



Human Palaeontology and Prehistory

## Social inequalities in the Neolithic of southern Europe: The grave goods of the Campo de Hockey necropolis (San Fernando, Cádiz, Spain)



*Inégalités sociales dans le Néolithique du Sud de l'Europe : les objets funéraires de la nécropole de Campo de Hockey (San Fernando, Cadix, Espagne)*

Eduardo Vijande Vila<sup>a</sup>, Salvador Domínguez-Bella<sup>b,\*</sup>, Juan Jesús Cantillo Duarte<sup>c</sup>, Javier Martínez López<sup>b</sup>, Antonio Barrena Tocino<sup>a</sup>

<sup>a</sup> Prehistory Area, Cádiz University, Faculty of Letters, 11001 Cádiz, Spain

<sup>b</sup> Earth Sciences Department, UGEA-PHAM. Cádiz University, Puerto Real, 11510 Cádiz, Spain

<sup>c</sup> Cádiz University, Faculty of Letters, 11001 Cádiz, Spain

## ARTICLE INFO

## Article history:

Received 9 August 2014

Accepted after revision 24 December 2014

Available online 27 February 2015

Handled by Marcel Otte

## Keywords:

Neolithic

Necropolis

Exotic products

Variscite-turquoise

Amber

Social hierarchical organisation

Southwest Europe

## ABSTRACT

The archaeological excavations carried out between August 2007 and July 2008 in the necropolis of Campo de Hockey (transit Vth–IVth millennium BC) documented levels and structures of interest. We report the first data on the grave goods study, with a special focus on the “funerary” as social work investment. The correlations between the “grave goods” (such as social prestige values) and funerary structures can be established. The individual, double or triple characters of these burials imply social effort and sometimes involve an investment of community work. In the study of the necropolis, it has been observed that very few tombs have grave goods elements; this finding is of great interest because it confirms that incipient hierarchisation processes occurred in these Neolithic societies of South Iberia. We emphasise the analysis of so-called exotic products (amber, turquoise, variscite, sillimanite, etc.) as indicators of inequality, focusing on the correspondence between them and the most monumental or complex structures. We also note the importance of the exploitation of marine resources, which is obvious given the insular nature of the settlement, not only for food but also for ornamental purposes.

© 2015 Académie des sciences. Published by Elsevier Masson SAS. All rights reserved.

## R É S U M É

Les fouilles archéologiques effectuées entre août 2007 et juillet 2008 dans la nécropole du « Campo de Hockey » (transition entre les V<sup>e</sup> et IV<sup>e</sup> millénaires avant J.-C.) ont permis de documenter des niveaux et des structures intéressantes. Nous apportons les premières données sur l'étude du mobilier de différentes sépultures, avec une attention toute particulière pour la dimension « funéraire » en tant qu'investissement de l'activité collective. Des

## Mots clés :

Néolithique

Nécropole

Produits exotiques

Variscite-turquoise

Ambre

Organisation sociale hiérarchisée

Sud-Ouest de l'Europe

\* Corresponding author.

E-mail address: salvador.dominguez@uca.es (S. Domínguez-Bella).

corrélations entre le mobilier funéraire (en tant que marqueur des valeurs de prestige social) et les structures des tombes peuvent être établies. Le caractère individuel, double ou triple de ces sépultures implique un effort social et suppose parfois un investissement de la force de travail de la communauté. Dans l'étude de cette nécropole, les tombes disposant d'un mobilier funéraire sont rares; cette donnée est d'un grand intérêt, car elle atteste l'apparition de processus de hiérarchisation sociale dans ces sociétés néolithiques du Sud de l'Ibérie. Nous insistons sur l'analyse de produits dits exotiques (ambre, turquoise, variscite, sillimanite, etc.) en tant qu'indicateurs d'inégalités, en nous concentrant sur la correspondance entre la présence de ces éléments et les structures funéraires les plus monumentales ou complexes. Il faut également remarquer le caractère significatif de l'exploitation des ressources marines; cela est évident compte tenu de la nature insulaire de cette communauté, non seulement dans l'approvisionnement en nourriture, mais également à des fins d'ornementation.

© 2015 Académie des sciences. Publié par Elsevier Masson SAS. Tous droits réservés.

## 1. Introduction

The archaeological site of Campo de Hockey was uncovered in 2007 as a result of work intended to result in the construction of a municipal hockey grass course. This site is located at the southern end of the municipality of San Fernando (Cádiz) (Fig. 1). The archaeological excavations carried out between August 2007 and July 2008 documented levels and structures of interest for the study of the southwestern Prehistory in the Iberian Peninsula (Vijande, 2009).

This site is located a few metres from the shoreline on a hillside at an altitude of 12–18 m, which provides a great visual dominance over the surrounding strategic locations. The insularity of this territory during Late Prehistory (Alonso et al., 2009; Arteaga et al., 2008) can be gathered by observing the change in the slope between the raised areas of the modern city and the salt flats and marshes that surround it.

The choice to establish in this site is not accidental but, rather, could respond to the presence of a variety of natural resources with great potential for exploitation. The area features soils of great value for the development of crops and for livestock production. There are also abundant pebbles of quartz, quartzite and chert supplied by the nearby rivers Guadalete, Arillo and San Pedro, which were used to make stone tools (Zazo et al., 1987). Finally, we should not forget the importance of the exploitation of marine resources for these societies, especially considering that they lived surrounded by the sea.

We present the first data on the grave goods of this necropolis. We are interested in the “funerary” as social work investment (Lull and Picazo, 1989). Hence, we establish correlations between the “grave goods” (such as social prestige values) and funerary structures because both imply significant social effort and sometimes involve an investment of community workforce. In the study of the Campo de Hockey necropolis, very few tombs have been observed to contain grave goods elements; these data are of great interest because they confirm that incipient hierarchisation processes occurred in these Neolithic societies.

We are interested in the study of burial records that allow us to infer socioeconomic behaviour, helping us to understand both “the world of the dead” and “the world of

the living.” These analyses should be made in relation to studies of habitat areas and production and analysis of the territory in which these societies developed.

## 2. Tribal social formations in the Bay of Cádiz environment

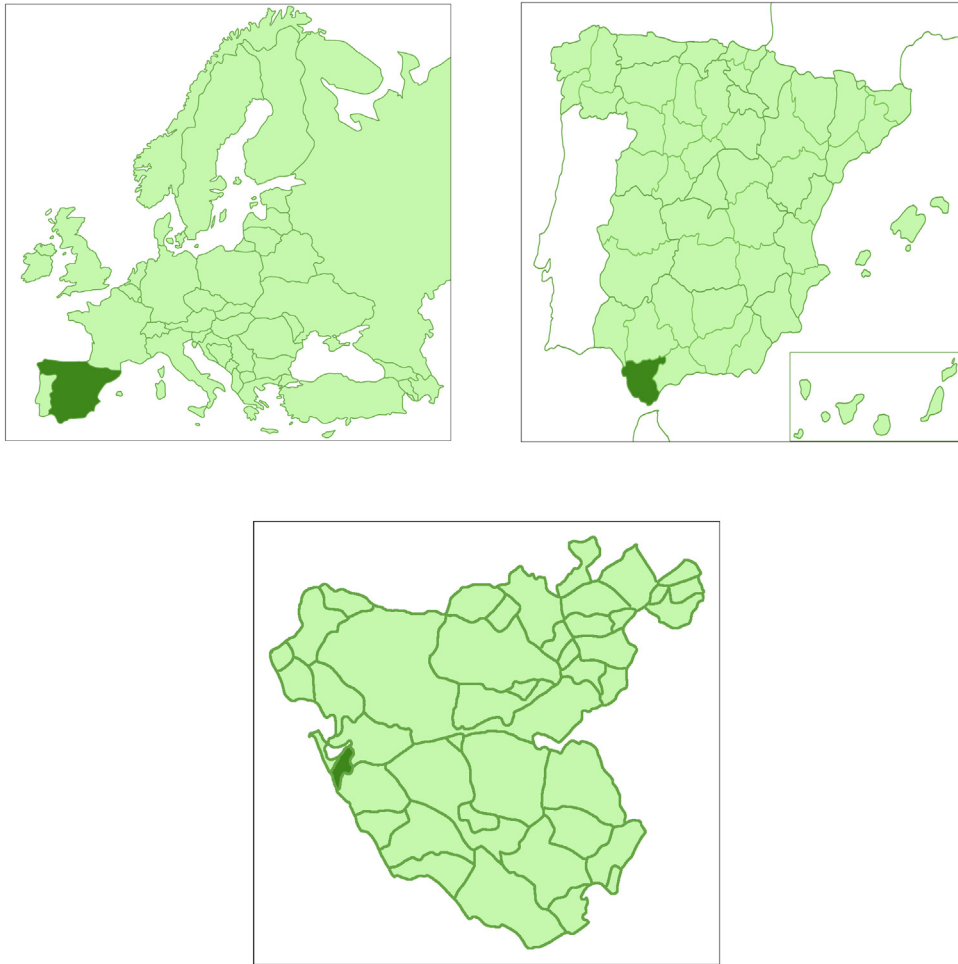
Based on the archaeological record, we intend to obtain inferences of a socioeconomic type and not limit ourselves to a mere typological description of archaeological items. These items are not the target of archaeology, but they do help understand socioeconomic aspects so that we can determine the lifestyles and modes of production of these societies.

