

# Early Neolithic ritual funerary behaviours in the Westernmost regions of the Mediterranean: new insights from Dehesilla Cave (southern Iberian Peninsula)

Daniel García Rivero<sup>1,2,3</sup>, Ruth Taylor<sup>1,2,3</sup>, Cláudia Umbelino<sup>3,2</sup>, Miriam Cubas<sup>4</sup>,  
María Barrera Cruz<sup>5,1</sup>, and Manuel J. Díaz Rodríguez<sup>1</sup>

<sup>1</sup> Department of Prehistory and Archaeology, University of Seville, Seville, ES  
garciarivero@us.es; ruth.taylor@hotmail.com; mdrodriguez@us.es

<sup>2</sup> Interdisciplinary Center for Archaeology and Evolution of Human Behavior, University of Algarve, Faro, PT

<sup>3</sup> Research Centre for Anthropology and Health, Department of Life Sciences, University of Coimbra, Coimbra, PT  
umbelino@antrop.uc.pt

<sup>4</sup> Department of History, University of Oviedo, Oviedo, ES; mcubas.morera@gmail.com

<sup>5</sup> Department of Prehistory, Archaeology and Ancient History, University of Valencia, Valencia, ES  
bacruzma@uv.es

**ABSTRACT** – *An intact archaeological context named Locus 1 has recently been discovered at Dehesilla Cave (southern Spain). The ritual funerary deposition consists of a complete pottery jar with part of a human calvarium over the mouth, and was occulted by large stone blocks. This paper offers a presentation of the new data provided mainly by the stratigraphic, osteological, pottery, lithic and radiocarbon analyses. A systematic review of the relevant evidence in the Iberian Peninsula during the Early Neolithic (c. 5600–4800 cal BC) provides a context for this finding and supports its interpretation with reference to several possible anthropological scenarios.*

**KEY WORDS** – *Neolithic; ritual; human skull; pottery jar; residue analysis*

## **Zgodnje neolitski pogrebni obredi v najbolj zahodnih regijah Sredozemlja: nova spoznanja iz jame Dehesilla (južni Iberski polotok)**

**IZVLEČEK** – *Nedavno so v jami Dehesilla (južna Španija) odkrili nepoškodovan pogrebni kontekst Locus 1. Gre za v celoti ohranjen keramičen lonec z delom človeškega lobanjskega svoda nad usti, ki je bil prekrit z večjimi kamnitimi bloki. V prispevku predstavljamo nove podatke, ki smo jih pridobili na podlagi stratigrafske in osteološke analize, analize keramike in kamnitih orodij ter z radiokarbonskim datiranjem. Najdbo postavljamo v kontekst s pomočjo sistematičnega pregleda relevantnih podatkov iz zgodnjega neolitika (ok. 5600-4800 pr. n. št.) na Iberskem polotoku in podpremo interpretacijo s sklicevanjem na različne možne antropološke scenarije.*

**KLJUČNE BESEDE** – *neolitik; obred; človeška lobanja; keramični lonec; analiza ostankov hrane*

## Introduction

Neolithic funerary practices in the Iberian Peninsula have caught the attention and interest of many archaeologists (e.g., Bernabeu et al. 2001; Rubio 2001; Pascual 2002; Gibaja 2004; Chambon 2008; Jiménez-Brobeil 2009; Bernabeu 2010; Carrasco et al. 2010; Pérez-Fernández, Soler 2010; Garrido-Pena et al. 2012; Alonso, Jiménez-Echevarría 2015; Rojo et al. 2016) as an empirical record of particular importance, as a direct means of approach to the populations of the past and, especially, to their symbolic and ritual behaviours.

In recent years, an increase can be observed in the archaeological evidence related to funerary practices during the Early Neolithic, c. 5600–4800 cal BC, in the Iberian Peninsula. A major body of information comes from cave sites in which disarticulated or isolated human bones are commonly found alongside other artefactual and faunal remains, admittedly as the probable result of complex cultural and post-depositional processes. When present, inhumations are usually individual, although several burials may be placed in the same area. There are also some unusual cases of secondary burials and rare multiple graves. For the same period, a smaller number of burials are known at open-air sites, where they tend to belong to individual and very rarely multiple inhumations inside pits within the living areas. The articulated bodies are generally placed in a flexed lateral decubitus position, with variable assemblages of grave goods or accompaniments, essentially of pottery, stone tools, worked bone, shell elements, and faunal remains (Garrido-Pena et al. 2012:145–147).

Dehesilla Cave (Cueva de la Dehesilla), located in the foothills of the Sub-Baetic System in southwestern Spain (Fig. 1), holds one of the oldest and richest Neolithic funerary records known in the Iberian Peninsula, although apparently unevenly distributed within the cave. The excavations carried out in 1977 and 1981 documented a series of burials (c. 8) attributed to the Early Neolithic (Acosta, Pellicer 1990) (extended information is provided in the Discussion), while the excavation of Area C003 during the 2016 field season (García-Rivero et al. 2018a) documented only a few isolated human bones in the Early Neolithic levels.

Another ritual funerary context named Locus 2 has been published recently, but belongs to a later archaeological period, namely the Middle Neolithic (García-Rivero et al. 2020).

During the archaeological excavation of Area C006 in 2017, a depositional context was discovered located in one of the innermost chambers of the cave, identified as Unit 10-Locus 1 (hereafter, Locus 1). This find takes on particular interest and importance, not only because of its singularity but also because it offers a unique opportunity to learn more about the ritual and funerary behaviours of the communities of the second half of the 6<sup>th</sup> millennium cal BC in the Iberian Peninsula.

The aim of this paper is thus twofold: first, to present the new finding documented at Dehesilla Cave, supported by a wide range of data provided by the technical means available today in archaeology; and second, to place this ritual funerary deposition within the broader context of the contemporaneous and comparable data known at present in the Iberian Peninsula. This comparative approach enables not



**Fig. 1. Location of Dehesilla Cave (Theme map: <https://www.naturalearthdata.com/> and [http://www.juntadeandalucia.es/insti\\_tutodeestadisticaycartografia](http://www.juntadeandalucia.es/insti_tutodeestadisticaycartografia)).**

only a systematic review of the current evidence, but also supports the formulation of a likely interpretation for the new archaeological context presented here. Moreover, it will enable us to highlight the singular characteristics of the Dehesilla Cave, Locust 1 deposition, and to shed new light on the ritual funerary behaviours during the Early Neolithic period in the Iberian Peninsula.

## Materials and methods

### Archaeological excavation

The unpublished context and data presented here are provided by the recent excavations carried out at Dehesilla Cave, and more specifically by the second excavation season, in 2017, and the work carried out in Area C006 located in Room 4, one of the innermost chambers of the cave (Fig. 2). The location of C006 coincides with an area in which the surface sheet of flowstone was broken and absent (Unit 0) and the irregular shape of the trench corresponds exactly with its limit. The excavated area is approx. 5m<sup>2</sup>, with a length of 5m running parallel to the west wall of the cave and a width of 1m. The excavation confirmed that only the upper levels immediately beneath the flowstone sheet were affected by recent human and animal activities. The excavation proceeded with great care, paying particular attention to the definition of the contacts between stratigraphic units (Harris 1991). The elements associated with the deposition were clearly identified and documented, and all of the archaeological materials and samples were recorded accordingly. The location of the archaeological features and finds was recorded in the field using total stations and laptops with EDM Mobile software (Dibble, McPherron 2010). The sediment was screened and a stable proportion was processed by flotation. Unprocessed samples were set aside for further analyses.

### Human remains

The human remains were analysed with the naked eye, with a magnifying glass (10x) and a Dino-Lite Edge Digital Microscope with a 30x to 70x magnification range. The state of preservation was assessed according to Jane E. Buikstra and Douglas H. Ubelaker (1994). Sex diagnosis, in one

case, was based on the maximum length of the talus, following Silva (1995). The estimation of age at death considered the traits recommended by Louise Scheuer and Sue Black (2000) for the non-adult individual, while the closure of the cranial suture of the adult individual was assessed according to Claude Masset (1989). Dental wear was described following Holly B. Smith (1984).

### Pottery analysis

The methods applied in the pottery analysis (Shepard 1956; Sinopoli 1991; Orton, Hughes 2014; Rice 2015; Hunt 2016) aimed to assess and reconstruct the probable nature of the depositional and taphonomic processes behind the creation of the assemblage under study, and to enable the typological (formal and decorative) characterisation of the ceramic materials. The quantification of the number of pottery fragments and the individual measurement of their size and weight helped to establish a series of reference values for the fragmentation of the deposit. After initial descriptive statistics, size was finally retained as the most appropriate proxy variable for the state of fragmentation. An exercise in cross-fitting was also completed, with the specific purpose of identifying sherds belonging to the same pots, with or without a direct physical connection.

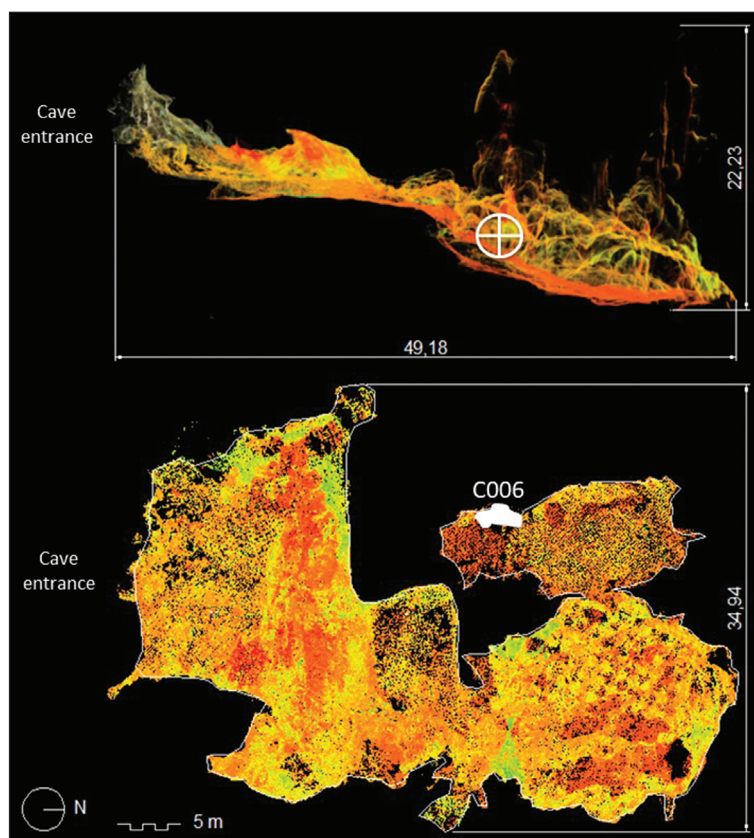


Fig. 2. Location of excavation area C006 on the 3D model of the cave.

Organic residue analysis was carried out on four pottery samples. The method applied focused on the organic residues absorbed by the clay matrix. Lipids were extracted following established protocols of one-step extraction and methylation with acidified methanol (Craig et al. 2011; Correa-Ascencio, Evershed 2014). Gas Chromatography-Flame Ion Detection (GC-FID) and Gas Chromatography-Mass Spectrometry (GC-MS) were used for all samples (Appendix 1). High Temperature Gas Chromatography-Mass Spectrometry (HTGC-MS) and Gas Chromatography-Combustion Isotope Ratio Mass Spectrometry (GC-C-IRMS) were applied on the single successful sample after the previous methods (Appendix 1). Stable carbon isotope values of methyl palmitate (C<sub>16:0</sub>) and methyl stearate (C<sub>18:0</sub>), as derived from precursor fatty acids, were measured by GC-C-IRMS, following existing procedures (Craig et al. 2012). The isotopic values of the main fatty acids (palmitic and stearic) were compared with compiled data from ruminant and non-ruminant adipose, and dairy and marine derived fatty acid resources throughout Europe (Appendix 2).

### **Lithics**

The stone tools were counted and analysed in two main groups: knapped and ground stone. The study of the knapped materials followed the Georges Laplace's (1966) analytical typology for retouch and extraction techniques, while the characterisation of particular technical attributes was complemented by the classification put forward by Bernaldo-Quirós *et al.* (1981). The metric description of the material was based on Bernardino Bagolini (1968). Backing, patina and macroscopic use-wear was determined by observation with a 20x magnifying glass. The typotechnological analysis followed the main syntheses

and terminological proposals for the western (Carvalho 1998; Carvalho, Gibaja 2005), southern (Martínez-Fernández, Afonso 2008) and eastern (Juan-Cabanilles 2008) regions of the Iberian Peninsula.

### **The archaeological deposit Locus 1**

#### ***Archaeological context***

Area C006 provides valuable information on the depositional processes of Room 4 (Fig. 3), the innermost and furthest chamber from the present-day mouth of the cave. The excavation documented a complete stratigraphic sequence and has made possible a number of observations regarding the nature and use of this part of the cave.

The surface level is constituted by a sheet of flowstone (Unit 0) with microgours and a thickness between 5 and 20cm. Underneath the flowstone the sequence includes several thick layers, which appear to correspond to natural depositional events in which rocks, sediments and water may have been carried down from Room 2 or, possibly, through cracks and chimneys in the roof of the cave. These levels display a descending south to north slope, *i.e.* from the hillside to the interior of the cave, and form a wedge-shaped accumulation in the southern half of the room. The anthropic sequence is formed by a number of levels defined on the basis of their stratigraphic characteristics and archaeological materials, belonging to different Neolithic periods (Fig. 4). This sequence spans (from top to bottom) from Late Neolithic (units 0, 1 and 4), Middle Neolithic B (units 5, 6 and 6b), Middle Neolithic A (units 7, 9, Structure 1 and Locus 2), to Early Neolithic (Locus 1 and units 8, 11, 12 and 13). The upper level (Unit 8) of the Early Neolithic sequence displays a marked

south to north descending slope, and contains numerous medium to large limestone blocks, some up to 70cm, possibly linked to rock fall and/or torrential events, and abundant archaeological materials.

During the formation of Unit 8, or soon after, an anthropic depositional event took place (Figs. 5 and 6.a). Locus 1 is therefore partially encased within Unit 8, although in proximity to its upper contact. The archaeological materials documented in Unit 8 are dated to the Early Neolithic, as are those of the depositional event. The deposition consists of a pottery vessel



**Fig. 3. Panoramic view from the centre to the South of Room 4.**

(No. C006-244) (Fig. 6.b) placed upright, surrounded by small stones, devoid of sediment but containing a light-coloured crust (Fig. 6.c). The mouth of the jar was covered by part of a human calvarium, and other isolated human remains were found among the packing stones. Finally, it was covered by a number of larger blocks, resting on a ring of medium-sized stones placed for this purpose around the mouth of the jar and supporting a final limestone capstone. This deposition may have involved the excavation of a small negative feature, not detected between the packing materials and the surrounding sediment.

### The human remains

The human cranium covering the mouth of the pottery vessel is represented by the posterior portion of the frontal bone and the anterior portion of the right and left parietal bones (Fig. 7.a), with an antero-posterior measurement of 180mm and medio-lateral of 130mm. The endocranial surface was facing down, and the frontal bone was oriented to the north.

This calvarium belonged to an adult, most probably of more than 45 years of age, based on the Stage 3 closure of the observed portions of coronal and sagittal sutures. Sex could not be determined since cranial thickness, which is average, was the only trait that could be assessed, therefore not permitting a reliable diagnosis.

The ectocranial surface displays two linear marks on the right side of the frontal bone (Fig. 7.b), both running perpendicular to the sagittal line, approx. 45 and 47mm from the coronal suture. With a length of

20 and at least 30mm, these marks are 2 to 3mm apart, almost parallel to each other. They are narrow and shallow, and display smooth (not jagged) sharp (well-defined) edges, a V-shaped cross-section and micro-striations (Fig. 7.c). The absence of bone remodelling indicates their *peri-* or *post-mortem* timing.

