evidence of local production were detected so far, so the circulation seems to have been restricted to the finished products.

2.5. Cinnabar (*fig. 5B*)

Cinnabar is also present at the *tholoi* type tombs and together with ochre was used as powder spread over the human remains or in small nodules integrated in the deposits. Following previous studies on the circulation of cinnabar (Hunt Ortiz/Hurtado Pérez 2010; Hunt Ortiz et al. 2011; Rogerio-Candelera et al. 2013; Dias/Mirão 2013), a recent study (Emslie et al. 2015) showed that several individuals from both tombs were highly contaminated with mercury, a fact that was associated to the cultural use of cinnabar in life (dietary or digenetic contamination in the funerary context were completely ruled out). Hg isotopic compositions of two contaminated human remains match cinnabar values from the mine of Almaden (Ciudad Real) 240km east of Perdigões establishing that mine as the probable source for at least part of the cinnabar used in those tombs.

2.6. Flint/Silicified Materials (*fig. 6*)

Flint and other silicified materials are relatively rare at Perdigões outside the funerary contexts. There are some flint blade segments and arrow heads in pit or ditch features but they are better represented in the *tholoi* type Tombs 1 and 2, the surface deposits of Tomb 3 (particularly large blades) and the deposits of human cremated remains of pits 16 and 40 (arrowheads). Flint and silicified materials are absent in the local and regional geology so they were necessarily imported but the majority of these materials have not yet been studied regarding their raw material and eventual provenance areas. However, a first preliminary analytic approach to the funerary assemblages of large blades revealed that several were made out of oolithic silicified limestone. They correspond to long well-patterned blades knapped through uniform pressure (Mendonça/Carvalho 2016). There is a total absence of cores and knapping residues that could be related to the production of such materials, so they must have arrived as finished products. The long distance circulation of large blades during the Neolithic and Chalcolithic in Central-South Portugal is a well-documented fact (Zilhão 1994; Carvalho 1995; Uerpmann 1995). In South Iberia the flow of oolithic silicified blades has been studied (Nocete et al. 2005) showing a supra regional circulation of normalised finished products with origin in the lithologies of the Mid-Upper Jurassic of the Betic Mountains in Andalusia, where Perdigões also seems to be integrated.

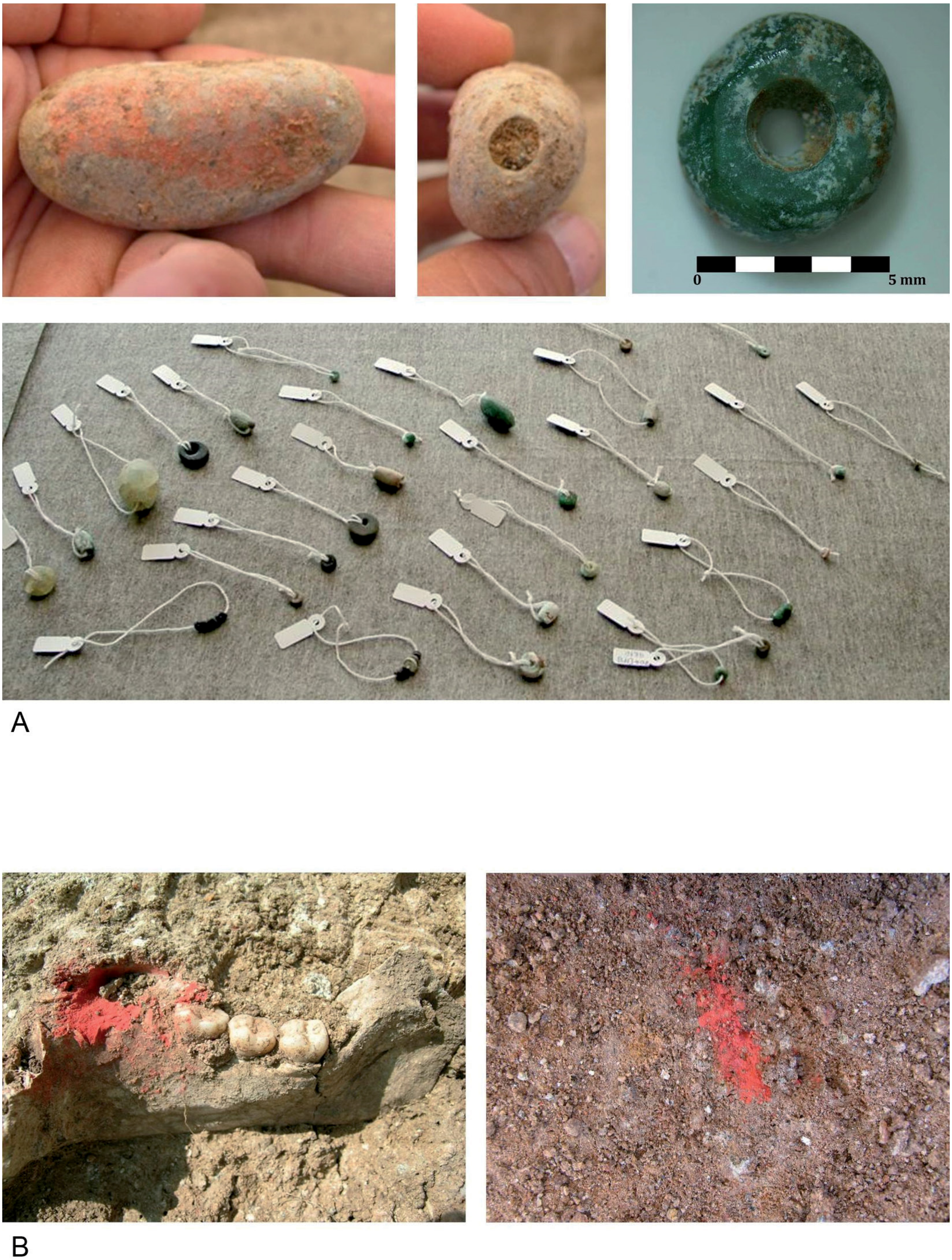

Fig. 5. (A) Variety of beads from Perdigões Tomb 1 and Tomb 2; (B) Cinnabar spread in the chambers of Tomb 2 and Tomb 1.

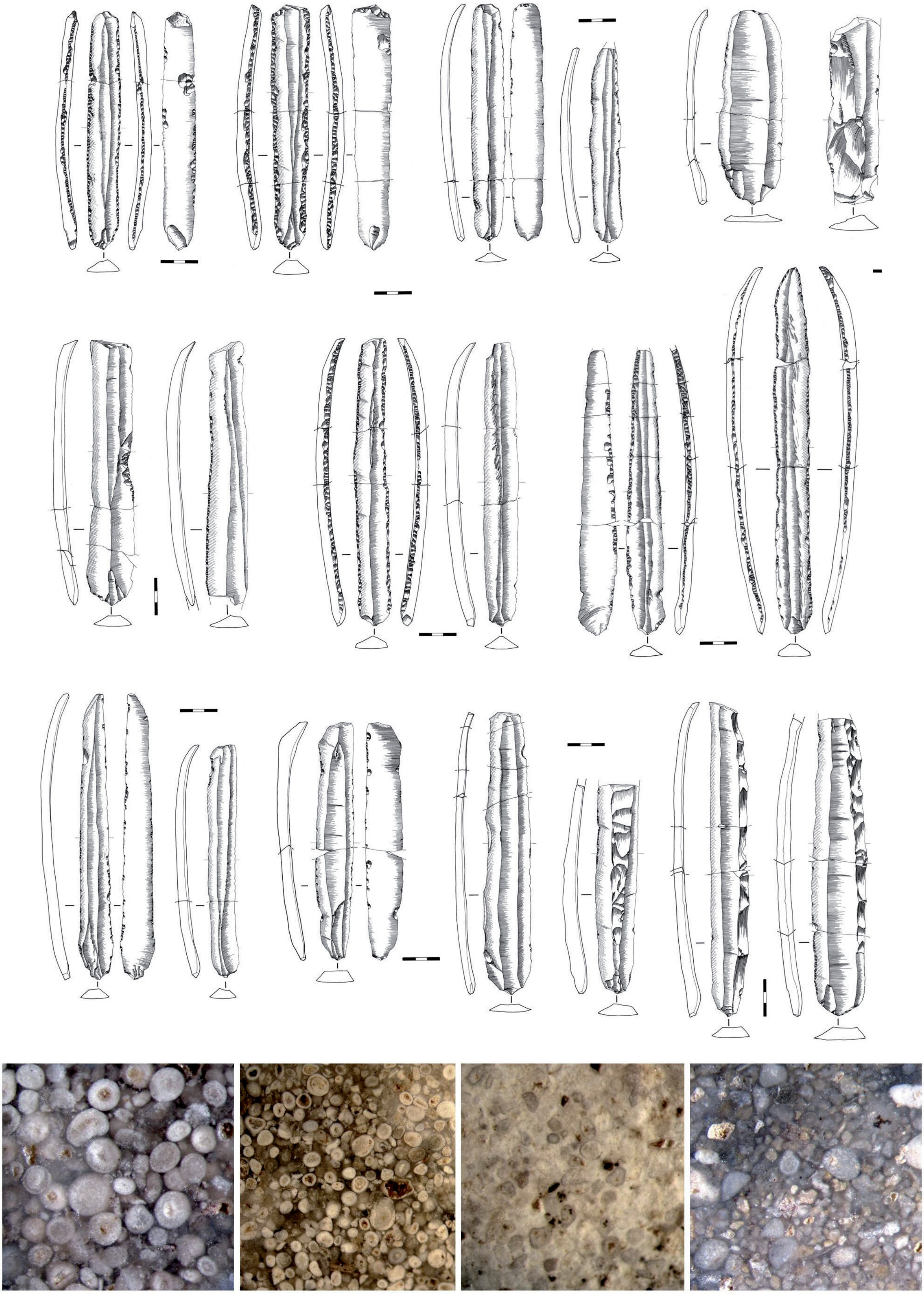

Fig. 6. Large blades from Tomb 3 and microscopic images of oolithic silicified blades from Tomb 1 and 3.

2.7. Ivory (*fig. 7*)

The studies of ivory circulation in Iberia have had a significant development in recent years (Schuhmacher/Cardoso 2007; Schuhmacher 2012; Liesau/Moreno 2012; García Sanjuán et al. 2013; Nocete et al. 2013) and a synthesis about the presence of ivory items in Perdigões was recently published (Valera et al. 2015). A total of 1348 records of ivory weighing 2,742kg were studied, the great majority small unclassified fragments. In terms of objects there is a significant variety: schematic and naturalistic anthropomorphic figurines, boxes, lunulae, zoomorphic figurines, combs, pins, decorated plaques, buttons, dagger hilts, staff, bracelets and the presence of raw materials (fragments of tusks) indicating also local production. This is also suggested by the production in ivory of a typical regional object: a staff. With the exception of a button (from Ditch 7) all studied ivory items were recorded in funerary contexts: 62 in Tomb 1, 755 in Tomb 2, ten in Pit 16, 223 in Pit 40 and 297 in Ambience 1. A small sample of items (only 16) from Tomb 1 and Tomb 2 was analysed (optical microscopy, isotope ratio mass spectroscopy of carbon and nitrogen, microcomputer-tomography and particle induced gamma-ray emission) and turned out to be from African savannah elephant (*Loxodonta africana africana*), possibly from the Atlantic North Africa.

2.8. 'Others': Quartz Crystal, Gold and Amber (*fig. 8*)

Other objects suggest exogenous origin to the local vicinity of Perdigões, although it is more difficult to propose possible areas of provenance. That is the case of a large quartz prismatic crystal from the chamber of Tomb 1 and the small gold foils from Tomb 2 (*fig. 8*). The gold items, that are also present in other south-western large ditch enclosures like Valencina de la Concepción (Murillo-Barroso et al. 2015), were made out of native pure gold, but the lack of a database for gold nuggets elemental compositions does not allow a determination of a specific origin for these objects (Soares et al. 2014). As for the prismatic crystal, the presence of this kind of items in Neolithic and Chalcolithic funerary contexts is relatively frequent in Galiza, Beira Alta, but they also appear in the Estremadura, Alentejo, the Algarve and western Andalusia (Leisner/Leisner 1959; Fábregas Valcarce 1983; Fábregas Valcarce/Rodríguez Rellán 2008; Valera 2007; Costa Camaré et al. 2011), usually with sizes smaller than 5cm. The exemplar from Perdigões though, measures 12cm, being one of the biggest known in Iberia in megalithic contexts only exceeded by the prismatic crystal from the Dolmen of Alberite. Due to its size it might have a distant exogenous origin (the study of the Alberite piece shows that the origin is not regional and may possibly be located in the areas of the Central System – Domínguez Bella/Morata Céspedes 1996, 199), although a regional origin in the area western of Évora is possible as well (Figueiredo 2011). Finally, two amber beads were collected at Tomb 1 (they are still being analyzed to determine their provenance).

3. Approaching the Role of Exogenous Materials at Perdigões

Things do not move for nothing, nor completely alone (Godelier 2000, 122, author 's translation)

3.1. Space, Routes and Circulation

The presented data shows that Perdigões was involved in a network of circulation of objects and raw materials that covered all the southwest quadrant of Iberia, some central areas of the peninsula and the western part of North Africa (*fig. 9*).

As referred to above, several elements document a relation with the Portuguese Estremadura, the western Atlantic coast and the estuaries of Sado and Tagus Rivers. This relation between the inland Alentejo and the Estremadura has been underlined for a long time, mainly in the context of circulation of amphibolite and sedimentary rock materials (Lillios 1997; Gonçalves 1989). In the opposite direction, relations with more interior and southern areas of Iberia seem to have developed through the middle Guadiana Basin and through the Sierra Morena Mountains connecting with the Guadalquivir Valley. In fact, Central Alentejo seems to have functioned as a main linking area between the

Fig. 7. Ivory items from Perdigões funerary contexts.

Fig. 8. (A) Prismatic quartz from Tomb 1 of Perdigões; (B) Gold foils from Tomb 2 of Perdigões.

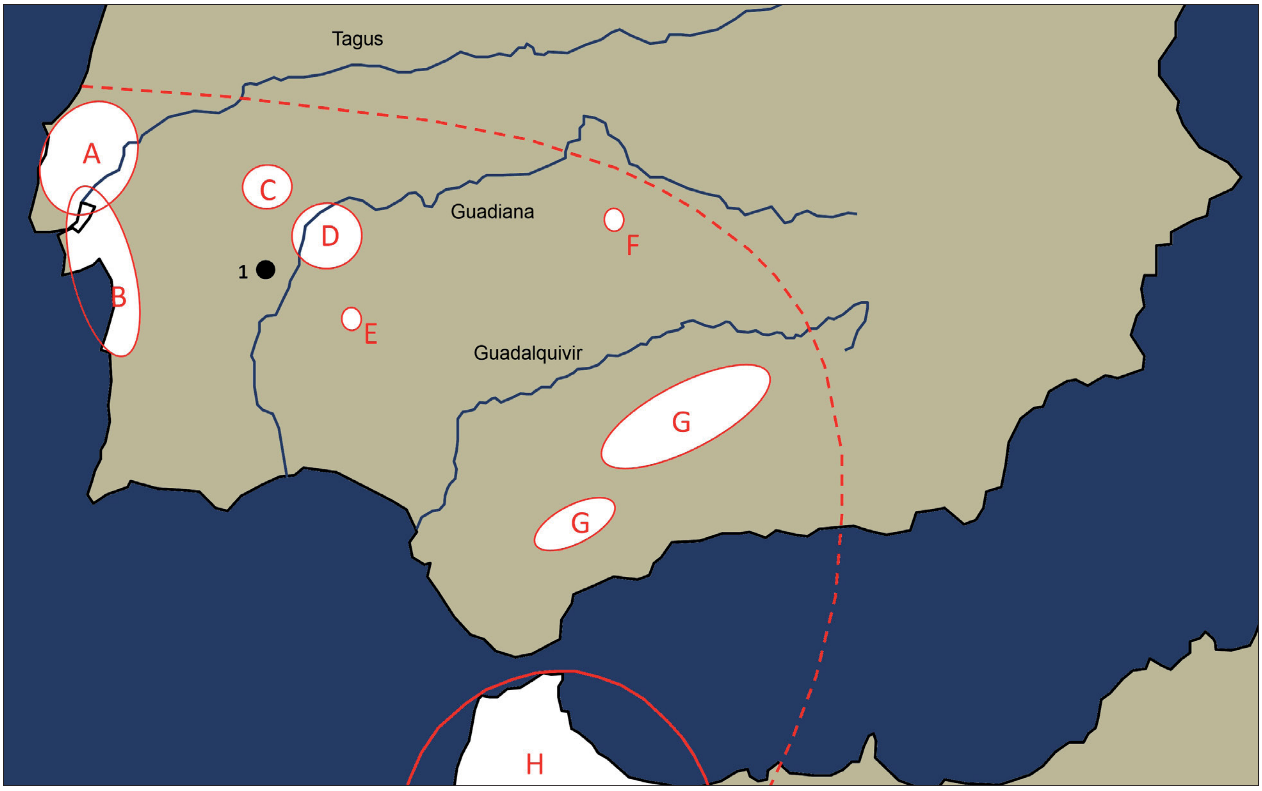

Fig. 9. Provisional coverage area of Perdigões exchange network: (A) Central Portuguese Estremadura; (B) Tagus and Sado estuaries and coast of Alentejo; C: Estremoz-Borba-Vila Viçosa area; (D) Tierra de Barros area; (E) Pico Centeno; (F) Almaden; (G) Jurassic silicified limestone outcrops of Betic Mountins; (H) western North Africa.

Portuguese Estremadura, the Spanish Extremadura and western Andalusia, a situation that could have been effective since Early Neolithic (Gonçalves 1989; Diniz 2007). The interaction between these regions seems to have increased during the late 4th and the 3rd mill. BC, probably following previously established traditional routes, developing a large scale exchange network that would abruptly collapse at the end of the 3rd mill. (Valera 2014; 2015). But how did this network operate and how did things flow through it? There is still a blurred image of how objects circulated. Namely whether there were regular routes directly connecting distant regions and aggregation centres, or whether the flow of objects was occurring mainly through a net of intermediary places based on neighbourhood relations, whether the circulation was operating over a vast hierarchical territory or over an area of middle range peer polities, whether the flow of goods was associated to substantial human mobility or was mainly related to processes of supplying large sedentary aggregation centres or whether things circulated as commodities (productions designed for exchange, see Appadurai 1986), tributes (Nocete 2001) or were integrated in social reciprocity mechanisms of a gift nature (Mauss 2008; Godelier 2000; Sahlins 1972). To approach these issues at sites like Perdigões we need to look into how the 'exogenous' is expressed there.

3.2. Questioning the 'Exogenous' at Perdigões

The moment when a project designed to study mobility and exchange at Perdigões is about to begin is hardly the ideal one to evaluate the role of the 'exogenous' at the site, still it seems reasonable to discuss some of the issues that will inform the inquiry that will orientate that research.

The number and variety of exogenous materials at Perdigões clearly document that the site was involved in a large network of contacts during its lifespan. And a first issue that immediately emerges is precisely the diachronic behaviour of the 'exogenous' at Perdigões. In fact, in these long-lasting places variables should be approached through a biographic perspective, for they have not a constant performance. In the case of Perdigões for the Late Neolithic phase (3400–2900 BC), although the site was already quite large (certainly more than 10ha), evidence of exchange is scarcer. The material culture in general reveals a high integration into the regional parameters in terms of raw materials and style, although some objects reflect an integration in a shared ideological sphere of a higher amplitude: the ceramic 'horn idols' (some decorated), the bone 'Almeriense Idols' or some schist decorated plaques. The items necessarily imported from non-local areas are restricted to some rare flint blades and some estuarine (*Cerastoderma edule*) and sea shells (*Pecten maximus* and *Trivia monacha*). A contrasting image is observable from the second quarter of the 3rd mill. BC, when the volume and diversity of exogenous items increases to reach a peak by the middle and third quarter of the millennium. The intensification of the 'exogenous' however, is related to a contextual particularity: the funerary contexts. In fact, with the exception of shells (namely *Pecten maximus*), some flint arrowheads, a limestone idol, a few ivory items and beads, all the above referred exogenous materials come from five funerary contexts: Tombs 1, 2 and 3 and Pits 16 and 40 with the depositions of cremated remains, all in all representing the remains of more than 400 individuals. So far, only two small pit graves were excavated at Perdigões belonging to the Late Neolithic phase (Valera et al. 2014b), corresponding to depositions of remains of three children and one adult female with only one shell (*Cerastoderma edule*) pendant associated. Since there is a tendency for the concentration of exotic materials in funerary contexts, the small number of excavated tombs from Late Neolithic Perdigões could explain in part the smaller numbers of exotic materials during this period. In fact, in recently excavated hypogea from the Late Neolithic in Alentejo, large normalised oolithic blades and ivory items were recorded in Sobreira de Cima (Valera 2013b). *Glyssimeris* bracelets were present at Outeiro Alto 2 (Valera et al. 2013) and oolithic blades were registered at the megalithic monument of Poço da Gateira (Nocete et al. 2005), showing the circulation of these exogenous items in the region in the middle and second half of the 4th mill. BC. Nevertheless, if we should expect a higher presence of exogenous materials in Late Neolithic Perdigões, if more funerary contexts of this period are found there, this will not challenge the idea that during the 3rd mill. there is a significant increase in amount and variety of imported materials at the site. But this diachronic tendency should be characterised and dated with more detail.

The increase in circulation of exotic materials in Southwest Iberia during the 3rd mill. BC has been associated with the development of social complexity, namely to a gradual increment of social inequality and social hierarchy. These factors are considered responsible for the increasing demand and consumption of exogenous valued raw materials and objects as forms of display to reinforce social status and related political power (Harrison/Gilman 1977; Jorge 1990; Nocete 2001; García Sanjuán et al. 2013). The tendency for these exotic materials to end up in funerary contexts, as it seems to happen at Perdigões, has also been noticed (Nocete et al. 2005; Costa Camaré et al. 2011) and interpreted as a way of transforming these contexts into forms of expressing social inequalities (Nocete et al. 2005). However, the situation detected in the Chalcolithic funerary contexts excavated so far at Perdigões allow alternative or complementary perspectives for the social role of exogenous items that should be further investigated.

Despite the fact that Tomb 1 and Tomb 2 in the eastern limits of Perdigões enclosures and the pits with the cremated remains in the central area of the enclosures have contemporaneous uses during the middle/third quarter of the 3rd mill. BC, it has recently been emphasised that they present different architectures, different treatments of the body and different material assemblages, which are nonetheless always rich in exotic items (Valera et al. 2015).

These funerary contexts are of a collective nature, resulting from secondary depositions and comprising individuals or parts of individuals completely diluted in a mass of bones where no sense of individuality or individual social rank can be recognied through any particular association to an assemblage of votive materials. Differentiation could only be established between the collectiveness of each tomb, but only regarding the architectures, body treatments and votive items, but not in their general 'value'.

In fact, in the pits with cremated remains pottery is always present in the form of small sherds unlike the complete pots found in the *tholoi* type tombs. In the pits arrowheads reveal different morphological typologies; knapped blades are missing, beads are made of different raw materials, copper awls are present, while in the *tholoi* type tombs copper items are extremely rare and ivory items show significant typological differences. The differences between assemblages are striking, but not in terms of wealth or quantity, and together with the other disparities (architecture, location and body treatment) suggest identity distinctions among groups exhibited through diverse ritual procedures.

Additionally, the exogenous materials are related to two different categories of objects in these assemblages. One relates to personal adornment and personal prestige, as in the case of bracelets, pins, combs, boxes, buttons or elements of daggers. Others, like the anthropomorphic and zoomorphic figurines, the small staff or the lunulae, refer to cosmologies and to the sacred or social order, being more related to ideas, roles or mythical characters than to concrete people. Therefore, if some exogenous items could directly address individual status, others could address ideological issues and associated social roles (Valera et al. 2015) and if they produced some sort of social differentiation it would be through those ideological referents. Thus, at Perdigões the exogenous items seem to respond to quite diverse social needs. They may have taken active parts in many practices performed in the site, but they mainly end up in contexts of a funerary nature. And if some personal items refer to the individual and could have contributed to enhance individual prestige, others seem to refer to ideologies, social roles and cosmologies, showing that the incorporation of exotic and distant raw materials was enacted in different dimensions of the compound social relations that were being forged in the enclosures. So, instead of assuming axiomatically the presence of exogenous materials as a simple reflection of social inequalities, this plurality must be present at the inquiry that is leading research.

Furthermore, the evaluation of these diversified social roles that exogenous materials may have assumed at Perdigões is also related to the problem of their value and to how they arrived at the site, a problem, which needs some previous theoretical clarifications.

4. Some Notes about Exchange and Value

The problem of exchange is tightly linked to the problem of value. The essentialist perspective of value (value as an intrinsically property of the thing) was questioned by Marx, that established value as something exterior determined by the quantity of social work needed for the production of the item, privileging the productive phase as the generator of value (see discussion in Appadurai 1986). This prevalence of production conditions in the generation of value is followed by the materialistic approaches to exchange in Iberia Late Prehistory. For the Guadalquivir Valley, it has been argued that the power of a dominant elite was resting not on the control of the circulation of goods but rather on the control of a labour force for resource exploitation and extraction of surplus (Nocete 2001; Nocete et al. 2005). Some decades earlier, Gilman argued in favour of a staple finance expanding system for the development of Millaran societies (assuming a similar model for the Portuguese Estremadura), considering that there was a 'relatively passive participation of the Millaran centers in the long-distance exchange networks of their time' (Gilman 1987, 28). It is underlined that there was not a generalised circulation of goods, but rather an exchange of a small number of products with roles related to social competition and that in the context of low technological development the increase of surplus to feed exchange can only be obtained through the coercive control of the labour force (Nocete 2001). The control of the means of production would be the only source of value of the exchange goods.

However, while defining commodities as products with use value for others, Marx himself enlarges the process of value generation, a path developed by others that put the focus on exchange as another source of economic value (Simmel 1978; Appadurai 1986; Kopytoff 1986). If production generates value so does exchange, circulation and consumption. This rupture with the strict focus on production in favour of the adoption of an approach to a global trajectory that considers production/exchange/distribution/consumption allows us to consider more complex mechanisms of value acquiring and more complex social lives for the exchanged items. Advocating for a biographical approach of things (Appadurai 1986; Kopytoff 1986) it is argued that a commodity (exchangeable good) is a situation (commodity-hood), a state in the biography of things, into which they can move in and out during their social lives. So there is no such thing as an essential commodity and an essential non commodity thing. Everything may assume the condition of exchangeable item and see its economic and symbolic value enhanced by entering in a local, regional or interregional interaction network regardless its production costs. Those conditions (the commodity candidacy of Appadurai 1986, 14) involve criteria that may be of symbolic, economic, social, moral or religious nature and they vary in time and space or in a same social historical context for regimes of value are not always a complete shared set of assumptions (Appdurai 1986, 15).

5. Back to Perdigões Exogenous' Items

The biographic approach to the generation of value leads us to the questions of 'what was the state of the exogenous items at Perdigões?' and 'was it the same for all them?'. In other words, were all the exogenous items known at Perdigões in a commodity-hood state? And were they all a result of exchange in a sense that they arrived at Perdigões as a result of a transaction (obtained through counterpart goods)?

Again, answering these questions is one of the goals of the new project that is about to begin for Perdigões. For the moment, we can only say that if there was something leaving Perdigões to exchange for these items we do not know what it was. Perdigões cannot be directly related to specific resources that could be a counterpart for such exchange and no areas of intensive and specialised production of goods for exchange were identified at the site so far. Animals could be an exchangeable resource, but some of them could very well also be 'exogenous' goods brought to be consumed there and the patterns of slaughter detected in some studied structures indicate the kill of very young animals (Costa 2013), which is more consistent with feasting and wealth exhibition than cattle subsistence management. On the other hand, the majority of exogenous materials at Perdigões can be classified in the category of 'prestige goods' and, in barter transactions, the spheres of exchange tend not to mix and are frequently hierarchic (Kopytoff 1986, 70 f.), so subsistence goods tend not to be used in the exchanges involving prestige goods. However, to what extent was cattle a subsistence or a prestige good?

In alternative, Perdigões could have played the role of a redistribution centre, especially if we take into consideration its geographical position between regions such as the Portuguese Estremadura, the Spanish Extremadura, the Lower Guadalquivir Valley and the Huelva and Algarve areas. In this hypothesis, what was exiting the site would be, in general terms, the same that was coming in, only in different directions. This redistribution role however, is not easy to empirically demonstrate and if it was effective it would only operate at higher scales of the network for the evidence for the local settlements shows that these exogenous items are always quite rare.

Yet, the fact that the majority of exogenous materials (even raw materials as the ivory tusks) are present in funerary contexts indicates that Perdigões was more than just an intermediary platform of circulation of goods. It might have been a place of consumption, where the absence of evident counterpart production suggests that we might be in presence of a place where wealth squandering social practices were performed in the context of social emulation and identity management strategies. In fact, the evaluation of the 'exogenous' in a site is not independent of the nature of the site and *vice versa*. Perdigões revealed a number of indicators – location, architectural designs, specific social practices, rarity of clear long lasting domestic structures (Valera et al. 2014b) – of a place for social interaction, where ritualised practices were performed. These involved significant collective work as a form of communal valorisation and important consumation of exogenous and exotic materials in collective funerary contexts, where no sense of individuality can be observed. Ongoing isotopic studies on human remains from Perdigões funerary contexts show that there was a significant presence of outsiders. The study of human teeth from Tombs 1 and 2 showed that, although they present profiles integrated in the Eurodont pattern (European population), they also present morphological frequencies that indicate genetic exchanges with African populations (Cunha 2015). These preliminary approaches to the populations of Perdigões during the 3rd mill. BC sustain the idea that the site may have been an important place for the convergence of people and materials with different provenances, and that some of the 'exogenous' objects present there may have come directly from more or less distant places, brought by foreigners and consumed in funerary practices involving local and foreign people. That is, they did not all arrive at Perdigões as commodities in transit in an exchange network, but rather as goods intended to be consumed in ritualised practices (that could have involved local exchange between groups, possibly closer to a reciprocity spirit than a profit oriented one) and deposited (buried) there. The value of these products would then result from a combination of several factors: the costs of production they originally represented, the value acquired during their life as commodities (exchangeable goods) before and after their arrival at the site, and the social role they were given to perform during their consuming phase in the funerary contexts. The latter taking them out of the exchange circuit of the living and introducing them into the circuits of the afterlife. We do not have access to all the biographic trajectories of these items, namely during the phase in which they circulate as commodities. We only have their contexts of final consumption and may identify with different degrees of accuracy the contexts of their origin and production. So, it is not easy to determine the value that might have been incorporated into them during circulation. But that does not mean that we should ignore it.

6. Final Remarks

During the last three decades interaction in general and more specifically exchange has been addressed in Iberian Late Prehistory through functionalist and materialist approaches in the context of the development of social complexity associated to the problem of increasing social inequality and, for some, the emergence of pristine forms of State. Though, reflexive analysis of the research process has underlined a certain 'inflation' of complexity (Gilman 1999; 2013; Chapman 2003), questioning the existence of clear social stratification and centralised political organisations (Díaz-del-Río 2006; Gilman 2013; García Sanjuán/Murrillo-Barroso 2013), while nonlinear historical trajectories are advocated, stressing the diversity of situations that can be observed all over the peninsula. Nevertheless, it is clear that at least since the last centuries of the 4th mill. and during almost the whole of the 3rd mill. BC there is evidence of a generalised increment of social complexity that reached higher levels in some Iberian regions, the Southwest being one of them. In that historical trajectory interaction played a central role, more central than some are prepared to accept, for it was through interaction that the social relations, their developments, resistances and achievements, were forged. In this perspective, exchange is not a by-product of production increase, demographic growth and social inequalities. It is at the heart of their processes of development, setting their parameters and making them possible.

The appreciation of this centrality is demonstrated in the recent increase of Iberian research on human mobility by isotopic analysis, of archaeometric studies of provenance of raw materials and objects, and of exchange networks. In a way, these studies represent the recognition of the need to generate new data in order to evaluate, contrast and question theories and institutionalised discourses. The large ditched enclosures are privileged contexts to develop this line of inquiry centred in the social roles of interaction and exchange in the historical trajectory generated by the Neolithic and Chalcolithic communities in Southwest Iberia. So hopefully, Perdigões will be able to produce important information for the ongoing debate on the development of social complexity in this region during the next few years.

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Bibliography

Appadurai 1986: A. Appadurai, Introduction. Commodities and the Politics of Value. In: A. Appadurai (ed.), The Social Life of Things. Commodities in Cultural Perspective (New York 1986) 3–63.

Cabaço 2009: N. Cabaço, Restos faunísticos em contexto funerário nos Perdigões, Reguengos de Monsaraz (Sepulcros 1 e 2) (Master Thesis Instituto Politécnico de Tomar 2009).

Cabral et al. 1988: J. M. P. Cabral/M. I. Prudêncio/M. A. Gouveia/J. Arnaud, Chemical and Mineralogical Characterization of Pre-Beaker and Beaker Pottery from Ferreira do Alentejo (Beja, Portugal). Proceedings of the 1988 Symposium of Archaeometry (Toronto 1988) 172–178.

Cámara Serrano/Molina González 2006: J. A. Cámara Serrano/F. Molina González, Selection of Data, Determinism and Scientific Relevance in Interpretations of Social Development in the Late Prehistory of the Iberian Southeast. In: P. Díaz-del-Río/L. García Sanjuán (eds.), Social Inequality in Iberian Late Prehistory. British Archaeological Reports. International Series 1525 (Oxford 2006) 32–49.

Carvalho 1995: A. F. Carvalho, O talhe da pedra e a transição Neolítico-Calcolítico no Centro e Sul de Portugal. Tecnologia e aspectos da organização da produção. Trabalhos de Arqueologia da EAM 3, 1995, 41–60.

Chapman 2003: R. W. Chapman, Archaeologies of Complexity (London 2003).

Coelho 2008: M. Coelho, A fauna malacológica proveniente do Sector I do recinto calcolítico dos Perdigões. Apontamentos de Arqueologia e Património 3, 2008, 35–40.

Costa 2013: C. M. C. Costa, Tafonomia em contexto pré-histórico. A zooarqueologia como recurso para a compreensão das „estruturas em negativo“ da Pré-História Recente (PhD-Thesis Universidade do Algarve 2013).

Costa Caramé et al. 2011: M. E. Costa Caramé/L. García Sanjuán/M. Murillo-Barroso/R. Parrilla Giráldez/D. W. Wheatley, Artefactos elaborados en rocas raras en los contextos funerarios del IV–II milenios cal ANE en el sur de España. Una revisión. Menga, Revista de Prehistoria de Andalucía, Monográfico 1, 2011, 253–293.

Cunha 2015: C. Cunha, Crossing the River. The Dental Morphology of Chalcolithic Populations in the Middle Guadiana (PhD-Thesis Coimbra 2015).

Dias/Mirão 2013: C. Dias/J. Mirão, Identificação de pigentos vermelhos recolhidos no hipogeu da Sobreira de Cima por microscopia de Raman e micrscopia electrónica de varrimento acoplada com espectroscopia de dispersão de energias de Raios-X (MEV-EDX). In: A. C. Valera (ed.), Sobreira de Cima. Necrópole de hipogeus do Neolítico (Vidigueira, Beja). ERA Monográfica 1, 2013, 101–108.

Dias et al. 2008: M. I. Dias/A. C. Valera/M. Lago/M. I. Prudêncio, Proveniência e tecnologia de produção de cerâmicas nos Perdigões. In: Actas do III Encontro de Arqueologia do SW (Aljustrel, 2006). Vipasca, Arqueologia e História 2.2 (Aljustrel 2008) 117–121.

Dias et al. 2017: M. I. Dias/Z. Kasztovszky/M. I. Prudêncio/A. C. Valera/B. Maróti/I. Harsányi/I. Kovács/Z. Szokefalvi-Nagy, X-ray and Neutron Based Non-Invasive Analysis of Pre-historical Stone Artefacts. A Contribution to Understand Mobility and Interaction Networks. Archaeological and Anthropological Sciences Journal 457, 2017, 1–15.

Díaz-del-Río 2006: P. Díaz-del-Río, An Appraisal of Social Inequalities in Central Iberia (c. 5300–1600 CAL BC). In: P. Díaz del Río/L. García Sanjuán (eds.), Social Inequality in Iberian Late Prehistory. British Archaeological Reports. International Series 1525 (Oxford 2006) 88–104.

Díaz-del-Río 2008: P. Díaz-del-Río, El contexto social de las agregaciones de población durante el Calcolítico peninsular. Era Arqueologia 8, 2008, 128–137.

Diniz 2007: M. Diniz, O sítio da Valada do Mato (Évora). Aspectos da neolitização no Interior/Sul de Portugal. Trabalhos de Arqueologia 48 (Lisboa 2007).

Domínguez Bella/Morata Céspedes 1996: S. Domínguez Bella/D. Morata Céspedes, Caracterización mineralógica y petrológicas de algunos objetos de ajuar y de los recubrimientos de las paredes y suelos de la cámara (materiales líticos y ocres). In: J. Ramos Muñoz/F. Giles Pacheco (eds.), El Dolmen de Alberite (Villamartín). Aportaciones a las Formas Económicas y Sociales de las Comunidades Neolíticas en el Noroeste de Cádiz (Cádiz 1996) 187–206.

Earle 2002: T. Earle, Bronze Age Economics. The Beginnings of Political Economies (Bouder 2002).

Earle/Ericson 1977: T. Earle/J. E. Ericson, Exchange Systems in Prehistory (New York 1977).

Emslie et al. 2015: S. D. Emslie/R. Brasso/W. P. Patterson/A. C. Valera/A. M. McKenzie/A.M. Silva/J. D. Gleason/J. D. Blum, Chronic Mercury Exposure in Late Neolithic/Chalcolithic Populations in Portugal from the Cultural Use of Cinnabar. Nature, Scientific Reports 5, 2015, 604–619.

Fábregas Valcarce 1983: R. Fábregas Valcarce, Los prismas de cuarzo en la cultura megalítica del Noroeste de la Península Ibérica. Brigantium 4, 1983, 7–12.

Fábregas Valcarce/Rodríguez Rellán 2008: R. Fábregas Valcarce/C. Rodríguez Rellán, Gestión del cuarzo y la pizarra en el Calcolítico peninsular. El santuario de El Pedroso (Trabazos de Aliste, Zamora). Trabajos de Prehistoria 65.1, 2008, 125–142.

Figueiredo 2011: M. O. Figueiredo, Quartzo de Pegmatitos Graníticos. Uma matéria prima para alta-tecnologia. Paper presented at the fórum CYTED-IBEROEKA, Valorização de Pegmatitos Litiníferos (Lisboa 2011). Unpublished presentation.

García Sanjuán/Murillo-Barroso 2013: L. García Sanjuán/M. Murillo-Barroso, Social Complexity in Copper Age Southern Iberia (ca. 3200–2200 Cal B.C.). Reviewing the ‘State’ Hypothesis at Valencina de la Concepción (Seville, Spain). In: M. Cruz Berrocal/L. García Sanjuán/A. Gilman (eds), The Prehistory of Iberia. Debating Early Social Stratification and the State (New York 2013) 119–140.

García Sanjuán et al. 2013: L. García Sanjuán/M. Luciáñez Triviño/T. X. Schuhmacher/D. Wheatley/A. Banerjee, Ivory Craftsmanship, Trade and Social Significance in the Southern Iberian Copper Age. The Evidence from the PP4-Montelirio Sector of Valencina de la Concepción (Seville, Spain). European Journal of Archaeology 16.4, 2013, 610–635.

Garrido Pena 2006: R. Garrido Pena, Transegalitarian Societies. An Ethnoarchaeological Model for the Analysis of Copper Age Bell Beaker Using Groups in Central Iberia. In: P. Díaz-del-Río/L. García Sanjuán (eds.), Social Inequality in Iberian Late Prehistory. British Archaeological Reports. International Series 1526 (Oxford 2006) 105–123.

Gilman 1987: A. Gilman, Unequal Development in Copper Age Iberia. In: E. M. Brumfiel/T. K. Earle (eds.), Specialization, Exchange, and Complex Societies (Cambridge 1987) 22–29.

Gilman 1999: A. Gilman, Veinte años de prehistoria funcionalista en el sureste de España. Boletín del Seminario de Estudios de Arte y Arqueología 65, 1999, 73–98.

Gilman 2013: A. Gilman, Were There States during Later Prehistory of Southern Iberia? In: M. Cruz Berrocal/L. García Sanjuán/A. Gilman (eds.), The Prehistory of Iberia. Debating Early Social Stratification and the State (Oxon 2013) 10–28.

Godelier 2000: M. Godelier, O enigma da dádiva, Edições 70 (Lisboa 2000).

Gonçalves 1989: V. S. Gonçalves, Megalitismo e metalurgia no alto Algarve oriental. Estudos e Memórias 2 (Lisboa 1989).

Harrison/Gilman 1977: R. Harrison/A. Gilman, Trade in the Second and Third Millennia BC between the Maghreb and Iberia. In: V. Markotic (ed.), Ancient Europe and the Mediterranean. Studies Presented in Honour of Hugh Hencken (Warminster 1977) 90–104.

Hayden 1995: B. Hayden, Pathways to Power. Principles for Creating Socioeconomic Inequalities. In: T. D. Price/G. M. Feinman (eds.), Foundations of Social Inequality (New York 1995) 15–86.

Jorge 1990: S. O. Jorge, Desenvolvimento da hierarquização social e da metalurgia. In: J. Serrão/A. H.Oliveira Marques (eds.), Nova História de Portugal. Portugal, das origens à romanização (Lisboa 1990) 163–212.

Hunt Ortiz et al. 2011: M. A. Hunt Ortiz/S. Consuerga Rodríguez/P. Díaz-Del-Río/V. Hurtado Pérez/I. Montero Ruiz, Neolithic and Calcolithic – VI to II Millennia BC – Use of Cinnabar (HgS) in the Iberian Peninsula: Analytical Identification and Lead Isotope Data for an Early Mineral Exploitation of the Almadén (Ciudad Real, Spain) Mining District. In: J. E. Ortiz/O. Puche/I. Rábano/L. F. Mazadiego (eds.), History of Research in Mineral Resources (Madrid 2011) 3–13.

Hunt Ortiz/Hurtado Pérez 2010: M. A. Hunt Ortiz/V. Hurtado Pérez, Pigmentos de sulfuro de mercurio e cinabrio e en contextos funerarios de época calcolítica en el sur de la Península Ibérica. Investigaciones sobre el uso, depósitos minerales explotados y redes de distribución a través de la caracterización composicional e isotópica. In: M. E. Sáiz Carrasco/R. López Romero/M. A. Cano Díaz Tendero/J. C. Calvo García (eds.), VIII Congreso Ibérico de Arqueometría, Actas (Teruel 2010) 123–131.

Kering/Shennan 2015: T. Kering/S. Shennan, Connecting Networks. Characterising Contact by Measuring Lithic Exchange in the European Neolithic (Oxford 2015).

Kopytoff 1986: I. Kopytoff, The Cultural Biography of Things. Commoditization as Process. In: A. Appadurai (ed.), The Social Life of Things. Commodities in Cultural Perspective (New York 1986) 65–91.

Lago et al. 1998: M. Lago/C. Duarte/A. Valera/J. Albergaria/F. Almeida/A. F. Carvalho, Povoado dos Perdigões (Reguengos de Monsaraz). Dados preliminares dos trabalhos arqueológicos realizados em 1997. Revista Portuguesa de Arqueologia 1.1, 1998, 45–152.

Leisner/Leisner 1959: G. Leisner/V. Leisner, Die Megalithgräber der Iberischen Halbinsel. Der Westen. Madrider Forschungen 1.2 (Berlin 1959).

Liesau/Moreno 2012: C. Liesau/E. Moreno, Marfiles campaniformes de Camino de las Yeseras (San Fernando de Henares, Madrid). In: A. Banerjee/J. A. López Padilla/T. X. Schuhmacher (eds.), Elfenbeinstudien. Marfil y elefantes en la Península Ibérica y el mediterráneo occidental. Iberia Arqueológica 16.1, 2012, 83–94.

Lillios 1997: K. Lillios, Amphibolite Tools of the Portuguese Copper Age (3000–2000 BC). Ageoarchaeological Approach to Prehistoric Economics and Symbolism. Geoarchaeology 12.2, 1997, 137–163.

Márquez Romero et al. 2011: J. E. Márquez Romero/A. C. Valera/H. Becker/V. Jiménez/J. Suàrez, El Complexo Arqueológico dos Perdigões (Reguengos de Monsaraz, Portugal). Prospecciones Geofísicas – Campaña 2008–09. Trabajos de Prehistoria 68.1, 2011, 175–186.

Mauss 2008: M. Mauss, Ensaio sobre a dádiva. Edições 70 (Lisboa 2008).

Mendonça/Carvalho 2016: M. Mendonça/A. F. Carvalho, A componente em pedra lascada dos monumentos funerários 1 e 2 do complexo arqueológico dos Perdigões (Reguengos de Monsaraz). Apontamentos de Arqueologia e Património 11, 2016, 33–45.

Morán/Parreira 2003: E. Morán/R. Parreira, O povoado calcolítico de Alcalar (Portimão) na paisagem cultural do Alvor no III milénio antes da nossa era. In: S. O. Jorge (ed.), Recintos murados da Pré-História Recente (Porto 2003) 305–327.

Morán/Parreira 2009: E. Morán/R. Parreira, La exhibición del poder en el megalitismo del Suroeste Peninsular. Três casos de estúdio en el extremo sur de Portugal. Cuadernos de Prehistoria y Arqueologia de la Universidad de Granada 19, 2009, 139–162.

Murillo-Barroso et al. 2015: M. Murillo-Barroso/M. Eleazar Costa Caramé/M. Díaz Guardamino Uribe/L. García Sanjuán/C. Mora Molina, A Reappraisal of Iberian Copper Age Goldwork. Craftmanship, Symbolism and Art in a Non-Funerary Gold Sheet from Valencina de la Concepción. Cambridge Archaeological Journal 25.3, 2015, 565–596.

Nocete 2001: F. Nocete, Tercer milenio A.N.E. Relaciones y contradicciones Centro/Periferia en el Valle del Guadalquivir (Barcelona 2001).

Nocete et al. 2005: F. Nocete/R. Sáez/J. M. Nieto/R. Cruz Auñón/R. Cabrero/E. Alex/M. R. Bayona, Circulation of Silicified Oolitic Limestone Blades in South-Iberia (Spain and Portugal) during the Third Millennium B.C. An Expression of a Core/Periphery Framework. Journal of Anthropological Archaeology 24.1, 2005, 62–81.

Nocete et al. 2013: F. Nocete/J. M. Vargas/T. X. Schuhmacher/A. Banerjee/W. Dindorf, The Ivory Workshop of Valencina de la Concepción (Seville, Spain) and the Identification of Ivory from Asian Elephant on the Iberian Peninsula in the First Half of the 3rd Millennium BC. Journal of Archaeological Science 40, 2013, 1579–1592. doi: 10.1016/j.jas.2012.10.028.

Odriozola 2006: C. Odriozola, Pottery Production during the Late Iberian Chalcolithic Period. Insights from the Mineralogical and Chemical Analysis of Spanish Middle Guadiana River Basin (Badajoz, Spain) Bell Beaker Pottery. Proceedings of the XV UISPP World Congress (Lisbon 2006).

Odriozola et al. 2008: C. P. Odriozola/V. Hurtado Pérez/M. I. Dias/A. C. Valera, Produção e consumo de campaniformes no vale do Guadiana. Uma perspectiva ibérica. Apontamentos de Arqueologia e Património 3, 2008, 45–52.

Odriozola et al. 2010: C. P. Odriozola/J. A. Linares Catela/V. Hurtado Pérez, Green Beads Provenance Analysis. Apontamentos de Arqueologia e Património 6, 2010, 47–51.

Polvorinos et al. 2002: A. Polvorinos/M. J. Hernández/V. Hurtado Pérez/J. Almarza, Arqueometria de cerámicas de la tumba 3 del yacimiento Calcolitico de la Pijotilla (Badajoz). In: IV Congreso Nacional de Arqueometria. Valencia, del 15 al 17 de octubre 2001 (Valencia 2002) 106–118.

Renfrew 1975: C. Renfrew, Trade as Action at a Distance. Questions of Interaction and Communication. In: J. A. Sabloff/C. C. Lamberg Karlovsky (eds.), Ancient Civilization and Trade (Albuquerque 1975) 3–39.

Renfrew 1986: C. Renfrew, Peer Polity Interaction and Socio-Political Change. In: C. Renfrew/J. F. Cherry (eds.), Peer Polity Interaction and Socio-Political Change (Cambridge 1986) 1–18.

Rogerio-Candelera et al. 2013: M. A. Rogerio-Candelera/L. K. Herrera/A. Z. Miller/L. G. Sanjuán/C. M. Molina/D. W. Wheatley/A. Justo/C. Saiz Jimenez, Allochthonous Red Pigments Used in Burial Practices at the Copper Age Site of Valencina de la Concepción (Sevilla, Spain). Characterisation and Social Dimension. Journal of Archaeological Science 40, 2013, 279–290.

Sahlins 1972: M. D. Sahlins, Stone Age Economics (Chicago 1972).

Scarre/Healy 1983: C. Scarre/F. Healy, Trade and Exchange in Prehistoric Europe. Oxbow Monograph 33 (Oxford 1983).

Schuhmacher 2012: T. X. Schuhmacher, Die Elfenbeinobjekte des Chalkolithikums und der Frühen Bronzezeit auf der Iberischen Halbinsel, Interdisziplinäre Studien zu Herkunft, Austausch, Verarbeitung und sozialer Bedeutung von Elfenbein. Iberia Archaeologica 16.2 (Darmstadt 2012).

Schuhmacher/Cardoso 2007: T. X. Schuhmacher/J. L. Cardoso 2007, Ivory Objects from the Chalcolithic Fortification of Leceia (Oeiras). Estudos Arqueológicos de Oeiras 15, 2007, 95–118.

Simmel 1978: G. Simmel, The Philosophy of Money (London 1978).

Soares et al. 2014: A. M. Soares/L. C. Alves/J. C. Frade/P. Valério/M. F. Araújo/A. Candeias/R. J. C. Silva/A. C. Valera, Bell Beaker Gold Foils from Perdigões (Southern Portugal). Manufacture and Use. Proceedings of the 39th International Symposium for Archaeometry (Leuven 2012) 120–124.

Uerpmann 1995: M. Uerpmann, A indústria de pedra lascada do Zambujal. Alguns resultados, Origens, Estruturas e Relações das Culturas Calcolíticas da Península Ibérica (Lisboa 1995) 37–43.

Valera 2007: A. C. Valera, Dinâmicas locais de identidade. Estruturação de um espaço de tradição no 3º milénio AC (Fornos de Algodres, Guarda) (Braga 2007).

Valera 2010: A. C. Valera, Mapping the Cosmos. A Cognitive Approach to Iberian Prehistoric Enclosures. In: A. C. Valera/L. Evangelista (eds.), The Idea of Enclosure in Recent Iberian Prehistory. British Archaeological Reports. International Series 2124 (Oxford 2010) 99–108.