This settlement is framed chronologically in a time of significant changes. The Vth millennium BC in this area is characterised by the consolidation of production (agricultural and livestock) over predatory (hunting, fishing and gathering) practices, resulting in the establishment of sedentary villager lifestyles.

The times at which villages appear act as a “fundamental physical basis of social units” (Vargas, 1987). Indeed, the establishment of villages will result in the ownership not only of land by these communities but also of hunting resources, fishing and shellfish territories, harvest, etc. The Necropolis of Campo de Hockey manifests a final “territorialisation” of the group and the emergence of new relations of production and reproduction based on lineage. The structure of the burial distributions clearly shows the presence of lineages through the combination of certain graves and family ties. DNA tests, which may confirm this hypothesis, are in progress.

All of the aforementioned findings present a clear example of the establishment of these groups in coastal areas, which is highly suitable for the development of agro-livestock activities and of great importance for the exploitation of marine resources.

The Campo de Hockey site has a widespread potential for the resolution of problems of great interest concerning these moments (Vijande, 2010) (territorialisation, appearance of villages, relations of filiation, etc.). In this article, we focus on the problems surrounding the origin of social inequalities. Differential access to various types of funerary



**Fig. 1.** (Colour online.) Geographical location of the T.M. San Fernando (municipality territory).

**Fig. 1.** (Couleur en ligne.) Emplacement géographique du terrain municipal de San Fernando.

structures and the individual elements of funerary goods undoubtedly constitute the first visible signs of social hierarchisation.

At the end of the Vth millennium, we observe the origin of sedentary forms of village life, such as clear ownership over land (but also over cynegetic resources, fishing or shell-fishing territories, gathering, etc.) by these communities. The land has been a constant factor in Neolithic societies since ancient times. In tribal societies, land and means of production are owned by the group that inhabits and controls it. However, we consider this assertion a working hypothesis.

Control over the work force will allow for an increase in production and hence a surplus (Molina et al., 2012: 431; Vijande, 2009). Villages such Campo de Hockey attest to this final “territorialisation” of the group and the emergence of new relations of production and reproduction. However, the village is not the only settlement that has these characteristics.

The Cantarranas settlement, a village with numerous silos that was launched in the transitional Vth–IVth millennia BC, showed similar characteristics. Furthermore, new

funeral manifestations that are only made possible by the existence of a new social structure appear. The phenomenon of the necropolis, with monumental tombs and grave goods, is possible only within a social structure with a certain capacity to produce surpluses. These surpluses will be controlled by a group or lineage that is prominent in the community, i.e., they will no longer be controlled in a communitarian way (Bate, 1984).

Andalusian sites with Neolithic silos indicate a clear accumulation of surpluses, agricultural products and grains, as evidenced by Arteaga and Cruz-Auñón (1999) or Nocete (2001) in the Guadalquivir countryside or the storage of seafood in the region of the Bay of Cádiz.

One of the most distinct examples is presented in the area of the Sierra of Cádiz foothills, with the Alberite I dolmen (Villamartin, Cádiz), contemporary to the Campo de Hockey settlement (Sttip and Tamers, 1996). This dolmen has elements that indicate social contradictions involving territorialisation and the consolidation of the farming system in the area. The imposing dimensions of the dolmen imply that great collective effort was required to erect the construction, which is possible only in tribal social

formations of “family groups” (Arteaga, 1992) or in societies that are already hierarchised (Nocete, 1989).

The documentation of numerous prestige objects, derived from distant sources through exchange routes, attests to the investment by the community of a part of the surplus for the benefit of an elite (we must remember that only two individuals were buried in this spectacular tomb). Therefore, evidence of social inequality is observed by emerging sectors of this community that will benefit from the proceeds of labour surplus products to erect structures and acquire monumental funerary objects of prestige that can only be enjoyed by this elite minority (Ramos and Giles, 1996).

### 3. The Neolithic necropolis of Campo de Hockey

Prior to the discovery of the Campo de Hockey site, the (*a priori*) low level of known prehistoric archaeological sites led to the hypothesis of a marginal occupation of the Island of San Fernando, inside the Bay of Cádiz, with respect to specific activities of mowing, livestock or plant and marine product collection (Ramos, 2008). This hypothesis was further reinforced by the insular orography itself that the city offered at that time.

We do not know the exact dimensions of this site because we have only been able to intervene in the site of the construction of the grass hockey sport stadium. Furthermore, only one-third of the total area of the parcel has been excavated (Fig. 2). Nevertheless, the documentation of prehistoric structures and levels in the western, eastern and northern regions manifests a continuity in the site beyond the limits of this urban plot and testifies to the presence of a village of considerable size.

The Campo de Hockey site has levels and archaeological structures that are chronologically ascribable to the transitional Vth–IVth millennia BC and the IIInd millennium BC, respectively. For the normative Neolithic period that concerns us, we have identified three functional areas within the village: a residential area, a storage area and the burial area or necropolis.

The residential area is located at the higher end of the site, and all indications suggest that it would spread to the west. In this area, we have documented two circular structures that we interpret as prehistoric cottage backgrounds and/or storage pits. In this case, the geological substrate is a Pliocene calcarenite without any trace of clay minerals; however, its use as a clay quarry is not possible.

The wells are typically Neolithic south of the Iberian Peninsula and show signs of association with agricultural crops.

Another possibility is the use of water wells, but the hydrologic and stratigraphic characteristics of this area do not appear to favour this type of use at all.

In relation to the production or storage area, we must note the discovery of five circular structures, which, based on their typology, we have called “pits”. These pits are located in the central part of the site (Fig. 2), and we defend the hypothesis that these structures were first used as silos. It was not possible until now to specify the type or types of products stored in the silos, even based on the dimensions of the structures. It is clear that their storage capacity must

have been massive (the diameter at the mouth reaches up to 5 m and the minimum depth is 3.70 m) (Vijande, 2009).

In this paper, we will focus specifically on the necropolis located at the eastern end of the site, from which we have excavated archaeological trenches (Cortes 7, 9, 12, 13, 14, 15, 16 and 17 in Fig. 2).

With respect to the types of graves, the most prominent are described in Table 2. The grave goods that are the most “prestigious” appear only in three tombs, which are precisely the most complex ones, and correspond to E11 C14 (TYPE VIII of Fig. 2), the grave E3 C15 (TYPE VII of Fig. 2) and the E4 C13B (Type V of Fig. 2). This finding is interesting because these types of tombs, which constitute a minority in the necropolis (spatially, types VII and VIII), are the most complex, with a large fossa and covered with a tumulus formed by slabs of medium size, and present the best grave goods, with exotic products such as variscite beads, turquoise pendant, amber pendants and high-quality votive rock axes of allochthonous origin.

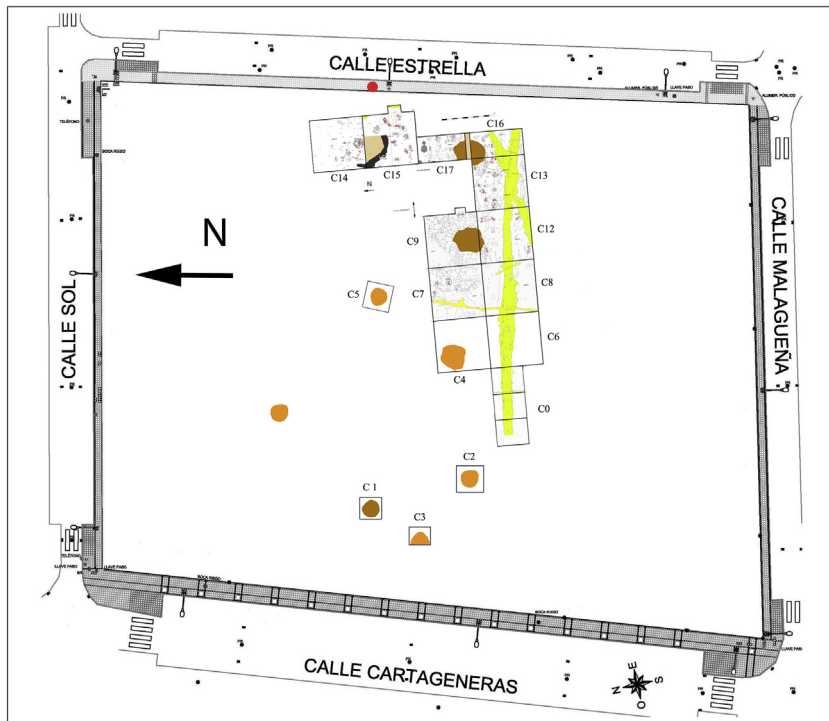
This necropolis forms part of a settlement of considerable size located along the coast and, more specifically, in an insular context (Fig. 3). The large number of documented funerary structures, together with the good condition of the burials, is key to providing knowledge about the lifestyle of these communities. Similarly, the analysis of exotic objects that were part of the grave goods provides us with interesting data concerning product distribution networks and the existing social inequalities.

