Research Article

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Fallen and Lost into the Abyss? A Mesolithic Human Skull from Sima Hedionda IV (Casares, Málaga, Iberian Peninsula)

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Abstract: The presence of scattered prehistoric human bones in caves and sinkholes is common in many regions of Iberia. These are usually interpreted as erratic elements coming from burial contexts, usually collective associations. These burial contexts are very frequent in karst areas of the Iberian Peninsula since the Early Neolithic, mostly in the Late Neolithic, and Copper Age, while findings from earlier chronologies are much more unusual. In this work, we present partial remains of a human skull from the Mesolithic period, recovered from a cave in the Strait of Gibraltar area. Although there is no conclusive evidence pointing to a dismantled burial context, this constitutes an isolated find, where its final location appears to be consistent with gravitational fall followed by water transportation.

Keywords: human remains, Mesolithic, Southern Iberia, sinkholes, radiocarbon

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1 Introduction

While the Neolithization process in Iberia has been largely explored, little is known about the archaeology of the last hunter-gatherers of the southern region. This has led to an apparent void that only seems to disappear with the irruption of the first Neolithic horizon in this territory. In Andalucía, the oldest Neolithic contexts are found in the coastal and nearby areas, indicated by radiocarbon dates on domestic caprines in Cueva de Nerja (Málaga) (NV2 Silo) and Cueva de la Dehesilla (15c–16b) (Algar, Cádiz). Both radiocarbon dates concur around 5500 cal. BC, marking the timing of the transitional horizon Mesolithic/Neolithic in southern Iberia (Aura Tortosa et al., 2013; García Rivero et al., 2018). After that, during the first centuries of farming strategies in the region, a high representation of archaeological contexts and sites is noted across southern Iberia, with a higher density of data from the last quarter of the sixth-millennium cal. BC (Martín Socas, Camalich Massieu, Caro Herrero, & Rodríguez-Santos, 2018).

The apparent scarcity of Epipalaeolithic/Mesolithic contexts is further increased by a gap between the end of the seventh and the first half of the sixth-millennium cal. BC. What caused this phenomenon does not seem to be easy to answer, but it has important consequences in the study and interpretation of the Neolithic process that occurred in the territory. Research on the few available contexts has been undertaken in conjunction with the analysis of the neolithization process in this region (Aura Tortosa et al., 2009).

In southern Valencia, the Late Mesolithic is better known in the Jucar and Segura basins, where human occupations have been interpreted in terms of autochthons vs colonists (i.e., Mesolithic vs Neolithic). In this area, the Neolithic occupation of previously empty spaces has been observed, in the case of Falguera and Tossal de la Roca, where a hiatus extends to the Late Mesolithic. Moreover, sites with Late Mesolithic occupation seem to lack Early Neolithic settlements (such as Arenal de la Virgen around the Villena lagoon, Alicante) (Juan Cabanilles & Martí Oliver, 2017).

The Andalusian Late Mesolithic is virtually unknown, except for the dates obtained at Retamar (Puerto de Santa María, Cádiz) (Ramos Muñoz & Lazarich González, 2002) and Cañada Honda (Aljaraque, Huelva) (Reis, Campos Jara, & Soares, 2020), in both cases on marine shell and, in Retamar, showing a high standard deviation and a succeeding Early Neolithic Phase. Throughout the region, the evidence of occupation seems to be limited to the coastal strip and no later than the end of the seventh-millennium cal. BC. At Cueva de Nerja (Malaga), Late Mesolithic stratigraphic sequences are found in two of the three excavated areas, the Sala del Vestibulo (NV) and the Sala Torca (NT), with charcoal dates from the mid-seventh millennium and beginning of the sixth-millennium cal. BC (Aura Tortosa et al., 2009, 2013). Similarly, the stratigraphic sequence of Bajondillo rock shelter (Torremolinos, Málaga), provided two dates falling in this chronological range (end of seventh-millennium cal. BC) (Cortés-Sánchez, 2007), associated with scarce lithic and ornaments elements (Martí Oliver, Aura Tortosa, Juan Cabanilles, García Puchol, & Fernández López de Pablo, 2009). Some pre-neolithic series from the north-eastern mountain ranges of Andalucía (Cueva del Nacimiento, Pontones, Jaén) show microblade technology (Asquerino Fernández & López, 1981). For instance, there is a Mesolithic phase identified in Cueva Ambrosio (Almería) (Suárez Márquez, 1981) with no associated ^{14}C dates, and some microliths (triangles) found in Alcolea (Córdoba) in a redeposit of much later chronology (Martínez Sánchez, 2013).

In southern Portugal, besides well-known shell midden sites in the Tagus (Muge) and Sado river valleys, occupational contexts are almost exclusively restricted to coastal or near-coastal sites. Oliveirinha, Pedra do Patacho, Fiais, Palheiroes do Alegra or Samouqueira sites on the Alentejo coast, and Castelejo and Rocha das Gaivotas at Cabo de São Vicente are composed of accumulations of biomaterials, mostly malacological elements. However, unlike other Iberian regions, ^{14}C dates obtained from Portuguese sites do not seem to show gaps in human occupation throughout the Late Mesolithic, although some interruptions have been observed in the seventh-millennium cal. BC (Cabo de San Vicente sites) (Carvalho, 2009; Dean, Valente, & Carvalho, 2012; Valente & Carvalho, 2009).

In any case, lithic morphotypes of the Boreal and early Atlantic in southern Iberia remain poorly known, with very few sites having provided abundant material assemblages. There, except on the Alentejo and Algarve coast (Portugal), the Sauveterrian and microblade elements are not clearly distinguished from the geometric component, reflecting the existence of multi-sequential assemblages, sedimentary gaps, and residual collections intermixed with elements of later chronology (Aura Tortosa et al., 2009). A clear example in this regard is that some surface assemblages of inner Andalusia have small-blade industries previously attributed to the Epipalaeolithic, though now identified as Early Neolithic (Asquerino Fernández, 1986, 1987a,b; Gavilán Ceballos, 1987).

2 Sima Hedionda IV Archaeological Context

The Sima Hedionda II/IV is a sinkhole in the Sierra de la Utrera karst formation, just over 5 km from the current coastline, in the Municipality of Casares (at the western edge of the Malaga coast) and located in the historic region of the Strait of Gibraltar (Figure 1). Sierra de la Utrera is a small mountain range comprising a calcareous plateau, highly modelled by karstification processes. This is made up of rocks of the Kimmeridgian-Oxfordian lithological top stage (Upper Jurassic, Torcal Formation, up to an altitude of 350 m a.s.l.) and a lower one (base), made up of a base of Middle Jurassic oolite limestones (Endrinal Formation) (Martín-Algarra, 2006). There are several large caves, some of which are archaeological sites, such as Gran Duque Cave, with a rich archaeological record dating from the Early Neolithic (Ferrando de la Lama, 1987). The one known as Sima Hedionda II or Sima Pito was located in the early 1970s, although

