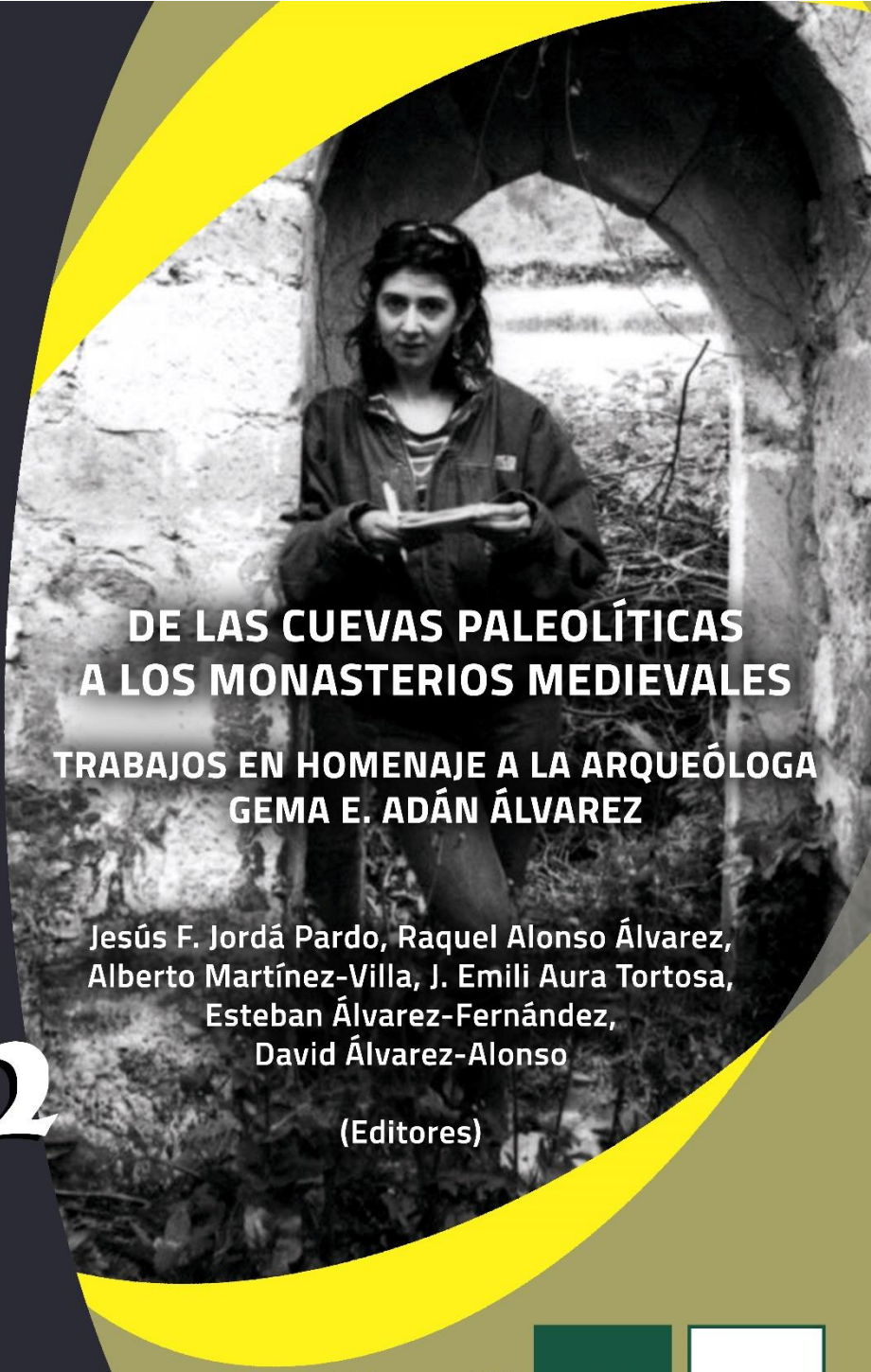
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DE LAS CUEVAS PALEOLÍTICAS A LOS MONASTERIOS MEDIEVALES

TRABAJOS EN HOMENAJE A LA ARQUEÓLOGA GEMA E. ADÁN ÁLVAREZ

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THE RESEARCH AT THE EL PORTALÓN DE CUEVA MAYOR (SIERRA DE ATAPUERCA, BURGOS, SPAIN). BALANCE AND PERSPECTIVES

Investigaciones en El Portalón de Cueva Mayor (Sierra de Atapuerca, Burgos, España). Balance y perspectivas

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Abstract: The Portalón of Cueva Mayor contains an extensive archaeo-sedimentary sequence that records the occupations of different human groups that chose the cave as a place to live, to be buried, and as a base for the exploitation and management of the resources of the Sierra de

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Atapuerca. A battery of nine dozen radiocarbon dates allows us to know the pulses of this extensive activity, which began in the ancient Neolithic, a little more than 7000 years ago, that was transformed into a burial site at the beginning of the Chalcolithic, and that, from the middle of this period and throughout the Bronze Age, became a place for the care, breeding and exploitation of livestock. The cycle ends with less active stays in the Iron Age, the Roman period and the Middle Ages.
Key words: *Recent Prehistory. Holocene. Atapuerca. Cultural and Paleontological record.*

Resumen: El Portalón de Cueva Mayor contiene una amplia secuencia sedimentaria que registra ocupaciones de diversos grupos humanos que eligieron la cavidad como lugar de hábitat, enterramiento y punto de apoyo para el aprovechamiento y gestión de los recursos de la sierra de Atapuerca. Una batería de nueve decenas de dataciones de radiocarbono permite conocer los pulsos de toda esa dilatada actividad que se inició en el Neolítico antiguo, hace poco más de 7000 años, que se reconvierte en lugar funerario a inicios del Calcolítico, y que, desde mediados de ese período y a lo largo de la edad del Bronce, se fija como lugar para el cuidado, cría y explotación de la cabaña ganadera. Termina el ciclo con estancias menos activas en la Edad del Hierro, Época Romana y la Edad Media.
Palabras clave: *Prehistoria reciente. Holoceno. Atapuerca. Registro Cultural y Paleontológico.*

1 Introduction

The Sierra de Atapuerca is located 15 km east of the city of Burgos, forms part of the foothills of the Iberian mountain range in the area known as the "Corredor de la Bureba", which connects the northern Iberian Meseta and the Ebro river valley (Figure 1). Within the Sierra, there is a karst system reaching 3,700 m in length, known as the Cueva Mayor-Cueva del Silo Karst system. Inside this system, numerous archaeo-paleontological sites from the Pleistocene and the Holocene have been discovered. Although the Sierra de Atapuerca is well known for its Pleistocene sites (ARSUAGA *et al.* 1997; BERMÚDEZ DE CASTRO *et al.* 1999), it also provides a rich stratigraphic record from the Holocene (CLARK *et al.* 1979; APELLÁNIZ and DOMINGO 1987; CARRETERO *et al.* 2008; VERGÉS *et al.* 2002). The whole complex of sites from the Sierra the Atapuerca are inscribed in the UNESCO Word Heritage List.

Among the Holocene archaeological sites found in the Cueva Mayor-Cueva del Silo karst system, the one located at its current entrance and known as El Portalón is of particular interest and the subject of this work. The relevance of this site is its prolonged human occupation, documented from the early Neolithic to historic times (CARRETERO *et al.* 2008). The abundance, richness, and variety of materials from El Portalón is indicative of the diversity of activities and events that took place at this exceptional site during recent prehistory.

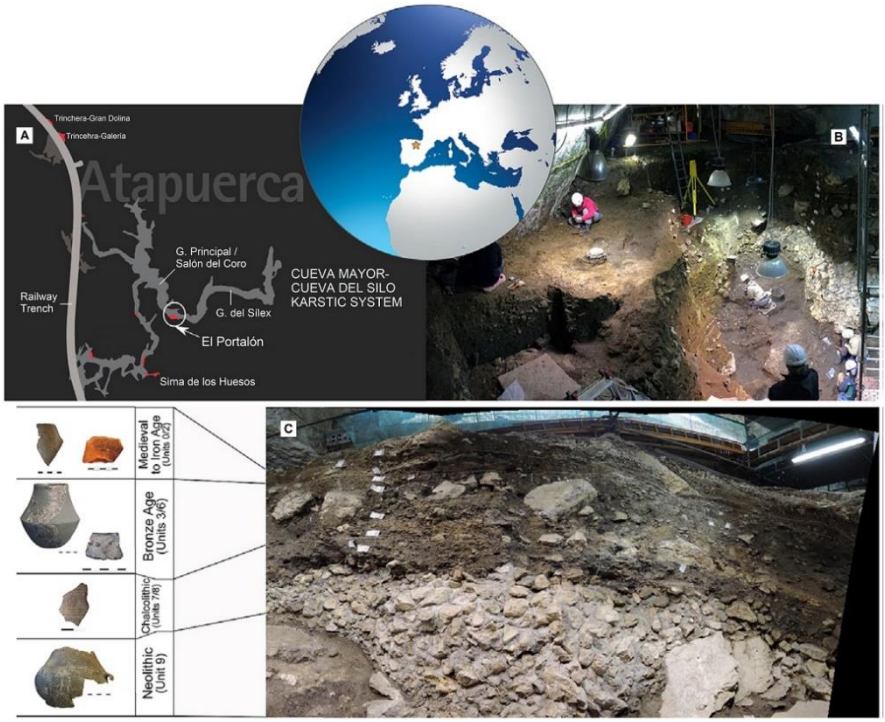


Figure 1. El Portalón de Cueva Mayor archaeological site. A) Location of the site in the northern Iberian plateau and within the Sierra de Atapuerca karstic system (Burgos). B) General view of the excavation area during 2017 campaign. In the upper excavation sector Bronce Age units are being excavated, in the bottom area Neolithic ones. C) Stratigraphic record of the southern profile of the excavation area (not visible in B). Note the funerary stone tumulus from the base of the Chalcolithic.