The chronology of the necropolis is complex due to the “horizontal stratigraphy” that exists at the site. It is a very extensive settlement, but it has low stratigraphic potency, making it impossible to correlate it stratigraphically with other structures.

To date, we have absolute dating data for the two levels of one of the pits (Fig. 4) and three of the funerary structures (Fig. 5 and Table 1: samples CNA 360, CNA 664 and CNA 833). Although only three tombs are dated, similarities with respect to the types of graves, grave goods and rituals enables us to propose the same chronocultural attribution for the entirety of the necropolis, although these data should be contrasted with new absolute dating data.

We defend the pits’ construction as storage structures at the end of the Vth millennium BC. After the abandonment of the settlement, the pits would become filled. We currently have an absolute dating for this first silting of sediments (Table 1: Sample CNA 835). In the case of Pit 1 Archaeological trench 2, we believe that over time, this first clogging became compacted into a small depression in the IIInd millennium BC and was used as a habitat structure (with a hearth in the basal area). The absolute dating of this hearth indicates a IIInd millennium BC chronology (Fig. 5 and Table 1: Sample CNA 832).

The absolute chronology offered by these Neolithic storage structures and burial is consistent with that of the recovered archaeological products. Regarding the stone industry, we noted the presence of small cores that generate a very small-sized lithic industry. Among the products that were retouched, we found a backed edge bladelet, drills, trapezoids, truncated pieces, lunates, scrapers, burins, chisels, etc. We also documented flint



**Fig. 2.** (Colour online.) Archaeological trenches excavated at the site of Campo de Hockey (Vijande, 2010).

**Fig. 2.** (Couleur en ligne.) Fosses archéologiques creusées sur le site de Campo de Hockey (Vijande, 2010).

blades of medium size, probably of allochthonous origin. The widespread presence of lithic products with cereal lustre indicates the importance that agricultural activity must have had for this community.

We have found an extensive necropolis in which anthropological studies in progress have identified 80 individuals to date (an indicative figure that may be subject to change after the end of this study). The sector we excavated represented one-third of the total necropolis located in this site (Fig. 2). We estimate that one-third of the necropolis was destroyed by the mechanical undercut prior to the construction of the sport building, before the

archaeological intervention, and that the last third has been preserved under the current turf sports field.

We have excavated 80 individuals, but we estimate that the machinery devastated another 80 graves during the civil engineering works conducted on the site of public works and that a space similar to the excavated necropolis (80 individuals) also remains intact. In addition, eastern and northern sections of the necropolis show a continuation of the same for the adjacent lands.

Because the excavation was of the rescue type, it was impossible to excavate the full extent of the land parcel due to the administrative imposition. The full extent of the

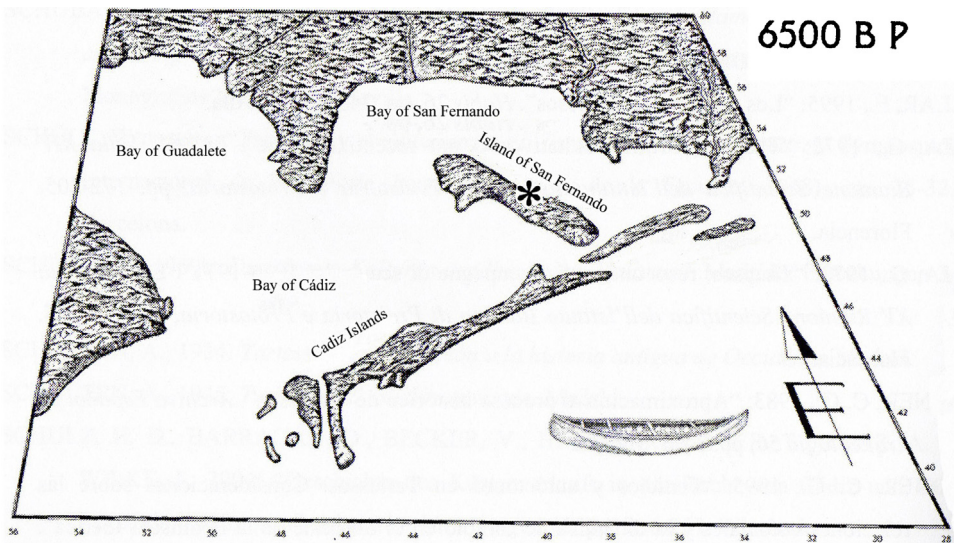
**Table 1**

<sup>14</sup>C dating of the Campo de Hockey archaeological site. All C14 dates have been calibrated using the Calib Radiocarbon Calibration Program with dates marked "(1)" calibrated with the Cal. Curve: Intcal04; those marked "(2)" calibrated with the Cal. Curve: marine04; those marked "(3)" calibrated with Cal. Curve: marine09; Intcal09 and those marked "(4)" calibrated with the Cal. Curve: Intcal09. Dating was performed at the National Accelerator Centre, in Seville, Spain.

**Tableau 1**

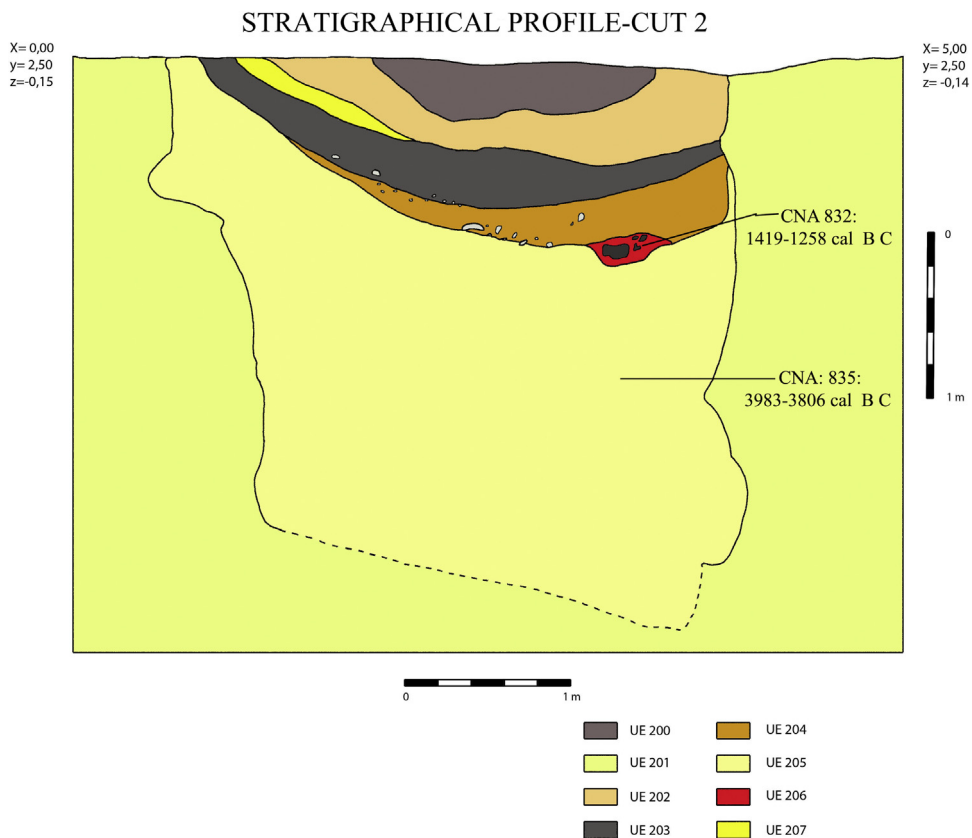
Datation <sup>14</sup>C du site archéologique de Campo de Hockey.