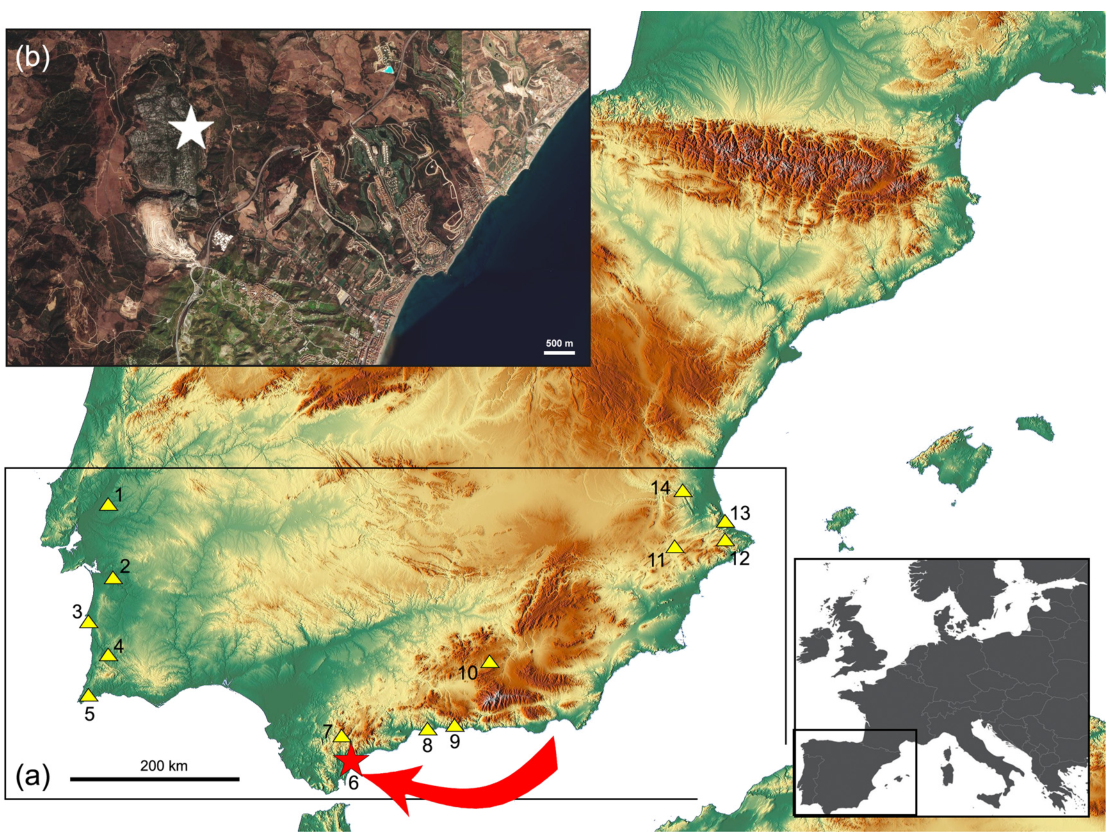

Figure 1: (a) Iberian Peninsula, indicating southern sites with published Mesolithic human remains. 1: Muge shell middens (Moita do Sebastião, Cabeço da Arruda, Cabeço do Amoreira, Fonte do Padre Pedro, Flor da Beira, and Cova da Onça, Ribatejo); 2: Sado sites (Cabeço das Amoreiras, Arapouco, Cabeço do Pez, Alentejo); 3: Samouqueira (Alentejo); 4: Fiais (Alentejo); 5: Vale Boi (Algarve); 6: Sima Hedionda II/IV (Casares Málaga); 7: Cueva del Esqueleto (Cortes de la Frontera, Málaga); 8:, Cueva del Higuerón-Tesoro (Cala del Moral, Málaga); 9: Cueva de Nerja (Maro, Málaga); 10: Cueva de la Cariguela (Píñar, Granada); 11: Casa Corona (Villena, Alicante); 12: Coves de Santa Maira (Castell de Castells, Alicante); and 13: El Collado (Oliva, Valencia). (b) Aerial view of Utrera Karstic formation, with Sima Hedionda II/IV site (white star) (Casares, Málaga).

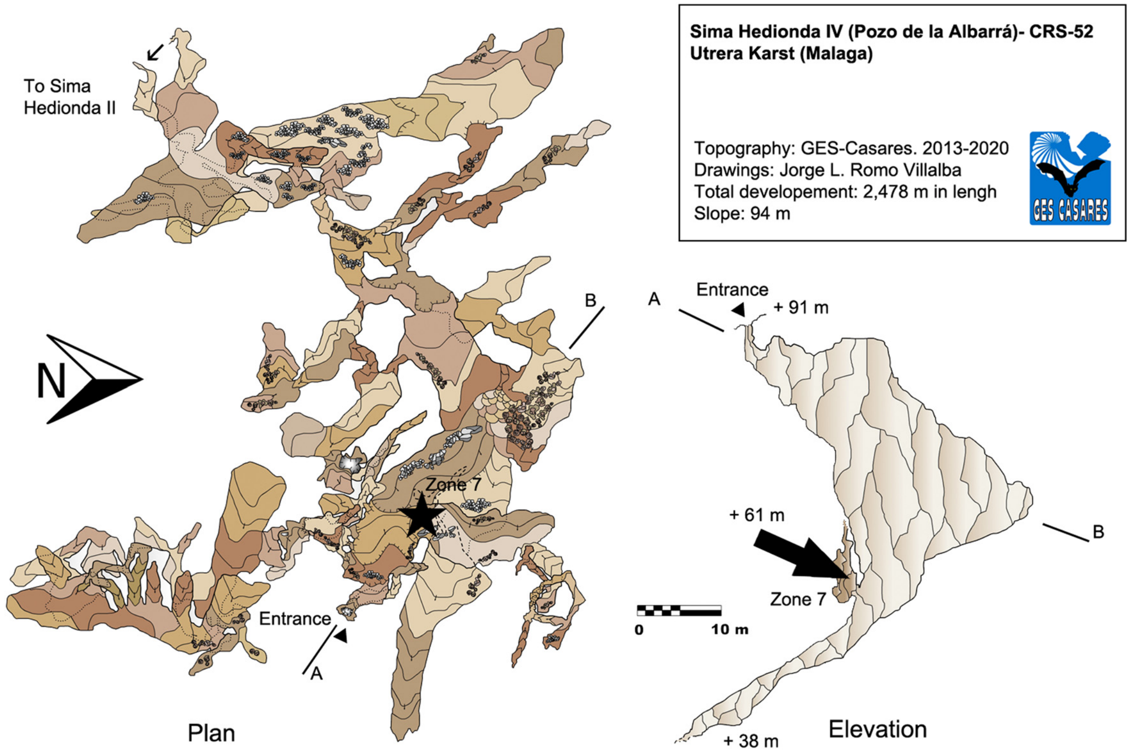

Figure 2: Plan (left) and elevation (cross-section) (right) of Sima Hedionda IV Cave. The figure shows the finding place (sector 7): a black star in the plan, and a black arrow in elevation (cross-section). Topography, drawings, and reference data by GES-Casares cavers club.

it was not until 2005 that it was completely explored. Then, a new system of galleries was found (called Hedionda IV), leading to the discovery of several archaeological remains.