Valera 2013a: A. C.Valera, Recintos de fossos da Pré-História Recente em Portugal. Investigação, discursos, salvaguarda e divulgação. Almadan, Segunda Série 18, 2013, 93–110.

Valera 2013b: A. C. Valera, Sobreira de Cima. Necrópole de hipogeus do Neolítico (Vidigueira, Beja). ERA Monográfica 1 (Lisboa 2013).

Valera 2014: A. C. Valera, Continuidades e descontinuidades entre o 3º e a primeira metade do 2º milénio a.n.e. no Sul de Portugal. Alguns apontamentos em tempos de acelerada mudança. In: A Idade do Bronze em Portugal. Os dados e os problemas (Actas da Mesa Redonda, Abrantes). Antrope, Série Monográfica 1 (Tomar 2014) 297–316.

Valera 2015: A. C. Valera, Social Change in the Late 3rd Millennium BC in Portugal. The Twilight of Enclosures. In: H. Meller/R. Risch/R. Jung/H. W. Arz (eds.), 2200 BC. Ein Klimasturz als Ursache für den Zerfall der Alten Welt? 2200 BC. A Climatic Breakdown as a Cause for the Collapse of the Old World? 7. Mitteldeutscher Archäologentag vom 23. bis 26. Oktober 2014 in Halle (Saale). 7th Archaeological Conference of Central Germany October 23–26, 2013 in Halle (Saale). Tagungen des Landesmuseums für Vorgeschichte Halle 13.1/2 (Halle/Saale 2015) 409–428.

Valera et al. 2000: A. C. Valera/M. Lago/C. Duarte/L. Evangelista, Ambientes funerários no complexo arqueológico dos Perdigões. Uma análise preliminar no contexto das práticas funerárias calcolíticas no Alentejo. ERA Aqueologia 2, 2000, 84–105.

Valera et al. 2006: A. C. Valera/J. P. Tereso/J. Rebuge, O Monte da Quinta 2 (Benavente) e a produção no Neolítico Final/Calcolítico do estuário do Tejo. Actas do IV congresso de Arqueologia Peninsular (Braga 2006) 291–305.

Valera et al. 2007: A. C. Valera/M. Lago/C. Duarte/M. I. Dias/M. I. Prudêncio, Investigação no complexo arqueológico dos Perdigões. Ponto da situação de dados e problemas, Actas do 4º Congresso de Arqueologia Peninsular (Braga 2007) 53–66.

Valera et. al. 2013: A. C. Valera/V. Filipe/N. Cabaço, O recinto de fosso do Outeiro Alto 2 (Brinches, Serpa). Apontamentos de Arqueologia e Património 9, 2013, 21–35.

Valera et al. 2014a: A. C. Valera/A. M. Silva/J. E. Márquez Romero, The Temporality of Perdigões Enclosures. Absolute Chronology of the Structures and Social Practices. Revista de Prehistoria y Arqueología de la Universidad de Sevilla 23, 2014, 11–26.

Valera et al. 2014b: A. C. Valera/A. M. Silva/C. Cunha/L. Evangelista, Funerary Practices and Body Manipulations at Neolithic and Chalcolithic Perdigões Ditched Enclosures (South Portugal). In: A. C. Valera (ed.), Recent Prehistoric Enclosures and Funerary Practices. British Archaeological Reports International Series 2676 (Oxford 2014) 37–57.

Valera et al. 2015: A. C. Valera/T. X. Schuhmacher/A. Banerjee, Ivory in the Chalcolithic Enclosure of Perdigões (South Portugal). The Social Role of an Exotic Raw Material. World Archaeology 47.3, 2015, 390–413.

Valera/Rebuge 2011: A. C. Valera/J. Rebuge, O Campaniforme no Alentejo. Contextos e circulação. Um breve balanço. Arqueologia do norte alentejano. Comunicações das 3as Jornadas, Câmara Municipal de Fronteira 2001, 111–121.

Wasserman/Faust 1994: S. Wasserman/K. Faust, Social Network Analysis. Methods and Applications (Cambridge 1994).

Zilhão 1994: J. Zilhão, A oficina de talhe neo-calcolítica de Casas de Baixo (Caxarias, Vila Nova de Ourém). Trabalhos de Arqueologia da EAM 2, 1994, 35–45.

ELENA MORÁN, RUI PARREIRA AND HELMUT BECKER

Alcalar and the Management of the Resources of Its Territorial Environment in the 3rd Millennium BCE

Keywords: Alcalar, Algarve, abiotic resources, plant resources, animal resources

Abstract

The results of the excavations, geophysical surveys, bioanthropological studies, studies of faunas and plants and radiocarbon dates of the various contexts, allowed to propose a model for the organisation of the Alcalar settlement, situated in the extreme south of Portugal, which from 2800 BCE was established as a large population agglomerate, with the functions of a power centre. The geographical diversity of the Alcalar territory, the maritime routes and land crossings provided access to a wide variety of resources to its inhabitants. The presence of exogenous materials and artefacts, although poorly represented, confirms the existence of exchange networks, mainly with Alentejo and Andalusia, but without discarding routes to Atlantic Europe and the Mediterranean.

1. History of Research

The territorial environment of the settlement of Alcalar (Algarve, Portugal), a site internationally known especially from the work of Estácio da Veiga (Veiga 1886; 1887; 1889) and the Leisners' megalithic corpus (Leisner/Leisner 1943; 1956, 25; 1959), was studied since the late 19th cent. until present times (see Morán/Parreira 2008; Morán 2001b; Morán 2014). The concentration of megalithic funerary buildings, the size of the barrows, the uniqueness of the objects recovered in the graves (especially objects manufactured in copper, decorated gold sheets, large oolitic limestone blades, large flint points of 'alcalarense' type, limestone mortars, etc.) and the recognition of correlated duelling areas led different authors to question the origin and meaning of that evidence (see Morán 2014).

In the late 1980s, when programming the research and enhancement of the tomb Alc7 in the eastern cluster of the Alcalar megalithic necropolis, Rui Parreira attributed an outstanding role to the Chalcolithic settlement of Alcalar, which because of its geographical position, would have been the 'central place' of a territory bounded by the Monchique Mountains and the Bay of Lagos (Parreira 1993; Parreira/Serpa 1995) (see *fig. 1*).

The archaeological work carried out in Alcalar focused initially (1987–1996) on the diagnosis of the construction processes and modes of use of the megalithic monuments. Excavations were carried in the eastern cluster of the megalithic necropolis (owned by the Portuguese State) to conserve and restore monuments Alc7 and Alc9. The necropolis of rock cut graves of Monte Canelas was also targeted for intervention, this resulting from an archaeological rescue. Since 1997, the research carried out in Alcalar focused on the entire settlement, taking into account the results of the geophysical surveys with caesium magnetometer.

It was Helmut Becker who, since the 1990s, developed the use of this method of geophysical prospecting in Atlantic-Mediterranean Chalcolithic contexts of the Iberian Peninsula. High sensitive prospection had been based on the complete reduction of the natural and technical temporal

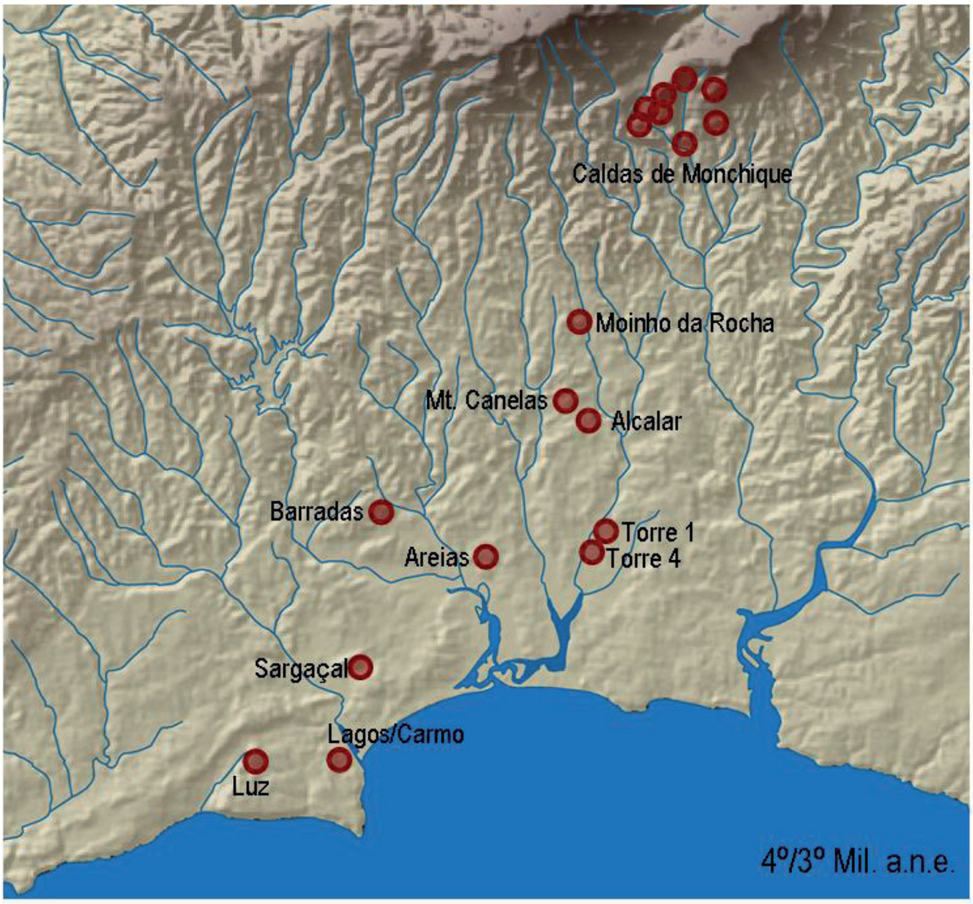

Fig. 1. Sites of the late 4th and 3rd mill. BCE in the territory of Alcalar (after: Morán 2014, 290).

geomagnetic variations (micropulsations, diurnal variation, powerlines, etc.) by measuring the difference between two sensors in vertical gradio- or variometer mode. However, first tests with the CS2/MEP720 Picotesla system in 1995 by Helmut Becker have shown that the two sensors could be arranged horizontally, in the so-called duo-sensor configuration mounted on a man-carried staff, measuring the total intensity of the geomagnetic field at two parallel tracks at same height above ground (typically 0,3m). The survey time in the field was reduced to half: a 20m grid in 0,5/0,1m raster could be measured in less than 10 minutes, a hectare in the same raster (200.000 samples) in 4 to 6 hours. The keys to this technique were given in several papers (Becker 1999a; 2009; 2013; Becker/Fassbinder 2001).[1] In Iberia, this technique was first used in the aim of a research project directed by Philine Kalb and Martin Höck in the Monfurado/Vale de Rodrigo area (Becker 1997; 1999b; Kalb/Höck 1997; Kalb 2003), where a modified caesium magnetometer SMARTMAG SM4G-Special (provided on request by the manufacturer Scintrex for archaeological prospection) was extensively and successfully tested in the duo-sensor configuration on the chalcolithic site of Monte da Ponte (Becker 1999a, 103; 1999b).

Since 1996, the same method was also tested and continued within our Alcalar project (Morán 2014). And it was then applied in the survey of the site of Perdigões and its set of ditched enclosures (Márquez Romero et al. 2011; Valera et al. 2014) and was systematically used for the project 'Geophysics and Archaeo-astronomy of Prehistoric Ditched Enclosures',[2] an extensive survey of prehistoric enclosures in South Portugal (see Valera/Becker 2011).

In our investigations in the settlement of Alcalar, the interpretation of magnetograms obtained with the duo-sensor configuration by Helmut

1 See <http://becker-prospection.com/tech.html> (last access 15/06/2017).

2 See <http://portugueseenclosures.blogspot.com> (last access 15/06/2017).

Becker from 1996 was contrasted by archaeological excavation. In addition, excavations continued in the eastern cluster of the megalithic necropolis (monuments Alc7 and Alc9) and in the rock cut grave necropolis of Monte Canelas.

The results of the excavations, geophysical surveys, the bioanthropological studies, studies of fauna and plants and radiocarbon dates of the various contexts, allowed to propose a model for the organisation of the settlement and a periodisation for the Alcalar settlement area, which from 2800 BCE onward established itself as a large population agglomerate with the functions of a power centre (Morán 2001b; 2014).

2. The Settlement of Alcalar in the 3rd Millennium and its Territorial Environment

The prehistoric settlement of Alcalar is located in the interfluve of the Farelo and Torre Rivers, whose final sections set, along with the streams of Arão and Odiáxere, a lagoon area known as Ria de Alvor. This territorial environment is bordered on the south by the Bay of Lagos, which extends between the capes of Ponta da Piedade and Ponta do Altar. To the north, its natural limits are the Monchique Mountains – which separate it from the Alentejo – and to the west the mountains of Espinhaço de Cão – which separate it from the Cape (São Vicente) lands and the Vincentine Coast. To the east this territory is bounded by the courses of the Arade River and its tributary stream Ribeira de Boina.

Between the mountains and the sea, furrowed from north to south by several streams, the Alcalar territory is like a natural amphitheatre that descends from the heights of Foia and Picota, where the reliefs almost reach the 1000m, through the Barrocal to the coastal zone of Algarve with its white sand beaches. The geographic diversity and the variety of resources that is implicit cannot alone justify the intense occupation of this territory in the 3rd mill. BCE, since it is necessary to look at their objective conditions from 6500 BP, corresponding to the maximum of the Flandrian transgression, to understand how the various communities had access to natural resources, and organised themselves to produce and reproduce socially.

As a result of investigations carried out within our research project, we gathered evidence of a historical process of economic and social transformation that traces back to the 3rd mill. BCE the pristine state formation in the extreme southwest of the Atlantic-Mediterranean Iberian arc (Morán 2001b). Considering the spatial analysis and stratigraphy of the prehistoric settlement of Alcalar and the different clusters of its megalithic necropolis, as well as the 23 absolute datings carried out, Morán proposed a timeline for the occupation of the Alcalar settlement and its surroundings territory (Morán 2014).

Under this proposal, **Period I** shows the first archaeological evidence of human occupation in the territory after the stabilisation of the Flandrian transgression, although going back into the 5th mill. BCE, with occupation horizons, some of them associated with menhirs, which are attributed to Neolithic gatherer communities who practiced a cereal agriculture (Morán 2008, 141). **Period II**, which runs from the second half of the 5th to the middle of the 4th mill. BCE, is barely recognisable in this territory. But **Period III** corresponds to the occupations of the second half of the 4th mill. BCE, as evidenced by the rock cut tombs necropolis of Monte Canelas (Morán/Parreira 2007, 77–87; Parreira 2010; Silva/Parreira 2010) and Torre 1 (de Sá 1904), the monument Alc1 of the Alcalar necropolis, and several settlements that line the banks of the old lagoon, as indicated since da Veiga's work in the area (Morán 2001a; Morán/Parreira 2004, 24). From all these empirical data we can infer that in the second half of the 4th mill. BCE and reaching the beginnings of the 3rd, an occupation of the territory was consolidated that led to differentiated dwelling spaces and diverse funerary architectures.

In **Period IV**, from 2800 BCE onward, the settlement of Alcalar was established as a large agglomeration of buildings. In its immediate surroundings, monumental graves with ceremonial related areas clustered on the hills bordering the dwelling area from the north. This settlement complex, with its dwelling and ceremonial areas, constituted in the 3rd mill. the power-centre of the surrounding territory of the Bay of Lagos (Morán 2001b; 2008, 141; 2014). Alcalar was therefore consolidated as a settlement with about 25ha, lavishly built, with houses with smashed mud walls and branches,

Fig. 2. The Chalcolithic settlement of Alcalar and its immediate surrounding area in the 3rd mill. BCE: dwelling areas (irregular polygons), barrows (circles), rock cut graves (diamonds) and natural caves (squares). Base map: CM de Portimão (after: Morán 2014, 53).

with centralised plan and central fire, and with fences defining functional areas, indicating a previous project adapted to the local topography. The profusion of cereal-pits in the habitat of the central area, the more or less concentric system of fences which protected it, and the sophistication of the access to the interior of the enclosures (see *fig. 3*), allows us to consider that there was a planning of a huge area for the storage of cereals, dried vegetables and other goods. In the immediate surroundings, different peripheral dwelling spaces were established (Morán 2014), like Poio, Mosqueiro, Amoreira and Casarão das Freiras. Other funerary areas are documented, such as, to the south, the tomb Poio 1 and the natural cave Poio 2, to the east the Monte Velho megalithic tombs and to the west, on the hill of the Serro do Algarve, the natural cave of Algueirão da Mulher Morta. Meanwhile, to the north the rock cut grave I of Monte Canelas was reoccupied, and throughout the country settlements attributable to this **Period IV**, as Barradas, near Arão (Silva/da Silva 2005), and Torre 4 (Marques et al. 2008) are recognised (see *fig. 2*).

In **Period V**, the transition from the 3rd to the 2nd mill. BCE, the absence of public works confirmed the dissolution of the centre of power and the emergence of small, self-sufficient settlements. In Alcalar elongated houses are now built on the former storage area, while the system of fences is no longer functional. The dwellings are now concentrated in the upper part of the settlement that additionally has a funerary function, as evidenced by pit burials near the houses.

3. The Use of Local Biotic Resources

The paleoethnobotanical studies on seeds and grains collected from the flotation of sediments from the pits of the Alcalar settlement and the studies of fauna from sediments that filled the excavated structures have shown that economy was

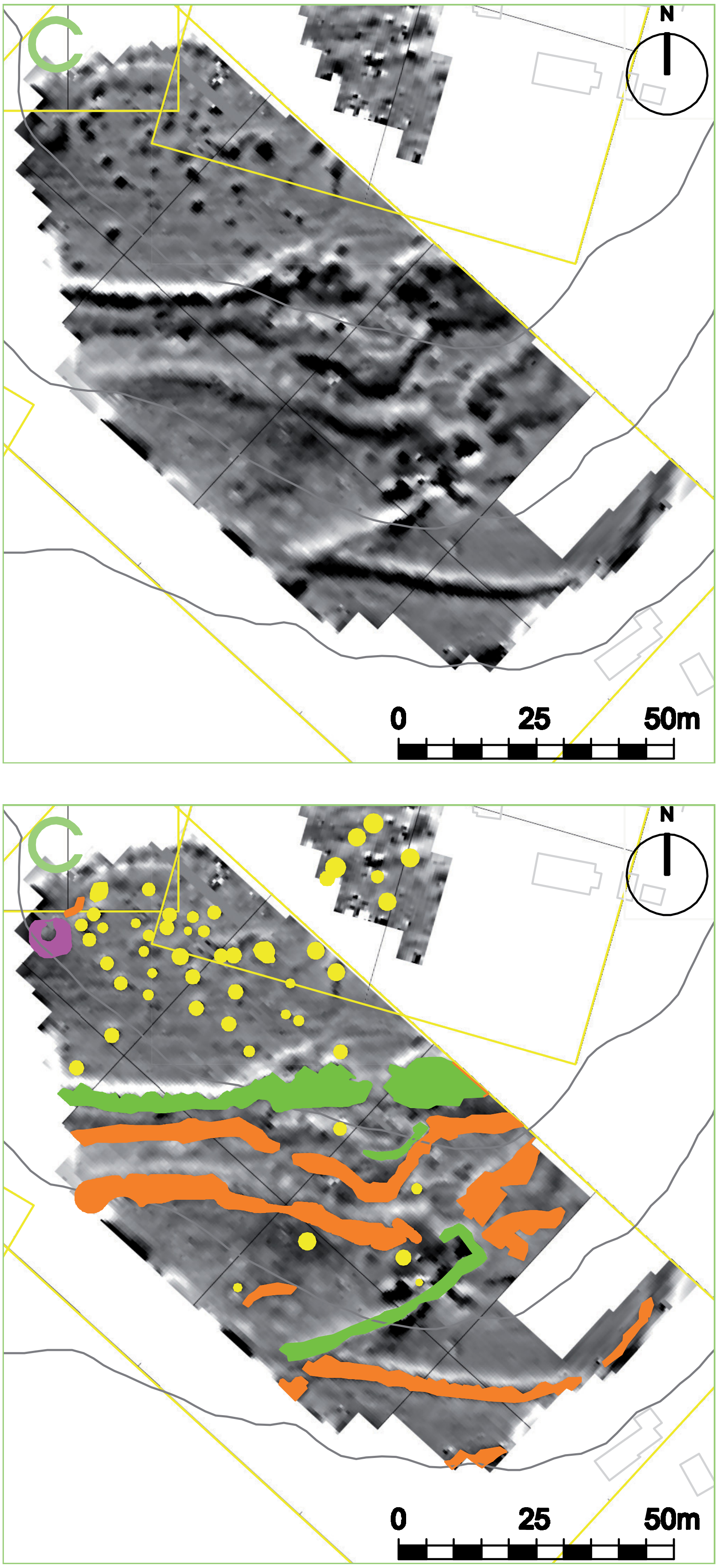

Fig. 3. Alcalar: settlement area with pits enclosed by a system of multiple fences with gates. Geophysical survey: H. Becker; interpretation: E. Morán (after: Morán 2014, 78 f.).

based on the exploitation of land and mainly on polyculture and animal production, predominantly pig, cow and sheep/goat, seasonally supplemented by collecting shellfish and hunting.

Moreover, the anthropological study of individuals buried in Monte Canelas shows the absence of diseases and the use of a balanced diet between protein intake of fish and shellfish and garden products. However, individuals showed moderate dental abrasion resulting from ingestion of cereals and dried fish, in this last case as a result of stone particles in the flour. Isotopic analysis based on δ^{13}C values (between -19.10 and -19.70) determined in the radiocarbon dating show a predominantly terrestrial diet (Carvalho 2007). Along with this, the frequency of dental caries indicates that the diet also included fermentable carbohydrates (possibly honey, carob and figs) and the presence of tartar indicates the ingestion of meat and starch contained in some seeds and tubers (Silva 1996, 118 f.; Morán 2001a, 121).

A planned production can be inferred, presupposing a knowledge of the natural environment that facilitated access to diversified resources. Territorial controlled management allowed to maintain an ecological balance and a rich and varied diet, along with a management of productive spaces, functional differences attributed to different soils, which improved the production and generated surplus resources, minimising unpredictable adversities in the production cycle.

3.1. Plant Resources

Analysis by Hans-Peter Stika on the botanical remains of Alcalar (Morán 2001a, 98; Stika 2014) revealed the practice of a diversified agriculture, with horticultural products of vegetables and cereal culture, represented by the remains of barley and wheat. Along with domestic cultures, seasonal consumption of wild plants, possibly growing randomly in the irrigated orchards, has been identified. The alternation of irrigated garden or rainfed crops should have been a standard practice in agricultural land next to the settlement, to favour the recovery of the soil and therefore allow continued agricultural practice each season. We must assume that in order to fertilise the fields grazing stubble at the end of the harvest has played a key role (Bernabeu et al. 1999, 274).

Along with agricultural production seeds, lobes, endocarps and pods of some wild species (*Asteraceae indet., Avena L. sp., Beta L.sp., Fabacea indet., Malva L. sp., Medicago L. sp., Poaceae indet.* and *Sherardia Arvensis L.*) were collected that may indicate a direct storage of produce grown without trite. The presence of many wild species may be an evidence for an intensive deforestation aimed to gain more arable land.

Trees and bushes of the nearby forests supplied fruit for human and/or animal consumption: acorns (*Quercus L. sp.*), hawthorn (*Crataegus L. sp.*) pine (*Pinus pinea*) and bilberries (*Myrtus communis L.*), in addition to the supply of wood for fire and construction.

Slabs of slate and calcareous stones for construction could have been picked by hand and transported individually by the builders in baskets made of vegetal fibres. Limestone blocks for the lintels of passages and niches, as well as the flagstones to close the vaults of the tholoi graves, although large and in some cases weighing nearly 2t could be transported with a minimum of three people, with the help of ropes, logs and crowbars.

3.2. Animal Resources: Vertebrates

Studies of vertebrate faunal remains were conducted by Jose Antonio Riquelme (Riquelme 2014).

The consumption of ovicaprids – with a predominance of *Ovis aries* over *Capra hircus* – highlights the fracturing of bone material carrying muscle mass, which is also associated with the handling of the specimen for consumption (dismemberment and fracturing) and the secondary action of dogs. Although all age ranges are represented, adults dominate over young individuals. The study of fauna seems to confirm that animal sacrifice was practiced before animals reached adulthood, following a pattern of meat exploitation mainly from male individuals. In the case of female animals, secondary products (milk of sheep and goats and sheep wool) were obtained from adult individuals. In the case of male animals, some individuals were used for breeding, ensuring the preservation of the herds and their regeneration.

Among the identified remains of *Bos taurus*, young, juvenile, subadult and adult ages are represented, but animals were killed mainly in young adulthood. The males were slaughtered at an early age to supply meat, reserving some individuals for reproduction and traction tasks. Although there is no evidence to support the existence of pack animals, they could integrate equipment for transporting materials, taking advantage of the terrain features, with soft inclinations which would not difficult the tasks. Female animals were slaughtered as adults in order to allow milking.

Pig skeletal remains were classified as belonging to domestic species, but considering the difficulty of identification, it is possible that some of the remains are from wild boar. Particularly striking is the abundance of identifiable phalanges, which has been interpreted as pieces that, by failing to provide meat mass, have been discarded completely. The slaughtering of young males, less than two years old, is dominating.

Although domestic fauna dominates, hunted animals have been also identified: rabbits (*Oryctolagus cuniculus*) and deer (*Cervus elaphus*), among the latter both sexes and all ages are represented but adult individuals are the majority.

According to the analyses pigs are the best represented group. Their importance implies a significant presence of forests and pastures with oaks (*Quercus faginea*) necessary for feeding them. Among the ovicaprids sheep seem to be better represented, presumably because of their wool. Remains of a sheep in anatomical connection found in the ditch in sector 16L of the settlement could reflect the importance of this species among ovicaprids. Cattle are represented in fourth place in terms of minimum number of individuals, although regarding their contribution of biomass to food consumption they range in second place.

In general the killing of young animals which provide better quality meat can be observed, keeping females until adulthood, for obtaining milk (sheep, goats and cows), wool (in the case of sheep), for use in field work (cattle) and for the maintenance and regeneration of herds (in all species).

The scarcity of wild animals, represented by rabbits and deer, but also by aurochs and horses, can relate to the development of control techniques and replacement of the herds, where the consumption of wild animals should be seen as marginal and complement the meat diet of the inhabitants in the settlement, where perhaps wild animals correspond to the hunted species to protect fields and preserve food necessary to the conservation of the herds.

3.3. Faunal Resources: Shellfish

The consumption of clams, otter shells and grooved razor shells is confirmed, with scarcer occurrence of oysters, scallops, mussels and barnacles. Calibration of consumed grooved razor shells and clams allows us speculate about life cycle control and respect for the conservation of the species, surely with a distinct seasonal consumption, conciliating the reproduction of the species with a balanced intake of protein to the group diet.

4. Local and Regional Abiotic Resources

The salt obtained from seawater, was a local mineral resource widely used in the preservation of food of animal origin. In addition, the abundance of grooved razor shells and the conservation status of its shells allows us to infer the use of salt for its capture.

The rock materials involved in the construction of the monument Alc7 have been studied by Real (2004). The lithological characterisation covered an area of nearly 5km around the monument allowing to extend the conclusions from the eastern cluster of the necropolis to the settlement area, monumental necropolis, and Monte Canelas.

For the construction of megalithic monuments rocks available in the neighbourhood were used: sedimentary rocks (white limestone, compact limestone, light grey limestone, oolitic limestone, sandstone) and metamorphic rocks (greywacke and slate). In the case of Alc7, the supply came from the slate and greywacke outcrops of Monte Canelas directly from the surface and up to 1.5km away from the monument.

Quartz, quartzite and greywacke available nearby served for making tools for agricultural work. White and grey silex and – in the limestone banks of Poio – silex nodules have been documented.

The carved stone objects include tools related to agriculture as some of the denticulate tools may have been used in sickles to cut vegetables, while some pieces with notches and other denticulate tools possibly served in the task of shellfishing (Morán et al. 2004, 191). Some of the scrapers show evidence of a transverse edge use similar to the traces left by work on dry skin, while others with retouched notches show wear marks that suggest work scraping and dotting wood, bone and horn (Morán et al. 2004, 192).

The production of the so-called mirian axes (Carvalho 2007), here presumably used to work wood, was performed with greywacke, carving and hammering its surface (Morán et al. 2004, 204).

Mill sleepers were prepared in sienit of the Serra de Monchique, although some were made of the local greywacke.

Copper is also present and although we do not know the location of mines was probably extracted from hinterland outcrops some of them reported in the nineteenth century (Veiga 1889, 37–79). Among the objects found during excavations those found in the niche of Alc3 stand out (Leisner/Leisner 1943, 238, Taf. 79). A piece of copper ore inside the house -770/-170 (the final phase of occupation of the settlement) and a gouge and punch collected in its neighbourhood confirm metallurgical activities in Alcalar (Morán 2014).

Gold was locally sourced and was used in adornments, two small bars from Alc4 and a plate from Alc11. Because of their fragmented state and because they were found during the early excavations, it is difficult to assign them to individual burials. Therefore, the exact way in which they were used remains unknown. It is assumed that all of them were used as coating of adornments or containers made of organic materials such as leather or wood (Ambruster/Parreira 1993, 201–211; Correia et al. 2013, 23 f.).

As for objects with possible ideological connotation, there is a set of cylindrical *baetyloi* made of local limestone – only one of them decorated in Moncarapacho type – deposited on the first section of the passage of Alc9 (Morán/Parreira 2007, 70). Numerous unfinished cylinders with surfaces in different states of completion suggest a local workshop (Morán et al. 2004, 206).

5. The Use of Foreign Resources

The geographical diversity of the Alcalar territory, the maritime routes and land crossings provided to its inhabitants access to a wide variety of raw materials for construction and for the production of artefacts. The presence of exogenous materials, although poorly represented, confirms the existence of exchange networks with the Alentejo and Andalusia, without discarding other more elongated routes to Atlantic Europe and the Mediterranean.

The raw material of polished stone tools is predominantly amphibolite of exogenous origin, followed by diorite and granite. Among the products axes and adzes dominate, in some cases they show traces of re-use altering its functionality: for instance axes reconverted into hammers, into hand mills or into strikers (Morán et al. 2004, 193–195).

An exogenous origin is confirmed for the decorated slate plates from Alc1 (Veiga 1886, 232, est. VIII) and Monte Canelas (Parreira 2010) produced in the interior Alentejo (Gonçalves 2004; Sousa/Gonçalves 2012), and an engraved plaque from the El Arteal type, which was collected in a dwelling context in the Alcalar settlement (Morán 2014, 224; 2016, 184). The large blades of silicified oolitic limestone collected in the niche of the Alc3 come possibly from the Sierra de Ronda (Nocete et al. 2005). The amber artefacts (Beck/Vilaça 1995) also have an exogenous origin. Among the materials from inside the Alc4 niche, ivory (a fragment of elephant tusk) has been registered split lengthwise with saw marks. It may have served for the local production of ivory artefacts (Veiga 1889, 213, 223; Schuhmacher et al. 2009, 994; Cardoso/Schuhmacher 2012, 101). There also was a trapezoidal shape sheet broken at the ends (Veiga 1889, 213, 223) and one plate flat on both sides with highly polished edge, which may have served as a straightener (Veiga 1889, 214, 223). Additionally numerous necklace beads made of green stones were found. They are still unexamined, but maycome from the variscite mines in West Andalusia (Nocete 2001, 107).

6. The Organisation of Production and Resource Management

Alcalar was established as power centre of the Bay of Lagos in the 3rd mill. BCE assuming a hegemonic position in the territorial organisation of the Chalcolithic communities in the western Algarve. The careful planning of the habitat space responds to the need to protect a socially segregated group, which controlled the production, ensuring the survival of the community, the consumption of food, and the protected storage of crops in case of crop failures, the same group which controlled the exchange routes of scarce goods and had the exclusive use of prestige items.

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Bibliography

Armbruster/Parreira 1993: B. Armbruster/R. Parreira, 2000 anos de ourivesaria arcaica em Portugal. In: B. Armbruster/R. Parreira (eds.), Inventário do Museu Nacional de Arqueologia. Colecção de Ourivesaria, I. Do Calcolítico à Idade do Bronze (Lisboa) 19–30.

Beck/Vilaça 1995: C. W. Beck/R. Vilaça, The Provenience of Portuguese Archeological Amber Artefacts. A Case Study from Moreirinha (Beira Baixa). Trabalhos de Antropologia e Etnologia. Porto 35.4, 1995, 207–219.

Becker 1997: H. Becker, Geophysikalische Prospektion in Vale de Rodrigo, Concelho Évora, Portugal. Madrider Mitteilungen 38, 1997, 21–35.

Becker 1999a: H. Becker, Duo- und Quadro-Sensor Configuration for High Speed/High Resolution Magnetic Prospecting with Caesium Magnetometer. In: J. W. E. Fassbinder/W. E. Irlinger (eds.), Archaeological Prospection. Arbeitshefte des Bayerischen Landesamtes für Denkmalpflege 108 (München 1999) 100–105.

Becker 1999b: H. Becker, Ultra High Resolution Caesium Magnetometry at Monte da Ponte, Concelho Évora, Portugal 1994–1996. In: J. W. E. Fassbinder/W. E. Irlinger (eds.), Archaeological Prospection. Arbeitshefte des Bayerischen Landesamtes für Denkmalpflege 108 (München 1999) 123–126.

Becker 2009: H. Becker, Caesium-Magnetometry for Landscape Archaeology. In: S. Campana/S. Piro (eds.), Seeing the Unseen. Geophysics and Landscape Archaeology (London 2009) 129–165.

Becker 2013: H. Becker, Magnetic Prospecting at Zambujal in 2001. A Test for Archaeological Prospection. Revista Portuguesa de Arqueologia 16, 2013, 33–135.

Becker/Fassbinder 2001: H. Becker/J. W. E. Fassbinder, Magnetic Prospecting in Archaeological Sites. Monuments and Sites 6 (München 2001) 102.

Becker/Valera 2011: H. Becker/A. C. Valera, Cosmologia e Recintos de Fossos da Pré-História Recente. Resultados da prospeção geofísica em Xancra (Cuba, Beja). Apontamentos de Arqueologia e Património 7, 2011, 23–32.

Bernabeu et al. 1999: J. Bernabeu/J. E. Aura/E. Badal, Al Oeste del Eden. Las primeras sociedades agrícolas en la Europa Mediterránea (Madrid 1999).

Cardoso/Schuhmacher 2012: J. L. Cardoso/T. X. Schuhmacher, Marfiles calcolíticos en Portugal. Estado de la cuestión. In: A. Banerjee/J. A. López Padilla/T. X. Schuhmacher, Elfenbeinstudien. Faszikel 1: Marfil y elefantes en la Península Ibérica y el Mediterráneo occidental. Iberia Archaeologica 16.1, 2012, 95–110.

Carvalho 2007: A. F. Carvalho, Novos dados sobre dois temas da Pré-História do Sul de Portugal. O Mirense e o processo de neolitização. Promontoria 5, 2007, 91–110.

Correia et al. 2013: V. H. Correia/R. Parreira/A. C. F. Silva, Archaic Jewellery in Portugal. The Glitter of Power (Lisboa 2013).

Goncalves 2004: V. S. Gonçalves, As Placas de Xisto Gravadas dos Sepulcros Colectivos de Aljezur (3º milénio a.n.e.). O Arqueólogo Português 6.22, 2004, 163–318.

Kalb 2003: P. Kalb, Vale de Rodrigo. Megalithforschungen in Portugal. Bericht der Römisch-Germanischen Kommission 83, 2003, 315–345.

Kalb/Höck 1997: P. Kalb/M. Höck, Untersuchungen im Megalithgebiet von Vale de Rodrigo, Concelho Évora, Portugal. Madrider Mitteilungen 38, 1997, 21–35.

Leisner/Leisner 1943: G. Leisner/V. Leisner, Die Megalithgräber der Iberischen Halbinsel. Der Süden. Römisch Germanische Forschungen 17 (Berlin 1943).

Leisner/Leisner 1956: G. Leisner/V. Leisner, Die Megalithgräber der Iberischen Halbinsel. Der Westen, 1. Madrider Forschungen 1.1 (Berlin 1956).

Leisner/Leisner 1959: G. Leisner/V. Leisner, Die Megalithgräber der Iberischen Halbinsel. Der Westen, 2. Madrider Forschungen 1.2 (Berlin 1959).

Marques et al. 2008: J. A. Marques/A. Rocha/G. Lopes/M. Liberato, Torre 4, Portimão. Um conjunto cerâmico alto-medieval. Xelb. Silves 8.2, 2008, 117–130.

Marquez Romero et al. 2011: J. E. Márquez Romero/A. Carlos Valera/H. Becker/V. Jiménez Jáimez/J. Suárez Padilla, El Complexo Arqueológico dos Perdigões (Reguengos de Monsaraz, Portugal). Prospecciones Geofísicas. Campañas 2008–09. Trabajos de Prehistoria 68.1, 2011, 175–186.

Morán 2001a: E. Morán, Aproximación al estudio geoarqueológico de Alcalar (Portimão, Algarve-Portugal) en el III milenio a.n.e. Tesis de Licenciatura (Sevilla 2001).

Morán 2001b: E. Morán, Aproximación al estudio geoarqueológico de Alcalar (Portimão, Algarve-Portugal) en el III milenio a.n.e. Evidencias arqueológicas de la existencia de una sociedad clasista inicial. Revista Atlántica-Mediterránea de Prehistoria y Arqueología Social 4, 2001, 169–205.

Morán 2008: E. Morán, Organização espacial do Povoado Calcolítico de Alcalar (Algarve, Portugal). Era Arqueologia 8, 2008, 138–147.

Morán 2014: E. Morán, El Asentamiento Prehistórico de Alcalar (Portimão, Portugal), La Organización del Território y el Proceso de Formación de un Estado Prístino en el Tercer Milénio a.n.e. (PhD Thesis Universidad de Sevilla 2014).

Morán 2016: E. Morán, Os produtos ideológicos «oculados» do terceiro milénio a.n.e. de Alcalar (Algarve, Portugal). In: A. C. Sousa/A. Carvalho/C. Viegas (eds.), Terra e Água. Escolher sementes, invocar a Deusa. Estudos em homenagem a Victor S. Gonçalves. Estudos and Memórias 9 (Lisboa 2016) 179–187.

Morán/Parreira 2004: E. Morán/R. Parreira (eds.), Alcalar 7. Estudo e reabilitação de um monumento megalítico. Cadernos 6 (Lisboa 2004).

Morán/Parreira 2007: E. Morán/R. Parreira, Alcalar. Monumentos Megalíticos. Roteiros da Arqueologia Portuguesa 10 (Lisboa 2007).

Morán/Parreira 2008: E. Morán/R. Parreira, Alcalar. Um projeto para o conhecimento, salvaguarda e promoção de uma paisagem cultural no Algarve. Al-Madan, Almada 16, 2008, 106–114.

Morán et al. 2004: E. Morán/R. Parreira/O. Sánchez Liranzo/A. Vera Fernández, Os artefactos recuperados nas escavações. In: E. Morán/R Parreira (eds.), Alcalar 7. Estudo e Reabilitação de um Monumento Megalítico. Cadernos 6 (Lisboa 2004) 172–223.

Nocete 2001: F. Nocete, Tercer milenio antes de nuestra era. Relaciones y contradicciones centro/periferia en el Valle del Guadalquivir (Barcelona 2001).

Nocete et al. 2005: F. Nocete/R. Sáez/J. M. Nieto/R. Cruz/R.Cabrero/E. Alex/M. R. Bayona, Circulation of Silicified Oolitic Limestone Blades in South-Iberia (Spain and Portugal) During the Third Millennium B.C. An Expression of a Core/Periphery Framework. Journal of Anthropological Archaeology 24, 2005, 62–81.

Parreira 1993: R. Parreira, Alcalar. Um «lugar central» no Barlavento Algarvio e o seu território no IV–III milénio a.C. In: Encuentro de Arqueologia del Suroeste (Huelva-Niebla), Documento de Trabajo. Pré-actas (Huelva 1993) 91–92.

Parreira 2010: R. Parreira, As placas de xisto gravadas do Hipogeu I de Monte Canelas (Alcalar). In: V. S. Gonçalves/A. C. Sousa (eds.), Transformação e Mudança no Centro e Sul de Portugal. O 4.º e o 3.º milénios a.n.e. Actas do Colóquio Internacional. Colecção Cascais Tempos Antigos 2 (Cascais, 4–7 Outubro 2005) (Cascais 2010) 399–419.

Parreira/Serpa 1995: R. Parreira/F. Serpa, Novos dados sobre o povoamento da região de Alcalar (Portimão) no IV e III milénios a.C. Trabalhos de Antropologia e Etnologia, Porto 35.3, 1995, 233–247.

Real 2004: F. Real, Litologia dos materiais de construção. In: E. Morán/R. Parreira (eds.), Alcalar 7. Estudo e Reabilitação de um Monumento Megalítico. Cadernos 6 (Lisboa 2004) 133–135.

Riquelme 2014: J. A. Riquelme, Estudio de los Restos Óseos de Vertebrados Procedentes de las Excavaciones Arqueológicas del Poblado Calcolítico de Alcalar, Sectores 15L y 16L (Granada 2014) (unpublished report).

de Sá 1904: B. de Sá, Explorações arqueológicas no Algarve em Março de 1904. O Archeologo Português 9, 1904, 173–179.

Schuhmacher et al. 2009: T. X. Schuhmacher/J. L. Cardoso/A. Banerjee, Sourcing African Ivory in Chalcolithic Portugal. Antiquity 83, 2009, 983–997.

Schuhmacher/Banerjee 2012: T. X. Schuhmacher/A. Banerjee, Procedencia e intercambio de marfil en el Calcolítico de la Peninsula Ibérica. In: M. Borrell/F. Borrell/J. Bosch/X. Clop/M. Molist (eds.), Xarxes al Neolític. Circulació i intercanvi de matèries, productes i idees a la Mediterrània occidental (VII–III millenni aC). Actes del Congrés Internacional Xarxes al Neolític. Rubricatum 5 (Barcelona 2012) 289–298.

Silva 1996: A. M. Silva, O Hipogeu de Monte Canelas I (IV–III milénios a.C.). Estudo paleobiológico da população humana exumada. Provas de aptidão pedagógica e capacidade científica. Trabalho de síntese (Coimbra 1996).

Silva/Parreira 2010: A. M. Silva/R. Parreira, Hipogeu I de Monte Canelas. Caracterização antropológica dos enterramentos in situ e das conexões anatómicas. In: V. S. Gonçalves/A. C. Sousa (eds.), Transformação e Mudança no Centro e Sul de Portugal. O 4.º e o 3.º milénios a.n.e. Actas do Colóquio Internacional (Cascais, 4–7 Outubro 2005). Colecção Cascais Tempos Antigos 2 (Cascais 2010) 421–428.

Silva/da Silva 2005: A. Silva/R. C. da Silva, Resultados da intervenção no sítio arqueológico de Barradas (Odiáxere, Lagos). Revista Portuguesa de Arqueologia 8.2, 2005, 55–106.

Sousa/Gonçalves 2012: A. C. Sousa/V. S. Gonçalves, In and Out. Tecnologías, símbolos e cultura material. Interacções e identidades regionais no Centro e Sul de Portugal no 3º milenioa.n.e. In: M. Borrell/F. Borrell/J. Bosch/X. Clop/M. Molist (eds.), Xarxes al Neolític. Circulació i intercanvi de matèries, productes i idees a la Mediterrània occidental (VII–III millenni a.C.). Actes del Congrés Internacional Xarxes al Neolític. Rubricatum 5 (Barcelona 2012) 383–392.

Stika 2014: H. P. Stika, Archäobotanische Untersuchungen in Alcalar (Stuttgart 2014) (unpublished report).

Valera/Becker 2011: A. C. Valera/H. Becker, Cosmologia e Recintos de Fossos da Pré-História Recente. Resultados da prospeção geofísica em Xancra (Cuba, Beja). Apontamentos de Arqueologia e Património 7, 2011, 23–32.

Valera et al. 2014: A. C. Valera/A. M. Silva/J. E. Marquez Romero, The Temporality of Perdigões Enclosures. Absolute Chronology of the Structures and Social Practices. Revista de prehistoria y arqueología de la Universidad de Sevilla 23, 2014, 11–16.

Veiga 1886: S. P. M. Veiga, Estácio da, Antiguidades Monumentais do Algarve, I (Lisboa 1886).

Veiga 1887: S. P. M. Veiga, Estácio da, Antiguidades Monumentais do Algarve, II (Lisboa 1887).

Veiga 1889: S. P. M. Veiga, Estácio da, Antiguidades Monumentais do Algarve, III (Lisboa 1889).

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Farming Economy and Wealth Economy in the Copper Age of the Lower Guadalquivir River
Debating Strategic Resources at Valencina de la Concepción (Seville, Spain)

Keywords: Copper Age, Iberian Peninsula, agriculture, animal husbandry, metallurgy, social complexity, copper, gold, flint, rock crystal, amber, cinnabar, ivory

Palabras Clave: Edad de Cobre, Península Ibérica, agricultura, ganadería, metalurgia, complejidad social, cobre, oro, sílex, cristal de roca, ámbar, cinabrio, marfil

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Abstract

In the last 10 years, research on the great Copper Age site of Valencina de la Concepción (Seville, Spain) has experienced major advances. New published studies have provided abundant data on the farming economy (especially animal husbandry) and on the supply and transformation of abiotic resources such as metals, rare rocks (flint, rock crystal, amber, cinnabar, variscite) and ivory. In this paper I review the state of the art of current research on the economy of the communities settled across the Lower Guadalquivir River in the Copper Age, focusing on strategic resources and their importance in the social organisation and cultural definition of these communities.

Resumen

En los últimos 10 años la investigación sobre el gran asentamiento calcolítico de Valencina de la Concepción (Sevilla) ha experimentado importantes avances. Los nuevos estudios publicados han aportado importantes datos sobre la economía ganadera y sobre el abastecimiento y transformación de recursos abióticos tales como metales, rocas raras (sílex, cristal de roca, ámbar, cinabrio, variscita) y marfil. En este artículo se realiza un repaso del estado actual de la investigación sobre la economía de las comunidades de la Edad del Cobre en el bajo Guadalquivir y Valencina, discutiendo los recursos estratégicos y su importancia en la organización social y la definición cultural de estas comunidades.

1. Introduction

The discussion on the farming economy and the wealth economy at the Copper Age site of Valencina de la Concepción (Seville, Spain) from the point of view of key (or strategic) resources[1] presents a number of empirical and methodological difficulties that demand some explaining. Given that many of these difficulties concern the whole of research at this site by and large (a matter that largely exceeds the space available in this article) I will only present here a summarised introduction to them – for an extended, recent discussion see García Sanjuán (2013).

Firstly, Valencina has a long chronology of occupation and use that, according to a recent study (García Sanjuán et al. forthcoming), unfolded between ca. 3200 and ca. 2300 calBCE. Despite the fact that the number of radiocarbon dates available and, subsequently, our understanding of the site's chronology have greatly improved as a result of this recent contribution, it is still impossible to establish in more or less detail the evolution that the forms of economic production underwent throughout that period of time. Therefore, any discussion of this problem will inevitably tend to be largely based on generalisations concerning the entire biography of the site, without taking into account the different processes, phases and episodes that occurred over the course of such a long period of time. This represents a serious disadvantage, seeing as recent data suggest that it is highly likely that Valencia underwent various phases between the end of the 4th mill. and the end of the 3rd mill. calBCE, with varying cultural and social patterns (García Sanjuán et al. forthcoming). An effort will be made to take this important point into consideration throughout this article to the extent possible; all in all, however, what is ultimately presented here is a reflection on the economy of the societies that frequented and/or occupied Valencina throughout the Copper Age in its entirety.

Secondly, the data available for analysing the issue discussed in this article are quite uneven and sometimes even quite deficient. For example, there is almost no direct archaebotanical data available to discuss agricultural production. Only one pollen study, conducted using samples taken from the Montelirio tholos (Llergo López et al. 2013) has been published, whereas, surprising as it may seem, not a single one of plant macro-remains has ever been carried out. Therefore, agriculture can presently be discussed only on the basis of indirect indicators such as the negative structures supposedly used for storage ('silos') or the lithic tools associated to agricultural tasks, with the limitations that these indicators entail. The study of animal husbandry presents a better empirical basis as a result of the publication (mainly over the last seven years) of archaeofaunal reports on the excavations conducted at the sectors of Cerro de la Cabeza/La Candelera/La Perrera (Hain 1982), Matarrubilla Partial Plan (Abril López et al. 2010), La Gallega (Bernáldez Sánchez et al. 2013), Calle Mariana Pineda (Pajuelo Pando/López Aldana 2013), Avenida de Andalucía (Sardá Piñero 2013), PP4-Montelirio (Liesau et al. 2014) and Montelirio tholos (Pajuelo Pando 2016), involving a total number of 49100 remains. Although these seven archaeozoology studies are quite valuable and, to a certain extent, capable of identifying some patterns that are probably meaningful at a very general level, unfortunately however, they do not come close to covering the enormous amount of animal remains that have been discovered at Valencina, most of which await study.

With regard to abiotic resources, especially rare rocks or metals, the availability of data is somewhat better, again a result of the publications produced over the last few years. These publications have dealt with the supply, transformation, distribution and use of raw lithic materials for knapping such as silicified oolitic limestones (Nocete Calvo et al. 2005), siliceous rocks (García Sanjuán et al. 2016) and rock crystal (Morgado Rodríguez et al. 2016), minerals used to craft ornaments such as variscite (Odriozola/García Sanjuán 2013) or amber (Murillo-Barroso/García Sanjuán 2013; Murillo-Barroso 2016a), minerals used for the elaboration of pigments such as cinnabar (Hunt Ortiz/Hurtado Pérez 2010; Rogerio Candelera et al. 2013), as well as metals such as gold (Murillo-Barroso et al. 2015; 2016b) and copper (Hunt Ortiz 2003; Nocete Calvo et al. 2008; Rodríguez Bayona 2013; Costa Caramé 2011, 236–248; 2013; etc.). Ivory, a material for which several important studies have recently been published (Vargas Jiménez et al. 2012; García

1 In line with the aims of this volume, by 'key' or 'strategic' resources I will understand those resources capable of triggering economic and social processes causing further social complexity in a given social formation, for example through surplus accumulation. The accumulation of surpluses is the primary cause for the emergence of qualitative changes in economic relationships and subsequent movements in the concentration and expression of power (Haldon 1993, 46).

Sanjuán et al. 2013; Nocete Calvo et al. 2013; Schuhmacher et al. 2013; Luciañez Triviño et al. 2014; Luciañez Triviño/García Sanjuán 2016) must also be added to this list. These contributions have made possible more informed interpretations on the role that Valencina played within the exchange networks of exotic raw materials that existed in Iberia during the 3rd mill. BCE. However, the current literature still presents significant deficiencies including, for example, those relating to the flint used for knapped tools, or the hard stones (granite, for instance) used to manufacture grinding tools that, up until now, have received insufficient attention.

