Radiocarbon, Vol 00, Nr 00, 2022, p 1–76 DOI:10.1017/RDC.2022.48

RADIOCARBON CHRONOLOGY OF DOLMENS IN THE IBERIAN SOUTHWEST: ARCHITECTURAL SEQUENCE AND TEMPORALITY IN THE EL POZUELO MEGALITHIC COMPLEX (HUELVA, SPAIN)

José Antonio Linares-Catela*

Prehistory Area, Department of History, Geography and Anthropology, Faculty of Humanities, Avenue Tres de Marzo, El Carmen Campus, University of Huelva, 21071 Huelva, Spain

ABSTRACT. This paper establishes the chronology of the El Pozuelo megalithic complex and discusses it in the context of other dolmens that have been dated in the southwest of the Iberian Peninsula. The working methodology combines the study of the stratigraphy and architectural sequence with the Bayesian modeling of the 27 AMS ^{14}C dates obtained for charcoal samples from the four monuments in the Los Llanetes cluster. The most significant chronological results (at 68% probability) are (a) the antiquity and long duration of the megalithic sites, in which several monumental structures succeeded one another ca. 3970–1980 cal BC; (b) the existences of different temporalities in the Late-Final Neolithic dolmens: simple chambers (3970–3760 cal BC), elongated chambers (3790–3620 cal BC) and multiple chambers (3660–3260 cal BC; (c) the continuity of activity during the Copper Age (2980–2580 and 2530–2180 cal BC); and (d) the permanence of megalithism in the Early Bronze Age, through the presence of terraced enclosures with circular platforms ca. 2230–1940 cal BC. This diachronic sequence and the contextualized analysis of the 152 available radiocarbon dates (27 new, 125 published) supports the establishment of the temporal dynamics of megalithism in the Iberian southwest, introducing key aspects on the emergence, span, and rebuilding of the different dolmens (passage graves, simple chambers, elongated chambers, and multiple chambers) and establishing the phases of activity and reuse of the different architectural types.

KEYWORDS: Bayesian modeling, dolmens, Iberian southwest, megalithism, radiocarbon AMS dating.

INTRODUCTION

Dating the Dolmens and the Problematics of the Study

One of the greatest difficulties in research into megalithic monuments is the determination of their age. The main problems arise in the sites themselves and types of samples used to date them. Most sites are characterized by complex stratigraphic sequences and long periods of use, in which the diverse stages that are recorded make it very difficult to establish the chronological sequence. Moreover, the radiocarbon dates obtained mostly for organic materials (charcoal, bone, wood, etc.) provide different chronometric results and possibilities for interpretation.

The greatest limitations emerge in the correlation of the resulting dates with the construction events, architectural rebuilding and episodes of use. Thus, the dates obtained for human bones in dolmens and collective burials provide a temporal range for funerary activity and not the building of the monument; in that way effectively determining a *terminus post quem* for its construction (Scarre 2010).

However, progress has been made in recent years. First, the dating methods have improved (Bronk Ramsey 1995; Bayliss and Whittle 2007), owing to the application of Bayesian statistical modeling for human osseous remains (Bronk Ramsey 2009) and improvements in the intervals in the calibration curves (Heaton et al. 2020; Reimer et al. 2020). Second, through the development of studies on stratified mortuary deposits with numerous calibrated radiocarbon dates for short-lived samples, especially bones. These have suggested

*Corresponding author. Email: ja.linares@dhga.uhu.es

that the periods of use of the tombs in several parts of western Europe correspond to specific generations of individuals (Whittle et al. 2007, 2008; Chambon et al. 2017; Steuri et al. 2019; Meadows et al. 2020).

The current state of knowledge of the age of megalithic monuments in the southern Iberian Peninsula is uneven. In recent years, research based on long series of radiocarbon dates for megalithic tombs in the southeast of the peninsula (Lozano Medina and Aranda Jiménez 2018) has obtained interesting results for the chronologies of the necropolises of El Barranquete (Aranda Jiménez and Lozano Medina 2014; Aranda Jiménez et al. 2017a), Panoría (Aranda Jiménez et al. 2017b, 2020a, 2022), Las Churuletas, La Atalaya and Llano del Jautón (Aranda Jiménez et al. 2017c), Los Millares (Aranda Jiménez et al. 2020b; Molina et al. 2020) and Mojácar (Aranda Jiménez et al. 2020c).