Both sinkholes (Sima Hedionda II and IV) are connected with each other forming a large cave system with nearly 100 m of slope and over 2,168 m of passage (Figure 2). The current entrance is located at 91 m above sea level, while its bottom gallery goes below. Between 2014 and 2015, this system was intensively explored through an archaeological survey conducted by one of us (MD Bretones), during which the inner topography was recorded. Inside, and along with different chambers and galleries, several archaeological deposits have been detected, most of which date back to the Early Neolithic (second half of the sixth-millennium cal. BC) (Bretones García et al., in press). Archaeological assemblages are located in different places, often in well-defined horizontal rooms and corridors, though some of them have also been documented at the end of vertical and inaccessible chasms, as a result of intentional displacements or episodic gravitational movements and dragging. In this case, there is evidence for use of the cave prior to the Early Neolithic, making it one of the few sites with Mesolithic human remains from southern Iberia.

3 Sector 7 (SHII/IV/7001–7006) Human Skull

Though skeletal material was found in upper areas of the cave, it was in an Early Neolithic context. Of particular interest is a set of human remains placed in a deep area (61 m a.s.l.), within a vertical fissure, 41 m deep, with a narrow base that was impossible to reach and far from the closest evidence for human use. This space was named sector 7, a small gallery currently accessible only from the cave's main hall, ending in a slope leading to a periodically flooded collector (Figure 3).

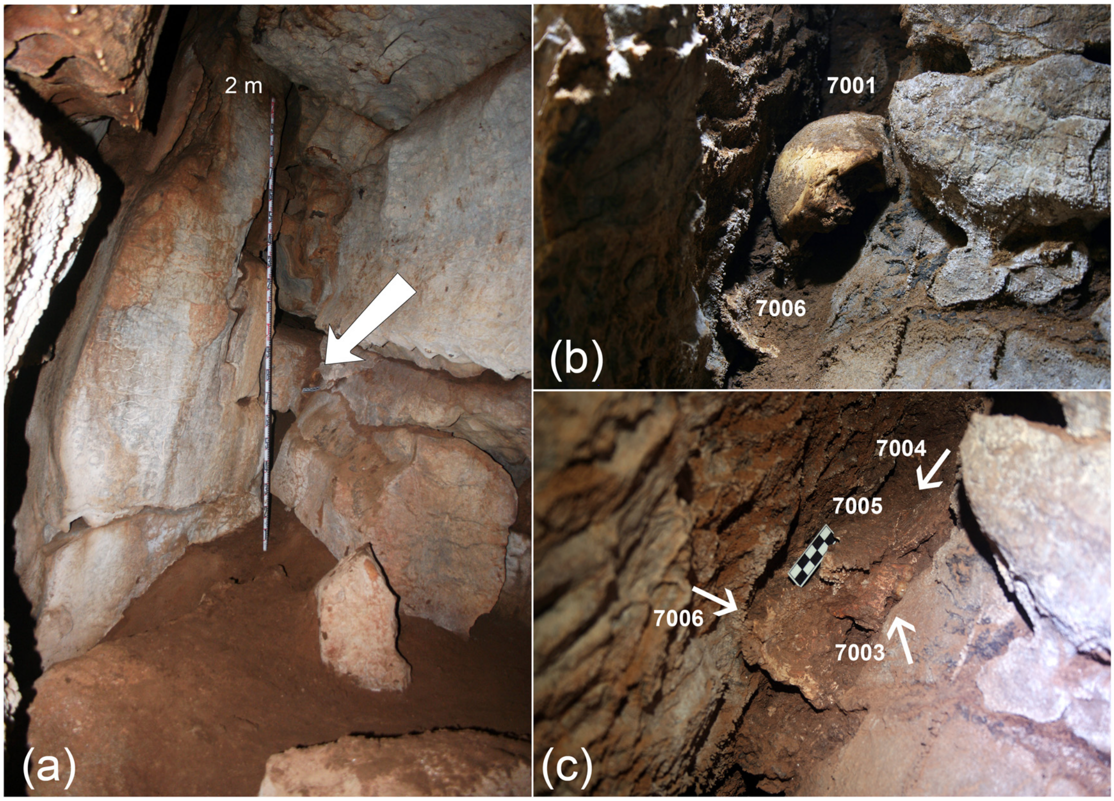

Figure 3: (a) Finding of human skull remains in sector 7 (Sima Hedionda II/IV Cave), embedded in a crack. (b) View of the frontal part of the human skull (7001) on-site. (c) View and position of highly cemented skull fragments placed below the frontal bone (once removed): 7003, maxilla fragment; 7004 and 7005, cranial vault fragments; 7006, temporal bone.

Figure 4: (a) View in *norma frontalis* of the frontal bone 7001 and (b) view in *norma lateralis*.

We detected five fragments, probably all part of the same skull. The largest bone fragment is a very robust frontal bone that initially seemed to be isolated (7001) (Figure 4). It shows a well-developed glabella and a strong supraorbital notch with numerous nutrient foramina. It also presents very large paranasal