1.1 Brief historiography of the discovery and previous works

The archaeological potential of the El Portalon has been acknowledged since the 19th century. The first scientific study of Cueva Mayor was carried out in the last third of the 19th century (SAMPAYO and ZUAZNÁVAR 1868) and motivated other researchers who published on the first archaeological remains of Portalón in the early 20th century (CARBALLO 1910; BREUIL and OBERMAIER 1913). In 1966, Francisco Jordá (University of Salamanca), conducted the first modern archaeological excavation of Portalón, but his results were not published. In 1972, Geoffrey A. Clark (University of Arizona), Lawrence G. Straus (University of New Mexico), and José Luis Uribarri (Diputación of Burgos), surveyed the Upper Palaeolithic sites of the Northern Plateau and made two test pits in Portalón that revealed in situ stratifications (2.6 m) and identified three cultural periods in the stratigraphical sequence: Roman, Bronze Age and phases of the Eneolithic (CLARK *et al*. 1979) (Figure 2). The discoveries of Clark and co-workers motivated Juan María Apellániz (University of Deusto), to excavate at Portalón from 1973 to 1983. Although his results were never

published, Apellániz defined a series of cultural levels verifying the presence of Medieval and late Roman materials and an important occupation during the Bronze Age subdivided into a Final, Middle and Early Bronze Age sequence (APELLÁNIZ and DOMINGO 1987). To achieve a more complete understanding of its archaeological potential a new excavation was initiated in 2000 as part of a current research project on the Sierra de Atapuerca. Our work since 2000 at El Portalón discovered a much longer stratigraphic sequence than the previously known strata. From 2001 to 2007 we excavated a disturbed area by a clandestine excavation and found some significant archaeological materials out of their original context. Since then, we are excavating the *in situ* sediments and a new large stratigraphical sequence with a complete set of radiocarbon dates has been performed demonstrating the potential of the site.

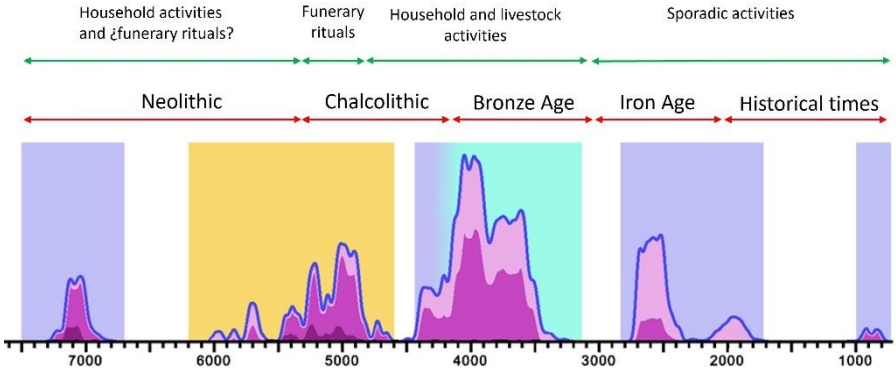


Figure 2. Chronological profile of El Portalón in calibrated dates according to CalPal. In dark purple the dates on human skeletal remains, in the intermediate purple dates on short-lived elements and in light purple dates on long-lived elements. Four phases of occupation are clearly visible (Chronology in years Cal BP).

1.2 Brief description of the site

El Portalón is one of the current entrances to the Cueva Mayor-Cueva del Silo karst system, ca. 1040 m asl. It never became fully clogged by external sediment. This site alone currently surpasses 200 m^2. However, this space is part of a much larger endokarst archaeological area that comprises the adjacent room known as the Salon del Coro or Galería Principal (which is part of El Portalón site itself) and the Galería del Sílex (Figure 1). Since the Middle Bronze Age, these areas have been separated by sedimentary deposits and roof collapses, but previously (during the Early Bronze, Chalcolithic, Neolithic and Upper Pleistocene), they constituted one single large space with more than 500 m of galleries where the aforementioned occupations were recorded. Currently, an excavation is being carried out on a small part (25 m^2) of what is actually an enormous complex site with different human activity areas.

The currently known stratigraphic sequence of El Portalón exceeds 10 m depth and is divided into 11 stratigraphic units grouped into two sedimentary units (CARRETERO *et al.*

2008). The lower sedimentary unit represents the Upper Pleistocene. It is identified with level 10, a 360 cm thick sedimentary unit subdivided into 16 subunits (P1–P16) and characterized by orange to brownish clayey sediments englobing different amounts of limestone clasts and coarser sandy sediments. Noteworthy is the presence of an abundant set of micro vertebrate remains, providing the unit with a significant palaeoenvironmental interest, while it records a potential human activity between subunits P8 and P15, where small flint and quartzite remains were founded. In chronological terms, this lower sedimentary unit, belongs to the final third of the Late Pleistocene. The top of the sequence (subunit P1) has been radiocarbon dated at 16,890+/−80 BP (Beta-209452), whereas subunit P11 has been dated at 30,300+/−190 BP (Beta-212190). It is interesting to note that the last unit before the first Neolithic occupation (level 9) corresponds to an archaeological sterile deposit of bat guano, postdated by a sedimentary hiatus until the mentioned early Neolithic unit.

The second sedimentary unit comprises the Holocene, that with a maximum depth of 630 cm is divided into nine stratigraphic units (Levels 9 to 0) and documents a wide range of human activities during of recent prehistory. It is characterized by sedimentary homogeneity and the cultural affiliation of their units is based on the material records and supported by a large radiochronological set (Figure 2). These data provide evidence for occupations in the Middle Ages, the Roman Age, the Iron Age I (Levels 0, 1 and 2), the Final, Middle and Early Bronze Age (Levels 3/4, 5), Chalcolithic (Levels 6, 7/8) and Neolithic / Mesolithic (Level 9). Although the Medieval and Roman occupations are interpreted as occasional and sparse, occupations during Iron Age, Bronze Age, Chalcolithic and Neolithic periods are characterized by thousands of archaeological artifacts as for wild and domestic animal bone remains which are an indicative of very intense human activity.

2 The cultural/archaeological record

We briefly describe here the main characteristics of the archaeological record with a concise contextualization of these within each of the occupation phases registered in El Portalón.

2.1 Neolithic (Level 9)

The recovered material culture in this level aligns perfectly with the Neolithic of the Upper Ebro Valley and the central Iberian Peninsula: a lithic industry with laminar technology featuring double bevel segments as identifying elements and unmodified flakes with a sickle gloss. An assemblage of well-crafted ceramics stands out, showcasing Boquique and Boquique-like decorations – also found in the Galería del Silex – as well as impressed designs on vessels of spherical or hemispherical shapes, mostly with flat bases and occasionally conical, often including ribbon handles. The collection of personal adornments corresponds well with findings in other relatively nearby caves such as La Vaquera, Cueva Lóbrega, or Los Husos. An exceptional example indicating that the inhabitants of El Portalón were well connected with other societies is the discovery of a ceramic fragment with comb impression depicting a ramiform/anthropomorphic motif (Figure 3) (ALDAY *et al*. 2017), an iconography that links El Portalón to the Iberian Mediterranean, Italian, and, unexpectedly, some Central

European productions (ALDAY *et al*. 2015). There is also evidence for the enhancement living conditions in the careful preparation of many fired clay floors to leveling the cave natural ground unevenness and described here for the first time in the Iberian Peninsula Neolithic context.