Taking these constraints into account, this paper is thus an attempt at a synthesis on the most important issues that are currently the focus of discussion with regard to strategic resources at Copper Age Valencina, concerning both the farming economy and the wealth economy, within the broader geographical context of the Lower Guadalquivir River Valley.

2. Agriculture and Livestock Farming

Valencina is located in an environment that already in the 3rd mill. BCE was optimal for agriculture and livestock farming. The lands of El Aljarafe and the fertile lowlands of Seville and Carmona rank among the areas with the greatest agricultural potential in the whole of Andalusia. This environment would have certainly provided in itself an important strategic advantage for the communities living along the Lower Guadalquivir, which as various surveys and excavations suggest must have been very densely populated at this time period. Among the excavated Chalcolithic sites of this region are Universidad Laboral (Seville) (Fernández Gómez/Alonso Sierra 1985), La Morita (Cantillana) (Acosta Martínez et al. 1987), El Acebuchal (Harrison et al. 1976; Lazarich González et al. 1997), Parque de Miraflores (Seville) (Lara Montero et al. 2006), El Gandul (Alcalá de Guadaira), which includes an important megalithic necropolis including various large *tholos* monuments, such as El Vaquero and Las Canteras (Hurtado Pérez/Amores Carredano 1984), or the city of Carmona itself, for which important evidence of Chalcolithic occupation has been published (Rovira Llorens/Gómez Ramos 1999; Conlin Hayes 2003; 2004) (*fig. 1*).[2]

Ironically, however, although the physical conditions of this area were particularly conducive to agriculture already in the 3rd mill. (as they have been throughout later historical periods), which might be connected to the significant population density, the hard empirical evidence regarding agricultural production at Valencina is found wanting. This can be partly explained by the fact that in the many excavations carried out at the site the relevant kinds of data have not been collected – regrettably, sieving and flotation of sediments has not been a common practice in the rescue excavations carried out at the site. In addition, the indirect indicators for agricultural activities do not necessarily suggest an intense agricultural production at Valencina itself. Firstly, none of the pits which in numerous excavation reports and publications have been recurrently described as 'silos' for the storage of cereals has ever been subjected to an exhaustive scientific study from the point of view of soil chemistry, sedimentology or plant remains conclusively proving this function. Secondly, there is also the fact that the number of grinding stones discovered at Valencina is quite low in comparison to other well-documented southern Iberian residential settlements of the 3rd and 2nd mill. BCE – see a discussion in García Sanjuán 2013, 34 f. Although no systematic review of the querns has been published as yet, a study currently under way suggests that most of them appear in a highly fragmented state and not whole, which casts further doubts about their patterns of use and deposition. As these stones are normally interpreted as means of production for the processing of cereals or other crops their low number in Valencina would suggest that the agricultural processing activities that took place at the site were limited. This in fact is quite consistent with some evidence obtained from the characterisation on the knapped lithic industry. According to the only synthesis available (Murillo Díaz 2013), the lithic assemblages found at Valencina present two

2 To this list of sites we can also add the ditched enclosure of Loma del Real Tesoro II (Carmona), excavated in January 2016 by the Universities of Tübingen and Seville as part of a joint research project whose study is currently underway. A preliminary report of this study is presented in this volume by Escudero Carrillo et al.

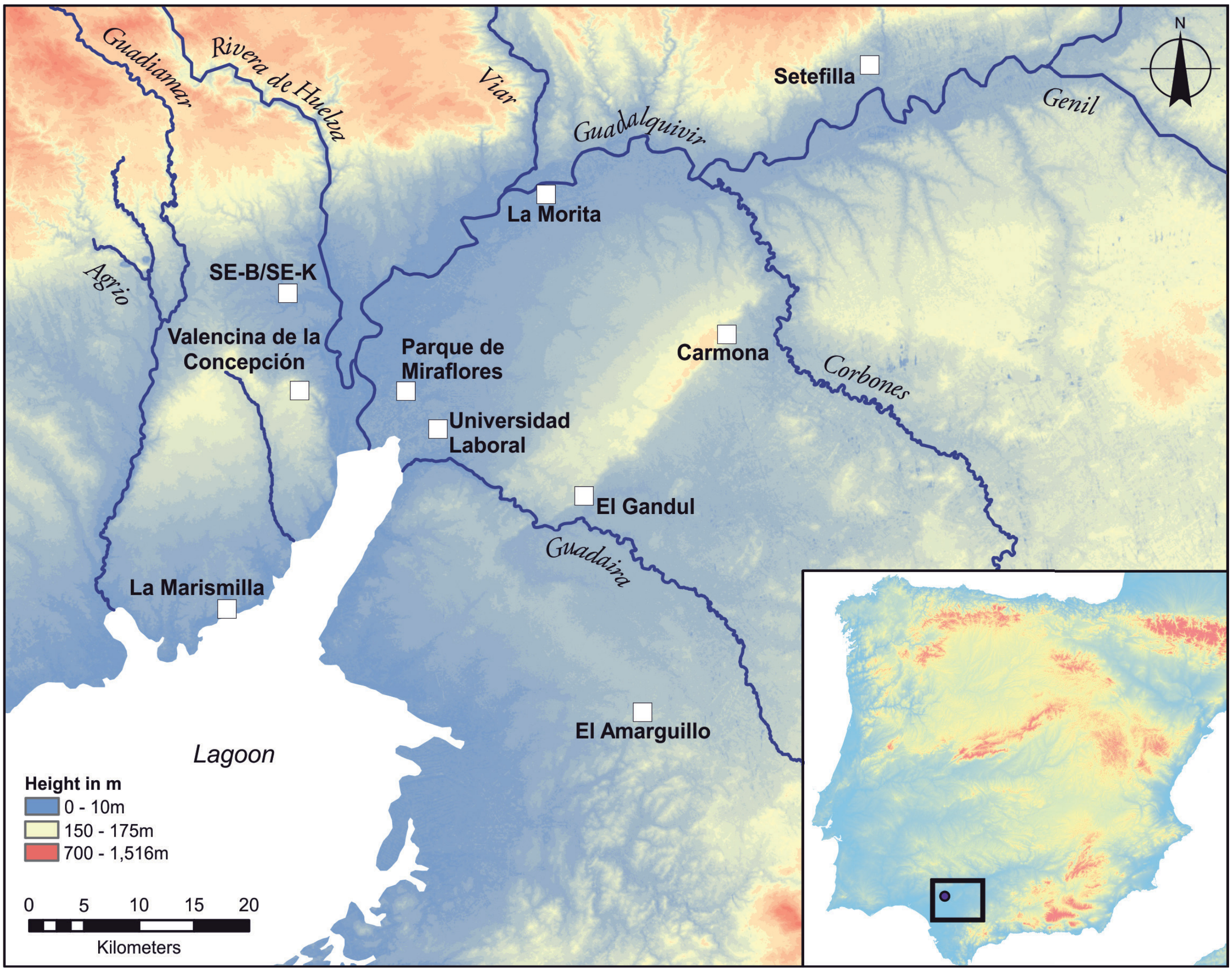

Fig. 1. Distribution map of a selection of excavated sites from the 3rd and 2nd mill. BCE in the lower Guadalquivir River (Sevilla province, Spain) (Design: David W. Wheatley).

remarkable features: (I) the pronounced lack of both cores and knapping debris (0.70% and 8.50% of the total number of lithic items, respectively), which would thus suggest that the tools were not manufactured at Valencina, but rather at other locations; (II) the lack of denticulated and sickle pieces that may have been associated with harvesting and threshing, again suggesting that these activities were not carried out *in situ* (Murillo Díaz 2013, 474, 481).[3]

3 This paper is a synthesis of an academic dissertation submitted 30 years ago (Murillo Díaz 1987). This work was based on the 847 lithic items found at the sectors of the site that had been excavated at the time (La Perrera, La Candelera, Polideportivo) as well as surface materials from its northern half. Dozens of other excavations haven been undertaken at Valencina since then but regrettably precious little research has been carried out on lithics ever since. Therefore, it is difficult to be sure as to how statistically representative these conclusions are.

As was previously mentioned, there is a greater amount of reliable data with regard to livestock farming. Table 1 summarises the data concerning the MNI for the six of the sectors at Valencina where fauna has been studied, excluding the Montelirio tholos.[4] In total, a minimum number of 767 animals (including domesticated animals, plus *Equus sp* and *Cervus elaphus*) have been identified at the site. Of these animals the most abundant are sheep and goats (37.1%), followed by pigs (33.3%), cattle (16.4%), dogs (5.2%), deer (5.0%) and equids (2.7%). Of course, the MNI percentages cannot be simply and directly interpreted in terms of the economic significance or strategic importance of each animal. In light of their nutritional, economic

4 For Calle Mariana Pineda s/n only the material from a selection of the excavated structures has been published.

Sector	***Bos taurus* and *bos primigenius***	***Sus sp.***	***Ovis aries* and *ovis capra***	***Canis familiaris***	***Equus sp.***	***Cervus elaphus***	**Total MNI**
La Perrera-La Candelera	84	194	205	32	16	27	558
Plan Parcial Matarrubilla	4	13	10	1	-	3	31
La Gallega	12	22	28	1	2	2	67
c/ Mariana Pineda s/n	9	17	28	4	1	4	63
c/ Avenida de Andalucía 9	4	6	3	1	1	1	16
PP4-Montelirio	13	4	11	1	1	2	32
Total	126 (16.42 %)	256 (33.37%)	285 (37.15%)	40 (5.21%)	21 (2.73%)	39 (5.08%)	767 (100%)

Tab. 1. Summary MNI data for the main domesticated species (plus deer) at Valencina de la Concepción. Percentages refer to the total MNI (Modified after: García Sanjuán 2013, 38).

or even social significance throughout the more recent historical periods for which statistical data exists and despite contributing a lower percentage to the overall MNI than the sheep and goat (37.15%), it seems likely at any rate, that both the pig (33.3%) and cattle (16.4%) played a more strategic role in Copper Age society – without underestimating the value of the sheep and goats.

In fact, there is evidence suggesting that pig farming could have played a particularly strategic role. In his study of nearly 1,000 pig bones from the sectors of La Perrera and La Candelera (MNI = 194), F. H. Hain (1982) concluded that these animals were medium-sized and slender in morphology, suggesting that they could be *dehesa* – forest free-roaming pigs.[5] Although as I have already mentioned, data from the plant environment at Valencina is very scarce, a study of archaeological pollen from the lakes of El Acebrón and Las Madres (located in Huelva, some 80km south-west of Valencina) demonstrated long ago that a basic and primitive farming system based on holm oak *dehesas* may have existed in SW Spain during the 3rd mill. calBCE[6] (Stevenson/Harrison 1992, 227).

Testament to the economic success of pig farming and its strategic importance is perhaps the presence of carved ivory figures representing pigs and acorns among the grave goods found at the great Montelirio *tholos* (*fig. 2* and *3*). Montelirio is a majestic megalithic monument unique among its southern Iberian Chalcolithic analogues insofar its grave goods and human deposits were found in near-pristine conditions (see Fernández Flores et al. 2016 for a full description). These carvings of pigs and acorns were placed alongside a host of sophisticated objects made of gold, flint, amber or ivory. The remarkable fact that, first, with the exception of a bird, the pig is the only animal represented in this grave,[7] second these representations are associated

5 The *dehesa* is a multifunctional agro-sylvo-pastoral system and cultural landscape found in Central and South-Western Iberia, based on human-managed natural forests of oaks, usually holm oak (*Quercus ilex*) and cork oak (*Quercus suber*). Besides its forestry exploitation the dehesa is used primarily for grazing of animals, very especially Iberian pigs, which are allowed to roam freely feeding on acorn.

6 In fact, this system would probably have had its origins in the Late Neolithic period.

7 In their review of zoomorphic figurines from the Late Neolithic and Copper Age in South-West Iberia Valera et al. (2014, 27) interpret these figurines as wild boars; this interpretation is based on assumptions concerning details of animal morphology that are not significantly evident on the tiny figurines. Not only F. H. Hain's (1982) report suggested the abundant presence of domestic pigs in Valencina, but the presence of carved acorns in the same grave as the comb with the pigs points to a conceptual association between the pig and the holm oak which is characteristic of a dehesa economy. Had the wild boar been a symbolically important animal in Valencina during the 3rd mill., it is highly likely that the tusks of these animals would have been used as decorative elements or personal objects, which is what happens in other cultures where the wild board is an important symbol, as is the case of the Bronze Age Mycenaean society.

Fig. 2. Ivory comb with zoomorphic figures from the Montelirio tholos main chamber (Photo: Miguel Ángel Blanco de la Rubia).

Fig. 4. Zoomorphic ceramic vessel depicting an equid from Structure 10.087 of the PP4-Montelirio sector (Photo: Miguel Ángel Blanco de la Rubia).

Fig. 3. Ivory acorns from the Montelirio tholos main chamber (Photo: David W. Wheatley).

with acorns (which probably would have been sewn onto some of the funerary attires or clothing found in the grave) and third that in a burial monument of such grandiosity the pig was used (together with important luxury grave goods), as a symbol of the high social status of its occupants suggest that owning *dehesa* pigs may have been a primary source of economic wealth, social prestige and even political power in Copper Age Valencina.

Additionally, although limited in quantity, the presence of *Equus sp.* (MNI = 21) stands out on the table of archaeofaunal remains. It is unclear whether these remains correspond to horses or to other equids, or whether they were domestic or wild. In the study on the La Perrera-La Candelera sector, F. H. Hain concluded that the problem regarding whether or not the equids were domestic (Hain 1982, 151) could not be solved. However, there is interesting indirect evidence that suggests that these animals may have played a strategic economic and social role among the communities that frequented or occupied Valencina during the 3rd mill. BCE. On the one hand, we should consider the zoomorphic pottery vessel depicting an equid (possibly a horse) found in structure 10.087 at the PP4-Montelirio sector (a simple pit burial) (*fig. 4*).[8] This piece is unique among the plastic arts of Copper Age South-West Iberia, which includes a handful of zoomorphic vessels (see Valera et al. 2014 for an updated inventory). Research on equid remains from 3rd mill. Iberia has traditionally been divided between those who have considered equids as part of domestic livestock farming and those who have viewed them as wild animals that were hunted – see discussion in Liesau, 2005; Matoso Silva et al. 2015. The remains of horses in Early Holocene wild fauna assemblages tend to be low (Liesau 2005, 1914), meaning that their appearance in Copper Age stratigraphic levels is somewhat abrupt. On

8 A 'phalanx idol' made with the phalanx of an equid was found in 'hut F70' at the La Perrera/La Candelera/Cerro de la Cabeza sector (Hurtado Pérez 2013, 320).

the other hand, it is generally accepted that remains from the Early Bronze Age onwards correspond to domestic horses (Liesau 2005, 1914) and it seems undeniable that horse riding had spread throughout western Europe by the second half of the 2nd mill. BCE, as shown by a wide range of evidence. To this, it must be added that strong evidence indicative of the existence of a domestic ass in Chalcolithic Iberia has been recently published (Cardoso et al. 2014) for the site of Leceia in Central Portugal.[9] In short, it could be argued that although there is no conclusive evidence as yet, one interesting element for future research is to look at to what extent equids may have constituted a strategic element of Valencina's economy during the 3rd mill. BCE. Horse domestication would be rather consistent with the high level of supra-regional connectivity that these communities had, as demonstrated by other types of evidence – notably the rare stones and exotic raw materials discussed below.

All in all, the available evidence suggests that Valencina was witness to an important animal-breeding economy that would have had a significant projection on the symbolic world[10] – for example through the use of selected animal parts in structured depositions and burials, or through zoomorphic figurines and ceramic vessels. Cattle and pigs in particular may have played a special role in the accumulation and representation of wealth; the importance of the equids is still unknown. Furthermore, there is evidence that strongly suggests that other species of animals, whether hunted (such as deer and wild boar) or harvested (such as molluscs: *Pecten*, *Patella*, *Glycymeris*, etc.) also played important social and symbolic roles, their remains being placed inside graves and structured depositions.

In fact, several indications demonstrate that the consumption of meat may have played a key role in the social practices that took place in Valencina. On the one hand, the study of 789 faunal remains from the PP-Matarrubilla sector suggested that 'The zooarchaeological assemblage has reflected a particular, selective transport, seeing as the reduced presence of phalanxes – bones of high density (…) seems to suggest that they were discarded beforehand at the slaughter areas' (Abril López et al. 2010, 97). The study of a selection of faunal remains from Calle Mariana Pineda s/n led to the very same conclusion: '…the majority of remains correspond to the forequarters and hindquarters (by far the parts which provide the greatest amount of meat) in addition to the relatively scant presence of parts corresponding to the legs, [which] leads us to consider the possibility of selective transport from the area where the animals were carved up to the area where the meat was consumed' (Pajuelo Pando/López Aldana 2013, 452). As I have suggested elsewhere (García Sanjuán 2013, 42), these findings present interesting implications when it comes to assessing the temporality of Valencina's occupation and frequentation. It seems that at PP-Matarrubilla and Calle Mariana Pineda s/n sectors animals were not raised and sacrificed *in situ* but instead, the anatomical parts that were fit for consumption were brought in order to be consumed. This of course, does not necessarily mean that animals were not raised and slaughtered in other parts of the site (or perhaps at other times). What is clear however, is that the presence of animal remains cannot *per se* be taken to prove the existence of major herds of domestic animals at the site itself. In addition, the nature of the faunal assemblages found at PP-Matarrubilla and Calle Mariana Pineda s/n sectors might suggest the existence of feasting in either funerals or celebrations connected with the Chalcolithic worldview. Possible evidence of feasting has been found at the only 'ditched enclosure' so far confirmed at Valencina, Structure 10.024 at the PP4-Montelirio sector. This structure consists of a circular ditch surrounding several circular pits (some of which cut the ditch itself), with a maximum diameter of 17 metres and a possible entrance on its southern side. A large amount of faunal remains were discovered in these pits and in the ditch, making up 95% of all of the remains uncovered at the PP4-Montelirio sector (Liesau et al. 2014, 77); large quantities of pottery were also unearthed here (Mora Molina et al. 2013, 274). This concentration of faunal remains and broken ceramic vessels seems to suggest conspicuous

9 But see genetic evidence suggesting otherwise (Cieslak et al. 2010).
10 This is consistent with the data obtained from other southern Iberian sites of the 4th and 3rd mill. BCE (Cámara Serrano et al. 2008; 2010).

consumption of food, including meat, by a relatively large contingent of people.

3. Craftsmanship of Exotic Raw Material

As was mentioned at the beginning of this article, research on Valencina over the last ten years has led to important breakthroughs in the study on the supply, transformation and consumption of certain exotic raw materials. These exotic raw materials would have been extremely valuable due to their inherent rarity and to the added value resulting from their transportation over long distances and the technical specialisation required to transform them into highly sophisticated objects. Among these exotic raw materials we must mention flint (plus silicified oolitic limestones), rock crystal, variscite, cinnabar, copper, gold and ivory. An in-depth discussion on the economic and social significance that each of these raw materials could have held in the communities that frequented and/or lived in Valencina throughout the 3rd mill. BCE would exceed the space available in this article. Thus, I will only discuss some issues that, in my opinion, are particularly relevant to understand their comparative significance as strategic resources.

Firstly, the **extraordinary connectivity** revealed by these exotic raw materials stands out. Table 2 summarises the currently available data. Among the raw materials that originated in Iberia, cinnabar, most likely from Ciudad Real in Central Spain (Rogerio Candelera et al. 2013, 286), variscite from Zamora in North-Western Spain (Odriozola/García Sanjuán 2013, 491) and flint from the Baetic mountain range (provinces of Granada and Malaga) (García Sanjuán et al. 2016) must be cited. The geochemical analysis on rock crystal was not quite as conclusive, but it suggested that they would have originated from either the Nevado-Filábride domain in the Baetic System, or from the schist-greywacke domain in the Central Iberian Zone of the Iberian Massif (Morgado Rodríguez et al. 2013, 12). These raw materials would have travelled distances of up to ca. 600km in order to reach Valencina. With regard to copper, there is a broad consensus that this material would have been supplied from the nearby pyrite belt in the province of Huelva, situated at a distance of a few dozen kilometres. In principle, the same could be said with regard to gold, although the lead isotope data is not as accurate (Murillo-Barroso et al. 2015, 587; Murillo-Barroso 2016b). The materials which are of proven or likely extra-peninsular origin are amber and ivory (to which we could also add ostrich egg shell). The available geochemical characterisations on amber suggests that this material likely originated in Sicily (Murillo-Barroso/García Sanjuán 2013, 517; Murillo-Barroso 2016a). Ivory on the other hand, may have travelled distances of several hundred (in the case of the African elephant) or several thousand kilometres (in the case of the Asian elephant) (García Sanjuán et al. 2013).

In Southern Iberia exchange networks for flint, variscite, amber and rock crystal covering hundreds of kilometres already existed in the Neolithic period (Costa Caramé et al. 2011). During the Copper Age, however, there were changes in the scope and intensity of the connectivity: (I) the number of objects made with the aforementioned raw materials increased substantially; (II) ivory took on a very special importance; (III) Valencina became a main reference point for this commercial activity.[11]

Secondly, attention must be drawn to the **scale of production and/or consumption** of strategic resources. The scale of copper production at Valencina cannot be measured exclusively on the basis of inferences made from residues of the smelting activity (as proposed by Nocete Calvo et al. 2008), but also in terms of the produced and consumed objects as well as by comparison with other contemporaneous sites (for a more in-depth discussion see Costa Caramé et al. 2010; Costa Caramé 2013; García Sanjuán 2013). With a total of 105 recorded items Valencina is one of the excavated Iberian Chalcolithic settlements with the highest count of copper artefacts. This can be compared with the 142 items from La Pijotilla (Badajoz), 96 from Los Millares (Santa Fe de Mondújar, Almería), ca. 90 from Almizaraque (Almería), 54 from Cabezo Juré (Alosno, Huelva), 43 from El Acebuchal (Carmona, Seville), 42 from Santa Justa (Alcoutim, Faro) and 21 from Perdigôes (Reguengos

11 This was probably due to a combination of factors such as the abundance of biotic and abiotic resources in its surroundings as well as its strategic location between Africa and Iberia, between the Atlantic Ocean and the Mediterranean Sea.

Material	Sector/Structure	Objects (type)	Objects (count)	Estimated provenance	References
Ivory	IES	Fragments	29	Asia	Vargas Jiménez et al. 2012
	Matarrubilla	Beads and others	87	Asia	Schuchmacher et al. 2013
	Montelirio	Various	*	Africa	Luciañez Triviño/ García Sanjuán 2016
	PP4-Montelirio (Structure 10.042-10.049)	Various	25*	Asia and Africa	García Sanjuán et al. 2013
Copper	La Pastora	Spear heads	29	Extra-Iberian: Anatolia/ Siria-Palestine (formal models)	Gernez 2011
Variscite	Matarrubilla	Beads	14	Iberia (Palazuelo de las Cuevas, Zamora)	Odriozola/ García Sanjuán 2013
Cinnabar	Montelirio		--	Iberia (¿Almadén, Ciudad Real?)	Hunt Ortiz/Hurtado Pérez 2010
	PP4-Montelirio (Structure 10.042-10.049)		--	Iberia (¿Almadén, Almadén, Ciudad Real?)	Rogerio Candelera et al. 2013
Ostrich egg-shell	Montelirio	Fragments Ostrich egg-shell		Extra-Iberian: north Africa	Fernández Flores/ Aycar Luengo 2013
	PP4-Montelirio (Structure 10.042-10.049)	Ostrich egg-shell	1	Extra-Iberian: north Africa	Unpublished
Rock crystal	Ontiveros	Arrowheads	16	Iberian	Morgado Rodríguez et al. 2015
	PP4-Montelirio (Structure 10.042-10.049)	Dagger blade	1	Iberian	Morgado Rodríguez et al. 2015
	Montelirio	Arrowheads (10), core (1), microblades (4)	15	Iberian	Morgado Rodríguez et al. 2015
Amber	PP4-Montelirio (Structure 10.042-10.049)	Dagger pommel	1	Extra-Iberian (Sicily)	Murillo-Barroso/ García Sanjuán 2013
Flint	PP4-Montelirio (Structure 10.042-10.049)	Dagger blade (1) and blades (61)	62	Málaga/Granada	José Antonio Lozano Rodríguez, personal communication

Tab. 2. Summary of objects and raw material of non-local provenance recorded at Valencina de la Concepción. (*) Estimate (under study) (Modified after: García Sanjuán 2013).

de Monsaraz, Évora) (García Sanjuán 2013, 43). These figures must be pondered against the fact that Valencina is by far the biggest of all of these settlements and that almost 130 excavations have been conducted in it. Comparatively, the tiny settlement of San Justa spanning approximately 300m^2 has practically half the number of copper objects as Valencina. Taken in isolation, the scale of copper production in Valencina might be portrayed as high, but seen in the context of the better known Chalcolithic sites it does not seem particularly high.

As far as gold is concerned it is difficult to make a quantitative estimate of the scale of production. In the few cases where gold has been found it appears mostly in the form of very small fragments of foil. In any case, a recent synthesis suggested that Valencina is along with Camino de las Yeseras (San Fernando de Henares, Madrid) the Iberian Copper Age site with the largest collection of gold (Murillo-Barroso et al. 2015, 585). The same could be said about ivory: the Montelirio tholos (5.3kg) and grave 10-042-10.049 from the PP4-Montelirio sector (2.6kg) present the largest collections of ivory objects ever documented in Iberian Copper Age, surpassing others such as Tomb 2 at Perdigões (1.7kg) (Luciañez Triviño/García Sanjuán 2016, 264), making Valencina the only site with both African and Asian elephant ivory (see Schuhmacher this Volume). Valencina also stands out as the site with the greatest volume of amber (Murillo-Barroso 2016a, 329) and rock crystal (García Sanjuán et al. 2016). Only with regard to variscite does Valencina seem to present a rather small amount of objects in comparison with other great Chalcolithic sites: besides the 14 beads documented at the megalithic monument of Matarrubilla no other piece of this material has been published to date (Odriozola/García Sanjuán 2013, 491).

Thirdly, it must be noted that evidence of the **local transformation** of rock crystal, copper, gold and ivory has been discovered in Valencina – thus suggesting the presence of fully developed *chaînes opératoires* locally. Although the evidence is not quite as clear in the case of variscite, amber and cinnabar, given the fact that there are major local precedents of these three materials dating to the Neolithic period, it does not seem unreasonable to assume that these raw materials were also locally transformed. With regard to flint, as previously mentioned, there are no clear records concerning cores or knapping debris (Murillo Díaz 2013). However, considering how the knapping of rock crystal (a material that because of its mechanical properties is much more difficult to work than flint) was locally mastered, it seems unlikely that there would not have been a community of artisans (from Valencina itself or from some of the nearby settlements along the Lower Guadalquivir River) capable of manufacturing the highly sophisticated objects discovered at the site, such as the long-barbed arrowheads from the *tholos* of Montelirio and the dagger blades also found at Structure 10.042-10.049 (García Sanjuán et al. 2016).

Fourthly, data from Valencina suggest that **the craftwork of some of these raw materials reached high levels of technical sophistication**. The long-barbed melonite arrowheads from the Montelirio *tholos* (*fig. 5*) and the flint dagger from grave 10.042-10.049 are among the most accomplished objects ever knapped in stone in Southern Iberian Late Prehistory. The same can be said with regard to the rock crystal arrowheads and the dagger blade from these graves – objects that are unparalleled in all of Western Europe (*fig. 6*). The gold foil with eye motifs from Structure 10.029, the largest piece of gold recorded in Chalcolithic Iberia, presents a lavish embossed decoration that includes 'oculi' motifs that to date, have only been identified on gold in the lower Guadalquivir Valley (Murillo-Barroso et al. 2015, 589) (*fig. 7*). Meanwhile, the ivory pieces documented at the large megalithic structures of Matarrubilla (the pectoral with multiple tubular beads), Montelirio (combs with zoomorphic decoration) and 10.042-10.049 (especially the hilt of the rock crystal dagger and its sheath, as well as the cornucopia carved in a tusk) are among the most sophisticated pieces made from this substance in the whole of Iberia (*fig. 8*). Therefore, it is reasonable to assume that a community of craftspeople of several different raw materials with a technical tradition unrivalled throughout Iberia existed during the 3rd mill. BCE in Valencina and/or the lower Guadalquivir Valley.

Continuing towards the aim of the meeting, which has given rise to this volume the fifth point to discuss would be **which of these raw materials (and the technical productions that were associated with them) were most strategic, and exactly which strategic role they played**. To this endit is crucial to pay attention to the nature of the manufactured objects and their context of use and deposition, even more than to the distances travelled by the raw materials or the technical mastery required for their transformation.

First of all, there is an interesting debate about whether copper metallurgy could have had a significant influence on the increase in social complexity that is observed in Valencina during the Copper Age, thus contributing to growing technical specialisation, scale of production and social inequality.[12] The study of the evidence recorded at the PP-Matarrubilla sector led to the suggestion that the transformation and use of this metal would have explained the emergence of a class society in the middle of a political system capable of exerting a centre-periphery type of territorial control, a true hallmark of a state formation process (Nocete Calvo et al. 2008, 731). Obviously, this view attributes a rather strategic nature to copper production. Later studies have criticised the premise upon which that interpretation is based (García Sanjuán/Murillo-Barroso 2013;

12 In fact, this debate echoes the existing debate on this question with regard to the entire Iberian Peninsula.

Fig. 5. Melonite arrowheads from the Montelirio tholos (Photo: Miguel Ángel Blanco de la Rubia).

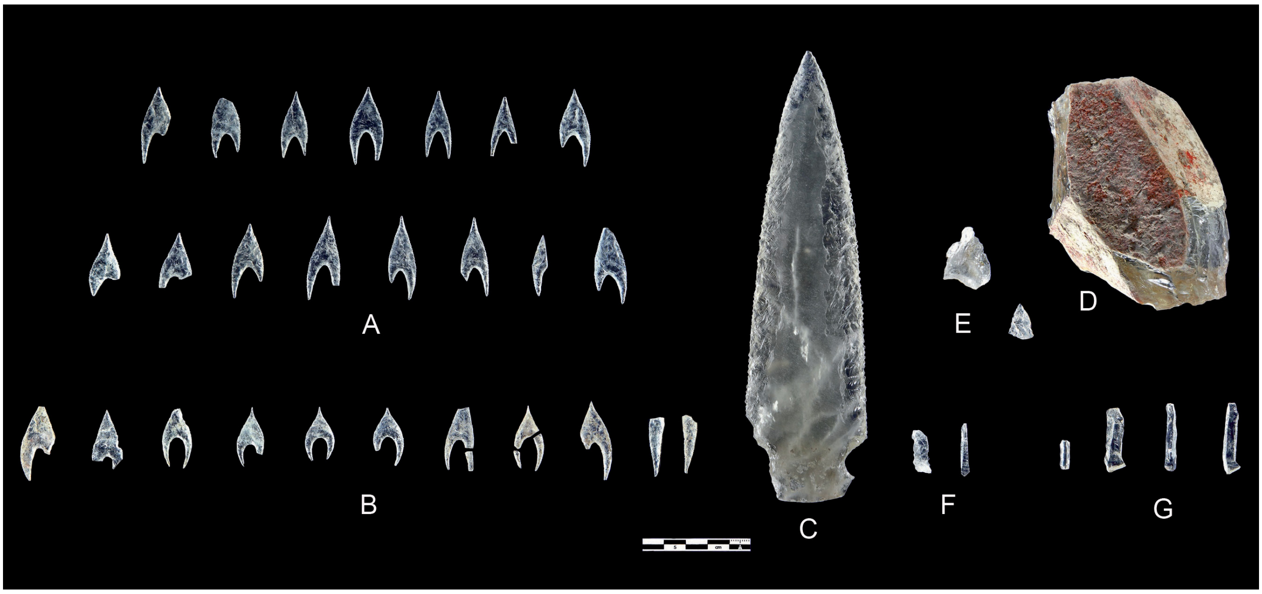

Fig. 6. Selection of rock crystal objects from Valencina. A: Ontiveros arrowheads; B: Montelirio tholos arrowheads; C: PP4-Montelirio dagger blade (Structure 10.049); D: Montelirio tholos core; E: PP4-Montelirio knapping debris (from UE-345 on the left and UE-919 on the right); F: PP4-Montelirio micro-blades (from Structure 10.015 on the left and Structure 10.043 on the right); G: Montelirio tholos microblades (Photo: Miguel Ángel Blanco de la Rubia).

García Sanjuán 2013, 42–46). Without going into the discussion on the scale of production briefly outlined above, what is shown by both the functional nature of the manufactured objects and their contexts of deposition does not indicate that copper production played such a massive strategic role but in fact, had less strategic importance than other raw materials such as ivory. The 105 copper-based artefacts (with an overall weight of just under 10kg) identified in Valencina are mainly classified as tools (punches, saws, axes, chisels) (Costa Caramé 2013, 465). Unlike what occurred during the Early Bronze Age (ca. 2200–1500 calBCE), Chalcolithic copper metallurgy was rarely used to produce personal ornaments and weapons (Murillo-Barroso/Montero Ruiz 2012). Even more relevant however, is the pronounced lack of copper objects in funerary deposits,

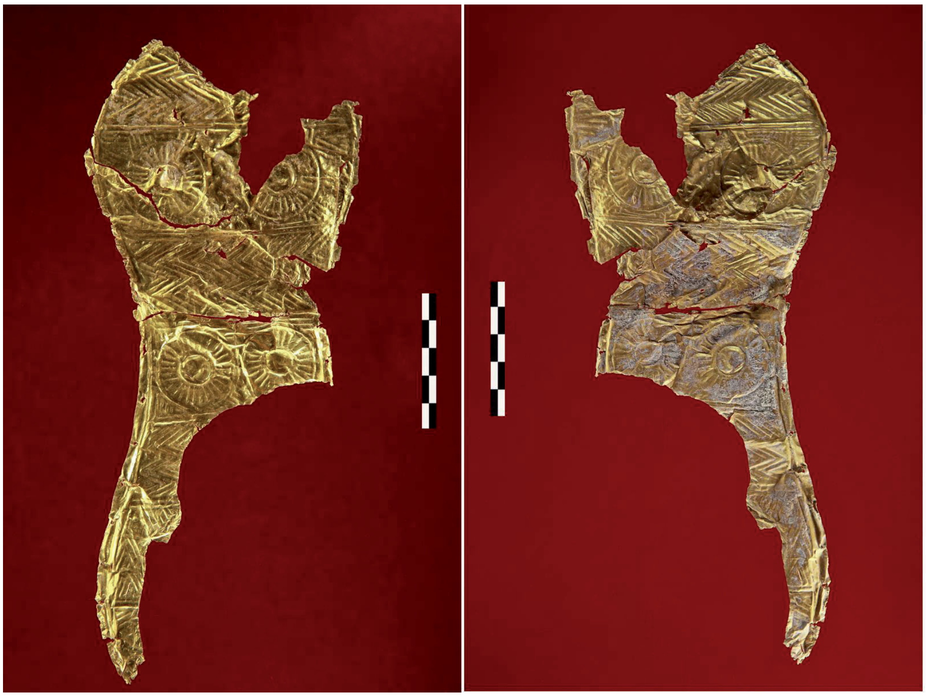

Fig. 7. Golden sheet decorated with embossed motifs found in Structure 10.029 of the PP4-Montelirio: Obverse on the left and reverse on the right (Photo: Miguel Ángel Blanco de la Rubia).

Fig. 8. Carved tusk of *elephas maximus* (Asian elephant) found in Structure 10.049 of the PP4-Montelirio (Photo: Miguel Ángel Blanco de la Rubia).

including the most sumptuous graves. Case in point are the Montelirio tholos (where no copper object was found) and the PP4-Montelirio sector where the excavation of 134 structures (61 of which presented evidence of formal deposition of human remains), only resulted in the discovery of six copper-based objects including two earrings, a punch, a Palmela arrowhead and an unidentified fragment. Grave 10.042-10.049, where an extraordinary collection of flint and ivory objects was uncovered, as well as amber and rock crystal, stands out for its almost complete lack of copper objects – reduced to one very small punch. In fact, the most impressive copper-based metal objects ever found at Valencina – the 29 spearheads from La Pastora (*fig. 9*) and the three copper axes from Calle Trabajadores 14–18 (with a total weight of 4.3kg, or in other words almost half the weight of all of the copper documented at the site) – were not used as grave goods at all. The spearheads were found at La Pastora's mound while the Calle Trabajadores copper axes were uncovered from a circular, underground non-funerary structure about 3.20m in diameter.

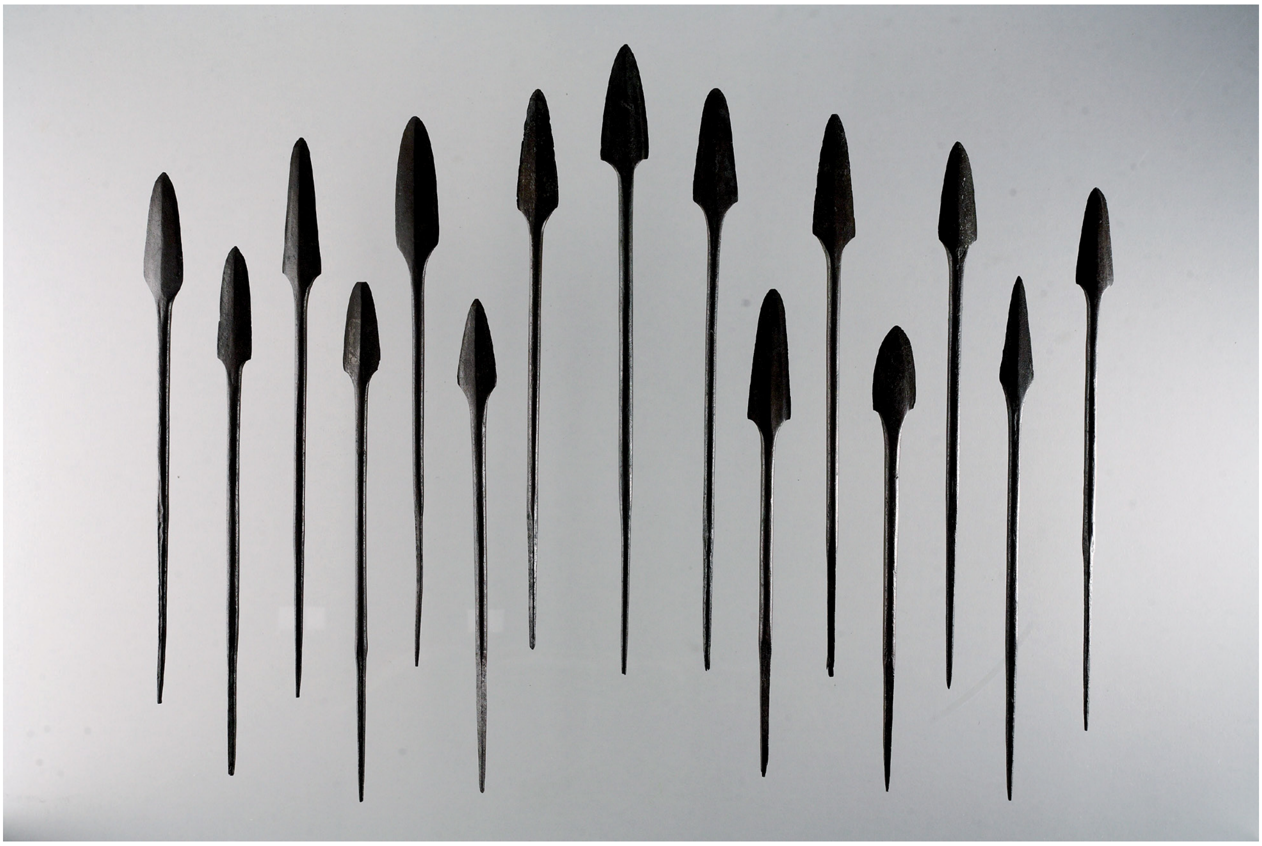

Fig. 9. Copper spear heads found in La Pastora's mound (Photo: Miguel Ángel Blanco de la Rubia).

Barring a few differences something similar can be said for gold. Fragments of small gold foils were unearthed from the interior of the *tholoi* of Matarrubilla, La Pastora and Montelirio and it is therefore conceivable that they were used as grave goods. However, it is extremely remarkable that the largest piece of gold from the site – and certainly the largest from all of Chalcolithic Iberia – was found in a pit of the PP4-Montelirio sector which had not been used as a tomb (Murillo-Barroso et al. 2015, 566–568).

Much clearer is the relationship between large funerary structures and the collections of ivory, rock crystal and flint. With the exception of a workshop discovered at the IES sector (with findings consisting mainly of pre-forms and chipping debris), the main collections of ivory objects were located at three large megalithic monuments: Matarrubilla, Montelirio and Structure 10-042-10.049. Although rock crystal was found in several different contexts – both funerary and non funerary – the most technically sophisticated objects were also deposited in large megalithic structures: Montelirio, Structure 10-042-10.049 and Ontiveros. The same can also be said with regard to the most sophisticated pieces of flint, which were mainly discovered in the *tholoi* of Montelirio and Structure 10.042-10.049.

All in all, the information currently available seems to paint a picture in which ivory, rock crystal, flint and gold were the most strategic exotic raw materials from a social and ideological perspective, whereas copper and variscite were much less prominent.

4. Conclusions

The discussion above suggests some of the patterns that presided over the economy of the communities settled in the Lower Guadalquivir Valley during the Copper Age, particularly in what refers to the exploitation and use of strategic resources.

With regard to agriculture, although it is clear that the territory presented opportunities for productive intensification (for example through increased labour investment and/or technological advances) the data fails to clarify the role that crop production played in the communities living and/or frequenting Valencina. Interpretations proposing that Valencina would have acted as the 'tax collection centre' of a state-level political entity which would have encompassed the entire Lower Guadalquivir Valley (Cruz-Auñón Briones/Arteaga Matute 1999, 604 f.), are based almost exclusively, on the assumption that all of the pits found at the site with a certain morphology were 'silos' used more or less simultaneously. These interpretations are not supported by other categories of data such as grinding stones, which are found in limited numbers (García Sanjuán/Murillo-Barroso 2013, 127 f.), nor by the chronological evidence suggesting that the site had a long chronology (almost one thousand years of occupation) with different phases of activity (García Sanjuán et al. forthcoming).

Livestock farming on the other hand, seems to have played a very important economic and social role. The only available results of carbon (δ13C) and nitrogen (δ15N) stable isotopes in bone collagen suggest a diet based mainly on C3 land resources, rich in proteins and low in marine components (Fontanals Coll et al. 2015, 7), with proteins being mainly obtained from C3 consumer herbivores (Díaz-Zorita Bonilla 2013, 198). This matches well other types of evidence suggesting that the farming of certain high-performance animals, especially the *dehesa* pig, may have become a strategic element in the accumulation of wealth and therefore a prime mover of increasing social complexity. Although evidence suggesting the presence of domestic equids is weaker, it also merits consideration particularly from the point of view of future research. Domestic equids would have fostered further communication, connectivity and territorial integration, which would have been reflected not only in the diversity of foreign products, but also in the presence of a significant proportion of non-local individuals. The stable isotopes $^{87}Sr/^{86}Sr$ results of a total of 33 Valencina individuals returned a total of 11 non-local individuals (a third of those sampled), which appears to be a rather high proportion (Díaz-Zorita Bonilla 2013, 195–199).

Overall, the data on the farming economy seem crucial to analyse the very nature of Valencina as a site. The low number of stone tools for harvesting, threshing and grinding added to the selective nature of the faunal remains found at PP-Matarrubilla and Calle Mariana Pineda sectors (indicating transportation of selected anatomical animal parts into the site) join other evidence such as, chiefly, the absence of residential structures like those documented at other Chalcolithic Iberian settlements, to suggest that Valencina may have been, either during all or part of its biography not a permanently occupied village, but rather a temporary gathering place, as was the case with Perdigões in the Portuguese Alentejo. The evidence of selective transport of anatomical animal parts in some sectors (PP-Matarrubilla and Calle Mariana Pineda) and the spatial concentration of faunal remains (in Structure 10.024) also suggest the importance that commensality practices may have held in certain sectors and/or periods of time throughout that biography.

With reference to the metalworking economy, Valencina stands out for its comparatively large number of recorded artefacts, which place it as one of the most important sites on the Iberian Peninsula, especially with regard to gold. However, when the context of use and deposition of these metals is considered, it becomes apparent that the social and ideological role of metals was complex and nuanced by various factors. Save for some exceptions, copper was generally used to manufacture simple tools and does not seem to have been of great importance as a vehicle of expression of higher social status in the funerary ideology. Copper is rarely found among the grave goods discovered inside the large megalithic burials excavated in recent years. Gold on the other hand does indeed appear to be employed as grave good on the inside of large *tholoi*, but the intrinsic and contextual characteristics of the foil uncovered at Structure 10.029 of the PP4-Montelirio sector suggest that this metal may have held a general symbolic meaning which associated it to the cult of the 'oculi' entity (possibly a solar divinity) that appears recurrently in Chalcolithic imagery. All of this indicates that within the funerary ideology (and presumably within the social structure) of the Chalcolithic communities that inhabited and/or occupied Valencina, copper played a rather limited role in terms of the expression of prestige and power of those individuals with the highest social standing. In particular, the individuals or groups (family units, factions) belonging to the élite that can be seen reflected in graves 10.042-10.049 and at Montelirio seem to have chosen objects made from ivory, flint, rock crystal and amber, and not copper, to make their power visible.

Perhaps for this reason, the supply and transformation of exotic raw materials seems to have been one of the most strategic activities within Valencina's Chalcolithic economy. Most likely invested with magical and/or symbolic properties due to their distant origins and perhaps shrouded in mystery (at least in the case of ivory, rock crystal and amber), these substances would have played a far more important strategic role than copper as vehicles for the expression of social status. Social competition, on the other hand, may have been connected to collective works requiring considerable labour investments (such as large megalithic monuments and ditches – perhaps ditched enclosures), and which probably entailed large-scale commensality practices. Therefore, the exoticism of what was remote and inaccessible would have been the parameter acting as the material reflection of the processes of increasing social complexity in Chalcolithic Valencina. Rather than copper, it was clearly the foreign raw materials transformed into spectacular, luxury objects, which were most directly associated with megalithic monuments such as Matarrubilla, La Pastora, Montelirio and Structure 10.042-10.049.

Of course, the discussion presented above raises more questions than answers; given our limitations on space, of all of the possibly relevant questions I will only address two. The first critical question is: what were the causes behind the gradual transformation of Valencina around 3200 calBCE into an enclave of unique importance within the Iberian Copper Age exchange networks? Very little is known about the processes that at the regional level gave rise to the establishment and flourishing of this great site. One hypothesis to be tested in the future is that the economic and commercial prominence of the communities of the Lower Guadalquivir Valley during the final third of the 4th mill. BCE was partly the result of the exploitation and trade of sea salt (García Sanjuán 2013, 50). Salt was a commodity of great strategic value during European Late Prehistory and the exploitation and trade of this product have been cited as the main reasons behind the emergence of prosperous communities during the Neolithic and Copper Age in several regions (Weller 2002). In Iberia there is growing evidence pointing to the production of salt between the Neolithic period and the Bronze Age (Delibes de Castro et al. 1998; Valera et al. 2006; Guerra Doce et al. 2011; Weller/Figuls 2010; 2012). Chalcolithic Valencina was situated in a marine environment. In fact, an important salt production centre has been identified at the site of La Marismilla (La Puebla del Río, Seville) barely 25km south of Valencina; although this site has not been radiocarbon dated, according to its excavators it presented a chronology compatible with the Late Neolithic and the Early Copper Age (Escacena Carrasco et al. 1996). It is therefore possible that salt – along with copper and other abiotic or even biotic resources – was at the root of the processes which gave rise to Valencina's transformation into a trading enclave.

The second question pertaining to the outcome of this study is: to what extent may the generalisations made above be considered valid with regard to Valencina's long period of use or occupation in its entirety? The comprehensive radiocarbon dating project recently carried out (García Sanjuán et al. forthcoming) suggests that we must be very cautious when making generalisations with regard to the economic and social structures of the communities that frequented and/or occupied Valencina. With an occupation that began around 3200 calBCE the site underwent an initial phase lasting for about 300 or 400 years; this phase was characterised by burials in artificial caves – such as those at La Huera and Calle Dinamarca – where the presence of exotic raw materials was extremely low. In contrast, a new phase characterised by greater social dynamism began around 2900–2800 and lasted until approximately 2600–2500 calBCE. During this new phase the funerary practices were rather focused on the south-east sector of the site: La Pastora, PP4-Montelirio and the *tholos* of Montelirio. This phase was characterised by the construction of megalithic monuments, as well as by the use of funerary paraphernalia made from exotic raw materials; this latter point would continue to characterise Valencina during what must have been a period of intense competition between groups and factions, perhaps in addition to an increasing social hierarchization. Elements suggesting the decline of this social process have been identified dating back to between 2500 to 2300 calBCE. This process finalises with what seems to be the cessation of activities at the site – or a reduction in activity to much lower levels – around 2300–2200 calBCE. Therefore, although the discussion presented here has shown the general economic framework of Copper Age Valencina over the course of almost one thousand years, the finer strategic roles played by the different economic resources could have varied substantially throughout these pronounced phases of the site's formation, emergence and decline.

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Bibliography

Acosta Martínez et al. 1987: P. Acosta Martínez/R. Cabrero García/R. Cruz-Auñón Briones/V. Hurtado Pérez, Informe preliminar sobre las excavaciones de La Morita (Cantillana, Sevilla), 1985. Anuario Arqueológico de Andalucía 1985. Volume II: Actividades de Urgencia (Sevilla 1987) 150–152.

Abril López et al. 2010: D. Abril López/F. Nocete Calvo/J. A. Riquelme Cantal/M. Rodríguez Bayona/N. Inacio, Zooarqueología del III milenio ANE. El barrio metalúrgico de Valencina de la Concepción (Sevilla). Complutum 21.1, 2010, 87–100.

Bernáldez Sánchez et al. 2013: E. Bernáldez Sánchez/M. Bernáldez Sánchez/E. García Viñas, ¿Campos de hoyos, campos de compost? Estudio tafonómico y paleobiológico del sector de La Gallega del yacimiento de Valencina de la Concepción (Sevilla). In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/M. T. Ruiz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción. Investigación y Tutela en el 150 Aniversario del descubrimiento de La Pastora (Sevilla 2013) 421–424.

Cámara Serrano et al. 2008: J. A. Cámara Serrano/R. Lizcano Prestel/C. Pérez Bareas/E. Gómez del Toro, Apropiación, sacrificio, consumo y exhibición ritual de los animales en el Polideportivo de Martos. Sus implicaciones en los orígenes de la desigualdad social. Cuadernos de Prehistoria y Arqueología de la Universidad de Granada 18, 2008, 55–89.