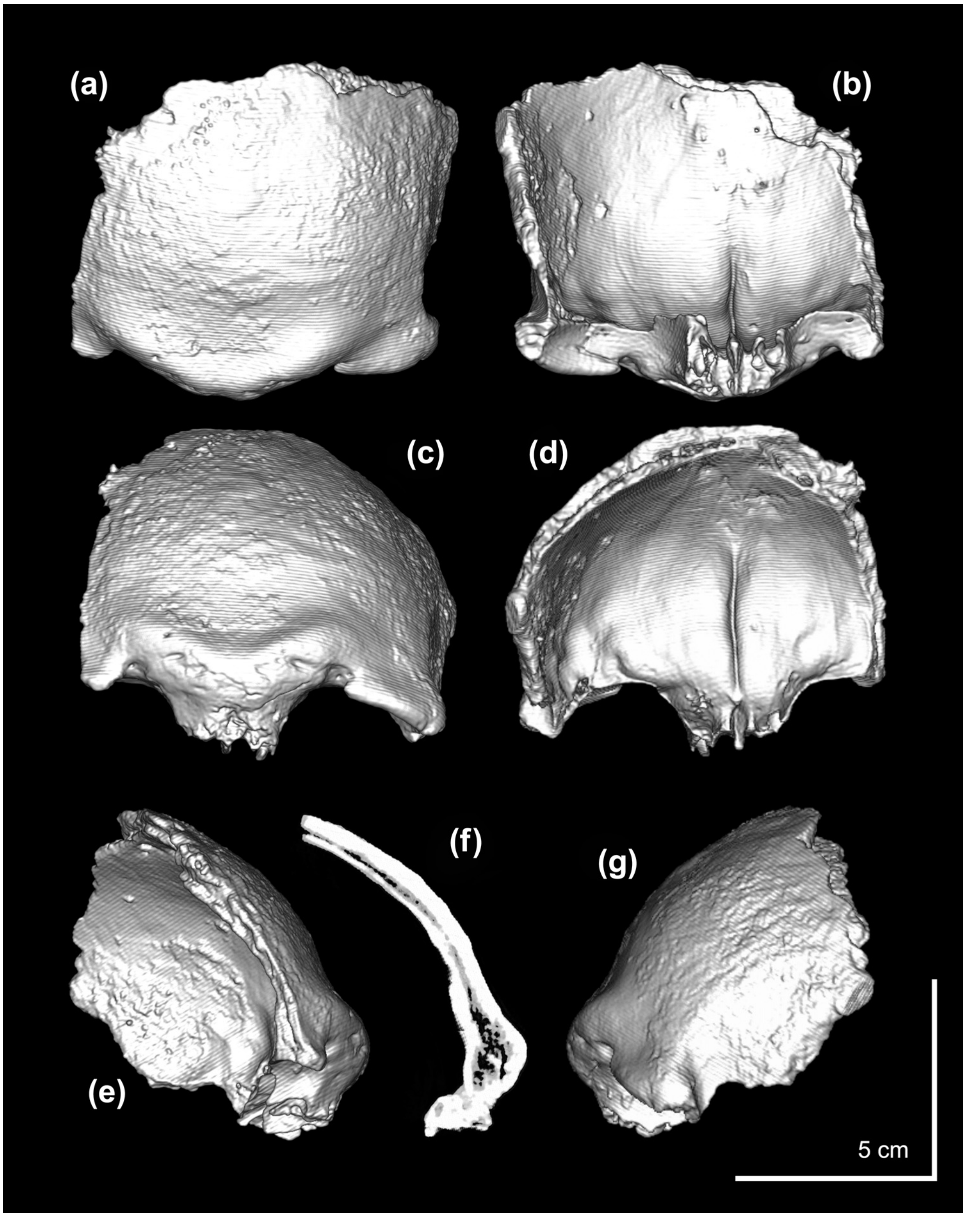

Figure 5: CT scan ectocranial views of frontal bone 7001 (by OsiriX DICOM Wiever): (a) *norma verticalis*, (b) superior part (endocranial), (c) *norma frontalis*, (d) posterior (endocranial), (e) right *norma lateralis*, (f) sagittal section, and (g) left *norma lateralis*.

sinuses. Likewise, it reveals very high porosity around the supraciliary arches and close to the coronal suture (not preserved), and periosteal bulges with irregular and diffuse porosity. Although nasal bones and specific measurement points were lost, interorbital width should be wide, based on the remaining portion (Figures 3–5). The cranial wall is quite thick and the endocranial surface shows a high development of the frontal crest (Figure 5).

Other fragments (Figure 3c) were found at the base of the fissure and cemented together by carbonate flowstone. These were two pieces of the cranial vault (7004 and 7005), a portion of the left temporal bone (7006), and a maxilla fragment (7003), retaining part of the right molar row (RM^1 and RM^2), showing slight wear in the occlusal plane. The absence of RM^3 could indicate non-eruption or agenesis. All remains are consistent with a single, very robust, adult male individual.

4 Contextual and Taphonomic Insights

Fragments 7003–7006 could not be clearly observed, given the intense calcareous formation around them, fixing the bones into the rock wall, so these were not removed. Flowstone masked and cemented the cranial remains, making safe extraction very difficult. Only frontal bone 7001 was found free from the rock and was recovered.

The frontal bone surface was observed with a 640 × 480 pixel dinolite digital microscope. No cut marks or other signs of human manipulation were observed. Regarding taphonomic conditions, it shows some ancient (post-mortem) breaks inside and outside, accompanied by fine cracks on the cranial surface that have slightly deformed this bone, mainly on the supraorbital flange. Other taphonomic conditions such as highly cemented surfaces and polished areas are observed. Inside the cranial vault (endocranial), as well as on the external bone surface, we can recognize patchy pigmentations of metallic oxides, most probably manganese. These are accompanied by small cracks and sinuous or star-shaped fractures (Figure 6).

Small cracks characterized by curled-up edges, probably were caused by changes in humidity in the karstic environment (Fernández-Jalvo & Andrews, 2016) suggesting swelling and shrinkage of the bone tissue over time. Brightness or polishing located in some areas of the external vault may be caused by slight abrasion with fine sand/clay sediment (Figure 6). This, together with manganese dots on the bone surface (López-González, Grandal-d´Anglade, & Vidal-Romaní, 2006) and the existence of fine sand and its arrangement on the hall floor around the location of the find, suggest episodic flooding and drainage inside the lower part of the cave, involving water transport events.

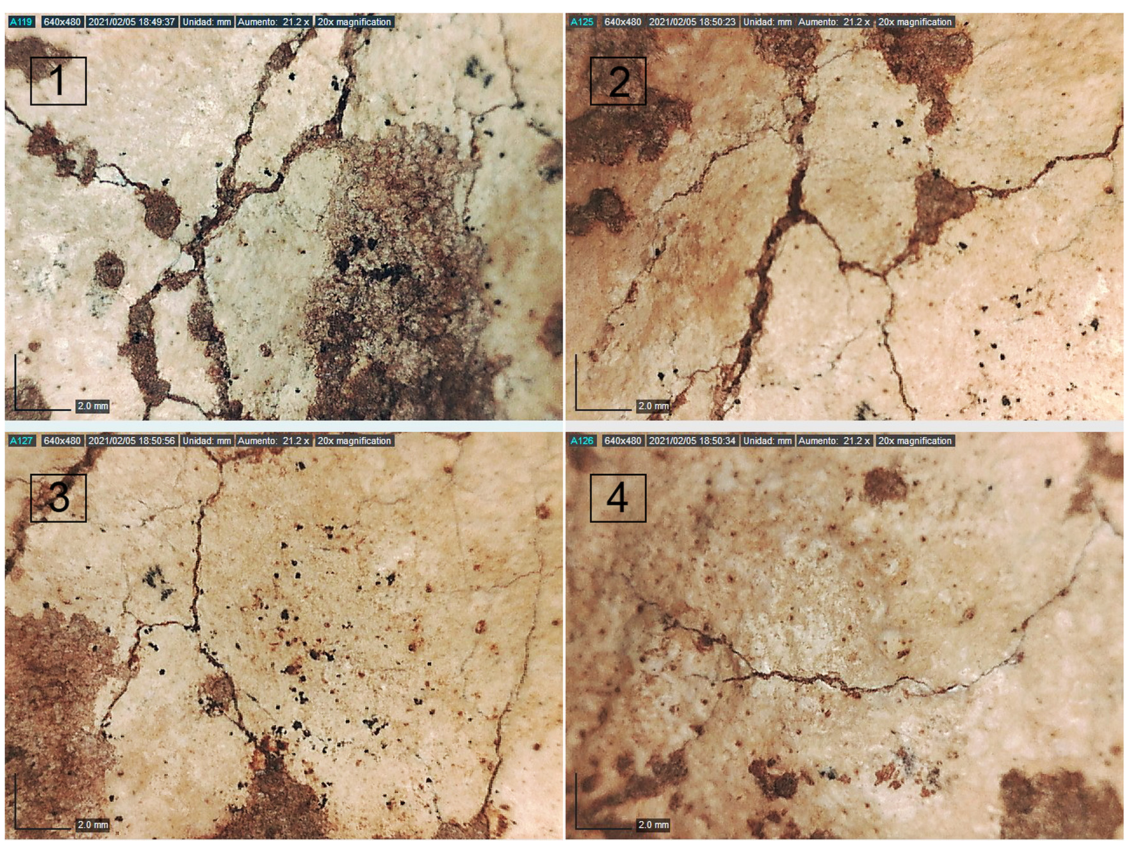

Figure 6: Four different views of the exterior cranial surface in the frontal bone 7001 (640 × 480 pixels Dinolite, 1 mm scale). 1–4: micro-cracks extended over the bone cortex; 1–3: black dots (probably manganese dioxide staining); 1 and 4: slightly bright over the frontal surfaces.