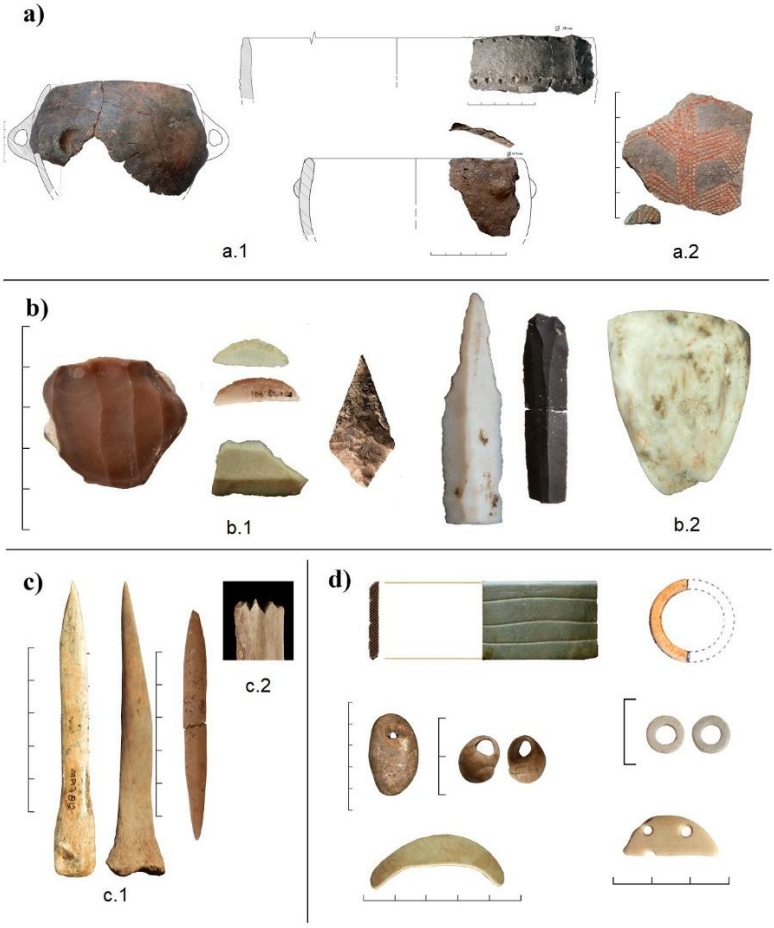


Figure 3. Neolithic cultural objects. Pots of culinary use (a.1); pottery fragments with ramiform-anthropomorphic decoration (a.2); lithic tools (Lamellar core, segments and trapezoid, arrowhead, drill, black flint blade (b.1) and polished axe made of gneiss (b.2). Bone awls (c.1) and gradine (c.2). Some decorative objects (d) such as a marble bracelet, ring made of bone, quartzite pendant, shell pendant, shell discoid beads; undrilled lunula and button also of Shell. Scales in cm.

2.2 Pre-Bell Beaker funerary Early Chalcolithic (Level 8)

At the beginning of the sixth millennium BP, El Portalón was chosen as the site of several burials (PÉREZ ROMERO *et al*. 2017 and see below). We encounter a multiple burial

resulting from the non-simultaneous accumulation of bodies within a cave over approximately half a millennium, exhibiting particular construction features. The formation of the tumulus structure seems to follow the clustering of small tumuli, sometimes lacking structure. The numerous large-format stones in the cave were rearranged to form burial mounds in which the corpses and ritual objects were placed. Associated with this structure is a strikingly dense inventory of material culture: ceramics featuring technical patterns common in domestic production (globular and truncated-cone-shaped pots, bowls, and carinated vessels of various sizes) with few decorations (embossed pellets and perforations). More personal items include adornments, specifically a pair of bone beads, two perforated seashells (*Gibberula miliaria*), alongside some freshwater shells (*Unio picturum*) (Figure 4). Red ochre lumps have also been collected, with debates concerning their symbolic and/or prophylactic function. The sepulchral nature of the site is noteworthy because represents one of the few tumulus burial in a cave known in Spain and the only one in the northern Meseta.

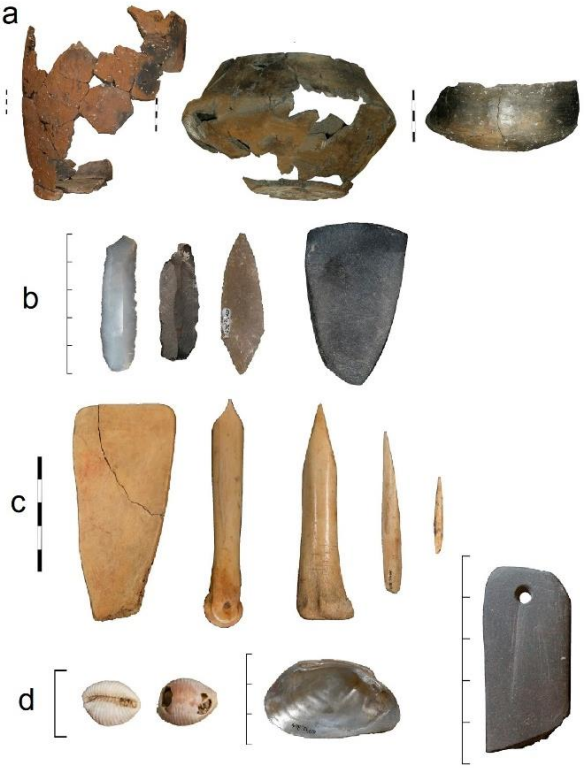


Figure 4. Chalcolithic funerary context in the El Portalón site associated to the child ATP-1420 burial. (a) Pottery: reconstruction of different pottery vessels associated to the burials. (b) Lithic objects: two flint laminae, an arrowhead made on flint and a pulished axe. (c) Bone objects: a spatula with red ocre residuals and several awls. (d) Personal ornaments: *Gibberula miliaria* and *Unio picturum* shells and a fragmented slate archery armguard. Scales in cm.

2.3 Pre-Bell Beaker (Level 7) and Bell-Beaker (Level 6) stabling Chalcolithic

During the late Pre-Bell Beaker phase, El Portalón transitioned from being a funerary space to a livestock stabling and domestic activities place. Given the characteristics of this area, these herders fitted out space for its new use, altering the previous funerary structure and building and stabling enclosure and a contiguous habitational area. The remodelling is evidenced by micromorphological analyses describing typical fumier-type microfacies resulting from the preparation of vegetal beds and dung accumulations that were occasionally fired. A step separates the stabling area from the living zone, where clay floors were prepared upon which hearths, silos and post-holes were arranged. The occupation floors correspond to levels of dark and grey clays archaeologically rich in organic remains and material culture.

The ceramics align with the general traits of Chalcolithic Meseta contexts (Figure 5). However, in the Bell Beaker phase, the coexistence of various decorative styles (Ciempozuelos, Marítimos, Somaén, and Silos/La Vaquera) is observed (PÉREZ ROMERO *et al*. 2017; 2022). Clear evidence of agricultural practices has been also detected, supported by the palynological and carpological data, along with diverse household items hinting at an economic model inclined towards group self-sufficiency.

2.4 Bronze Age (Levels 5, 4, and 3)

During the Bronze Age, with almost 2 meter-thick of stratigraphy across its three levels, we undoubtedly encounter one of the most active periods in the extensive history of El Portalón. The Early Bronze Age (Level 5) encompasses the first 35 cm of the sequence, the Middle Bronze Age (Level 4) spans between 70 and 150 cm in depth depending on sectors, and the Late Bronze Age (Level 3) corresponds to the last 16 cm. The entire sequence is highly homogeneous, consisting of grey silty-clay and sandy sediments with abundant charcoal, ashes, organic matter, and a rich archaeological record. In the Middle Bronze Age, numerous limestone clasts and large blocks resulting from collapses of walls and ceilings are detected.

The material culture (Figure 6) stands out in terms of the abundance of ceramic fragments, typologically and formally displaying remarkable homogeneity throughout the millennium that this cultural phase endured, possibly conceived under a single criterion, functionality. The ceramic fabrics are highly refined or contain small to medium-sized inclusions; the walls are smoothly polished, burnished, and occasionally rough; the firings, reducing, demonstrate technical mastery, despite irregular firing observed in some fragments. Production predominantly revolves around simple vessels where, compared to the Chalcolithic, there is a decline in the proportion of incised decorations (spikes, zigzags, and grids) and impressed ones in favor of more common modeled, digitated or not, decorations on coarse vessels. In the Late Bronze Age, decorations are enriched with "stitched lines," bands of impressions, and Boquique, all characteristic of the Cogotas I culture (PÉREZ ROMERO *et al*. 2016).