Several traits support the *peri-mortem* and anthropogenic nature of these marks. The colouration of the incisions, similar to the rest of the bone surface, points to marks made only a short time after death, while the bone still preserved all of its biomechanical properties. In contrast, *post-mortem* marks with a recent origin would be light in colour and have jagged edges (Buikstra, Ubelaker 1994; White et al. 2012; Gresky et al. 2017). Vascular impressions and markings from plant roots can be excluded due to the straight, linear and parallel aspect of the marks, and the presence of micro-striations. Trampling may also produce shallow striations but is expected to create marks with a random orientation (White et al. 2012). The tooth marks made by carnivores are known to display a typical pattern of pitting, scoring and puncturing, particularly on the trabecular extremities of long bones (Buikstra, Ubelaker 1994; White et al. 2012). However, they may also produce parallel grooves with different cross-sections depending on the tooth cusp (Shipman 1981), which are more difficult to distinguish from intentional marks. Rodent gnawing may also result in shallow, parallel or sub-parallel grooves, usually on bony prominences (Buikstra, Ubelaker 1994; White et al. 2012). Yet, the marks produced by carnivores and rodents are square bottomed in section (Shipman 1981; Buikstra, Ubelaker 1994; White et

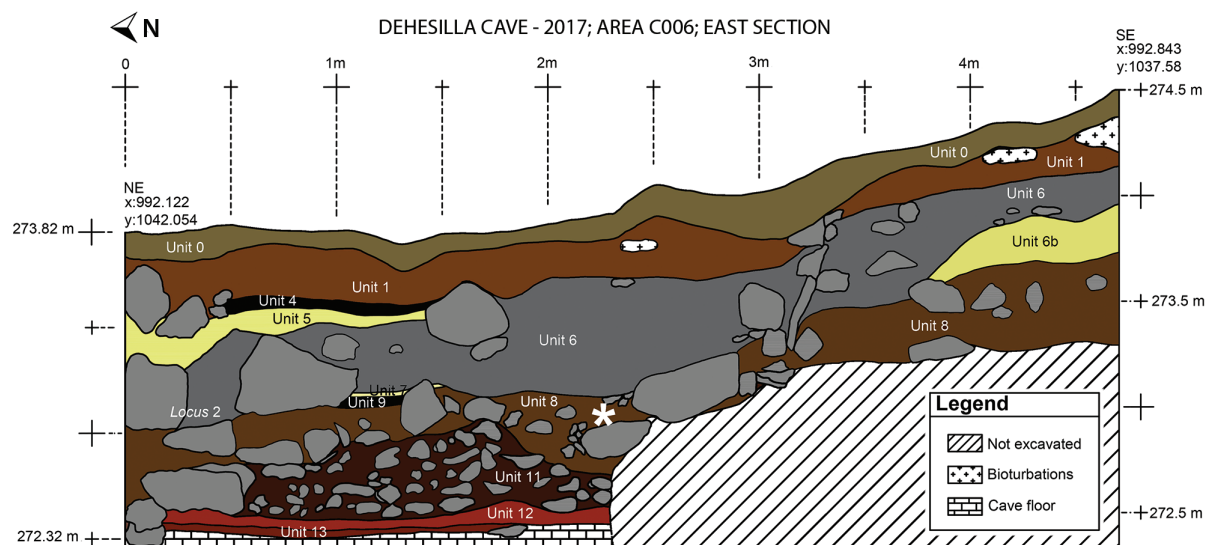
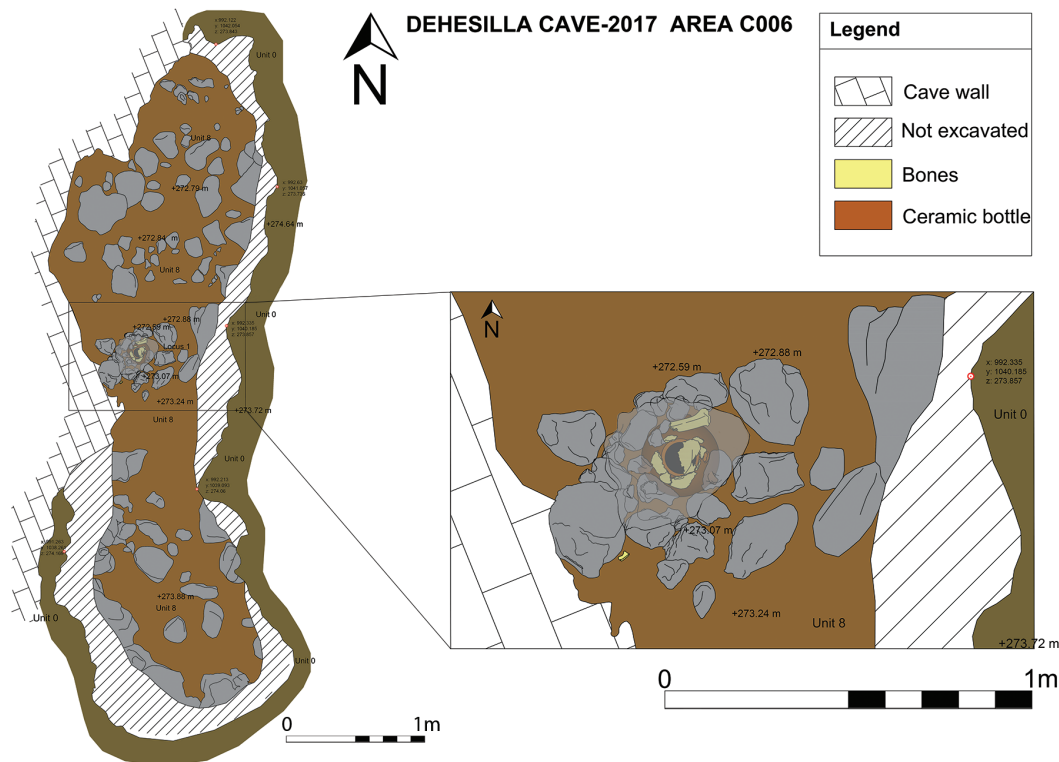


Fig. 4. East section of C006 (the white asterisk indicates the location on the section nearest to Locus 1).



**Fig. 5.** Plan of the stratigraphic phase corresponding to Locus 1.

al. 2012), a trait that is not observed in this case. The linear and parallel placement, the smooth edges and V-shaped cross-section, and the presence of micro-striations on the Locus 1 cranium are, therefore, strong evidence of the peri-mortem anthropogenic origin of the marks and are indicative of the use of a stone tool (Shipman 1981; Bello et al. 2016; Santana et al. 2019).

In addition to the cranium, another seven human bones and one tooth were recovered from Locus 1 (Tab. 1, Figs. 8 and 9). Sex determination and estimation of age at death were only possible in two cases. The complete talus (DH17-6-Locus 1-3), with a maximum length of 47.28mm, is consistent with a female individual. The thoracic vertebral neural arch (DH17-6-Locus 1-2) does not display the neuro-central fusion that usually takes place by the age of 6 (Scheuer, Black 2000), thus providing an upper age limit, while the lower age limit is provided by the fusion of the posterior synchondrosis that usually occurs by the age of 2 years (Scheuer, Black 2000). The thoracic vertebral neural arch may therefore be attributed to a child between the age of 2 and 6 years.

The poor preservation of the rest of the osteological material, characterised by small bone fragments representing less than 25% of the skeletal element,

does not provide any further reliable information pertaining to sex and age at death, other than their belonging to adult individuals. The small size of the medial condyle of the femur may indicate a female or an adolescent individual. The same observation is valid for the scapula fragment from the region of the right glenoid cavity which, although incomplete, points most probably to a female. The only tooth recovered, a left mandibular first premolar, displays Grade 4 occlusal dental wear, according to Smith's (1984) classification.

With the exception of the thoracic vertebra from a non-adult individual, all of the other bones and the tooth could eventually belong to the same adult individual. The minimum number of individuals represented in Locus 1 would therefore be two and the maximum number eight, in the case that all of the elements belonged to different individuals. Only DNA analysis may, in time, shed light on this question. In any case, it is not clear beyond doubt that the fragmentary human remains, with the exception of the calvarium, were introduced intentionally in the deposition.

### Pottery

The complete pottery jar (C006-244) deposited in Locus 1 is an ovoid form with a restricted neck and a simple rim, belonging to the type known as ampho-

roid or *botella* in common typologies (Llobregat 1973; Bernabeu 1989). Its surfaces are smooth, undecorated, with three approximately equidistant handles located on the gentle shoulder. It is slightly asymmetrical in the areas of the rim, neck and height of the handles (Fig. 10). The preservation of the base was compromised and could not be physically reconstructed, thus the curvature of the base and height of the vessel are estimated on the basis of the known parameters.

In addition to this complete jar, there is an assemblage of 50 pottery fragments with a total weight of 560g (Fig. 9). No sherds belonging to the same pots, with or without a direct physical refit, were identified.

This is, therefore, a very strong suggestion that each pottery record of the Locus 1 fragmentary assemblage belongs to a different vessel, thus indicating a large number of pots although represented only by single and small fragments ( $T = 3.7\text{cm}$  maximum axis).

This pattern of fragmentation and representation is in complete contrast to the physical integrity of the jar included as a central element of the deposition, thus supporting the reconstruction of a depositional event in which a single and complete pottery vessel was carefully placed. On the grounds of these observations, it is probable that the fragmentary pottery assemblage associated with Locus 1 may form part of the context merely as a component of the fill of the negative feature surrounding the deposited jar, that is as an incidental inclusion in the packing material.

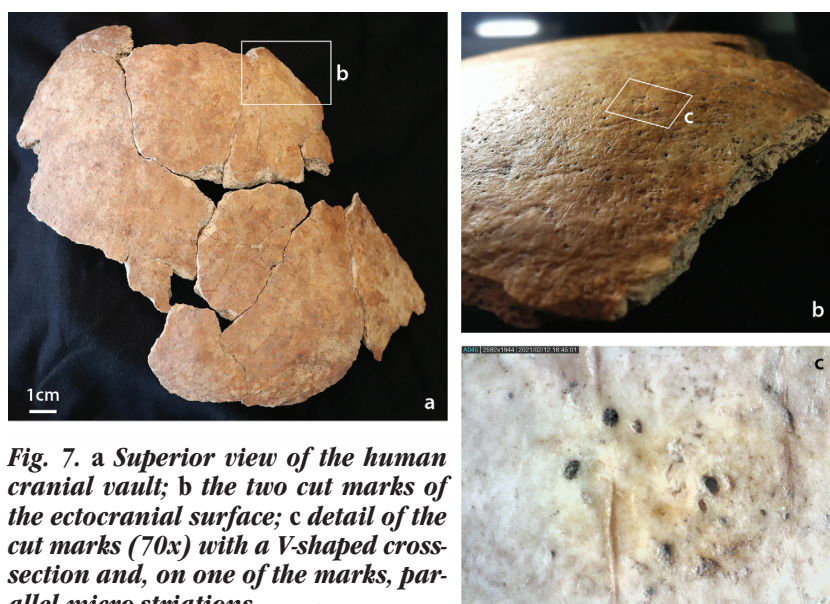
The characteristics of the fragmentary pottery assemblage display strong affinities with the pottery record of Unit 8 in which the deposition was made. The formal and technological traits and the presence of characteristic decorative techniques place the context in an advanced Early Neoli-



**Fig. 6.** a Locus 1 after removing the large limestone cover stone; b section of the deposition after the excavation of its northern half; c remains of a white crust inside the jar.

thic horizon, with a particularly noteworthy presence of impressed and 'almagra' wares (Fig. 11) (Navarrete 1976; Navarrete, Capel 1980; Bernabeu 1989; Acosta, Pellicer 1990; Capel et al. 2006; Pardo-Gordó et al. 2021). Applied decoration is documented in a single case in the form of a finger-impressed cordon. Incised decoration is also present, and is exclusively linked to slipped wares, mainly to the bright red 'almagra' pottery and secondarily to those of dull brownish hue.

There are eight fragments (all undecorated) with physical evidence of alteration from direct contact with heat sources, during long periods of time and/



**Fig. 7.** a Superior view of the human cranial vault; b the two cut marks of the ectocranial surface; c detail of the cut marks (70x) with a V-shaped cross-section and, on one of the marks, parallel micro-striations.

or with low oxygen levels. Fragment ID-10 (C006-188) also preserves a carbonized residue and has been sampled for organic residue analysis (see below). The observed effect is the reduction-carbonization of the wall of these fragments from the internal surface of the vessel. This may indicate their use as fire holders or lamps, although not necessarily linked to the ritual deposition but explained more broadly by the location and conditions of the inaccessible chamber.

### Organic residue analysis

Three samples from the pottery jar with visible remains of a white crust, and one sample from the above-mentioned fragment with carbonized residue, were analysed. Interpretable amounts of lipids ( $>5\mu\text{g/g}$ ) were obtained from two samples (Tab. 2). However, in one of these cases the value is very close to the threshold. Low lipid preservation in the analysed samples is in accordance with other studies undertaken in the Mediterranean and southeastern Europe (Evershed et al. 2008; Spiteri et al. 2016). Just one sample LD-10 (the pottery sherd with carbonized residue, not the amphoroid jar) met the criteria in order to carry out further analysis by GC-MS and GC-C-IRMS.

The molecular composition is formed by a distribution of saturated fatty acids ( $\text{C}_{14:0}$  and  $\text{C}_{26:0}$ ), unsaturated fatty acids ( $\text{C}_{16:1}$ ,  $\text{C}_{18:1}$ ,  $\text{C}_{22:1}$ ) and  $\text{C}_{23}$  alkane (Fig. 12). However, this molecular composition is limited due to the absence of specific sterols or molecular biomarkers. For that reason, we carried out the isotopic analysis ( $\delta^{13}\text{C}$ ) of the two main saturated fatty acids ( $\text{C}_{16:0}$  and  $\text{C}_{18:0}$ ) to distinguish the resource type in comparison with modern authentic fats. As well as absolute ranges, ruminant adipose, ruminant dairy and porcine fats are distinguished according to differences in the carbon isotope values



Fig. 8. Assemblage of human remains from Locus 1.

between the two main fatty acids ( $\Delta^{13}\text{C} = \delta^{13}\text{C}_{\text{C}_{18:0}} - \delta^{13}\text{C}_{\text{C}_{16:0}}$ ) (Copley et al. 2002).

Comparison of isotopic values ( $\delta^{13}\text{C}_{\text{C}_{16:0}}$ :  $-30.45$  and  $\delta^{13}\text{C}_{\text{C}_{18:0}}$ :  $-30.94$ ;  $\Delta^{13}\text{C}$ :  $0.49$ ) with modern European reference fats and oils (Appendix 2) suggests that the pottery vessel was probably used in the processing of mixed ruminant and non-ruminant animal resources. However, due to the low specificity of the chromatogram and the absence of any molecular biomarkers, this interpretation is based only on the isotopic signal of the palmitic and stearic acids. The result from sample LD-10, belonging to an indeterminate pottery form, is in accord with the pattern observed recurrently in the use of the

Specimen numbers	Skeletal elements	Side	Completeness	Age	Sex
DH17-6-Locus 1-2	Vertebral arch of a thoracic vertebra	–	100%	Non-adult	–
DH17-6-Locus 1-3 (C006-228)	Talus	Left	100%	Adult	Female
DH17-6-Locus 1-4 (C006-197)	Femur medial condyle	?	< 25%	Adult	Unknown
DH17-6-Locus 1-5 (C006-218)	Femur fragment from the anterior region	?	< 25%	Adult	Unknown
DH17-6-Locus 1-6 (C006-217)	Parietal bone (from the region of the sagittal suture)	?	< 25%	Adult	Unknown
DH17-6-8-8 (C006-249)	Tibia (proximal half of the anterior and posterior region of the shaft)	Left	25–75%	Adult	Unknown
DH17-6-8-10 (C006-251)	Lower first premolar tooth	Left	100%	Adult	Unknown
DH17-6-10-1	Scapula fragment from the region of the glenoid cavity	Right	< 25%	Adult	Female?

Tab. 1. Human remains recovered from Locus 1.

earliest pottery of the Atlantic facade of the Iberian Peninsula (Cubas et al. 2020).

**Lithics**

Locus 1 yielded a total of eight lithic elements, seven knapped and one ground (Tab. 3 and Fig. 9). The first group includes tools – blades and flakes with and without retouch – and reduction products. The second group contains only one element, identified as a fragment of a pebble used as a hammer stone as indicated by the surface scars (Fig. 13.L1-7).

The knapped lithic elements are made out of grey (3), beige (3) or brown (1) flint, and correspond to four blades, two flakes and one undiagnostic reduction flake. In addition to the traits described below, flat (2) and pointed (1) platforms and proximal truncation (2) are also documented. There is one case of a third extraction cortex and two cases of heat treatment, with and without the creation of thermal domes.

Among the tools, a sickle blade with a faceted proximal platform and abrupt, deep, and partially continuous distal retouch (Fig. 13.L1-4) and a mesoproximal blade fragment with a dihedral platform (Fig. 13.L1-1) are noteworthy, as they also display use-wear patina. The traceological analysis currently in progress on part of the Dehesilla Cave lithic assemblage confirms that the wear on the sickle blade is consistent with the cutting of cereals, with striations and abrasions in the form of pecking due to the cutting of stalks close to the ground. This type of element is similar to those documented in other Andalusian Neolithic caves, such as El Toro, Nerja, Murciélagos de Zuheros or the sites of Bajondillo and Los Castillejos (Ibáñez, González 1996; Rodríguez 2004; Carvalho et al. 2012; Perales et al. 2015).