Cámara Serrano et al. 2010: J. A. Cámara Serrano/J. A. Riquelme Cantal/C. Pérez Bareas/R. Lizcano Prestel/A. Burgos Juárez/F. Torres Torres, Sacrificio de animales y ritual en el Polideportivo de Martos. La Alberquilla (Martos, Jaén). Cuadernos de Prehistoria y Arqueología de la Universidad de Granada 20, 2010, 295–327.

Cardoso et al. 2014: J. L. Cardoso/J. T. Vilstrup/V. Eisenmann/L. Orlando, First Evidence of Equus asinus L. in the Chalcolithic Disputes the Phoenicians as the First to Introduce Donkeys Into the Iberian Peninsula. Journal of Archaeological Science 40, 2014, 4483–4490.

Cieslak et al. 2010: M. Cieslak/M. Pruvost/N. Benecke/M. Hofreiter/A. Morales Muñiz/M. Reissmann/A. Ludwig, Origin and History of Mitochondrial DNA Lineages in Domestic Horses. PLoSOne 5.12, last updated 20.12.2010, <http://dx.doi.org/10.1371/journal.pone.0015311> (last access 10.02.2017).

Conlin Hayes 2003: E. Conlin Hayes, Los inicios del III milenio a.C. en Carmona. Las evidencias arqueológicas. Carmona. Revista de Estudios Locales 1, 2003, 83–143.

Conlin Hayes 2004: E. Conlin Hayes, El poblado calcolítico de Carmona (Sevilla). In: Actas de los Simposios de Prehistoria de la Cueva de Nerja. La Problemática del Neolítico en Andalucía. Las Primeras Sociedades Metalúrgicas en Andalucía (Neria 2004) 370–378.

Costa Caramé 2011: M. E. Costa Caramé, La Metalurgia y sus Repercusiones Económicas, Sociales e Ideológicas en las Comunidades del III y II Milenios cal ANE en el Suroeste de la Península Ibérica (Sevilla 2011).

Costa Caramé 2013: M. E. Costa Caramé, La actividad metalúrgica en Valencina de la Concepción (Sevilla). Probelmática y situación actual de la investigación. In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/M. T. Ruiz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción. Investigación y Tutela en el 150 Aniversario del descubrimiento de La Pastora (Sevilla 2013) 459–468.

Costa Caramé et al. 2010: M. E. Costa Caramé/M. Díaz-Zorita Bonilla/L. García Sanjuán/D. Wheatley, The Copper Age Settlement of Valencina de la Concepción (Seville, Spain). Demography, Metallurgy and Spatial Organisation. Trabajos de Prehistoria 67.1, 2010, 87–118.

Costa Caramé et al. 2011: M. E. Costa Caramé/L. García Sanjuán/M. Murillo-Barroso/R. Parrilla Giráldez/D. W. Wheatley, Artefacts Produced in Rare Rocks from Funerary Contexts of the 4^{th}–2^{nd} mill. calBCE in Southern Spain. A Review. In: L. García Sanjuán/C. Scarre/D. Wheatley (eds.), Exploring Time and Matter in Prehistoric Monuments. Absolute Chronology and Rare Rocks in European Megaliths. Proceedings of the 2^{nd} European Megalithic Studies Group Meeting (Seville, Spain, November 2008). Menga. Journal of Andalusian Prehistory. Monograph 1 (Sevilla 2011) 253–293.

Cruz-Auñón Briones/Arteaga Matute 1999: R. Cruz-Auñón Briones/O. Arteaga Matute, Acerca de un campo de silos y un foso de cierre prehistóricos ubicados en la Estacada Larga (Valencina de la Concepción, Sevilla). Excavación de urgencia de 1995. Anuario Arqueológico de Andalucía 1995. Volume 3 (Seville 1999) 600–607.

Delibes de Castro et al. 1998: G. Delibes de Castro/A. Viñe/M. Salvador, Santioste, una factoría salinera de los inicios de la Edad del Bronce en Otero de Sariegos (Zamora). In: G. Delibes De Castro (ed.), Minerales y Metales en la Prehistoria Reciente. Algunos Testimonios de su Explotación y Laboreo en la Península Ibérica. Studia Archaeologica 88 (Valladolid 1998) 155–198.

Díaz-Zorita Bonilla 2013: M. Díaz-Zorita Bonilla, The Copper Age in South-West Spain. A Bioarchaeological Approach to Prehistoric Social Organisation (Unpublished PhD-Thesis University of Durham 2013).

Escacena Carrasco et al. 1996: J. L. Escacena Carrasco/M. Rodríguez De Zuloaga Montesino/I. Ladrón de Guevara Sánchez, Guadalquivir Salobre. Elaboración Prehistórica de Sal Marina en las Antiguas Bocas del Río (Sevilla 1996).

Fernández Flores et al. 2016: Á. Fernández Flores/L. García Sanjuán/M. Díaz-Zorita Bonilla (eds.), Montelirio. Un Gran Monumento Megalítico de la Edad del Cobre (Sevilla 2016).

Fernández Gómez/Alonso Sierra 1985: F. Fernández Gómez/J. Alonso Sierra, Un poblado de cabaña campaniforme en la Universidad Laboral de Sevilla. Noticiario Arqueológico Hispánico 25, 1985, 7–26.

Fontanals Coll et al. 2015: M. Fontanals Coll/M. Díaz-Zorita Bonilla/E. Subirá, A Palaeodietary Study of Stable Isotope Analysis from a High-Status Burial in the Copper Age. The Montelirio Megalithic Structure at Valencina de la Concepción-Castilleja de Guzmán, Spain. International Journal of Osteoarchaeology 26.3, 2015, 447–459, last updated 06.03.2015 <http://onlinelibrary.wiley.com/doi/10.1002/oa.2435/pdf> (last access 10.02.2017).

García Sanjuán 2013: L. García Sanjuán, El asentamiento de la Edad del Cobre de Valencina de la Concepción. Estado actual de la investigación, debates y perspectivas. In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/M. T. Ruiz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción. Investigación y Tutela en el 150 Aniversario del descubrimiento de La Pastora (Sevilla 2013) 21–59.

García Sanjuán/Murillo-Barroso 2013: L. García Sanjuán/M. Murillo-Barroso, Social Complexity in Copper Age Southern Iberia (c. 3200–2200 cal BC). Reviewing the 'State' Hypothesis at Valencina de la Concepción (Seville, Spain). In: M. Cruz Berrocal/L. García Sanjuán/A. Gilman (eds.), The Prehistory of Iberia. Debating Early Social Stratification and the State (New York 2013) 119–140.

García Sanjuán et al. 2013: L. García Sanjuán/M. Luciañez Triviño/T. Schuhmacher/D. Wheatley/A. Banerjee, Ivory Craftsmanship, Trade and Social Significance in the Southern Iberian Copper Age. The Evidence from the PP4-Montelirio Sector of Valencina de la Concepción (Seville, Spain). European Journal of Archaeology 16.4, 2013, 610–635.

García Sanjuán et al 2016: L. García Sanjuán/J. A. Lozano Rodríguez/O. Sánchez Liranzo/J. F. Gibaja Bao/V. Aranda Sánchez, La industria lítica del tholos de Montelirio. In: Á. Fernández Flores/L. García Sanjuán/M. Díaz-Zorita Bonilla (eds.), Montelirio. Un Gran Monumento Megalítico de la Edad del Cobre (Sevilla 2016) 311–344.

García Sanjuán et al. forthcoming: L. García Sanjuán/L. Cáceres Puro/M. E. Costa Caramé/M. Díaz Guardamino Uribe/M. Díaz-Zorita Bonilla/Á. Fernández Flores/V. Hurtado Pérez/P. M. López Aldana/E. Méndez Izquierdo/A. Pajuelo Pando/J. Rodríguez Vidal/J. M. Vargas Jiménez/D. Wheatley/E. Dunbar/C. Bronk Ramsey/A. Bayliss/N. Beavan/D. Hamilton/A. Whittle, Assembling the Dead, Gathering the Living. Radiocarbon Dating and Bayesian Modeling for Copper Age Valencina de la Concepción (Sevilla, Spain). Journal of World Prehistory (forthcoming).

Guerra Doce et al. 2011: E. Guerra Doce/G. Delibes de Castro/J. Abarquero Moras/J. M. Del Val Recio/A. L. Palomino Lázaro, The Beaker Salt Production Centre of Molino Sanchón II, Zamora, Spain. Antiquity 85.329, 2011, 805–818.

Hain 1982: F. H. Hain, Kupferzeitliche Tierknochenfunde aus Valencina de la Concepción, Sevilla. Studien über frühe Tierknochenfunde von der iberischen Halbinsel 8 (München 1982).

Haldon 1993: J. Haldon, The State and the Tributary Mode of Production (London 1993).

Harrison et al. 1976: R. J. Harrison/T. Bubner/V. Hibbs, The Beaker Pottery from El Acebuchal (Carmona). Madrider Mitteilungen 17, 1976, 79–141.

Hunt Ortiz 2003: M. A. Hunt Ortiz, Prehistoric Mining and Metallurgy in Southwest Iberian Peninsula. British Archaeological Reports. International Series 1188 (Oxford 2003).

Hunt Ortiz/Hurtado Pérez 2010: M. A. Hunt Ortiz/V. Hurtado Pérez, Pigmentos de sulfuro de mercurio (cinabrio) en contextos funerarios de época calcolítica en el Sur de la península Ibérica.Investigaciones sobre el uso, depósitos minerales explotados y redes de distribución a través de la caracterización composicional e isotópica. In: M. E. Sainz Carrasco/R. López Romero/M. A. Cano Díaz Tendero/J. C. Calvo García (eds.), Actas del VIII Congreso Ibérico de Arqueometría (Teruel, 19–21 de Octubre de 2009) (Teruel 2010) 123–132.

Hurtado Pérez 2013: V. Hurtado Pérez, Los ídolos del asentamiento de Valencina de la Concepción (Sevilla). Una revisión. In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/M. T. Ruiz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción. Investigación y Tutela en el 150 Aniversario del descubrimiento de La Pastora (Sevilla 2013) 311–327.

Hurtado Pérez/Amores Carredano 1984: V. Hurtado Pérez/F. Amores Carredano, El tholos de Las Canteras y los enterramientos del Bronce en la necrópolis de El Gandul (Alcalá de Guadaira, Sevilla). Cuadernos de Prehistoria y Arqueología de la Universidad de Granada 9, 1984, 147–174.

Lara Montero et al. 2006: D. A. Lara Montero/D. Barragán Mallofret/M. Garrido Martín, El asentamiento calcolítico del Parque de Miraflores. Resultados preliminares. SPAL. Revista de Prehistoria y Arqueología 13, 2006, 245–256.

Lazarich González et al. 1997: M. Lazarich González/I. Ladrón de Guevara Sánchez/M. Rodríguez/M. Sánchez, El yacimiento de El Acebuchal (Carmona, Sevilla). Un análisis de las estructuras calcolíticas a través de los escritos inéditos de J. Bonsor e historiografía. SPAL. Revista de Prehistoria y Arqueología 4, 1997, 81–100.

Liesau 2005: C. Liesau, Arqueozoología del caballo en la antigua iberia, Gladius 25, 2005, 187–206.

Liesau et al. 2014: C. Liesau/M. T. Aparicio Alonso/R. Araujo Armero/R. Llorente Rodríguez/A. Morales Muñiz, La fauna del sector PP4-Montelirio del yacimiento prehistórico de Valencina de la Concepción (Sevilla). Economía y simbolismo de los animales en una comunidad del III milenio. Menga. Revista de Prehistoria de Andalucía 5, 2014, 69–96.

Llergo López et al. 2013: Y. Llergo López/M. A. Royo García/C. Granados Trillo/Á. Fernández Flores/F. Borja Barrera/J. L. Ubera Jiménez, El entorno vegetal de Valencina de la Concepción (Sevilla) en el III milenio AC. Una aproximación palinológica. In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/M. T. Ruiz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción. Investigación y Tutela en el 150 Aniversario del descubrimiento de La Pastora (Sevilla 2013) 409–420.

Luciañez Triviño/García Sanjuán 2016: M. Luciañez Triviño/L. García Sanjuán, Los marfiles del tholos de Montelirio. In: Á. Fernández Flores/L. García Sanjuán/M. Díaz-Zorita Bonilla (eds.), Montelirio. Un Gran Monumento Megalítico de la Edad del Cobre (Sevilla 2016) 245–272.

Luciañez Triviño et al. 2014: M. Luciañez Triviño/L. García Sanjuán/T. Schuhmacher, Restaurierung von archäologischem Elfenbein am Beispiel von vier chalkolithischen Elfenbeinobjekte aus der Siedlung von Valencina de la Concepción (Sevilla). Restaurierung und Archäologie 6, 2014, 71–87.

Matoso Silva et al. 2015: R. Matoso Silva/M. Bower/C. Detry/S. Valenzuela/C. Fernández Rodríguez/S. Davis/J. A. Riquelme Cantal/D. Álvarez Lao/A. M. Arruda/C. Viegas/C. Luís, Tracing the History of the Horse in Iberia and North Africa Through Ancient DNA. In: C. Oliveira/R. Morais/A. Morillo Cerdán (eds.), Archaeo Analytics. Chromatography and DNA Analysis in Archaeology (Esposende 2015) 217–227.

Murillo-Barroso 2016a: M. Murillo-Barroso, El ámbar del tholos de Montelirio. In: Á. Fernández Flores/L. García Sanjuán/M. Díaz-Zorita Bonilla (eds.), Montelirio. Un Gran Monumento Megalítico de la Edad del Cobre (Sevilla 2016) 311–344.

Murillo-Barroso 2016b: M. Murillo-Barroso, El oro del tholos de Montelirio en el contexto de la tecnología áurea de Valencina. In: Á. Fernández Flores/L. García Sanjuán/M. Díaz-Zorita Bonilla (eds.), Montelirio. Un Gran Monumento Megalítico de la Edad del Cobre (Sevilla 2016) 285–310.

Murillo-Barroso/Montero Ruiz 2012: M. Murillo-Barroso/I. Montero Ruiz, Copper Ornaments in the Iberian Chalcolithic. Technology Versus Social Demand. Journal of Mediterranean Archaeology 25.1, 2012, 53–73.

Murillo-Barroso et al. 2015: M. Murillo-Barroso/M. Costa Caramé/M. Díaz Guardamino Uribe/L. García Sanjuán/C. Mora Molina, A Reappraisal of Iberian Copper Age Goldwork. Craftmanship, Symbolism and Art in a Non-Funerary Golden-Sheet from Valencina de la Concepción. Cambridge Archaeological Journal 25.3, 2015, 565–596.

Murillo-Barroso/García Sanjuán 2013: M. Murillo-Barroso/L. García Sanjuán, El pomo de ámbar de la Estructura 10.042–10.049 del Sector PP4-Montelirio del asentamiento de Valencina de la Concepción (Sevilla). In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/M. T. Ruiz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción. Investigación y Tutela en el 150 Aniversario del descubrimiento de La Pastora (Sevilla 2013) 511–519.

Murillo Díaz 1987: T. Murillo Díaz, La Industria Lítica Tallada del Yacimiento Calcolítico de Valencina de la Concepción (Sevilla) (Unpublished PhD-Thesis University of Seville 1987).

Murillo Díaz 2013: T. Murillo Díaz, La manufactura de artefactos líticos de la Edad del Cobre en el territorio de Valencina de la Concepción (Sevilla). In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/M. T. Ruiz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción. Investigación y Tutela en el 150 Aniversario del descubrimiento de La Pastora (Sevilla 2013) 469–484.

Nocete Calvo et al. 2005: F. Nocete Calvo/R. Sáez Ramos/J. M. Nieto Liñán/R. Cruz-Auñón/R. Briones/R. Cabrero García/E. Alex/M. Rodríguez Bayona, Circulation of Silicified Oolitic Limestone Blades in South-Iberia (Spain and Portugal) during the Third Millennium B.C. An Expression of a Core/Periphery Framework. Journal of Anthropological Archaeology 24.1, 2005, 62–81.

Nocete Calvo et al. 2008: F. Nocete Calvo/G. Queipo de Llano/R. Sáez Ramos/J. M. Nieto Liñán/N. Inácio/M. Rodríguez Bayona/A. Peramo/J. M. Vargas Jiménez/R. Cruz-Auñón/R. Briones/J. I. Gil Ibarguchi/J. F. Santos, The Smelting Quarter of Valencina de la Concepción (Seville, Spain). The Specialised Copper Industry in a Political Centre of the Guadalquivir Valley during the Third Millennium BC (2750–2500 BC). Journal of Archaeological Science 35, 2008, 717–732.

Nocete Calvo et al. 2013: F. Nocete Calvo/J. M. Vargas Jiménez/T. Schuhmacher/A. Banerjee/W. Dindorf, The Ivory Workshop of Valencina de la Concepción (Seville, Spain) and the Identification of Ivory from Asian Elephant on the Iberian Peninsula in the first Half of the 3rd millennium BC. Journal of Archaeological Science 40, 2013, 1579–1592.

Odriozola/García Sanjuán 2013: C. Odriozola/L. García Sanjuán, Las cuentas de collar de piedra verde de Matarrubilla (Valencina de la Concepción (Sevilla). In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/V. M. T. Ruiz Moreno/R. Cruz-Auñón/R. Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción (Sevilla). Investigación y Tutela en el 150 Aniversario del Descubrimiento de La Pastora (Sevilla 2013) 485–493.

Pajuelo Pando/López Aldana 2013: A. Pajuelo Pando/P. López Aldana, Estudio arqueozoológico de estructuras significativas de c/Mariana de Pineda s/n (Valencina de la Concepción, Sevilla). In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/M. T. Ruiz Moreno/R. Cruz-Auñón/R. Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción. Investigación y Tutela en el 150 Aniversario del descubrimiento de La Pastora (Sevilla 2013) 445–458.

Pajuelo Pando 2016: A. Pajuelo Pando, Los restos de animales de Montelirio. In: Á. Fernández Flores/L. García Sanjuán/M. Díaz-Zorita Bonilla (eds.), Montelirio. Un Gran Monumento Megalítico de la Edad del Cobre (Sevilla 2016) 455–468.

Rogerio Candelera et al. 2013: M. A. Rogerio Candelera/L. K. Herrera/A. Z. Miller/L. García Sanjuán/C. Mora Molina/D. W. Wheatley/A. Justo/C. Saiz Jiménez, Allochthonous Red Pigments Used in Burial Practices at the Copper Age Site of Valencina de la Concepción (Sevilla, Spain). Characterisation and Social Dimension. Journal of Archaeological Science 40, 2013, 279–290.

Rovira Llorens/Gómez Ramos 1999: S. Rovira Llorens/P. Gómez Ramos, Metalurgia calcolítica en Carmona (Sevilla). SPAL. Revista de Prehistoria y Arqueología 7, 1999, 69–79.

Sardá Piñero 2013: D. Sardá Piñero, Estructuras negativas multifuncionales en Avenida de Andalucía nº 9 Valencina de la Concepción (Sevilla). In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/M. T. Ruiz Moreno/R. Cruz-Auñón/R. Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción. Investigación y Tutela en el 150 Aniversario del descubrimiento de La Pastora (Sevilla 2013) 151–156.

Schuhmacher et al. 2013: T. Schuhmacher/A. Banerjee/W. Dindorf/F. Nocete Calvo/J. M. Vargas Jiménez, Los marfiles del yacimiento de Valencina de la Concepción (Sevilla) en el contexto del Calcolítico del suroeste peninsular. In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/M. T. Ruiz Moreno/R. Cruz-Auñón/R. Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción. Investigación y Tutela en el 150 Aniversario del descubrimiento de La Pastora (Sevilla 2013) 495–510.

Stevenson/Harrison 1992: A. C. Stevenson/R. J. Harrison, Ancient Forests in Spain. A Model for Land-Use and Dry Forest Management in Southwest Spain from 4000 BC to 1900 AD. Proceedings of the Prehistoric Society 58, 1992, 227–247.

Valera et al. 2006: A. C. Valera/J. P. Tereso/J. Rebuge, O Monte da Quinta 2 (Benavente) e a produção de sal no Neolítico Final/Calcolítico do estuário do Tejo. Do Epipaleolítico ao Calcolítico na Península Ibérica. In: Actas dos IV Congresso de Arqueología Peninsular (Faro, 14 a 19 Setembro 2004) (Faro 2006) 291–306.

Valera et al. 2014: A. C. Valera/L. Shaw Evangelista/P. Castanheira, Zoomorphic Figurines and the Problem of Human-Animal Relationship in Neolithic and Chalcolithic Southwest Iberia. Menga. Journal of Andalusian Prehistory 5, 2014, 15–41.

Vargas Jiménez et al. 2012: J. M. Vargas Jiménez/F. Nocete Calvo/T. Schuhmacher, Contextos de producción de objetos de marfil en Valencina de la Concepción (Sevilla). In: A. Banerjee/J. A. López Padilla/T. Schuhmacher (eds.), Marfil y Elefantes en la Península Ibérica y el Mediterráneo. Actas del Coloquio Internacional en Alicante (26–27 de Noviembre de 2008) (Mainz 2012) 69–82.

Weller 2002: O. Weller, Aux Origines de la Production du sel en Europe. In: O. Weller (ed.), Archéologie du Sel. Techniques et sociétés dans la Pré- et Protohistoire Européenne. In: Actes du colloque 12.2 du XIVe Congrès de l'UISPP (Liège, 2001) et de la Table Ronde du Comité des Salines de France (Paris, 1998). Internationale Archäologie.Arbeitsgemeinschaft, Symposium, Tagung, Kongress 3 (Rahden/Westf. 2002) 163–175.

Weller/Figuls 2010: O. Weller/A. Figuls, Las herramientas líticas del Solsonià.Distribución de los útiles de corneana e intercambios durante el Neolítico medio catalán. La Vall Salina de Cardona y la minería de la sal. In: S. Domínguez Bella/J. Ramos Muñoz/J. Gutiérrez López/M. Pérez Rodríguez (eds.), Minerales y Rocas en las Sociedades de la Prehistoria (Cádiz 2010) 213–224.

JAVIER ESCUDERO CARRILLO, MARTA DÍAZ-ZORITA BONILLA, MARTIN BARTELHEIM AND LEONARDO GARCÍA SANJUÁN

Chalcolithic Enclosures in the Lower Guadalquivir Basin

La Loma Del Real Tesoro (Carmona, Seville, Spain) and Its Resources

Keywords: Copper Age, enclosures, Bell Beaker, ditches, geophysics

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Abstract

As part of a research project looking at the use of resources in Chalcolithic settlements in the region surrounding the site of Valencina de la Concepción, in the lower Guadalquivir Basin (Seville province, SW Spain) a new site named La Loma del Real Tesoro (henceforth LRT) is being investigated. It consists of two different sectors with LRT-I measuring 6ha and LRT-II 8ha. In 2015 and 2016 LRT-II was investigated by means of surface survey, geophysical survey, geo-morphological core drilling and targeted archaeological excavation. This study has led to the discovery of a major complex including six ditched enclosures, four of which are arranged in concentric fashion. This paper presents the preliminary results of this fieldwork, providing a basic description of the site within the context of other known ditched enclosures and ditched sites along the Guadalquivir River Valley. The study of material culture and organic remains, still under way, shows an abundant presence of ceramics, lithics, green stones, faunal remains and some isolated human remains, suggesting a complex pattern of use for this settlement.

Introduction

Running roughly from the North-East to the South-West and surrounded by the Baetic Mountain Range at the South and the Sierra Morena System (southern edge of the Spanish Central Plateau) at the North, the Guadalquivir River represents the main hydrological system of Andalusia, Spain's

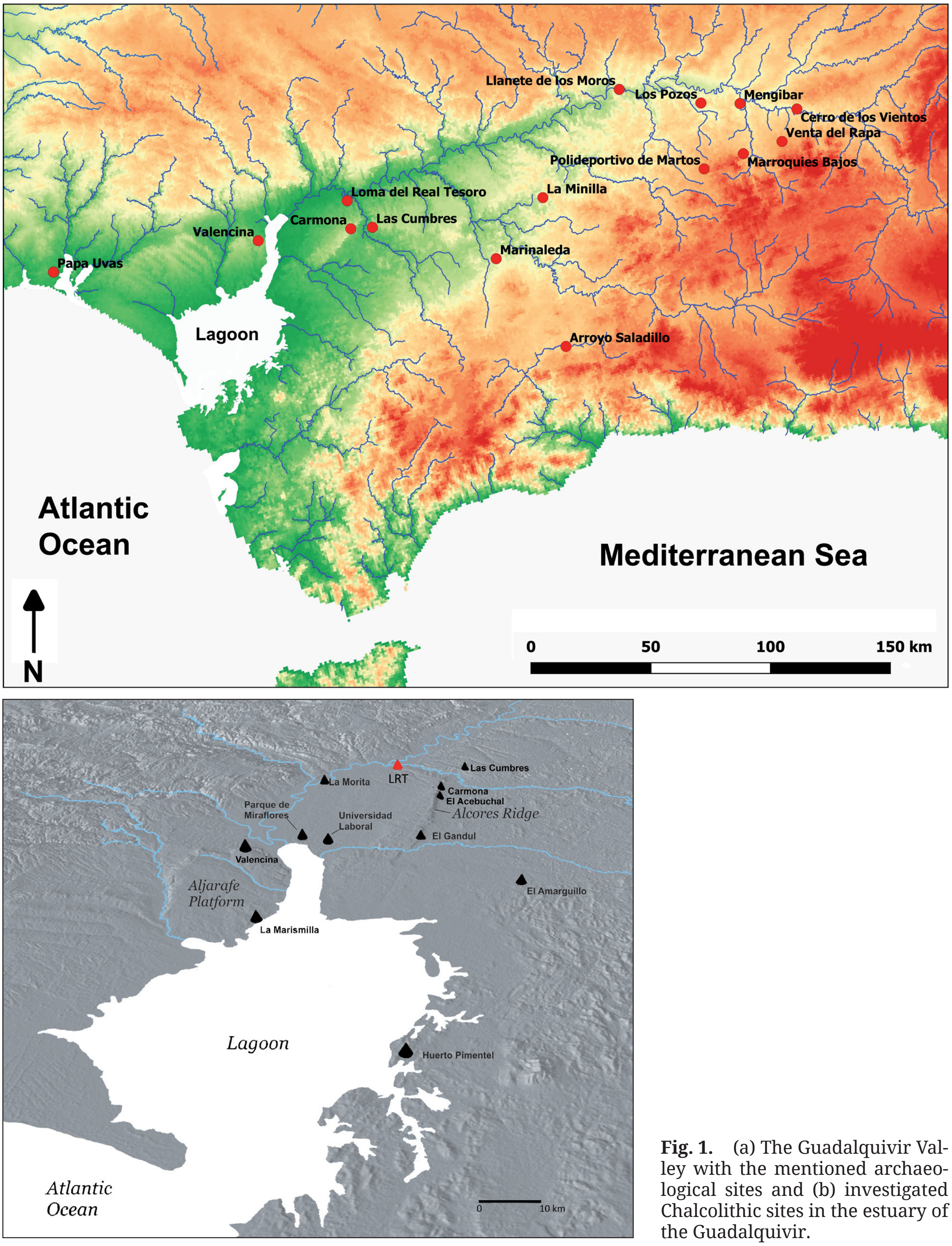

Fig. 1. (a) The Guadalquivir Valley with the mentioned archaeological sites and (b) investigated Chalcolithic sites in the estuary of the Guadalquivir.

southernmost region. In the last 20 years, the list of Late Neolithic and Copper Age (4th and 3rd mill. calBC) ditched enclosures (or simply sites with ditches) located along the Guadalquivir River Valley has increased considerably. Thus, this list now includes the sites of Valencina de la Concepción (see García Sanjuán 2013; García Sanjuán et al. 2017 for recent discussions of the rather vast bibliography on this site), Las Cumbres (Fernández Caro 1991), Carmona (Márquez Romero/Jiménez Jáimez 2010, 178–180) and Marinaleda (Caro Gómez et al. 2004) in the Lower River Valley, Seville province; the sites of La Minilla (Ruiz Lara 1987; 1991) and Llanete de Los Moros (Martín de la Cruz et al. 2004) in Córdoba, at the Middle Valley; and the sites of Marroquíes Bajos (Zafra de la Torre et al. 1999; 2003; Sánchez Vizcaíno et al. 2005; Cámara Serrano et al. 2012a; 2012b; Aranda Jiménez et al. 2016; etc.), Polideportivo de Martos (Lizcano Prestel et al. 1997; Lizano Prestel/Cámara Serrano 2003; Lizano Prestel et al. 2008; Afonso Marrero et al. 2014), Venta del Rapa (Lechuga Chica et al. 2014), Cerro de los Vientos (Soto Civantos et al. 2014), Los Pozos (Hornos Mata 1987) and Mengibar (Plazas et al. 2006) in the Jaén province, across the Upper Guadalquivir River. In addition to this, outside the hydrological basin of the Guadalquivir River in a strict sense but in the surrounding regions, the sites of Papa Uvas (Aljaraque, Huelva) (Martín de la Cruz 1985; 1986) and Arroyo Saladillo (Antequera, Málaga) (Fernández Rodríguez et al. 2017) must be added. The location of all these sites is shown in fig. 1a.

Particularly, the Lower Guadalquivir Valley was home to a dense Late Neolithic and Copper Age occupation, including the sites mentioned above as well as others in which no ditches have been found so far (*fig. 1b*). This comes as no surprise. With its alluvial soils and its perennial water supply, the Lower Guadalquivir Basin is one of the most fertile regions in Iberia. Together with the rich mineral supplies from the neighbouring Sierra Morena, the coastal resources from the Guadalquivir estuary and the good accessibility by boat, the economic conditions for early farming communities were excellent.

These natural settings have frequently been made responsible for the emergence of the largest known site of the Iberian Chalcolithic, Valencina de la Concepción, located close to the ancient river mouth near the modern city of Seville. However, as one of us (L. García Sanjuán) discusses elsewhere in this volume, unfortunately the rise and development of Copper Age communities at Valencina is far from being properly understood due to still insufficient research into economic issues within the site and in the surrounding area. In addition to this, it is worth noting that with the exception of Valencina and Marroquíes Bajos, both massive sites well above the 100ha mark, which have been more intensely excavated due to their proximity to two major urban centres (Seville and Jaén respectively), very little is known about the genesis, chronology, biography and decline of the ditched enclosures phenomenon in the Guadalquivir River Valley. This is particularly true of the lower Guadalquivir Valley where, outside Valencina, ditched sites have only been documented in Las Cumbres and Carmona by short rescue excavations that were not followed by any further scientific research.

Bearing this in mind, in 2015 the University of Tübingen in collaboration with the University of Seville started a research project entitled 'Sociocultural Change and the Use of Resources during the Late SW Iberian Prehistory'. This project was aimed at further expanding the understanding of the complex patterns of demographic, economic and social expansion that took place in the Lower Guadalquivir Valley in the 4th and 3rd mill. BC, with a particular focus on the development of the ditched enclosures phenomenon. The main aim of this project was to better comprehend the economic system in this region during this time period with Valencina as the most accomplished expression of the interdependencies between the use of resources and socioeconomic developments. To this end, in 2015 a series of surveys and visits were carried out at various locations of this region. As a result, a site called Loma del Real Tesoro, located in the Carmona municipality, some 35km north of Valencina, was chosen to start fresh research. The most important criteria for its selection were its location close to the Guadalquivir river, the abundance and character of surface material at the site and its accessibility for field work.[1] This site was also selected under the assumption that it was likely to have been part of the regional sociocultural network that gave rise to Valencina as a 'mega-site' of human aggregation, production, exchange and as a major burial place. By contrasting

1 We would again like to thank the landowner of 'Hacienda Las Coronas', Andrés López Raya, for his most enthusiastic support to our research project.

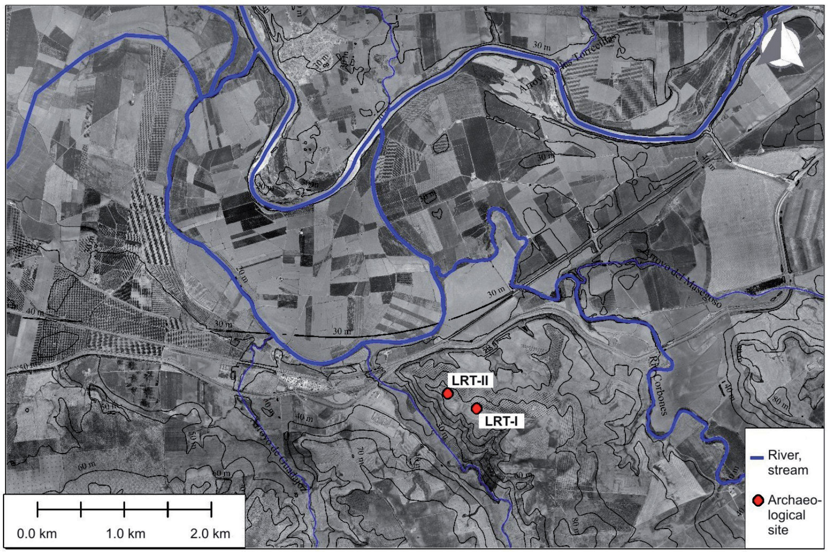

Fig. 2. Location of La Loma del Real Tesoro (LRT) on a quaternary terrace above the Guadalquivir River with the surrounding water courses.

Fig. 3. View of Sierra Morena from LRT-II.

the conditions at Loma del Real Tesoro with those in Valencina we expect to gain insights into the relations of smaller and larger sites within a territory of shared cultural and social traits, perhaps economically integrated and inter-connected through practices focused at the ‘mega-site’. On the basis of the assumption that subsistence economy and wealth economy might have both played a major role in the functioning of social integration and social competition, the main research focus was on livestock breeding and the exchange/supply of abiotic resources.

Therefore, the results presented here are a preliminary report of the research work carried out within the project ‘Sociocultural Change and the Use of Resources during the Late SW Iberian Prehistory’ belonging to the project A02 ‘Many Ores and Little Water’ within the SFB 1070 ResourceCultures of the University of Tübingen between 2016 and 2017 and funded by the DFG (German Research Foundation).

The Site: La Loma del Real Tesoro

La Loma del Real Tesoro was discovered in 2002 during the review and cataloguing of archaeological sites of the territory of Carmona (Seville). It is located close to the northern limit of the district of Carmona, 2km east of the village of Guadajoz on the left bank of the third Quaternary terrace of the Guadalquivir River. There are two different sectors to the site, named Loma del Real Tesoro I and Loma del Real Tesoro II (henceforth LRT-I and LRT-II).

The site is located on a strip of land 80m above sea level with a high visibility in all directions. This area is surrounded by the Guadalquivir River in the north, the Las Adelfas stream on the west and the Corbones River in the east. Therefore fresh water supplies are guaranteed (*fig. 2*).

The soil is formed by an early quaternary sedimentary formation based on red clay and silt with marl, quartzite sand and limestone with abundant quartzite pebbles. As well as offering good quality soil for agricultural practice, this location is on a contact zone between two different ecosystems that offer a wide variety of resources: towards the north the Sierra Morena offers a great variety of lithic resources and copper ores (*fig. 3*); at the south, north and east are the fertile lands of the Vega del Corbones and Vega del Guadalquivir. Both sectors are also crossed by the droveway called Cordel de Cerro Gordo, which leads to Guadajoz. Results of palynological analysis from samples taken in Carmona broadly representing the 3rd mill. BC environment have shown a Mediterranean climate where vegetation would be characterised by Mediterranean forest, underbrush of gum rockroses (*Cistus ladanifer*) and heathers (*Calluna vulgaris*) with olive tree (*Olea europeana sylvestris*), pine (*Pinus pinea*) and holm oak (*Quercus ilex*), cork oak (*Quercus suber*) and kermes oak (*Quercus coccifera*) (Llergo López/Ubera Jiménez 2008, 2381).

Material and Methods

Fieldwork at LRT was divided into two phases. The first one consisted in a micro fieldwalking survey aimed at obtaining information about the size and the character of its two sectors (LRT-I and LRT-II). The second one was a geophysical survey intended to provide insights into the layout and spatial structure of the site. The geophysical survey was undertaken by Helmut Becker in 2015 with a caesium magnetometer Geometrics G-858G with double sensor configuration for high speed and high resolution. The grid system was established as 40 x 40m and each grid was georeferenced with a Thaler TO-D207 GPS. The northern part of LRT-I and the southern part of LRT-II could not be analysed due to the presence of orange tree plantations. The total extension of the geophysical works in LRT-I was around 2ha and 2.36ha for LRT-II.

The results of the geophysical analyses combined with the analysis of historical orthophotos (dated to 1956, 1977, 1997, 1998, 2004, 2007, 2008, 2010 and 2013) revealed two different sectors located 400m from each other with a wide variety of structures (*fig. 4*). These results suggest that the total area in LRT-I is around 6ha while LRT-II spans over 8.25ha approximately.

Results

LRT-I

The geophysics at LRT-I reveal a settlement formed by two ditches around a central area of 2ha approximately. Both enclosures are incomplete, but enclosure 1 is around 2m wide and enclosure 2 is 1m wide and, according to the interpretation by H. Becker, could be a palisade. In the area between the two ditches and in the exterior there is a high concentration of negative structures with variable sizes ranging from 1 to 3m in width. Linear features and irregular small structures have also been documented (*fig. 5a*). In the eastern area, three linear structures with a northwest-southeast orientation were found, most likely linked to an ancient droveway or track (*fig. 5b*). The high concentration of slate fragments on the surface of the eastern part of the site might suggest the presence of possible funerary structures.[2]

LRT-II

LRT-II is located 400m to the northwest from LRT-I. The surface scatter of material culture covers around 9.5ha and includes, among other elements, Bell-Beaker type ceramics and a wide variety of lithics. The combined analysis of the aerial photos and magnetometry (*fig. 6*) reveals several ditched

2 At the nearby 'mega-site' of Valencina de la Concepción the presence of slate or schist slabs is almost invariably associated with funerary deposits (García Sanjuán/Díaz-Zorita Bonilla 2013, 393).

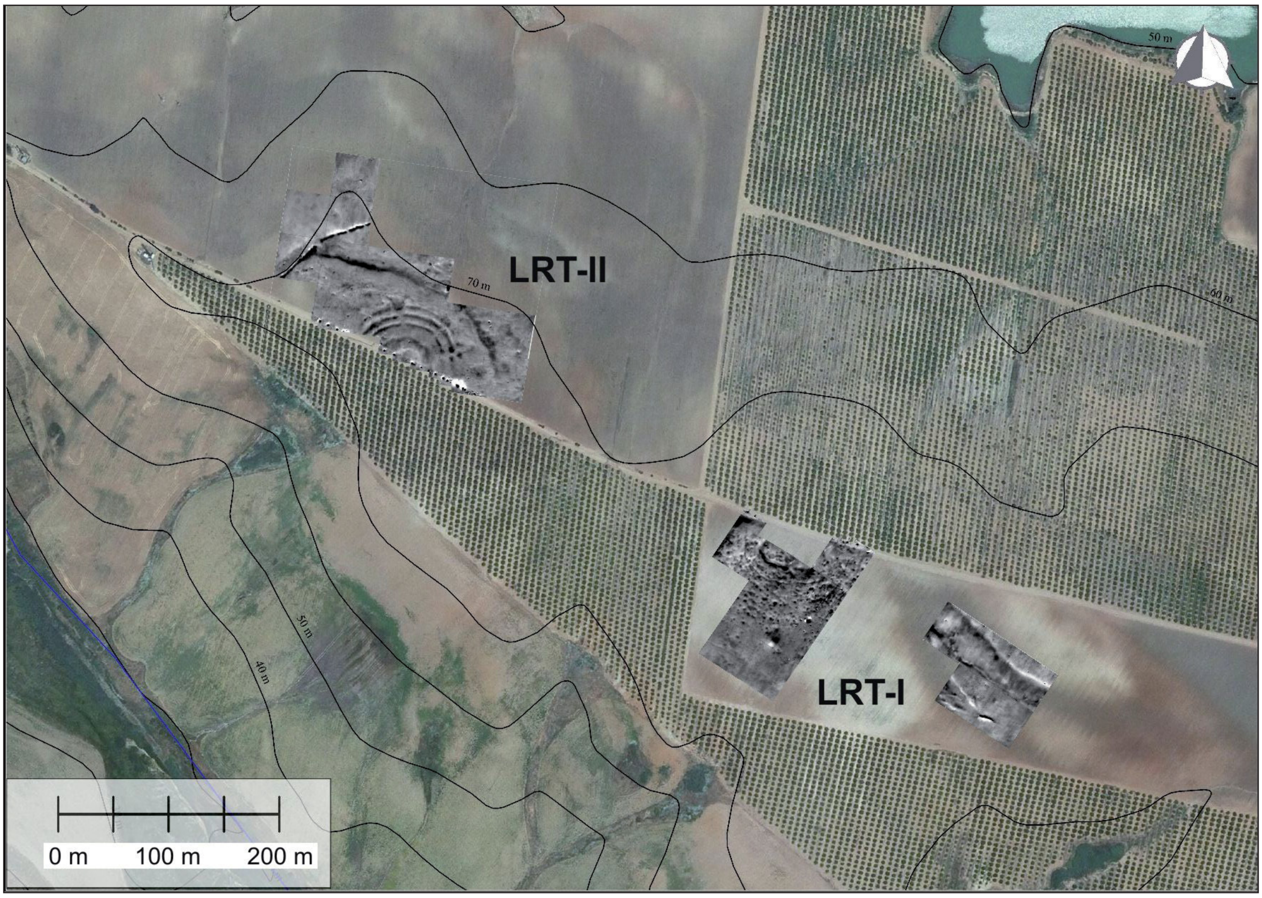

Fig. 4. Results of the geophysical measurements in LRT-I and LRT-II fitted into orthophotos.

enclosures arranged in a concentric manner, pretty much as is known in various southern Portuguese Late Neolithic and Copper Age sites such as Perdigões (Márquez Romero et al. 2011).

The centre of the complex is occupied by a circular structure with an estimated diameter of 20m and an estimated area of 315m². In plan and concept, this structure seems very similar to the large negative feature (described as a 'gran cubeta') about 600m² located at the centre of the concentric ditch system of Camino de las Yeseras (San Fernando de Henares, Madrid) (Liesau et al. 2008, 101 f.).

Enclosures 1 to 4, all of which are circular in plan, were arranged concentrically around the large central structure. Enclosure 1 is a sinuous ditch similar to those in the sites of Xancra (Valera/Becker 2011) or Outeiro Alto 2 (Valera/Filipe 2010) in Portugal. The total diameter of enclosure 1 is 50m, with a perimeter of 154m, the ditch approximately 4m in width. Enclosure 2 has a diameter of 73m and a perimeter of 242m. Its ditch is divided into 4 segments about 27m long and 3m wide. Enclosure 3 has a diameter of around 90m and a perimeter of 323m. Its ditch is also divided into 4 segments between 20 and 37m long and approximately 4m wide. On its south-eastern quadrant, enclosure 3 presents a 'deformation' of its circular plan. The ditch seems to adjust to enclose some element inside. The same feature exactly is found in ditch no. 1 of Perdigões, whose circular plan was adjusted to enclose the megalithic burials at the eastern side of the site. At LRT-II, enclosure 4 is formed by a circular ditch of 3.5m width, with an approximate diameter of 109m and a 359m perimeter. According to the geophysics, the north part of the enclosure is divided into 4 transects of 30m each forming three different accesses. On its south-eastern quadrant, the layout of enclosure 4 was also adjusted to the 'deformation' of enclosure 3 described above.

Enclosures 5 and 6 appear further beyond enclosures 1 to 4 and seem to have different plans

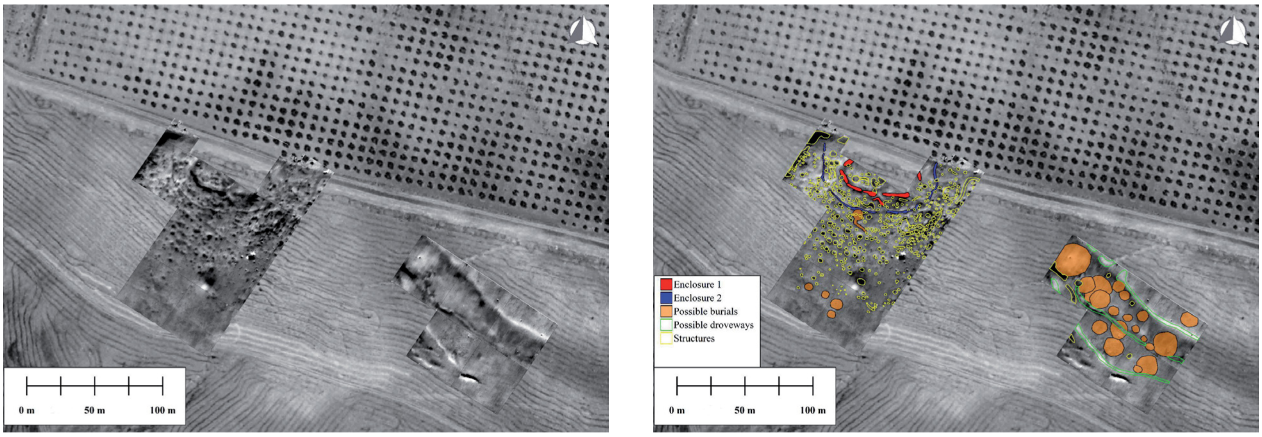

Fig. 5. LRT-I: (a) Site plan based on geophysical measurements fitted into orthophotos. (b) The interpreted site plan according to visible structures.

Fig. 6. LRT-II: (a) Results of geophysical measurements fitted into orthophotos from 1977 where the southern half of the enclosures can be seen as dark patches in the soil. (b) The interpreted site plan according to visible structures.

and much bigger diameters. Enclosure 5 covers 5ha approximately and presents a slightly oval plan with a northwest-southeast orientation. Finally, only the northern half of enclosure 6 has been identified in the geophysical surveys, although the southern part of the ditch is clearly visible on the aerial photographs. Enclosure 6 shows again a circular plan, with an area of ca. 4ha delimited by a segmented ditch with segments of variable length (between approximately 12 and 6m each segment). A possible access in the northeast area can be observed.

The geophysical survey also revealed a multitude of smaller features throughout the site, both inside and outside the enclosures. Due to the presence of an orange tree plantation when the magnetometry fieldwork was carried out in the summer of 2015, it was not possible to continue the survey into the southern part of the site. However, aerial photographs totally confirm the closing of all the enclosures in the south and an access similar to Outeiro Alto 2 (Valera/Filipe 2010) (*fig. 6*) to the whole complex. The removal of the orange trees in 2016 provides the opportunity for a full survey of the area, which is scheduled for 2018.

Excavation was planned on the basis of these survey results and carried out in January and February 2016. The excavation was made by way of a long trench with a southwest-northeast orientation (50m in length and 3m in width) cutting the LRT-II complex all the way from the central feature to enclosure 3 while also covering one of the ditch gaps or intervals visible on enclosure 2. Later, the excavation area was expanded to further test the layout of ditches 2 and 3 to the south and to the north. In total, the resulting excavation area was of 517m^2.

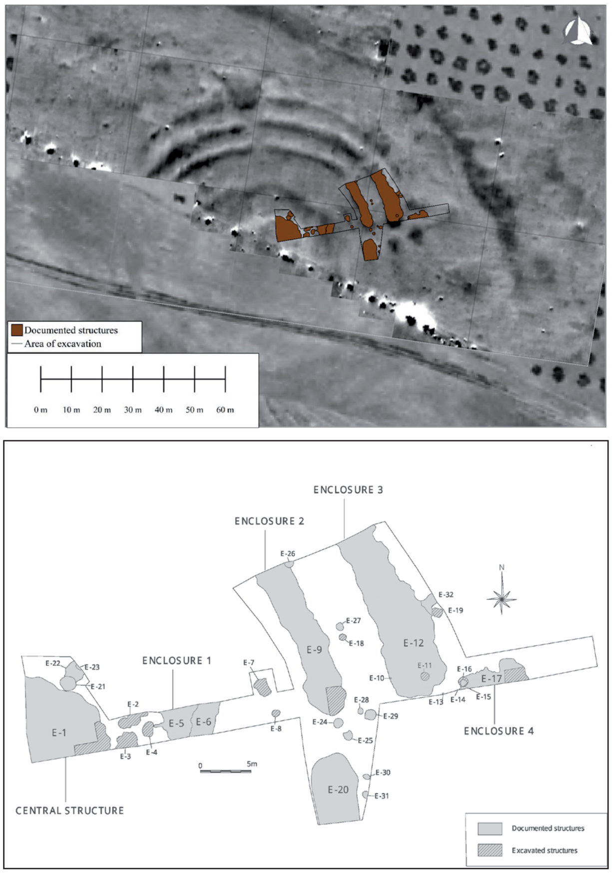

Fig. 7. LRT-II: (a) The excavation area inserted into the geophysical results and (b) detailed excavation plan.

The topsoil was removed with machinery, all the archaeological features becoming readily visible within 20 or 30cm of depth. All features were delimited, cleaned and identified by hand. A total of 32 structures were documented and georeferenced, but only ten of them were fully excavated to the bedrock (*fig. 7*).

Description and Dating of the Structures

The excavation record obtained from LRT-II is currently under study. Therefore, what follows here is a preliminary description of the evidence recovered. The 32 structures have been classified according to 4 categories based on their form and size, strictly avoiding any terminology involving preconceived ideas about their functions such as those still often used in Spanish and Andalusian archaeology in the description of 4th and 3rd mill. BC sites ('silos', 'dumps', 'hut floors' etc.). The different types are as follows:

– Ditches: Their length is greater than their width and depth. A total of 4 ditches could be identified during the excavation. Structures E5/6, E9, E12 and E17 (being part of enclosures 1, 2, 3 and 4 respectively) belong to this category (*fig. 8a*).
– Conical Pits: Truncated cone shape. The base of the structure is wider than its upper part. Structures E3 and E4 are included in this category (*fig. 8b*).
– Cylindrical Pits: Circular plan. The maximum depth is one meter and their diameter is lower than their depth. Here we include structures E2 and E11 (*fig. 8c*).
– Basins: Circular or oval plan. Their upper maximum axis or diameter is larger than their depth. Structures E7, E8, E15 and E16 are included in this category (*fig. 8d*).
– Macro negative structure: the central area of the site is a circular macro negative structure (E1) with an estimated diameter of 16.5m and a depth of 2.20m (*fig. 8e*).

The precise chronology of each of the features is still under study. Overall, 19 samples were submitted for dating at the Centro Nacional de Aceleradores (CNA, University of Seville). Of these, 16 failed due to poor collagen preservation while three provided reliable results (*fig. 9*).

Further samples have been submitted in order to obtain a more precise chronology for the features discovered. According to the evidence currently available, the site would have been in use over a long period of time spanning the whole of the 3rd mill. BC.