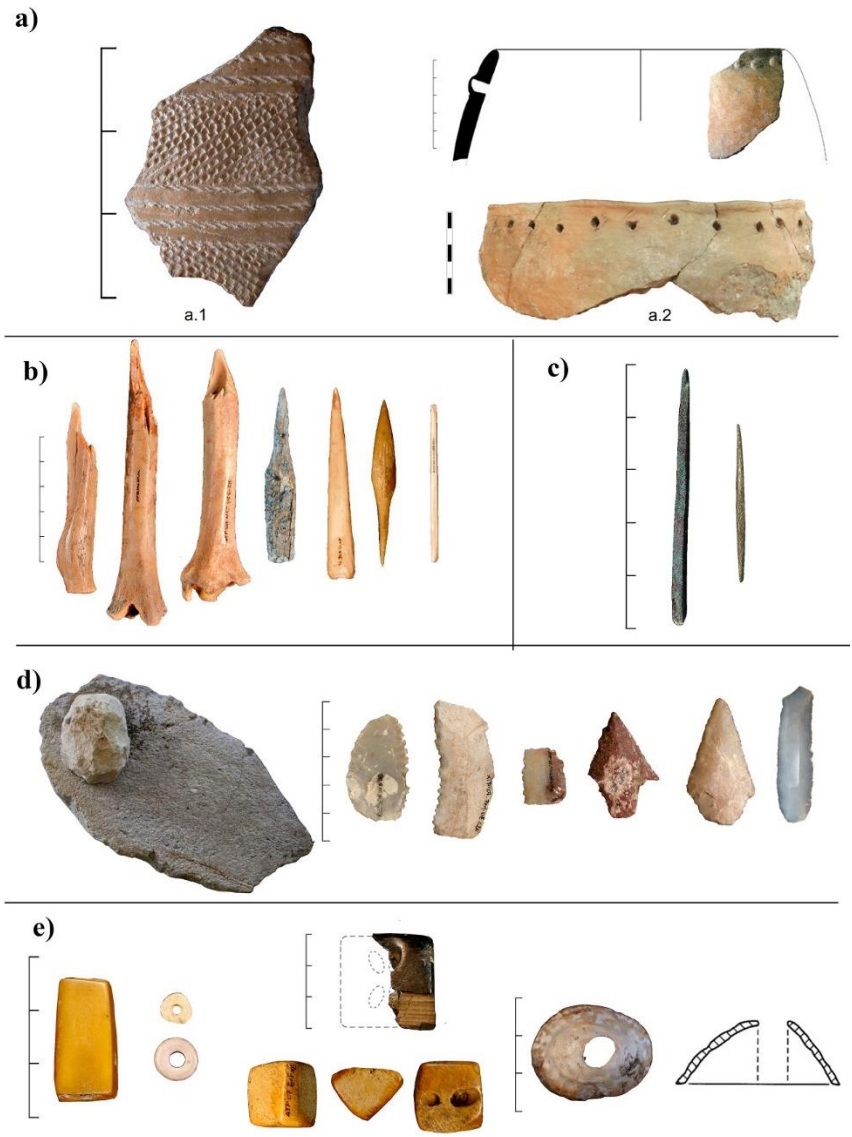


Figure 5. Habitat and stabling Chalcolithic context. a) Pottery: fragment with bell-baker decoration (a.1); Globular pot and bowl of common pottery. b) Bone tools: five owls, an arrowhead and and a fragment of a needle. c) Metal objects: owls made of bronze. d) lithic tools: barchiform mill; three sickle teeth; two arrowheads and a white flint blade. e) Personal ornaments: faceted bead, discoidal beads; prismatic-shaped button made of ivory, prismatic-shaped V-perforated button and shell with irregular apical perforation. Scales in cm.

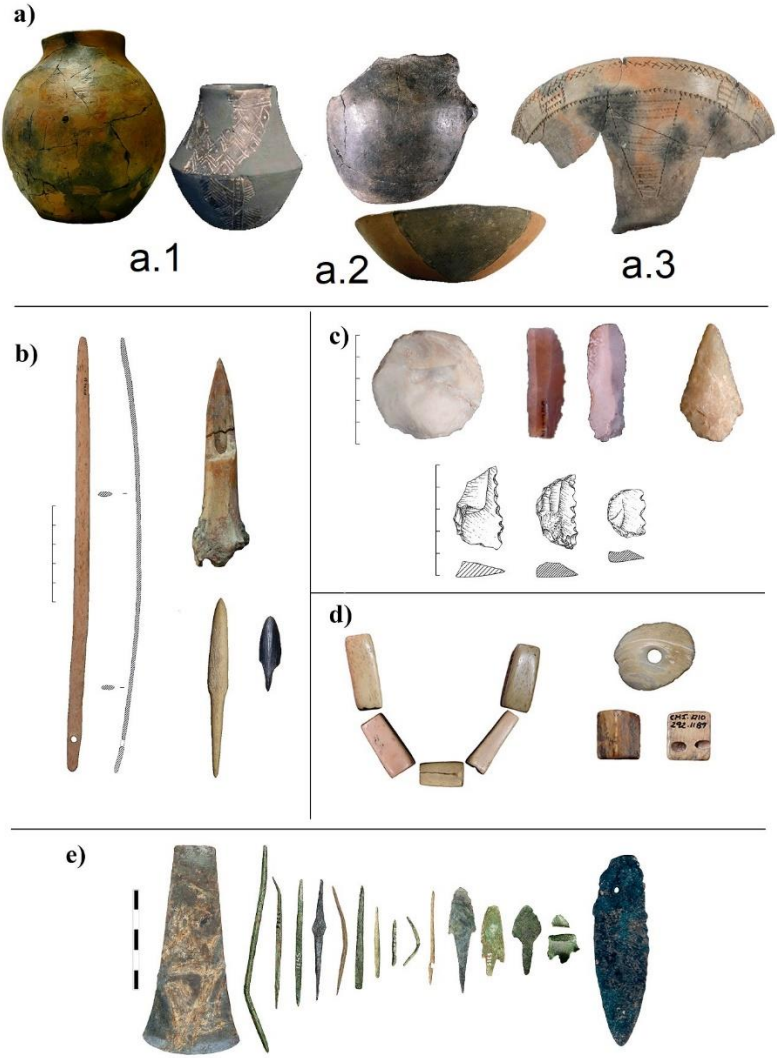


Figure 6. Bronze Age objects. Common storage/cooking pottery and 'prestige' pottery from the Early Bronze Age (a.1); Common pottery from the Middle Bronce Age (a.2) and carinated bowl with cogotas decoration from the late Bronze age. b) Bone Industry: Lozenge-shaped needle (its curvilinear morphology and thinness make them unsuitable for sewing work; awl of articular base made out of ovicaprid metapodial; oval arrowhead with a well differentiated stem and a lanceolate arrowhead with a slight differentiation of the stem. c) Lithic tools: scraper, blades, arrowhead and sickle teeth (all made of flint). d) Personal ornaments: Set of bone faceted beads; discoidal bed made on a patella and prismatic V-perforated button made on bone. e) Metal objects: axe made of bronze, a set of ten owls, arrowheads, and a dagger. Scales in cm.

The production of bone tools, mainly from ovicaprids, is typologically varied, especially in the Early Bronze Age (accumulating two-thirds of the objects despite being the least thick level) (PÉREZ ROMERO *et al*. 2015). Lithic tools are scarce and of little significance, except for the presence of laminar supports with sickle-tooth retouches, a striking circumstance considering that agricultural activities were presumed to occur in the valley floor rather than in the rugged and less fertile lands of the Sierra de Atapuerca. However, the presence of hand mills and grinding stones suggests that El Portalón was used for processing and preserving vegetables (perhaps in the wide-mouthed ceramic vessels or excavated silos). While not striking, the presence of 23 complete metallic objects is significant: axes, simple and double-pointed punches, arrowheads, and a possible dagger complemented by adornments (a bead, part of a gold fibula, and a gold bracelet). Since there is no evidence of local production, the repertoire is presumed to result from exchanges (possibly with the managed livestock?), indicating the economic solvency of the group.

2.5 Iron Age (Level 2)

With a maximum thickness of about 30 cm, this level consists of highly organic anthropogenic sediments. It alternates large patches of ashes and dark-toned silty-clays with charcoal, scarcely any limestone clasts, and shows significant thermal impact due to the presence of substantial ash layers. In this level, both ceramics and four chronological dates corresponding to Iron Age I have been identified. The archaeological materials comprise around a hundred ceramic fragments, mostly related to common household items, occasionally adorned with some digitations, undulations, and simple incisions (Figure 7) (PÉREZ ROMERO *et al*. 2013). Notable among them is an artifact of the so-called prestigious ceramics, displaying slightly more complex decoration (two bands separated by an undecorated strip bordered by a series of small excised triangles from which hang chevrons filled with incised patterns).

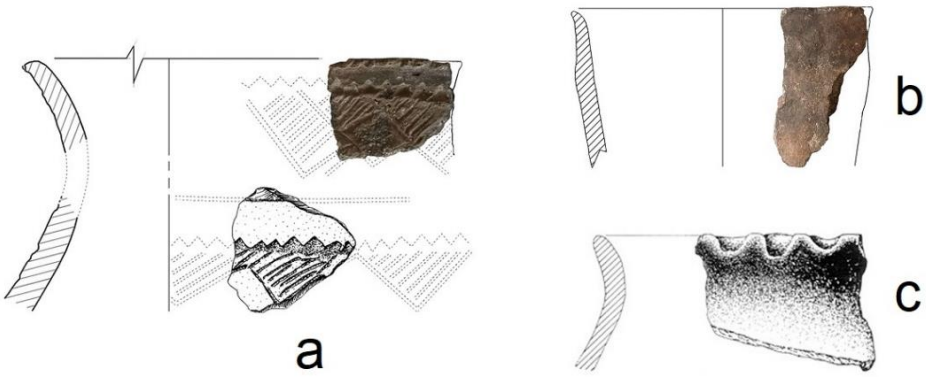


Figure 7. Iron age pottery. a) Prestige pottery with decoration parallel to the border consisting of excised lines and triangles filled with incised lines. b) common or cooking pottery.

2.6 Historical Times (Levels 1 and 0)

The interest in the cave was not confined to prehistoric times; conversely, at the dawn of the historical period, various groups accessed El Portalón. Level 1 corresponds to elements from the Roman period. With a maximum thickness of about 40 cm, it comprises a unit of brownish clays with interspersed ash and charcoal and abundant limestone clasts of varying sizes. Among the archaeological materials there are 324 fragments of late Hispanic Terra Sigillata, Campanian, and common pottery; 69 lithic objects - flakes, nodules of various rocks, and possibly a sandstone mortar; 62 metallic pieces (nails, hooks, rivets, a chisel, or a spearhead). Notably, the recovery includes a couple of tokens, a bone die (numbered in the usual series of seven), and a glass paste seal ring (Figure 8) (PÉREZ ROMERO 2021).