The second element with use-wear is a fragment of a blade with a very sharp edge without retouch that, according to the traceological analysis, seems to have

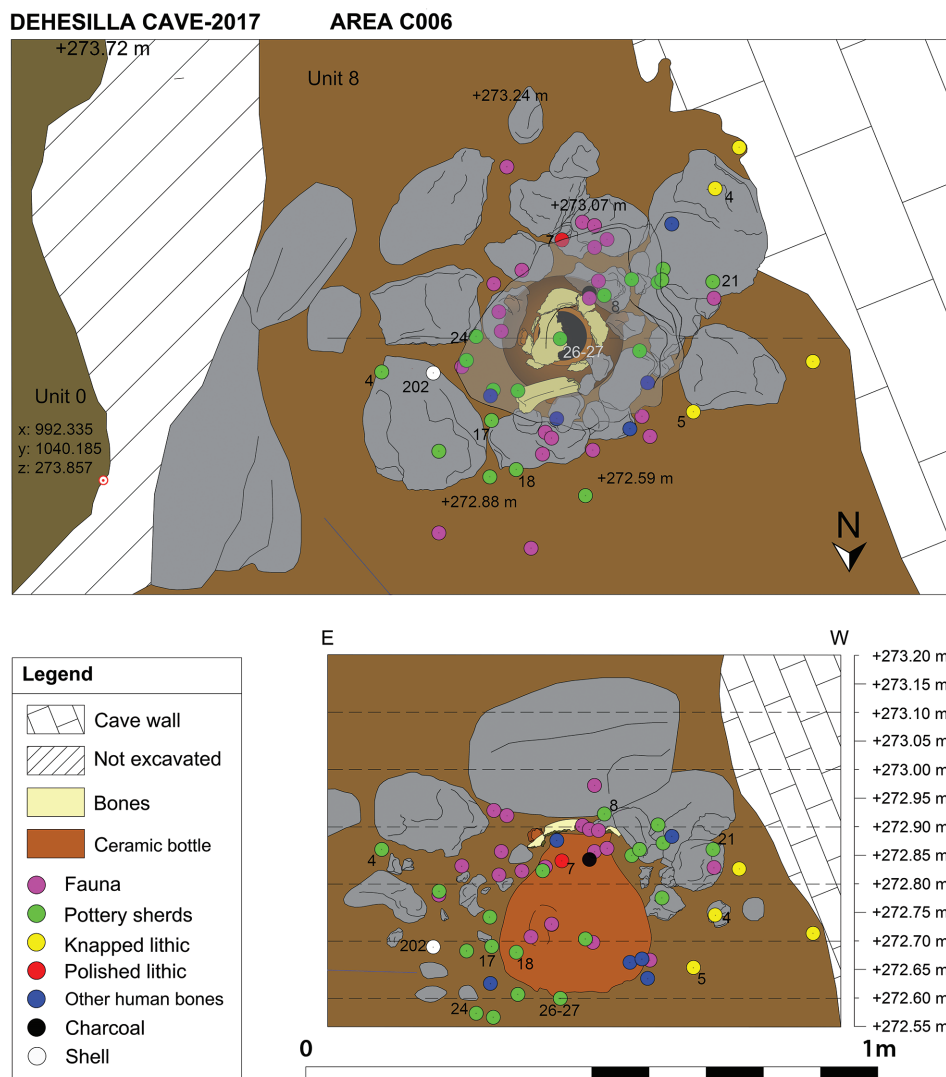
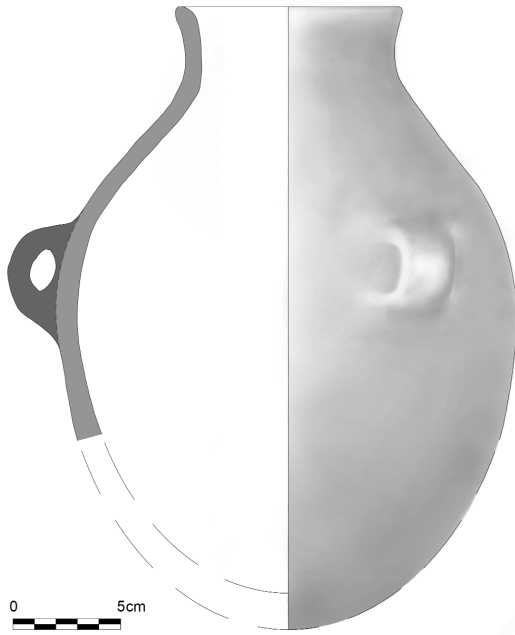


Fig. 9. Plan and section of the location of the archaeological materials documented in Locus 1.



**Fig. 10. Reconstruction of pottery vessel C006-244.**

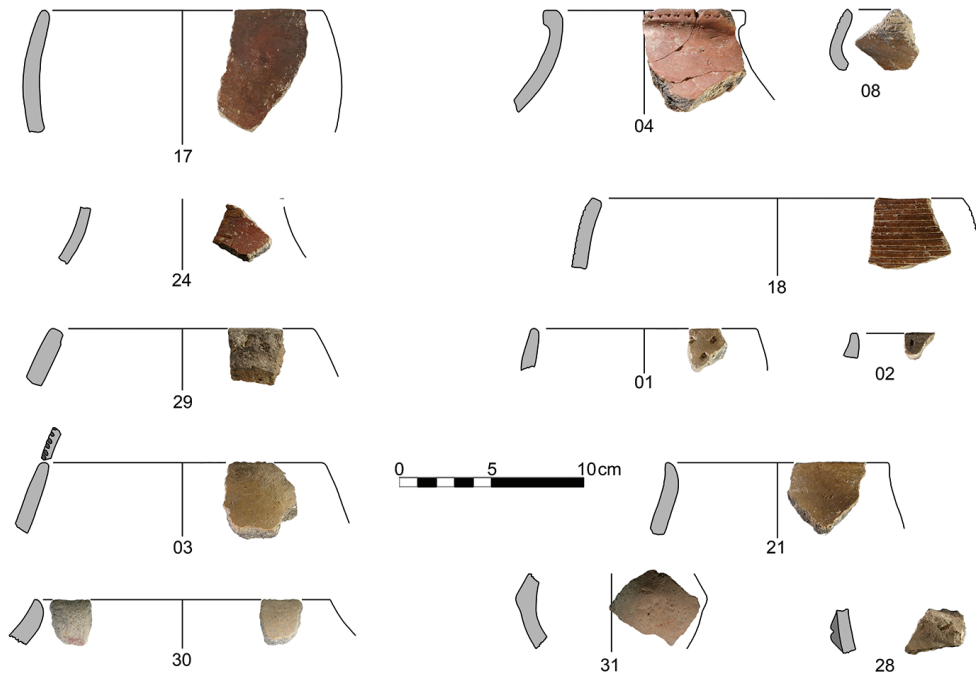
been used to cut an indeterminate soft material. In the context of Locus 1, it is perhaps possible to relate this instrument to the cut marks on the human calvarium and to the removal of flesh. However, as noted above regarding the accidental presence of pottery sherds, we cannot securely discard the same depositional nature of the elements of the lithic assemblage of Locus 1. Indeed, the types of elements found here are common throughout the entire stratigraphical sequence. Heat treatment, along with the presence of the sickle blade, are traits identified par-

ticularly in other Andalusian Neolithic sites (cf. Ibáñez, González 1996; Vera 1997; Rodríguez 2004; Carvalho et al. 2012; Morgado, Pelegrín 2013; Perales et al. 2015; Gibaja et al. 2017; Ibáñez et al. 2017).

**Faunal and botanical remains**

Small faunal remains were recovered from the sediment surrounding the pottery jar. Sheep or goat, suid, bovine, deer and rabbit are present, as well as some rare invertebrates. A Unionida valve, identified as *Potomida littoralis* (C006-202), was identified near the pottery vessel. The faunal assemblage of Locus 1 is identical in both taxonomical and taphonomic terms to Unit 8, surrounding the deposition, as well as to the contents of most of the levels of the same excavation area. It is therefore likely that these elements were included indirectly in the deposition. The only exception may be the freshwater mussel shell, since this kind of specimen is very unusual throughout the entire sequence.

Despite having processed a stable proportion of sediment by flotation, barely any botanical remains were recovered, with the exception of a fragment of taxonomically indeterminate carbonized seed and a few, very rare, wood charcoal fragments, including wild olive and an unidentified angiosperm. The relationship of these botanical remains with the Locus 1 depositional event cannot be safely assumed, as has been suggested with regard to other materials discussed above.



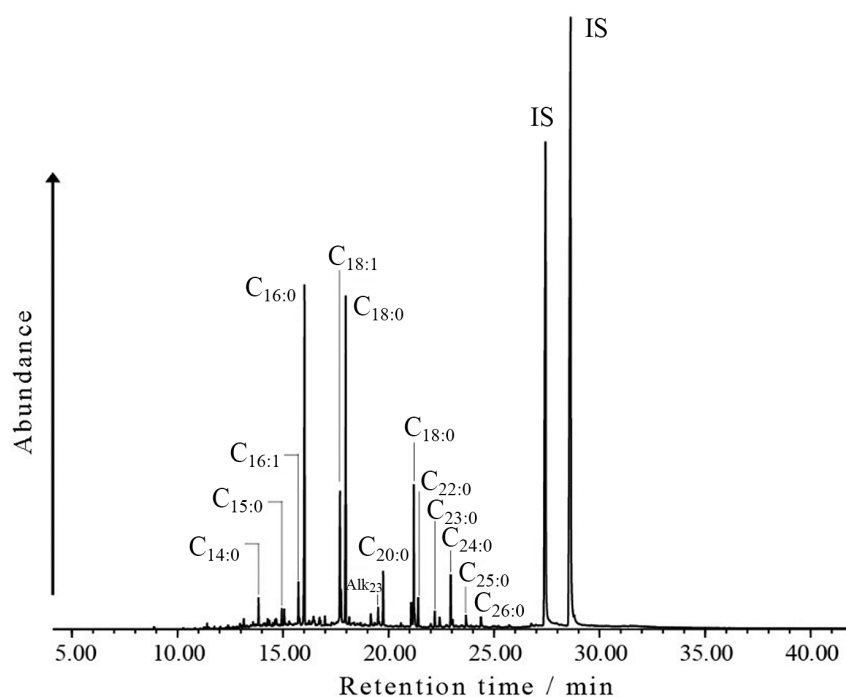
**Fig. 11. Selection of the fragmentary pottery assemblage recovered from Locus 1.**

### Radiocarbon dating

Two samples were selected from Locus 1 for radiocarbon dating: one from the human cranium itself, and the other from the white crust from inside the pottery vessel. The latter unfortunately did not work, while the sample from the skull bone dated to 5222–5036 cal BC (calibrated to two sigmas) (Tab. 4). This date is consistent with the characteristics of the pottery assemblage.

This new date is also coherent within the current body of radiocarbon dates in the Iberian Peninsula. Recent reviews of these dates have established a fundamental chronological span for the Early Neolithic between *c.* 5600–4800 cal BC, which, in addition, supports the first Neolithic arrivals to the Iberian Peninsula by way of the Mediterranean coast (Rojo et al. 2012; García-Puchol et al. 2017; Bernabeu et al. 2018).

The available radiocarbon dates for the Andalusian Early Neolithic indicate a maximum range *c.* 5500–4700 cal BC, but there is generally a greater density of dates in the last centuries of the 6<sup>th</sup> millennium cal BC (Martín-Socas et al. 2018), as is the case here. The oldest dates come from Dehesilla Cave itself, where excavations in Area C003 documented at the very base of the sequence a stratigraphical level including impressed pottery of Mediterranean influence, followed by other levels characterized by ‘al-magra’ wares (García-Rivero et al. 2018a; Taylor,



**Fig. 12.** Partial gas chromatogram showing the distribution of the molecular composition in sample LD-10.

Sample Id.	Sample mass (mg)	Lipid concentration (µg/g)
LD_1	1010	5.11
LD_2	1090	4.88
LD_3	1260	4.01
LD_10	1120	13.60*

\* Sample selected for GC-MS and GC-C-IRMS analyses.

**Tab. 2.** Summary of the analysed samples and their lipid concentrations.

García-Rivero 2021). Other archaeological sites with similarly very old dates in Andalusia are the caves of Nerja (Jordá, Aura 2008) and Esqueleto (Carrasco, Martínez 2014). This suggests that the arrival of the first Neolithic populations took place on the coastal line.

The accumulation of radiocarbon dates between *c.* 5300–5000 cal BC indicates a period of notable replication and consolidation of these populations throughout the south of the Iberian Peninsula. In contrast, a drop in radiocarbon dates can be observed around 4700 cal BC, suggesting a decrease in the human populations during most of the second half of 5<sup>th</sup> millennia cal BC (Molina et al. 2017; García-Rivero et al. 2018a).

### Ritual funerary contexts in the Iberian Early Neolithic

The funerary practices of the Early Neolithic in the Iberian Peninsula have been considered previously in several specific works of synthesis (e.g., Rubio 2001; 2004; Garrido-Pena et al. 2012). The general overview outlined in these works can be updated with some recently discovered contexts and new data (Oms et al. 2017; Gibaja et al. 2018; Alt et al. 2020). Broadly, the fundamental behaviours of the Early Neolithic funerary record of the Iberian Peninsula are essentially embodied in the concept of individual burial in a flexed lateral position, with relatively few elements of material accompaniment. Burials are more abundant in caves, but also exist in open-air settlements where they may of-

Typology		f	Retouched tool	%	Use-wear	%	Total
Knapped (87.5%)	Blades 57%	4	2	50%	2	50%	7
	Flakes 28.6%	2	0	—	0	—	
	Indeterminate 14.3%	1	0	—	0	—	
Ground (12.5%)	Hammer 100%	1	—	—	1	100%	1

**Tab. 3. Lithic assemblage.**

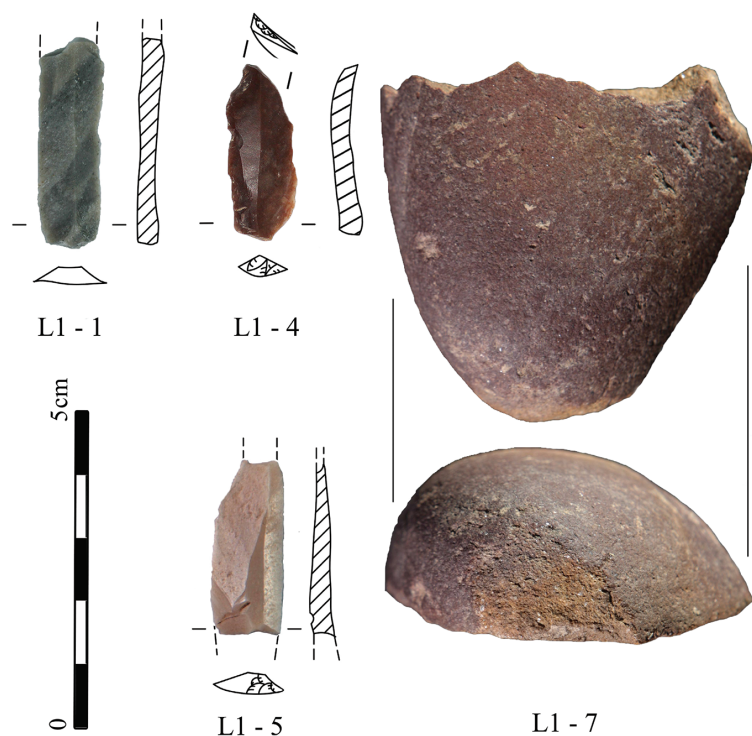
ten share domestic contexts or, occasionally, be placed in distinct spaces, in some cases considered as designated burial grounds.

As well as the normative and formal primary burials, another recurring pattern is the identification of more or less isolated remains, which usually appear mixed together with pottery fragments and fauna, as well as with lithic elements and shells, in areas and levels of presumably ordinary activities. This type of finding actually constitutes the majority of the funerary record, and has generally been interpreted as evidence of secondary burials, involving ritual practices in which bones were moved and recategorized, or as a result of the common post-depositional processes that shape the stratigraphic palimpsests of caves. Even at present, it is not easy to discriminate between the two processes, and there is some uncertainty about the precise meaning of this fragmentary

record and its possible cultural background. In a separate and concise group, there is evidence of intentional depositional events of a special nature, which remain rare and incompletely understood. In order to shed light on the new discovery at Dehesilla Cave, we will focus here on the Early Neolithic ritual funerary contexts in the Iberian Peninsula that include either or both of the two main elements of the depositional context Locus 1, that is, the differential treatment of crania and/or the specific use of pottery jars. The comparative contexts have been characterized on the basis of their structural features and material markers of ritual behaviours. These archaeological contexts and traits are summarized in Table 5, and their locations in the Iberian Peninsula are shown in Fig. 14. This overview provides a broader context for the Locus 1 deposition, and aims to lay the ground for its interpretative discussion.