Additional dating insights may be obtained from the analysis of material culture. Decorated and undecorated Bell Beaker pottery fragments were found in structures E1, E3, E9 and E17. Most of the ceramic fragments documented in LRT-I belong to plates, closed bowls, cups and globular forms with polished and smooth surfaces. At LRT-II bowls, cups and beakers with polished and smooth surface treatment were found together with Bell Beakers decorated in the Maritime as well as in the Geometric Dotted style. According to Lazarich González (2005, 365), the Maritime style coexisted with other decoration styles in the lower

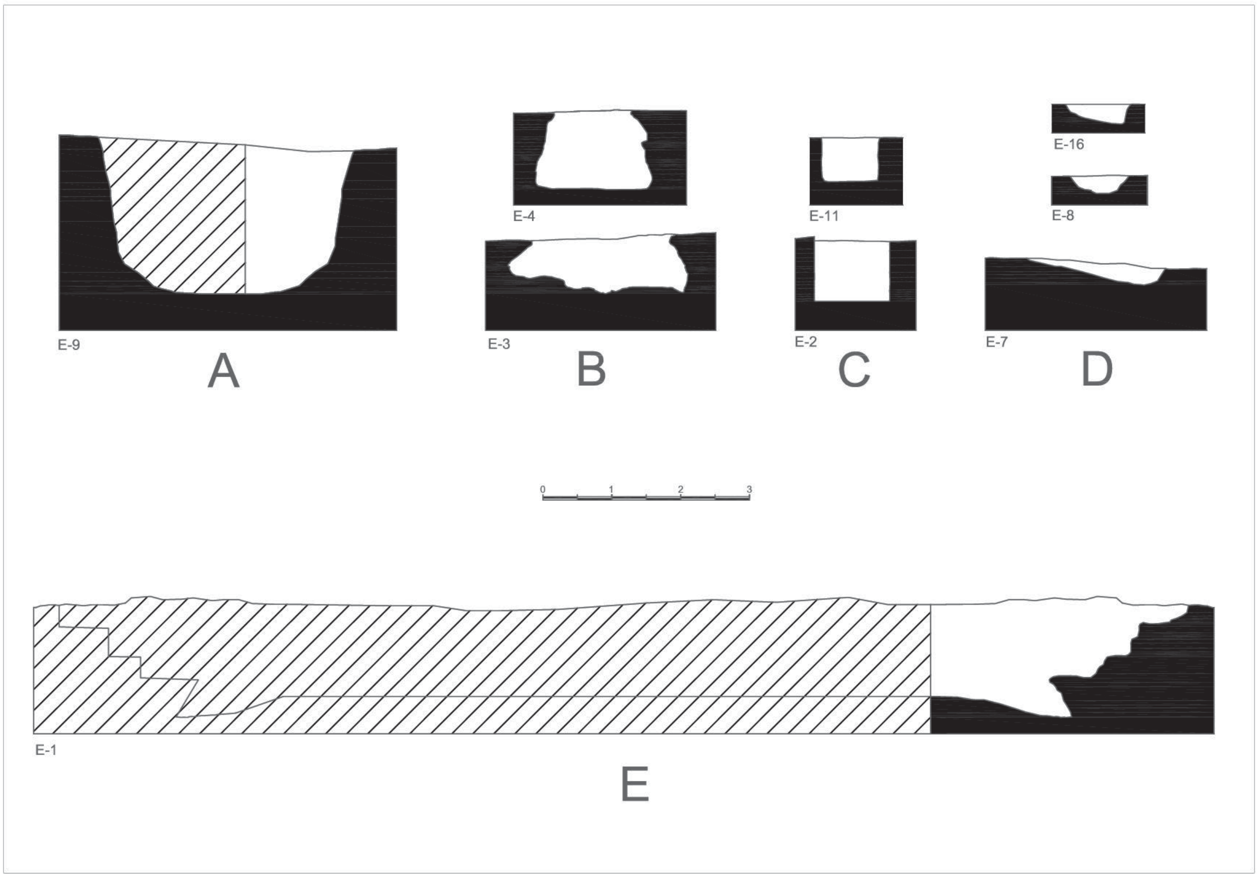

Fig. 8. Types of negative features at LRT-II. A: Ditches; B: Conical pits; C: Cylindrical pits; D: Basins; E: Macro negative structure.

Guadalquivir River, but this was the first to disappear towards the end of the 3rd mill. BC. The radiocarbon chronology of the Bell Beaker phenomenon in western Andalusia is very poor (Lazarich González 2000, 132). The available radiocarbon dates in the Iberian Peninsula suggest a start of the Bell Beaker phenomenon around 2800 BC (Bailly/Salanova 1999) and it is possible that it lasted until the beginning of the 2nd mill. BC (Balsera Nieto et al. 2015, 146). The widespread presence of Bell Beaker pottery at LRT-II (in itself an interesting feature of this site) combined with the currently available radiocarbon determinations suggest a long occupation for the site.

Pits E2, E3 and E4 were connected to one another via small 'pipes' below the surface and so were structure E3 and the central macro structure E1 as well as E4 and the innermost circular ditch E5/6 (= enclosure 1) (*fig. 10*). In principle, this might suggest these five structures were in use at the same time. The ^{14}C date from the bottom of pit E4 implies that this structure was in use at least at the beginning of the 3rd mill. BC. For how long the pits, the central structure E1 and the ditch E5/6 were kept functional and open remains unclear at the present time. The fact that the three concentric ditches E9, E12 und E17 (= enclosures 2, 3, 4) were formed around the central installations including ditch E5/6 suggests that they could have been at least visible at the time of the construction of these ditches. The earlier ^{14}C date from ditch E9 (CNA-4296) suggests that this happened in the earlier part of the 3rd mill. The later date CNA-3785 from the upper part of ditch E9 suggests that this ditch must have been still open at least around the middle or even at the end of the 3rd mill. At the present state of investigation it seems possible to assume a use span of several centuries for LRT-II or at least knowledge about the existence and importance of the inner structures E1 and E5/6.

With the aim of further understanding the depositional dynamics and the formation processes of the infill of all the structures, and particularly the ditches, as well as to understand their depth,

Lab. No.	Sample No.	Date BP	CalBC 2σ	Sample Type	Provenance
CNA 4295	LRT-09	4284 ± 34	3011-2873	Bone-Canis familiaris Diaphysis	Bottom of Structure E4
CNA 4296	LRT-24	4216 ± 37	2904-2677	Bone-Macrofauna. Rib	Bottom of Structure E9 = Enclosure 2
CNA 3785	LRT-12	3820 ± 31	2451-2144	Bone-Macrofauna. Diaphysis	Upper part of Structure E9 = Enclosure 2

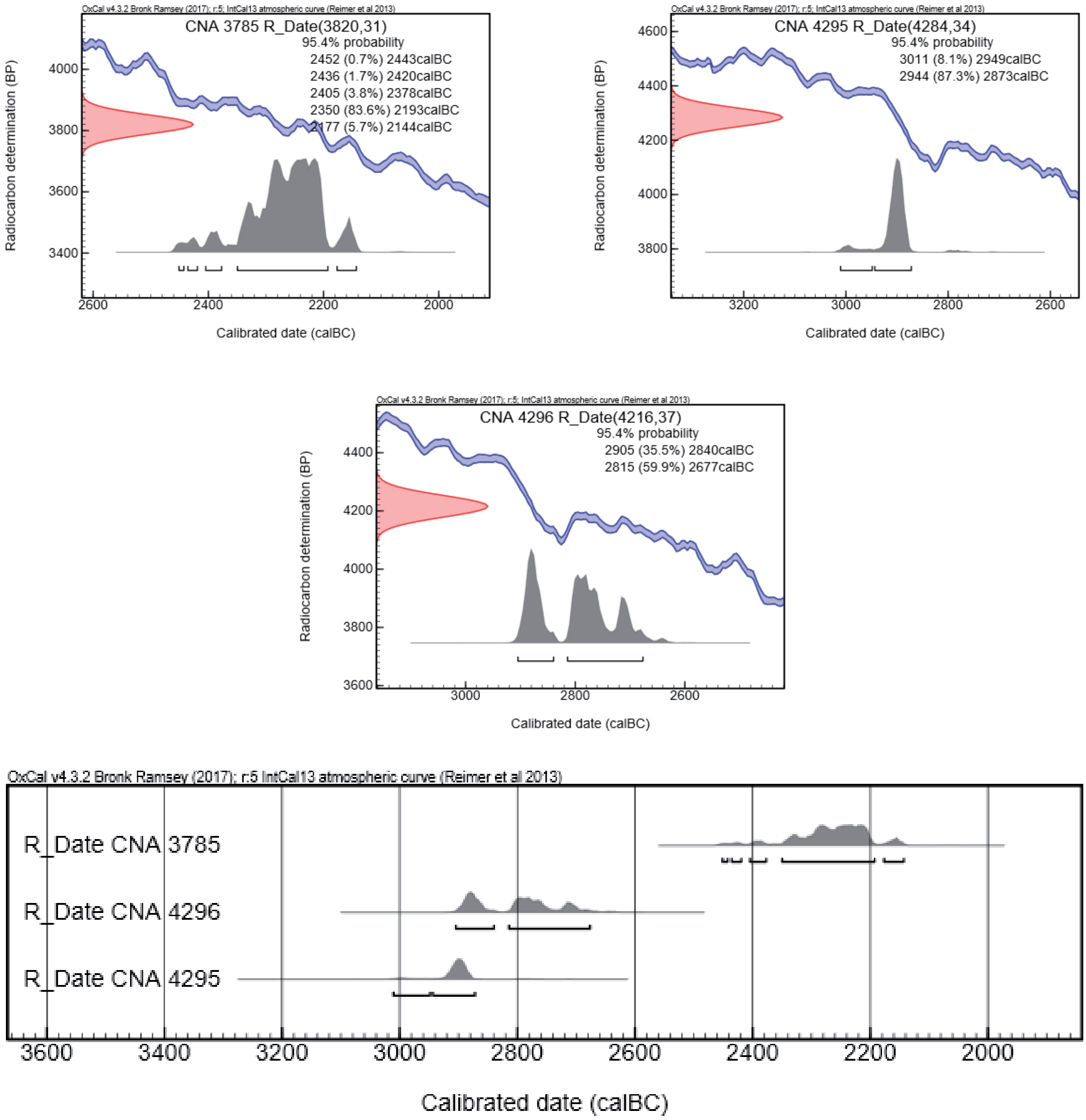

Fig. 9. ^{14}C results from LRT-II.

a team led by Francisco and César Borja Barreda (from the universities of Huelva and Seville respectively) carried out a series of core drillings at various points of the excavation area (*fig. 11*).

A total of six core drills were performed by mechanical means at enclosures 1, 2 and 3 as well as in the central structure (*fig. 12*). A core drill of the bedrock in the area between enclosures 2 and

Fig. 10. Overhead view of structures E1, E2, E3, E4 and E5.

3 was also carried out in order to provide contrast data. These core drillings will provide evidence to understand the formation process of the infill inside the features as well as the section of features, and will also provide additional samples for dating, sedimentology and pollen analysis.

Fig. 11. Core drill al LRT-II.

Discussion: Resources, Functionality and Temporality

As was mentioned above, LRT is located on a strategic position that commands control of the route from the north via a possible ford over the Guadalquivir River towards the fertile Corbones river basin close to Carmona and the Los Alcores ridge. In the opposite direction this location allows an easy access to the so-called Iberian Pyrite Belt in the western Sierra Morena where copper ores and a great variety of lithic resources are available (*fig. 13*).

The full characterisation of the lithic assemblage recovered at LRT is currently underway. However, a preliminary inspection reveals that most of the lithic tools from the site are made from sandstones and quartzite while other types of stones include quartz, slate, rock crystal, limestone

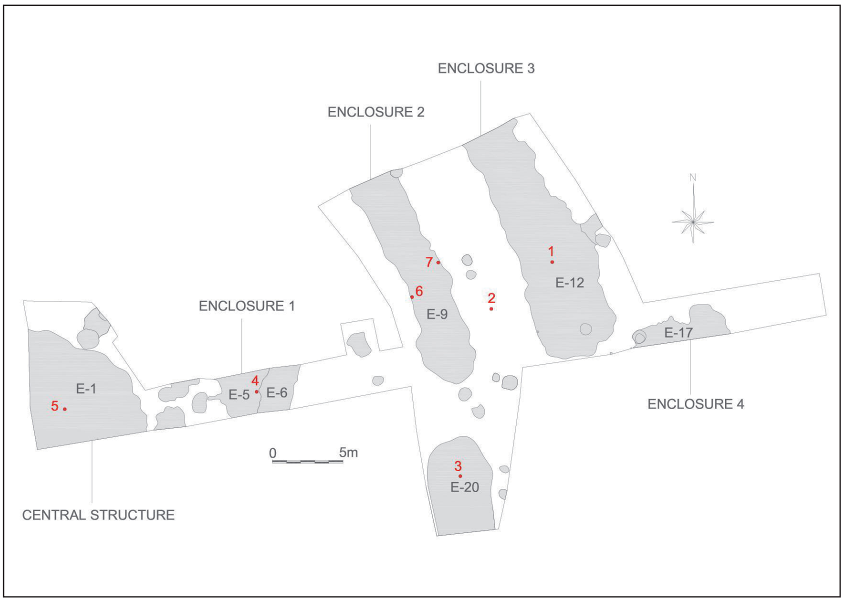

Fig. 12. Location of the geomorphology core drillings.

and basalt. These types of rocks are available not further away than 20km.

The techno-typological analysis of the lithic assemblage shows a high proportion of tools related with domestic activities (axes, denticulates, racloirs) as well as agricultural practice (grinding stones, adzes). The overall composition of the assemblage, however, does not suggest that tools were produced *in situ* at LRT-II as debris and other intermediate elements of the lithic production *chaîne opératoire* are absent.

Undoubtedly, a remarkable feature at LRT is the abundant presence of Bell Beaker pottery. Well-documented Bell Beaker settlements are altogether rare in the Lower Guadalquivir Basin, despite the obvious importance of this type of pottery in the region. Among the Bell Beaker pottery sites in that area (which are mostly known through surface surveys) there are usually a high proportion of dishes, and closed forms, like pots and vessels related with domestic contexts.

The preliminary results of the study of the LRT Bell Beaker pottery suggest that LRT-I and LRT-II were contemporary but perhaps achieved different functions. According to Lazarich González (2005, 365), Copper Age Andalusian ceramic assemblages essentially display a continuity between the pre-Bell Beaker and Bell Beaker groups.

The spectrum of animal bones and plant remains recovered during the excavations in LRT-II does not differ significantly from that in Valencina or other Chalcolithic sites in the Guadalquivir valley with a predominance of bovids over pigs and sheep and goats among the livestock. They could have easily been pastured in the floodplains of the Guadalquivir. The presence of horse in certain contexts is also significant. Despite this, the archaeozoological analysis is still ongoing so these results are still preliminary. Isolated human bones have been also documented in the central structure (E1) and enclosures 2 (E9) and 4 (E17) as well as structure E19.

Conclusions

On the basis of the currently available evidence it would be premature to present a general interpretation of Loma del Real Tesoro. The results of the ongoing geo-morphological and sedimentological analysis, characterisation of raw materials, as well as further radiocarbon dating, are essential in order to achieve a better understanding of the site. Recent studies based on Bayesian modelling of multiple radiocarbon determinations have shown that major Iberian sites with ditched enclosures or ditch systems such as Camino de las Yeseras (Madrid), Marroquíes Bajos (Jaén) or Valencina de la Concepción (Sevilla) had very complex temporality patterns (Balsera Nieto et al. 2015; Aranda Jiménez et al. 2016; García Sanjuán et al. forthcoming), which is in line with earlier findings from other

European regions (Whittle et al. 2011). These results clearly challenge previously held assumptions about the nature of these sites and the functionality of the ditches and pits found in them – see Márquez Romero/Jiménez Jáimez 2010 for a comprehensive discussion of the Iberian evidence. Studies based on material culture have also shed some light on the complex temporality patterns of Iberian ditched sites: at El Ventorro (Madrid), some negative features were intentionally backfilled, most of them in a single event, the pottery analysis suggesting the possible presence of fragments of the same object in different contexts as well as fragments with different taphonomic lives (Blanco González/Chapman 2014).

In this context Loma del Real Tesoro presents conditions that make it very suitable as a 'laboratory' site for the study of the ditched enclosures phenomenon along the Guadalquivir River, and particularly in its lower basin. Unlike Valencina de la Concepción, which as a site basically lies under two modern towns (Valencina de la Concepción and Castilleja de Guzmán), which makes its study very complicated, LRT is a fully extant and accessible site. This opens up opportunities to understand its spatial organisation and layout, as well as multiple problems regarding temporality and functionality.

In principle, the excavation carried out in 2016 suggests a number of characteristics. First, the arrangement or plan of the five inner-most ditches seems to gravitate around a massive, deep and yet enigmatic round-plan negative feature located at its very centre. This 'massive pit' seems to lay at the heart and origin of the whole ditched system of LRT, but this preliminary impression will require further analysis, including precise dating. Around this feature, four massive ditches were excavated forming a concentric plan. This layout seems to be the result of a pre-conceived idea (or plan), but at this point it is impossible to tell whether these ditches were cut and used as part of a single project executed in a single event, or, as it seems more likely in light of the recent studies mentioned above, were produced over a long period of time as the result of repeated social practices at the site.

The myriad of pits and negative features revealed by the magnetometry suggest a very intense activity at the site. This is rather interesting

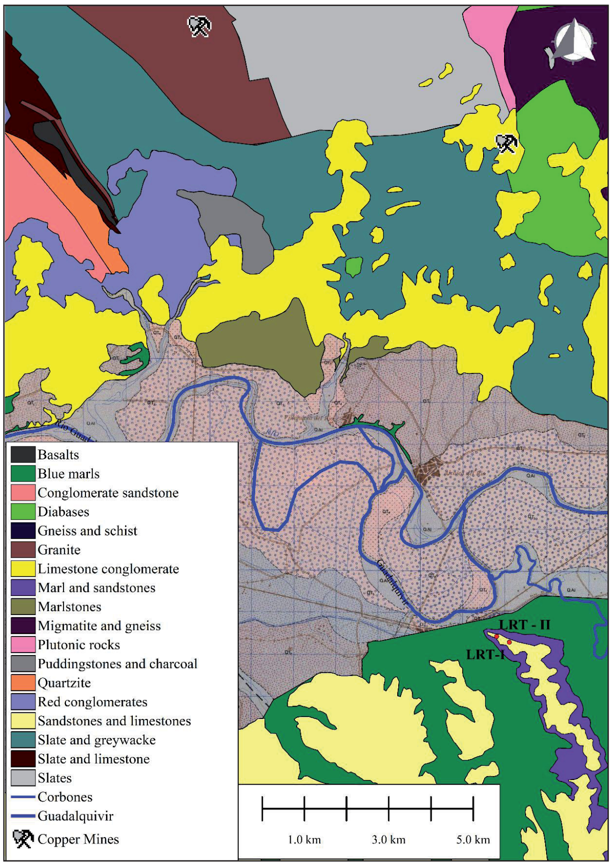

Fig. 13. Geological map of the surroundings of LRT-I and LRT-II showing possible provenances of raw materials used for finished objects on the site.

in itself, as LRT is located very close to sites like Carmona, El Acebuchal, El Gandul and Valencina, where evidence of equally intense activity during the Copper Age is not in short supply – not the least in the form of major megalithic monuments. Therefore, LRT further underlines the scale of the demographic growth experienced by the communities of this region since the late 4th mill. BC. And yet, none of the structures excavated at LRT in 2016 suggests a residential use. The spectrum of animal bones and plant remains identified at LRT does not differ significantly from that in Valencina or other Chalcolithic sites in the Guadalquivir Valley, but further details about the processing and consumption of meat are pending study.

Was LRT a 'village'? Or was it a 'gathering place' used mainly for seasonal meetings and social interaction? Or was it perhaps a mixture of the two? This debate is clearly open at present as far as Valencina is concerned (García Sanjuán 2013; García Sanjuán et al. 2017; forthcoming) and more generally within the context of the Iberian Peninsula (Márquez Romero/Jiménez Jáimez 2010). The ongoing study of LRT will without doubt throw some new light on this issue as well as on the use of resources in a local and regional context. The location of the site on the banks of the Guadalquivir was in many respects favourable: not only did the river provide water all year round, but it could also have served as an important waterway linking LRT with the nearby estuary and large parts of the inland areas of Andalusia. The important ford next to the site (which in modern times was used for a droveway) provided an easy access to the mineral-rich Sierra Morena. This all went along with the very good conditions for animal husbandry and agriculture offered by pastures in the river meadows and fertile soils in the surroundings.

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Bibliography

Afonso Marrero et al. 2014: J. A. Afonso Marrero/J. A. Cámara Serrano/L. Spanedda/J. A. Esquivel Guerrero/R. Lizcano Prestel/C. Pérez Bareas/J. A. Riquelme Cantal, Nuevas aportaciones para la periodización del yacimiento del Polideportivo de Martos (Jaén). La evaluación estadística de las dataciones obtenidas para contextos rituals. Archivo de Prehistoria Levantina 30, 2014, 133–158.

Aranda Jiménez et al. 2016: G. Aranda Jiménez/Á. Lozano Medina/J. Escudero Carrillo/M. Sánchez Romero/E. Alarcón García/S. Fernández Martín/M. Díaz-Zorita Bonilla/V. Barba Colmenero, Cronología y temporalidad de los recintos de fosos prehistóricos. El caso de Marroquíes Bajos (Jaén). Trabajos de Prehistoria 73.2, 2016, 231–250.

Bailly/Salanova 1999: M. Bailly/L. Salanova, Les dates radiocarbone du Campaniforme en Europe occidentale. Analyse critique des principales séries de dates. Actes du 3éme Congrés International ^{14}C et Archéologie (Lyon, April 1998). Mémoires de la Societé Préhistorique Française 26/Sup. 1999 à la Revue d´Archéométrie, 1999, 219–224.

Balsera Nieto et al. 2015: V. Balsera Nieto/J. Bernabeu Aubán/M. Costa Caramé/P. Díaz-Del-Río/L. García Sanjuán/S. Pardo, The Radiocarbon Chronology of Southern Spain's Late Prehistory (5600–1000 Cal BC). A Comparative Review. Oxford Journal of Archaeology 34.2, 2015, 139–156.

Blanco González/Chapman 2014: A. Blanco González/J. Chapman, Revisiting the Chalcolithic Site of El Ventorro (Madrid, Spain). Ceramic Re-Fitting and Taphonomy. Proceedings of the Prehistoric Society 80, 2014, 87–103.

Cámara Serrano et al. 2012a: J. A. Cámara Serrano/L. Spanedda/R. Sánchez Susí/M. F. García Cuevas/A. González Herrera/J. Nicas Perales, La cronología absoluta de Marroquíes (Jaén) en el contexto de la Prehistoria Reciente del Alto Guadalquivir. Antiquitas 24, 81–94.

Cámara Serrano et al. 2012b: J. A. Cámara Serrano/R. Sánchez Susí/Z. Laffranchi/S. Martín Flórez/J. A. Riquelme Cantal/L. Spanedda/M. F. García Cuevas/A. González Herrera/S. Jiménez Brobeil/J. Nicas Perales, La cronología y variedad de los sistemas funerarios en Marroquíes. Una aproximación desde las excavaciones del Sistema Tranviario de Jaén. Saguntum 44, 2012, 47–66.

Caro Gómez et al. 2004: J. A. Caro Gómez/R. Cruz-Auñón Briones/L. García Sanjuán, Excavación de urgencia en el asentamiento de la Edad del Cobre de Marinaleda (Marinaleda, Sevilla). Anuario Arqueológico de Andalucía/2001. Tomo III. Actividades de Urgencia (Sevilla 2004) 920–928.

Fernández Caro 1991: J. J. Fernández Caro, Excavaciones de urgencia en “Las Cumbres”, Carmona, Sevilla. Anuario Arqueológico de Andalucía 1989. Volume 3 (Sevilla 1991) 397–404.

Fernández Rodríguez et al. 2017: L. E. Fernández Rodríguez/M. I. Cisneros García/A. Arcas Barranquero, Primera aproximación a los aspectos funerarios durante el Neolítico Reciente en el asentamiento de Arroyo Saladillo (Antequera, Málaga). Mainake 35, 2017, 31–52.

García Sanjuán 2013: L. García Sanjuán, El asentamiento de la Edad del Cobre de Valencina de la Concepción. Estado actual de la investigación, debates y perspectivas. In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/T. Ruiz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción. Investigación y Tutela en el 150 Aniversario del descubrimiento de La Pastora (Sevilla 2013) 21–59.

García Sanjuán/Díaz-Zorita Bonilla 2013: L. García Sanjuán/M. Díaz-Zorita Bonilla, Prácticas funerarias en estructuras negativas en el asentamiento prehistórico de Valencina de la Concepción (Sevilla, España). Análisis contextual y osteoarqueológico. In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/T. Ruiz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción (Sevilla). Investigación y Tutela en el 150 Aniversario del Descubrimiento de La Pastora (Sevilla 2013) 387–403.

García Sanjuán et al. 2017: L. García Sanjuán/C. Scarre/D. Wheatley, The Mega-Site of Valencina de la Concepción (Seville, Spain). Debating Settlement Form, Monumentality and Aggregation in Southern Iberian Copper Age Societies. Journal of World Prehistory 30.3, 2017, 239–257.

García Sanjuán et al. forthcoming: L. García Sanjuán/L. Cáceres Puro/M. E. Costa Caramé/M. Díaz-Guardamino-Uribe/M. Díaz-Zorita Bonilla/A. Fernández Flores/V. Hurtado Pérez/P. M. LópezAldana/E. Méndez Izquierdo/A. Pajuelo Pando/J. Rodríguez Vidal/J. M. Vargas Jiménez/D. Wheatley/A. Delgado-Huertas/E. Dunbar/A. Mora González/C. Bronk Ramsey/A. Bayliss/N. Beavan/D. Hamilton/A. Whittle, Assembling the Dead, Gathering the Living. Radiocarbon Dating and Bayesian Modeling for Copper Age Valencina de la Concepción (Sevilla, Spain). Journal of World Prehistory (forthcoming).

Hornos Mata et al. 1987: F. Hornos Mata/F. Nocete Calvo/C. Pérez, Actuación arqueológica de urgencia en el yacimiento de Los Pozos en Higuera de Arjona (Jaén). Anuario Arqueológico de Andalucía 1986. Volume 3 (Sevilla 1987) 198–202.

Lazarich González 2000: M. Lazarich González, Estado actual de la investigación sobre el campaniforme en Andalucía occidental. Madrider Mitteilungen 41, 2000, 112–138.

Lazarich González 2005: M. Lazarich González, El Campaniforme en Andalucía. In: M. A. Rojo Guerra/R. Garrido Pena/I. García Martínez de Lagrán (eds.), El Campaniforme en la Península Ibérica y su contexto Europeo (Valladolid 2005) 351–370.

Lechuga Chica et al. 2014: M. A. Lechuga Chica/M. Soto Civantos/M. O. Rodríguez-Ariza, El poblado calcolítico Venta del Rapa (finales III milenio Cal. BC.), Mancha Real, Jaén. Un recinto de fosos entre las estribaciones de Sierra Mágina y el Alto Guadalquivir. Trabajos de Prehistoria 71.2, 2014, 353–367.

Liesau et al. 2008: C. Liesau/C. Blasco/P. Ríos/J. Vega/R. Menduiña/J. F. Blanco/J. Baena/T. Herrera/A. Petri/J. L. Gómez, Un espacio compartido por vivos y muertos. El poblado calcolítico de fosos de Camino de las Yeseras (San Fernando de Henares, Madrid). Complutum 18.1, 2008, 97–120.

Lizcano Prestel et al. 1997: R. Lizcano Prestel/J. A. Cámara Serrano/ J. A. Riquelme Cantal/M. L. Cañabate/A. Sánchez/J. A. Afondo Marrero, El Polideportivo de Martos. Producción económica y símbolos de cohesión en un asentamiento del Neolítico Final en las Campiñas del Alto Guadalquivir. Cuadernos de Prehistoria y Arqueología de la Universidad de Granada 16/17, 1991/1992, 5–101.

Lizcano Prestel/Cámara Serrano 2003: R. Lizcano Prestel/J. A. Cámara Serrano, Producción económica y sedentarización. El registro arqueológico del Polideportivo de Martos (Jaén). Sociedades Recolectoras y Primeros Productores. Actas de las Jornadas Temáticas Andaluzas de Arqueología (Ronda, 28 al 30 de Octubre de 2003) (Sevilla 2003) 229–248.

Llergo López/Ubera Jiménez 2008: Y. Llergo López/J. L. Ubera Jiménez, Cambios en el entorno vegetal de Carmona. Sevilla desde el Calcolítico hasta el Medievo. CAREL 6, 2008, 2369–2393.

Márquez Romero/Jiménez Jáimez 2010: J. E. Márquez Romero/V. Jiménez Jáimez, Recintos de Fosos. Genealogía y Significado de una Tradición en la Prehistoria del Suroeste de la Península Ibérica (IV–III milenios AC) (Málaga 2010).

Márquez Romero et al. 2011: J. E. Márquez Romero/A. C. Valera/H. Becker/V. Jiménez Jáimez/J. Suarez Padilla, El complexo arqueológico dos Perdigões (Reguengos de Monsaraz, Portugal). Prospecciones geofísicas. Campañas 2008–09. Trabajos de Prehistoria 68.1, 2011, 175–186.

Martín de la Cruz 1985: J. C. Martín de la Cruz, Papa Uvas I. Aljaraque, Huelva. Campañas de 1976 a 1979. Excavaciones Arqueológicas en España 136 (Madrid 1985).

Martín de la Cruz 1986: J. C. Martín de la Cruz, Papa Uvas II. Aljaraque, Huelva. Campañas de 1981 a 1983. Excavaciones Arqueológicas en España 149 (Madrid 1986).

Martín de la Cruz et al. 2004: J. C. Martín de la Cruz/A. Lucena/J. L. Liébana, Excavación arqueológica de urgencia en la ladera sureste del Llanete de los Moros (Montoro, Córdoba). Anuario Arqueológico de Andalucía 2001. Volume 3 (Sevilla 2004) 321–325.

Plazas et al. 2006: E. Plazas/A. Nieto/V. Barba/M. Navarro/F. Arias, Actividad arqueológica de urgencia en el nuevo polígono industrial de Mengívar (Jaén). Anuario Arqueológico de Andalucía 2003. Volume 3.1 (Sevilla 2006) 676–690.

Ruiz Lara 1987: D. Ruiz Lara, Excavación arqueológica de urgencia en La Minilla (La Rambla, Córdoba). Anuario Arqueológico de Andalucía 1986. Volume 3 (Sevilla 1987) 124–126.

Ruiz Lara 1991: D. Ruiz Lara, Excavación arqueológica de urgencia en La Minilla (La Rambla, Córdoba). Campaña de 1989. Anuario Arqueológico de Andalucía 1989. Volume 3 (Sevilla 1991) 157–163.

Sánchez Vizcaíno et al. 2005: A. Sánchez Vizcaíno/J. P. Bellón Ruíz/C. Rueda Galán, Nuevos datos sobre la Zona Arqueológica de Marroquíes Bajos. El quinto foso. Trabajos de Prehistoria 62.2, 2005, 151–164.

Soto Civantos et al. 2014: M. Soto Civantos/M. A. Lechuga Chica/M. F. Pérez Cano/M. J. Díaz García/R. Fernández Casado/J. L. Serrano Peña, Un nuevo poblado de fosos en la Autovía del Olivar. El Cerro de los Vientos (T. M. Baeza, Jaén). In: E. García Alfonso (ed.), Actas del II Congreso de Prehistoria de Andalucía (Antequera, 15, 16 y 17 de febrero de 2012). Movilidad, Contacto y Cambio (Sevilla 2014) 379–386.

Valera/Filipe 2010: A. C. Valera/V. Filipe, Outeiro Alto 2 (Brinches, Serpa). Nota preliminar sobre um espaço funerário e de socialização do Neolítico Final à Idade do Bronze. Apontamentos de Arqueologia e Património 5 (Lisbon 2010) 49–56.

Valera/Becker 2011: A. C. Valera/H. Becker, Cosmologia e recintos de fossos da Pré-História Recente. Resultados da prospecção geofísica em Xancra (Cuba, Beja). Apontamentos de Arqueologia e Património 7 (Lisboa 2011) 23–32.

Whittle et al. 2011: A. Whittle/F. Healey/A. Bayliss, Gathering Time. Dating the Early Neolithic Enclosures of Southern Britain and Ireland (Oxford 2011).

Zafra de la Torre et al. 1999: N. Zafra de la Torre/F. Hornos Mata/M. Castro López, Una macro-aldea en el origen del modo de vida campesino: Marroquíes Bajos (Jaén) c. 2500–2000 cal. ANE. Trabajos de Prehistoria 56.1, 1999, 77–102.

Zafra de la Torre et al. 2003: N. Zafra de la Torre/M. Castro López/F. Hornos Mata, Sucesión y simultaneidad en un gran asentamiento. La cronología de la macro-aldea de Marroquíes Bajos, Jaén. C. 2500–2000 cal ANE. Trabajos de Prehistoria 60.2, 2003, 79–90.

MERCEDES MURILLO-BARROSO
AND IGNACIO MONTERO-RUIZ

The Social Value of Things

Amber and Copper in the Iberian Chalcolithic

Quel intérêt voulez-vous qu'on trouve encore à fouiller la terre pour y chercher de petits diamants presque sans valeur, du moment où il sera aussi aisé d'en fabriquer industriellement de toutes dimensions que de faire des pains de quatre livres!
(J. Verne, L'Étoile du Sud)

Keywords: value; amber; copper; metallurgy; Late Prehistory; provenance studies

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Abstract

If the social meaning of objects is culturally attributed, and thus depends on a given specific context; if it has a dynamic and contingent nature and it is not a property inherent to materiality in itself; if the value of objects is ultimately the materialised reflection of an interpersonal relationship, how and through what processes do objects acquire value? How and through which processes do they change over time and space? And finally, how and through what indicators can we deduce the social value that prehistoric objects held in their day?

In this article, we will carry out a comparative review of the role of amber and metal on the Iberian Peninsula. Drawing from the resource availability, working processes, and the use, exchange, and amortisation of objects, we will address the social meaning of both resources during Late Prehistory and how it changed over time.

Introduction: The Social Value of Things

If we had to define Late Prehistory with a single feature, we would choose experimentation. Experimentation with new techniques, with new technologies, and above all, with new resources. Starting from the so-called Neolithic revolution, the amount of the different resources utilised multiplies. Secondary products arrive on the scene, and the use of raw materials expands from organic resources (including ivory and ostrich eggshell) to a myriad of abiotic materials such as obsidian, green stones, rock crystal, quartz, cinnabar, and the first use of metals (e.g. Costa et al. 2011; Montero-Ruiz/Murillo-Barroso 2014). However, not all these resources had the same social significance. The different social meaning acquired by each of these materials, which goes beyond their mere physical-chemical and functional properties, depends on various interrelated factors. This allows the value of an object to change throughout its social life, geographically and temporally depending on the specific context in which it is valued.

The first question to be answered should therefore be: what are the factors involved in the social

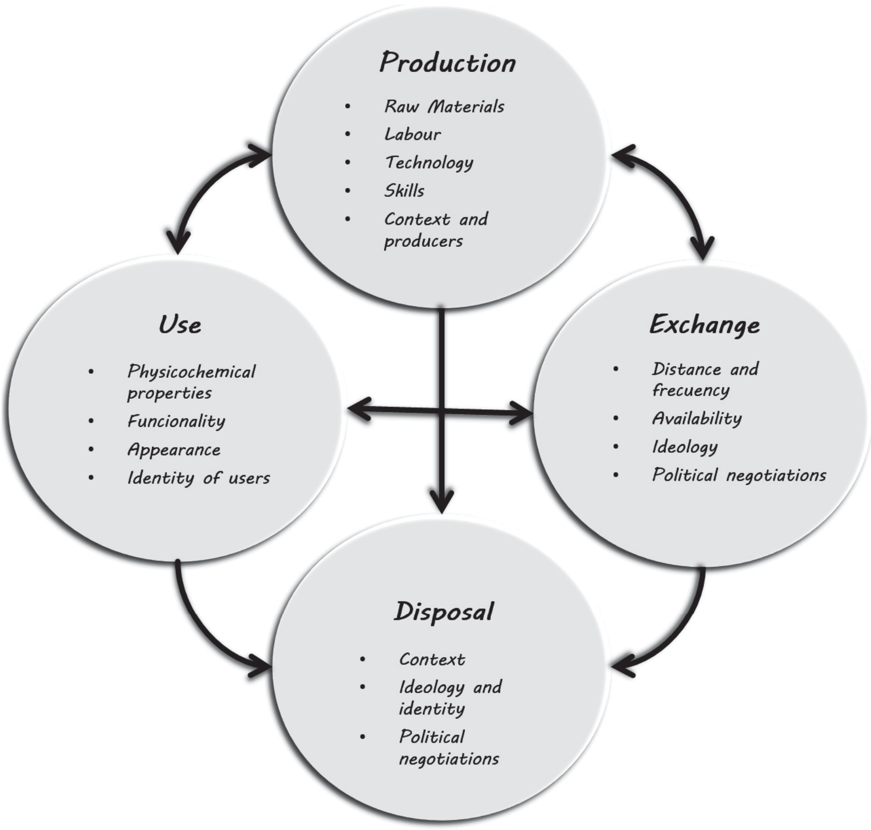

Fig. 1. Schematic representation of the social process of value assessment.

significance of objects, and how can we infer them from archaeological materiality? If we are attempting to understand the social meaning of objects, we cannot omit the question of value.

Value is not an ahistorical or inalienable attribute of objects, but rather a dynamic, social, and contingent feature that depends on concrete, essentially political factors (Graeber 2001), or perhaps more accurately, on political economy. Therefore, to evaluate the social value of prehistoric objects, we must study their production as well as their exchange and final amortisation. The variations observed in the value of objects should therefore be analysed in relation to the wider socio-political changes taking place in the society in question. The value of an object can even vary over its social life: the initial value it is given after its production can differ from the final value given to the same object at the moment of its amortisation (Flad 2012). It can even be fetishised, abstracting itself from the social relationships that gave it value and becoming considered a holder of value in itself (Graeber 2001, 76). These characteristics of production and exchange, deposition contexts, relationship to other objects, and even the processes of fetishisation and the ability of objects to 'accumulate memory' (Graeber 2001, 34) are what must be analysed in order to understand the role and social significance of certain objects.

Firstly, the value of an object is granted at the moment of its manufacture and therefore depends on the specific characteristics and circumstances of the production process in a given society. The first influence on this process is the raw material (*fig. 1*). It is not so much the physical-chemical properties of the material (which will have a greater influence on the evaluation of the functional use of the object), but rather the availability and accessibility of the resources needed for its creation that will contribute more decisively to the social value of an object (Montero-Ruiz 2002). A scarce raw material acquires high symbolic or social value, given its exotic nature, while also embodying a greater economic value than a nearby, accessible resource, due to the need to mobilise a greater amount of work to obtain it. A second characteristic that contributes to the social value of an object at the moment of its production is the technology and work necessary for its transformation, as well as the need, or lack thereof, of specific knowledge or certain skills; that is to say, whether or not specialised labour is necessary for its manufacture.

To quantify the amount of socially-necessary work and skills required for the manufacture of a given object is a useful approach for the relative evaluation of certain aspects of the social significance of things. The social status of producers, as well as the social context of production, has been articulated by Flad (2012) in regard to the social significance of objects in a way similar to Costin's concept of attached production (Costin 1991), especially in contexts of sacred or ritualised production, with a high political burden, or with the participation of the elite in the production process.

Secondly, the use of an object is perhaps the clearest characteristic of the value assessment process. It seems obvious that a useless object, one that does not serve to satisfy human needs (whether they are subsistence, functional, artistic, aesthetic, cultural, or ideological needs) is completely lacking in value, as valueless is any work involved in its creation. In this regard, the physical-chemical characteristics of an object play an important role, including those relating to their mechanical functionality, as well as their physical appearance, especially when the use of the objects is ideological. Objects with a greater significance and social value are generally those used to symbolise central ideas, cosmologies and beliefs, or as a form of ostentation, therefore representing important political component (e.g. Burger 2012; Murillo-Barroso et al. 2015a; Perea 2005; Renfrew 1986; 2012). In the same way, the identities of consumers and the contexts of use will have a decisive influence, allowing for the modification of the use value of the same object, socially and geographically.

Thirdly, objects acquire an 'exchange value' as commodities. In the case of Late Prehistory, the high value given to certain raw materials because of their qualities, or perhaps more importantly due to their scarcity and exotism in certain areas, lead to the development and consolidation of extensive trade networks (e.g. Renfrew 2012; Earle et al. 2015; Ling/Stos Gale 2015). These networks contributed to – although not determined – the processes of social stratification that were under development in the communities involved in these long-distance exchanges. However, on the Iberian Peninsula, the volume of these exchanges does not seem to be sufficiently important as to have a clear impact in local social processes until the 1st mill. BC (e.g. Gilman 1993; Murillo-Barroso et al. 2016). During the exchange process, all the factors that gave value to the object during its production (accessibility of raw materials, the amount of work, skills and technology needed for its transformation) come into play, in addition to the work necessary for distribution. To this end, the advances in archaeometric techniques for determining provenances, along with the spatial analysis of contact routes are contributing greatly to the advancement of knowledge of contact routes and exchange networks. In regard to the distribution of objects, whether maritime trade requiring the implementation and development of navigation techniques is needed; whether warriors have to be mobilised to protect exchange routes (Guerrero Ayuso 2010; Rowland/Ling 2010; Earle et al. 2015); whether it involved well-consolidated and travelled exchange routes or occasional contacts, etc. All of them will be factors that contribute to the object's value. Additionally, and this is especially true for pre-capitalist economies, it also involves the ideological and political character of exchange in the Maussian sense of gift exchange. Context also becomes vitally important, as while certain objects are common and easily exchanged in certain areas or at certain times, these same objects can be considered extremely unique and valued in other spatial and temporal contexts.

Finally, the political and ideological aspects and the identities of the consumers acquire special relevance at the moment of the amortisation of the object at the end of their useful lifespan. Accordingly, from an archaeological point of view, context is everything if we hope to infer the social value of objects at the end of their social life. We must evaluate the location of the object relative to other objects and individuals as well as their relationship in terms of presence/absence, abundance/scarcity (e.g. Renfrew 1986); whether they are found complete or fragmented (e.g. Chapman 2000); if it constitutes intentional destruction of valuable objects as a form of ostentation of the potlaches type; if they are individual or collective contexts, ritualised or domestic, etc.

Ultimately, the factors that contribute to the social value of objects are varied and interrelated. It is the balance between them that causes an object to acquire a certain value in a concrete space and moment in time. However, this balance changes with time and space, causing our assessment of the social value of prehistoric objects to always be partial and limited. In this article we will carry out a review of the social role of amber and metal in the Late Prehistory of the Iberian Peninsula. We will assess the factors that had an influence on the social significance of these resources, from their collection and transformation to their disposal or deposition in the archaeological record. We will discuss the consumption of amber and metal in a concrete manner as case studies allowing us to compare the social value given to each one in relative terms, as well as its evolution over time. The changes identified in regard to their social value will be studied relative to the socio-political changes taking place at the time.

Amber and Copper on the Iberian Chalcolithic

The Chalcolithic (ca. 3200–2200 calBC) is perhaps the moment when the Iberian Peninsula most clearly participates in long-distance exchange prior to its integration into the 'World System' of the 1st mill. BC (Guerrero Ayuso 2010; Díaz-del-Río 2011). The presence of 'exotic' materials such as ivory, ostrich eggshell, and as in the case in question, amber, becomes evident. Nevertheless, it is worth noting that these foreign elements are most highly concentrated at the largest archaeological sites, such as Valencina de la Concepción or Los Millares, where there was a greater capacity for the mobilisation of work and acquisition of foreign raw materials (Díaz-del-Río 2011; 2013).

Production and Distribution

Differing from the case of ivory (Nocete et al. 2013), to-date there has been no evidence of amber-working areas at Chalcolithic sites. The presence of unworked nodules of local amber, occuring somewhat more frequently during the Upper Palaeolithic at sites along the Cantabrian Coast (Álvarez Fernández et al. 2005), practically disappears with the exception of a nodule of raw amber at Tomb E3 at Paraje de Monte Bajo, Alcalá de los Gazules, Cádiz (Lazarich et al. 2009, 77), which at the moment lacks an analysis of origin.

On the Iberian Peninsula, Álvarez Fernández et al. (2005) and Peñalver et al. (2007) have located some 40 deposits of Cretaceous amber along the Cantabrian Coast and surrounding areas, notably including Peñacerrada (Alava), San Just (Teruel), and El Soplao (Cantabria). Rovira i Port (1994) noted the presence of geological amber in the area surrounding Barcelona, and Domínguez Bella et al. (2001) also identified geological amber deposits in the area of Puerto del Boyar, Grazalema, Cádiz. Geological amber has also been documented in the area of Guadalajara (Cerdeño et al. 2012) and along the coast of Portugal (Vilaça et al. 2002), although at neither of these locations does it appear as abundantly as in the area of the Cantabrian Range, where an extensive characterisation of the deposits was carried out, being the FTIR spectrum characteristic of the deposits well defined (Alonso et al. 2000). Unfortunately, the remaining locations with peninsular amber lack extensive FTIR characterisation, with only a single geological sample analysed at the Barcelona, Guadalajara, and Grazalema sites, respectively. Therefore, to-date, the only reliable comparison with local resources that can be made is with the amber of the Cantabrian Coast, given that a single sample cannot be representative of a deposit's geological variability. Nevertheless, it can serve as a starting point for comparison with archaeological materials until there is a better characterisation of peninsular amber, especially considering that the uncharacterised amber deposits are small occurrences while the main amber deposits from the Cantabrian Coast have been subjected to extensive research.

In regard to the archaeological pieces of amber, the number of objects analysed is also very small. Provenance analyses of origin have only been carried out at four sites (*fig. 2*): at the tumuli of Trikuaizti I and Larrarte (Guipuzcoa), Caves 1 and 3 of the Valle de las Higueras (Toledo) and PP4-Montelirio (Seville).

At the tumulus of Trikuaizti I (Guipuzcoa), in addition to the abundant lithic industry, researchers recorded more than 30 quartz crystals, a Bell Beaker pot and various fragments of non-decorated pottery, two laminar gold beads

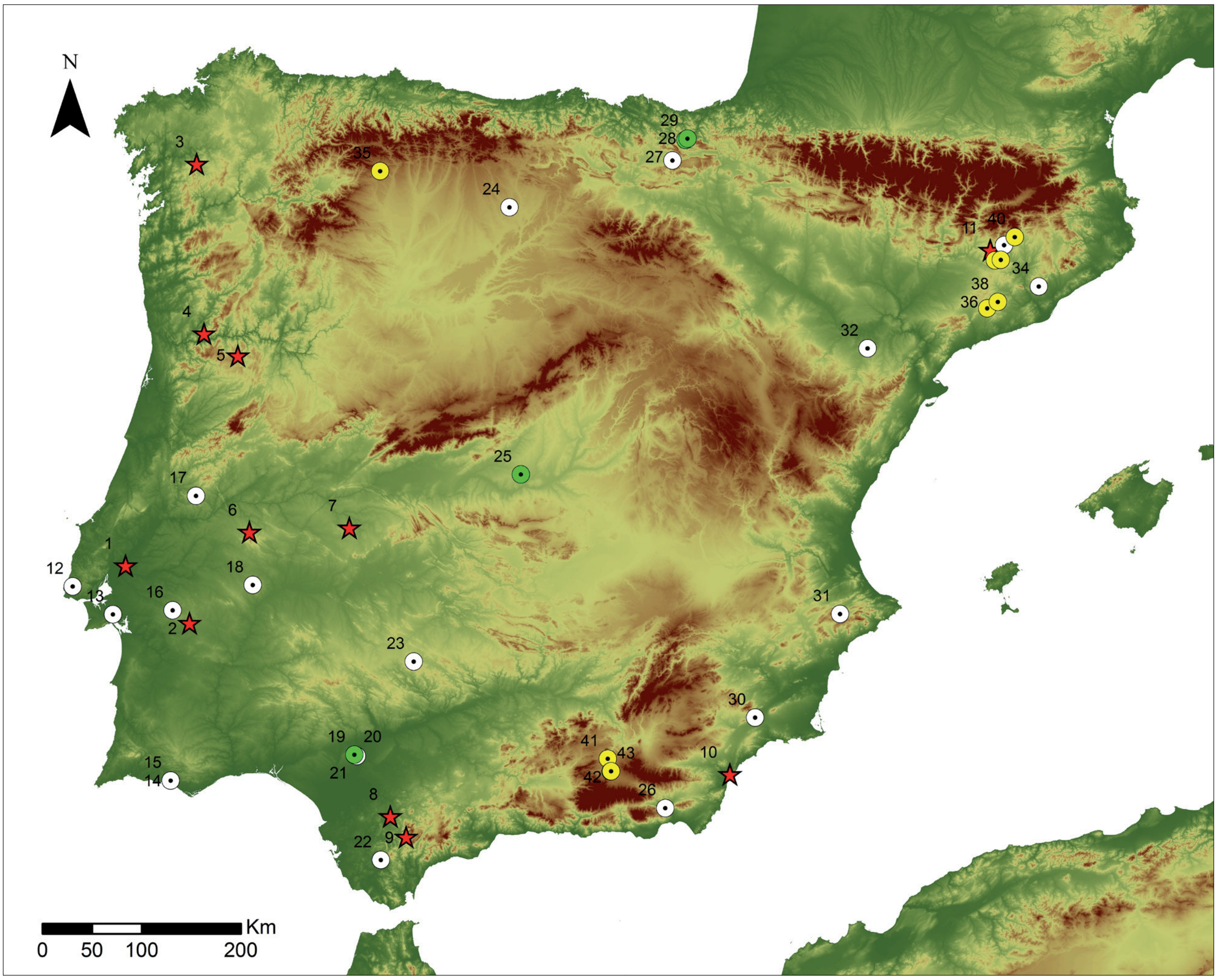

Fig. 2. Archaeological sites with amber. **Neolithic sites** (red stars): 1. Cabeço da Amoreira; 2. Anta Grande do Zambujeiro; 3. Chousa Nova; 4. Dolmen de Mamoa V de Chã de Arcas; 5. Orca de Seixas; 6. Anta dos Pombais; 7. Campo de Hockey Necropolis; 8. Dolmen of Alberite; 9. El Juncal; 10. La Encantada 3; 11. Tumulus of Cal Rajolí. **Chalcolithic sites** (white dots; green dots: chalcolithic amber with provenance analyses): 12. Bela Vista; 13. Cave III, Quinta do Anjo; 14. Alcalar 3; 15. Alcalar 4; 16. Anta Grande da Comenda da Igreja; 17. Anta de Vale de Antas; 18. Atalaião dos Sapateiros; 19. PP4-Valencina de la Concepción; 20. Dolmen de Montelirio; 21. Caño Ronco; 22. Sepulture E3 of Paraje del Monte Bajo; 23. Los Delgados I; 24. La Velilla; 25. Caves 1 and 3, Valle de las Higueras; 26. Los Millares, tombs 4, 7, 12, 63 and 74; 27. Gorostiarán E; 28. Trikuaizti I; 29. Larrarte; 30. Blanquizares de Lebor; 31. Cova de La Pastora; 32. Castell Morrés; 33. La Fossa del Gegant; 34. Cova del Frare. **Reutilised sites with Chalcolithic as well as Bronze Age materials** (yellow dots): 35. Dolmen of Las Arnillas; 36. Cova de El Garrofet; 37. La Pera; 38. Cova de la Roca del Frare; 39. Collet; 40. Tumulus I of El Bosc; 41. Llano de la Teja 18; 42. Llano de la Sabina 97; 43. Llano de la Sabina 99.