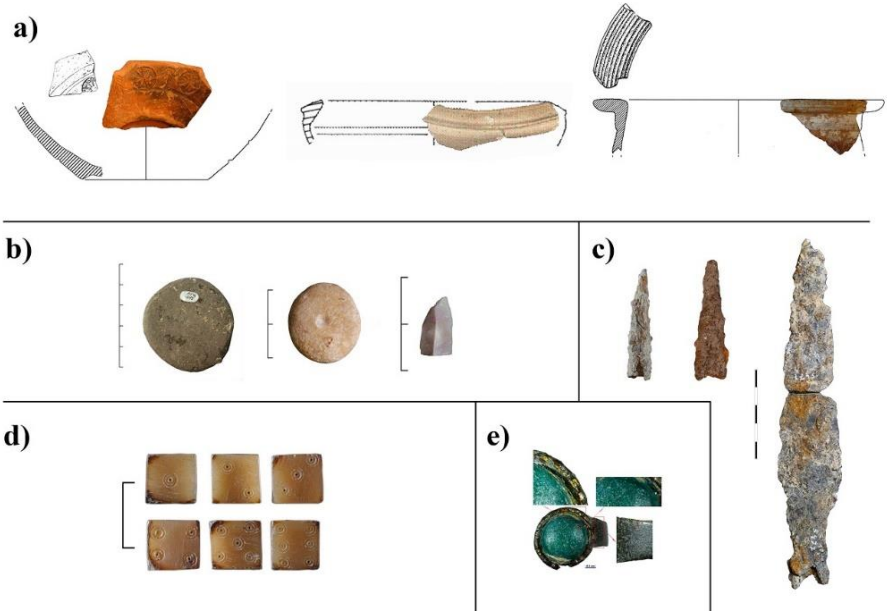


Figure 8. Elements from the Roman period. a) Pottery: Late Terra sigillata hispánica; bowl of thin walls. b) lithic tools: two tokens made of quartzite and a pointed flint blade c) Metal objects: conical iron ferrules and a laurel leaf-shaped arrowheads. d) Bone tools: the six sides of a die made of bone. e) Personal ornaments: ring made in copper, brass and vitreous paste. Scales in cm.

Finally, Level 0, corresponding to the irregular alteration of the first 15 to 68 cm of the sequence, indicates that El Portalón was also occupied in medieval times. This level displays a higher accumulation of blocks resulting from ceiling collapses, along with archaeological materials from different periods. It contains approximately 600 ceramic fragments, primarily wheel-thrown (some with incisions, grooves, impressions, or paintings), and bone artifacts such as an intricately decorated weaver's needle dated to the High Middle Ages (11th century). The lithic inventory is limited to two fragments of gray flint with no diagnostic value and various fragments of quartzites and sandstones. The assemblage likely reflects the use

of the cave for storing and handling foodstuffs (judging by pottery types). Additionally, the singular find of an Almohad gold dobla (PÉREZ-ROMERO *et al.* 2010) places this level in the 13th century (Figure 9).



Figure 9. Medieval objects. Above, pot for culinary use. Below, a gold Almohad dobla in the name of Abu Hafs 'Umar al-Murtada (AD 646-665 Hejira/1248-1266). To the right, a split weaver's awl with a spatula-shaped heel and a concave-convex cross-section made on bone. Scales in cm.

3 The human remains

Most human remains found at present within archaeological context at El Portalón come from the Chalcolitic period. There are however some isolated human remains from the Neolithic and Bronze Age (GÜNTHER *et al.* 2015; VALDIOSERA *et al*. 2018), which suggests possible funerary rites during these periods, which we have not yet been detected in the excavated area. Of the thirteen dates of human remains, two date back to 6100 cal BP; nine fall between 4600 and 4200 cal BP, and two more date to 3700 and 3390 cal BP. In other words, there is an Early Neolithic funerary episode; another more substantial one during the fifth millennium (the pre-Bell Beaker and Bell Beaker Chalcolithic) and a Late Bronze Age episode. Additionally, the presence of geometric microliths among the archaeological remains suggests that they correspond to one or several burials approximately between

5000 and 4600 BP, which have not been dated. It is noteworthy moreover, that numerous human remains scattered on the surface were discovered in the nearby Galeria del Silex (APELLÁNIZ and DOMINGO 1987) and that our recent study points to the use of this Gallery also as a funerary space from the Early Neolithic, throughout the Chalcolithic, and lasted until the beginning of the Bronze Age (MOLINA-ALMANSA *et al.* 2023).

What it is certain is that during the Early Chalcolithic El Portalón was used as a "Sanctuary" or burial ground for humans. A series of radiocarbon dates obtained from seeds and human and animal bones place the funerary contexts at the end of the fifth millennium BP and suggest a repetitive burial activity in this cave along 500 years. A possible collapse of a large part of the roof during this period and the later habitation and stabling use of the cave by late Chalcolithic and Bronze Age people have contributed to the disturbances of the funerary structures (PÉREZ-ROMERO *et al*. 2017). Thus, mainly isolated bones from adults and subadults have been recovered scattered among the limestone blocks of the tumular structure.

Within this scattered sample, the minimum number of adult individuals (MNI) was calculated based on the most repeated piece and at least three individuals can be recognized by three jaws, three right tibiae or three right toe first phalanges. One woman and one man can be easily recognized by their innominate bones and probably they were relatively young or middle-aged adults judging by the condition of their pubic symphysis and auricular facet surfaces. Also, the good condition of other bones that might be associated with them, especially vertebrae, point to the presence of young or middle-aged adults. The third adult individual can be recognized by the last three lumbar vertebrae (L3, L4 and L5) and the sacrum, that on the contrary shows a clear pathological state (flattening of the vertebral bodies, eburnations, osteophytes and Schmorl nodes). These traits support the presence of one individual older than the previous two. The size of the lumbar vertebrae and the sacrum is compatible with a male, although the diagnosis is less reliable.

Regarding the **subadults** (NMI=5), numerous isolated bones have been recovered, mostly hand and foot elements and in this case, to determine the minimum number of individuals the developmental stage achieved by the bones has been taken into account. There is a perinatal individual of less than three months old, another child around 3-4 years old, two more that died during childhood around 6-7 years old, one of them represented by isolated bones and one recovered complete in its original burial. Finally, the fifth subadult probably died in the beginning of his youth around 12 years old.

As mentioned, although many of the burials were later disturbed by late Chalcolithic and Bronze Age herders, the intact body of a 6.5-7 years old child buried in a pit-like structure made from stones was found in 2012 (Figure 10) (PÉREZ ROMERO *et al*. 2017). Ceramic objects were placed around the head, chest, knees and feet. A complete calf accompanies the burial, suggesting a ritual of commensality. The meat would be part of the grave goods and for some authors the bovids would be sacrificed only for the higher social sectors, as opposed to the ovicaprids, which would be offered to individuals of a lower social levels. The excellent state of preservation facilitated the detailed study of the teeth and bones in the skull, face, arms and legs. Anthropological analysis has revealed that this child might have suffered from both rickets and scurvy in at least two different periods of his/her short life

(CASTILLA *et al.* 2014). The signs of these diseases on the teeth and bones identify the first episode between the age of 18 m months and 3 years, precisely the period when children are being weaned and start to add other food sources to breast milk. Abnormal curvature of the long bones may be related to rickets at an age when the subject was still crawling or learning to walk. Other signs on the bones show a second episode at 4-5 years which cannot be linked to weaning. It might be related to a lack of vitamin C due to a monotonous diet based on cereals and lack of vitamin-rich food such as fruit and vegetables.

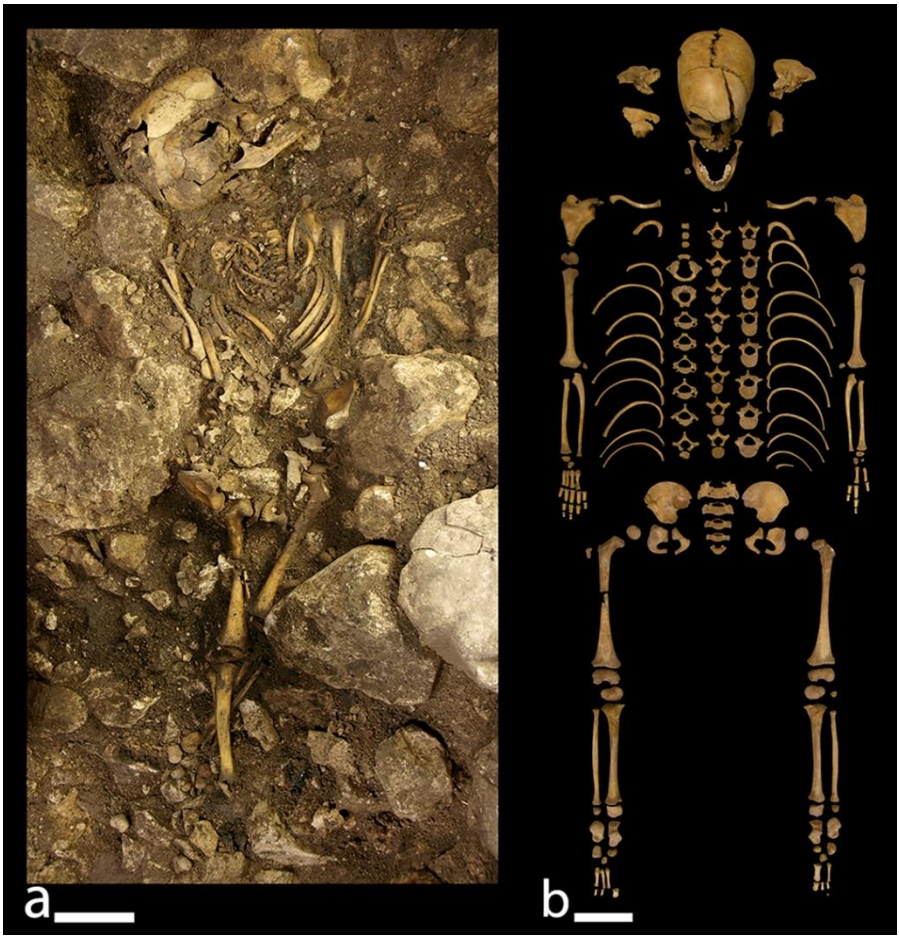


Figure 10. (a) View of the excavation of ATP-1420 child buried during Chalcolithic times in the El Portalón site in the tumular structure and (b) its recovered bones.