At Dehesilla Cave, several Early Neolithic burials were documented during the 1981 excavations (Acosta, Pellicer 1990:57–58): seven inhumations (four children, one juvenile and two adults, both female)

and two cases of isolated skeletal elements – a cranium and a mandible – belonging to two different adult individuals were identified in Levels VI and V. These two levels contained ceramic and lithic materials consistent with the Early Neolithic period (Acosta, Pellicer 1990). The radiocarbon date from a charcoal fragment at the base of the burials (Layer 13 of Level VI), acting as a post quem reference, is 5468–4992 cal BC (cf. Acosta, Pellicer 1990:87; García-Rivero et al. 2018a:126). The majority of the remains belong to formal burials, mostly flexed and placed on one side. The human remains were later studied from an anthropological and paleopathological perspective, and the existence of *cribra orbitalia* was noted in two of the children (Robledo, Jiménez-Brobeil 1994). The cranium showed signs of cremation, and was found next to a hearth with numerous *Iberus alonensis* snail shells (Acosta,



**Fig. 13. Lithic assemblage documented in Locus 1: L1-1 meso-proximal blade fragment; L1-4 sickle blade (C006-247); L1-5 mesial blade fragment with partial retouch on the proximal break (C006-252); L1-7 hammer stone fragment (C006-231).**

Lab. code	Sample Id.	Context	Sample	% Extract.	%C	%N	C:N	Date BP	pM	$\delta^{13}\text{C}$ ‰	Cal BC 2 $\sigma$	p*= 1.00
CNA4493	DH17-21	Locus 1	Homo – Skull	3.9 <sup>1</sup>	31.9	11.6	3.2	6180±30	46.31±0.18	-18.17±1.50	5222–5036	1.00

<sup>1</sup> Method: Collagen extraction and purification. Ultrafiltration.

**Tab. 4. Radiocarbon date. The calibration is made with IntCal13.14c Northern Hemisphere atmospheric radiocarbon calibration curve in the software Calib 7.0 (Reimer et al. 2013).**

*Pellicer 1990.58*). The mandible appeared to be an isolated element.

The presence of disarticulated and isolated jaw bones or other post-cranial remains is common and well-documented, not only in all of the prehistoric contexts known to date at Dehesilla Cave, but also in many other Neolithic caves throughout the south of the Iberian Peninsula, probably in part caused by post-depositional processes. In contrast, the case of the isolated adult cranium is relevant here, not because skulls are unusual in the archaeological record, but because their specific deposition and contexts often have an intentional dimension that must have been guided by a particular pattern of ritual behaviour. In this case, it may also be significant that the cranium was found in association with a hearth and terrestrial snail shells.

In Andalusia, the funerary record of this Early Neolithic period is characterised mainly by scattered remains, more or less isolated, and some burials, mainly documented in caves. This is the case, for example, at one of the most emblematic Andalusian sites that was discovered in the 19<sup>th</sup> century, Cueva de los Murciélagos de Albuñol, which has a substantial funerary record, including both formal burials and remains dispersed over the floor of different areas of the cave, and among which there are numerous isolated crania (*Góngora 1868; Molina et al. 2012*). Unfortunately, the funerary record cannot be securely attributed to the different Neolithic periods, despite a radiocarbon date for the famous weaved baskets that would place at least some of the remains in the advanced Early Neolithic (*Castro et al. 1996*).

Cueva de la Carihueta (Carigüela) also contains numerous human remains throughout its sequence (*Pellicer 1964; Navarrete 1976; Arribas, Molina 1979*), most of which are not anatomically connected, in addition to certain stratigraphic problems probably caused by the funerary use of the cave itself (*Carrasco et al. 2010*). However, more than twenty burials have been attributed to the Early Neolithic, occasionally with signs of treatment, including defle-

shing, suggestive to some authors of cannibalistic practices (*Botella et al. 2000; Carrasco et al. 2012; Molina et al. 2012.436*).

On the coast of Málaga, Cueva de Nerja has provided many remains of Early Neolithic burials (*Fernández et al. 2005*). Of particular interest here are two burials from the base of the Neolithic sequence in the Sala Torca, one adult and one child, with evidence of cremation (*Pellicer, Acosta 1986.446*); and, perhaps more notably, the remains from level V of area NM-84 in the room known as Sala de la Mina, in which a juvenile cranium was found in association with typical pottery of the period, knapped lithics and stone hand-grinders, bone awls, charred acorns and fish remains (*Pellicer, Acosta 1986.368*).

In one of the innermost and inaccessible areas of Cueva de El Toro, there are several human remains lacking any anatomical connection. These include part of the calvarium of an adult male, with part of the frontal and both parietal bones, dated to the advanced Early Neolithic (*Martín-Socas et al. 2004; Santana et al. 2019*). It bears a series of up to 59 cut marks on the external surface made with a sharp lithic tool and by a process of defleshing, also displaying a V-shaped mark and remains of ochre (*Guijo 2004*). This particular calvarium has been interpreted recently as a skull cup linked to ritualistic cannibalism (*Santana et al. 2019*).

On the coast of Cádiz, at the open-air site of El Retamar, there is a double burial of a woman and a man, whose bodies were dusted with ochre (*Bueno 2002; Ramos, Lazarich 2002*). The male skull was intentionally displaced from the rest of the body, and a specimen of *Cardium edule* was located at his feet, while the mandible of the female individual was placed between the long bones of her lower extremities.

In the coastal area of central and southern Portugal, apart from Neolithic burials on some of the Mesolithic shell middens (*e.g., Bicho et al. 2013; 2017*), burials in caves are predominant and especially abun-

dant in the Portuguese Estremadura and Alentejo-Ribatejo regions. As for evidence of rituals, the trepanation (without survival) of a skull from Casa da Moura (Cardoso 2007.241; Carreira, Cardoso 2002) belonging to a young adult male could be of interest (Antunes et al. 2009). However, only one (carried out on an ulna) of the 12 radiocarbon dates provided for the level containing the human remains fits the advanced Early Neolithic period, in accordance with the characteristics of the pottery assemblage (Carreira, Cardoso 2002), while the remaining dates are more recent (Carvalho, Cardoso 2011.396).

In the Meseta region, individual burials in pits and isolated remains in secondary contexts are both documented. The cranium of an adult male between 20 and 30 years of age is noteworthy, with a slight depression of the nasal bone, documented at Cueva de la Vaquera in Segovia, in association with several ribs and the tooth of a sheep or goat (Estremera, Valle 1999). Interpreted as a relic (Delibes et al. 1999), it has recently been dated to the transition between the sixth and fifth millennia cal BC (Garrido-Pena et al. 2012.148).

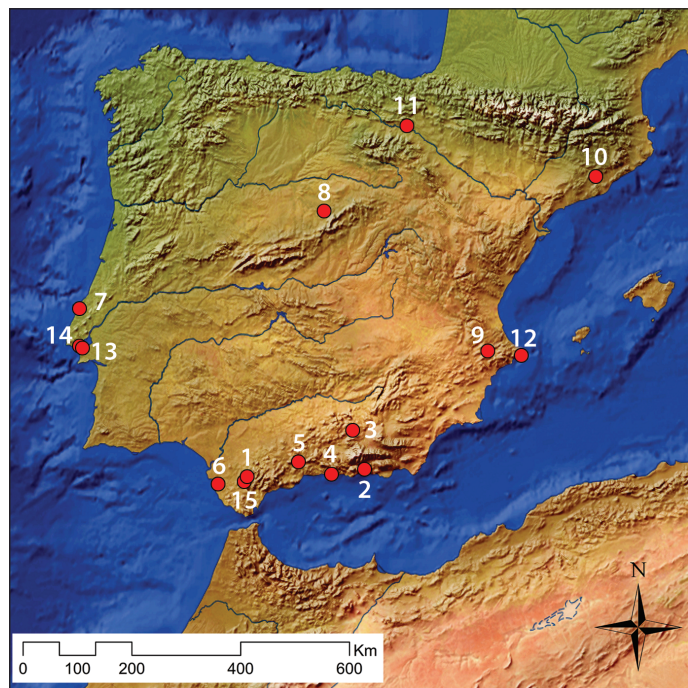
On the Valencian coast, the predominant funerary evidence is provided by dispersed human remains, especially from caves (Bernabeu et al. 2001). Of particular interest to us here is the well-known case of the ritual funerary deposition of Cova de la Sarsa. It is formed by two crania, one male and one

female, the latter with trauma to the left parietal, and various post-cranial elements. They were deposited in a crevice in the cave wall, delimited by a stone structure, and located in an area difficult to access. In the same area there are cave paintings, and the human remains were accompanied by an assemblage of cardial pottery with the remains of pigment, worked bone and lithic elements, and shells (Miguel 2008; García Borja et al. 2011).

At the Catalan Cova dels Lladres, a cranium and other human remains were found on the floor of the cave alongside a globular pottery container with two handles and a band of incised decoration (Pla, Junyent 1970). In stratigraphy, several burials are also known to be associated with two globular jars, with a high neck, lug handles and incised decoration. One of them was placed on the neck of another fragmented jar of the same type, and contained a substantial assemblage of perforated shell beads, many on *Cardium edule*, as well as numerous variscite pendants (Ten 1980).

The type of pottery jar, usually referred to as amphoroid or *botella* (Llobregat 1973; Bernabeu 1989; Fábregas et al. 2019), was very common during the Early Neolithic, and continued in later periods. The shape, with a cylindrical neck, globular body and semi-spherical or often cone-shaped base, may reflect their use as containers for liquids or substances with a similar behaviour. This form is frequently

**Fig. 14. Location map of the archaeological sites mentioned in the text (see Appendix 3), numbered as follows: 1 Cueva de la Dehesilla, Jerez de la Frontera, Cádiz (García Rivero et al. 2018); 2 Cueva de los Murciélagos, Albuñol, Granada (Góngora 1868); 3 Cueva de la Carihuela or Carigüela, Los Montes, Granada (Carrión et al. 2019); 4 Cueva de Nerja, Nerja, Málaga (Jordá et al. 2003); 5 Cueva del Toro, El Torcal de Antequera, Málaga (Martín Socas et al. 2004); 6 El Retamar, Puerto Real, Cádiz (Ramos, Lazarich 2002); 7 Casa da Moura, Óbidos, Portugal (Cardoso et al. 2018a); 8 Cueva de la Vaquera, Torreiglesias, Segovia (Estremera 2003); 9 Cova de la Sarsa, Bocairent, Valencia (Asquerino 1978); 10 Cova dels Lladres, Vacarisses, Barcelona (Ten 1980); 11 Los Cascajos, Navarra (Iriarte et al. 2019); 12 Cova de les Cendres, Moraira-Teulada, Alicante (García-Puchol 2005; Bernabeu, Molina 2009); 13 Antigos armazéns Sommer, Lisboa, Portugal (Rebelo et al. 2017; Cardoso et al. 2018a); 14 Pálacio Ludovice, Lisboa, Portugal (Duarte et al. 2020); 15 Cueva del Picado, Cádiz (Mora 1970) (Theme map: <https://www.naturalearthdata.com/>).**



**Tab. 5. Archaeological characteristics of the Early Neolithic ritual deposits of the Iberian Peninsula. The date range given for each context corresponds to the maximum chronological rang (cal BC – 2σ) based on the available data set (Lab Codes) calibrated to two sigma according to the original publications (References).**

Site	Differential treatment of skulls	Location Structures	Trauma - Marks Manipulation	Pottery jar	Grave goods Accompaniments	Cal BC – 2σ	Lab Code	References
Cueva de la Dehesilla	V (male, >45 yrs)	Innermost area, stone cover	Two incisions	V	Lithics, <i>Potomida littoralis</i>	5222-5036 <sup>a</sup>	CNA-4493	This paper
Cueva de la Dehesilla	V (adult)	First room	Cremation?	None	<i>Iberus alonensis</i>	–	–	Acosta, Pellicer 1990
Cueva de los Murciélagos	V	Deepest area	–	–	Esparto grass fibres	5210-4840 <sup>b</sup>	CSI-C-1133	Góngora 1868; Cacho et al. 1996; Molina et al. 2012
Cueva de la Carihuela or Carigüela	V?	–	Defleshing Cannibalism?	–	Fauna	5517-5060 <sup>b</sup>	Col-1566-7 1560, 1564 Pta-9163 Col-1567	Pellicer 1964; Navarrete 1976; Arribas, Molina 1979; Botella 2000; Fernández et al. 2007; Carrasco et al. 2012; Molina et al. 2012a; Martín et al. 2018
Cueva de Nerja	V (juvenile)	NM-84 Sala de la Mina	–	–	Pottery, knapped lithics, hand grinders and querns, awls, acorns and fish remains	5484-4798 <sup>b</sup>	OxA-26077-86	Acosta, Pellicer 1986; Fernández et al. 2005; Martins et al. 2015
Cueva de El Toro	V (male, aprox. 30 yrs)	Innermost area	Defleshing 59 incisions V-shaped mark Ochre Cannibalism? Skull-cup?	None	Undecorated pottery	5040-4850 <sup>a</sup> 5472-4463 <sup>b</sup>	Beta-365288 GrN-15440 15443-4 Beta-174308 Beta-341131-2 Beta-365287-8 365290 365292-4 Beta-498412	Guijo 2004; Martín Socas et al. 2004; Santana et al. 2019
El Retamar	V (male, approx. 25 yrs)	Habitat (hearths, stone structures and shellmiddens) Open air	Ochre powder	None	Cardium edule	5497-5202 <sup>b, c</sup>	Beta-90122	Ramos, Lazarich 2002; Bueno 2002; Ramos et al. 2010
Casa da Moura	V (male)	–	Trepanation	–	–	5020-3000 <sup>b</sup>	TO-953, 2092-4 Wk-28004-5 28007, 28009-10 OxA-5506	Carreira, Cardoso 2002; Cardoso 2007; Carvalho, Cardoso 2011

Site	Differential treatment of skulls	Location Structures	Trauma - Marks Manipulation	Pottery jar	Grave goods Accompaniments	Cal BC – 2σ	Lab Code	References
Cueva de la Vaquera	V (male, approx. 25 yrs)	Habitat	Depression of the nasal bone	None	Ribs, sheep or goat tooth	6052-4695 <sup>b</sup>	GrN-17386 22930-3, 8241 9226, 9228	Estremera, Valle 1999; Estremera 2003; Dellbes et al. 1999; Garrido Pena et al. 2012
Cova de la Sarsa	V (male and female)	Wall crack and stone wall Occulted Rock art	Female: parietal injury	–	Near complete cardiac jar, pigment, bone and stone tools, shells ( <i>Columbella</i> , <i>Cardium</i> )	5470-5220 <sup>b</sup>	OxA-V-2392-26	Miguel Ibáñez 2008; García-Borja 2012
Cova dels Lladres	V	Formal burial 3 globular jars	–	V	<i>Cardium edule</i> , shells, variscite	–	–	Ten 1980
Los Cascajos	None	Pit (Estructura 475) Cenotaph?	None	V	Necklace	5500-3750 <sup>b</sup>	Ua-16024-5 16203, 17793 17795, 24423-8 GrA-16204 16208-11, 16942	García-Gazólaz, Sesma 2007; García-Gazólaz et al. 2011; García-Martínez 2012
Cova de les Cendres	None	Pit	None	V	–	5310-4900 <sup>a</sup>	Beta-75217	Bernabeu, Molina 2009
Antigos armazéns Sommer	None	Burial pit Open air habitat	None	V	Pottery sherds, lithics and fauna (casual?)	5200-4890 <sup>a</sup>	Wk-45573	Cardoso et al. 2018
Pálacio Ludovice	None	Burial pit Open air habitat	–	V	Pottery sherds (undecorated, impressed, incised and boquique), lithics	–	–	Simões et al. 2020
Cueva del Picado	None	Individual burial	None	V	–	–	–	Mora 1970

a Direct date from the archaeological materials included in this table.

b Indirect date from other materials of the broader archaeological context.

c Calibration with the Marine13 curve.

found in domestic contexts, as well as in funerary depositions. We will, therefore, only mention here some cases that, like Locus 1, illustrate the funerary and/or ritual use of this type of jar throughout the Iberian Peninsula.

The open-air settlement of Los Cascajos in Navarra had a specific area, a designated burial ground, with over thirty individual burials, and several ritual graves or pits containing material remains. Structure 475 is of special interest here, holding a complete jar, placed on top of a necklace of discoidal beads (García-Gazólaz, Sesma 2007; García-Gazólaz et al. 2011; Rojo et al. 2016). At Cova de les Cendres, on the coast of Alicante, a jar was found intact inside a pit, covered by a large flat stone (Bernabeu et al. 2001). On the opposite side of the Iberian Peninsula, two such pottery containers have recently been documented in association with two separate individual burials in Lisbon. Both jars are decorated: one with *boquique* or stab-and-drag technique, at the Antigos armazéns Sommer (Cardoso et al. 2018b); and the other with incisions and impressions, at Palácio Ludovice (Simões et al. 2020). Returning to the south, amphoroid jars are documented at various sites vicinity of Dehesilla Cave, including an individual burial context at Cueva del Picado (Mora 1970:283).