(one of them out of context with 20% Ag), two jet beads, a sandstone bead, a green stone, twelve small shale or marl beads, and a globular amber bead (Mujika/Armendariz 1991, 128). This bead was analysed by Álvarez et al. (2005) who identified the characteristics typical of the Cretaceous amber of the Iberian Peninsula, concluding that it was derived from a supply of local resources.

At the dolmen of Larrarte (Guipuzcoa), excavators also noted the presence of a basalt slab (56 x 21 x 6cm), which could be considered an anthropomorphic stela, along with three large stones (limonite) perforated longitudinally in addition to a predominantly-Chalcolithic set of grave goods, with abundant lithic industry, fragments of Bell Beaker and non-decorated pottery, eleven jet beads, four possibly-limonite beads, two limestone beads, three green beads, and one amber bead (Mujika/Armendariz 1991, 156 f.). The amber bead, which was analysed by Álvarez Fernández et al. (2005), clearly displayed characteristic features of Baltic amber, with a flatband between 1250 and 1180cm^{-1} followed by a strong absorption peak at 1154cm^{-1}.

To-date, this constitutes the only evidence of Baltic amber on the Iberian Peninsula during the Chalcolithic. It is also the first evidence of the arrival of Baltic amber to the Iberian Peninsula, something that would become more frequent starting in the Bronze Age and especially during the Late Bronze Age/Early Iron Age (Murillo-Barroso/Martinón-Torres 2012).

The third site with analysed Chalcolithic amber is the necropolis of the Valle de las Higueras, where two amber beads were documented in Caves 1 and 5 (Bueno Ramírez et al. 2005; 2012). In Cave 1, the amber appeared along with two variscite beads, as well as Bell Beaker pottery and two flint arrowheads with traces of cinnabar. In Cave 3, with around twenty inhumations, in addition to the amber, excavators also recovered variscite beads. The amber beads were analysed by Professor Domínguez Bella, who ruled out their Baltic origin, although for the moment no concrete origin has been able to be established (Bueno Ramírez et al. 2012, 26).

Finally, the last Chalcolithic site with amber objects analysed is Valencina de la Concepción (Seville) with an amber pomel from the PP4-Montelirio and pendants from the dolmen de Montelirio analysed. The amber pommel is perhaps one of the most noteworthy pieces in the Prehistory of the Iberian Peninsula, given that it is the only amber object that is not a bead or a pendant. We are referring to a semi-circular pommel that possibly belonged to the flint halberd handle that it appeared with. In this case, the amber was deposited as part of a set of grave goods for an individual covered with cinnabar, accompanied by other significant objects such as an unworked elephant tusk, a plate with an almond-shaped edge partially covered by red pigment, 23 flint strips, numerous ivory objects (many of them decorated and considerably fragmented), and a copper awl (Murillo-Barroso/García Sanjuán 2013). The dolmen de Montelirio (see below) also stands out because of the large amount of amber beads: more than 250 objects which were also analysed (Murillo-Barroso 2016).

The analysis of these pieces allowed a Baltic provenance to be clearly ruled out, nor do them adapt to the results published by Peñalver et al. (2007) in regard to the Cretaceous amber of the Northern Iberian Peninsula. It also cannot be related to the analysed samples from Cádiz (Domínguez Bella et al. 2001), Guadalajara (Cerdeño et al. 2012), or Catalonia (Rovira i Port 1994). For the moment, as has already been discussed somewhere else in greater detail (Murillo-Barroso/García Sanjuán 2013; Murillo-Barroso/Martinón-Torres 2012; Murillo-Barroso 2016), the reference spectra most similar to the pommel from the PP4-Montelirio and to the pendants from the Dolmen de Montelirio is that of the Sicilian simetite defined by Beck and Hartnett (1993). Further archaeological amber samples from Iberia have revealed patterns similar to those of simetite. These include the amber from the Neolithic megalithic tombs of Alberite (Cádiz), Mamoa V (Portugal), and Chousa Nova (Pontevedra). The amber beads found in Alberite were identified as simetite by Dominguez Bella et al. (2001); while Vilaça et al. (2002) and Domínguez Bella and Bóveda Fernández (2011) acknowledged the resemblance with simetite of amber objects found in Mamoa V and Chousa Nova but noted that a local origin from botanical sources similar to the Sicilian simetite should not be rejected either. A more systematic characterisation of the peninsular sites beyond the Cantabrian Coast would be necessary in order to more definitively rule out an Iberian origin. However, all the Iberian geological amber hitherto analysed shows different patterns than simetite and has been shown to be of a Cretaceous origin, while simetite is a Terciarian amber, thus the hypothesis of a local origin for these beads is not supported by current evidence. At least until local amber showing the same characteristic spectrum is discovered and analysed, a Sicilian provenance remains the most probable option for both the Montelirio objects and for the other artefacts mentioned above.

Therefore, in regard to the production and distribution of amber, we can observe that despite having local resources, the arrival of foreign material can be identified, although the analysed samples are yet sparse. The absence of archaeological evidence for workshops and nodules of raw amber could support the idea of greater consumption of foreign amber, which probably arrived to the Iberian Peninsula in the form of already-finished objects. The results of the analysis currently under-way will help us to confirm or nuance this hypothesis.

If correct, this preference for resources of foreign amber would need to be understood in political terms, as it would allow for the establishment of links and relationships between local and foreign elites. Control or restricted access to objects subjected to long-distance exchange would contribute to ostentation and significance of higher status, also including other resources such as ivory or ostrich eggshell. However, the overall scarce volume of amber documented prevents us to propose intensive trade networks, but sporadic exchanges, as the total volume of exchange would be reduced (see below).

The situation in regard to copper metallurgy is precisely the opposite. While amber resources are relatively scarce on the Iberian Peninsula with the exception of the northern area, copper resources are considerably abundant in practically the entire region, often appearing on the surface, facilitating their access to prehistoric communities (Montero-Ruiz 1994; Bartelheim/Montero-Ruiz 2009; Rovira/Montero-Ruiz 2013). Nevertheless, and despite this abundance of surface copper resources, mining technology had already been developed on the Iberian Peninsula since the Neolithic, making access to resources viable in technological terms. This is evidenced by the flint mines at Casa Montero (5400–5000 calBC), with ca. 3500 shafts of up to 7m deep (Díaz-del-Río et al. 2006), or the variscite mines combining shafts and galleries at Gavà, Barcelona, which reached 15m in depth (Borrell et al. 2015).

We also have clear evidence of copper mining dating from the 3rd mill. BC. The clearest examples are the mines at El Áramo, El Milagro, or La Profunda (de Blas 1989; 1998) in the northern façade, even though the easy accessibility of surface secondary carbonates as well as historical mining activity have contributed to the invisibility of a large part of prehistoric mining efforts. This great abundance and accessibility of copper resources are two of the factors that have most notoriously contributed to the limited value of metal. As an example, gold can be more easily obtained using simpler technology than copper, given that it generally occurs in its native state and it being the most malleable metal, its mechanical transformation is very simple; however, due to its greater scarcity, it is a metal with much greater social value.

Once copper ores have been extracted, their transformation into metal does not require excessively complex technology as has been demonstrated both by archaeometallurgical and experimental studies (e.g. Hanning et al. 2010; Montero-Ruiz 1994; Murillo-Barroso et al. 2017; Rovira 2002; Rovira/Montero-Ruiz 2013), the fundamentals of which, in terms of development of mining techniques and pyrotechnology, can already be found during the Neolithic. Therefore, as has been discussed in more detail somewhere else (e.g. Rovira 2002; Rovira/Montero-Ruiz 2013), Chalcolithic metalworking on the Iberian Peninsula is mainly characterised by its technological primitivism and poor efficiency. There are no clearly-documented furnace structures (see Gauß 2013 for a critical review of the structures known as 'Chalcolithic furnaces'). Ores are directly smelted, without the addition of fluxes, in common ceramic vessels under open fires. Specific ventilation systems are not required either. Air can be supplied by blowing through a reed which implies having little control of the redox conditions, and consequently producing immature slags, frequently with relicts of unsmelted ore with high viscosity, complicating the separation of the metallic copper and causing the subsequent loss of high amounts of copper in the slag (e.g. Murillo-Barroso et al. 2017; Rovira 2002; Rovira/Montero-Ruiz 2013).

This technology is carried out inside villages, in the same domestic areas where other subsistence, pottery, stone or textile production was performed. These contexts for metalworking appear to reflect collective and domestic production designed to fulfil daily necessities, rather than specialised labour or directed to exchange. In fact, the volume of metal produced does not seem to exceed community needs (Bartelheim 2007).

Provenance studies of the origin of Chalcolithic metal objects likewise do not reflect the existence of large long-distance trade networks. Provenance analyses of metals by lead isotopes have proliferated during the last two decades, and the results are revealing a high variability of sources, indicating that there were multiple mineralisations utilised. Nevertheless, the mobility of resources is generally limited, prioritising regional resources, although they may take place over a certain distance. Using some examples of the main metallurgical sites that have undergone a complete archaeometric study, the metal at sites in the South-West of the country, such as Zambujal (Torres Vedras, Portugal), San Blas (Cheles, Badajoz), La Pijotilla (Badajoz), Cabezo Juré (Alosno, Huelva) or Valencina de la Concepción (Seville), seem to have their origins in the mineralisations of the surrounding area, especially Ossa Morena and the Pyrite Belt (Hunt et al. 2009, 89–92; 2012; Müller et al. 2007, 22–24; Nocete et al. 2008, 723; Sáez et al. 2004). In the same way, sites like Almizaraque (Almeria) or La Vital (Valencia) seem to prioritise the resources of the South-East (Montero-Ruiz/Murillo-Barroso 2010; Rovira/Montero-Ruiz 2011, 225–227) and a similar pattern can be observed in the region of Madrid (unpublished data) or the area of the Ebro River estuary (Montero-Ruiz 2017). To date, no case has been documented with the presence of extra-peninsular metal, nor we do have evidence of metal originating from other regions of the Peninsula (for example, no metal from the Asturian-Leonese mines has been identified in the South of Iberia). During these first periods of metallurgy, the abundant copper resources of the Iberian Peninsula cause it to remain out of long-distance metal exchange.

Consumption

In regard to the consumption of these resources, the total volume of amber objects turns out to be relatively small: the number of sites with amber doubles during the Chalcolithic going from ten sites in the Neolithic to 21 (*fig. 2*). However, the amount of Chalcolithic amber that has been recovered is less than that of the Neolithic, oscillating between one and five beads per tomb. From the Neolithic we have a total of 79 amber beads, but only approximately 47 have been recovered from the Chalcolithic. One exception would be the Dolmen de Montelirio, which significantly stands out quantitatively and qualitatively, with more than 250 beads and pendants of different shapes (Murillo-Barroso 2016). This is the tomb containing the largest quantity of recovered amber from the Late Prehistory of the Peninsula. However, if we observe it in relative terms, the amber beads are proportionally scarce in comparison with beads made of other materials. To provide only a few examples, only three out of more than a thousand beads from the Alberite dolmen were made of amber (Domínguez Bella et al. 2001, 621); just three out of 1,107 beads from Cova de la Pastora (Alcoy) were crafted on amber (García Puchol et al. 2012, 286); three out of 573 beads from Tomb 7 of Los Millares (Almeria) (Leisner/Leisner 1943, 26 f.); and only five out of 3,299 beads of Los Millares 12 (Leisner/Leisner 1943, 25). Even in the case of the Dolmen de Montelirio, the >250 amber beads are proportionally scarce if we compare them to the 1 million beads documented at the same site (Díaz-Guardamino Uribe et al. 2016, 346).

Therefore, it can be observed that there was a smaller concentration of amber consumption during the Chalcolithic, with double the sites using it. This could be the result of a greater amount of population centres with an elite capable of obtaining foreign resources, notably including Los Millares and especially Valencina de la Concepción, a site that received, by a large margin, the largest amount of amber pieces and the most unique objects such as the pommel of the halberd of PP4 and the amber pendants of the Dolmen de Montelirio (also reflected by the exceptional nature of the ivory carvings at the same site). Nevertheless, with the exception of Valencina, the total volume of amortisated amber between 3200–2200 calBC is relatively scarce, making it possible that these exchanges resulted more from occasional contacts than from frequent exchanges through extensive and completely-consolidated networks. It is therefore difficult to think that sporadic exchanges (also assuming that all the amber was foreign), would have the ability to have a decisive impact on the alteration of internal processes or be the trigger for cultural changes among the peninsular groups.

The type of objects crafted in amber and their contexts for amortisation do seem to reflect a symbolic significance attributed to this resource. With the exception of the aforementioned pommel from PP4 in Valencina, practically the entirety of the objects crafted in amber are beads or pendants created to be worn by an individual as a necklace or incorporated into fabric. 100% of the objects also appear in funerary contexts generally associated with concrete individuals. They are therefore elements with a strong connotation of identity and status. Amber furthermore, is normally accompanied by other exotic or symbolic elements such as the ostrich eggshell beads at Los Millares 12 (Leisner/Leisner 1943, 25); the idols at the Cova de la Pastora (Alicante) and Los Millares 7, 12, and 74 (Soler Díaz 2002, 348–354; Leisner/Leisner 1943, 24–27); the rock crystals in the dolmen of Trikuaizti I (Guipuzcoa), the Paraje de Monte Bajo (Alcalá de los Gazules) or the PP4 at Valencina de la Concepción (Mujika/Armendariz 1991, 127; Lazarich et al. 2009, 76 f.; Murillo-Barroso/García Sanjuán 2013, 513); in addition to the ivory at the Cova de la Pastora (Alicante), Los Millares 12 and 63, the PP4-Montelirio and the Dolmen de Montelirio in Valencina or the necropolis of Alcalar 3 and 4 (Algarve) (García Puchol et al. 2012, 286; Leisner/Leisner 1943, 25, 51, 237, 239; Murillo-Barroso/García Sanjuán 2013, 513; Fernández Flores/Aycart Luengo 2013); the green beads in the dolmens of Trikuaizti I and Larrarte (Guipuzcoa), the Cova del Frare (Barcelona) or the Valle de las Higueras (Toledo) (Mujika/Armendariz 1991, 127, 157; Rovira i Port 1994, 73; Bueno Ramírez et al. 2005, 74); or the cinnabar, ochre, and red pigments at La Velilla (Palencia), the Valle de las Higueras (Toledo), Los Millares 12 and 74, PP4 and at Montelirio in Valencina de la Concepción, the Paraje de Monte Bajo (Alcalá de los Gazules), or the necropolis of Alcalar 4 (Algarve) (Zapatero 1989, 11; Bueno Ramírez et al. 2005, 75; Leisner/Leisner 1943, 24 f., 237, 239; Rogerio Candelera et al. 2013; Fernández Flores/Aycart Luengo 2013; Lazarich et al. 2009, 76 f.). Less frequent is the presence of metal in tombs containing amber. Gold appears in the form of thin strips at Trikuaizti I (Guipuzcoa), Alcalar 4 (Algarve) and the Dolmen de Montelirio (Valencina) (Mujika/Armendariz 1991, 127; Leisner/Leisner 1943, 239; Fernández Flores/Aycart Luengo 2013; Fernández Flores et al. 2016), while copper is absent at some of the most important tombs, such as the Dolmen de Montelirio in Valencina de la Concepción, and where it does appear it does so scarcely and generally in the form of awls. These appear at Gorostiarán (Guipuzcoa), Valle de las Higueras 3 (Toledo), PP4 at Valencina de la Concepción, Los Millares 12 and 7 (in the latter tomb an axe, chisel, and blade fragment were also documented), and the Necropolis of Alcalar 3 and 4 (Algarve), where, by a large margin, the largest amount of metal has been found, specifically three axes, a small chisel, two small flat tools, five daggers, two awls, a saw, and six blades, some of them fragmented (Apellániz Castroviejo 1973, 222; Bueno Ramírez et al. 2005, 75; Murillo-Barroso/García Sanjuán 2013, 513; Leisner/Leisner 1943, 25–27, 237, 239).

Apart from the tombs containing amber objects and other exotic elements, it is significant that the typology of the copper objects up to the final moments of the Chalcolithic is limited to tools or weapons, with the notable absence of ornaments or potentially-symbolic elements (Murillo-Barroso/Montero-Ruiz 2012). This is in clear contrast to the metallurgical tradition of the Near East and Central Europe, where the first production of metal was oriented towards the production of elements for body ornament. Although, as we have sustained, there is a large amount of body adornaments crafted in a great variety of raw materials, copper was not a material chosen by Chalcolithic communities for the creation of body ornaments.

Equally significant is the fact that, in contrast to the amber objects deposited exclusively as ornaments in funerary contexts, copper objects appear almost equally in domestic and funerary contexts. In the case of the southeast, 43% of metal objects were recovered in domestic contexts, compared with 57% in funerary contexts (Montero-Ruiz 1994, 214). This is similar to the case of Valencina de la Concepción, where 46% of the metal was deposited in the so-called domestic area, while 54% came from the necropolis (Costa et al. 2010, 98), with all of the objects being tools or tools/weapons. We do not observe, therefore, that copper was designated preferentially for contexts marked by an important symbolic, ideological, or ritualised significance.

These typological and contextual differences seem to reflect the importance that exotic materials must have had for Chalcolithic funerary ideology and consequently, the importance of the acquisition and manufacture of scare raw materials, as well as the social significance that body ornaments must have had among Neolithic and Copper Age communities (Skeates 2010, 75). At the same time, it reveals the limited ideo-technical value reached by metal during the Chalcolithic, perhaps as a consequence of its great abundance and accessibility on the Iberian Peninsula.

Changing Values: The Leap to the Bronze Age

The situation that we have described for the Chalcolithic changes substantially upon the arrival of the Bronze Age. Especially significant is the drastic reduction in the number of objects crafted in amber during the 2nd mill. BC, something that will change again during the Late Bronze Age/Early Iron Age with the inclusion of the Iberian Peninsula in the continental, and especially Mediterranean, exchange networks. Other exotic elements, such as ostrich eggshell, jet, or rock crystal, also diminish in use during the 2nd mill. BC (Costa et al. 2011).

The objects recovered in definite Bronze Age contexts are limited to eight,[1] and none of them represent the usual pattern of individual burial characteristic of the Bronze Age: Pedra Cabana, Cabana del Moro in Colomera, Can Cuca, Bullons and Muricecs in Lleida, Cova de Can Mauri and Cova de les Pixarelles in Barcelona, and Los Lagos I in Cantabria. It is significant that all the amber documented in the Bronze Age is concentrated along the northern façade of the country, and especially in the northeast, without reaching the rest of the Peninsula. Provenance studies were carried out at four of these sites: Los Lagos I, Pedra Cabana, Cabana del Moro in Colmera, and Muricecs. Los Lagos I, on the Cantabrian Coast, revealed a consumption of local resources (Gutiérrez Morillo 2003) while the three Catalonian sites showed Baltic origin of the amber (Rovira i Port 1994; Murillo-Barroso/Martinón-Torres 2012), perhaps reflecting some continental contacts with southern France via the Pyrenees, also suggested by the metal deposits that accompanied the amber in the case of Muricecs (Gallart i Fernández 2006; Montero-Ruiz et al. 2015).

The total absence of amber in Argaric contexts is striking, as there are several extensively excavated sites with tombs containing notable sets of grave goods. Its use, mainly documented in the Northeast at collective burial sites or reutilisations maintaining ‘archaic’ practices, seems to reflect the fact that in the new social relationships of the Argaric society, amber had lost its relevant social value as a marker of identity. If we accept that the amber recovered in the burial sites of Fonelas 18 and La Sabina 97 and 99 (Guadix) have an Argaric chronology – although these three tombs display reuse of materials from the Chalcolithic as well as the Middle and Late Bronze Age (Lorrio/Montero-Ruiz 2004) –, its use in burials that preserve previous funerary practices and do not follow standard Argaric burial norm, could reflect a continuation of ancestral traditions. It might also be a response from the people excluded from the new social and ideological practices and value system of the Argaric Bronze Age; a conscious and explicit rejection of Argaric values (Aranda 2015; Graeber 2013; Murillo-Barroso/Martinón-Torres 2012, 209).

On the contrary, the change in the consumption of metal is the opposite. The number of metal objects recovered during the 2nd mill. BC, is five times greater and they change substantially (e.g. Montero-Ruiz 1993, 53; 1994). While we have no metal ornaments from the Chalcolithic, during the Bronze Age this is the predominant typology (Murillo-Barroso/Montero-Ruiz 2012, 59 f.). Nevertheless, even in the Argaric world, copper was late to acquire important social significance as an element for body adornament, and only appears frequently starting in 1800 calBC. The first metal ornaments were made of silver and gold (Murillo-Barroso/Montero-Ruiz 2012, 60), something that Castro et al. (1993/1994, 101) interpret as an example of differential access to metal ornaments in the Argaric society, with their first appearance in the tombs of the elite, later becoming more accessible in their copper version starting in 1800 calBC.

In fact, the introduction of bronze into the Argaric society also seems to be closely related to the development of these elements for adornment. We have more than 400 compositional analyses of Argaric objects (Junghans et al. 1960; 1968; Arribas

1 We will not consider nine more discoveries in collective and reused contexts in which materials from the Chalcolithic to the Late Bronze Age appear mixed, as it is not possible to clearly place the amber in a specific moment in the Middle Bronze Age.

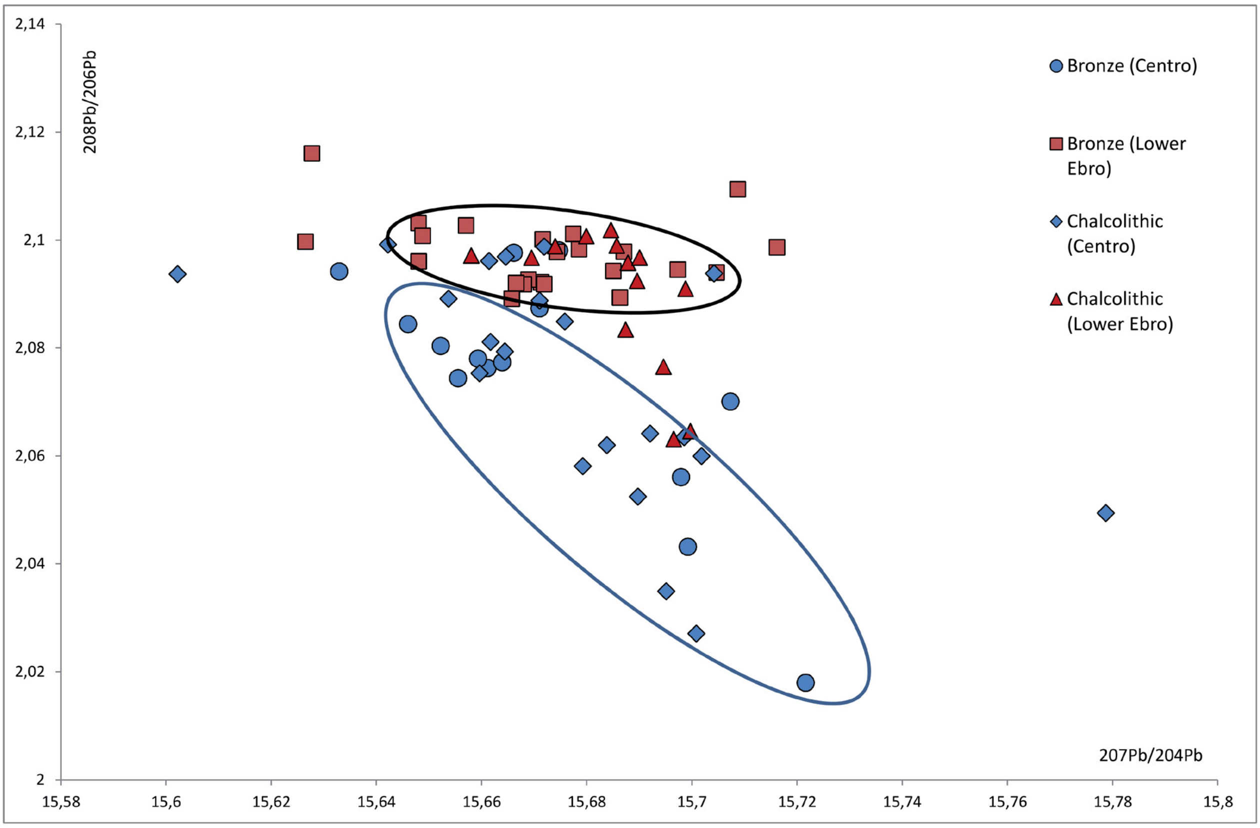

Fig. 3. Isotopic signatures of Chalcolithic and Bronze Age objects from the Central area of Iberia and the Lower Ebro area. Note that two different patterns can be distinguished reflecting a regionalised copper consumption.

et al. 1989; Hook et al. 1991; Montero-Ruiz 1994; Rovira et al. 1997; Simón 1998; Stos Gale et al. 1999; Murillo-Barroso et al. 2015b) in which a positive correlation can be observed between the elemental composition and the type of object (Montero-Ruiz 1994). The majority of the ornaments analysed (60%) were crafted in bronze, while tools and tools/weapons were mostly crafted in arsenical copper: 100% of the halberds, 86% of awls, 84% of daggers, 82% of axes, and 72% of swords (Murillo-Barroso et al. forthcoming). In addition, metallographic studies display a similar hardness in the Argaric objects made of arsenical copper and those of bronze, putting into question the functional superiority in practice of the latter alloy compared with arsenical copper and making us to consider other aspects as determining factors in the social value of the new metal, such as appearance and especially the scarcity of tin in comparison with arsenical copper (Aranda et al. 2012).

In regards to the procurement of these resources during the Bronze Age, a regional distribution and consumption of the metal is maintained, without significant changes to the supply sources of ores, as can be observed in the isotopic data of the metals of the central area of the country (Madrid and Toledo) and of the lower Ebro (Tarragona and Castellon) (*fig. 3*). Although, we cannot reliably carry out this chronological comparison in the South-East – given that we have Chalcolithic data mainly derived from sites near the coast and Argaric sites mainly in the interior (Granada and Jaen) – the comparisons between the Argaric metals and those of the Bronze Age in the Lower Ebro show that there is no relationship between the two areas, and we still do not find copper originating from the Asturian-Leonese mines still in operation (*fig. 4*). Even if the use of diverse resources within these regions could generate an exchange of metal between population centres (Murillo-Barroso et al. 2015b), these exchanges do not seem to go beyond these wide regional areas, or were not carried out in a sufficiently intense manner. This regional production also seems to have taken place in the central area of the Iberian Peninsula (Montero-Ruiz 1998; Ruiz Taboada/Montero-Ruiz 2000).

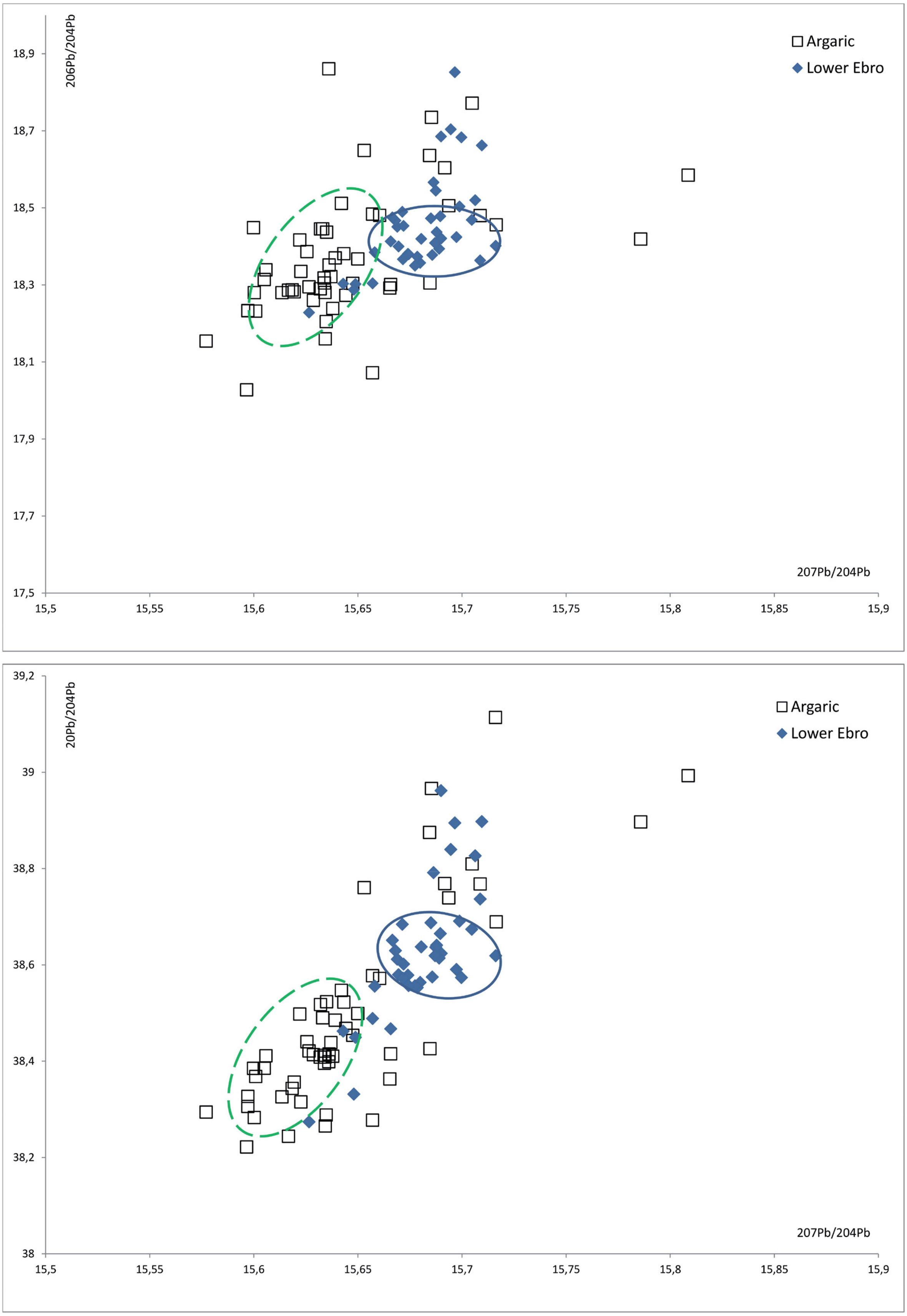

Fig. 4. Isotopic signatures of Bronze Age objects from the Argaric area and the Lower Ebro. As also noted in fig. 3 two different patterns in copper supplies can be distinguished reflecting regional catchment areas for copper ores.

This preference for regional resources seems consistent with the drastic reduction in exotic elements. In the societies of the Iberian Peninsula that were developing a process of marked social differentiation (especially evident in the Argaric world, but not exclusive to it), amber and the exotic raw materials used during the Chalcolithic cease to be used as markers of prestige or social status in order to give prevalence to metallic elements, especially ornments and weapons. The new elites break with the symbolic expressions of the Chalcolithic (*baetylus*, idols, ostrich eggshell, amber etc.) and establish new ideological and symbolic standards with which to endorse their power in which amber will not play any role, replaced by metallic elements.

This need to establish a new ideological expression that favours individuality over the more communal ideologies of previous ages also could be conditioned by a possible breakdown (intentional or not) of the Mediterranean contacts that favoured the arrival of exogenous material (Murillo-Barroso/Martinón-Torres 2012, 209), which would be consistent with the establishment of areas for the acquisition of regional metals as well as the absence of extra-peninsular metal. Something that would change again during the Late Bronze Age/Early Iron Age, a moment in which the Iberian Peninsula becomes once again completely integrated into the long-distance trade networks of Europe and the Eastern Mediterranean.

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Bibliography

Alonso et al. 2000: J. Alonso/A. Arillo/E. Barrón/C. Corral/J. Grimalt/J. López/R. López/X. Martínez Declòs/V. Ortuño/E. Peñalver/P.R. Trincão, A new Fossil Resin with Biological Inclusions in Lower Cretaceous Deposits from Álava (Northern Spain, Basque-Cantabrian Basin). Journal of Paleontology 74.1, 2000, 158–178.

Álvarez Fernández et al. 2005: E. Álvarez Fernández/E. Peñalver/X. Declòs, La presencia de ámbar en los yacimientos prehistóricos (del Paleolítico Superior a la Edad del Bronce) de la Cornisa Cantábrica y sus fuentes de aprovisionamiento. Zephyrus 58, 2005, 147–170.

Apellániz Castroviejo 1973: J. M. Apellániz Castroviejo, Corpus de Materiales de las Culturas Prehistoricas con Ceramica de la Poblacion de Cavernas del Pais Vasco Meridional. Munibe. Suplemento 1 (San Sebastián 1973).

Aranda 2015: G. Aranda, Resistencia e involución social en las comunidades de la Edad del Bronce del sureste de la Península Ibérica. Trabajos de Prehistoria 72.1, 2015, 126–144.

Aranda et al. 2012: G. Aranda/E. Alarcón/M. Murillo-Barroso/I. Montero-Ruiz/S. Jiménez Brobeil/M. Sánchez /M. O. Rodríguez Ariza, El yacimiento argárico del Cerro de San Cristóbal (Ogíjares, Granada). Menga. Revista de Prehistoria de Andalucía 3, 2012, 141–164.

Arribas et al. 1989: A. Arribas/P. Craddock/F. Molina/B. Rothemberg/D. Hook, Investigación arqueometalúrgica en yacimientos de la Edad del Cobre y Bronce en el Sudeste de Iberia. In: C. Domergue (ed.), Minería y metalurgia en las antiguas civilizaciones mediterráneas y europeas. Volume 1 (Madrid 1989) 71–79.

Bartelheim 2007: M. Bartelheim, Die Rolle der Metallurgie in vorgeschichtlichen Gesellschaften. Sozioökonomische und kulturhistorische Aspekte der Ressourcennutzung. Ein Vergleich zwischen Andalusien, Zypern und dem Nordalpenraum. Forschungen zur Archäometrie und Altertumswissenschaft 2 (Rahden/Westf. 2007).

Bartelheim/Montero-Ruiz 2009: M. Bartelheim/I. Montero-Ruiz, Many Ores and Little Water. The Use of Resources during the Bronze Age on the Iberian Peninsula. In: M. Bartelheim/H. Stäuble (eds.), The Economic Foundations of the European Bronze Age. Forschungen zur Archäometrie und Altertumswissenschaft 4 (Rahden/Westf. 2009) 5–22.

Beck/Hartnett 1993: C. Beck/H. Hartnett, Sicilian Amber. In: C. Beck/J. Bouzek (eds.), Amber in Archaeology. Proceedings of the II International Conference on Amber in Archaeology, Liblice, 1990 (Prague 1993) 36–47.

de Blas 1989: M. Á. de Blas, La minería prehistórica del cobre en las montañas asturleonesas. In: C. Domergue (ed.), Minería y metalurgia en las antiguas civilizaciones mediterráneas y europeas (Madrid 1989) 143–165.

de Blas 1998: M. Á. de Blas, Producción e intercambio de metal. La singularidad de las minas de cobre prehistóricas del aramo y El Milagro (Asturias). In: G. Delibes de Castro (ed.), Minerales y metales en la prehistoria reciente. algunos testimonios de su explotación y laboreo en la Península Ibérica (Valladolid 1998) 71–104.

Borrell et al. 2015: F. Borrell/J. Bosch/T. Majó, Life and Death in the Neolithic Variscite Mines at Gavà (Barcelona, Spain). Antiquity 89.343, 2015, 72–90.

Burger 2012: R. L. Burger, The Construction of Values during the Peruvian Formative. In: J. K. Papadopoulos/G. Urton (eds.), The Construction of Value in The Ancient World (Los Angeles 2012) 288–305.

Bueno Ramírez et al. 2005: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann, Ritual campaniforme, ritual colectivo. La Necrópolis de cuevas artificiales del Valle de las Higueras, Huecas, Toledo. Trabajos de Prehistoria 62.2, 2005, 67–90.

Bueno Ramírez et al. 2012: P. Bueno Ramírez/R. Barroso Bermejo/R. de Balbín Behrmann (eds.), 5.000 Años Atrás. Primeros Agricultores y Metalúrgicos del Valle de Huecas (Huecas, Toledo) (Toledo 2012).

Castro et al. 1993/1994: P. Castro/R. Chapman/S. Gili/V. Lull/R. Micó/C. Rihuete/M. E. Sanahuja, Tiempos sociales de los contextos funerarios argáricos. Anales de Prehistoria y Arqueología 9, 1993/1994, 77–106.

Cerdeño et al. 2012: M. L. Cerdeño/J. A. Martínez/F. Agua/T. Sagardoy/M. Monasterio, Ámbar en la Meseta Oriental durante el Bronce Final. Yacimientos locales e importaciones bálticas. Trabajos de Prehistoria 69.2, 2012, 375–384.

Chapman 2000: J. Chapman, Fragmentation in Archaeology (London 2000).

Costa et al. 2010: M. Costa/M. Díaz-Zorita/L. García Sanjuán, El asentamiento de la Edad del Cobre de Valencina de la Concepción (Sevilla). Demografía, organización espacial y metalurgia. Trabajos de Prehistoria 67.1, 2010, 85–117.

Costa et al. 2011: M. Costa/L. García Sanjuán/M. Murillo-Barroso/R. Parrilla/D. Wheatley, Rocas raras en los contextos funerarios del IV–II milenios cal ANE en el Sur de España. Una revisión. In: L. García Sanjuán/C. Scarre/D. Wheatley (eds.), Exploring Time and Matter in Prehistoric Monuments. Absolute Chronology and Rare Rocks in European Megaliths. Proceedings of the 2nd European Megalithic Studies Group Meeting (Seville, Spain, November 2008). Menga. Journal of Andalusian Prehistory. Monograph 1 (Antequera 2011) 253–293.

Costin 1991: C. Costin, Craft Specialization. Issues in Defining, Documenting, and Explaining the Organization of Production. In: M. B. Shiffer (ed.), Archaeological Method and Theory (Tucson 1991) 1–56.

Díaz-del-Río 2011: P. Díaz-del-Río, Labor in the Making of Iberian Copper Age Lineages. In: K. T. Lillios (ed.), Comparative Archaeologies. The American Southwest (AD 900–1600) and the Iberian Peninsula (3000–1500 BC) (Oxford 2011) 37–56.

Díaz-del-Río 2013: P. Díaz-del-Río, Las agregaciones de población del III milenio AC en la Península Ibérica. In: L. García Sanjuán/V. Hurtado Pérez/J. M. Vargas/T. Ruiz/R. Cruz Auñón (eds.), El asentamiento prehistórico de Valencina de la Concepción (Sevilla). Investigación y tutela en el 150 aniversario del Descubrimiento de La Pastora (Sevilla 2013) 65–76.

Díaz-del-Río et al. 2006: P. Díaz-del-Río/S. Consuegra/N. Castañeda/M. Capote/C. Criado/M. A. Bustillo/J. L. Pérez Jiménez, The Earliest Flint Mine in Iberia. Antiquity Project Gallery 80.307. <http://www.antiquity.ac.uk/projgall/diazdelrio307/> (last access 15.05.2017).

Díaz-Guardamino Uribe et al. 2016: M. Díaz-Guardamino Uribe/D. W. Wheatley/E. F. Williams/J. Á. Garrido Cordero, Los textiles elaborados con cuentas perforadas de Montelirio. In: Á. Fernández Flores/L. García Sanjuán/M. Díaz-Zorita Bonilla (eds.), Montelirio. Un Gran Monumento Megalítico de la Edad del Cobre (Sevilla 2016) 345–364.

Domínguez Bella et al. 2001: S. Domínguez Bella/M. A. Álvarez/J. Ramos, Estudio analítico de las cuentas de collar de ámbar del Dolmen de Alberite (Villamartín, Cádiz). Naturaleza química y mineralógica e implicaciones sobre su origen. In: B. Gómez/M. A. Respaldiza/M. L. Pardo (eds.), III Congreso Nacional de Arqueometría (Sevilla 2001) 621–630.

Dominguez Bella/Bóveda Fernández 2011: S. Dominguez Bella/M. J. Bóveda Fernández, Variscita y ámbar en el Neolítico Gallego. Análisis arqueométrico del collar del túmulo I de Chousa Nova, Silleda (Galicia). Trabajos de Prehistoria 68.2, 2011, 369–380.

Earle et al. 2015: T. Earle/J. Ling/C. Uhnér/Z. Stos Gale/L. Melheim, The Political Economy and Metal Trade in Bronze Age Europe. Understanding Regional Variability in Terms of Comparative Advantages and Articulations. European Journal of Archaeology 18.4, 2015, 633–657.

Fernández Flores/Aycart Luengo 2013: A. Fernández Flores/V. Aycart Luengo, Montelirio. Un sepulcro clave para la comprensión del registro de los grandes monumentos megalíticos de Valencina de la Concepción-Castilleja de Guzmán (Sevilla). In: L. García Sanjuán/V. Hurtado Pérez/J. M. Vargas/T. Ruiz/R. Cruz Auñón (eds.), El asentamiento prehistórico de Valencina de la Concepción (Sevilla). Investigación y tutela en el 150 aniversario del Descubrimiento de La Pastora (Sevilla 2013) 233–261.

Fernández Flores et al. 2016: Á. Fernández Flores/L. García Sanjuán/M. Díaz-Zorita Bonilla (eds.), Montelirio. Un Gran Monumento Megalítico de la Edad del Cobre (Sevilla 2016).

Flad 2012: R. Flad, Bronze, Jade, Gold, and Ivory. Valuable Objects in Ancient Sichuan. In: J. K. Papadopoulos/G. Urton (eds.), The Construction of Value in The Ancient World (Los Angeles 2012) 306–335.

Gallart i Fernández 2006: J. R. Gallart i Fernàndez, Notícia sobreun nou dipòsit de la cova dels Muricecs de-Cellers (Llimiana, Pallars Jussà). Cota Zero 21, 2006, 10–13.

García Puchol et al. 2012: O. García Puchol/S. B McClure/J. Juan/J. Pascual/J. Gibaja, Objetos singulares/objetos foráneos. Evidencias de circulación de artesanías en el depósito funerario del Neolítico Final/Calcolítico de la Cova de La Pastora (Alcoi, Alacant). In: M. Borrell/F. Borrell/J. Bosch/X. Clop/M. Molist (eds.), Xarxes al Neolític. Circulació i intercanvi de matèries, productes i idees a la Mediterrània occidental (VII–III millenni aC). Actes del Congrés Internacional Xarxes al Neolític. Revista del Museu de Gavà. Rubricatum 5 (Barcelona 2012) 281–288.

Gauß 2013: R. Gauß, The Development of Metallurgy on the Iberian Peninsula. Technological and Social Patterns of a Long-term Innovation Process. In: S. Burmeister/S. Hansen/M. Kunst/N. Müller Scheeßel (eds.), Metal Matters. Innovative Technologies and Social Change in Prehistory and Antiquity (Rahden/Westf. 2013) 209–229.

Gilman 1993: Gilman, Cambio cultural y contacto en la Prehistoria de la Europa Mediterránea. Trabajos de Prehistoria 50, 1993, 103–111.

Graeber 2001: D. Graeber, Toward an Anthropological Theory of Value (London 2001).

Graeber 2013: D. Graeber, Culture as Creative Refusal. Cambridge Anthropology 31.2, 2013, 1–19.

Guerrero Ayuso 2010: V. M. Guerrero Ayuso, Barcos calcolíticos (c. 2500/2000 BC) del Mediterráneo occidental. Pyrenae 41.2, 2010, 29–48.

Gutiérrez Morillo 2003: A. Gutiérrez Morillo, Sustancias exóticas en la Prehistoria Reciente del sur de Cantabria. El ámbar de Los Lagos I (Campoo de Suso). In: CAEAP (ed.), Veinticinco Años de Investigaciones Sobre el Patrimonio Cultural de Cantabria (Santander 2003) 137–144.

Hanning et al. 2010: E. Hanning/R. Gauß/G. Goldenberg, Metal para Zambujal. Reconstrucción experimental de una tecnología de 5.000 años. Trabajos de Prehistoria 67.2, 2010, 287–304.

Hook et al. 1991: D. Hook/A. Arribas/P. T. Craddock/F. Molina/B. Rothenberg, Copper and Silver in Bronze Age Spain. In: W. H. Waldren/R. C. Keennard (eds.), Bell Beakers of the Western Mediterranean. British Archaeological Reports. International Series 331 (Oxford 1987) 147–172.

Hunt et al. 2009: M. Hunt/V. Hurtado Pérez/I. Montero-Ruiz/S. Rovira/J. F. Santos Zaldegui, Chalcolithic Metal Production and Provenance in the Site of San Blas (Cheles, Badajoz, Spain). In: AIM (ed.), Second International Conference Archaeometallurgy in Europe (Aquileia, 17–21 June 2007) (Milano 2007) 81–92.

Hunt et al. 2012: M. Hunt/M. I. Martínez Navarrete/V. Hurtado Pérez/I. Montero-Ruiz. Procedencia de las puntas de jabalina del "Dolmen de la Pastora" (Valencina de la Concepción, Sevilla). Trabajos de Prehistoria 69.2, 2012, 357–374.

Junghans et al. 1960: S. Junghans/E. Sangmeister/M. Schroder, Metallanalysen Kupferzeitlicher und frühbronzezeitlicher Bodenfunde aus Europe. Studien zu den Anfängen der Metallurgie 1 (Berlin 1960).

Junghans et al. 1968: S. Junghans/E. Sangmeister/M. Schroder, Kupfer und Bronze in der frühen Metallzeit Europas. Studien zu den Anfängen der Metallurgie 2 (Berlin 1968).

Lazarich et al. 2009: M. Lazarich/J. Valetín/V. Jenkins/P. Peralta/E. Briceño/A. Ramos/M. J. Richarte/A. M. Carreras/M. Núñez/M. Versaci/S. Stratton/M. Sánchez/J. M. Grillé, Paraje de Monte Bajo (Alcalá de los Gazules). Una nueva necrópolis de cuevas artificiales en el sur de la provincia de Cádiz. Almoraima 39, 2009, 67–83.

Leisner/Leisner 1943: G. Leisner/V. Leisner, Die Megalitgräber der Iberischen Halbinsel. Der Süden. Römisch-Germanische Forschungen 17 (Berlín 1943).

Ling/Stos Gale 2015: J. Ling/Z. Stos Gale, Representations of Oxhide Ingots in Scandinavian Rock Art. The Sketchbook of a Bronze Age Traveller? Antiquity 89, 2015, 191–209.

Lorrio/Montero-Ruiz 2004: A. Lorrio/I. Montero-Ruiz, Reutilización de sepulcros colectivos en el Sureste de la Península Ibérica. La colección Siret. Trabajos de Prehistoria 61.1, 2004, 99–116.

Montero-Ruiz 1993: I. Montero-Ruiz, Bronze Age Metallurgy in Southeast Spain. Antiquity 67.254, 1993, 46–57.

Montero-Ruiz 1994: I. Montero, El origen de la metalurgia en el Sudeste de la Península Ibérica (Almería 1994).

Montero-Ruiz 1998: I. Montero-Ruiz, Aprovechamiento de recursos minerales y comercialización de objetos metálicos. Una perspectiva analítica. In: G. Delibes de Castro (ed.), Minerales y Metales en la Prehistoria Reciente. Algunos Testimonios de su Explotación y Laboreo en la Península Ibérica. Studia Archaeologica 88 (Valladolid 1998) 199–226.

Montero-Ruiz 2002: I. Montero-Ruiz, Metal y circulación de bienes en la Prehistoria Reciente. Cypsela 14, 2002, 55–68.

Montero-Ruiz 2017: I. Montero-Ruiz, La Solana del Bepo from an Archaeometallurgical Perspective. In: N. Rafel/I. Soriano/S. Delgado Raack (eds.), A Prehistoric Copper Mine in the North-East of the Iberian Peninsula. Solana del Bepo (Uldemolins, Tarragona). Revista de Arqueologia de Ponet. Extra 2, 2017, 65–79.

Montero-Ruiz/Murillo-Barroso 2010: I. Montero-Ruiz/M. Murillo-Barroso, La producción metalúrgica en las sociedades argáricas y sus implicaciones sociales. Una propuesta de investigación. Menga. Revista de prehistoria de Andalucía 1, 2010, 37–51.

Montero-Ruiz/Murillo-Barroso 2014: I. Montero-Ruiz/M. Murillo-Barroso, Difusión o innovación tecnológica. Los inicios de la metalurgia en la Península Ibérica. In: E. García (ed.), Movilidad, Contacto y Cambio. Actas del II Congreso de Prehistoria de Andalucía (Sevilla 2014) 65–75.

Montero-Ruiz et al. 2015: I. Montero-Ruiz/J. Gallart/O. García Vuelta/M. I. Martínez Navarrete, Homogénéité ou hétérogénéité dans le métal des dépôts de l'Âge du Bronze. Estimations sur leur formation à partir des isotopes du plomb. L'anthropologie 119, 2015, 89–105.

Mujika/Armendariz 1991: J. A. Mujika/A. Armendariz, Excavaciones en la estación megalítica de Murumendi (Beasain). Munibe 43, 1991, 105–165.

Müller et al. 2007: R. Müller/G. Goldenberg/M. Bartelheim/M. Kunst/E. Pernicka, Zambujal and the Beginnings of Metallurgy in Southern Portugal. In: S. La Niece/D. Hook/P. Craddock (eds.), Metals and Mines. Studies in Archaeometallurgy (London 2007) 15–26.

Murillo-Barroso 2016: M. Murillo-Barroso, El ámbar del tholos de Montelirio. In: Á. Fernández Flores/L. García Sanjuán/M. Díaz-Zorita Bonilla (eds.), Montelirio. Un Gran Monumento Megalítico de la Edad del Cobre (Sevilla 2016) 311–344.

Murillo-Barroso/Martinón-Torres 2012: M. Murillo-Barroso/M. Martinón-Torres, Amber Sources and Trade in the Prehistory of the Iberian Peninsula. European Journal of Archaeology 15.2, 2012, 187–216.

Murillo-Barroso/Montero-Ruiz 2012: M. Murillo-Barroso/I. Montero-Ruiz, Copper Ornaments in the Iberian Chalcolithic. Technology Versus Social Demand. Journal of Mediterranean Archaeology 25.1, 2012, 53–73.

Murillo-Barroso/García Sanjuán 2013: M. Murillo-Barroso/L. García Sanjuán, El pomo de ámbar de la Estructura 10.042-10.049 del Sector PP4-Montelirio del asentamiento de Valencina de la Concepción (Sevilla). In: L. García Sanjuán/V. Hurtado Pérez/J. M. Vargas/T. Ruiz/R. Cruz (eds.), El asentamiento prehistórico de Valencina de la Concepción (Sevilla). Investigación y tutela en el 150 aniversario del Descubrimiento de La Pastora (Sevilla 2013) 511–520.