Site	Context	Sample	Date BP	Date cal. BC.(2σ)	Sample Reference	References
Campo de Hockey (1)	Double burial in a simple pit	Human bone	5020 ± 50	3948–3708	CNA360	Vijande, 2009: 273
Campo de Hockey (2)	Double burial pit covered by a tumulus	Shell (Monodonta lineata)	5650 ± 40	4221–3990	CNA664	Vijande, 2009: 274
Campo de Hockey (3)	Individual burial cist	Shell (Múrex Brandaris)	5665 ± 50	4244–3983	CNA833	This work unpublished
Campo de Hockey (3)	Circular structure (pit) Corte 2- UE 205	Shell (Monodonta lineata)	5485 ± 30	3983–3806	CNA835	This work unpublished
Campo de Hockey (4)	Circular structure (pit) Trench C2- UE206	Coal	3065 ± 35	1419–1258	CNA832	This work unpublished



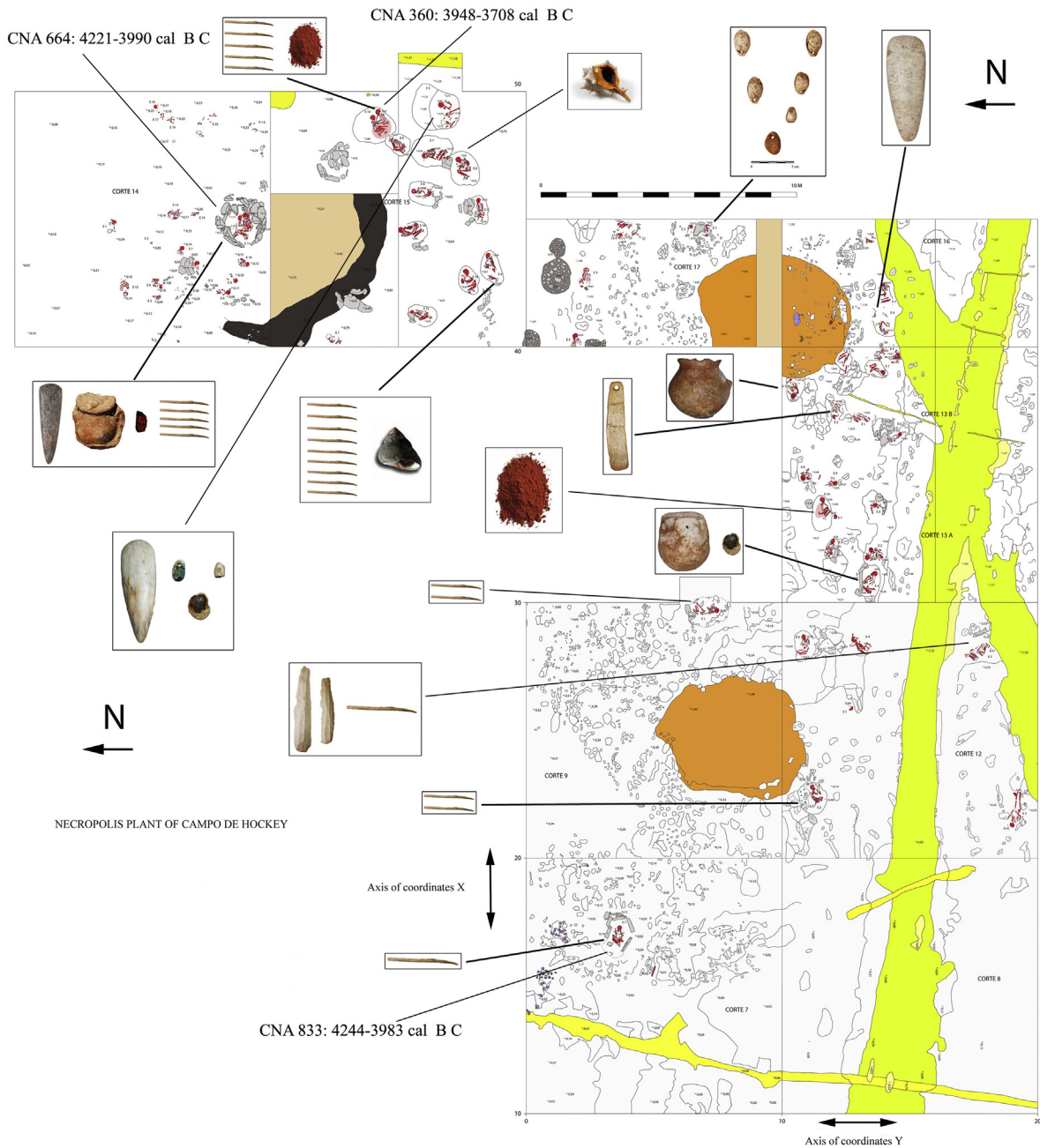
**Fig. 3.** Graphical representation of a reconstruction of the Cadiz bay, when the sea reached its highest level in the Holocene, after completing the Flandrian Transgression, 6500 years ago (from [Arteaga et al., 2008](#)). \*Campo de Hockey site.

**Fig. 3.** Représentation graphique d'une reconstitution de la baie de Cadix, au moment où la mer atteignait son niveau maximal au cours de l'Holocène, à la fin de la transgression flandrienne, il y a 6500 ans (d'après [Arteaga et al., 2008](#)). \*Site de Campo de Hockey.



**Fig. 4.** (Colour online.) Stratigraphic profile of the circular structure number 1 of the Archaeological trench 2 with indication of the C 14 data. South–north profile, archaeological trench 2.

**Fig. 4.** (Couleur en ligne.) Profil stratigraphique de la structure circulaire numéro 1, à partir de la tranchée archéologique 2, avec les indications de datation au C<sup>14</sup>. Profil sud–nord, tranchée archéologique 2.



**Fig. 5.** (Colour online.) Campo de Hockey Necropolis plant, with the spatial location of grave goods shown.  
**Fig. 5.** (Couleur en ligne.) Plan de la nécropole de Campo de Hockey, avec localisation spatiale du mobilier funéraire.

site is 9500 m<sup>2</sup>, and it has been proved that there are many more burials in the southwestern sector. Thus, if we estimate a density similar to that of the excavated graves, the total number of burials at this site (the visible part on the excavated soil) is several hundreds. At the moment, it is impossible to identify the exact number of individuals.

These data refer only to the site studied. Clearly, the settlement (and thus the necropolis) would extend beyond the limits of this urban planning parcel, which does appear to

reflect the stratigraphy and should be considered in future urban planning of the area.

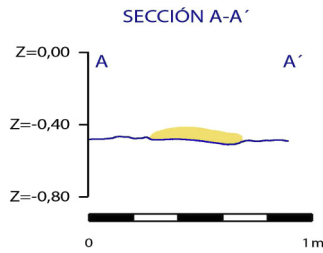
This archaeological site is, for various reasons, a type of funerary manifestation practically unknown in Lower Andalusia for the chronologies considered. First, this is a perfectly planned necropolis, in which the presence of tumuli and vertical slabs (by way of steles) has prevented the construction of burial sites on other ones. Second, compared to the rituals of collective burials typical of megalithic

**Table 2**

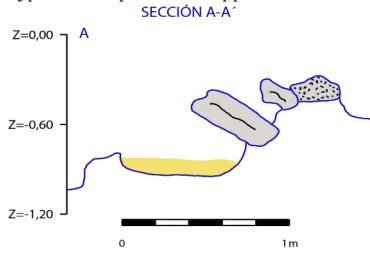
Typology of documented burials at the Campo de Hockey site (Vijande, 2009).

**Tableau 2**

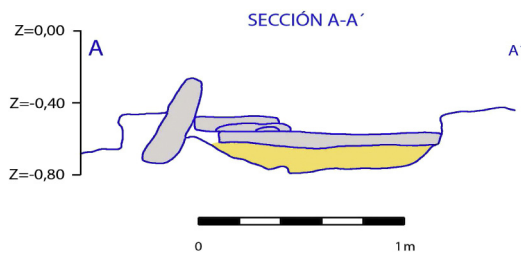
Typologie des tombes documentées sur le site de Campo de Hockey (Vijande, 2009).



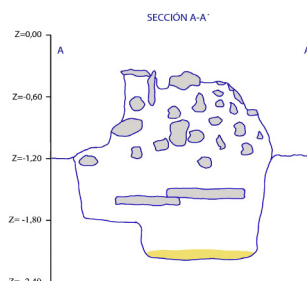
Type I. Burial pit with no apparent structure.



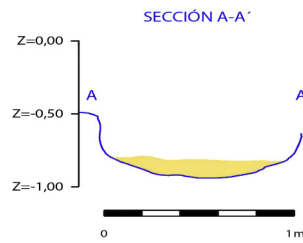
Type III. Burial pit with 45° inclined slabs in one of its sides, in order to protect and mark the location of the structure.