This overview allows for a number of inferences to be made. A striking initial observation is that there is no identical context to the one presented here, in such a way that Locus 1 constitutes a certainly singular case. Some of the individual ritual traits are, however, common to several sites. Based on the present state of the available data, which is of course influenced by the relative qualities of the archaeological records, we may reflect on the degree of similarity or affinity between Locus 1 at Dehesilla Cave and the contexts documented at other sites.

The depositions documented at Cova de la Sarsa, Cueva de El Toro and in the old excavations at Dehesilla Cave itself are apparently among the closest to Locus 1, at least in terms of their clearly ritual nature provided by the particular use of crania (not pottery jars). At these three cave sites, skulls (some with trauma and/or markings) are located in the deepest and most inaccessible areas, as far as possible from the areas of daily activities, a pattern that may reflect ritual behaviours and beliefs shared between these populations. A similar situation is found at Cova dels Lladres, with particular regard to the finding of a human cranium in association with a decorated pottery jar.

The finds analysed from Cova de les Cendres and the open-air site of Los Cascajos are clear examples of closed and well-preserved contexts with pottery jars deposited inside pits created for this purpose within specific ritual areas. Structure 475 of Los Cascajos is located within a funerary area, yet appears to be of a different functional nature to the rest of the pits at the site. In the case of Cova de les Cendres, the deposition was made in a crevice next to the location of rock art. Pottery jars are also documented at the Antigos armazéns Sommer, Palácio Ludovice and Cueva del Picado, although in these cases they are associated with inhumations, the most common and widespread formal treatment of Neolithic human remains.

The other sites mentioned are perhaps a little further from the ritual characteristics of the previous cases, and are more in line with the usual findings of disarticulated or isolated remains that predominate in the Neolithic record. It is worth noting, however, the case of the Sala de la Mina at Nerja, due to the peculiarity of some of the materials documented in the close proximity of the human cranium. Likewise, the double burial at El Retamar, although quite a different type of context, corroborates the well-known differential treatment, probably symbolic, given to skulls.

### Discussion of the possible interpretative scenarios for the Locus 1 deposit

Cut marks on human skulls are often attributed to processes of defleshing and/or scalping, and their distribution on the cranial bones makes it possible to distinguish between these two types of intentional treatments. In the removal of soft tissues, cut marks are observed on bone surfaces at the sites of tendon and ligament insertions (Buikstra, Ubelaker 1994). In the removal of the scalp, the marks typically form small clusters on the frontal, parietal and occipital bones, in a kind of circle around the calvarium (White et al. 2012; Gresky et al. 2017). The incompleteness of the Locus 1 cranium does not enable a clear interpretation of the observed marks, other than their anthropogenic nature. Indeed, they indicate the use of a lithic tool for *periosteum* removal, although it is impossible to infer the precise purpose of the gestures involved.

The (negative) results of the organic residue analyses on the pottery jar are conducive to the observation that the samples do not contain absorbed fats, and that the white crust found inside the pot is not

an organic substance. Despite the frequency of this pottery form in the Neolithic record of the Iberian Peninsula, only the results of residue analysis carried out on the cardinal jar from Cova Eirós in Lugo are currently known (Fábregas et al. 2019). This analysis indicated that the vessel had been used in the processing of ruminant animal meat and vegetal resources. These results contrast with those obtained from the Locus 1 jar, in which the lipid concentration obtained from the analysed samples was below the minimum threshold, and evidence of alteration from heat/fire was absent. These observations may be related to the low intensity or null use of the vessel for storage, food preparation or cooking before its deposition.

Deciphering the meaning of Locus 1 is, therefore, not an easy task, considering a number of additional factors. There are not many depositions of this type dating to the Early Neolithic in the Iberian Peninsula, and this finding at Dehesilla Cave is also quite different from other known contexts. There is also a certain scarcity of studies that attempt to specifically address the interpretation of such depositions (e.g., Jiménez-Brobeil 1990; Rubio 2001; Jiménez-Brobeil et al. 2009), beyond their simple description, and such studies are more common for later periods, from the Late Neolithic onwards, and are particularly concerned with megalithic activities.

However, there is a wealth of general knowledge provided by other geographic and chronological contexts, both from ethnography and archaeology, including the Central European Neolithic and the LBK culture, and especially the Pre-Pottery Neolithic B of the Near East, that provides rich and diverse data regarding the differential funerary and ritualistic treatment of human skulls. The reference to these analogies here, of course, does not imply any assumption of a relationship of ancestry nor of a historical link between these and our case study, although they may provisionally constitute a frame of reference that will serve as a guide in our interpretative exploration. Reference to the main interpretations developed in these comparative archaeological contexts may, indeed, enable us to narrow down the number of interpretative scenarios that may be aligned with the Locus 1 deposition.

The recurrence of isolated human remains, and of skulls in particular, some displaying marks from injuries, has led some authors to interpret them, both in the European framework and Near East, as war trophies or evidence of cannibalistic practices (Villa

et al. 1986; Villa 1992; Courtim 2000; Testar 2008; Le Bras-Goude et al. 2010; Marginedas et al. 2020). In the specific context of the Neolithic period in the Iberian Peninsula, anthropological studies have drawn attention for over thirty years to practices such as the defleshing of the dead and the possible existence of ritualistic cannibalism (Botella 1973; Jiménez-Brobeil 1990; Jiménez-Brobeil et al. 1986; 1996; 2009; Botella et al. 2000; Santana et al. 2019). Moreover, possible evidence of Neolithic cannibalism has been noted at several cave sites in southern Spain, such as Tontas, Carigüela, Malalmuerzo, Mayólicas, Honda and de las Azuelas (province of Granada) and El Toro (province of Málaga) (Botella 1973; Botella et al. 2000; Jiménez-Brobeil et al. 1986; Solari et al. 2012; Santana et al. 2019).

However, many of these human remains, unfortunately, do not have a precise chronological identification, beyond their general Neolithic attribution, and there is very scarce evidence of this type dated securely to the Early Neolithic (e.g., Jiménez-Brobeil 1990:125), perhaps with the exceptions of Cueva de la Carigüela and Cueva de El Toro. An aggressive type of cannibalism has also been proposed based on evidence at Carigüela and Malalmuerzo (Jiménez-Brobeil et al. 2009), due to the lack of care in the treatment of the remains and the high frequency of head injuries as an indicator of interpersonal violence. Recently this possible interpretation has also been put forward at El Toro (Santana et al. 2019).

Several features of Locus 1 do not seem to fit with its interpretation as a war trophy, as we would expect this type of deposition to be socially visible to the general population, rather than being carried out in a hidden, secretive place and a remote part of a cave. It also does not align, at least in exclusive terms, with a cannibalistic interpretation, especially in its belligerent form. Indeed, for this interpretation to stand, the Early Neolithic human remains of Dehesilla Cave would need to display more common evidence of this kind (cut marks from the removal of the scalp and flesh, from percussion for the creation of calottes, etc.), which in fact is not present (Robledo, Jiménez-Brobeil 1994).

Ritualistic cannibalism of a funerary (and perhaps exceptional) nature cannot be ruled out, nor can the identification of the calvarium as a skull cup, a type of object that is quite widespread in the ethnographic and archaeological literature (e.g., Botella et al. 2000; Bouslestin 2012; Bouslestin, Copey 2015; San-

tana et al. 2019; Marginedas et al. 2020). Moreover, the association of a possible skull cup next to a pottery vessel, identified typologically as a jar or bottle, is suggestive. In any case, a scenario of ritualistic funerary cannibalism would necessarily imply other behavioural models, not necessarily alternative but at least complementary, and particular symbolic components, which appear to be present in the Locus 1 depositional context.

There are several other diverse interpretations of the symbolic dimension of the differential treatment of skulls: foundational rites (Contenson 1992); ritual celebrations through sacrifice and consumption (Goring-Morris, Horwitz 2007); expressions of social identities (individual and collective) (Kuijt 2008; Croucher 2006); worship of ancestors (Kenyon 1953; Bienert 1991) or elders (Cauwin 2000), if not of deities and spirits, related to wisdom, virility and fertility (Freeman 1979) or to supernatural powers or vital forces (Deleonardis 2000; Verhoeven 2002; Jammo 2014).

Emic interpretations have usually explored the basis and social or systemic (etic) consequences of ritual, in the sense of behaviours with beneficial or adaptive effects for the community, and often understood in terms of social organization, that is, hierarchy, kinship relations, cohesion and social memory (Cauwin 2000; Verhoeven 2002; Testart 2008; Bocquentin et al. 2016; Hacıdow, Knüsel 2017). The reasons behind past rituals are now far from our current possibilities of corroboration, since they require a certain knowledge of the structure and the cultural diversity of the population under study, which is beyond the scope of present research. Some of the theoretical behavioural models mentioned above are simply impossible to consider here, because they require a more substantial record and a more detailed knowledge than that provided by the archaeological record. Perhaps the most obvious aspect is that which envisages the expression of social identities.

In the specific case of Locus 1, the scenario of a ritual celebration may be ruled out, since there is no direct evidence of sacrifice or consumption. Interpretation as a foundational rite related to the occupation and establishment of populations at the site is also unlikely, given that the radiocarbon date from the cranium itself is notably later than the first Neolithic evidence at the cave, dated to the middle of the sixth millennium BC (cf. García Rivero et al. 2018a). However, a foundational event related to the arrival of a different population after the early

pioneer group(s) cannot be discarded, within the framework of complex dynamics of mobility with a degree of nomadic behaviour.

The *peri mortem* marks increase the probability that the death of the individual may have been linked directly to the timing of the ritual deposition itself, although a cranium recovered from an earlier primary burial, in line with an ancestor cult scenario, is not impossible. A heterogeneous and inclusive view of this hypothesis would, in fact, be viable, taking into account the relatively advanced age of the Locus 1 individual (>45 years) and the consideration of mature individuals as social guides or leaders. The individual whose cranium was included in the Locus 1 deposition has the highest age of the entire sample considered in this study, and it can also be noted that six of the seven sexually identified crania from the analysed sites belong to male individuals. Another interesting observation is that, among the eight or nine individuals previously documented at Dehesilla Cave, there are currently no secure formal male burials. Future research into this line of interpretation in relation to Locus 1 will require, among other things, a DNA analysis to confirm the alleged affiliation of this individual to the same population group as the other burials at the site.

The interpretative model of the cult of supernatural entities or powers, whether deities or spirits, cannot easily be corroborated. In the Iberian reference literature on the Early Neolithic period, the identification of anthropomorphic figures in a posture of prayer in both pottery decoration and rock art depictions is relatively widespread (e.g., Hernández 2000; Escacena 2018). If such figures are related to religious or supernatural cults, and given that they mostly share the feature of arms outstretched above the head, it is likely that the entities or powers invoked must be located in the heights, in the sky or on the tops of mountains, a belief in fact widespread in many ancient cultures of the Mediterranean. Most of the supposedly contemporaneous rock art is located in open-air panels, and thus in shelters and in the external and accessible areas (near the entrance) of caves. The magical-religious rituals known from ethnographic, archaeological and textual records usually include many meanings: propitiatory and supplicatory rites, augury or premonitory rites, prophylactic and purification rites, as well as apotropaic rites of protection and dissuasion.

The specific finding that brings us here, a pottery jar partially buried in the ground and sealed symboli-

cally and physically with a human calvarium and a large and heavy limestone block, not only occupies a hidden location in the depths of the cave, but also demonstrates, by its own structural features, a deliberate occultation. On the basis of these characteristics, and in contrast to the above, it is possible to suggest a tentative association between the deposition and the chthonic or telluric entities or forces, whether they were deities or even malign powers or spirits. It is worth recalling that the jar buried in a pit inside the cave of Cova de les Cendres was also covered by a large stone. The sealed, hidden and inviolable deposition of Locus 1 could have had a dissuasive or apotropaic character, perhaps as a container of properties, forces or spirits, although not necessarily incompatible with other functions (to predict, propitiate, purify or pray). The known cases of superstitious beliefs and religious rites of this nature, in addition to the differential use of skulls, are relatively numerous in the ethnographic record (*Yakar, Hershkovitz 1988*), but are also common in the Prehistoric European and Near Eastern archaeological records (*Bonogofsky 2001; 2006; Borić 2003; Rubio 2004; Slon et al. 2014; Maier 2017*), as well as in the Semitic texts (e.g., *Schmandt-Besserat 2013; Del Olmo 2015*).

## Conclusions

This article has focused particularly on the comparative data for the isolated finding of human crania. Of the available sample, fortunately, many of the contexts are relatively well preserved, or sufficiently so, at least enough to corroborate the particular or differential use of these skeletal elements throughout much of the geography of the Iberian Peninsula.

The analysis of the data has enabled some recurrent patterns to be observed. Practically all of the known cases are located inside caves, most of them in relatively deep and remote chambers or crevices, and therefore display a tangible degree of differential treatment compared to the overall funerary record. There is also a bias in the demographic profile of the subjects, since most of the remains belong to adult males. Many cases show evidence of anthropogenic lesions, including incisions and cut marks, trepanation or trauma. They are usually accompanied by assemblages of materials, which include, in order of their relative frequency, shells, pottery, lithic and bone instruments or faunal remains. The known contexts probably reflect a diversity of specific activities and, therefore, of interpretive scenarios, but clearly share some behavioural traits and patterns

of a ritual nature. It can therefore be put forward that these depositions probably took place within a relatively common framework of cultural behaviours and traditions of a highly symbolic nature.

The specific case of Locus 1 is singular because it provides a depositional context with an unusually good state of preservation, only paralleled at a few other Iberian sites. At least two factors contributed to this: the location in a deep and inaccessible area of the cave, without evidence of occupation and barely any sign of disturbance, and the distinctive structural characteristics of the deposition, including a heavy stone cover. It is the only discovery to date in the Iberian Peninsula of a complete pottery jar covered by a human cranium, which also makes it an extraordinary archaeological context for the Prehistory of Western Europe.

Locus 1 materializes a ritual funerary event and extends the possibilities of knowledge about the symbolic behaviour of the first Neolithic populations of the Peninsula and the Western Mediterranean. This study has allowed us to explore the theoretical interpretative models currently available for the differential treatment of human skulls in this area, and has enabled us to narrow down the range of interpretative possibilities for this particular depositional context. However, it is impossible at present to offer a single firm reconstruction, and several anthropological scenarios that could explain this finding more precisely must be left open, including ritualistic cannibalism, rites related to the elders or leaders, and/or cults to the supernatural entities or forces.

## FUNDING

*This research has been carried out within the project “High-resolution chronology and cultural evolution in the South of the Iberian Peninsula (c. 7000–4000 cal BC): a multiscale approach” (PGC2018-096943-A-C22), funded by: FEDER/Spanish Ministry of Science and Innovation – State Research Agency. The data presented here are provided by the project “Cueva de la Dehesilla: Estudio arqueológico y paleoambiental para el conocimiento de la ocupación humana prehistórica de la Sierra de Cádiz”. The 2017 archaeological field season received financial support from several funding programs from the University of Seville (VI Plan Propio de Investigación y Transferencia, III Plan Propio de Docencia, Facultad de Geografía e Historia and Dpto. de Prehistoria y Arqueología), as well as from the Research Centre for Anthropology and Health, University of Coimbra (UIDB/00283/2020).*

## ACKNOWLEDGEMENTS

A number of people and entities have collaborated with logistic support and diverse resources for the tasks developed by the Dehesilla Project during the 2017 season: Algar Local Council, Jerez de la Frontera Archaeological Museum, EvoCultura-Association for the study of human behaviour and cultural diversity, as well as the Díaz Romero family. Drs João Cascalheira and Célia Gonçalves from the Interdisciplinary Center for Archaeology and Evolution of Human Behavior (ICArEHB), Universidade do Algarve, helped setting up the georeferencing system implemented in the field. Juan Carlos Vera, of the University of Huelva, assisted in the typological identification of the lithic assemblage, while the traceological analysis is being carried out by Juan Francisco Gibaja, of the Escuela Española de Historia y Arqueología en Roma, CSIC. Eloísa Bernáldez and Esteban García Viñas, of the Instituto Andaluz del Patrimonio Histórico, Seville, provided the taxonomical identifications of the fauna and Patricia Monteiro, of the ICArEHB, Universidade do Algarve, the anthracological determinations. Drs Miguel Botella and Sylvia Jiménez showed a generous disposition on our visit to the Faculty of Medicine of the University of Granada, when we recently reviewed the human osteological remains from the early excavations of Dehesilla Cave. David López, Patricia Virino, Pablo Gutiérrez, Jericó Mancera, Elena Trujillo and Araceli Barrera participated in the archaeological excavation and the processing of the finds during 2017. Finally, we would like to thank the Editors of *Documenta Praehistorica* for their interest in our work. The comments from the two anonymous reviewers assigned by the journal helped to improve the structure and clarity of the initial version of the paper.