Murillo-Barroso et al. 2015a: M. Murillo-Barroso/M. E. Costa/M. Díaz-Guardamino/L. García Sanjuán/C. Mora, A Reappraisal of Iberian Copper Age Goldwork. Craftmanship, Symbolism and Art in a Non-Funerary Gold Sheet from Valencina de la Concepción. Cambridge Archaeological Journal 25.3, 2015, 565–596.

Murillo-Barroso et al. 2015b: M. Murillo-Barroso/I. Montero/G. Aranda, An Insight into the Organisation of Metal Production in the Argaric Society. Journal of Archaeological Science Reports 2, 2015, 141–155.

Murillo-Barroso et al. 2016: M. Murillo-Barroso/I. Montero-Ruiz/N. Rafel/M. Hunt/X. L. Armada, Macro-Regional Scale of Silver Production in Iberia during the 1st Millennium BC in the Context of Mediterranean Contacts. Oxford Journal of Archaeology 35.1, 2016, 75–100.

Murillo-Barroso et al. 2017: M. Murillo-Barroso/M. Martinón-Torres/M. D. Camalich Massieu/D. Martín Socas/F. Molina Gonzalez, Early Metallurgy in SE Iberia. The Workshop of Las Pilas (Mojácar, Almería, Spain). Archaeological and Anthropological Sciences. DOI: 10.1007/s12520-016-0451-8

Murillo-Barroso et al. forthcoming: M. Murillo-Barroso/G. Aranda/I. Montero-Ruiz, What Role did Really Bronze Play in the Argaric Society? In: T. Rehren/X. Tianjin/C. Jianli/L. Nickel/P. Rui (eds.), Making Metals and Moulding Society. A Global Perspective on the Emergence of Bronze Age Social Complexity (Oxford forthcoming).

Nocete et al. 2013: F. Nocete/J. M. Vargas/T. X. Schuhmacher/A. Banerjee/W. Dindorf, The Ivory Workshop of Valencina de la Concepción (Seville, Spain) and the Identification of Ivory from Asian Elephant on the Iberian Peninsula in the First Half of the 3rd Millennium BC. Journal of Archaeological Science 40.3, 2013, 1579–1592.

Nocete et al. 2008: F. Nocete/G. Queipo/R. Sáez/J. M. Nieto/N. Inácio/M. R. Bayona/A. Peramo/J. M. Vargas/R. Cruz Auñón/J. I. Gil Ibarguchi/J. F. Santos, The Smelting Quarter of Valencina de la Concepción (Seville, Spain). The Specialised Copper Industry in a Political Centre of the Guadalquivir Valley during the Third Millennium BC (2750–2500 BC). Journal of Archaeological Science 35.3, 2008, 717–732.

Peñalver et al. 2007: E. Peñalver/E. Álvarez Fernández/P. Arias/X. Declòs/R. Ontañón, Local Amber in a Paleolithic Context in Cantabrian Spain. The Case of La Garma A. Journal of Archaeological Science 34.6, 2007, 843–849.

Perea 2005: A. Perea, Mecanismos identitarios y de construcción de poder n la transición Bronce-Hierro. Trabajos de Prehistoria 62.2, 2005, 91–103.

Renfrew 1986: C. Renfrew, Varna and the Emergence of Wealth in Prehistoric Europe. In: A. Appadurai (ed.), The Social Life of Things. Commodities in Cultural Perspective (Cambridge 1986) 141–168.

Renfrew 2012: C. Renfrew, Systems of Value among Material Things. The Nexus of Fungibility and Measure. In: J. K. Papadopoulos/G. Urton (eds.), The Construction of Value in The Ancient World. Cotsen Institute of Archaeology 5 (Los Angeles 2012) 249–460.

Rogerio Candelera et al. 2013: M. A. Rogerio Candelera/L. K. Herrera/A. Z. Miller/L. García Sanjuán/C. Mora/D. Wheatley/A. Justo/C. Saiz Jimenez, Red Pigments Used in Burial Practices at the Copper Age Site of Valencina de la Concepción (Seville, Spain). Characterisation and Social Dimension. Journal of Archaeological Science 40.1, 2013, 279–290.

Rovira 2002: S. Rovira, Early Slags and Smelting By-Products of Copper Metallurgy in Spain. In: M. Bartelheim/E. Pernicka/R. Krause (eds.), The Beginnings of Metallurgy in the Old World I (Rahden/Westf. 2002) 83–98.

Rovira/Montero-Ruiz 2011: S. Rovira/I. Montero-Ruiz, Aspectos Metalúrgicos. In: G. Pérez Jordá/J. Bernabeu/Y. Carrión/O. García/L. Molina/M. Gómez (eds.), La Vital (Gandia, Valencia). Vida y muerte en la desembocadura del Serpis durante el II y el I milenio a.C. (Valencia 2011) 219–227.

Rovira/Montero-Ruiz 2013: S. Rovira/I. Montero-Ruiz, Iberia. Technological Development of Prehistoric Metallurgy. In: S. Burmeister/S. Hansen/M. Kunst/N. Müller Scheeßel (eds.), Metal Matters. Innovative Technologies and Social Change in Prehistory and Antiquity (Rahden/Westf. 2013) 231–239.

Rovira et al. 1997: S. Rovira/I. Montero-Ruiz/S. Consuegra, Las primeras etapas metalúrgicas en la Península Ibérica (Madrid 1997).

Rovira i Port 1994: J. Rovira i Port, Ámbar y pasta vítrea. Elementos de prestigio entre el neolítico avanzado y el Bronce Final del Nordeste de la Península Ibérica. Un primer estado de la cuestión. Quadernos de Prehistoria Castellana 16, 1994, 67–91.

Rowland/Ling 2010: M. Rowland/J. Ling, Boundaries, Flows and Connectivities. Mobility and Stasis in the Bronze Age. In: S. Bergerbrant/S. Sabatini (eds.), Counterpoint. Essays in Archaeology and Heritage Studies in Honour of Professor Kristian Kristiansen (Oxford 2013) 517–529.

Ruiz Taboada/Montero-Ruiz 2000: A. Ruiz Taboada/I. Montero-Ruiz, The Pattern of Use of Stone and Copper in Central Spain during the Bronze Age. European Journal of Archaeology 3.3, 2000, 350–369.

Sáez et al. 2004: R. Saez/F. Nocete/D. Camalich, La captación de materias primas para la metalurgia en Cabezo Jure. In: F. Nocete (ed.) Proyecto de Investigación Arqueológica para el análisis de la desigualdad social en el Suroeste de la Península Ibérica (Sevilla 2004) 265–272.

Simón 1998: J. L. Simón, La metalurgia prehistórica valenciana (Valencia 1998).

Skeates 2010: R Skeates, The Art of Memory. Personal Ornaments in Copper Age Southeast Italy. In: K. Lillios/V. Tsamis (eds.), Everyday Memory in Prehistoric Europe (Oxford 2010) 73–84.

Soler Díaz 2002: J. Soler Díaz, Cuevas de inhumación múltiple en la Comunidad Valenciana (Madrid/Alicante 2002).

Stos Gale et al. 1999: Z. Stos Gale/M. Hunt/N. Gale, Análisis elemental y de isótopos de plomo de objetos metálicos de los sondeos de Gatas. In: P. Castro/R. Chapman/S. Gili/V. Lull/R. Micó/C. Rihuete/R. Risch/M. E. Sanahuja (eds.), Proyecto Gatas 2. La dinámica arqueoecológica de la ocupación prehistórica (Sevilla 1999) 347–361.

Vilaça et al. 2002: R. Vilaça/C. W. Beck/E. C. Stout, Provenience Analysis of Prehistoric Amber Artifacts in Portugal. Madrider Mitteilungen 43, 2002, 61–79.

Zapatero 1989: P. Zapatero, La Velilla, un enterramiento de tradición dolménica en el valle del Valdavia. Publicaciones de la Institución Tello Téllez de Meneses 60, 1989, 7–13.

THOMAS X. SCHUHMACHER

Ivory Exchange Networks in the Chalcolithic of the Western Mediterranean

To the memory of Rui Boaventura, who would have read it.

The world is changed because you are made of ivory and gold (Oscar Wilde, The Picture of Dorian Gray, 1890).

Keywords: ivory, exchange, scientific analysis, Iberian Peninsula, Maghreb, Chalcolithic, peer-polity interaction

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Abstract

By two comprehensive research projects, financed by the German Research Foundation (Deutsche Forschungsgemeinschaft, DFG, Bonn) and located at the German Archaeological Institute (Madrid) we attempted to compile a new catalogue – as complete as possible – of all ivory objects from the Iberian Peninsula and north-western Africa dated from the beginning of the Chalcolithic at about 3000 BC until the end of the Early Bronze Age about 1650 BC. During these works, we recognised approximately 2000 ivory objects and analysed 150 objects by scientific methods, including measurement of the Schreger angle by optical microscopy, Fourier Transformed Infrared (FTIR)-Spectroscopy, elemental analysis and Isotopic Ratio Mass Spectrometry. The detailed study of the pieces and their contexts as well as the scientific analysis could give new dates on the chronological and geographical distribution, their social importance and the origin and exchange of the raw material. In this way, we recognised the existence of two different exchange networks during the Chalcolithic, by which on one hand Asian ivory reached the Southeast of the Iberian Peninsula and the Guadalquivir estuary and on the other hand African ivory from the Maghreb came to south-western Spain and Portugal. In the Pre-Beaker as well as in the Bell Beaker Chalcolithic local elites maintained this exchange network in order to obtain exotic objects by a sort of peer-polity interaction to express their prestige and power.

Introduction

Being exotic to the Iberian Peninsula, ivory was of special interest from the beginning of archaeological investigation, because it was supposed to give clear hints with respect to prehistoric overseas contacts and exchange. As early as the late 19th cent., S. P. M. Estácio da Veiga exposed the idea that finished ivory objects as well as the raw material were imported from northern Africa (Veiga 1886–1891, vol. 1, 268–270; vol. 2, 212). L. Siret (1913, 33) already differentiated between pieces made of elephant and others from hippopotamus ivory and thought about both groups being imported from Egypt as finished objects. J. C. Serra Ráfols (1925, 87) pointed out that, on the contrary, there was really no evidence for an Egyptian origin, and that we should consider Northwest Africa to be the source. At the same time A. Götze (1925, 87) argued that local fossilised ivory was too fragile and brittle to have been used. Finally, A. Jodin (1957) and G. Camps (1960) related the finds of ivory on the Iberian Peninsula to the appearance of Bell Beakers in Northwest Africa. Since then a Northwest African origin has been widely accepted (Harrison/Gilman 1977; Spindler 1981. See Poyato/Hernando 1988 for an opposing view). Subsequently, there were specific studies of the relations between the Iberian Peninsula and Northwest Africa during the Bell Beaker period. But in fact this was only an assumption based on the geographic proximity, while scientific analysis had never been made to confirm this.

In their monumental work on the megalithic tombs of the Iberian Peninsula, the Leisners (Leisner/Leisner 1943) included a list of ivory objects from the southern part of the peninsula. Later, A. Gilman and R. Harrison (1977) produced an updated inventory list for ivory objects known from bibliographic sources. After that, only a few regional works have been published, those of K. Spindler (1981) for Portugal and of J. L. Pascual Benito (1995) for the País Valenciano.

Therefore, in two comprehensive research projects, financed by the German Research Foundation (Deutsche Forschungsgemeinschaft, DFG, Bonn) and located at the German Archaeological Institute (Madrid) we attempted to compile a new catalogue – as complete as possible – of all ivory objects from the Iberian Peninsula and Northwest Africa dated from the beginning of the Chalcolithic at about 3000 BC until the end of the Early Bronze Age about 1650 BC (Schuhmacher 2012a; 2016).[1] Our preliminary work has revealed that the aggregate number of prehistoric ivory objects known, and thus the scale of ivory exchange, is much greater, than previously thought. In fact, we have recognised approximately 2000 ivory objects. The detailed study of the pieces and their contexts as well as the scientific analysis could give new dates on the chronologic and geographic distribution, their social importance and the origin and exchange of the raw material.

The Beginning of the Use of Ivory

We can affirm that the utilisation of ivory on the Iberian Peninsula began in the second half of the 4th mill. BC (Schuhmacher 2013; 2016). We know at least several very thin bracelets in hypogea 1 and one comb of ivory coming out of hypogea 5 in Sobreira de Cima (Alentejo, Portugal) (Valera et al. 2008).[2] Three of the published radiocarbon dates place the burials in these rock-cut tombs in the period of 3357–3099 calBC.[3] One date, albeit slightly earlier, might be compatible with this range. Another one, the only one from tomb 5, dates already into the first half of the 3rd mill. BC. Six OSL-dates situate the tombs 1 and 2 also into the second half of the 4th mill. BC.[4]

Here we have to remind two AMS-dates from ivory pins from a rock-cut tomb in Praia das Maçãs (Sintra, Portugal), which delivered a similar result with 3312–2916 calBC.[5] It is therefore clear that the use of ivory appears quite suddenly at the

1 DFG-Project: SCHU 1539/2-1.2 and SCHU 1539/3-1 under the direction of the author and Dr. A. Banerjee (University of Mainz). The research group was integrated by W. Dindorf (†), Dr. F. Enzmann (both University of Mainz), Prof. Dr. Th. Reischmann (Mainz), Dr. Ch. Sastri (Proteosys AG Mainz) and Dr. A. Mikdad (INSAP, Rabat).

2 Excavation by ERA Arqueologia S. A., Lisbon.

3 All radiocarbon dates are made on human bones: Beta-231071 (AMS): 4670 ± 50 BP = 3517–3371 calBC (tomb 3); Sac-2260: 4530 ± 50 BP = 3357–3111 calBC (tomb 1); Sac-2261: 4500 ± 70 BP = 3344–3099 calBC (tomb 1); Sac-2256: 4520 ± 35 BP = 3350–3114 calBC (tomb 4); Beta-232637 (AMS): 4080 ± 40 = 2839–2500 calBP (tomb 5) (Valera et al. 2008). All dates in this text are calibrated by OxCal 4.1 and are given with a probability of 68,2% (1 sigma) (Bronk Ramsey 2009).

4 SBC-3: 5231,4 ± 369,6 BP for tomb 1 and 4897 ± 259,8 BP for tomb 2 (Dias et al. 2008).

5 OxA-5509 (AMS): 4410 ± 75 BP = 3312–2916 calBC and OxA-5510 (AMS): 4395 ± 60 BP = 3096–2916 calBC (Soares 2003, table 5).

end of the 4th mill. BC in a burial context of a Late Neolithic or Early Chalcolithic.

The question is, why does ivory use begin at this moment, whereas for the whole Neolithic of the Iberian Peninsula, until now, we could not find any ivory objects? Is this related to the supposed start of complexity at the beginning of the Chalcolithic? Are the exchange networks expanding because of the need for prestige objects of an elite in formation? Or do we have to look for external, extra-peninsular, causes?

The analysis of five fragments of bracelets and the comb from Sobreira de Cima reveal that we are talking about ivory from the African Savannah elephant (*Loxodonta africana africana)* (Schuhmacher 2013; 2016). If we look at Northwest Africa we can see, that there a first use of ivory begins at about 4000 BC, related to an increasing importance of Saharan elements, like ceramics with comb impressions or ceramics type Rouazi-El Kiffen and Ashakar (Daugas 2002, 151–153; Daugas/El Idrissi 2008, 67 f.; Banerjee et al. 2011a; Linstädter 2016; Schuhmacher 2016). This is probably caused by a migration of human groups from the Central Sahara to the Atlantic and Mediterranean coasts of North Africa due to the drying of the Sahara at the end of the 'African Humid Period' (Nehren 1992, 204 f.; Escacena 2000; Daugas 2002, 151–153; Linstädter 2016). At the same time, it seems possible as well that elephants of the species *Loxodonta africana africana* migrated north.[6] This would have brought elephants and human groups, who used ivory, for the first time in sight and reach of the societies of the Southern Iberian Peninsula. It would therefore be a possible explication for the sudden beginning of ivory use on the Iberian Peninsula at the end of the 4th mill. BC.

But it seems difficult to relate the highly sophisticated and very varied ivory industry of the Iberian Peninsula dated to the beginning of the 3rd mill. BC to the much more 'primitive', because it was much more restricted in forms and technique, of the Maghreb, so that this northward movement of people in Northern Africa might not be the only cause (Schuhmacher 2012a; 2016; Schuhmacher/Banerjee 2012). Furthermore, our scientific investigations indicate that, besides African ivory, around the Guadalquivir estuary and in the Southeast ivory from the Asian elephant was also in use as early as the beginning of the 3rd mill. BC, although the dates we have at the moment, are slightly later than the ones from Sobreira de Cima and Praia das Maçãs.[7] The nearest source for that kind of ivory in the 3rd mill. BC was the Near East. Therefore, it seems possible that not only Asian ivory but also the know-how of the production of ivory objects goes back to the Orient, principally the zone of Syria (Nocete et al. 2013). So the beginning of ivory working on the Iberian Peninsula could be due to external factors, innate to the Eastern Mediterranean.

The Distribution of Ivory Objects

For the first half of the 3rd mill. BC we could register 374 ivory objects with a total weight of nearly 3kg (*fig. 1*) on the Iberian Peninsula (Schuhmacher 2012a, 300–345 Table 4; Valera et al. 2015). Amongst the ivory objects from this period idols of different types, cylindrical boxes, beads, combs, pins and collars and occasionally also buttons, bracelets and plaques are predominant. The major part of these objects, 62% in Spain and 51% in Portugal, came from collective burials. If we look at the geographical distribution, we find several centres, the peninsula of Lisbon and the Spanish Southeast, the Portuguese Alentejo together with the Spanish Middle Guadiana valley and the Guadalquivir valley. We can observe a clear connection between the distribution of the ivory objects and the coast and the river system.

During the second half of the 3rd mill. BC, in accordance with the diffusion of the Bell Beaker phenomenon, the distribution of ivory objects changes in respect to the Early Chalcolithic. Now

6 On the methods used for the source analysis of ivory and our identification of North African elephant as belonging to the species *Loxodonta africana africana* (African Savannah elephant) see Banerjee et al. 2011a; Schuhmacher 2016.

7 In this case the analysed ivory was coincident with ivory from the modern Asian elephant (*Elephas maximus*) and different from that of modern African elephants (*Loxodonta africana africana* and *Loxodonta africana cyclotis*) and did also not coincide with that of extinct elephants (*Mammuthus primigenius* or *Elephas antiquus*). It was also different from our analysis on ivory from prehistoric samples of North African elephant from Morocco. On the methods used for the source analysis of ivory see Nocete et al. 2013; Schuhmacher 2016.

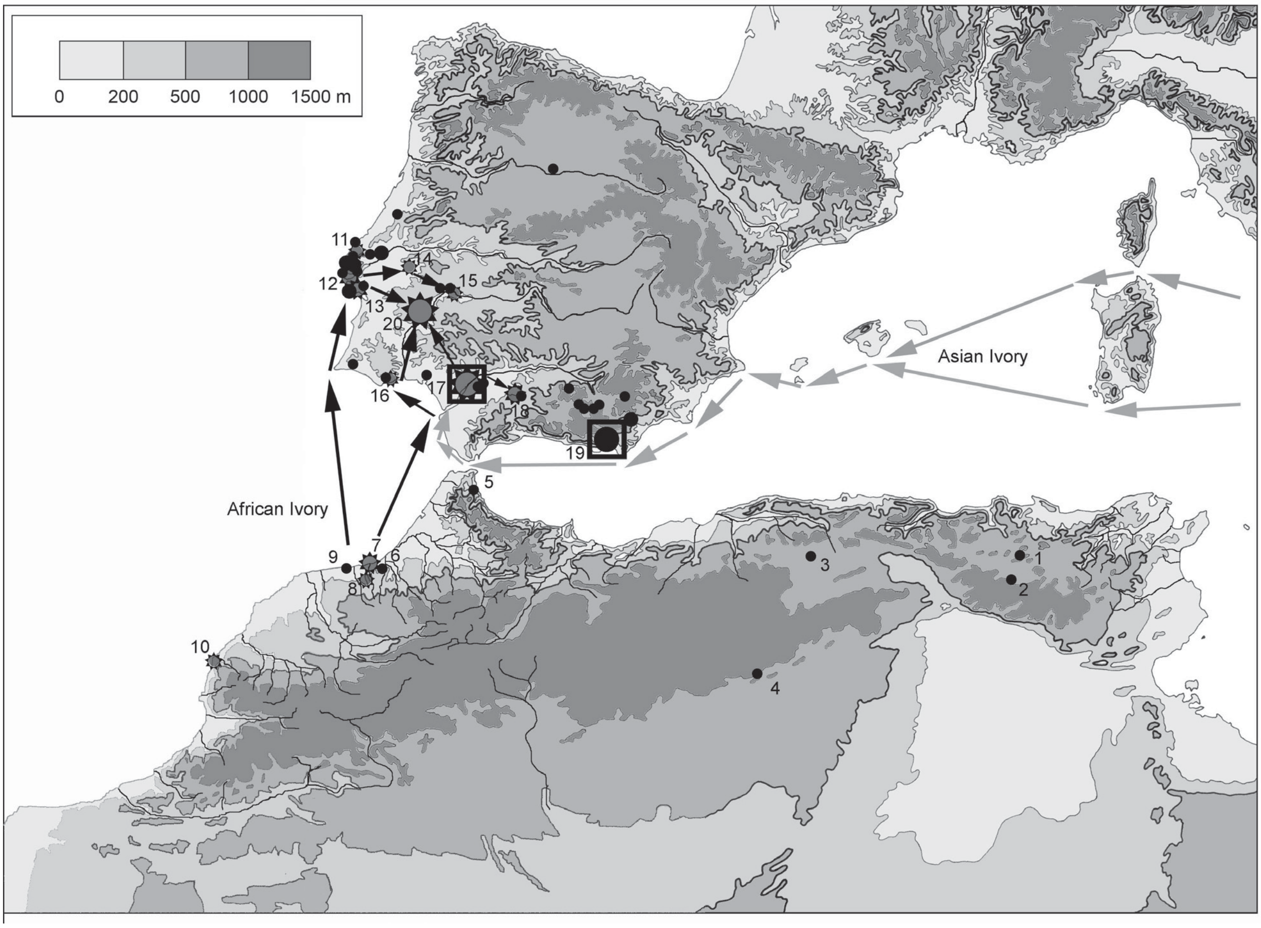

Fig. 1. Distribution by number of the elephant tusks and ivory objects (●) during the Older Chalcolithic (aprox. end of the 4. mill. BC until 2500 BC) on the Iberian Peninsula in comparison with the situation of the Late and Final Neolitic (approx. 4500–2500 BC) in northwestern Africa. The results of the scientific analyses – *Elephas maximus* (□) and *Loxodonta a. africana* (☼) – and the routes of ivory exchange are represented. 1 Bou Zabaouine; 2 Khanguet Si Mohammed Tahar (Grotte Capélleti); 3 Columnata; 4 Brézina (R'ar Msakna); 5 Kahf Taht el Ghar; 6 Dar es-Soltan; 7 Rouazi-Skhirat; 8 Kehf-el-Baroud; 9 El Kiffen; 10 Cap Sim; 11 Zambujal und Cova da Moura; 12 Leceia; 13 Palmela; 14 Capela; 15 La Pijotilla; 16 Nora; 17 Valencina de la Concepción; 18 Cueva Antoniana; 19 Los Millares; 20 Perdigões. • 1–5 objects; ● 6–10 objects; ⬤ more than 10 objects.

apart from Portugal, the Spanish Southwest and Southeast, which are still the areas with the most numerous occurrence, we assist to an expansion to the Spanish Levant, centre and even the north of the Peninsula (*fig. 2*). We can date 545 ivory objects to this period of time. An increase in the total number and a loss in weight of the ivory objects (2350g) in respect to the Early Chalcolithic is observed. Now we mainly find small buttons with a V-perforation (29%), followed by beads and pendants, raw material and half-finished objects, but also anthropomorphic idols with folded arms (Schuhmacher 2004; Blanco 1962, fig. 1, pl. 1. 2. 5; Fernández Gómez/Oliva 1980; Arribas 1977; Moreno 1994, 382 no. 46), for example in Marroquíes Altos, Torre del Campo (both in Jaén), La Pijotilla (Badajoz), probably El Malagón (Granada) and recently dozens of these idols made of ivory in the settlement of Perdigões (Valera et al. 2015). Also in this period, a 63% of the ivory objects came out of collective burials, but at the end of this period the individual interments of the first Early Bronze Age cultures appear.

The Social Role of Ivory

The social importance of ivory during the Early Chalcolithic can be demonstrated by the necropolis of Los Millares (Santa Fe de Mondújar, Almería) (Almagro/Arribas 1963; Chapman 1981; Molina/Cámara 2005, 57–62; Schuhmacher 2011; 2012a,

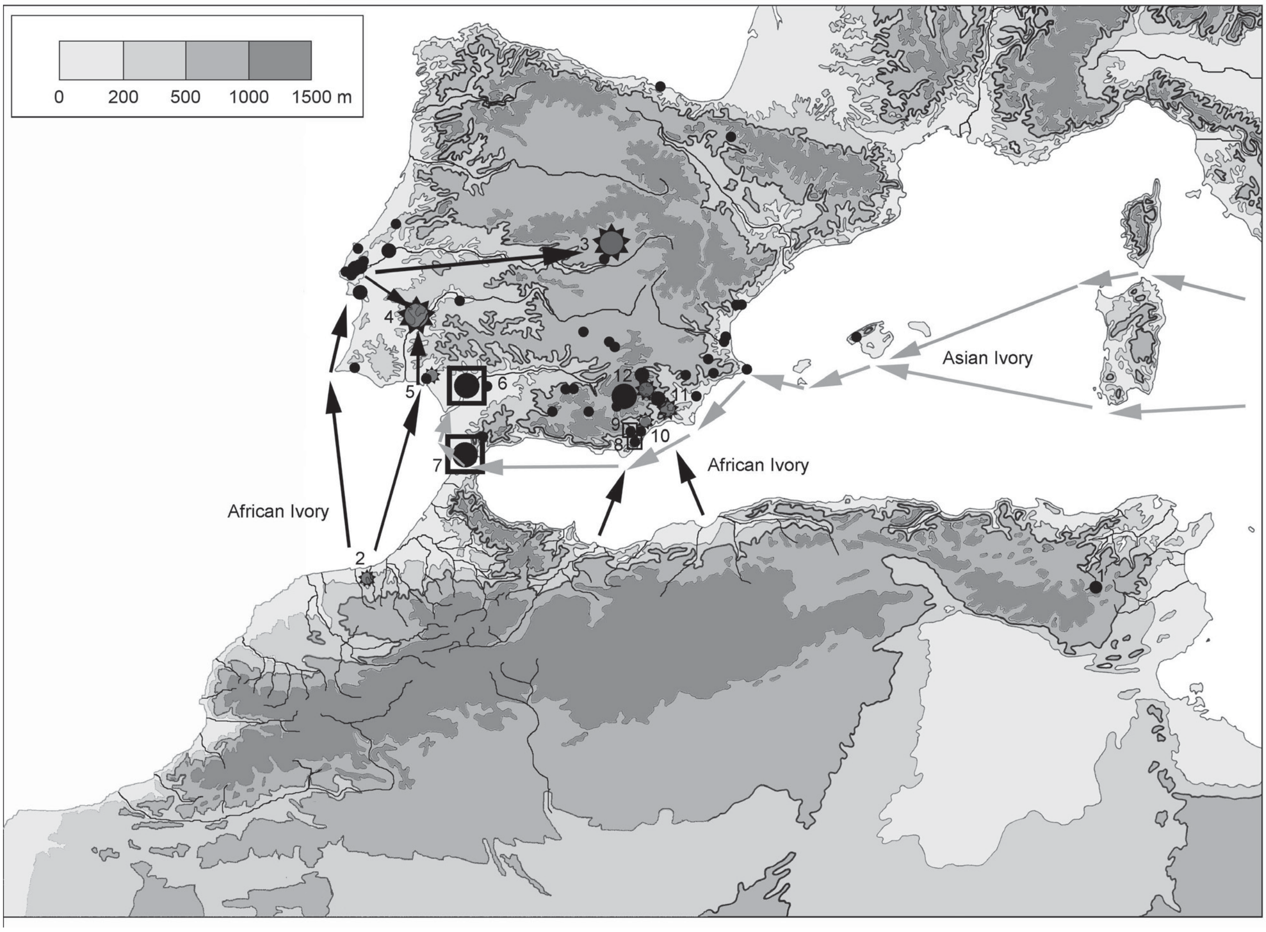

Fig. 2. Younger Chalcolithic/Older Early Bronze Age. Distribution of ivory objects on the Iberian Peninsula and in the Maghreb (●) by number. The results of the scientific analyses – *Elephas maximus* (□) and *Loxodonta a. africana* (☼) – and the routes of ivory exchange are represented. 1 Damous-el-Ahmar; 2 Kehf el Baroud; Camino de Yeseras; 4 Perdigões; 5 La Orden-Seminario de Huelva, 6 Valencina de la Concepción; 7 Los Algarbes; 8 Gatas; 9 El Argar; 10 Fuente Álamo; 11 La Bastida de Totana; 12 Molinos de Papel. • 1–5 objects; ● 6–10 objects; ● more than 10 objects.

383–386, Abb. 124; 2012b; Afonso et al. 2011). Here the 85 burial monuments extend over a surface of 13ha in front of the outer fortification wall of this settlement. The monuments are for the biggest part tombs with false domes (*tholoi*). These tombs, excavated in their majority by L. Siret, delivered 48 ivory objects, distributed among nine tombs. R. Chapman could demonstrate that only part of the population was buried in these tombs. Although they do not differentiate much in the effort inverted in their construction, they do in the richness of their offerings. Chapman differentiated a group of eight tombs (5, 7, 8, 9, 12, 16, 40 and 63) called ‘prestige tombs’, clearly highlighted by the quantity and diversity of their grave goods. Among them are all the tombs with ivory (tombs 5, 7, 8, 12, 40), except tomb 71, which we can situate on the plan of the necropolis. Later studies led to similar conclusions (Molina/Cámara 2005, 57–62; Afonso et al. 2011). Following Afonso et al., the tombs 7 and 40 belong to the richest group A, tombs 5 and 12 to group B and tomb 8 to group C. Although A. Mederos (1993/94, 217–220) criticised the classification of Chapman, he came to the conclusion that only the exotic grave objects like ivory and ostrich eggs are suited for a social differentiation of the tombs. In his view, the tombs 8, 12, 40 and 63 are the most important ones, corresponding to the founding lineages of Los Millares during the Final Neolithic/Early Chalcolithic, and tombs 5 and 7 to non-founding lineages, which gained importance during the Middle Chalcolithic.

Of special interest is tomb 40, one of the tombs with the richest grave offerings of the necropolis of Los Millares (Leisner/Leisner 1943, 21–24, Taf. 9/10). It does not only contain the highest number of ivory objects, among them cylindrical idols and boxes and combs, but also numerous metal objects and flint arrowheads. And we do find exceptional grave goods like containers and idols of stone, painted and symbolic pottery.

We have to be conscientious that we are talking about collective burials. Probably a kinship group was buried together in one tomb (Chapman 1981, 408; Cruz Auñon et al. 2010, 54 f.; Afonso et al. 2011, 299). Thus, the differences in number and quality of grave goods, besides other differences between tombs, e.g. size, architectural complexity, primarily refer to differences in social rank or prestige between groups of persons (Valera et al. 2015). But this does not necessarily exclude the existence of outstanding individuals with a high prestige among these groups, reflected in the offerings belonging to one specific burial, although many times camouflaged under a supposed collectivity. In Los Millares the documentation available in most cases does not allow to individualise inhumations and their grave goods, but in other monuments this seems to be possible to a certain degree, e.g. Praia das Maçãs (Portugal) (Leisner et al. 1969).

In regard to Valencina de la Concepción, only recently a compilation of the information available has been started. This will enable us to do a similar study in the future (Cruz Auñon et al. 2010; Cruz-Auñón Briones/Mejías 2013). But we can already say that there are some specific tombs, extremely rich in their offerings and outstanding in their monumentality. Structure 10042-10049 from PP4-Montelirio is a megalithic funerary construction with two chambers (García Sanjuán et al. 2013; Luciañez Triviño et al. 2013). There is an access corridor with a maximum length of 12m and maximum width of 0.7m, bounded by slate slabs. This leads into the first chamber with a maximum diameter of 2.57m, which was partially destroyed by work carried out in 1998 in this sector of the site. The remains of four persons were identified between the access corridor and the first chamber. From the first chamber a second corridor connects it with the second chamber. This second chamber, which is better preserved than the first, has a maximum diameter of 2.16m and is enclosed by 23 slabs. Two stratigraphic layers could be identified in the second chamber, which contains only the inhumation of a male of 20–25 years. In total, with over 50 objects found in the first chamber and access corridor and about 100 in the second chamber (more than 30 items in the lower level and over 70 in the upper), structure 10042-10049 yielded some 150 objects. In some cases made from non-local raw materials (such as amber, cinnabar and ivory, and also an ostrich egg) which, together with the architecture of the grave and its position in respect to the others, suggests that the persons buried there enjoyed high social status. The 22 ivory objects identified from this grave represent 56.4% of the total recovered from sector PP4-Montelirio (39 pieces), although this count will probably increase as their study progresses. Albeit it is not the Chalcolithic funerary structure containing the most ivory objects found in Iberia, structure 10042-10049 certainly held the largest quantity in gross weight (*table 1*). Among the 39 ivory artefacts identified in the PP4-Montelirio sector are bracelets, hairpins, various types of containers, two elephant tusks (one unworked and the other with carved decoration), plaques, the hilt of a dagger and part of what may be its sheath, a pair of combs or ornamental combs, and remains of other, unidentified objects.

It seems clear that we find extraordinary objects of ivory in the Dolmen de Montelirio as well as in tomb 10049 and that in both cases the majority of the grave goods belong to one or only a few individuals. Therefore, it might be possible to identify a first notion of individuality, a change from a segmented society to one with an emerging elite with high prestige and power (García Sanjuán 2006, 157; Cruz-Auñón Briones/Mejías 2013, 196 f.). Nevertheless, it will be necessary to study more intensively these and other tombs to understand the grade of hierarchization and complexity of these societies. Clearly these personalities are the beneficiaries of the exchange of ivory and other exotic goods, used to express their prestige and power, no matter whether we have to call them ‘big men’ or ‘chiefs’ (compare Strahm 2002). But are these personalities also the ones who organised the middle and long-range exchange of prestige goods? Are they the merchants of ivory themselves?

There is another fact that might help to clarify this question. In tomb 10049 of Valencina an

Sites	Context	Area Settlement	Ivory objects	
			number	weight (g)
Zambujal	Settlement		2	3
	Cabeço da Arruda tomb 1		1	2
	Cova da Moura		1	1
	Total	**> 2,5 ha**	**4**	**6**
Vila Nova de São Pedro		aprox. 1,5 ha	8	min. 8
Leceia		aprox. 1,5 ha	10	16
Praia das Maçãs	Tomb		8	min. 132,8
Palmela	Tomb 2		1	1
	Tomb 3		1	12
	Total		**2**	**13**
Alcalar		20 ha	1	17
Perdigões	Tomb 1		62*	142,9*
	Tomb 2		203*	546*
	Total	**16 ha**	**265***	**688,9***
La Pijotilla		80 ha	3	>63
Valencina de la Concepción	Pit 402		36*	69,6*
	Señorío de Guzmán tomb 2		1	29,3
	Señorío de Guzmán tomb 3		1	
	Montelirio tomb		min. 2	
	Tomb 10.042-10.049		min. 25	min. 1198
	Total	**max. 230 ha**	**min. 65**	**min. 1296,9**
Gilena	Cueva Antoniana tomb 1		9	12,7
	Juan Corrales tomb 1		1	
	Total		**10**	**min. 12,7**
Los Millares	Tomb 5		3	24
	Tomb 7		5	34,5
	Tomb 8		3	
	Tomb 12		11	min. 105
	Tomb 20		1	
	Tomb 31		1	
	Tomb 40		22	min. 97,9
	Tomb 59		1	
	Tomb 71		1	
	Total	**6 ha**	**48**	**min. 261,4**

* includes fragments

Tab. 1. Number and weight of ivory objects in different settlements and tombs of the Older Chalcolithic period.

elephant tusk appeared, complete but cut transversally into three pieces (*fig. 3*). Afterwards the three pieces were deposited together, as if the tusk were still intact. Was this tusk thought to be transformed into objects for the dead buried in this tomb? But did this man die before the objects were finished, so that instead the unworked tusk was included among the grave-goods? Or, on the contrary, are the tusk and the ostrich egg an expression of the control over the exchange of exotic goods, which

Fig. 3. Valencina de la Concepción (Seville). Elephant tusk from tomb 10.042-10.049.

this person carried out, and therefore the tusk was taken out of circulation? Or do we see here the tomb of a specialist who worked ivory? It seems like the last possibility is the least probable, because, besides the silex blades and the copper awl, we did not find any other items in the tomb, which would be appropriate for such work, for example there is no copper saw.

In the ditched enclosure of Perdigões (Portugal) two tholos tombs were excavated (Valera et al. 2015). Tomb 1 was used only during the first half of the 3rd mill. BC and delivered, amongst others, 60 objects and fragments of ivory. Tomb 2 had two phases of use. To the first phase, dated to the Pre-Beaker Chalcolithic of the first half of the 3rd mill. BC, 89 objects and 114 fragments can be assigned. In both tombs we find also raw material and production waste of ivory. Therefore, it seems possible that among the dead of the two tombs we could find also some ivory craftsmen. However, because of the collective burial rites, with more than 100 individuals in tomb 1, it is impossible to individualise the inhumations and their grave goods.

In any case, as the ivory workshop from Valencina de la Concepión as well as the raw material fragments in Perdigões demonstrate, the majority of the Asian as well as the African ivory should have arrived already in the first quarter of the 3rd mill. BC in the form of raw material, to be worked locally (Vargas et al. 2012; Nocete et al. 2013). In Valencina a pit (402), formed like the figure eight, was discovered in the southern margin of a metallurgic quarter, excavated between 2001 and 2005 and situated in the southwestern periphery of the settlement. The pit contained a concentration of ivory together with bone tools, mainly pins and spatulas, flint blades, a crucible, fragments of rock crystal and ceramic fragments. The ivory consists of raw material, half-finished objects and production waste. Inside the same pit and next to a concentration of ivory, a copper saw was deposited.

It may be said that in the Late Chalcolithic/beginning of the Early Bronze Age (ca. 2500–1900 BC), the number of ivory objects grows, compared to the Early Chalcolithic period, while the total weight diminishes (Schuhmacher 2011; 2012a, 392–394; 2012b; 2016). At the same time, the geographical distribution of ivory objects expands; the exchange networks within the Iberian Peninsula are growing. Therefore, there are now many small ivory objects in the hands of many people. Thus, we could either suppose a certain popularisation and loss of importance of ivory or, on the contrary, a growing elite group. A few contexts stand out with an extraordinary number and variety of objects, such as the tombs of Matarrubilla (Sevilla) (Obermaier 1919; Collantes 1969), Los Algarbes 5 (Cádiz) (Posac 1975; Rivero 1988, 82 f.; Mata Almonte 1991; García Jiménez et al. 2011) and the funerary area 2 of Camino de Yeseras (Madrid) (Liesau et al. 2008; 2011). It seems clear that only very few prominent personalities from a growing elite were allowed a great staff with ivory and gold elements. As in the previous phase, these characters seem to be those, who organised the exchange at a long and medium distance. Here we must mention the necropolis of Los Algarbes located near the Strait of Gibraltar (*fig. 2*). Due to its geographical location, it seems reasonable to assume that the corresponding settlement played an important role in relation to maritime traffic through the strait. Also for this time, the social structure still needs to be analysed, in order to decide whether we need to call these outstanding figures 'big men' or 'chiefs'. In fact, in the case of the dead buried in the hypogeum of the funerary area 2 of Camino de Yeseras it seems like we are talking about a religious leader (Blasco et al. 2009; Blasco/Ríos 2010, 368 f.). These exchange systems surely conform social strategies of the leaders to obtain exotic objects like ivory to underline and express their power and prestige. These strategies include, as Garrido (2006, 84 f.) explains, alliances, political pacts, marriage agreements and the exchange of prestige objects.

The Source of Ivory and its Exchange

According to our scientific analysis on ivory objects from the Iberian Peninsula we are able to recognise two different exchange networks of ivory during the Chalcolithic (Banerjee et al. 2011; Schuhmacher/Banerjee 2012; Nocete et al. 2013; Schuhmacher 2016). So, during the Early Chalcolithic Asian ivory dominates in the southeast of the Iberian Peninsula and African Savannah elephant ivory in what is today Portugal and the Spanish Extremadura (*fig. 1*). In the Guadalquivir Valley we find both types of raw material. In the Early Chalcolithic of Los Millares (Almería) we found ivory of the Asian elephant in 80% of the samples, although we have to admit that the number of analysis is still small. The rest is from *Elephas antiquus*. In Valencina de la Concepción (Seville), including tombs 10042-10049 and the one of Montelirio, 77% of the analysed samples are from Asian elephant ivory, the rest is African.

For the second half of the 3rd mill. BC we have a total of 56 analyses. Regarding the Portuguese Estremadura, we made a considerable effort to clarify what kind of ivory was mainly used during the Bell Beaker period (approx. 2600–2000 BC) (Schuhmacher/Banerjee 2011; Schuhmacher 2012a, 415, Catalogue 2; Schuhmacher et al. 2013). In this respect, up to now we failed to clarify the situation, but just could confirm the use of sperm whale teeth. We currently have a total of 15 analyses of four sites from the Tagus estuary that have provided sperm whale ivory. Given the small number of these findings, lack of harpoons and scenes of whale hunting and a very small amount of whale bones in settlements, we conclude that this reflects a use of beached animals.

Besides these 15 objects from the region of the Tagus estuary, in the second half of the 3rd mill. BC most are made of ivory from *Elephas antiquus* (32.6%), followed by ivory from the Asian (19.6%) and the African Savannah elephant (19.6%) (Schuhmacher 2012a; 2016; Valera et al. 2015).

But the raw material composition of ivory again seems to differ geographically. In the Southwest, in the tomb of Matarrubilla, belonging to the site of Valencina de la Concepción (Seville) six of twelve analysed objects are ivory from the Asian elephant, the rest is from *Elephas antiquus* (*fig. 2*). In tomb 5 of Los Algarbes there is also one Asian and another one from *Elephas antiquus*, the latter was also identified in one piece from the tomb of Señorío de Guzmán (Valencina de la Concepción). Among the objects from the tombs in Perdigões one button and six other objects were clearly datable into Bell Beaker times and are made from African Savannah elephant ivory, the same as an idol from La Orden (Seminario de Huelva). From one tomb in Camino de Yeseras (Madrid) we could analyse ten pieces, nine being from ivory of *Elephas antiquus* and one from African ivory.

The analysed contexts of the southeastern El Argar Bronze Age, like Molinos de Papel, La Bastida, Gatas, Fuente Álamo and El Argar belong already to the Early Bronze Age, between 2250 and 1900 BC. Here we recorded six times African Savannah elephant and in two cases Asian elephant ivory.

But where exactly did this Asian ivory come from and how did it reach the Iberian Peninsula? From literal, figurative and archaeological sources we do know about the existence of the so called Syrian elephant, in fact a variant of the Asian elephant. This would be the nearest source of Asian elephant ivory in the 3rd mill. BC (Nocete et al. 2013; Schuhmacher 2016). A supply of Asian elephant ivory to the Iberian Peninsula from or via Syria seems therefore possible. But the problem is that the few studies undertaken until now rather suggest that in the Levant as well as in Egypt, Crete and Greece until the beginning of the Final Bronze Age the most part of the ivory used was hippopotamus ivory. On the other hand some recent investigations about the Final Bronze Age of Ugarit (Gachet-Bizollon 2007, 15 f., 240) demonstrate that, even though a 60% of the ivory is hippopotamus ivory, in contexts of the Royal Palace the percentage of elephant ivory increases up to 85%. This could indicate a higher appreciation of elephant ivory and its connection with the highest spheres of society. Hence, a preference of elephant ivory for an exchange of prestige goods between elites would not be strange. We also should not forget that on the Iberian Peninsula the use of ivory and its manufacture is an innovation beginning at the end of the 4th mill. BC, whereas in the Orient ivory manufacture already starts at the end of the 5th or the beginning of the 4th mill. BC (Nocete et al. 2013). Therefore, it seems reasonable to suppose that not only the raw material but also the know-how related to ivory reached the Iberian Peninsula by sea and ultimately from the East.

The problem is not only the geographic origin of the raw material but also the routes and the mode of exchange. Unfortunately, detailed studies and scientific analysis of the ivory objects in Italy, Southern France, Corsica and Sardinia, indeed for almost the whole of the Mediterranean outside the Iberian Peninsula, are still missing.[8] Therefore, by now, it does not seem possible to reconstruct with accuracy this exchange of Asian ivory over the Mediterranean during the Chalcolithic.

Regarding African Savannah elephant ivory, we detect a big quantity of figurative representations of elephants in North African rock art, for example in Morocco south of the Atlas (Banerjee et al. 2011a; 2011b; Schuhmacher 2016). In addition, we do have literal sources and figurative representations from Punic and Roman times talking about their presence until the 8th cent. AD. We could affirm that this North African elephant belonged to the species *Loxodonta africana africana* or African Savannah elephant, detected in our analysis on ivory objects from the Iberian Peninsula and the Maghreb. In the Maghreb in the 4th and 3rd mill. BC we do find ivory raw material and objects in the region between Rabat and Casablanca, in concrete in Dar es-Soltan, Rouazi-Skhirat, Kehf-el-Baroud and El Kiffen (*fig. 1*). First strontium isotope analysis demonstrate that the $^{87/86}$Sr rate of some ivory objects out of two tombs of Perdigões coincides with the one of ivory raw material from the cave of Kehf-el-Baroud (Morocco). Other samples from La Pijotilla (Badajoz) on the contrary show rates similar to those from Cap Sim (Essaouira, Marruecos). This seems to confirm that at least part of the African ivory came from the Atlantic coast of Morocco to the Portuguese Alentejo and the Spanish Extremadura, probably via the Guadalquivir (Valencina de la Concepción) and the Tagus estuaries. As the ivory tusk from tomb 10042-10049 from Valencina de la Concepción and the corresponding grave goods corroborate, it came together with ostrich eggs primarily as raw material to the southern Atlantic coast of the Iberian Peninsula.

Unfortunately, ostrich eggs did not get enough scientific attention since the publication of the tombs of Los Millares by the Leisners. Tomb 12 of Los Millares delivered 800 beads made of ostrich egg-shells and another twelve were found in tomb 63 (Leisner/Leisner 1943; Harrison/Gilman 1977). Recent finds of ostrich egg fragments in the smaller chamber of the tomb of Montelirio and a complete egg in the upper level of tomb 10049 finally confirm these dates (Fernández/Aycart 2013; García Sanjuán et al. 2013). Those finds are documented in Morocco in the contemporaneous necropolis of Rouazi-Skhirat and in the caves of Kehf-el-Baroud and Dar es-Soltan (Wailly 1973–1975, 53; Bokbot 2005, 144 f.; Ruhlmann 1951, 100).

Other elements which highlight this relationship in the first half of the 3rd mill. BC are cylindrical boxes of ivory, found primarily in the Portuguese Estremadura, but also in the Alentejo, Southwest and Southeast Spain, as well as in the contemporaneous necropolis of Rouazi-Skhirat (Rabat) (Daugas 2002; Bokbot 2005, 145 f., fig. 27, 28) (*fig. 4*).[9] Other elements reached Northwest Africa in exchange for ivory, like painted pottery, found in level IIIb of Gar Cahal (Ceuta), or the copper axes and bifacial silex daggers from Gar

8 Recently first analyses have been made on material from the tomb of Padre Iossu (Sardinia), detecting also ivory from the Asian elephant. This therefore might confirm our results and clarify part of the exchange route of that raw material for the second half of the 3rd mill. BC (Morillo 2015). I thank J. M. Morillo for allowing me to consult his Master thesis.

9 I would like to thank J.-P. Daugas for further information on these finds.

Cahal (Tetuan) and Kehf-el-Baroud (Ben Slimane) (Bokbot 2005, 147–149 Abb. 36–38; Monteagudo 1977, 34-41 Nr. 93–138A). In Kehf-el-Baroud two copper awls were found too.

We could add another ceramic type to this discussion. Daugas saw similarities between the vessels with comb impressions of the type Rouazi-el Kiffen and such of the Bell Beaker horizon (Daugas 2002, 151–153. Compare Bokbot 2005, 148 f.). He thinks it possible that the ceramics of the type Rouazi-El Kiffen did take part in the evolution of the Bell Beaker ceramics of the Iberian Peninsula. Turek recently revisited this idea, proposing that the Bell Beaker phenomenon originated out of this contact between Northwest Africa and the Portuguese Estremadura (Turek 2012).

Harrison and Gilman already postulated an exchange of North African ivory for products from the Bell Beaker culture on the Iberian Peninsula in the second half of the 3rd mill. BC (Harrison/Gilman 1977; Souville 1984, 241–245; Bokbot 2005, 167). Unfortunately, our analyses are still not able to confirm this, as we still lack evidence for African ivory in the Tagus estuary. Up to now in the Tagus area we only could detect sperm whale ivory (Schuhmacher/Banerjee 2011; Schuhmacher et al. 2013). However, the presence of African ivory in La Orden (Huelva), Perdigões (Alentejo) and Camino de Yeseras might affirm that the Atlantic route from Northwest Africa to the Spanish Southwest and Central Portugal was still active (Schuhmacher 2012a, 425–429; 2016). Thus, the sea routes from Northwest Africa to Central Portugal pass by the coast of Huelva.

In contrast, in the Maghreb we effectively recognise a fairly large number of objects, probably imported from the Iberian Peninsula (Banerjee et al. 2011a; Schuhmacher 2014; 2016). Amongst this material we find Bell Beakers, Palmela points, a halberd, a tanged dagger, metal awls and a wrist-guard (*fig. 5*). Among the Bell Beaker ceramics, apart from maritime vessels, other fragments were identified, whose decorations and shapes remind others from the Iberian Peninsula, and more specifically, the estuaries of Tagus and Guadalquivir. As it is known, the Palmela points also show a concentration in their distribution throughout these two regions. The sites of the Maghreb, which provided materials imported from the Iberian Peninsula, are mostly concentrated around Tangier and also around Rabat and Casablanca. Some import goods were redistributed inland, towards the Fez area. Therefore, it is here on the Atlantic coast between Casablanca and Tangier where ivory was shipped towards the estuaries of Guadalquivir and Tagus.

Fig. 4. Cylindrical box from the necropolis of Rouazi-Skhirat (Morocco).