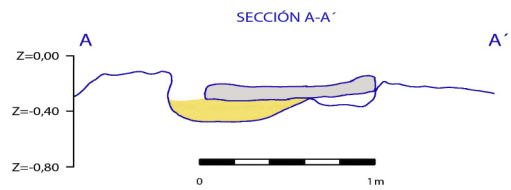
Type V. Burial pit with horizontal slab or slabs as a cover and vertical slab as a stele that signals the location of the structure.



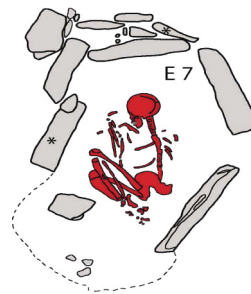
Type VII. Structure made of a burial pit dug in the bedrock level, with vertical slabs as a cover protecting individuals and finished with a mound of small and medium size stones that indicates the position of this structure within the necropolis.



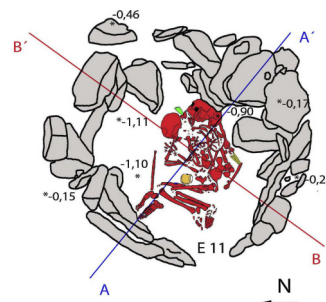
Type II. Simple burial pit.



Type IV. Burial pit with slab or horizontal slabs, as a cover.



Type VI. Cist or box made from a base of vertical slabs.



Type VIII. Megalithic structure composed of a two-meter-in-diameter circular burial pit excavated in the geological and covered by a mound composed of medium and large size slabs. Also, this structure is delimited by a perimetral burial pit of 1.15 m width and 10 m in diameter approximately.

monuments, the Campo de Hockey Necropolis presents individual burials, with the subjects placed in a foetal position and reclining on the right or left side, hands placed at breast height or under the face (Fig. 6). The presence of these double or triple burials is very interesting. Anthropological studies (University of Granada) are currently being finalised, and the results concerning gender, age and

violent death will serve to address issues related to care for the dead (Testar, 2004).

Only three burials have been documented as double (E3 C15, E10 and E11 C15 C14), and two have been documented as triples (E2 and E3 C13A C16A). This documentation has allowed for the identification of a variety of types of funerary structures (Table 2, Vijande, 2009): I.- Burials





**Fig. 6.** (Colour online.) Individual inhumations of the Campo de Hockey necropolis, in burial E4 C13.

**Fig. 6.** (Couleur en ligne.) Inhumations individuelles dans la nécropole du campo de Hockey.

without apparent structure or pit; II.- Simple pit burial; III.- Burial pit with slabs inclined by 45° on one of its sides to protect and mark the location of the structure; IV.- Trench with horizontal slab or slabs as a cover; V.- Trench with horizontal slab or slabs as a cover and vertical slab as stele mode, signalling the location of the structure; VI.- Cist or box made of vertical slabs; VII.- Structure formed by a pit excavated in the geological level, with vertical slabs as a cover protecting individuals and topped with a tumulus formed by small and medium stones that indicate the position of this structure within the necropolis; VIII.- Megalithic structure composed of a circular pit two metres in diameter excavated in the geological level and covered by a mound composed of slabs of medium and large sizes. Additionally, this structure is delimited by a perimeter trench 1.15 m wide and approximately 10 m in diameter.

Based on the social archaeology, a grave goods study that considers funerary structures is deemed necessary to observe possible signs of an incipient hierarchisation and of social inequality.

#### 4. The grave goods of Campo de Hockey necropolis: archaeometric study

The interest in this necropolis lies in the individual character of the burials. Although grave goods items are not very abundant, the individual burials make it possible to associate each object with each individual and a funerary structure.

For prestige grave goods items, we relate “exotic products”, i.e., objects that are not needed in everyday life, to social value associated with aspects of ideology or social awareness (Domínguez-Bella et al., 2008: 213). These products are interesting because they can be indicators of inequality and because they may provide evidence of the true articulation of product distribution networks (sometimes from very far away) (Cassen et al., 2011, 2012; Guilaine, 2002; Domínguez-Bella et al., 2002, 2008; Domínguez-Bella, 2004; Guilaine, 2002, Querré et al., 2012). We have observed a correspondence between the

most notable graves and the presence of these exotic elements of social prestige.

We define the social value of exoticism by the difficulty of accessing these products. Areas of geological sources are considerably distant from the site and prove the existence of distribution networks. Moreover, these products are placed only in the tombs of personalities (more complex tombs) and not in other more ordinary graves, which gives the graves a special character and social distinction. Examples of this value are found among the same exotic products, such as variscite and amber, and in large Neolithic tombs, such as Carnac (variscite, sillimanite, jadeite), Evora (Anta Grande do Zambujeiro) (variscite, amber), and Alberite I, Cádiz (variscite, amber).

##### 4.1. Amber

Up to three amber beads have been documented in this necropolis. One of them was localised *in situ* by way of a pendant on the neck of an individual from a single burial (E4 C13) (Fig. 7 and Fig. 8:11). A second bead formed part of the variscite and turquoise necklace of an individual buried in a double grave (E3 C15). Finally, a new bead appeared in the double megalithic tomb, but not in its original position (E11 C14) (Fig. 8:12). In all cases, the amber was a dark, reddish-brown colour with a high degree of alteration.

These samples have been archaeometrically analysed using spectroscopic techniques, specifically FTIR, using 3 mg of sample pressed into KBr pellets. After these analyses, all of which indicated a lack of the so-called “Baltic shoulder” characteristic of succinite, we can affirm that these ambers are not succinite of Baltic origin. The use of the amber artefacts as pendants is unambiguously confirmed because they have been documented *in situ* around the neck of an individual (Fig. 7, Vijande, 2011: 16).

These pendants manufactured from amber have been found exclusively in three funerary structures (C14 E11, E3 and E4 C15 C13), which are precisely those that required great social effort for construction by the community (Types V, VII and VIII, Table 2). We hypothesise that such graves belonged to the ruling class because amber



**Fig. 7.** (Colour online.) Amber pendant documented in situ, at the neck of the individual from the E4 C13 burial.  
**Fig. 7.** (Couleur en ligne.) Pendentif en ambre documenté in situ, au cou d'un individu de la tombe E4 C13.



**Fig. 8.** (Colour online.) Grave goods objects from the Campo de Hockey necropolis.  
**Fig. 8.** (Couleur en ligne.) Mobilier funéraire de la nécropole du Campo de Hockey.

pendant elements were clearly linked to power. All of these results suggest the existence of authentic circulation networks of allochthonous exotic products, for which access would have been limited to a few members of the society (Domínguez-Bella, 2012; Domínguez-Bella and Morata Céspedes, 1995; Domínguez-Bella et al., 2001, 2008: 216).

Further analyses of amber samples are in progress to try to obtain better information about their possible origin. The Neolithic amber closest to the site of Campo Hockey is that of the Alberite I dolmen (Villamartín, Cádiz), exhibiting a simetite composition; to date, the only known source of geological simetite is the Simeto river in Sicily (Domínguez-Bella and Morata Céspedes, 1995, 2000). In any case, geological deposits known to date, with the presence of amber in the Iberian Peninsula and North Africa, are at least 400 km away, confirming a remote source for this material and its clearly exotic character in this area. In any case, the analyses indicate that the material is not Baltic amber (succinite).

#### 4.2. Variscite and turquoise

Two other stone beads, green and blue in colour, have been found in the tomb E3 C15 and may have formed part of a necklace (Vijande, 2011: 17).

An archaeometric analysis of these beads has been undertaken within a broad analytical program that we have been conducting over the past two decades on phosphate minerals from the recent Prehistory of the Iberian Peninsula (Domínguez-Bella and Morata Céspedes, 1995; Domínguez-Bella, 2004, 2012; Querré et al., 2012). Techniques such as WDXRF and LXRD have been applied directly to these objects, always in non-destructive mode. PIXE-PIGE analyses were also conducted using the same samples, as part of the Callais project, at the AGLAE facility, Louvre Museum, Paris, within the framework of the CHARISMA program. These analyses are still ongoing.

The results of these analyses have shown that one object is a variscite bead (Fig. 8: 14; Fig. 9B) and the other a turquoise bead (Fig. 8: 13; Fig. 9C). The variscite necklace bead represents an interesting recycling process because after the breakup of the original bead hole, it was rotated and returned to drilling to obtain a new, usable necklace bead. This fact, documented here for the first time and also observed in the burial of the Neolithic dolmen Errekatzuetako Atxa (Zeanuri, Bizkaia) (Domínguez-Bella, 2012), clearly indicates the level of appreciation that Neolithic societies had for this material, which is clearly a prestige material exclusive to local elites.