∴

## References

- Acosta P., Pellic Britisher M. 1990. *La Cueva de la Dehesilla (Jerez de la Frontera). Las primeras civilizaciones productoras en Andalucía occidental*. CSIC. Jerez de la Frontera.
- Alonso C., Jiménez Echevarría J. 2014. Contribución al estudio del poblamiento, modos de vida y ritual funerario del neolítico antiguo: el asentamiento al aire libre de El Prado (Pancorbo, Burgos). *Zephyrus* 74: 41–64.
- Alt K. W., Tejedor C., Nicklisch N., +23 authors, and Rojo Guerra M. A. 2020. A massacre of early Neolithic farmers in the high Pyrenees at Els Trocs, Spain. *Scientific reports* 10(1): 2131. <https://doi.org/10.1038/s41598-020-58483-9>
- Antunes M. T., Cardoso J. L., and Cunha A. S. 2009. Espólio humano da Gruta da Casa da Moura (Cesareda): observações osteológicas crânio-faciais. *Estudos Arqueológicos Oeiras* 17: 175–221.
- Arribas A., Molina F. 1979. *El poblado de 'Los Castillejos' en las Peñas de los Gitanos (Montefrío, Granada): campaña de excavaciones de 1971*. Secretariado de Publicaciones de la Universidad de Granada. Granada.
- Asquerino M. D. 1978. Cova de la Sarsa (Bocairente, Valencia). Análisis estadístico y tipológico de materiales sin estratigrafía (1971–1974). *Sagvntvn* 13: 99–226.
- Bagolini B. 1968. Ricerche sulle dimensioni dei manufatti litici preistorici non ritoccati. *Annali Università Ferrara* 15(10): 195–219.
- Bell J. G., Preston T., Henderson R. J., Strachan F., Bron J. E., Cooper K., and Morrison D. J. 2007. Discrimination of wild and cultured European sea bass (*Dicentrarchus labrax*) using chemical and isotopic analyses. *Journal of Agricultural and Food Chemistry* 55: 5934–5941. <https://doi.org/10.1021/jf0704561>
- Bello S. M., Wallduck R., Dimitrijević V., Živaljević I., and Stringer C. B. 2016. Cannibalism versus funerary defleshing and disarticulation after a period of decay: comparisons of bone modifications from four prehistoric sites. *American Journal of Physical Anthropology* 161(4): 722–743. <https://doi.org/10.1002/ajpa.23079>
- Bernabeu J. 1989. *La tradición cultural de las cerámicas impresas en la zona oriental de la Península Ibérica*. Serie de Trabajos Varios 86. Servicio de Investigación Prehistórica. Valencia.
2010. El mundo funerario entre el VI y el II milenio AC. In A. Pérez-Fernández, B. Soler Mayor (eds.), *Restos de vida, restos de muerte*. Diputación de Valencia. Valencia: 45–54.
- Bernabeu J., Molina L. (eds.) 2009. *La Cova de les Cendres*. Museo Arqueológico de Alicante. Alicante.
- Bernabeu J., Molina L., and García-Puchol O. 2001. El mundo funerario en el horizonte cardial valenciano: un registro oculto. *Sagvntvn* 33: 27–36.
- Bernabeu J., García-Puchol O., and Orozco-Köhler T. 2018. New insights relating to the beginning of the Neolithic

- in the eastern Spain: Evaluating empirical data and modelled predictions. *Quaternary International* 470: 439–450. <https://doi.org/10.1016/j.quaint.2017.03.071>
- Bernaldo-Quirós F., Cabrera V., Cacho C., and Vega L. G. 1981. Proyecto de análisis técnico para las industrias líticas. *Trabajos de Prehistoria* 38: 9–37.
- Bicho N., Cascalheira J., Gonçalves C., Umbelino C., García-Rivero D., and André L. 2017. Resilience, replacement and acculturation in the Mesolithic/Neolithic transition: the case of Muge, central Portugal. *Quaternary International* 446: 31–42. <https://doi.org/10.1016/j.quaint.2016.09.049>
- Bicho N., Cascalheira J., Marreiros J., Gonçalves C., Pereira T., and Dias R. 2013. Chronology of the Mesolithic occupation of the Muge valley, central Portugal: the case of Cabeço da Amoreira. *Quaternary International* 308: 130–139. <https://doi.org/10.1016/j.quaint.2012.10.049>
- Bienert H. D. 1991. Skull cult in the prehistoric Near East. *Journal of Prehistoric Religion* 5: 9–23.
- Bocquentin F., Kudas E., and Ortiz A. 2016. Headless but still eloquent! Acephalous skeletons as witnesses of Pre-Pottery Neolithic North-South Levant. *Paléorient* 42(2): 35–55. <https://doi.org/10.3406/paleo.2016.5719>
- Bonogofsky M. 2001. Cranial modeling and Neolithic bone modification at 'Ain Ghazal: new interpretations. *Paléorient* 27(2): 141–146. <https://doi.org/10.3406/paleo.2001.4734>
2006. Complexity in context: Plain, painted and modeled skulls from the Neolithic Middle East. In M. Bonogofsky (ed.), *Skull Collection, Modification and Decoration*. BAR International Series 1539. Archaeopress. Oxford: 15–28.
- Borić D. 2003. 'Deep time' metaphor: mnemonic and apotropaic practices at Lepenski Vir. *Journal of Social Archaeology* 3(1): 46–74. <https://doi.org/10.1177/1469605303003001098>
- Boulestin B. 2012. Quelques réflexions à propos des coupes crâniennes préhistoriques. In B. Boulestin, D. Henry-Gambier (eds.), *Crânes trophées, crânes d'ancêtres et autres pratiques autour de la tête: problèmes d'interprétation en archéologie*. BAR International Series 2415. Archaeopress. Oxford: 35–45.
- Boulestin B., Coupey A. S. 2015. *Cannibalism in the linear pottery culture: The human remains from Herxheim*. Archaeopress Publishing Limited. Oxford.
- Botella M. C. 1973. Restos humanos eneolíticos con incisiones de la provincia de Granada. *Anales del Desarrollo* 17(41–42): 401–423.
- Botella M. C., Jiménez S. A., Alemán I., Du Souich P., and García C. 2000. Evidencias de canibalismo en el Neolítico español. In L. Caro, H. Rodríguez, E. Sánchez, B. López and M. J. Blanco (eds.), *Tendencias actuales de investigación en la antropología física española*. Universidad de León. León: 43–56.
- Bueno O. 2002. Estudios de los restos humanos aparecidos en el yacimiento de "El Retamar". In J. Ramos, M. Lazarich (eds.), *El asentamiento de 'El Retamar' (Puerto Real, Cádiz). Contribución al estudio de la formación social tribal a los inicios de la economía de producción en la Bahía de Cádiz*. Universidad de Cádiz. Cádiz: 241–248.
- Buikstra J. E., Ubelaker D. H. 1994. *Standards for data collection from human skeletal remains: proceedings of a seminar at the Field Museum of Natural History*. Arkansas Archaeological Survey Research Series. Fayetteville.
- Cacho C., Papi C., Sánchez-Barriga A., and Alonso F. 1996. La cestería decorada de la cueva de los Murciélagos (Albuñol, Granada). *Complutum* 6(1): 105–122.
- Capel J., Huertas F., Pozzuoli A., and Linares J. 2006. Red ochre decorations in Spanish Neolithic ceramics: a mineralogical and technological study. *Journal of Archaeological Science* 33: 1157–1166. <https://doi.org/10.1016/j.jas.2005.12.004>
- Cardoso J. L. 2007. *Pré-história de Portugal*. Universidade Aberta. Lisboa.
- Cardoso J. L., Medeiros S., and Martins F. 2018a. 150 anos depois: uma rara placa de xisto decorada encontrada na gruta da Casa da Moura (Óbidos). *Revista Portuguesa de Arqueologia* 21: 57–69.
- Cardoso J. L., Rebelo P., Neto N., and Ribeiro R. A. 2018b. Enterramento do neolítico antigo em fossa na zona ribeirinha de Lisboa (antigos armazéns Sommer). *Estudos Arqueológicos de Oeiras* 24: 125–140.
- Carrasco J. L., Martínez F. 2014. Las cronologías absolutas del Neolítico Antiguo en el sur de la península ibérica. Nuevas dataciones. *Archivo de Prehistoria Levantina* 30: 57–80.
- Carrasco J. L., Pachón J. A., and Martínez-Sevilla F. 2010. Las necrópolis neolíticas en Sierra Harana y sus estribaciones (Granada): nuevos modelos interpretativos. *Antiquitas* 22: 21–34.
- Carrasco J. L., Pachón J. A., and Gámiz J. G. 2012. Las cerámicas neolíticas pintadas en Andalucía y sus contextos arqueológicos. *Antiquitas* 24: 17–79.
- Carreira J. R., Cardoso J. L. 2002. A gruta da Casa da Moura (Cesareda, Óbidos) e sua ocupação pós-paleolítica. *Estudos Arqueológicos de Oeiras* 10: 249–361.

- Carrer F., Colonese A. C., Lucquin A., +4 authors, and Craig O. E. 2016. Chemical analysis of pottery demonstrates Prehistoric origin for high-altitude alpine dairying. *PLoS ONE* 11(4): e0151442. <https://doi.org/10.1371/journal.pone.0151442>
- Carrión J. S., Fernández S., Jimenez J. M., +8 authors, and Walker M. J. 2019. The sequence at Carihuela Cave and its potential for research into Neanderthal ecology and the Mousterian in southern Spain. *Quaternary Science Reviews* 217: 194–216. <https://doi.org/10.1016/j.quascirev.2019.04.012>
- Carvalho A. F. 1998. *Talhe da pedra no Neolítico antigo do Maciço Calcáreo das Serras d'Aire e Candeeiros (Estremadura Portuguesa). Um primeiro modelo tecnológico e tipológico*. Colibri. Lisboa.
- Carvalho A. F., Cardoso J. L. 2011. A cronologia absoluta das ocupações funerárias da gruta da Casa da Moura (Óbidos). *Estudos Arqueológicos de Oeiras* 18: 393–405.
- Carvalho A. F., Gibaja J. F. 2005. Talhe da pedra no Neolítico antigo do Maciço Calcáreo Estremenho (Portugal): matérias-primas, tecnologia e análise funcional. In P. Arias, R. Ontañón, and C. García-Moncó (eds.), *Actas del III Congreso del Neolítico en la Península Ibérica*. Universidad de Cantabria. Santander: 373–382.
- Carvalho A. F., Gibaja J. F., and Gavián B. 2012. Technologie, typologie et analyses fonctionnelles de l'outillage lithique durant le Néolithique Ancien dans la Cueva de Murciélagos de Zuheros (Córdoba, Espagne): réflexions sur la néolithisation du sud de la Péninsule Ibérique. *L'Anthropologie* 116: 148–170.
- Cauvin J. 2000. *The birth of the gods and the origins of agriculture*. Cambridge University Press. Cambridge.
- Chambon P. 2008. Alguns trets de les pràctiques funeràries del Neolític postcardial. *Quarhis* 4: 70–75.
- Copley M. S., Berstan R., Docherty G., +4 authors, and Evershed R. 2003. Direct chemical evidence for widespread dairying in prehistoric Britain. *Proceedings of the National Academy of Sciences of the United States of America* 100(4): 1524–1529. <https://doi.org/10.1073/pnas.0335955100>
- Correa-Ascencio M., Evershed P. 2014. High throughput screening of organic residues in archaeological potsherds using direct acidified methanol extraction. *Analytical Methods* 6: 1330–1340. <https://doi.org/10.1039/C3AY41678J>
- Courtin J. 2000. *Les premiers paysans du Midi*. La Maison des Roches éditeur. Paris.
- Craig O. E., Allen R. B., Thompson A., Stevens R. E., Steele V. J., and Heron C. 2012. Distinguishing wild ruminant lipids by gas chromatography/combustion/isotope ratio mass spectrometry. *Rapid Communications in Mass Spectrometry* 26(19): 235. <https://doi.org/10.1002/rcm.6349> 9-2364.
- Craig O. E., Steele V. J., Fischer A., +7 authors, and Heron C. 2011. Ancient lipids reveal continuity in culinary practices across the transition to agriculture in Northern Europe. *Proceedings of the National Academy of Sciences of the United States of America* 108(44): 17910–17915. <https://doi.org/10.1073/pnas.1107202108>
- Cramp L. J. E., Jones J., Sheridan A., +4 authors, and Evershed R. P. 2014. Immediate replacement of fishing with dairying by the earliest farmers of the northeast Atlantic archipelagos. *Proceedings of the Royal Society of London B Biological Sciences* 281(1780): 20132372. <https://doi.org/10.1098/rspb.2013.2372>
- Croucher K. 2006. Getting ahead: exploring meanings of skulls in the Neolithic Near East. In M. Bonogofsky (ed.), *Skull Collection, Modification and Decoration*. BAR International Series 1539. Archaeopress. Oxford: 29–44.
- Cubas M., Lucquin A. J. A., Robson H. K., +20 authors, and Craig O. E. 2020. Latitudinal gradient in dairy production with the introduction of farming in Atlantic Europe. *Nature Communications* 11(1): 1–9. <https://doi.org/10.1038/s41467-020-15907-4>
- Del Olmo G. 2015. The Marzeah and the Ugaritic magic ritual system. A close reading of KTU 1.114. *Aula Orientalis* 32: 221–241.
- DeLeonardis L. 2000. The body context: interpreting Early Nasca decapitated burials. *Latin American Antiquity* 11(4): 363–386. <https://doi.org/10.2307/972002>
- Delibes G., Estremera M. S., Alonso O., and Pastor F. 1999. ¿Sepultura o reliquia? A propósito de un cráneo hallado en ambiente habitacional en la Cueva de la Vaquera (Segovia). *Saguntum Extra* 2: 429–434.
- Dibble H., McPherron S. 2010. *Old Stone Age*. <http://www.oldstoneage.com/software/edm-mobile.shtml>. Accessed 22 March 2020.
- Dudd S. N. 1999. *Molecular and isotopic characterization of animal fats in archaeological pottery*. Unpublished PhD Thesis. School of Chemistry. University of Bristol. <https://research-information.bris.ac.uk/ws/portalfiles/portal/34490556/DX213544.pdf>
- Escacena J. L. 2018. Orantes neolíticos de Andalucía. Imágenes sobre vasijas de cerámica. *Boletín del Museo Arqueológico Nacional* 37: 25–42.
- Estremera M. S. 2003. *Primeros agricultores y ganaderos en la Meseta Norte: el Neolítico de la Cueva de*