5 Chronometric Analysis

Considering the exceptional nature of this find, we also proceeded to radiocarbon date a sample obtained from RM^2 (dentin), a subsample obtained from the portion selected for archaeogenetic analysis. While initial DNA screening of this individual yielded low quantities of endogenous DNA (<1%) for genomic analysis, it was possible to determine the biological sex as male. Micro-sample dating of collagen confirmed a Mesolithic chronology. The result (Beta-424650) was an AMS date of 7600 ± 30 BP (Table 1, Figure 7).

Organic content from the tooth sample used for radiocarbon dating and archaeogenetics gave $\delta^{13}C$ but not $\delta^{15}N$ results. We then attempted to obtain results from a frontal fragment (3.5 g), using the protocol of Bocherens et al. (1991) and the IACT-CSIC facilities (Stable Isotopes Biogeochemistry Laboratory, Granada, Spain). However, no results were obtained due to the lack of usable collagen; no further sampling was attempted. IRMS $\delta^{13}C$ values on the tooth (−17.0; Table 1) are similar to results from Mesolithic individuals from Cueva de Nerja (CNA3293.2.1, Sala Torca, level 13, "Pepita") (Fernández Rodríguez et al., 2020) and burials 3 and 4 at El Collado (Oliva, Valencia). In these cases, while all sites are close to the coast, stable isotope analyses reveal a mostly terrestrial diet (Fernández Rodríguez et al., 2020; Gibaja Bao et al., 2015), like other non-Iberian coastal examples from the Western Mediterranean (Goude et al., 2016). The dating was carried out by Beta in 2015, with ultrafiltration, but % collagen and the C:N value were not reported at that time.

We have calibrated the above using two approaches. The first, Model A in Figure 7 and Table 1, follows the IntCal20 (Reimer et al., 2020) atmospheric curve and assumes a fully terrestrial diet. Model B follows a mixed curve and marine reservoir effect. We used a ΔR of 94 ± 61, which comes from the information available in the 14CHONO Marine 20 database related to the West Mediterranean. This offset is the same used in other studies concerning the early Holocene of the Iberian Mediterranean coast (Brisset, Bujarchs, Ballesteros Navarro, & Fernández López de Pablo, 2018), including the cases of Mesolithic individuals from Nerja and El Collado (Fernández Rodríguez et al., 2020). The marine diet value of 20% used here is close to those of the Cueva de Nerja individual and El Collado burials 3 and 4. $\delta^{13}C$ values are −17.35 for Cueva de Nerja and −17.6 for the two El Collado individuals. On the basis of these sites, we are assuming that the Mesolithic population has a marine dietary intake (Salazar García et al., 2014). Table 1 and Figure 7 include all published data for Mesolithic human remains in Andalucía.

6 Discussion

Cranial fragments found in Sima Hedionda IV zone 7 (SHII/IV/7001-6), are among the few human remains dated to the Mesolithic in southern Iberia; no further material was found. This is the southernmost site with Mesolithic human remains in Spain. Both location and taphonomy suggest a natural percolation from

Table 1: Numeric data of the three ^{14}C datings on Mesolithic human remains in Andalusia using the two calibration models

Site	Code	BP	SD	$\delta^{15}N$ ‰ (Air-N2)	$\delta^{13}C$ ‰ (V-PDB)	BC cal. 68.2%	BC cal. 95.4%	Model
C.Esqueleto	Beta-324381(?)	7560	40	n.d.	n.d.	6452–6401	6475–6266	A
						6372–6256	6404–6230	B
S.Hedionda	Beta-424650	7600	30	**n.d.**	−17	6463–6431	6498–6411	A
7003-RM^2						6412–6268	6421–6250	B
Nerja-Pepita	CNA3293.2.1	7907	39	11.55	−17.35	6906–6654	7032–6647	A
						6685–6588	6744–6498	B

CNA-3293: Nerja "Pepita," Beta-424650: Sima Hedionda IV (7003-RM_2), Beta-324381(?): Esqueleto Cave. Model A: atmospheric curve (Intcal20) (Reimer et al., 2020); Model B: mixed with a 20% of marine curve (Heaton et al., 2020), including a ΔR value of 94 ± 61. Software used, Oxcal4.4.4.

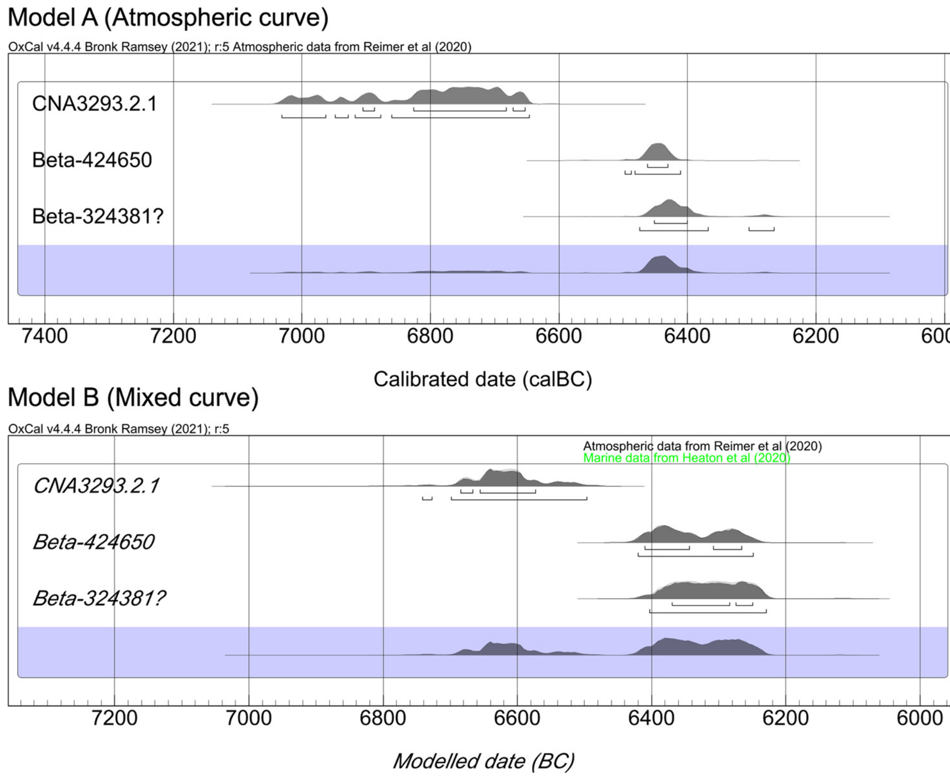

Figure 7: Multi-plots and sums applying the two calibration models. CNA-3293: Nerja "Pepita," Beta-424650: Sima Hedionda IV (7003-RM_2), Beta-324381(?) (lab code to be confirmed): Esqueleto Cave. Model A: atmospheric curve (Intcal20) (Reimer et al., 2020); Model B: mixed with a 20% of marine curve (Heaton et al., 2020), including a ΔR value of 94 ± 61. Software used, Oxcal4.4.4.

above, once skeletonized, including water transport (Belcastro et al., 2021). Location and condition of the cranial finds preclude meaningful comment on their origin, be it burial, funerary assemblage, or chance event such as an accident. No evidence exists that allows comment on cultural elements associated with the find, or their absence.