Dietary habits were also inferred through occlusal and buccal dental microwear analysis on human teeth from the Chalcolithic of El Portalón (GARCÍA-GONZÁLEZ *et al.* 2017).

The findings suggest that the diet of this populations from the Northern Plateau was less abrasive than, for example, the counterparts' populations from the Mediterranean coast, due mainly to high meat consumption of the formers. The environmental factors are more appropriate for animal husbandry on the Northern Plateau and, accordingly, a difference in food resources must be responsible for the observed differences in regard to microwear features. Furthermore, the consumption of meat is not equivalent in sub-adult and adult individuals from El Portalón and younger individuals show a harder diet with less meat intake than older ones.

4 The ancient DNA analyses

Analysis of old DNA from human and animal remains found in El Portalón is making a significant contribution to major scientific debates. The transition from a foraging subsistence strategy to a sedentary farming society is arguably the greatest innovation in human history. However, its effect in Iberian people remains unresolved. in 2015 we published the first genome-wide sequence data from eight human remains excavated in El Portalón and dated to between 5,500 and 3,500 years cal BP (GÜNTHER *et al.* 2015). We show that these individuals emerged from the same ancestral gene pool as early farmers in other parts of Europe, suggesting that migration was one of the ways of transferring farming practices throughout western Eurasia. In contrast to central and northern early European farmers, the Chalcolithic individuals from El Portalón, additionally mixed with local southwestern hunter–gatherers. The proportion of hunter–gatherer-related admixture into early farmers also increased over the course of two millennia. The Chalcolithic El Portalón individuals showed greatest genetic affinity to modern-day Basques, who have long been considered linguistic and genetic isolates linked to the Mesolithic whereas all other European early farmers show greater genetic similarity to modern-day Sardinians. Furthermore, all modern-day Iberian groups except the Basques display distinct admixture with Caucasus/Central Asian and North African groups, possibly related to historical migration events. This scenario, which we outlined a decade ago, still holds some of its conclusions, although recent contributions provide a more detailed understanding of the complex dynamics of post-Mesolithic European populations.

Most recently, in El Portalón, we contribute to study the impact of prehistoric (Neolithic–Bronze Age) migrations in Iberia by analyzing genomic and dietary data covering a four-millennial temporal transect (7,500–3,500 cal BP) (VALDIOSERA *et al.* 2018). The Neolithization of Europe has been associated with large-scale migrations from Anatolia, which was followed by migrations of herders from the Pontic steppe at the onset of the Bronze Age. Southwestern Europe was one of the last parts of the continent reached by these migrations, and modern-day populations from this region show intriguing similarities to the initial Neolithic migrants. Our study show that Iberian farmers and Early Central European farmers exhibit significant genetic differences, suggesting two independent fronts of the Neolithic expansion. The first Neolithic migrants that arrived in Iberia had low levels of genetic diversity, potentially reflecting a small number of individuals; this diversity gradually increased over time from mixing with local hunter-gatherers and potential population expansion. The impact of post-Neolithic migrations on Iberia was much smaller

than for the rest of the continent, showing little external influence from the Neolithic to the Bronze Age. Paleodietary reconstruction shows that these populations have a remarkable degree of dietary homogeneity across space and time, suggesting a strong reliance on terrestrial food resources despite changing culture and genetic make-up.

A **genetic analysis of adult human bones** from El Portalón (SVERRISDÓTTIR *et al.* 2014) also revealed, that the Bronze Age shepherds still lacked the genetic mutation which now allows us to properly digest milk lactose as adults, and thus use it as a source of calcium and vitamins. Since the current populations on the Iberian Peninsula have a high frequency of this mutation, it follows that this trait was probably selected very quickly in populations which did not have it. We purposed that the causes of selection of this adaptation, were perhaps related to famine periods which were probably frequent in prehistory. When crops failed, the heavy consumption of dairy products would have been a good alternative, which may have led to episodes of strong natural selection for lactose tolerant individuals, i.e. people who could properly and comfortably digest these products.

Genetic analysis of cow remains from El Portalón (ANDERUNG *et al.* 2005) has corroborated ancient contacts between the peoples of North Africa and Iberia across the Strait of Gibraltar. A typical mitochondrial genetic strain of African cattle (Haplotype T1), which was thought to have arrived in Europe during the Muslim expansion in the 8th century, found in an early Bronze Age cow from El Portalón, shows that the arrival of this haplotype is much older than previously thought, thus corroborating archaeological evidence of contact between the two continents across the Strait in recent prehistoric times at least. But since the initial expansion of domestic cattle into Europe during the Neolithic period, taurine cattle (*Bos taurus*) and their wild ancestor, the aurochs (*Bos primigenius*), had overlapping ranges leading to ample opportunities for intentional and unintentional hybridization. We detected auroch DNA in remains from El Portalón initially attributed to domestic cattle on the basis of size and shape, evidence that these animals were not only hunted but also that there was deliberate cross-breeding between wild and domestic animals. In a very recent and much more complete study (GÜNTHER *et al.* 2023), we performed a bioarcheological analysis of 24 *Bos* remains from Northern Iberia (18 from El Portalón) dating from the Mesolithic to the Roman period to investigate the extent of domestic-wild hybridization over time, providing insight into the species' behavior and human management by aligning changes with cultural and genomic transitions in the archaeological record. Our results show frequent hybridization during the Neolithic and Chalcolithic, likely reflecting a mix of hunting and herding or relatively unmanaged domestic herds, with mostly male aurochs and female domestic cattle involved in hybridization. This is supported by isotopic evidence of ecological niche sharing, with only a few domestic cattle possibly being managed. The proportion of aurochs ancestry in domestic cattle remains relatively constant from about 4,000 years ago, probably due to herd management and selection against hybrids, coinciding with other cultural transitions. The constant level of wild ancestry (~20%) continues into modern western European breeds including the Spanish Lidia cattle which is used in bullfighting but does not display genome-wide elevated levels of aurochs ancestry.

Genetic analysis of **horse remains** from El Portalón has also contributed to the debate about possible local episodes of domestication of these animals on the Iberian Peninsula (LIRA *et al.* 2010).

5 The paleontological record

5.1 Large mammals

The taxonomic and anatomical identification of faunal remains along the sequence of El Portalón revealed 5,461 Number of Identified Specimens (NISP) in the Neolithic to Bronze Age contexts. Bones from domesticated animals dominate the assemblage in all the periods, however, remains of wild animals are particularly abundant in the Neolithic and Bronze Age units, constituting up to 25% of the total NISP. In all periods, the main domestic animals were ovicaprids (*Ovis aries*/*Capra hircus*) followed by cattle (*Bos taurus*) and pigs (*Sus domesticus*) (Figure 11) (GALINDO-PELLICENA *et al*. 2014; 2017b, 2020). Ovicaprid remains are always the most abundant faunal remains for all periods and are particularly abundant in the Chalcolithic, both for the Funerary and Stabling phase. Pig remains are relatively rare in the domesticated faunal assemblage but their proportion is relatively constant through time. Cattle are relatively abundant in the Neolithic, decrease in the Funerary Chalcolithic and increase again Stabling Chalcolithic and Bronze Age. The mortality profiles of the animals allow us to better understand the general trends in subsistence strategies and the evolution of these strategies through the four prehistoric periods (FRANCÉS *et al.* 2021). Slightly different exploitation pattern is observed for each period: in the Neolithic and Funerary Chalcolithic a mixed exploitation (dairy and meat) is observed for both ruminant herds, without other secondary product management. During the Stabling Chalcolithic context, the observation of an additional (older) age class in comparison to earlier phases may suggest intensification of other secondary products as fleece in ovicaprids; as traction or keeping the livestock can also be interpreted in the case of cattle (GALINDO-PELLICENA *et al*. 2017a). Finally, during the Bronze Age, a milk and meat-oriented exploitation appears to have prevailed, more focus on meat in the case of ovicaprids and focused on milk in the cattle. However, it is noteworthy that during the Early and Middle Bronze Age, the horse constitutes the third best represented taxa and its frequency is very high in comparison with other Iberian sites of similar chronologies. The butchery marks, fire alteration, fracture pattern and percussion damage observed on horse bone remains, indicate the human consumption of horses in these periods. But for this species, the mortality profile (most of them less than 3,5 years) is focused on consumption of the foal meat, in contrast with the management of this species in the majority of the Iberian sites of similar age, in which horses tend to be slaughtered and eaten only after having been used while still alive. Therefore, the frequency and role of horses in the Bronze Age of El Portalón is unique in the context of other sites on the Peninsula that belong to the same chronology.