- La Vaquera (Torreiglesias, Segovia)*. Junta de Castilla y León. León.
- Estremera M. S., Valle A. D. 1999. Las almagras neolíticas de la Cueva de la Vaquera (Segovia): la transformación térmica de la goethita en relación con los cambios de color de la pintura cerámica. *Boletín del Seminario de Estudios de Arte y Arqueología* 65: 43–52.
- Evershed R. P. 2008. Organic residue analysis in archaeology: the archaeological biomarker revolution. *Archaeometry* 50: 895–924. <https://doi.org/10.1111/j.1475-4754.2008.00446.x>
- Evershed R. P., Payne S., Sherratt A. G., +18 authors, and Burton M. M. 2008. Earliest date for milk use in the Near East and southeastern Europe linked to cattle herding. *Nature* 455: 528–531. <https://doi.org/10.1038/nature07180>
- Fábregas R., Carvalho A. F., Lombera A., Cubas M., Lucquin A., Craig O., and Rodríguez-Álvarez X. P. 2019. Vaso con decoración cardial de Cova Eirós (Triacastela, Lugo). *Trabajos de Prehistoria* 76(1): 147–160. <https://doi.org/10.3989/tp.2019.12231>
- Fernández E., Cortés M., Pérez-Pérez A., and Turbón D. 2005. Primeras secuencias de DNA de muestras prehistóricas andaluzas. In M. Pellicer, A. Arribas (eds.), *II y III Simposios de Prehistoria Cueva de Nerja*. Fundación Cueva de Nerja. Nerja: 208–215.
- Freeman D. 1979. Severed heads that germinate. In R. H. Hook (ed.), *Fantasy and symbol: Studies in anthropological interpretation*. Academic Press. New York: 233–246.
- García Borja P., Salazar D. C., Pérez-Fernández A., Pardo-Gordó S., and Casanova V. 2011. El Neolítico antiguo cardial y la Cova de la Sarsa (Bocairent, València). Nuevas perspectivas a partir de su registro funerario. *Munibe* 62: 175–195.
- García-Gazólaz J., García-Sesma J. 2007. Enterramientos en el poblado neolítico de Los Cascajos (Los Arcos, Navarra). In M. A. Hurtado (ed.), *La tierra te sea leve. Arqueología de la muerte en Navarra*. Gobierno de Navarra. Pamplona: 52–58.
- García-Gazólaz J., García-Sesma J., Rojo M. A., Alday A., Garrido R., and García-Martínez I. 2011. Los Cascajos (Los Arcos, Navarra). *Saguntum* 12: 135–140.
- García-Martínez I. 2012. *El proceso de neolitización en el Interior Peninsular: la Submeseta norte y el Alto Valle del Ebro: El análisis de la cerámica como herramienta interpretativa*. Universidad de Valladolid. Valladolid.
- García-Puchol O. 2005. *El proceso de neolitización en la fachada mediterránea de la península Ibérica. Tecnología y tipología de la piedra tallada*. BAR International Series 1430. Archaeopress. Oxford.
- García-Puchol O., Bernabeu J., Barton C. M., Pardo-Gordó S., McClure S. B., and Díez-Castillo A. 2018. A Bayesian approach for timing the neolithization in Mediterranean Iberia. *Radiocarbon* 60(1): 181–205. <https://doi.org/10.1017/RDC.2017.61>
- García-Rivero D., Vera J. C., Díaz-Rodríguez M. J., Barrera M., Taylor R., Pérez-Aguilar L. G., and Umbelino C. 2018a. La Cueva de la Dehesilla (Sierra de Cádiz): vuelta a un sitio clave para el neolítico del sur de la península ibérica. *Munibe* 69: 123–144.
- García-Rivero D., Taylor R., Pérez-Aguilar L. G., +5 authors, and Bernáldez Sánchez E. 2018b. Andalusí populations at La Dehesilla Cave (Sierra de Cádiz, Southern Iberia): and interdisciplinary approach to their rural economic systems. *Journal of Islamic Archaeology* 5(2): 119–151.
- García-Rivero D., Taylor R., Umbelino C., +10 authors, and Pérez-González J. 2020. The exceptional finding of Locus 2 at Dehesilla Cave and the Middle Neolithic ritual funerary practices of the Iberian Peninsula. *PLoS ONE* 15(8): e0236961. <https://doi.org/10.1371/journal.pone.0236961>
- Garrido-Pena R., Rojo M. A., Tejedor C., and García-Martínez I. 2012. Las máscaras de la muerte: ritos funerarios en el Neolítico de la Península Ibérica. In M. A. Rojo, R. Garrido-Pena, and I. García-Martínez (eds.), *El Neolítico en la Península Ibérica y su contexto europeo*. Cátedra. Madrid: 143–174.
- Gibaja J. F. 2004. Prácticas funerarias durante el Neolítico en Cataluña. *Mainake* 26: 9–27.
- Gibaja J. F., Mazzucco N., Ibáñez J. J., +5 authors, and López C. 2017. Reconociendo el camino seguido por las primeras comunidades neolíticas asentadas en el Mediterráneo centro-occidental a través del análisis de sus hoces. *Arkeogazte* 7: 5–24.
- Gibaja J. F., Morell B., López-Onaindia D., Zémour A., Bosch A., Tarrús J., and Eulàlia M. 2018. Nuevos datos cronológicos sobre la cueva sepulcral neolítica de l'Avellaner (Les Planes d'Hostoles, Girona). *Munibe* 69: 145–155. <https://doi.org/10.21630/maa.2018.69.01>
- Góngora M. D. 1868. *Antigüedades prehistóricas de Andalucía*. C. Maro. Madrid.
- Goring-Morris N., Horwitz L. K. 2007. Funerals and feasts during the Pre-Pottery Neolithic B of the Near East. *Antiquity* 81(314): 902–919. <https://doi.org/10.1017/S0003598X00095995>

- Gresky J., Haelm J., and Clare L. 2017. Modified human crania from Göbekli Tepe provide evidence for a new form of Neolithic skull cult. *Science Advances* 3(6): e-1700564. DOI: 10.1126/sciadv.1700564
- Guijo J. M. 2004. Paleoañtropololía. In D. Martín-Socas, M. D. Cámalich, and P. González Quintero (eds.), *La cueva de El Toro (Sierra de El Torcal-Antequera-Málaga). Un modelo de ocupación ganadera en el territorio andaluz entre el VI y II milenios ANE*. Junta de Andalucía. Sevilla: 287-290.
- Haddow S. D., Knüsel C. J. 2017. Skull retrieval and secondary burial practices in the Neolithic Near East: Recent insights from Çatalhöyük, Turkey. *Bioarchaeology International* 1(1/2): 52-71. <https://doi.org/10.5744/bi.2017.1002>
- Harris E. C. 1991. *Principios de estratigrafía arqueológica*. Crítica. Barcelona.
- Hernández M. S. 2000. Sobre la religión neolítica: A propósito del arte macroesquemático. In M. H. Olcina, J. A. Soler (eds.), *Scripta in Honorem Enrique A. Llobregat Conesa*. Diputación Provincial de Alicante. Alicante: 137-156.
- Hunt A. M. W. (ed.) 2016. *The Oxford handbook of archaeological ceramic analysis*. Oxford University Press. Oxford.
- Ibáñez J. J., Gibaja J. F., Gassin B., and Mazzucco N. 2017. Paths and rhythms in the spread of agriculture in the Western Mediterranean: the contribution of the analysis of harvesting technology. In O. García Puchol, D. C. Salazar (eds.), *Times of Neolithic transition along the Western Mediterranean*. Springer. Cham: 339-371.
- Ibáñez J. J., González J. E. 1996. La función de los útiles tallados neolíticos de la Cueva de los Murciélagos de Zuheros (Córdoba). Primeros resultados. *Rubricatum* 1: 169-176.
- Iriarte E., Del Val M., García-Martínez I., Rojo Guerra M. A., Tejedor C., García-Gazólaz J., and Sesma-Sesma J. 2019. Contexto paleoambiental del yacimiento Neolítico de Los Cascajos (Navarra, España): quimioestratigrafía de la secuencia sedimentaria holocena del río Odrón. *Boletín de la Sociedad Geológica Mexicana* 71(2): 261-273.
- Jammo S. 2014. *A study of skull symbolism in Near Eastern Neolithic societies*. Unpublished PhD Thesis. University of Tsukuba. Tsukuba.
- Jiménez-Brobeil S. A. 1990. Rituales funerarios neolíticos en la Alta Andalucía. Estado actual de la cuestión. *Zephyrus* 43: 125-130.
- Jiménez-Brobeil S. A., Botella M. C., Alemán I., and Sánchez A. P. M. G. 1996. Cráneos trepanados neolíticos de Andalucía Oriental. In A. Pérez-Pérez (ed.), *Actas del III Congreso Nacional de Paleopatología*. Fundación Uriach. Barcelona: 271-276.
- Jiménez-Brobeil S. A., Du Souich P. H., and Al Oumaoui I. 2009. Possible relationship of cranial traumatic injuries with violence in the south-east Iberian Peninsula from the Neolithic to the Bronze Age. *American Journal of Physical Anthropology* 140(3): 465-475. <https://doi.org/10.1002/ajpa.21089>
- Jiménez-Brobeil S. A., Ortega J. A., and García-Sánchez M. 1986. Incisiones intencionales sobre huesos humanos del Neolítico de la Cueva de Malalmuerzo. *Antropología y Paleoecología Humana* 4: 39-65.
- Jordá J. F., Aura J. E. 2008. 70 fechas para una cueva: revisión crítica de 70 dataciones C14 del Pleistoceno Superior y Holoceno de la Cueva de Nerja (Málaga, Andalucía, España). *Espacio, Tiempo y Forma* 1: 239-256.
- Jordá J. F., Aura J. E., Rodrigo M. J., Pérez M., and Badal E. 2003. El registro paleobiológico cuaternario del yacimiento arqueológico de la Cueva de Nerja (Málaga, España). *Boletín de la Real Sociedad Española de Historia Natural Sección Geológica* 98(1-4): 73-89.
- Juan-Cabanilles J. 2008. *El utillaje de piedra tallada en la Prehistoria reciente valenciana. Aspectos tipológicos, estilísticos y evolutivos*. Diputación de Valencia. Valencia.
- Kenyon K. M. 1953. Neolithic Portrait- Skulls from Jericho. *Antiquity* XXVII(106): 105-107.
- Kuijt I. 2008. The regeneration of life: Neolithic structures of symbolic remembering and forgetting. *Current Anthropology* 49(2): 171-197. <https://doi.org/10.1086/526097>
- Laplace G. 1966. *Recherches sur l'origine et l'évolution des complexes leptolithiques*. Mélanges Archeolog Historie 4. Ecole Française de Rome. Paris.
- Le Bras-Goude G., Binder D., Zémour A., and Richards M. P. 2010. New radiocarbon dates and isotope analysis of Neolithic human and animal bone from the Fontbrégoua Cave (Salernes, Var, France). *Journal of Anthropological Science* 88: 167-178.
- Llobregat E. A. 1973. Del fin del Neolítico de cerámicas impresas al comienzo de la Edad del Bronce en la región valenciana: precisiones sobre cronología absoluta. *Saguntum* 9: 3-10.
- Maier C. I. 2017. *Off with their heads! An analysis of the Levantine plastered skulls during the Pre-Pottery Neolithic B*. Unpublished thesis for graduation with Honors in Anthropology. Whitman College. Walla Walla. Washington. <https://arminda.whitman.edu/theses/350>

- Marginedas F., Rodríguez-Hidalgo A., Soto M., Bello S. M., Cáceres I., Huguet R., and Saladié P. 2020. Making skull cups: Butchering traces on cannibalised human skulls from five European archaeological sites. *Journal of Archaeological Science* 114: 105076. <https://doi.org/10.1016/j.jas.2020.105076>
- Martín-Socas D., Cálalich, M. D., and González-Quintero P. 2004. *La cueva de El Toro (Sierra de El Torcal-Antequera-Málaga). Un modelo de ocupación ganadera en el territorio andaluz entre el VI y II milenios ANE*. Conserjería de Cultura de la Junta de Andalucía. Sevilla.
- Martín-Socas D., Cálalich M. D., Caro J. L., and Rodríguez-Santos F. J. 2018. The beginning of the Neolithic in Andalusia. *Quaternary International* 470: 451–471. <https://doi.org/10.1016/j.quaint.2017.06.057>
- Martínez-Fernández G., Afonso J. A. 2008. L'évolution des ensembles d'artefacts en pierre taillé pendant la Préhistoire récente au Sud-est de la Péninsule ibérique. In M. H. Dias-Meirinho, V. Lea, K. Gernigon, P. Fouéré, F. Briois, and M. Bailly (eds.), *Les industries lithiques taillées des IVe et IIIe millénaires en Europe Occidentale*. Hadrian books. Oxford: 291–308.
- Martins H., Oms F. X., Pereira L., Pike A. W., Rowsell K., and Zilhão J. 2015. Radiocarbon dating the beginning of the Neolithic in Iberia: new results, new problems. *Journal of Mediterranean Archaeology* 28(1): 105–131. <http://dx.doi.org/10.1558/jmea.v28i1.27503>
- Masset C. 1989. Age estimation on the basis of cranial sutures. In M. Y. Springfield (ed.), *Age markers in the human skeleton*. CC Thomas. Işcan: 71–103.
- Miguel M. P. 2008. La Cova de la Sarsa (Bocairent, Valencia): Osteoarqueología de un yacimiento del Neolítico cardial. In M. S. Hernández, J. Soler, and J. López (eds.), *IV Congreso del Neolítico Peninsular*. MARQ. Alicante: 85–91.
- Molina F., Cámara J. A., Alfonso J. A., Gámiz J., Capel J., and Martínez G. 2017. Hiatus in an archaeological multi-level site: Los Castillejos in Las Peñas de los Gitanos (Montefrío, Granada). In M. Cupitò, M. Vidale, and A. Angelini (eds.), *Beyond limits. Studi in onore di Giovanni Leonardi*. Università degli Studi di Padova. Padova: 91–100.
- Molina F., Cámara J. A., and López Sáez J. A. 2012. Andalucía. In M. A. Rojo, R. Garrido, and I. García-Martínez (eds.), *El Neolítico en la Península Ibérica y su contexto europeo*. Cátedra. Madrid: 405–462.
- Mora L. 1970. El yacimiento prehistórico de la Cueva de Picado (Cádiz). *Trabajos de Prehistoria* 27: 279–286.
- Morgado A., Pelegrin J. 2012. Origin and development of pressure blade production in the Southern Iberian Peninsula (6<sup>th</sup>–3<sup>rd</sup> Millennium B.C.). In P. Desrosiers (ed.), *The Emergence of Pressure Blade Making*. Springer. Boston: 219–235.
- Navarrete M. S. 1976. La cultura de las cuevas con cerámica decorada en Andalucía Oriental. *Cuadernos de Prehistoria y Arqueología de la Universidad de Granada* 1: 59–73.
- Navarrete M. S., Capel J. 1980. Algunas consideraciones sobre la cerámica a la almagra del Neolítico andaluz. *Cuadernos de Prehistoria de Granada* 5: 15–34.
- Oms F. X., Daura J., Sanz M., Mendiola S., Pedro M., and Martínez P. 2017. First evidence of collective human inhumation from the cardial neolithic (Cova Bonica, Barcelona, NE Iberian Peninsula). *Journal of Field Archaeology* 42(1): 43–53. <https://doi.org/10.1080/00934690.2016.1260407>
- Orton C., Hughes M. 2014. *Pottery in Archaeology*. Cambridge University Press. Cambridge.
- Pardo-Gordó S, Gómez-Bach A, Molist M., and Bernabeu J. (eds.) 2021. *Contextualizando la cerámica impresa: Horizontes culturales en la península ibérica*. Universitat Autònoma de Barcelona. Bellaterra.
- Pascual J. L. 2002. Incineración y cremación parcial en contextos funerarios neolíticos y calcolíticos del este peninsular al sur del Xúquer. In M. Kunst, M. A. Rojo (eds.), *Sobre el significado del fuego en los rituales funerarios del Neolítico*. Secretariado de Publicaciones e Intercambio Editorial. Valladolid: 155–190.
- Pellicer M. 1964. *El Neolítico y el Bronce de la Cueva de la Carigüela de Piñar (Granada)*. Trabajos de Prehistoria 15. CSIC. Madrid.
- Pellicer M., Acosta P. 1986. *Neolítico y Calcolítico de la Cueva de Nerja*. Trabajos sobre la Cueva de Nerja 6. Patronato de la Cueva de Nerja. Málaga.
- Perales U., Gibaja J. F., Afonso J. A., Martínez G., Cámara J. A., and Molina F. 2015. Análisis funcional del utillaje laminar del neolítico antiguo de Castillejos de Montefrío (Granada). *Spal* 24: 15–33. <http://dx.doi.org/10.12795/spal.2015i24.01>
- Pérez-Fernández A., Soler B. (eds.) 2010. *Restos de vida, restos de muerte*. Diputación de Valencia. Valencia.
- Pla J., Junyent E. 1970. Noticia sobre el hallazgo de un vaso en la Cova dels Lladres (Vacarisses, Barcelona). *Pyrenae* 6: 43–46.
- Ramos J., Lazarich M. 2002. *El asentamiento de 'El Retamar' (Puerto Real, Cádiz)*. Contribución al estudio de

*la formación social tribal a los inicios de la economía de producción en la Bahía de Cádiz*. Universidad de Cádiz. Cádiz.

Ramos J., Pérez M., Domínguez S., Vijande E., and Jesús J. 2010. Estado actual del conocimiento de las sociedades tribales neolíticas en el ámbito de la región histórica del Estrecho de Gibraltar. Proyectos e ideas en desarrollo. In J. F. Gibaja and A. F. Carvalho (eds.), *Os últimos caçadores-recolectores e as primeiras comunidades produtoras do sul da Península Ibérica e do norte de Marrocos*. Universidade do Algarve. Faro: 107–118.

Recio C., Martín Q., and Raposo C. 2013. GC-C-IRMS analysis of FAMES as a tool to ascertain the diet of Iberian pigs used for the production of pork products with high added value. *Grasas y Aceites* 64(2): 181–190.

Rice P. 2015. *Pottery analysis: a sourcebook*. The University of Chicago Press. Chicago.

Robledo B., Jiménez-Brobeil S. A. 1994. Restos humanos neolíticos de la Cueva de la Dehesilla (Algar, Cádiz). In *Actas del II Congreso de Historia de Andalucía*. Prehistoria. Monte de Piedad. Córdoba: 211–218.

Rodríguez A. 2004. Análisis funcional de los instrumentos líticos tallados. In D. Martín-Socas (ed.), *La Cueva de El Toro (Sierra de El Torcal, Antequera-Málaga). Un modelo de ocupación ganadera en territorio andaluz entre el VI y II milenios A.N.E.* Junta de Andalucía. Sevilla: 135–160.

Rojo M., Garrido-Pena R., and García-Martínez I. (eds.) 2012. *El Neolítico en la Península Ibérica y su contexto europeo*. Cátedra. Madrid.

Rojo M., García Martínez I., Garrido R., +11 authors, and Magallón H. A. 2016. Enterramientos del Neolítico antiguo en el interior peninsular: nuevos datos para una actualización de la evidencia empírica. In *Del neolítico a l'edat del bronze en el Mediterrani occidental. Estudis en homenatge a Bernat Martí Oliver*. STV 119. Servicio de Investigación Prehistórica del Museo de Valencia. Valencia: 181–210.