In Northeast Spain, variscite beads have been found in certain tombs, sometimes dozens of them, because there are variscite geological deposits (Palaeozoic shale in Gava-Montcada) with a very well-organised mining operation in the Neolithic and a short distance from the “pit graves”, which explains the abundance of this material in these tombs and its presence in almost all of them. Thus, in this region of Spain, they would not have been considered rare and exotic raw materials. However, this was not the case in the Campo de Hockey site. All of the buried people in Catalonia would not necessarily be considered to have

belonged to privileged or aristocratic classes, quite unlike the situation in Campo de Hockey.

#### 4.3. Polished axes

Equally interesting is the presence of three polished stone axes, two of exceptional manufacture made of sillimanite, of the fibrolite variety (Fig. 9A), and both with a clearly allochthonous origin (of the total three axes located throughout the necropolis) and appearing in the two most notable tombs (E3 and E11 C15 C14) (Fig. 8: 1 and 2) (Vijande, 2011: 15). The absence, *a priori*, of traces of use (to be confirmed by functional studies) would suggest the votive character of these objects and their prestige value. The third axe is made from metamorphic rock, perhaps a type of amphibolite, with quartz, epidote and mica, in addition to amphibole, in this case a pargasitic hornblende (Fig. 8: 3).

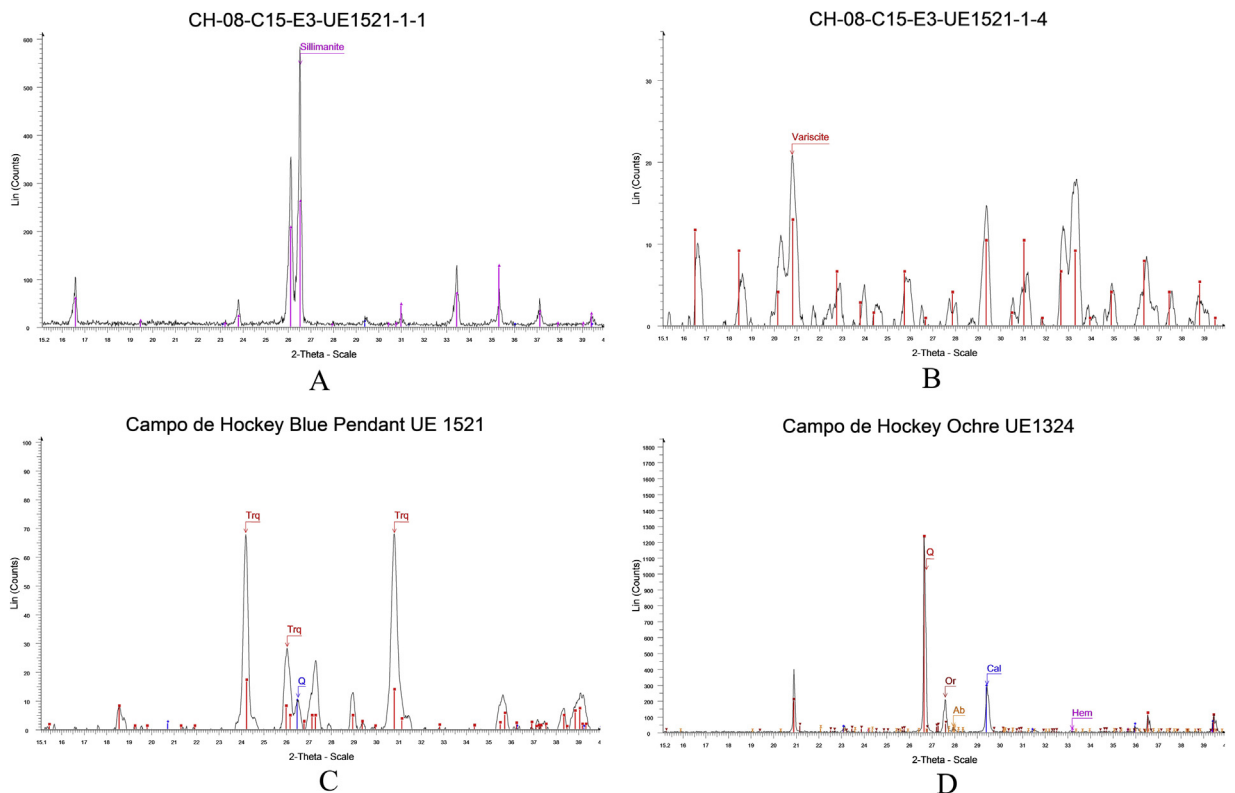
In addition to these three polished axes, which are clearly infused with symbolic content or prestige, a polished object made from black rock, consisting of an axe, has been recovered from the perimeter trench of the archaeological site, with the edge completely dulled by use, perhaps as a tool to percuss and construct the trench. The archaeometric analysis of this piece indicates a typical composition of a dolerite rock, consisting in: anorthite-type plagioclase, clinopyroxene of a pigeonite type and possibly quartz, such that it can be considered an evolved member of the ophite group (Portugal-Ferreira et al., 1995). This rock may have a local origin because there are outcrops of these doleritic lithology materials in the Subbetic region (Domínguez-Bella et al., 2008).

Regarding the knapped stone industry, we can only mention the presence, *in situ*, of two blades of flint in the burial E5 C12 (Fig. 8: 7). Based on their position, we conclude that the blades had handles, which have not been preserved, and that their owner would have held it them one of his hands. Because of the blades' size and the type of flint from which they were fashioned, we can affirm an allochthonous provenance from the Bay of Cádiz (Vijande, 2011: 20).

The presence of these exotic elements is indicative of the knowledge of basic navigational techniques of these societies. This settlement was settled on a strictly insular territory, distanced from the continent by several hundred metres. Sea navigation (Arteaga et al., 2008) must have been a routine activity for these communities to redistribute all types of products (not only exotic ones) (Vijande, 2009).

#### 4.4. Bone industry and seashells

In addition to these elements of prestige, in the necropolis, we have found several objects that we consider grave goods and that present a functional or ornamental character (Fig. 8: 5, 7, 8, 10–14). The bone needles localised *in situ* at the back of the skull of various individuals stand out quantitatively, and they can be associated with a head-dress (Vijande, 2011: 21). The needles present approximate dimensions of 8.5 × 0.3 cm and a circular cross-section (Fig. 8: 10). They have been documented in the following



**Fig. 9.** (Colour online.) X ray diffractograms of samples from grave goods of the Campo de Hockey necropolis. A. X-ray diffractogram of sillimanite axe. B. X-ray diffractogram of variscite necklace bead. C. X-ray diffractogram of turquoise pendant. D. X-ray diffractogram of red ochre from the C15 E10 double burial.

**Fig. 9.** (Couleur en ligne.) Résultats de la caractérisation minéralogique par diffraction X d'éléments du mobilier funéraire de la nécropole de Campo de Hockey. A. Diffractogramme X d'une hache en sillimanite. B. Diffractogramme X d'une perle de collier en variscite. C. Diffractogramme X d'un pendentif en turquoise. D. Diffractogramme X d'un ocre rouge provenant de la tombe double C15 E10.

burials: E7 C7 (1 needle) C9 E1 (2 needles *in situ*), C12 E5 (1 needle *in situ*), E2 C12 (2 needles), E11 C14 (5 needles), C15 E4 (9 needles *in situ*), and E10 C15 (5 needles *in situ*).

The presence in the burial E2 C13B of an elongated bone pendant perforated in its upper part with a bezel finish at its lower end is also significant (Vijande, 2011: 21) (Fig. 8: 8). The pendant has been documented, *in situ*, on the back of an individual infant and may have had a decorative or apotropaic function.

Equally interesting has been the discovery of a shell necklace in the burial E1 C17A (Fig. 8: 5). It is composed of five drilled specimens of the species *Zonaria pyrum* and finished by a perforated beach pebble (Vijande, 2011: 20; Cantillo, 2012). The necklace has been documented, *in situ*, around the neck of an individual infant, which suggests the importance of marine resources for this island community, both for food and ornamental purposes.