Also, the dog domestication, its success and the role of dogs in prehistory of humankind are currently being studied and discussed by scholars of various disciplines. At present, our morphological and metrical analyses indicate that 130 dog bone remains have been identified from the El Portalón site, including from the Neolithic (NISP = 23), Chalcolithic (Pre-Bell Beaker Chalcolithic and Bell Beaker Chalcolithic) (NISP = 26), Early Bronze Age, Middle Bronze Age and Late Bronze Age (NISP = 81). The mandibles of genus *Canis* from the early and middle Bronze Age from the El Portalón demonstrate that these mandibles are smaller in size than modern wolves but they keep some primitive traits in their morphology focused in the carnassial region, specialized for shearing (BLÁZQUEZ-ORTA *et al.*

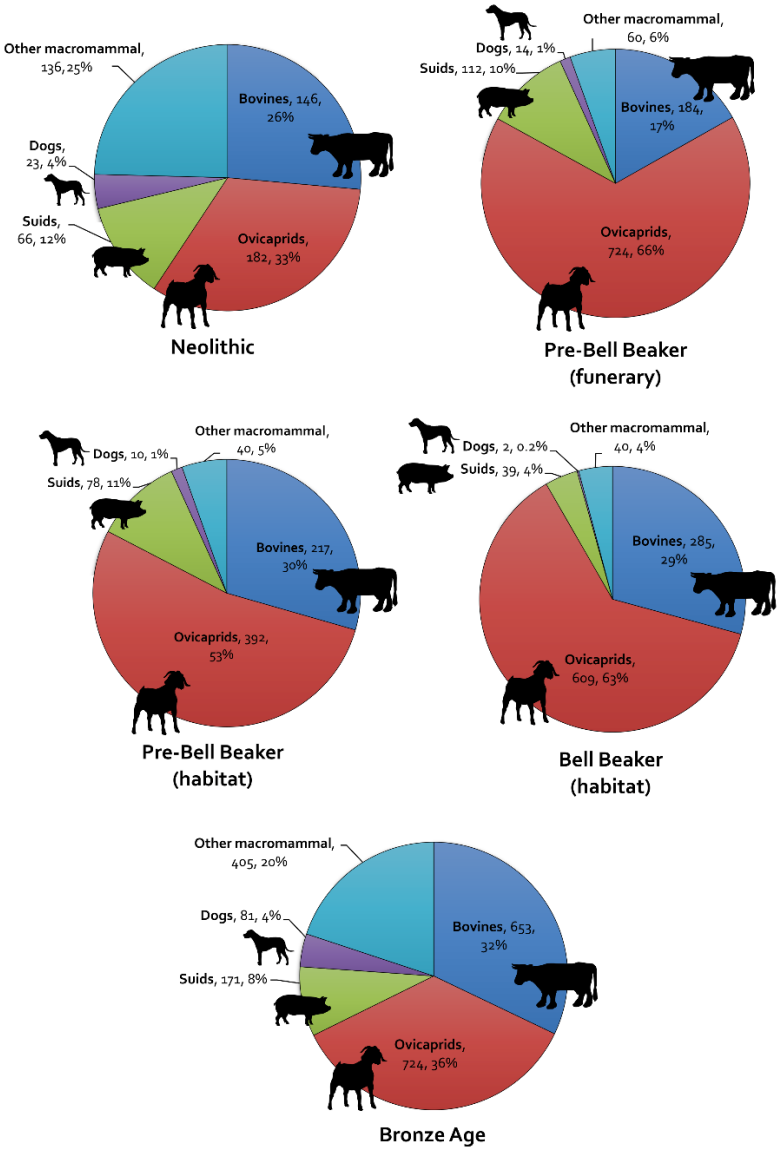


Figure 11. Frequency of domestic fauna by taxon in the different cultural units of El Portalón. Among the domestic fauna, the most represented group is the ovicaprines (*Ovis aries* and *Capra hircus*) followed by *Bos taurus* and *Sus domesticus*. Usually present in this kind of sites and chronologies but in lesser frequency are *Canis familiaris* and *Equus caballus*. Together with the domestic fauna, there is a significant percentage of wild animals (37%) the most abundant being *Cervus elaphus*, *Capreolus capreolus* and *Vulpes vulpes*.

2022). However, the taphonomic evidence suggests that domestic dogs were, at least occasionally, part of the diet of the humans who inhabited the El Portalón site (GALINDO-PELLICENA *et al.* 2022), a fact that might be caused either by food shortages and hunger or as dog meat was considered as a delicacy. Evidence of dog consumption at the El Portalón encompasses cut marks, fresh bone fractures, human tooth marks and fire modifications, thus constituting clear evidence of cynophagy, at least in the Chalcolithic and Bronze Age levels in different contexts (habitat and funerary). Furthermore, the fire alterations on two bone remains from the Neolithic suggest likely dog consumption due to the domestic character of the stratigraphical units where these bone remains were found.

5.2 Small mammals

The Pleistocene small vertebrates of El Portalón (LÓPEZ-GARCÍA *et al.* 2010) comprise at least 25 species many of which are ecothermal (sensitive to temperature) show variations in their taxonomic diversity throughout the sequence. Results from the small-vertebrate associations indicate that the landscape had open habitats in the vicinity of the Atapuerca caves throughout the sequence, with wet locales in the surrounding area. Woodland and water stream meadows were more developed during "warm" periods (Is5, Is6/Is7 and Is3/Is4), whereas during "cold" periods (H3 and LGM) the environment was slightly more humid in response to winter precipitation and the opening of the landscape.

The small-mammal associations at the Chalcolithic Levels of El Portalón (ROFES *et al.* 2021) has proven to be useful to characterize the different archaeo-stratigraphical units as independent entities: the Early Chalcolithic funerary context and the Late Chalcolithic habitat/stabling context (with the latter comprising three different archaeological units according to their origin, namely prepared floors, activity floors and stabling surfaces or fumiers). The exclusive presence of certain taxa, together with the statistical difference in relative taxonomic ratios, points to the integrity and unpolluted condition of the funerary context while the interspersed arrangement of the different habitat context's units made them prone to inter-pollution. The unexpected presence of *Pliomys lenki* and *Chionomys nivalis* in the prepared floors evidences their Upper Pleistocene allochthonous origin. An environment dominated by woodland, shrubland and wet meadows, with moderate presence of grassland, inland wetlands and rocky areas, is inferred from the small-mammal association of the Early Chalcolithic levels.

6 Archaeometry

A pioneer study of magnetic properties through thermal demagnetization of natural remanent magnetization (NRM) have been used on an archaeomagnetic and rock-magnetic study performed on a set of Neolithic and Chalcolithic potsherds from El Portalón to investigate their thermal history and reconstruct their functionality (FRANCÉS-NEGRO *et al.* 2019). Two types of palaeomagnetic behavior were observed that are related to the temperatures reached acquired during the object manufacture and or a partial reheating during their use. Our results show that some samples reached a high heating temperature (> 600 °C) in manufacture and were most probably used as storage vessels, while others acquired their present magnetic signal during their last reheating, for example in cooking

activities (< 450 °C). This study shows experimentally that is possible to infer the last reheating temperatures in prehistoric ceramics and to relate them to their possible use in the past. On the other hand, to investigate into human subsistence strategies, product exploitation and animal management through time at El Portalón, we performed a study of lipid residue analyses from 108 pottery sherds from the Neolithic, Chalcolithic and Bronze Age periods (FRANCÉS-NEGRO *et al.* 2021). The animal products identified in the sherds are in accordance with the animal species exploitation inferred from archaeozoological studies at the site (see above). The molecular and isotopic analyses of lipid extracts provide evidence for the use of carcass and dairy products at the site and the diachronic evolution of identified products show no major variations in livestock husbandry or diet due to cultural or environmental change. The organic residue data gathered from Neolithic to Bronze Age pottery remains from El Portalón were included in a large-scale study to understand the origin and processes by which lactose tolerance developed in human populations over the last 10,000 years (Evershed *et al.* 2022) supporting our previous genetic studies on human bones from the site (SVERRISDÓTTIR *et al.* 2014, and see above). Finally, the compositional profile of the ceramic products of El Portalón was identify in a large-scale compositional study from the Neolithic to the Chalcolithic periods (FRANCÉS-NEGRO 2020). A group of 114 pottery samples were analysed by petrography, X-ray diffraction and X-ray fluorescence and an experimental recreation was carried out with raw material from the surroundings of the site, showing that their chemical profiles support the local origin of the raw materials used for the vessel's elaboration.

7 Paleoenvironmental research

Portalón's large stratigraphic sequence and its long palinological record is also being used in major studies of the climate and environmental patterns in the Upper Pleistocene and Holocene (RUIZ-ZAPATA *et al.* 2003; LÓPEZ-GARCÍA *et al.* 2010; MARTÍNEZ-PILLADO *et al.* 2014). Pollen studies carried out on level 10 show that the sequence is dominated by Pinus, Ericaceae and Asteraceae, with sporadic appearances of the taxa Picea, deciduous Quercus and Corylus, indicating the existence of woodlands that are cold and humid in character and are not very dense or are in the process of degradation, with non-arboreal pollen (NAP) representing more than 50% in almost all the sublevels, except sublevel P9, where arboreal pollen (AP) attains 50% of the total of pollen grains.