The frontal bone was the only fragment that could be extracted and observed in detail. It is notable for its robusticity, with characteristics defined in similar cases as "palaeomorphic," showing a great development of the supraorbital region, with a heavy glabella and thick supraorbital margins, and wide supraorbital notches. Analogous skull traits, rare in Neolithic and later Iberian examples, have been observed in other Iberian Mesolithic skulls, such as Cuartamentero Cave (Asturias) (Drak Hernández, 2016; Garralda Benajes, 1982) or the individual 1 (adult male) from the collective burial of Cingle del Mas Nou (Ares del Maestrat, Castelló) (Olaria Puyoles, 2020). Some of these morphologies have been noted as common in other examples from Western Europe (Drak Hernández, 2016), reflecting nutritional and adaptive patterns shared by hunter-gatherers (Katz, Grote, & Weaver, 2017).

In Iberia, burial deposits from this period are very rare. Even today, the Muge and Sado sites in Portugal make up the vast majority of the skeletal remains known since the first finds in the 1860s (Peyroteo-Stjertna, 2016). However, in recent times, the discovery of Mesolithic human remains has become increasingly frequent, both as complete burials (La Braña, León) (Vidal Encinas, Fernández Rodríguez, Prada Marcos, & Fuertes Prieto, 2008) or as a result of accidental events (Chan do Lindeiro) (Serrulla Rech & Sanín Matías, 2017). True necropoli or collective burials have also been identified, such as El Collado (Oliva, Valencia) (Gibaja Bao et al., 2015), Casa Corona (Villena, Alicante) (Fernández López de Pablo, Gómez Puche, Ferrer García, & Yll Aguirre, 2011), Cingle del Mas Nou (Ares del Maestrat, Castelló) (Olaria Puyoles, 2020), and Los Canes (Asturias) (Arias Cabal et al., 2009), while other more fragmentary contexts include apparent anthropic marks and possible anthropophagy (Santa Maira, Alicante) (Morales Pérez et al., 2017). Radiocarbon series obtained from Mesolithic contexts in the southern half of Iberia extend from the ninth to the first half of the sixth-millennium cal. BC, spread throughout the entire first and second Mesolithic, with a high proportion distributed along the Iberian coastal strip, both Atlantic and Mediterranean. In this respect, the dominance of dates on undetermined charcoal and marine shell, even with marine correction, makes it difficult to compare them, including a different ΔR established for Atlantic and Mediterranean waters (Fernández Rodríguez et al., 2020).

In Andalucía, dates of Mesolithic human remains are very scarce. The Cueva de Nerja burial (known as "Pepita") is the only known intentional grave of this period in Andalucía. It was discovered by Manuel Pellicer in Level 13 of Sala Torca (García Sánchez, 1982). Until very recently, there was only a conventional ^{14}C date obtained from a mixture of charcoal recovered from the burial environment (GAK-8967, 8260 ± 360 BP), with a high standard deviation (Aura Tortosa et al., 2009). A new dating (CNA-3293, 7907 ± 39 BP) on bone collagen has confirmed this chronology (Figure 7, Table 1) (Fernández Rodríguez et al., 2020). At present, there are 11 published dates, mostly on charcoal and some of them with a high standard deviation, linked to the first and second Mesolithic coming from Cueva de Nerja (Sala Torca and Vestibulo) (Aura Tortosa et al., 2009).

There are published dates for two other Mesolithic individuals in Malaga province. In Cueva del Esqueleto, Cortes de la Frontera, among some human remains dated to the Neolithic, a human skull yielded the date Beta-324381(?), 7560 ± 40 BP (Carrasco Rus & Martínez Sevilla, 2014, p. 63), with a calibrated date very close (6400–6200 cal. BC) to those provided by the Sima Hedionda sample (Figure 7, Table 1), although isotopic data are unknown. Also, 12 human "robust and thick" cranial remains and two postcranial elements were found at Cueva del Higuerón/del Tesoro (Rincón de la Victoria). Direct ^{14}C analysis of the human bones yielded a date of 6760–6500 cal. BC, but without the original date information, lab number, or calibration criteria. This is the only known chronological information (Muñoz Gambero et al., 2006). This date is consistent with other radiocarbon dates on human bone in Mesolithic context in Andalucía, all from the seventh-millennium cal. BC.

Finally, a partial mandible was found by J.P. Spahni during the 1950s in Carigüela Cave (Car1) (Piñar, Granada), in level III, associated with a pre-Neolithic lithic industry and a fragment of parietal bone (Garcia Sánchez, 1960). The sample allowed its palaeogenetic classification as a western hunter-gatherer, showing high genetic affinity to other individuals sequenced around 9700–5500 cal. BC (Olalde et al., 2019). This could also be placed between the end of the Upper Pleistocene and the Early Neolithic, even though it has not been radiocarbon dated.

In summary, human remains recovered from Mesolithic contexts in Andalucía are largely dated to the seventh-millennium cal. BC. The overall relationship of this to general occupation levels has not been discussed to date. Radiocarbon data obtained from other materials (charcoal, marine shell, or terrestrial fauna) show a pattern of human settlement that appears to end ca. 6200 cal. BC coinciding with the 8.2 BP cold climatic event, centuries before the appearance of the Early Neolithic (Aura Tortosa et al., 2009; Cortés-Sánchez et al., 2012). In this sense, recent research supports a "no man's land" scenario prior to the spread of first farming communities in coastal Andalusia (Perrin & Manen, 2021).

7 Conclusion

The skull from Sima Hedionda, SHII/IV/7001-7, was from an adult male, identified from morphological and archaeogenetic analysis. While the remains are incomplete, the frontal bone morphology (robusticity and highly developed supraorbital region) resembles some Mesolithic finds from Europe, including the Iberian Peninsula. The only isotopic data, for ^{13}C levels, suggest a diet comprising significant marine resources.

Its location, crushed inside a deep fissure, and within an area subject to periodic flooding, argues for water deposition. Further interpretation is not possible, whether related to a burial or resulting from an accident. Any scenario would have been followed by water or gravitational transport. Given the morphology of the cavern, which ends close to sea level, and the depth of the find within it, we consider the possibility of a deliberate deposit as unlikely. Taphonomic evidence strongly supports water flooding as the final factor in the formation of this deposit.

The discovery of this Mesolithic individual is significant not only for its location and circumstances but also as one of the few Mesolithic human remains in Andalucía. In this region, as also seen in other parts of Mediterranean Spain, the appearance of Early Neolithic farmers seems to follow a gap or hiatus, difficult to evaluate at present. The Sima Hedionda find, dated to ca. 6500–6200 cal. BC, falls within the cluster of ^{14}C dates from skeletal remains in Andalucía, all from the seventh-millennium cal. BC, and before the 8200 cal. BP cold event.

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References

Arias Cabal, P., Armendariz, Á., Balbín Behrmann, R., Fano, M. A., Fernández-Tresguerres, J., González Morales, M. R., & Arrizabalaga, Á. (2009). Burials in the cave: New evidence on mortuary practices during the Mesolithic of Cantabrian Spain. In S. McCartan, R. Schulting, G. Warren, & P. Woodman (Eds.), *Mesolithic Horizons. Papers presented at the Seventh International Conference on the Mesolithic in Europe, Belfast 2005* (pp. 648–654). Oxford: Oxbow Books.