In contrast, in the southwest of the peninsula fewer monuments have been dated by a long series of samples. Studies have focused on Copper Age collective tombs, such as the hypogea and tholoi at the mega-site of Valencina de la Concepción (García Sanjuán et al. 2018), the Tholos of Montelirio (Bayliss et al. 2016), the necropolis of La Orden-Seminario (Linares-Catela and Vera Rodríguez 2021) and several corbelled tombs in Alentejo, such as Centirã 2 (Robles et al. 2013), Cardim 6 (Valera et al. 2019) and Perdigões 4 (Valera and Wood 2020).

The chronological study of dolmens in southwest Iberia is seriously limited by the small number of dated sites in both Spain and Portugal. Only 62 megalithic funerary monuments have been dated by 134 radiocarbon determinations on organic materials (bone, charcoal, marine shells). The present study has not included four dates from Poço da Gateira 1, Gorginos 2, Anta Grande da Comenda da Igreja and Farisoa 1 (Whittle and Arnaud 1975), because they were obtained on ceramic samples by thermoluminescence and suffer from a high standard deviation of the chronometric results (Table S1). At most sites, one, two or three dates have been obtained, generally for the funerary levels. In contrast, few sites are dated by four or more determinations for different contexts, as at Santa Margarida 3 (Gonçalves 2003a), Azután (Bueno et al. 2005), Soto (Linares-Catela and Mora Molina 2018), Carrascal (Silva et al. 2019), Pedras Brancas (Silva et al. 2021) and Campo de Hockey necropolis (Vijande-Vila et al. 2022). Additionally, no chronological sequences have been established at particular dolmens with stratified dates and using Bayesian modeling. Regional analyses integrating the radiocarbon dates from both countries are equally scarce (Boaventura 2011; García Sanjuán et al. 2011; Boaventura and Mataloto 2013; Carvalho and Cardoso 2015; Mataloto et al. 2017; Schulz Paulsson 2017; Rocha 2020). This makes it very difficult to determine the temporalities of the different construction models. In this context, the chronology of the dolmens has traditionally been based on evolutionary formal schemes in which chrono-cultural sequences are established by typological classifications of architectures and grave goods.

The present study is based on the radiocarbon chronology of the El Pozuelo complex and its study contextualized in the diachronic sequence of funerary megalithic sites in the Iberian southwest. It therefore sets two inter-connected objectives. The first focuses on determining the chronological sequence of the Los Llanetes cluster. These four monuments are characterized by a complex architectural sequence, long temporality and diversity of functions. The combined analysis of the stratigraphic-structural sequence and the Bayesian modeling of 27 radiocarbon dates for charcoal samples, mostly short-lived, is able to establish the chronologies of the construction, structural reform, uses and reuses of the

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

monuments during Later Prehistory. It should be noted that this is the first chronological study of dolmens in the southwest of the Iberian Peninsula to be supported by Bayesian modeling and a long series of stratified dates from the construction units, internal and external structures and levels of use.

The second objective aims to contextualise the chronometric results within the dynamics of funerary megalithic dolmens in southwest Iberia, which comprise a long sequence from the late fifth millennium to the start of the second millennium cal BC. The area of study encompasses the southwest of the peninsula, principally the zone to the south of the River Tagus, including the Portuguese regions of Estremadura, Alentejo and Algarve, and Western Andalusia (Huelva, Cádiz, Seville, Córboba, and Málaga provinces). In this geographic area, several models with similar traits have been proposed for the period from the Middle Neolithic to the Early Bronze Age: protomegalithic tombs, dolmens and megalithic cists. The area is characterized by architectural polymorphism and territorial concentrations in the types of monuments. This may correspond to building specialisations, regional styles and/or synchronic or diachronic processes.

With this study, the statistics mentioned above increase to 66 sites dated by 161 determinations, of which 9 dates from previous occupation levels of 8 dolmens have been excluded for the chronological models (Table S2). These are occupation or activity traces preceding the construction of the monuments, and in some cases might be significantly older. The analysis and clustering of the 152 dates available (27 news, 125 published) for the different architectural models may contribute to establishing the chronology of the dolmens and support the proposal of more robust temporal schemes in southwest Iberia.