In this respect, attention is also drawn to the intentional deposit of some shells of malacological species, such as *Bolinus brandaris* (E6 C15) and *Osilinus lineatus* (E4 C15), which may be part of a type of funerary ritual or may highlight social aspects related to activities carried out during the residents' lifetime (Cantillo and Vijande, 2010; Cantillo, 2012). The appearance of these molluscs

demonstrates the existence of a clear relationship between these social groups and the sea, which is documented by a large amount of remains used for ornamental purposes but also as foodstuffs. The analysis of the remains has demonstrated the great taxonomic variability that existed when they were collected, highlighting the collection of bivalve species such as *Glycimeris glycimeris*, *Ruditapes decussatus*, *Solen marginatus*, *Venus verrucosa*, *Chlamys* sp., *Cerastoderma edule*, *Ostrea* sp., *Pecten maximus*, *Aequipecten commutatis*, *Acanthocardia tuberculata* and *Barbatia Barbata* and gastropods such as *Cerithium vulgatum*, *Osilinus lineatus*, *Osilinus turbinata*, *Bolinus brandaris*, *Hexaplex trunculus*, *Charonia lampas*, *Ocenebra erinacea*, *Stramonita haemastoma*, *Cymatium parthenopeum*, *Nassarius reticulatus*, *Patella* sp., *Patella ulyssiponensis*, *patella rustica*, *Conus mediterraneus* and *Columbella rustica*. Crustaceans were also identified, including *Balanus* sp. and *Brachyura* sp., as were the remains of a cephalopod of the species *Sepia* sp. (Cantillo, 2012).

#### 4.5. Ceramic and ochre

With respect to ceramics, we cite the documentation of up to three ceramic recipients deposited at the burials C13B E3, E4 and E11 C14 C13 (Fig. 8: 4, 6 and 9).



**Fig. 10.** (Colour online.) Detail view of the embraced couple popularly known as “the San Fernando lovers” in the C15 E10 double burial, Campo de Hockey necropolis.

**Fig. 10.** (Couleur en ligne.) Vue de détail du couple enlacé, connu généralement sous le nom de « San Fernando lovers » dans la tombe double C15 E10, nécropole du Campo de Hockey.

Certain types of organic content were likely deposited in their interior. In the E4 C3B burial, one of the arms of the buried, instead of climbing up the face, extends to the waist level, holding a small globular vessel with double drilling to the height of the edge. At E3 C13B, a ceramic vessel of globular morphology placed *in situ* in the hand of the deceased is documented. This vessel has two mamelons as decorative elements and an incised line marking on the neck. Finally, in the double burial C14 E11, we have located in a secondary position a complete ceramic vessel with two mamelons. This position is likely due to the removal suffered by the first individual to accommodate the second one (Vijande, 2011: 18).

Finally, we must mention the presence of red pigment (ochre) in the E10 C13A burial and the C15 E10 double burial (Fig. 10). Traditionally, a clear symbolic content has been attributed to this element, particularly iron ochre with a composition attributed to the presence of hematite (Domínguez-Bella, 2011), although other authors make a claim for antiseptic and deodorant use, especially in the case of cinnabar (Martín Gil et al., 1995). In this case, we have analysed the pigments of the double burial tomb, which have proved to be of hematite origin (Fig. 9: D).

## 5. Conclusions

The Campo de Hockey necropolis indicates a new type of funerary expression for the Neolithic period in the southern Iberian Peninsula. The presence of a large necropolis with individual burials (with some double or triple burials) and tombs of various types is a phenomenon unique for this region. Due to its special features, this Neolithic settlement has a high potential for the resolution of questions of great interest at this moment regarding the transition between the Vth and IVth millennia BC (territorialisation, sedentary village appearance, relations of filiation, the beginning of the social hierarchisation, etc.).

We were able to verify a direct relationship between the main funerary structures (C14 E11, E3 and E4 C15 C13) and the most valuable grave goods of the entire necropolis. In this respect, our attention is drawn to the exclusive presence of amber pendants in these remarkable tombs, which leads us to hypothesise that such graves belonged to the ruling classes. These amber pendants constitute prestige elements clearly linked to power. A similar situation occurs with votive polished axes and with variscite and turquoise beads that are documented almost exclusively in these funerary structures.

Archaeometric analyses of these grave goods elements have allowed us to determine the nature of the raw mineral materials used in their production and their allochthonous character, which reflects the existence of large distribution and exchange networks for these moments of the Prehistory of the SW Iberian Peninsula. In addition, the arrival of these exotic products in this island territory, within the Bay of Cádiz, demonstrates the practice of navigation by part of this community, a practice that would be equally exploited to perform productive tasks such as fishing.

Currently, we are conducting anthropological studies that, on the one hand, allow for the determination of the sex of individuals to identify possible gender differentiations at the spatial level in the necropolis and in relation to the type of graves and grave goods; on the other hand, these studies allow us to examine, through diet analysis, whether there is a correspondence between the differential access to prestige goods and the differential access to food resources.

Since the end of the Vth millennium BC, it has been observed that ownership of land (including hunting resources, fishing or shell-fishing areas, harvesting, etc.) began to be exercised by Neolithic societies. The Campo de Hockey settlement is a clear example of this trend; the archaeological record provides us with evidence of a predominance of productive practices (agricultural and livestock) over predatory practices (hunting, fishing and gathering), enabling the emergence of sedentary village lifestyles. We are witnessing the appearance of villages and the emergence among them of political relations and the exchange of raw materials or manufactured goods (Vargas, 1987). This settlement provides evidence of a definitive territorialisation of the group, and it will allow us to approach issues concerning possible new relations of production and reproduction based on lineage (Blasco et al., 2005; Shennan, 1987). We defend the hypothesis of a physical reproduction of the group (through exogamy) and

reproduction as owners of the land, where ownership would be inherited by their children. This territorialisation also guarantees exclusive access to the resources of its members (Vicent, 1991; Vijande, 2009, Pérez, 2003, 2005, 2008) and promotes the intensification of agricultural and livestock practices, which, in turn, will generate surpluses that will be controlled by a part of the community. These internal inequalities will be reflected in the presence or absence of prestige objects among grave goods and in the typology of the tombs.

### Acknowledgements

This study was partially supported by the I+D+I Spanish national research DGI project HAR2008-06477-C03-02/HIST, 'La implantación de las especies domésticas en la Europa Atlántica: Sociedades Neolíticas y uso de materias primas líticas en la región del Estrecho de Gibraltar', by the research group P.A.I. HUM-440 of the Junta de Andalucía government. Variscite and turquoise analysis was performed under the CALLAIS project, directed by S. Domínguez-Bella, with transnational access to the AGLAE facility of the C2RMF, Paris, France, provided in 2010 under the CHARISMA Cultural Heritage Advanced Research Infrastructures, 7th European Framework Program. Authorisation for the excavations was provided by the Andalusian government. Laboratory work was performed in the UGEAPHAM Archaeometrical Unit of the University of Cádiz and in the Municipal Museum of San Fernando, Cádiz. The authors are grateful to the two anonymous reviewers and editors for providing very helpful comments and suggestions. Finally, we thank Ms. Ana Durante for her editorial assistance and Max Luaces for the French translation.