On the other hand, paleoclimatic studies are also being carried out based on the isotopic and geochemical analysis of speleothems (stalagmites) of the Cueva Mayor karst system (MARTÍNEZ-PILLADO *et al.* 2014). The time interval recorded in the speleothems from the Estatuas sector (14 kyr – Present) and in the pollen sequence studied from the El Portalón site (17 kyr – 2kyr) overlap by ca. 14-2 kyr allowing to infer paleoenvironmental proxies of different nature and evaluate the validity of both types of paleoenvironmental record. Studying paleoenvironmental conditions from different sedimentary records (detrital-anthropic/archaeological vs. chemical/speleothem) from the same cave setting provides more complete knowledge and allows us to detect and clarify the influence that human occupation can leave on them. The correlation of both proxies (14-2 kyr) establishes well-differentiated paleoclimatic intervals, with non-gradual transits, and a hiatus of at least 7 ka

that covers the end of the Pleistocene and the initial Holocene (ca. 13-6 kyr). Starting at 5.900 BP, the existence of alternating environmental conditions and human occupation in Cueva Mayor is evident. The pollen indicators of relatively humid environments alternating with associations with a higher index of xeric taxa, the alternation of micrite-sparite sheets and the deposits of shoot and charcoal fragments between the growth lines in the speleothem studied, are clear reflections of these parameters. Environmental conditions became drier at 4.2 kyr, decreasing the abundances of forest indicators and nitrophilous taxa and increasing xeric taxa. This fact could be amplified by human agricultural activity already evident from the previous phase and increasingly profuse, as demonstrated by the repeated recording of shoot from anthropogenic fires in the speleothem record studied.

8 Discussion and Conclusions

The earliest confirmed occupation in El Portalón dates back to the Neolithic period, a sociocultural phase that in the region began around 7.600 calibrated years Before Present (cal BP). After several centuries of experimenting with agricultural and livestock activities, around 7,300 cal BP, there was a shift in settlement patterns, marked by the establishment of open-air villages in valleys and occasional visits to shelters and caves in mountainous areas for livestock management (Figure 12). It's in this context that human groups actively became interested in the Sierra de Atapuerca, not merely as an opportunistic action by a group of shepherds, but rather understood within a well-woven regional dynamic. In El Portalón's Neolithic context, evidence indicates an agricultural economy involving *Triticum aestivum/durum*, domestic fauna (Figure 11), combined with the gathering of acorns, hazelnuts, and hunting of *Cervus elaphus*, *Capreolus capreolus*, *Sus scrofa*, *Equus hydruntinus*, or *Oryctolagus cuniculus*.

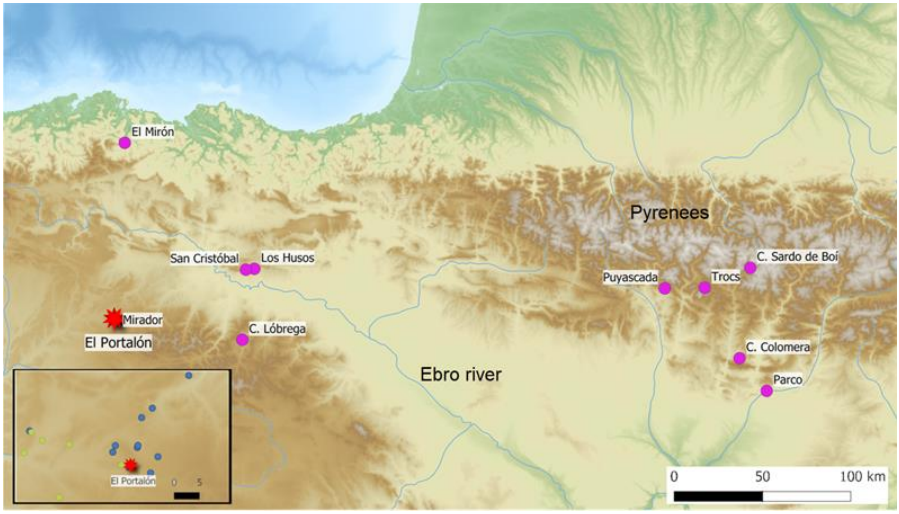


Figure 12. Regional map with Neolithic sites of stabling of the same chronology as El Portaón. The inner square shows the presence of megalithic structures around the El Portalón area.

Following this phase, El Portalón was chosen to accommodate several burials. Contextualizing this, it's worth noting that this new function coincides with the beginning of megalithism in the region. Considering the presence of dolmenic structures in the vicinity of El Portalón, archaeologists face the challenge of explaining the duality in burial practices. This matter is complex as it juxtaposes the monumentality of dolmens against concealment within caves. Nevertheless, what is noteworthy in El Portalón is the construction of a large tumulus structure or the grouping of several tumuli, intending to also mark ("memorialize") the burials. The outcome is a multiple burial complex involving non-simultaneous accumulation of individuals over about two centuries. In addition to El Portalón, there are two other well-known Holocene sites in the Sierra de Atapuerca: Galería del Sílex in Cueva Mayor, which could have functioned as a funeral gallery used from the Early Neolithic through the Chalcolithic to the early Bronze Age, and Cueva del Mirador, which was utilized for livestock stabling and exploitation over millennia. When considered together, the emerging evidence from these three sites increasingly positions the Sierra de Atapuerca as an essential source of information about Holocene people in the interior of the Iberian Peninsula.

El Portalón resumed its habitation function around 4,500 cal BP during the Late Chalcolithic, where the lower portion corresponds to the Pre-Bell Beaker Chalcolithic phase (Level 7), and the upper part to Bell-Beaker culture (Level 6). These were times of considerable activity, manifested in the preparation of a separated stable and a habitation zone. In the later, clay floor was prepared with added clays, upon which hearths were arranged and holes were dug for posts and storage.

During the Bronze Age, El Portalón experienced one of the most active periods in its extensive history, manifested by the considerable depth of sediment levels, the numerous well-defined sedimentary structures, and the extensive catalogue of material culture. We suggest that the Sierra de Atapuerca, in combination with the lands of the Arlanzón Valley, offered the community opportunities for diverse, autonomous, and surplus economic activities. The exploitation of livestock—sheep, pigs, and cattle—undoubtedly drove the activities in El Portalón during the Bronze Age, alongside the management of agricultural production, an area where our knowledge needs improvement. Tools for harvesting, grain processing, and product preservation hint at agricultural activities. Remarkably, the consumption of horse meat stands out as unique in comparison to other sites of the same period. Hunting practices likely coexisted, alongside presumed forest exploitation (fruits, wood), showcasing a comprehensive understanding of the territory and its potential.

During the mid-second millennium, El Portalón hosted an Iron Age community after approximately 600 years of cave abandonment. This phase generated organic clayed sediments interspersed with substantial patches of ashes and charcoal. Rather than representing a permanent settlement, we propose these actions were supplementary to activities conducted elsewhere. While the objective could have been exploitation of the region, we hypothesize that the notable thermal impact on the land might suggest the development of some form of ritualism. Could this have been linked to cremation practices prevalent during that era? This proposal might explain the scarcity of recovered material culture.

Interest in the cave wasn't limited to prehistoric times; on the contrary, at the onset of the historical period, various groups accessed El Portalón. The political, economic, and social instability of the Late Roman Empire might have prompted people to view caves as places of refuge and economic alternatives. Additionally, the discovery of weaponry elements in El Portalón suggests the enclave's use for territorial control. It's important to note that Atapuerca is situated along the corridor connecting the Duero Valley with that of the Ebro, adding significance to its strategic location. In this context, the traditional Camino de Santiago traverses, through various routes, both sides of the Sierra de Atapuerca. El Portalón might have also served as a refuge for certain medieval groups, leaving behind scant evidence indicating the cave's use for storing and handling food items (based on pottery types). However, a 13th-century Almohad coin stands out as a unique find in the region. Its characteristics and the specific location of discovery, deep within a cave and in a hard-to-reach area far from the entrance, suggest an act of concealment or perhaps an offering, although the possibility of accidental loss cannot be entirely dismissed.

We acknowledge that the site is better understood when observed with a broader perspective, considering its involvement in the cultural networks woven around it (Figure 12). From around 7,300 cal BP, Neolithic societies began exploiting mountain environments, seeking refuge alongside their livestock in extensive caves and shelters—El Portalón being one of several examples. Toward the late Neolithic and into the subsequent Chalcolithic period, funerary practices became essential cultural markers. Within a regional and local context marked by megalithic tombs, the cave housed several burials. The intense economic activity, including significant milestones such as the revolution of secondary products, mining operations for various resources, or salt trade, to name just a few relevant regional factors, depict societies that, progressing through the Metal Ages, diversified and specialized their activities. The management of livestock through stables gives El Portalón its significance, especially considering the proliferation of numerous and vibrant open-air settlements in its vicinity. Towards the end of prehistory and the dawn of history, El Portalón lost some of its vitality but continued to interest various human groups.

In summary, El Portalón's archaeological record embodies the vitality of populations settled around the Arlanzón River. Since the Early Neolithic, these groups selected the cave as part of an integrated exploitation system of their environment and as a place to express their ritualistic interests. Six millennia of cultural experiences make El Portalón an essential reference point for understanding our past.

9 Acknowledgements

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