The Megalithic Complex of El Pozuelo

The El Pozuelo complex (Zalamea la Real, Huelva) is in the Eastern Andévalo region, at the southwestern end of the Sierra Morena (Figure 1). It is located in the Volcanic-Sedimentary Complex of the Iberian Pyrite Belt, where basic, acidic and intermediate volcanic rocks outcrop. The largest concentration of dolmen necropolises in the Province of Huelva is found in this environment, and it is also one of the densest groups in the Iberian southwest.

This megalithic necropolis is the best known and most outstanding, as it is the largest and most diverse in its architecture (Cerdán et al. 1952; Leisner and Leisner 1956, 1959; Piñón Varela 1987, 2004; Linares-Catela 2016). It consists of 13 megalithic monuments in an east-west band around two streams that are tributaries to the headwaters of the River Tinto (Figure 1a). It is arranged in three clusters. Los Llanetes in the east, at the head of the Agua Fría Ravine and next to the Chinflón copper mines, formed by four dolmens (no. 1–4); El Riscal-La Veguilla, on the bank of Los Pinos, with five dolmens (no. 5–9); and Los Lomeritos, with two dolmens (no. 11 and 12). The dolmens of Los Rubios (no. 10) and Martín Gil (no. 13) are located at either end of the group. The dolmens are noteworthy because of the variety in the structure of the orthostats inside circular mounds of clay and stones. They include dolmens with a simple chamber (no. 8, 11, and 12), dolmens with an elongated chamber (no. 9 and 10), a covered gallery with central pillars (no. 4) and dolmens with multiple chambers in different spatial designs: double chambers (no. 1, 2, and 3); cruciform designs with two (no. 7) or four side-chambers (no. 13); and asymmetric structures with four asymmetric chambers, several antechambers, and passages (no. 5 and 6).