Asquerino Fernández, M. D. (1986). La Fuente de las Palomas (Carcabuey): Nueva estación epipaleolítica en el sur de Córdoba. *Estudios de Prehistoria Cordobesa*, *1*, 21–37.

Asquerino Fernández, M. D. (1987a). El Olivar de las Patudas, yacimiento epipaleolítico en el Norte de Córdoba. *Boletín de la Real Academia de Córdoba*, *112*, 119–130.

Asquerino Fernández, M. D. (1987b). Estado actual de la investigación sobre el Epipaleolitico en la provincia de Córdoba. *Estudios de Prehistoria Cordobesa*, *3*, 27–51.

Asquerino Fernández, M. D., & López, P. (1981). La Cueva del Nacimiento (Pontones): Un yacimiento neolítico en la Sierra del Segura. *Trabajos de Prehistoria*, *38*, 109–152.

Aura Tortosa, E., Jordá Pardo, J. F., Pérez Ripoll, M., Morales Pérez, J. V., García Puchol, O., González-Tablas Sastre, F. J., & Avezuela Aristu, B. (2009). Epipaleolítico y Mesolítico en Andalucía Oriental. Primeras notas a partir de los datos de la Cueva de Nerja (Málaga, España). In P. Utrilla Miranda & L. Montes Ramírez (Eds.), *El Mesolítico geométrico en la Península Ibérica* (pp. 343–360). Zaragoza: Universidad de Zaragoza.

Aura Tortosa, J. E., Jordá Pardo, J. F., García Borja, P., García Puchol, O., Badal, E., Pérez Ripoll, M., & Morales Pérez, J. V. (2013). Una perspectiva mediterránea sobre el proceso de neolitización. Los datos de la cueva de Nerja en el contexto de Andalucía (España). *Menga*, *4*, 53–78.
Belcastro, M. G., Nicolosi, T., Sorrentino, R., Mariotti, V., Pietrobelli, A., Betuzzi, M., De Waele, J. (2021). Unveiling an odd fate after death: The isolated Eneolithic cranium discovered in the Marcel Loubens Cave (Bologna, Northern Italy). *PLoS One*, *16*(3), 1–30. doi: 10.1371/journal.pone.0247306.
Bocherens, H., Fizet, M., Mariotti, A., Vandermeersch, B., Borel, J. P., & Bellon, G. (1991). Isotopic biogeochemistry (13C, 15N) of fossil vertebrate collagen: Application to the study of a past food web including Neandertal man. *Journal of Human Evolution*, *20*, 481–492.
Bretones García, M. D., López Flores, I., Ruiz Borrega, M. P., Martínez Sánchez, R. M., Vera Rodríguez, J. C., Martínez Fernández, M. J., & Pintos Zanca, L. (in press). Actuación arqueológica en Sima Hedionda II y IV (Casares, Málaga). Un proyecto colectivo para un yacimiento subterráneo excepcional. *Proceedings of III Congreso de Prehistoria de Andalucía: I + D + i en la Prehistoria del Sur Peninsular*.
Brisset, E., Bujarchs, F., Ballesteros Navarro, B. J., & Fernández López de Pablo, J. (2018). Socio-ecological adaptation to Early-Holocene sea-level rise in the western mediterranean. *Global and Planetary Change*, *169*, 156–167.
Carrasco Rus, J., & Martínez Sevilla, F. (2014). Las cronologías absolutas del Neolítico Antiguo en el sur de la península ibérica. Nuevas dataciones. *Archivo de Prehistoria Levantina, XXX*, 57–80.
Carvalho, A. F. (2009). O Mesolitico final em portugal. In P. Utrilla Miranda & L. Montes Ramínez (Eds.), *El Mesolítico Geométrico en la Península Ibérica* (pp. 33–68). Zaragoza: Universidad de Zaragoza.
Cortés-Sánchez, M. (Ed.). (2007). *Cueva Bajondillo* (*Torremolinos*). *Secuencia cronocultural y paleoambiental del Cuaternario reciente en la Bahía de Málaga*. Málaga: CEDMA.
Cortés-Sánchez, M., Jiménez Espejo, F. J., Simón-Vallejo, M. D., Gibaja Bao, J. F., Carvalho, A. F., Martínez-Ruiz, F., & Bicho, N. F. (2012). The Mesolithic–Neolithic transition in southern Iberia. *Quaternary Research*, *77*(2), 221–234.
Dean, R. M., Valente, M. J., & Carvalho, A. F. (2012). The Mesolithic/Neolithic transition on the Costa Vicentina, Portugal. *Quaternary International*, *264*, 100–108.
Drak Hernández, L. (2016). *Las poblaciones del Holoceno inicial en la región cantábrica: Cambios ambientales y microevolución humana*. (PhD thesis). Universidad Complutense de Madrid, Madrid.
Fernández-Jalvo, Y., & Andrews, P. (2016). *Atlas of Taphonomic Identifications*. New York: Springer.
Fernández López de Pablo, J., Gómez Puche, M., Ferrer García, C., & Yll Aguirre, R. (2011). El arenal de la virgen (Villena, Alicante), primer asentamiento perilacustre del mesolítico de muescas y denticulados en la Peninsula Iberica: Datos culturales, cronoestratigráficos y contextualización paleoambiental. *Zephyrus*, *LXVIII*, 87–114.
Fernández Rodríguez, L. E., Sanchidrián Torti, J. L., Jiménez-Brobeil, S., Remolins Zamora, G., Díaz-Zorita Bonilla, M., Morell, B., & Gibaja Bao, J. F. (2020). Mesolithic human remains at Cueva de Nerja (Málaga, Spain): Anthropological, isotopic and radiocarbon data. *Archaeological and Anthropological Sciences*, *12*, 250. 10.1007/s12520-020-01207-x.
Ferrando de la Lama, M. (1987). Cueva del Gran Duque (Casares, Málaga). *Mainake*, *8–9*, 105–128.
García Rivero, D., Vera Rodríguez, J. C., Díaz Rodríguez, M. J., Barrera Cruz, M., Taylor, R., Pérez Aguilar, L. G., & Umbelino, C. (2018). La Cueva de la Dehesilla (Sierra de Cádiz): Vuelta a un sitio clave para el Neolítico del sur de la península ibérica. *Munibe. Antropologia-Arkeologia*, *69*, 123–144.
Garcia Sánchez, M. (1960). Restos humanos del paleolítico medio y superior y del eneolítico de Piñar (Granada). *Trabajos del Instituto Bernardino de Sahagún de Antropologia y Etnografia*, *15*(2), 17–72.
García Sánchez, M. (1982). El esqueleto epipaleolítico de la Cueva de Nerja (Málaga). *Cuadernos de Prehistoria de la Universidad de Granada*, *7*, 37–71.
Garralda Benajes, M. D. (1982). El cráneo asturiense de Cuartamentero (Llanes, Oviedo). *Kobie*, *12*, 7–29.
Gavilán Ceballos, B. (1987). El yacimiento epipaleolítico de los Llanos de Jarcas (Cabra, Córdoba). *Estudios de Prehistoria Cordobesa*, *2*, 7–27.
Gibaja Bao, J. F., Subirà, M. E., Terradas, X., Santos, F.-J., Agulló, L., Gómez Martínez, I., … Fernández López de Pablo, J. (2015). The emergence of Mesolithic Cemeteries in SW Europe: Insights from the El Collado (Oliva, Valencia, Spain) Radiocarbon Record. *PLoS One*, *10*(1), e0115505. 10.1371/journal.pone.0115505
Goude, G., Wilmes, M., Wood, R., Courtaud, P., Leandri, F., Cesari, J., & Grün, R. (2016). New insights into Mesolithic human diet in the Mediterranean from stable isotope analysis: The sites of Campu Stefanu and Torre d'Aquila, Corsica. *International Journal of Osteoarchaeology*, *27*(4), 707–714.
Heaton, T. J., Köhler, P., Butzin, M., Bard, E., Reimer, R. W., Austin, W. E. N., …Skinner, L. (2020). Marine20. The marine radiocarbon age calibration curve (0-55,00 BP). *Radiocarbon*, *62*(4), *779*–820.
Juan Cabanilles, J., & Martí Oliver, B. (2017). New approaches to the Neolithic transition: The last hunters and first farmers of the Western Mediterranean. In O. García Puchol & D. C. Salazar-García (Eds.), *Times of Neolithic Transition along the Western Mediterranean* (pp. 33–68). New York: Springer.
Katz, D. C., Grote, M. N., & Weaver, T. D. (2017). Changes in human skull morphology across the agricultural transition are consistent with softer diets in preindustrial farming groups. *PNAS*, *114*(34), 9050–9055.
López-González, F., Grandal-d´Anglade, A., & Vidal-Romaní, J. R. (2006). Deciphering bone depositional sequences in caves through the study of manganese coatings. *Journal of Archaeological Science*, *33*, 707–717.