### References

- Alonso, C., Gracia, F.J., Benavente, J., 2009. Evolución histórica de la línea de costa en el sector meridional de la Bahía de Cádiz. *Revista Atlántica-Mediterránea de Prehistoria y Arqueología Social* 11, 13–37.
- Arteaga, O., Cruz-Auñón, R., 1999. Una valoración del patrimonio histórico en el campo de silos de la finca El Cuervo-RTVA (Valencina de la Concepción, Sevilla). Excavación de urgencia de 1995. *Anuario Arqueológico de Andalucía, 1995 vol. III*, 608–616.
- Arteaga, O., Schulz, H., Roos, A.M., 2008. Geoarqueología Dialéctica en la Bahía de Cádiz. In: Arteaga, O., Schulz, H. (Eds.), *Geoarqueología y proceso histórico en la Bahía de Cádiz*. Revista Atlántica-Mediterránea de Prehistoria y Arqueología Social, 10, pp. 21–116.
- Bate, L.F., 1984. Hipótesis sobre la sociedad clasista inicial. *Boletín de Antropología Americana* 9, 47–87.
- Blasco, A., Edo, M., Villalba, M.J., 2005. Neolítico Avanzado y cambio cultural. Reflexiones sobre la complejidad de algunas sociedades neolíticas europeas. In: Arias, P., Ontañón, R., García-Moncó, R.C. (Eds.), *III Congreso del Neolítico en la Península Ibérica*. Cantabria, pp. 823–832.
- Cantillo, J.J., (Ph.D. Doctoral Thesis) 2012. Análisis arqueomalacológico del Abrigo y Cueva de Benzú (Ceuta). El aprovechamiento de los recursos acuáticos por sociedades prehistóricas en la región histórica del Estrecho de Gibraltar. Cadiz University.
- Cantillo, J.J., Vijande, E., 2010. Las conchas marinas como ajueres funerarios. Su utilización en la necrópolis neolítica de Campo de Hockey (San Fernando, Cádiz). *Revista Hades* 7, 29–30.
- Cassen, S., Pétrequin, P., Boujot, C., Domínguez-Bella, S., Guiavarc'h, M., M.P., Querré, G., 2011. Measuring distinction inside the architectures of the Carnac region: from sign to material. In: Müller, J., Furrholt, M. (Eds.), *Megaliths and Identities. Frühe Monumentalität und soziale Differenzierung*. Ed. Dr. Rudolf Habelt GmbH, pp. 225–248.
- Cassen, S., Boujot, C., Domínguez-Bella, S., Guiavarc'h, M., Le Pennec, C., Prieto Martínez, M.P., Querré, G., Santrot, M.E., Vigier, E., 2012. Dépôts bretons, tumulus carnacéens et circulations à longue distance. In: Pétrequin, P., Cassen, S., Errera, M., Klassen, L., Sheridan, A. (Eds.), *JADE. Grandes haches alpines du Néolithique européen. Ve et IVe millénaires av. J.-C. Collection Les cahiers de la MSHE Ledoux n° 17*. Série Dynamiques territoriales n° 6, tome 1, Chap. 16. Presses Universitaires de Franche-Comté n° 1224, pp. 918–995.
- Domínguez-Bella, S., 2004. Variscite, a prestige mineral in the Neolithic-Aeneolithic Europe. Raw material sources and possible distribution routes. *Slovak Geol. Mag.* 1-2, 151–158.
- Domínguez-Bella, S., 2011. Rojo y verde: los minerales en la vida y la muerte del megalitismo Neolítico. In: Barbeiro, V.J. (Ed.), *IV Encontro Arqueológico do Barbanza*. Centro Arqueológico de Barbanza y Universidad Santiago Compostela, Boiro, DVD n° 6. ISAN: 0000-0002-D41B-0000-P-0000-0000-0.
- Domínguez-Bella, S., 2012. Archaeomineralogy of prehistoric artifacts and gemstones. In: Herrero, J.M., Vendrell, M. (Eds.), *Archaeometry and Cultural Heritage: the Contribution of Mineralogy*. Seminarios SEM, Vol. 9. Sociedad Española de Mineralogía, Madrid, 112 p. ISSN 1698-5478, pp. 5–28.
- Domínguez-Bella, S., Morata Céspedes, D., 1995. Aplicación de las técnicas mineralógicas y petrológicas a la arqueometría. Estudio de materiales del dolmen de Alberite (Villamartín, Cádiz). *Zephyrus XLVIII*, 129–142.
- Domínguez-Bella, S., Álvarez, M.P., Ramos, J., 2001. 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: Gomez, B., et al. (Eds.), *II Congreso Nacional de Arqueometría*, pp. 621–630.
- Domínguez-Bella, S., Morata, D., De La Rosa, J., Ramos, J., 2002. Neolithic trade routes in SW Iberian Peninsula? Variscite green beads from some Neolithic sites in the Cádiz province (SW Spain): raw materials and provenance areas. In: *Proceedings of 32 International Symposium on Archaeometry*. México D.F. 2000, Electronic Book. Universidad Nacional Autónoma de México, México D.F.
- Domínguez-Bella, S., Ramos, J., Pérez, M., 2008. Productos arqueológicos exóticos en los contextos de los yacimientos prehistóricos de la Banda Atlántica de Cádiz. Inferencias de su documentación. In: Ramos, J. (Ed.), *La ocupación prehistórica de la campiña litoral y banda atlántica de Cádiz. Aproximación al estudio de las sociedades cazadoras-recolectoras y tribales-comunitarias y clasistas iniciales*. Junta de Andalucía, Sevilla, pp. 213–230.
- Guilaine, J., 2002. Matériaux, productions, circulations du Néolithique à l'Âge du Bronze. Errance, Paris.
- Lull, V., Picazo, M., 1989. Arqueología de la muerte y estructura social. *Archivo Español de Arqueología* 62, 5–20.
- Martín Gil, J., Martín Gil, F., Delibes De Castro, G., Zapatero Magdaleno, P., Sarabia, F.J., 1995. The first known use of vermillion. *Experientia* 51, 759–761.
- Molina, F., Cámara, J.A., López Sáez, J.A., 2012. Andalucía. In: Rojo, M.A., Garrida, R., García Martínez de Lagrán, I. (Eds.), *El Neolítico en la Península Ibérica y su contexto europeo*. Editorial Cátedra, Madrid, pp. 405–462.
- Nocete, F., 1989. El espacio de la coerción. La transición al estado en las campinas del Alto Guadalquivir (España). 3000–1500 a.C. *Bar International Series*, 492, Oxford.
- Nocete, F., 2001. Tercer milenio antes de nuestra era. Relaciones y contradicciones centro/periferia en el Valle del Guadalquivir. Barcelona.
- Pérez, M., [PhD thesis] 2003. Primitivas comunidades aldeanas en Andalucía. Universidad de Cádiz.
- Pérez, M., 2005. Sociedades cazadoras-recolectoras-pescadoras y agricultoras en el Suroeste: una propuesta para un cambio social. *Arqueología y Territorio* 2, 153–168.
- Pérez, M., 2008. Sociedades tribales y modo de reproducción. Cuestionamientos al registro arqueológico del suroeste. In: Escoriza, T., López, J.M., Navarro, A. (Eds.), *Mujeres y arqueología. Nuevas aportaciones desde el materialismo histórico. Homenaje al profesor Manuel Carrilero Millán*, pp. 157–194.
- Portugal-Ferreira, M., Morata, D., Puga, E., Demant, A., Aguirre, L., 1995. Evolución geoquímica y temporal del magmatismo básico Mesozoico en las zonas externas de las cordilleras béticas. *Estudios Geol.* 51, 109–118.
- Querré, G., Domínguez-Bella, S., Cassen, S., 2012. La variscite ibérique. Exploitation, diffusion au cours du Néolithique. In: Querré, G., Marchand, G. (Eds.), *Roches et Sociétés de la Préhistoire. Entre massifs cristallins et bassins sédimentaires. Le nord-ouest de la France dans son contexte européen*. Presses Universitaires de Rennes (PUR), Rennes, pp. 307–315.
- Ramos, J., 2008. La ocupación prehistórica de la campiña litoral y banda atlántica de Cádiz. Aproximación al estudio de las sociedades

- cazadoras-recolectoras y tribales-comunitarias y clasistas iniciales. *Arqueología Monografías*. Junta de Andalucía, Sevilla.
- Ramos, J., Giles, F., 1996. El dolmen de Alberite (Villamartín). Aportaciones a las formas económicas y sociales de las comunidades neolíticas en el NW de Cádiz. *Serv. Pub. Universidad de Cádiz*.
- Shennan, S.J., 1987. Trends in the study of later European prehistory 16. *Cota Zero* 5, 91–101.
- Sttip, J.J., Tamers, M.A., 1996. Dataciones absolutas. In: Ramos Muñoz, J., Giles Pacheco, F. (Eds.), *El dolmen de Alberite (Villamartín). Aportaciones a las formas económicas y sociales de las comunidades neolíticas en el NW de Cádiz*. *Serv. Pub. Universidad de Cádiz (Spain)*, pp. 179–186.
- Testar, A., 2004. *Les morts d'accompagnement. La servitude volontaire I, II*. Éditions Errance.
- Vargas, I., 1987. La formación económico social tribal. *Boletín de Antropología Americana* 15, 15–26.
- Vicent, J.M., 1991. El neolítico: transformaciones sociales y económicas. *Boletín de Antropología Americana* 24, 29–36.
- Vijande, E., 2009. El poblado de Campo de Hockey (San Fernando, Cádiz): resultados preliminares y líneas de investigación futuras para el conocimiento de las formaciones sociales tribales en la Bahía de Cádiz (tránsito V-IV milenios a.n.e.). *Revista Atlántica-Mediterránea de Prehistoria y Arqueología Social* 11, 265–284.
- Vijande, E., 2010. Formaciones sociales tribales en la región histórica del Estrecho de Gibraltar (VI-IV milenios a.n.e.). Los ejemplos de la Cueva de Benzú (Ceuta) y el asentamiento de Campo de Hockey (San Fernando, Cádiz) [Ph.D. Tesis Doctoral].
- Vijande, E., 2011. La necrópolis neolítica de Campo de Hockey. La muerte hace seis mil años en la Isla de San Fernando. Catálogo de los materiales expuestos en el Museo Histórico Municipal de San Fernando. Fundación Municipal de Cultura. Ayuntamiento de San Fernando.
- Zazo, C., Goy, J.L., García De Domingo, A., González, J., Hernáiz, P.P., 1987. San Fernando. Mapa Geológico de España. I.G.M.E. Hoja 11-46. E. 1: 50.000. Madrid.