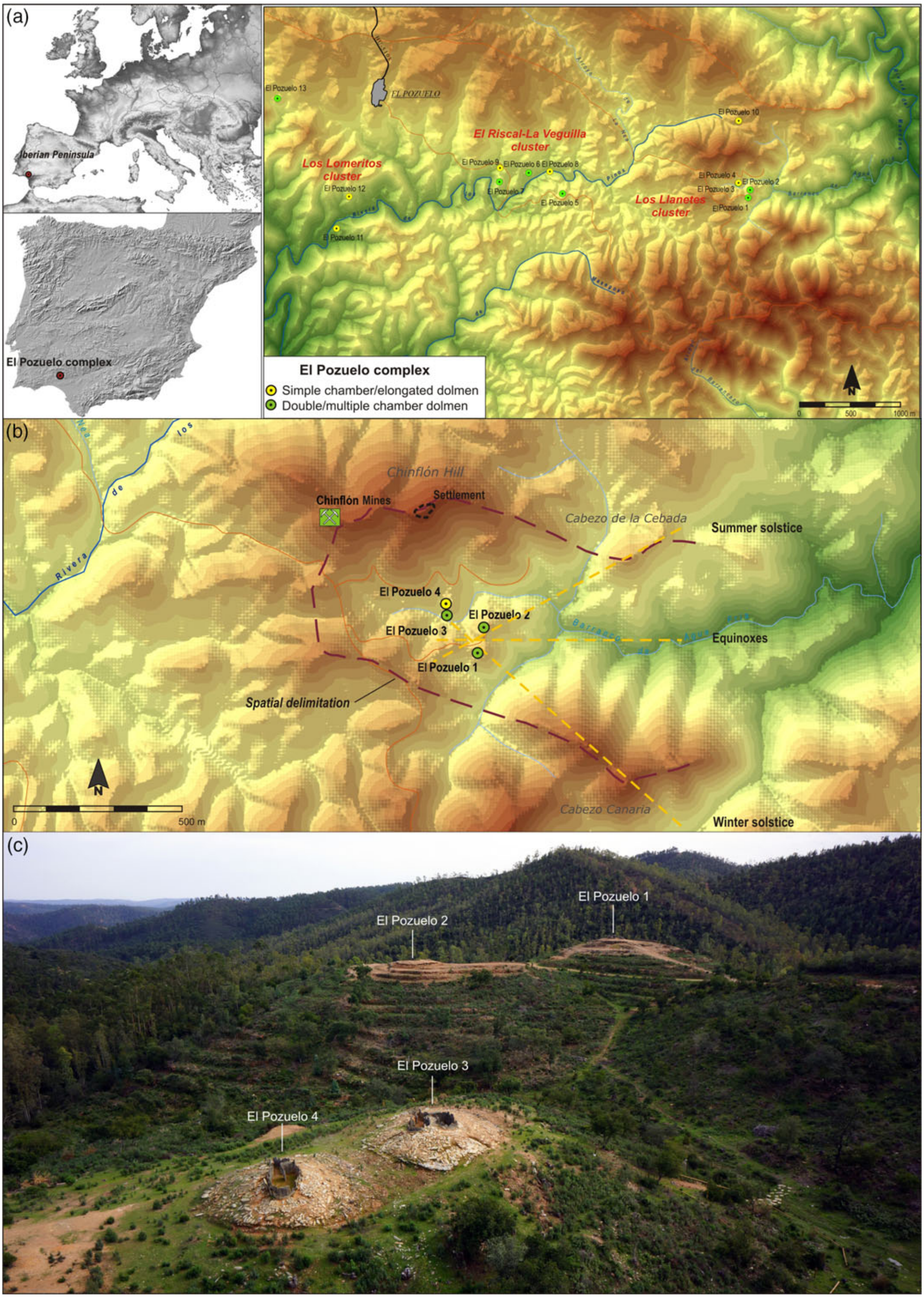

Figure 1 Location of the Los Llanetes cluster, El Pozuelo complex: (a) siting and distribution of El Pozuelo megalithic group; (b) Megalithic landscape of Los Llanetes; (c) view of the Los Llanetes cluster.

The chronology of these monuments has traditionally been based on the evolution in the typology of the architecture and grave goods. The simpler dolmens, those with a single or elongated chamber were dated in the Late Neolithic, due to finds of certain type-fossils for the fourth millennium BC in the sequence of regional megalithism, such as geometric artefacts, adzes, pottery types, plaque and/or cruciform idols, etc. However, the monuments with multiple chambers have been interpreted as the expression of a local architectural style, representative of late megalithism in the Copper Age and developed as a consequence of the emergence of the first mining-metallurgical societies in the area (Cerdán et al. 1952; Blanco Freijeiro and Rothenberg 1981). Before now, only one radiocarbon date was available, for El Pozuelo 6. It has even been argued that the whole necropolis developed in the second half of the third millennium BC (Nocete et al. 2004).

MATERIALS AND METHODS

Architectural Sequence and Charcoal Sampling

The present study has focused on the four monuments in Los Llanetes, the eastern cluster in the El Pozuelo megalithic complex. They are located in the valley; distributed in pairs of monuments and creating an area reserved for the realm of the dead, within a megalithic landscape that includes the settlement on Chinflón Hill, the copper mines and the natural surrounding formations (Figure 1b). Dolmens 1 and 2 occupy two different mounds connecting by gentle slopes, while Dolmens 3 and 4 are on a flat promontory (Figure 1c). They were excavated in 1946, giving rise to the study of the architectures and grave goods (Cerdán et al. 1952).

The documentation and materials used for the present study come from two archaeological fieldwork projects in 2009–2010 and 2012–2014. This work employed a methodology that included extensive excavation of areas, a full architectural study of internal spaces and the selective micro-spatial exploration of outer areas: the mounds, front access zone and the surrounding areas. The stratigraphic record has not been exhausted in any of the excavated sectors, leaving sections for future research. This working method has succeeded in reconstructing the stratigraphic-structural sequence of the remains and their position in a relative chronology; and it has identified the structural phases, the stages of activity and materials associated with them.

Research in the Los Llanetes cluster enabled an interpretation of the stratigraphy, architecture and diachronic sequence that is more complex archaeologically than was traditionally thought (Linares-Catela 2017). Three elements can be emphasized:

- The final form of the monuments is the result of the concatenation of a series of architectural projects. In each of these, different models of dolmens were superimposed, with a tendency from simpler to more complex monuments (Figure 2). Each model displays particular characteristics and was constructed with different purposes and intentions.
- The existence of "megalithic operational chains" associated with each primary building project or reform. The work was characterized by the sophistication, specialization, and continuity of a technical tradition, seen in the selection of materials, treatment and building systems (Linares-Catela 2021).