Martí Oliver, B., Aura Tortosa, E., Juan Cabanilles, J., García Puchol, O., & Fernández López de Pablo, J. (2009). El Mesolítico geométrico de tipo Cocina en el País Valenciano. In P. Utrilla Miranda & L. Montes Ramírez (Eds.), *El Mesolítico geométrico en la Península Ibérica* (pp. 205–258). Zaragoza: Universidad de Zaragoza.

Martín-Algarra, A. (2006). El patrimonio geológico de Casares: Geología de la Sierra de la Utrera y su entorno. *Casares. 200 millones de años de* Historia. Libro de actas de las I Jornadas sobre patrimonio de Casares (pp. 11–54). Málaga: Ayuntamiento de Casares.

Martín Socas, D., Camalich Massieu, M. D., Caro Herrero, J. L., & Rodríguez-Santos, F. J. (2018). The beginning of the Neolithic in Andalusia. *Quaternary International*, *470B*, 451–471.

Martínez Sánchez, R. M. (2013). *El IV milenio ANE en el Guadalquivir Medio. Intensificación agrícola y fragua de la comunidad doméstica aldeana*. Oxford: Archaeopress.

Morales Pérez, J. V., Salazar-García, D. C., De Miguel Ibáñez, M. P., Miret Estruch, C., Jordá Pardo, J. F., Verdasco Cebrián, C. C., & Aura Tortosa, J. E. (2017). Funerary practices or food delicatessen? Human remains with anthropic marks from the Western Mediterranean Mesolithic. *Journal of Anthropological Archaeology*, *45*, 115–130.

Muñoz Gambero, J. M., Arsuaga Ferreras, J. L., Martínez, I., Gracia, A., Carretero, J. M., & Cruz, M. (2006). A new Mesolithic cranium from the Cueva del Higueron (Malaga). *UISPP/IUPPS XV Congress, Book of Abstracts* (pp. 740). Lisbon.

Olalde, Í., Mallick, S., Patterson, N., Rohland, N., Villalba-Mouco, V., Silva, M., & Reich, D. (2019). The genomic history of the Iberian Peninsula over the past 8000 years. *Science*, *363*(6432), 1230–1234. 10.1126/science.aav4040

Olaria Puyoles, C. (2020). *Cingle del Mas nou: Vida y muerte en el 7000 BP. Un campamento temporal del Mesolítico reciente, inmerso en los procesos de neolitización, con inhumación colectiva.* (*Parque rupestre de Gasulla, Ares del Maestre, Alto Maestrazgo, Castellón, España*). Castelló: Diputació de Castelló.

Perrin, T., & Manen, C. (2021). Potential interactions between Mesolithic hunter-gatherers and Neolithic farmers in the Western Mediterranean: The geochronological data revisited. *PLoS One*, *16*(3), e0246964. 10.1371/journal.pone.0246964

Peyroteo-Stjertna, R. (2016). Death in the Mesolithic. *Mortuary Practices of the Last Hunter-Gatherers of the South-Western Iberian Peninsula, 7th–6th Millennium BCE*. (PhD thesis). Uppsala University, Uppsala.

Ramos Muñoz, J., & Lazarich González, M. (2002). *El asentamiento de "El Retamar"* (*Puerto Real, Cádiz*)*: Contribución al estudio de la formación social tribal y a los inicios de la economía de producción en la Bahía de Cádiz*. Cádiz: Universidad de Cádiz.

Reimer, P. J., Austin, W. E., N., Bard, E., Bayliss, A., Blackwell, P. G., Bronk Ramsey, C.,, … Talamo, S. (2020). The IntCal20 Northern Hemisphere radiocarbon age calibration curve (0–55 cal kBP). *Radiocarbon*, *62*(4), 725–757.

Reis, H., Campos Jara, P., & Soares, P. (2020). El conchero de Cañada Honda I (Aljaraque, Huelva, España): Nuevos datos para su caracterización cronológica y tecnocultural. *Onoba*, *8*, 165–192.

Salazar García, D. C., Aura, J. E., Olària, C., Talamo, S., Morales, J. V., & Richards, M. P. (2014). Isotope evidence for the use of marine resources in the Eastern Iberia. *Journal of Archaeological Science*, *42*, 231–240

Serrulla Rech, F., & Sanín Matías, M. (2017). Forensic anthropological report of Elba. *Cadernos Lab. Xeolóxico de Laxe*, *39*, 35–72.

Suárez Márquez, Á. (1981). Cueva Ambrosio (Vélez Blanco, Almería). Nuevas aportaciones al estudio del Epipaleolítico del Sudeste peninsular. *Antropología y Paleoecología Humana*, *2*, 43–54.

Valente, M. J., & Carvalho, A. F. (2009). Recent developments in Early Holocene hunter-gatherer subsistence and settlement: A view from south-western Iberia. In S. McCartan, R. Schulting, G. Warren, & P. Woodman (Eds.), *Mesolithic Horizons. Papers presented at the Seventh International Conference on the Mesolithic in Europe, Belfast 2005* (pp. 312–317). Oxford: Oxbow Books.

Vidal Encinas, J. M., Fernández Rodríguez, C., Prada Marcos, M. E., & Fuertes Prieto, M. N. (2008). Los hombres mesolíticos de la Braña-Arintero (Valdelugueros, León): Un hallazgo funerario excepcional en la vertiente meridional de la cordillera cantábrica. *Férvedes*, *5*, 153–164.