Rubio I. 2001. El mundo funerario neolítico peninsular: algunas reflexiones sobre su trasfondo social. *Anales de Prehistoria y Arqueología* 17: 53–66.

2004. Rituales de cráneos y enterramiento en el Neolítico precerámico del Próximo Oriente. *Cuadernos de Prehistoria y Arqueología de la Universidad Autónoma de Madrid* 30: 27–45.

Santana J., Rodríguez-Santos F. J., Camalich-Massieu M. D., Martín-Socas D., and Fregel R. 2019. Aggressive or funerary cannibalism? Skull-cup and the human bone manipu-

lation in Cueva de El Toro (Early Neolithic, southern Iberia). *American Physical Anthropology* 169: 31–54.

Scheuer L., Black S. 2000. *Developmental juvenile osteology*. Academic Press. London.

Schmandt-Besserat D. (ed.) 2013. *Symbols at 'Ain Ghazal*. Ain Ghazal excavation reports 3. Bibliotheca neolithica Asiae meridionalis et occidentalis. Ex Oriente. Berlin.

Shepard A. O. 1956. *Ceramics for the archaeologist*. Carnegie Institution of Washington. Washington.

Shipman P. 1981. Applications of scanning electron microscopy to taphonomic problems. *Annals of the New York Academy of Sciences* 376: 357–385.

Silva A. M. 1995. Sex assessment using the calcaneus and talus. *Antropologia Portuguesa* 13: 107–119.

Simões C. D., Rebelo P., Neto N., and Cardoso J. L. 2020. Lisboa no Neolítico Antigo: resultados das escavações no Palácio Ludovice. *Estudos Arqueológicos de Oeiras* 26: 11–40.

Sinopoli C. M. 1991. *Approaches to archaeological ceramics*. Springer. Boston.

Slon V., Sarig R., Hershkovitz I., Khalaily H., and Milevski I. 2014. The plastered skulls from the Pre-Pottery Neolithic B site of Yiftahel (Israel)—A computed tomography-based analysis. *PloS One* 9(2): e89242. <https://doi.org/10.1371/journal.pone.0089242>

Smith B. H. 1984. Patterns of molar wear in hunter-gatherers and agriculturalists. *American Journal of Physical Anthropology* 63: 39–84. <https://doi.org/10.1002/ajpa.1330630107>

Solari A., Botella M., and Alemán I. 2012. *Canibalismo en la Cueva de Malamuerzo: identificación de huellas de manipulación intencional en restos óseos humanos de origen arqueológico (Granada, España)*. BAR International Series 2418. Archaeopress. Oxford.

Spangenberg J. E., Jacomet S., and Schibler J. 2006. Chemical analyses of organic residues in archaeological pottery from Arbon Bleiche 3, Switzerland: evidence for dairying in the late Neolithic. *Journal of Archaeological Science* 33: 1–13. <https://doi.org/10.1016/j.jas.2005.05.013>

Spiteri C. D. 2012. *Pottery use at the transition to agriculture in the western Mediterranean. Evidence from biomolecular and isotopic characterisation of organic residues in Impressed/Cardial ware vessels*. Unpublished PhD Thesis. Department of Archaeology. University of York. York. <https://core.ac.uk/download/pdf/9848297.pdf>

- Spiteri C. D., Gillis R. E., Roffet-Salque M., +9 authors, and Evershed R. P. 2016. Regional asynchronicity in dairy production and processing in early farming communities of the northern Mediterranean. *Proceedings of the National Academy of Sciences of the United States of America* 113: 13594–13599. <https://doi.org/10.1073/pnas.1607810113>
- Reimer P. J., Bard E., Bayliss A., +26 authors, and van der Plicht J. 2013. IntCal13 and Marine radiocarbon age calibration curves 0–50000 years cal BP. *Radiocarbon* 55(4): 1869–1887. doi: 10.2458/azu\_js\_rc.55.16947
- Taylor R., García-Rivero D. 2021. Evidencias sobre el posible contexto del horizonte impresso en la cueva de la Dehesilla: caracterización cerámica y definición respecto al Neolítico antiguo andaluz tradicional. In S. Pardo-Gordó, A. Gómez-Bach, M. Molist, and J. Bernabeu (eds.), *Contextualizando la cerámica impressa: Horizontes culturales en la península ibérica*. Universitat Autònoma de Barcelona. Bellaterra: 153–166.
- Taylor R., Pérez-Aguilar L., and García-Rivero D. 2018. La secuencia arqueológica andalusí (siglos XI–XII) de la Cueva de La Dehesilla (Sierra de Cádiz, España). *Arqueología y Territorio Medieval* 25: 107–143. <https://doi.org/10.17561/aytm.v25.4>
- Ten R. 1980. Notes entorn del Neolític Vallesà. *Arraona* 10: 6–25.
- Testart A. 2008. Des crânes et des vautours ou la guerre oubliée. *Paléorient* 34: 35–58.
- Vera J. C. 1997. Algunos aspectos tecno-tipológicos y morfo-funcionales de industrias líticas talladas del neolítico andaluz. In *Actas del XXIV Congreso Nacional de Arqueología, II*. Instituto de Patrimonio Histórico. Murcia: 37–42.
- Verhoeven M. 2002. Ritual and ideology in the Pre-Pottery Neolithic B of the Levant and Southeast Anatolia. *Cambridge Archaeological Journal* 12(2): 233–258. doi:10.1017/S0959774302000124
- Villa P. 1992. Cannibalism in prehistoric Europe. *Evolutionary Anthropology* 1(3): 93–104. <https://doi.org/10.1002/evan.1360010307>
- Villa P., Courtin J., Helmer D., +5 authors, and Branca M. 1986. Un cas de cannibalisme au Néolithique. *Gallia Préhistoire* 29(1): 143–171.
- White T., Black M., and Folkens P. 2012. *Human osteology*. Academic Press. Amsterdam.
- Yakar R., Hershkovitz I. 1988. The modelled skulls of Nahal Hemar. *Atiqot* 18: 59–63.

∴

## Appendix 1

### Methods of the organic residue analyses

#### Lipid extraction

Lipids were extracted following established protocols of one-step extraction and methylation with acidified methanol (Craig et al. 2013; Correa-Ascencio, Evershed 2014). After cleaning the surface of the sherd, we took 2g of homogenised pottery powder. Prior extraction C<sub>34:0</sub> n-alkane was introduced as internal standard (10µl of hexatriacontane C<sub>34:0</sub>). Methanol (4ml) was added to 1g of pottery powder and the mixture sonicated during 15 min. Sulphuric acid (H<sub>2</sub>SO<sub>4</sub>–800µL) was used to acidify the suspension that was then heated in glass tubes during 4 hours at 70°C. Lipids were extracted from the centrifuged pottery powder with n-hexane (3x4ml). Internal standard (10µl of hexatriacontane C<sub>36:0</sub>) was added to all the samples to quantify the relative abundance of lipids. One sample (LD-10, 1g) was also extracted using 2:1 DCM:MeOH (3x2mL) to produce a total lipid extract (TLE) following established protocols (66). The extracts were then dried under N<sub>2</sub> and derivatized with N-O-bis(trimethylsilyl)trifluoroacetamide (BSTFA) heated at 70°C for 1 hour.

#### Analytical protocol

##### Gas Chromatography-Flame Ion Detector (GC-FID)

GC-FID was carried out in all samples (n=4) using an Agilent 7890S gas chromatograph (Agilent Technologies, Cheadle, Cheshire, UK). A splitless injector was used to inject the sample (1µL) at 300°C into the GC. The column used was a polyimidecoated fused silica DB-1 (15m x 320µm x 0.1µm; J&W Scientific, Folsom, CA, USA). The carrier gas was helium with pressure set at 3.3 psi and with a flow rate of 2ml/min and velocity of 46.57cm/s. The temperature program

was set at 100°C for 2 minutes, raised by 20°C/min until 325°C for 3 minutes. Quantification of lipid preservation was calculated according to  $(\text{Area}(\text{Sample})/\text{Area}(\text{IS})) * (\text{Weight}(\text{IS})/\text{Weight}(\text{Ceramic sample}))$ , omitting contaminant peaks such as plasticisers.

#### ***Gas Chromatography-Mass Spectrometry (GC-MS)***

GC-MS analysis was undertaken on 4 acidified lipid extracts to identify the main molecular components. An Agilent 7890A series chromatograph was used, attached to an Agilent 5975 Inert XL mass detector (Agilent technologies, Cheshire, UK). A splitless injector was used to keep the sample at 300°C (1 $\mu$ L). Helium was used as carrier gas with a constant flow of 3mL/min. The ionisation energy of the MS was 70eV and spectra were obtained by scanning between 3 and 44. A DB-23 (50%-Cyanopropyl)-methylpolysiloxane column (60m 0.250mm 0.25mm; J & Scientific, Folsom, CA, USA) was used. The temperature was set at 50°C for 2 minutes, then raised by 10°C/min until it reached 100°C, then raised by 4°C/min to 140°C, then by 0.5°C/min to 160°C, then by 20°C/min to 250°C where it was maintained for 10 minutes. Peak integration and quantification was carried out using ChemStation Rev. B.04.02 SP1. Automated integration was selected over manual integration to avoid inconsistencies. The analytical protocol was oriented to the identification of main molecular components (saturated and unsaturated fatty acids, branched fatty acids, dicarboxylic fatty acids, alkanes and isoprenoid fatty acids, u-(o-alkylphenyl) alkanolic and phytanic acids).

#### ***High Temperature Gas Chromatography-Mass Spectrometry (HTGC-MS)***

HTGC-MS was performed on the TLE extracts (n=1) using a 7890A Series chromatograph attached to a 5975C Inert XL mass-selective detector with a quadrupole mass analyser (Agilent Technologies, Cheshire, UK). The carrier gas was helium, and the inlet/column head-pressure was constant. The GC column was inserted directly into the ion source of the mass spectrometer. The ionisation energy of the mass spectrometer was 70eV and spectra were obtained by scanning between  $m/z$  50 and 1000. General screening of the TLE was performed using a DB-5 MS (5%-phenyl)-methylpolysiloxane column (30m x 0.250mm x 0.25 $\mu$ m; J&W Scientific, Folsom, CA, USA). The temperature for this column was set at 50°C for 2 minutes, then raised by 10°C/min to 325°C, where it was held for 15 minutes. A second analysis was performed with a HT-DB1 100% Dimethylpolysiloxane (15m x 0.320mm x 0.1 $\mu$ m) (J&W Scientific, Folsom, CA, USA) column. The injector was maintained at 350°C. The temperature of the oven was set at 50°C for 2 minutes, and then raised by 10°C/min to 350°C, where it was held for 15 minutes.

#### ***Gas Chromatography-Combustion Isotope Ratio Mass Spectrometry (GC-C-IRMS)***

GC-C-IRMS analysis was undertaken on 1 sample because it was the only extract which preserved the enough amount of C<sub>16:0</sub> and C<sub>18:0</sub> to be analysed. Stable carbon isotope values of methyl palmitate (C<sub>16:0</sub>) and methyl stearate (C<sub>18:0</sub>), derived from precursor fatty acids were measured by GC-C-IRMS, following existing procedure (Craig et al. 2012). An Isoprime 100 (Isoprime, Cheshire, UK) linked to a Hewlett Packard 7890B series GC (Agilent Technologies, Santa Clara, CA, USA) with an Isoprime GC5 interface (Isoprime Cheshire, UK) was used for the analysis. One  $\mu$ L of each sample was injected into DB-5MS ultra-inert fused-silica column. The temperature was set at 50°C for 0.5 minutes, then raised by 10°C/min to 300°C where it was held for 10 minutes. The carrier gas used was ultra-high purity grade helium with a flow rate of 3mL/min. The gas flow eluting from the column was split into two streams. One was directed into an Agilent 5975C inert mass spectrometer detector (MSD), for the sake of sample identification and quantification, while the other was directed through the GC5 furnace tube (CuO) kept at 850°C to oxidise all the carbon species to CO<sub>2</sub>. A clear resolution and baseline separation of the analysed peaks were achieved. Eluted products were ionized in the mass spectrometer by electron impact and ion intensities of  $m/z$  44, 45 and 46 were recorded for automatic computing of the <sup>13</sup>C/<sup>12</sup>C ratio of each peak in the extracts. Data analysis was carried out with IonVantage and IonOS softwares (Isoprime, Cheshire, UK) and was based on comparisons with standard reference gas (CO<sub>2</sub>) of known isotopic composition that was repeatedly measured. The results of the analysis were expressed in per mill (‰) relative to an international standard, VPDB. The accuracy and precision of the instrument was determined on n-alkanoic acid ester standards of known isotopic composition (Indiana standard F8-3). The mean  $\pm$ S.D. values of these were  $29.82 \pm 0.16\text{‰}$  and  $23.28 \pm 0.19\text{‰}$  for the methyl ester of C<sub>16:0</sub> (reported mean value vs. VPDB  $-29.90 \pm 0.03\text{‰}$ ) and C<sub>18:0</sub> (reported mean value vs. VPDB  $-23.24 \pm 0.01\text{‰}$ ) respectively. Each sample was measured in replicate (mean of S.D. 0.11‰ for C<sub>16:0</sub> and 0.10‰ for C<sub>18:0</sub>). Values were also corrected subsequent to analysis to account for the methylation of the carboxyl group that occurs during acid extraction. Corrections were based on comparisons with a standard mixture of C<sub>16:0</sub> and C<sub>18:0</sub> fatty acids of known isotopic composition processed in each batch under identical conditions. To compare the isotopic values of the main fatty acids (palmitic and stearic), data obtained on ruminant, and non-ruminant adipose fat, dairy and marine derived fatty acids resources throughout Europe have been compiled (Appendix 2).

## Appendix 2

### *Data obtained on ruminant and non-ruminant adipose fat, dairy and marine derived fatty acids throughout Europe*

Resource	Values (‰)		
	$\delta^{13}C_{16:0}$	$\delta^{13}C_{18:0}$	$\Delta^{13}C(C_{18:0}-C_{16:0})$
<b>Porcine adipose fats</b>			
Mean	-25.2	-24.4	0.8
Standard deviation	0.8	0.9	0.6
N	66	66	66
<b>Ruminant adipose fats</b>			
Mean	-29.1	-30.7	-1.6
Standard deviation	1.3	1.9	1.0
N	32	32	66
<b>Ruminant dairy fats</b>			
Mean	-28.7	-33.6	-4.8
Standard deviation	1.7	2.4	1.4
N	36	36	66
<b>Marine oils</b>			
Mean	-22.8	-22.3	0.5
Standard deviation	2.6	2.6	1.2
N	100	100	66

*Summary of  $\delta^{13}C$  values of  $C_{16:0}$  and  $C_{18:0}$  n-alkanoic acids obtained from modern European reference fats and oils (ruminant, non-ruminant, dairy and marine) (Craig et al. 2013; Cramp et al. 2014; Dudd 1999; Spangenberg et al. 2006; Bell et al. 2007; Spiteri 2012; Recio et al. 2013).*

∴

## Appendix 3

### *Geographic coordinates for the archaeological sites mentioned in the text*

No.	Site	X	Y	Latitude	Longitude	UTM Zone
1	Cueva de la Dehesilla	264554.81	4061867.432	36°40'21.7862" N	5°38'4.2919" W	30
2	Cueva de los Murciélagos	483892.52	4075115.45	36°49'16.1954" N	3°10'50.165" W	30
3	Cueva de la Carigüela	461989.158	4144825.745	37°26'56" N	3°25'47" W	30
4	Cueva de Nerja	424695.324	4069025.891	36°45'48.271" N	3°50'37.3128" W	30
5	Cueva del Toro	363234.189	4091203.509	36°57'23" N	4°32'10" W	30
6	El Retamar	753619.904	4046164.546	36°31'35" N	6°9'59" W	29
7	Casa da Moura	478091.82	4353132.739	39°19'36" N	9°15'15" W	29
8	Cueva de la Vaquera	411222.3	4549088	41°5'15" N	4°3'25" W	30
9	Cova de la Sarsa	712672.739	4292999.192	38°45'34" N	0°33'09" W	30
10	Cova dels Lladres	409242.963	4603718.884	41°34'45.4" N	1°54'40.8" E	31
11	Los Cascajos	564468.418	4709469.643	42°32'03" N	2°12'54" W	30
12	Cova de les Cendres	252261.347	4285836.315	38°41'09" N	0°09'07" E	31
13	Antigos armazéns Sommer	488672.516	4284614.07	38°42'34" N	9°07'49" W	29
14	Palacio Ludovice	487465.719	4285139.897	38°42'51" N	9°08'39" W	29
15	Cueva del Picado	262198.62	4054892.33	36°36'33.5715" N	5°39'31.3417" W	30