The Process of Exchange

In the case of the exchange of African ivory we do have evidence that at the end of the 4th and the whole of the 3rd mill. BC at least part of the ivory came from the Atlantic coast of Morocco and reached the Guadalquivir estuary, the Portuguese Algarve and the Tagus estuary by an Atlantic searoute (Ponsich 1974; Belén et al. 1996, 354 f.; Schuhmacher 2012a, 418–429, fig. 153, 156). But how did this exchange work? Who were the merchants?

As we have seen, in the Early Chalcolithic on the Iberian Peninsula objects of ivory are considered prestige objects present in monumental tombs and related with elites. We still do not know well the contemporaneous societies of the Maghreb. For example we are still lacking settlements and we do have only two contemporaneous necropoleis (El Kiffen and Rouazi-Skhirat) (Bailloud/Mieg 1964; Lacombe et al. 1990; Daugas 2002; Lacombe 2004; Linstädter 2004, 53–57; Texier et al. 2008).

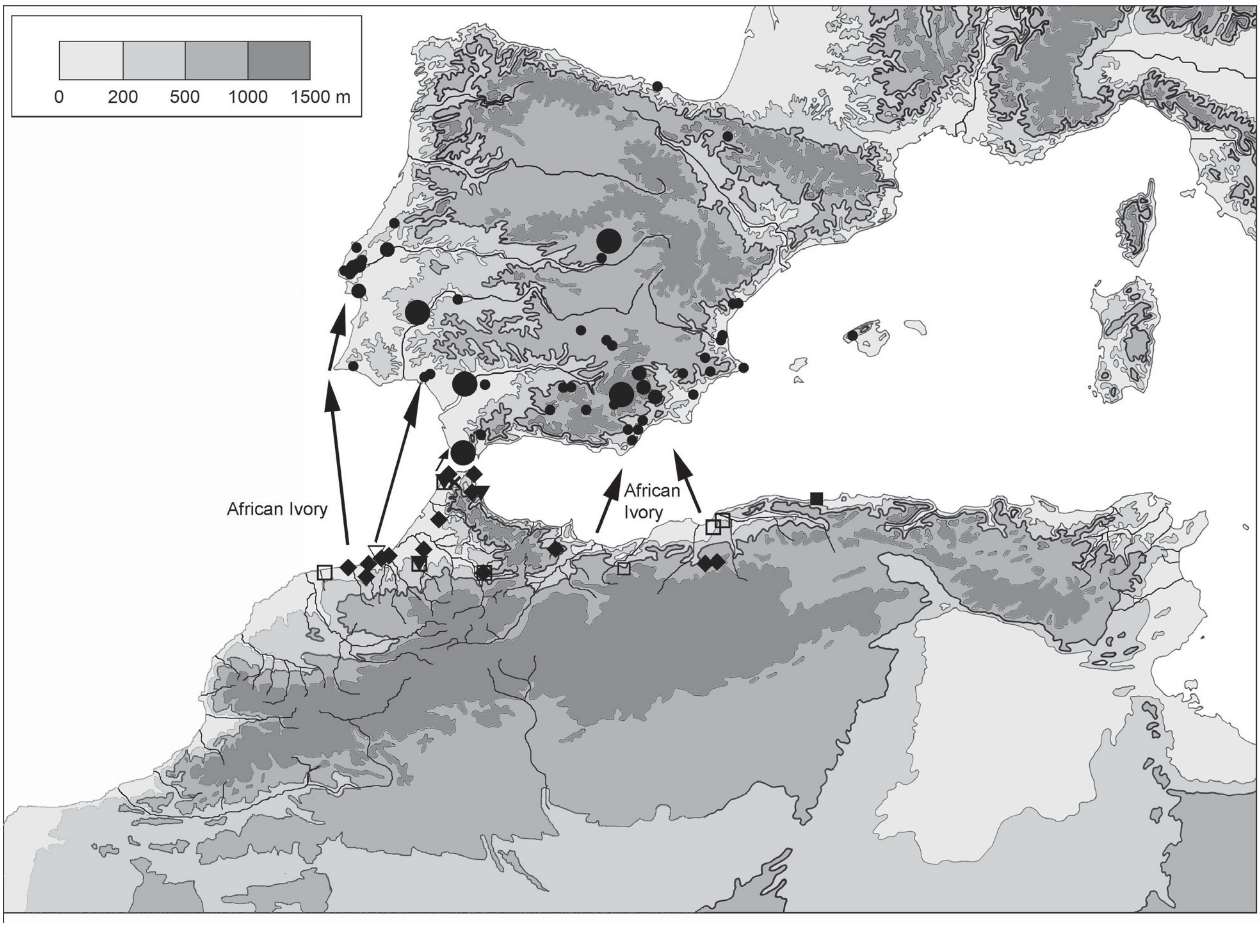

Fig. 5. Exchange network in the Bell Beaker period between Northwest Africa and the Iberian Peninsula. Distribution of ivory objects on the Iberian Peninsula (●) in comparison with the distribution of objects imported to the Magreb from the Iberian Peninsula and the exchange routes for African ivory. Bell Beaker ceramics (◆), Palmela points (□), Copper awls (▼), Halberds (×), Tanged Copper Daggers (■) and Wrist-guards (▽).

They show a fragmentary documentation, yet it seems clear that the presence of ivory in some of these burials was an exception and probably a sign of prestige, connected at least in Rouazi-Skhirat to individuals. Perhaps we are also witnessing the beginning of a process of social differentiation and the birth of elites in the Maghreb, which nevertheless is still not perceived clearly. The amount of exchanged ivory is small and probably sporadic. Are we therefore experiencing an exchange of prestige objects among elites on a small scale? The lack of respective data and clear detection of elites calls for caution, assuming a sort of 'peer-polity interaction' seems the most likely path (Renfrew 1986).

For the second half of the 3rd mill. BC in Northwest Africa the number of known cemeteries and individual graves is still very small as well (Schuhmacher 2014; 2016). Nevertheless, the few burials containing metal objects, Bell Beaker vessels or other elements from the Bell Beaker complex of the Iberian Peninsula – all imported – like the ones from Mers, Aïn Dalia el Kebira, Sidi Slimane y Ifri n'Amr or Moussa, give us the first indications of an incipient elite, who differentiates itself by funerary goods imitating the elites from the Iberian Peninsula. Still, we are talking about an exchange of prestige objects at a small scale. At least now, in the second half of the 3rd mill. BC, the ivory exchange with the Iberian Peninsula appears to have caused the emergence of elites in the Maghreb, which until then were difficult to recognise (Harrison/Gilman 1977, 97–99).

But who were the seafarers and merchants and who brought the African ivory to the Iberian Peninsula? In any case, we can talk about an exchange controlled by an elite. It seems like the

Chalcolithic societies of the Iberian Peninsula were much more complex than the ones of Northwest Africa and had much more benefit of this ivory exchange, so we would expect Iberian seafarers going to the Maghreb in order to get the ivory. Here we should remember the fact that we are still lacking any information about Chalcolithic sea-going vessels – although they had to exist – for the Iberian Peninsula, as the oldest ones represented on Iberian rock-art probably date to the Final Bronze Age (Mielke/Schuhmacher 2011).

Thanks to the ivory tusk found in the tomb 10049 in Valencina de la Concepción, we know that African ivory was imported, at least partially, as raw material to the Iberian Peninsula to be processed locally. This is demonstrated by the ivory workshop in Valencina de la Concepción, although in the latter case it was Asian ivory (Nocete et al. 2013; García Sanjuán et al. 2013; Luciañez Triviño et al. 2013).

The big settlement of Valencina de la Concepción without any doubt played an important role in the exchange, reception, transformation, redistribution and consumption of ivory (Nocete et al. 2013; García Sanjuán et al. 2013). The tombs and the ivory workshop related to this site delivered one of the most numerous contexts of ivory objects for the Early Chalcolithic and the Bell Beaker Chalcolithic. Together with the presence of other exotic objects this highlights the importance of Valencina in middle and long distance exchange (compare Sindbæk 2013, 86). There is an ongoing discussion about the character of this site and the exact size of the site in any specific moment in time is an open question. There are arguments favouring major horizontal movements of the site during time or even the possibility of different contemporaneous sites (Mederos et al. 2015; Schuhmacher et al. 2015). Questioning whether we are talking about a permanent settlement, other possibilities like a meeting-point are brought in discussion (García Sanjuán 2013, 35). It is correct, that we are still lacking almost any evidence for domestic structures like huts, but the presence of numerous furnaces or crucibles for the reduction and smelting of copper, non-ritual domestic pits (besides others obviously of ritualistic character), grave monuments, common ware ceramics and the presence of grinding stones speaks in favour of a permanent settlement. The reduced number of grinding stones and the lack of habitational structures, like huts, probably is due to the lack of systematic research on the site and cannot be used as an argument against the assumption of a settlement. Although in Los Millares we still lack an ivory workshop and ivory raw material, it should have fulfilled the same role for the Southeast (Schuhmacher 2012a). Other centres, where the ivory arrived during the first half of the 3rd mill. BC, could be Alcalar (Algarve), although the amount of ivory documented there is still very small (*table 2*).

During the Chalcolithic a quite big amount of ivory appears in some tombs in Atlantic Central Portugal, such as Praia das Maçãs for the Early Chalcolithic or Palmela for the Bell Beaker period. On the other hand, some ivory objects are documented in the fortified settlements, such as Leceia, Zambujal, Vila Nova de São Pedro and Pedra do Ouro, but their number is, until now, quite small (*figs. 1–3*). Of course, this corresponds to the fact, that in the Chalcolithic ivory artefacts appear mainly in funerary contexts and not settlements. Here, in many cases we still do not know the settlement corresponding to the tombs with ivory, or this settlement has not yet been excavated. In contrast, in Leceia, Vila Nova de São Pedro, Pedra do Ouro, we still lack the corresponding funeral monuments. In the case of Zambujal the burials of the corresponding artificial cave of Cabeço de Arruda and the cave Cova de Moura at least delivered a few ivory objects. For all these reasons it is still very difficult to determine the role of the fortified settlements of the Portuguese Estremadura in the ivory exchange. Sousa and Gonçalves (2012, 387, 391) argue that the Portuguese Estremadura is a territory that shows little territorial hierarchization. The exotic objects disseminate among the big number of fortified settlements. They also claim, that the tombs of this region do not show much signs of social differentiation. But this is only partially true, as we actually do find tombs, although with a collective ritual, which contain much more prestige objects than others, such as Praia das Maçãs. Furthermore, Waterman et al. (2015) observed dietary differences between different burials in the Portuguese Estremadura based on stable isotope analysis. So, the persons buried at Cova da Moura show a higher protein intake, which could

Site	Context	Area Settlement	Ivory objects	
			number	weight (g)
Palmela	Tomb 1		6	6,5
	Tomb 4		3	14
	Total		9	20,5
Pedra do Ouro	Settlement	0,15 ha	5	9
Verdelha dos Ruivos	Funerary cave		6	9
Vila Nova de São Pedro		aprox. 1,5 ha	6	7
Perdigões	Tomb 2		572*	1208,4*
	Ambience 1		297	300,8
	Pit 16		10	2,9
	Pit 40		223	542,1
	Total	16 ha	1102	2054,2*
La Pijotilla		80 ha	2	28
Valencina de la Concepción	Tomb of Matarrubilla	max. 230 ha	86	618,5
Los Algarbes	Tomb 5		121	105,3
Cerro de la Virgen	Settlement		12	-
Camino de Yeseras	Rock-cut tomb	aprox. 20 ha	24	6,9

Tab. 2. Number and weight of ivory objects in different settlements and tombs of the Younger Chalcolithic/Bell Beaker period.

be caused by a social differentiation, especially if we take in mind that the Cova da Moura burials also exhibit a higher number and greater diversity of rare raw materials (Thomas 2011). And we have to assume that the Cova da Moura burials are related to the fortified settlement of Zambujal.

It is true, that the differences, both in size, architecture and prestige objects between the fortified settlements in Estremadura are small and the number of ivory objects is quite scattered over many sites. Nevertheless, we do believe they played a central role in the exchange of ivory (Jorge/Jorge 1997, 134–136; Kunst 1995; Schuhmacher/Cardoso 2007; Schuhmacher 2012a, 308–311, 329–331), although almost none stands out among the others. At the same time, the distribution of ivory objects does not match with a 'down-the-line'-exchange, but an exchange organised by elites (Renfrew 1984; 1986).

The Redistribution of Ivory Objects in the Iberian Peninsula

African ivory probably reached the sites near the Tagus estuary and from there this material was redistributed towards inner Portugal, the Alentejo and the middle Guadiana (Schuhmacher 2012b, 294–296; 2016). The arguments sustaining this are various. In the Alentejo as well as in the Peninsulae of Lisbon and Setúbal African elephant ivory was used, whereas in the Guadalquivir estuary we do have a majority of Asian ivory, although the latest analyses demonstrated a certain amount of African ivory in Valencina as well as in Gilena (Seville).

We do have additional arguments resulting from other investigation projects:

a) R. Müller could demonstrate that the copper used in the Tagus estuary came from the Alentejo region (Müller/Soares 2008; Müller/Cardoso 2008; Cardoso/Carvalhosa 1995; Cardoso 2004; Sousa/Gonçalves 2012; Gauss 2015), the same region J. L. Cardoso identified as a source for amphibolite. So both could have acted as a gift in return for ivory.
b) In the Portuguese Estremadura we do find only some schist plaques whereas these objects do have their major distribution in the Alentejo (Sousa/Gonçalves 2012; Boaventura 2011). On the other hand, objects made of limestone

show the reverse pattern, their majority comes from the Portuguese Estremadura and only a minority from the Alentejo.

c) First results of strontium isotope analysis on human bones reveal that part of the population buried in two tombs of the settlement of Perdigões situated in the Alentejo region originally came from the Lisbon peninsula (Hillier et al. 2010). At the same time, Waterman and her team could verify that the opposite movement of persons occurred too (Waterman et al. 2014).

Still, we cannot completely exclude that African ivory reached the Middle Guadiana regions, e.g. Perdigões and La Pijotilla, by a southern route, upriver the Guadiana or by the Guadalquivir estuary (Valencina de la Concepción). Studies on teeth morphology on individuals from the tombs of Perdigões and Cerro de las Baterías (La Albuera, Badajoz) and DNA studies from Perdigões indicate the presence of African elements (Cunha 2012; 2015, 217–227, 267 f., 281 f.; Afonso et al. 2013). This contrasts the results of other analyses, although of small sample size, on individuals from the tombs of Bolores and Feteira in the Portuguese Estremadura, where other non-African traits could be detected.

In any case, among the materials exchanged by the river system between the Tagus estuary and the Alentejo we have to include ivory (Boaventura 2011). So in Perdigões (Alentejo) we can find big quantities of ivory in two tombs (Valera et al. 2015). Among finished objects there raw material and production waste occurs as well, indicating that probably also raw material was exchanged in order to process it locally. Valera et al. (2015, 402–404) postulate, that 'several circumstances favour the possibility that the site operated as a meeting place'. This refers to the already published studies on strontium isotopes and teeth morphology, which suggest a significant presence of outsiders in Perdigões, coming from the region of the Tagus estuary. It is even possible that, related with the ivory exchange, restricted movements of people from Northern Africa to the Iberian Peninsula took place too.

In the second half of the 3rd mill. BC we are facing a growth of consumption of local ivory like that of *Elephas antiquus* and of sperm whale (Schuhmacher/Banerjee 2011; Schuhmacher 2012a; Schuhmacher et al. 2013). Otherwise, we consider the hypothesis of Harrison and Gilman (Harrison/Gilman 1977; Souville 1984, 241–245; Bokbot 2005, 167; Banerjee et al. 2011a; Schuhmacher 2012a; 2016) of an exchange of North African ivory for objects of the Bell Beaker complex to be valid, as demonstrated by the proper distribution of the ivory objects on the Iberian Peninsula and the Bell Beaker objects in Northern African (*fig. 5*). In fact, a big part of the decorations and forms of North African Bell Beakers do find parallels in the Bell Beaker complex Palmela (Portugal) and the ones of the Guadalquivir valley. Still, we have to admit, that at present the results of our analyses only partially can corroborate this hypothesis, as we still lack proof for a utilisation of African ivory in the Bell Beaker period in the Portuguese Estremadura. Then again, we could detect it in Perdigões (Alentejo) and in the settlement of La Orden-Seminario de Huelva.

We suppose that the process was similar as before, an exchange of ivory from the Tagus estuary to the Alentejo, among others because of the presence of Asian ivory in the Guadalquivir estuary and a simultaneous lack of African ivory. But now we see that the African ivory also came upstream and reached the sites of Central Spain like Camino de Yeseras (San Fernando de Henares, Madrid) and probably Humanejos (Parla, Madrid) (Ríos/Liesau 2011, 365–367 figs. 4, 5; Liesau et al. 2011). Thus, in Yeseras we find besides an utilisation of local Elephas antiquus ivory at least one sample of ivory from *Loxodonta africana africana*. Among others the presence of two buttons with double appendices in Humanejos underlines the connection, as this is a form typical for the Tagus estuary and only rarely present outside this region (Uscatescu 1992, 83–86, fig. 35; Schuhmacher 2012a, 202–208 figs. 54, 55; 2016). In Humanejos a Carrapatas type halberd appeared as well, a form of clear Atlantic origin (Pardo et al. 2011, figs. 3, 7; Schuhmacher 2002). We also will have to ask ourselves, whether this concentration of ivory artefacts in the south of Madrid, Camino de Yeseras, Humanejos and Ciempozuelos, could not be related to the resources of flint and salt available and exploited there (Ríos 2011, 47–51 figs. 17, 19).

Conclusions

The studies on ivory objects from the Chalcolithic period of the Iberian Peninsula and Northwest Africa demonstrated that the consumption of ivory objects on the Iberian Peninsula during the Chalcolithic was more important than previously thought. We could affirm the beginning of ivory use at the end of the 4th mill. BC corresponding with the start of social complexity and a prestige based elite. It is possible that this sudden beginning on the Iberian Peninsula in part was due to northward movements of population – and elephants – in Northwest Africa caused by the drying of the Sahara region. Still, the quite complex ivory manufacture of the Iberian Peninsula needs secondary explanations, which probably lie in other external factors innate to the Eastern Mediterranean, if we consider that part of the ivory used in Southeast and Southwest Spain belongs to the Asian elephant.

At the same time, from the Atlantic coast of what is today Morroco African elephant ivory reached the fortified settlements and/or ditched enclosures of the Atlantic coasts of Portugal and southwestern Spain by peer-polity interaction in exchange for painted pottery, metal objects and silex daggers in the Early Chalcolithic and Bell Beaker vessels and other objects of the Bell Beaker complex in the Late Chalcolithic. Mainly raw material came to the Iberian Peninsula, where it was processed locally, redistributed and consumed in elite burials. Especially between the Portuguese Estremadura and the Alentejo (Perdigões) we could detect a complex network of exchange related with the redistribution of ivory. This implies also the movement of individuals. Ivory clearly serves as a prestigious material for the local elites to express their status and power and the exchange of ivory finally contributes to the development of a local elite in Northwest Africa.

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Bibliography

Afonso et al. 2011: J. A. Afonso Marrero/J. A. Cámara Serrano/G. Martínez Fernández/F. Molina González, Objetos en materias primas exoticas y estructura jerárquica de las tumbas de la necrópolis de Los Millares (Santa Fé de Mondújar, Almería, España). In: L. García/C. Scarre/D. W. Wheatley (eds.), Exploring Time and Matter in Prehistoric Monuments. Absolute Chronology and Rare Rocks in European Megaliths, Proceedings of the 2nd European Megalithic Studies Group Meeting, Seville (Spain), November 2008, Menga Monográfico 1 (Seville 2011) 295–333.

Afonso et al. 2013: C. Afonso/A. M. Silva/A. Malgosa, Late Neolithic/Chalcolithic in Portugal. Preliminary Results from Ancient DNA Analysis. Poster Presented at I Bioanthropological Meeting (Coimbra 2013).

Almagro/Arribas 1963: M. Almagro Basch/A. Arribas, El poblado y la necrópolis megalíticos de Los Millares (Santa Fé de Mondújar, Almería). Bibliotheca Praehistorica Hispana 3 (Madrid 1963).

Arribas 1977: A. Arribas, El idolo de „El Malagón“ (Cullar-Baza, Granada). Cuadernos de Prehistoria de la Universidad de Granada 2, 1977, 63–82.

Bailloud/Mieg 1964: G. Bailloud/P. Mieg de Boofzheim, La nécropole néolithique d´El-Kiffen. Libyca 12, 1964, 95–171.

Banerjee et al. 2011a: A. Banerjee/W. Dindorf/A. Mikdad/T. Reischmann/T. X. Schuhmacher, Die Elfenbeinfunde aus Kehf-el-Baroud (Ziaïda, Ben Slimane, Marokko) und die Frage des Nordafrikanischen Elefanten. Madrider Mitteilungen 52, 2011, 113–138.

Banerjee et al. 2011b: A. Banerjee/A. El Khayari/D. Marzoli/J. Eiwanger/F. Enzmann/J. Goebbels/P. M. Grootes/J. Huth/M. Hüls/D. Meinel/J. Michel/M.-J. Nadeau/T. Reischmann/J.-O. Schwarz, Naturwissenschaftliche Untersuchungen zum Elfenbein von Sidi Harraz/Cap Sim und Mogador (Essaouira, Marokko). Madrider Mitteilungen 52, 2011, 87–138.

Belén et al. 1996: M. Belén/J. L. Escacena/C. López Roa/A. Rodero, Fenicios en el Atlántico. Excavaciones españolas en Lixus. Los conjuntos „C. Montalbán" y „Cata Basílica". In: M. A. Querol/T. Chapa (eds.), Homenaje al Prof. M. Fernández Miranda. Complutum Extra 6.1, 1996, 339–357.

Blanco 1962: A. Blanco Freijeiro, Die ältesten plastischen Menschendarstellungen der Iberischen Halbinsel. Madrider Mitteilungen 3, 1962, 11–20.

Blasco et al. 2009: C. Blasco/C. Liesau/P. Ríos/J. F. Blanco/R. Aliaga/E. Moreno/A. Daza (eds.), Kupferzeitliche Siedlungsbestattungen mit Glockenbecher- und Prestigebeigaben aus dem Grabenwerk von El Camino de Las Yeseras (San Fernando de Henares, Prov. Madrid). Untersuchungen zur Typologie des Grabritus und zu dessen sozialer Symbolik. Madrider Mitteilungen 50, 2009, 40–70.

Blasco/Ríos 2010: C. Blasco/P. Ríos, La función del metal entre los grupos campaniformes. Oro versus cobre. El ejemplo de la región de Madrid. Trabajos de Prehistoria 67.2, 2010, 359–372.

Boaventura 2011: R. Boaventura, Bodies in Motion. Implications of Gender in Long-Distance Exchange between the Lisbon and Alentejo Regions of Portugal in the Late Neolithic. In: K. T. Lillios (ed.), Comparative Archaeologies. The American Southwest (900–1600 AD) and the Iberian Peninsula (3000–1500 BC) (Oxford 2011) 207–219.

Bokbot 2005: Y. Bokbot, La civilización del vaso Campaniforme en Marruecos y la cuestión del sustrato Calcolítico precampaniforme. In: M. A. Rojo Guerra/R. Garrido Pena/I. García Martínez de Lagrán (eds.), El campaniforme en la Península Ibérica y su contexto europeo (Valladolid 2005) 137–173.

Bronk Ramsey 2009: C. Bronk Ramsey, Bayesian Analysis of Radiocarbon Dates. Radiocarbon 51.1, 2009, 337–360.

Camps 1960: G. Camps, Les traces d'un Age du Bronze en Afrique du Nord. Revue Africaine 104, 1960, 31–55.

Cardoso 2004: J. L. Cardoso, Polished Stone Artefacts at the Prehistoric Settlement of Leceia (Oeiras). Madrider Mitteilungen 45, 2004, 1–32.

Cardoso/Carvalhosa 1995: J. L. Cardoso/A. B. Carvalhosa, Estudos petrográficos de artefactos de pedra polida do povoado pré-histórico de Leceia (Oeiras). Análises de proveniências. Estudos Arqueológicos de Oeiras 5, 1995, 123–151.

Chapman 1981: R. Chapman, Archaeological Theory and Communal Burial in Prehistoric Europe. In: N. Hammond/I. Hodder/G. Isaac (eds.), Pattern of the Past. Studies in the Honour of David Clarke (Cambridge 1981).

Collantes 1969: F. Collantes de Terán, El dolmen de Matarubilla. In: V Symposion Internacional de Prehistoria Peninsular, Jerez de la Frontera 1969 (Barcelona 1969) 47–61.

Cruz-Auñón Briones/Mejías 2013: R. Cruz-Auñón Briones/J. C. Mejías García, Diversidad de prácticas funerarias e identidades en el asentamiento de Valencina de la Concepción (Sevilla). In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/T. Ruiz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción (Sevilla). Investigación y tutela en el 150 Aniversario del Descubrimiento del Tholos de La Pastora (Sevilla 2013) 175–199.

Cruz Auñon et al. 2010: R. Cruz-Auñón/F. Nocete/J. C. Mejías, Ciertos aspectos funerarios en la necrópolis de Valencina-Castilleja (Sevilla). In: D. Calado/M. Baldia/M. Boulanger (eds.), Monumental Questions. Prehistoric Megaliths, Mounds and Enclosures. British Archaeological Reports. International Series 211 (Oxford 2010) 51–56.

Cunha 2012: C. Cunha, Caracterização da morfologia dentária no Médio Guadiana no Neolítico Final-Calcolítico. Fundamentação para o mapeamento morfológico das populações locais na Préhistória recente. Apontamentos de Arqueologia e Património 8, 2012, 49–55.

Cunha 2015: C. M. S. Cunha, Crossing the River. The Dental Morphology of Chalcolithic Populations in the Middle Guadiana (PhD-Thesis Universidade de Coimbra 2015).

Daugas 2002: J.-P. Daugas, Le néolithique du Maroc. Pour un modèle d'évolution chronologique et culturelle. Bulletin d'Archéologie Marocaine 19, 2002, 135–175.

Daugas/El Idrissi 2008: J.-P. Daugas/A. El Idrissi, Neolitico Antiguo de Marruecos en su contexto regional. In: J. Ramos/M. Zouak/D. Bernal/B. Raissouni (eds.), Las ocupaciones humanas de la cueva de Caf Taht el Ghar (Tetuán). Colección de Monografías del Museo Arqueológico de Tetuán 1 (Cádiz 2008) 63–91.

Dias et al. 2008: M. I. Dias/M. I. Prudêncio/J. Sanjurjo Sànchez/G. O. Cardoso/D. Franco, Datação por luminescência de sedimentos de sepulcros artificiais da necrópole pré-histórica da Sobreira de Cima (Vidigueira). Resultados preliminares. Apontamentos de Arqueologia e Património 2, 2008, 31–40.

Escacena 2000: J. L. Escacena Carrasco, Applications of evolutive archaeology. Migrations from Africa to Iberia in the Recent Prehistory. In: A. Arnaiz Villena (ed.), Prehistoric Iberia. Genetics, Anthropology and Linguistics (New York 2000) 125–162.

Fernández/Aycart 2013: A. Fernández Flores/V. Aycart Luengo, El dolmen de Montelirio. Un sepulcro clave para la comprensión de los grandes monumentos funerarios de Valencina-Castilleja. In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/T. Ruiz Moreno/R. Cruz-Auñón (eds.), El Asentamiento Prehistórico de Valencina de la Concepción (Sevilla). Investigación y tutela en el 150 Aniversario del Descubrimiento del Tholos de La Pastora (Sevilla 2013) 233–260.

Fernández Gómez/Oliva 1980: F. Fernández Gómez/D. Oliva Alonso, Los ídolos calcolíticos del Cerro de la Cabeza (Valencina de la Concepción, Sevilla). Madrider Mitteilungen 21, 1980, 20–44.

Gachet-Bizollon 2007: J. Gachet-Bizollon, Les ivoires d'Ougarit et l'art des ivoires du Levant au Bronze Récent. Ras Shamra-Ougarit 16 (Paris 2007).

García Jiménez et al. 2011: I. García Jiménez/V. Castañeda Fernánez/F. Prados Martínez, La necrópolis de cuevas artificiales de Los Algarbes, Tarifa (Cadiz). Nuevas explicaciones históricas a raíz de las actuales investigaciones. In: Memorial Luis Siret, I Congreso de Prehistoria de Andalucía, La tutela del patrimonio prehistórico (Sevilla 2011) 583–586.

García Sanjuán 2006: L. García Sanjuán, Funerary Ideology and Social Inequality in the Late Prehistory of the Iberian South-West (c. 3300–850 cal BC). In: P. Díaz del Rio/L. García Sanjuán (eds.), Social Inequality in Iberian Late Prehistory. British Archaeological Reports. International Series 1525 (Oxford 2006) 149–169.

García Sanjuán 2013: L. García Sanjuán, El asentamiento de la Edad del Cobre de Valencina de la Concepción: Estado actual de la investigación, debates y perspectivas. In: L. García Sanjuán/J. M. Vargas Jiménez/V. Hurtado Pérez/T. Ruiz Moreno/R. Cruz-Auñón Briones (eds.), El Asentamiento Prehistórico de Valencina de la Concepción (Sevilla). Investigación y Tutela en el 150 Aniversario del Descubrimiento de La Pastora. Universidad de Sevilla (Sevilla 2013) 21–59.

García Sanjuán et al. 2013: L. García Sanjuán/M. Luciáñez Triviño/T. X. Schuhmacher/D. Wheatley/A. Banerjee, Ivory Craftsmanship, Trade and Social Significance in the Southern Iberian Copper Age. The Evidence from the PP4-Montelirio Sector of Valencina de la Concepción (Seville, Spain). European Journal of Archaeology 16.4, 2013, 610–635.

Garrido 2006: R. Garrido Pena, Transegalitarian Societies. An Ethnoarchaeological Model for the Analysis of Copper Age Bell Beaker Using Groups in Central Iberia. In: P. Díaz-del-Río/L. García Sanjuán (eds.), Social Inequality in Iberian Late Prehistory. British Archaeological Reports. International Series 1525 (Oxford 2006) 81–96.

Gauss 2015: R. Gauss, Zambujal und die Anfänge der Metallurgie in der Estremadura (Portugal). Technologie der Kupfergewinnung, Herkunft des Metalls und soziokulturelle Bedeutung der Innovation. Iberia Archaeologica 15.1 (Tübingen 2015).

Götze 1925: A. Götze, cf. Elfenbein, Europa. In: M. Ebert (ed.), Reallexikon der Vorgeschichte 3 (Berlin 1925) 87.

Harrison 1977: R. J. Harrison, The Bell Beaker Cultures of Spain and Portugal. American School of Prehistoric Research, Bulletin 35 (Cambridge 1977).

Harrison/Gilman 1977: R. J. Harrison/A. Gilman, Trade in the Second and Third Millennia B.C. between the Maghreb and Iberia. In: V. Markotic (ed.), Ancient Europe and the Mediterranean. Studies in Honour of Hugh Hencken (Warminster 1977) 90–104.

Hillier et al. 2010: M. Hillier/R. Boaventura/V. Grimes, Moving Around? Testing Mobility with Strontium Isotopes (86Sr/87Sr) in the Late Neolithic of South-Central Portugal. Poster Presented at the 8º Encontro de Arqueologia do Algarve. A Arqueologia e as outras Ciências (Silves 2010).

Jodin 1957: A. Jodin, Les problèmes de la civilisation du vase campaniforme au Maroc. Hespéris 44, 1957, 353–360.

Jorge/Jorge 1997: S. Oliveira Jorge/V. Oliveira Jorge, The Neolithic/Chalcolithic Transition in Portugal. In: M. Díaz Andreu/S. Keay (eds.), The Archaeology of Iberia. The Dynamics of Change (London 1997) 128–142.

Kunst 1995: M. Kunst, Central Places and Social Complexity in the Iberian Copper Age. In: K. T. Lillios (ed.), The Origins of Complex Societies in Late Prehistoric Iberia (Ann Arbor 1995) 32–43.

Lacombe 2004: J.-P. Lacombe, Anthropologie du Néolithique marocain. La nécropole de Skhirat. Approche chrono-géographique des dysplasies pariétales. Antropo 7, 2004, 155–162.

Lacombe et al. 1990: J.-P. Lacombe/J.-P. Daugas/F.-Z. Sbihi Alaoui, La nécropole néolithique de Rouazi-Skhirat (Maroc). Présentation de l'etude des sépultures. Bulletins et Mémoires de la Société d´Anthropologie de Paris Nouvelle Série 2.3/4, 1990, 55–60.

Leisner/Leisner 1943: G. Leisner/V. Leisner, Die Megalithgräber der Iberischen Halbinsel. Der Süden. Römisch Germanische Forschungen 17 (Berlin 1943).

Leisner et al. 1969: V. Leisner/G. Zbyszewski/O. da Veiga Ferreira, Les monuments préhistoriques de Praia das Maçãs et de Casainhos (Lisboa 1969).

Liesau et al. 2008: C. Liesau/C. Blasco/P. Rios/J. Vega/R. Menduiña/J. F. Blanco/J. Baena/T. Herrera/A. Petri/J. L. Gómez, Un espacio compartido por vivos y muertos. El poblado calcolítico de fosos de Camino de Yeseras (San Fernando de Henares, Madrid). Complutum 19, 2008, 97–120.

Liesau et al. 2011: C. Liesau/A. Banerjee/J.-O. Schwarz, Camino de las Yeseras' Ivory Collection. Advances in Analysis Technology Used in Identifying Raw Material. In: C. Blasco/C. Liesau/P. Ríos (eds.), Yacimientos calcolíticos con campaniforme de la región de Madrid. Nuevos estudios. Patrimonio Arqueológico de Madrid 6 (Madrid 2011) 381–386.

Linstädter 2004: J. Linstädter, Zum Frühneolithikum des westlichen Mittelmeerraumes. Die Keramik der Fundstelle Hassi Ouenzga. Forschungen zur allgemeinen und vergleichenden Archäologie 9 (Aachen 2004).

Linstädter 2016: J. Linstädter, Climate Induced Mobility and the Missing Middle Neolithic in Morocco. In: M. Reindel/K. Bartl/ F. Lüth/N. Benecke (eds.), Palaeoenvironment and the Development of Early Settlements, Proceedings of the International Conferences Palaeoenvironment and the Development of Early Societies (Şanlıurfa/ Turkey 5–7 October 2012) and The Development of Early Settlement in Arid Regions (Aqaba/Jordan 12–15 November 2013). Menschen – Kulturen – Traditionen, Forschungs-Cluster 1.14 (Rahden/Westf. 2016) 63–80.

Luciañez Triviño et al. 2013: M. Luciañez Triviño/L. García Sanjuán/T. X. Schuhmacher, Restaurierung von archäologischem Elfenbein am Beispiel von vier chalkolithischen Elfenbeinobjekten aus der Siedlung von Valencina de la Concepción (Sevilla). Restaurierung und Archäologie 6, 2013, 71–87.

Mata Almonte 1991: E. Mata Almonte, Informe sobre la intervención en el yacimiento de Los Algarbes, Tarifa (Cadiz). Campaña 1990. In: Anuario Arqueológico de Andalucía. Volume 3: Actividades de urgencia. (Cadiz 1991) 83–93.

Mederos 1993/1994: A. Mederos, Los estados incipientes del sureste de la Península Ibérica. Repercusiones en las cuencas de los ríos Aguas, Antas y Almanzora. Almería (4500–1300 A.C./5300–1600 A.C.) (PhD-Thesis Universidad de La Laguna 1993/1994).

Mederos et al. 2015: A. Mederos/J. M. Vargas/T. X. Schuhmacher/F. Falkenstein/T. Link, Prospecciones arqueológicas y geo-magnéticas en los cerros de La Cabeza y del Mármol, sector Norte del poblado calcolítico de Valencina (Sevilla). Campaña de 2014, SPAL. Revista de Prehistoria y Arqueología de la Universidad de Sevilla 25, 2016, 11–42; <http://dx.doi.org/10.12795/spal.2016i25.01> (last access: 07.02.2017).

Mielke/Schuhmacher 2011: D. P. Mielke/T. X. Schuhmacher, Zeugnisse prähistorischer Seefahrt? Die Felsbilder mit Schiffsdarstellungen von der Iberischen Halbinsel. In: In Poseidons Reich 16. Frühe Seefahrt im Mittelmeer. Von den Anfängen bis zur späten Bronzezeit 800 v. Chr., DEGUWA-Tagung, Heidelberg. Skyllis 11.2 (Heidelberg 2011) 74–87.

Molina/Cámara 2005: F. Molina/J. A. Cámara, Los Millares. Guía del yacimiento arqueológico (Sevilla 2005).

Monteagudo 1977: L. Monteagudo, Die Beile auf der Iberischen Halbinsel. Prähistorische Bronzefunde 9.6 (München 1977).

Moreno 1994: A. Moreno Onorato, El Malagón. Un asentamiento de la Edad del Cobre en el altiplano de Cullar Chirivel (PhD-Thesis Universidad de Granada 1994) (Microfiche-Edition).

Morillo 2015: J. M. Morillo León, On-field characterization of Late-Prehistoric Mediterranean Ivories with Portable Instruments and Noninvasive Techniques (unpublished Master Thesis Università La Sapienza di Roma 2015).

Müller/Cardoso 2008: R. Müller/J. L. Cardoso, The Origin and Use of Copper at the Chalcolithic Fortification of Leceia (Oeiras, Portugal). Madrider Mitteilungen 49, 2008, 64–93.

Müller/Soares 2008: R. Müller/A. M. Monge Soares, Traces of Early Copper Production at the Chalcolithic Fortification of Vila Nova de São Pedro (Zambuja, Portugal). Madrider Mitteilungen 49, 2008, 94–114.

Nehren 1992: R. Nehren, Zur Prähistorie der Maghrebländer (Marokko- Algerien-Tunesien). Materialien zur allgemeinen und vergleichenden Archäologie 49.1 (Mainz 1992).

Nocete et al. 2013: F. Nocete/J. M. Vargas/T. X. Schuhmacher/A. Banerjee/W. Dindorf, The Ivory Workshop of Valencia de la Concepción (Seville, Spain) and the Identification of Ivory from Asian Elephant on the Iberian Peninsula in the First Half of the 3rd Millennium B.C. Journal of Archaeological Science 40, 2013, 1579–1592.

Obermaier 1919: H. Obermaier, El dolmen de Matarubilla (Madrid 1919).

Pardo et al. 2011: A. I. Pardo/J. Barrio/L. Gutiérrez, Arqueología, restauración y arqueometría. Principios básicos para una colaboración eficaz. In: C. Blasco/C. Liesau/P. Ríos (eds.), Yacimientos calcolíticos con campaniforme de la región de Madrid. Nuevos estudios. Patrimonio Arqueológico de Madrid 6 (Madrid 2011) 87–98.

Pascual Benito 1995: J. L. Pascual Benito, Origen y significado del marfil durante el Horizonte Campaniforme y los inicios de la Edad del Bronce en el País Valenciano. Saguntum 29, 1995, 19–31.

Ponsich 1974: M. Ponsich, La navigation antique dans le détroit de Gibraltar. In: R. Chevalier (ed.), Litérature gréco-romaine et géographie historique, Mélanges offerts a Roger Dion. Ceasarodunum 9bis (Paris 1974) 257–273.

Posac 1975: C. Posac Mon, Los Algarbes (Tarifa). Una necrópolis de la Edad del Bronce. Noticiario Arqueológico Hispánico, Prehistoria 4, 1975, 87–119.

Poyato/Hernando 1988: C. Poyato Holgado/A. Hernando Grande, Relaciones entre la Península Ibérica y el Norte de Africa. „Marfil y campaniforme“. In: Actas del Congreso Internacional „El Estrecho de Gibraltar“, Ceuta 1987. Volume I (Madrid 1988) 317–329.

Renfrew 1984: C. Renfrew, Approaches to Social Archaeology (Oxford 1984).

Renfrew 1986: C. Renfrew, Introduction. Peer Polity Interaction and Socio-Political Change. In: C. Renfrew/J. F. Cherry (eds.), Peer Polity Interaction and Socio-Political Change. New Directions in Archaeology (Cambridge 1986) 1–18.

Ríos 2011: P. Ríos, El medio físico. Análisis preliminar de los recursos naturales del III milenio en la región de Madrid. In: C. Blasco/C. Liesau/P. Ríos (eds.), Yacimientos calcolíticos con campaniforme de la región de Madrid. Nuevos estudios. Patrimonio Arqueológico de Madrid 6 (Madrid 2011) 29–69.

Ríos/Liesau 2011: P. Ríos/C. Liesau, Elementos de adorno simbólicos y colorantes en contextos funerarios y singulares. In: C. Blasco/C. Liesau/P. Ríos (eds.), Yacimientos calcolíticos con campaniforme de la región de Madrid. Nuevos estudios. Patrimonio Arqueológico de Madrid 6 (Madrid 2011) 357–370.

Rivero 1988: E. Rivero Galán, Análisis de las Cuevas Artificiales en Andalucía y Portugal (Sevilla 1988).

Ruhlmann 1951: A. Ruhlmann, La grotte préhistorique de Dar es-Soltan. Collection Hespéris 11 (Paris 1951).

Schuhmacher 2002: T. X. Schuhmacher, Some Remarks on the Origin and Chronology of Halberds in Europe. Oxford Journal of Archaeology 21, 2002, 263–288.

Schuhmacher 2004: T. X. Schuhmacher, Frühbronzezeitliche Kontakte im westlichen und zentralen Mittelmeerraum und die Rolle der Iberischen Halbinsel. Madrider Mitteilungen 45, 2004, 147–180.

Schuhmacher 2011: T. X. Schuhmacher, Elfenbein des Chalkolithikums und der Frühen Bronzezeit auf der Iberischen Halbinsel. Ergebnisse eines Interdisziplinären Forschungsprojekts. In: A. Banerjee/C. Eckmann (eds.), Elfenbein und Archäologie, INCENTIVS-Tagungsbeiträge 2004–2007. Römisch-Germanisches Zentralmuseum Tagungen 7 (Mainz 2011) 91–122.

Schuhmacher 2012a: T. X. Schuhmacher, Die Elfenbeinobjekte des Chalkolithikums und der Frühen Bronzezeit auf der Iberischen Halbinsel. Interdisziplinäre Studien zu Herkunft, Austausch, Verarbeitung und sozialer Bedeutung von Elfenbein. Iberia Archaeologica 16.2 (Darmstadt 2012).

Schuhmacher 2012b: T. X. Schuhmacher, El marfil en España desde el Calcolítico al Bronce antiguo. Resultados de un proyecto de investigación interdisciplinar. In: A. Banerjee/J. A. López Padilla/T. X. Schuhmacher (eds.), Marfil y Elefantes en la Península Ibérica y el Mediterráneo, Internationale Tagung Museo Arqueológico de Alicante, 26.–27. November 2008. Iberia Archaeologica 16.1 (Darmstadt 2012) 45–68.

Schuhmacher 2013: T. X. Schuhmacher, Ivory from Sobreira de Cima (Vidigueira, Beja). In: A. C. Valera (eds.), Sobreira de Cima. Necrópole de hipogeus do Neolitico (Vidigueira, Beja). ERA Monográfica 1 (Lissabon 2013) 95–97.

Schuhmacher 2014: T. X. Schuhmacher, Dancing in the Dark? The Westernmost “Cypriot” Knot-Headed Pin from Aïn Smene (Morocco). Cuadernos de Prehistoria y Arqueología de la Universidad Autónoma de Madrid 40, 2014, 41–50.

Schuhmacher 2016: T. X. Schuhmacher, Elefanten und Elfenbein auf der Iberischen Halbinsel und in Nordwest-Afrika. Interdisziplinäre Studien zu Austauschsystemen im 3. und der ersten Hälfte des 2. Jts. v. Chr. Iberia Archaeologica 16.3 (Tübingen 2016).

Schuhmacher/Banerjee 2011: T. X. Schuhmacher/A. Banerjee, Pottwalelfenbein im chalkolithischen Portugal. Restaurierung und Archäologie 4, 2011, 107–119.

Schuhmacher/Banerjee 2012: T. X. Schuhmacher/A. Banerjee, Procedencia e intercambio de marfil en el Calcolítico de la Península Ibérica. In: M. Borrell/F. Borrell/J. Bosch/X. Clop/M. Molist (eds.), Xarxes al Neolític. Circulació i intercanvi de matèries, productes i idees a la Mediterrània occidental (VII–III millenni aC). Actes del Congrés Internacional Xarxes al Neolític. Revista del Museu de Gavà, Rubricatum 5 (Barcelona 2012) 289–298.

Schuhmacher/Cardoso 2007: T. X. Schuhmacher/J. L. Cardoso, Ivory Objects from the Chalcolithic Fortification of Leceia (Oeiras). Estudos Arqueologicos de Oeiras 15, 2007, 95–118.

Schuhmacher et al. 2013: T. X. Schuhmacher/A. Banerjee/W. Dindorf/C. Sastri/T. Sauvage, The Use of Sperm Whale Ivory in Chalcolithic Portugal. Trabajos de Prehistoria 70, 2013, 185–203.

Schuhmacher et al. 2015: T. X. Schuhmacher/F. Falkenstein/T. Link/A. Mederos/J. M. Vargas, Archäologische und geophysikalische Prospektionen im Nordbereich der chalkolithischen Siedlung von Valencina de la Concepción bei Sevilla (Andalusien) im Jahr 2014. Madrider Mitteilungen 56, 2015, 1–39.

Serra Ráfols 1925 : J. de C. Serra Ràfols, cf. Elfenbein, Pyrenäenhalbinsel. In: M. Ebert (ed.), Reallexikon der Vorgeschichte. Volume 3 (Berlin 1925) 87–88.

Sindbæk 2013: S. M. Sindbæk, Broken Links and Black Boxes. Material Affiliations and Contextual Network Synthesis in the Viking World. In: C. Knappet (ed.), Network Analysis in Archaeology. New Approaches to Regional Interaction (Oxford 2013) 71–94.

Siret 1913: L. Siret, Questions de chronologie et d‘éthnographie ibériques (Paris 1913).

Soares 2003: J. Soares, Os hipogeus pré-históricos da Quinta do Anjo (Palmela) e as economias do simbólico (Setúbal 2003).

Sousa/Gonçalves 2012: A. C. Sousa/V. Gonçalves, In and Out. Tecnologias, símbolos e cultura material . Interacções e identidades regionais no Centro e Sul de Portugal no 3º milénio A.N.E. In: M. Borrell/F. Borrell/J. Bosch/X. Clop/M. Molist (eds.), Xarxes al Neolític. Circulació i intercanvi de matèries, productes i idees a la Mediterrània occidental (VII–III millenni aC). Actes del Congrés Internacional Xarxes al Neolític. Revista del Museu de Gavà, Rubricatum 5 (Barcelona 2012) 383–392.

Souville 1984: G. Souville, Découverte récente de vases campaniformes au Maroc. In: J. Guilaine (ed.), L'Âge du cuivre européen (Paris 1984) 241–245.

Spindler 1981: K. Spindler, Cova da Moura. Die Besiedlung des Atlantischen Küstengebietes Portugals vom Neolithikum bis an das Ende der Bronzezeit. Madrider Beiträge 7 (Mainz 1981).

Strahm 2002: C. Strahm, Tradition und Wandel der sozialen Strukturen vom 3. zum 2. vorchristlichen Jahrtausend. In: J. Müller (ed.), Vom Endneolithikum zur Frühbronzezeit. Muster sozialen Wandels? Tagung Bamberg 2001 (Bonn 2002) 175–194.

Texier et al. 2008: J.-P. Teixier/J.-P. Raynal/D. Lefèvre/J.-P. Daugas/F.-Z. Sbihi Alaoui, Le site néolithique de Rouazi à Skhirat (Maroc). Contexte stratigraphique et évoliution morpho-dynamique de son environnement littoral. Quaternaire 19.3, 2008, 239–247.

Thomas 2011: J. T. Thomas, Fashioning Identities, Forging Inequalities. Late Neolithic/Copper Age Personal Ornaments of the Portuguese Estremadura. European Journal of Archaeology 14.1/2, 2011, 29–59.

Turek 2012: J. Turek, Origin of the Bell Beaker Phenomenon. The Moroccan Connection. In: H. Fokkens/F. Nicolis (eds.), Background to Beakers. Inquiries into Regional Cultural Backgrounds of the Bell Beaker complex (Leiden 2012) 191–203.

Uscatescu 1992: A. Uscatescu, Los botones de perforación en „V“ en la Península Ibérica y las Baleares durante la Edad de los Metales (Madrid 1992).

Valera et al. 2008: A. C. Valera/A. Monge Soares/M. Coelho, Primeiras datas de radiocarbono para a necrópole de hipogeus da Sobreira de Cima (Vidigueira, Beja). Apontamentos de Arqueologia e Património 2, 2008, 27–30.

Valera et al. 2015: A. C. Valera/T. X. Schuhmacher/A. Banerjee, Ivory in the Chalcolithic Enclosure of Perdigões (South Portugal). The Social Role of an Exotic Raw Material. World Archaeology 47.3, 2015, 390–413. DOI: 10.1080/00438243.2015.1014571.

Vargas et al. 2012: J. M. Vargas Jiménez/F. Nocete Calvo/T. X. Schuhmacher, Contextos de producción de marfil en Valencina de la Concepción (Sevilla). In: A. Banerjee/J. A. López Padilla/T. X. Schuhmacher (eds.), Marfil y Elefantes en la Península Ibérica y el Mediterráneo occidental, Actas del coloquio internacional, Museo Arqueológico de Alicante 2008. Iberia Archaeologica 16.1 (Darmstadt 2012) 69–81.

Veiga 1886–1891: S. P. Martins Estácio da Veiga, Palaeoethnologia. Antiguidades monumentães do Algarve. 4 Volumes (Lisboa 1886–1891).

de Wailly 1973–1975: A. de Wailly, Le site du Kef-el-Baroud. Bulletin d'Archéologie Marocaine 9, 1973–1975, 39–101.

Waterman et al. 2014: A. J. Waterman/D. W. Peate/A. M. Silva/J. T. Thomas, In Search of Homelands. Using Strontium Isotope Analysis to Identify Biological Markers of Mobility in Late Prehistoric Portugal. Journal of Archaeological Science 42, 2014, 119–127.

Waterman et al. 2015: A. J. Waterman/R. H. Tykot/A. M. Silva, Stable Isotope Analysis of Diet-Based Social Differentiation at Late Prehistoric Collective Burials in South-Western Portugal. Archaeometry 58.1, 2015, 131–151. DOI: 10.111/arcm.12159.

The Iberian Peninsula displays extreme geographic and climatic differences, resulting in very different local preconditions. To what extent are these responsible for the heterogeneous social and cultural development in different regions observable during the 3rd mill. BC? To answer this question it is necessary to identify what was considered to be a resource and to determine how these resources were valuated.
This book aims at investigating and reconstructing the dynamics and the diversity of the sociocultural manifestations on the Iberian Peninsula in relation to the use of resources in a comprehensive way during the Chalcolithic. In general regional overviews and detailed studies of the use of infrastructure, raw materials or social relations the possibilities to identify key resources as factors in these processes are explored.

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