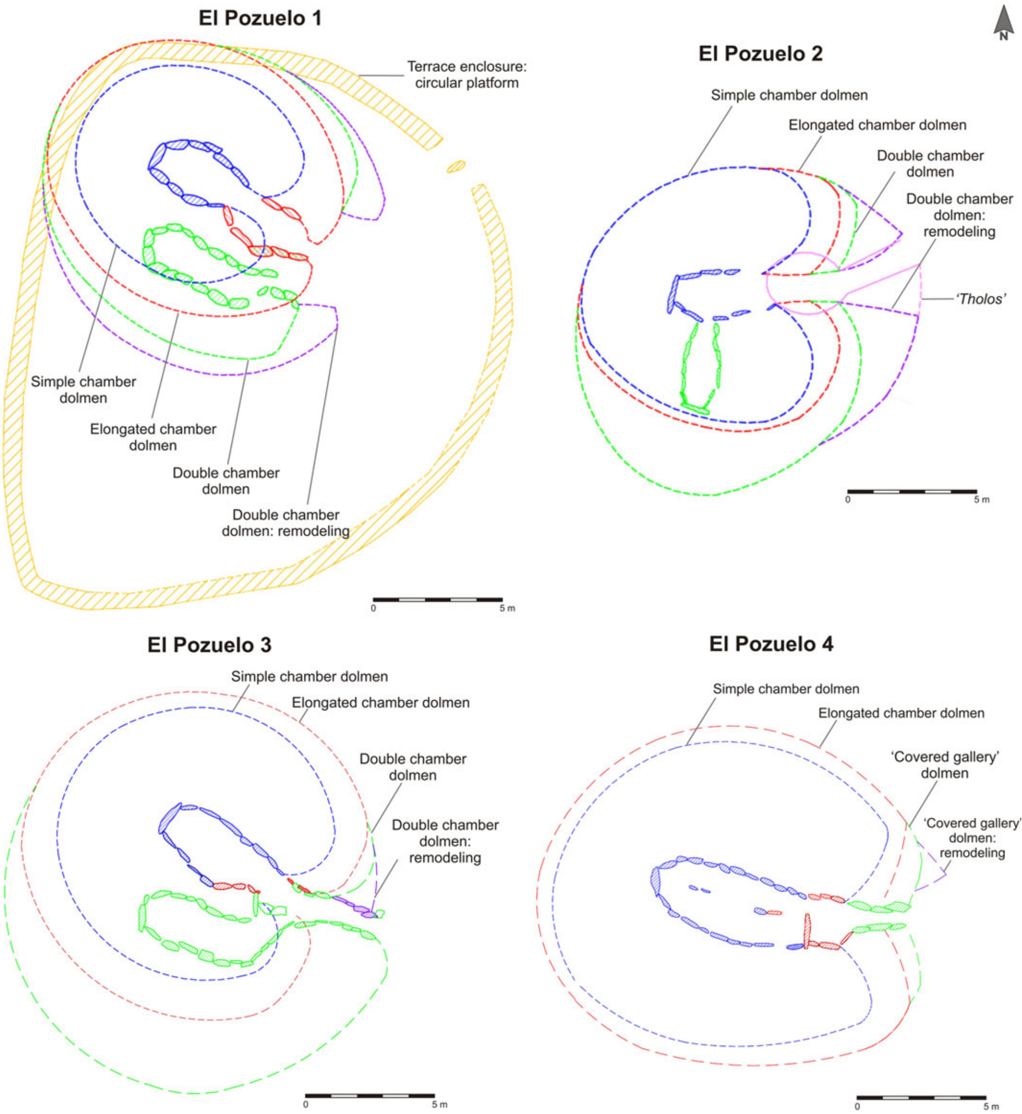

Figure 2 Architectural sequence of the Los Llanetes cluster, El Pozuelo complex. Evolution of the monuments.

- The long and complex duration of the cluster, with materials characterising different chrono-cultural phases in Later Prehistory, from the Late Neolithic to the Bronze Age, and various historical periods.

Nonetheless, each dolmen displays particular stratigraphies, an architectural biography and specific activity in Later Prehistory.

Dolmen 1 is a mound containing two parallel chambers with independent accesses (Figure 3). They clearly differ in their shape, size and heights. The circular mound is delimited by a ring of kerbstones. On the outside, a circular stone platform and two stepped levels of terraces are delimited by drystone walls that form a monumental enclosure that is more recent than the

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

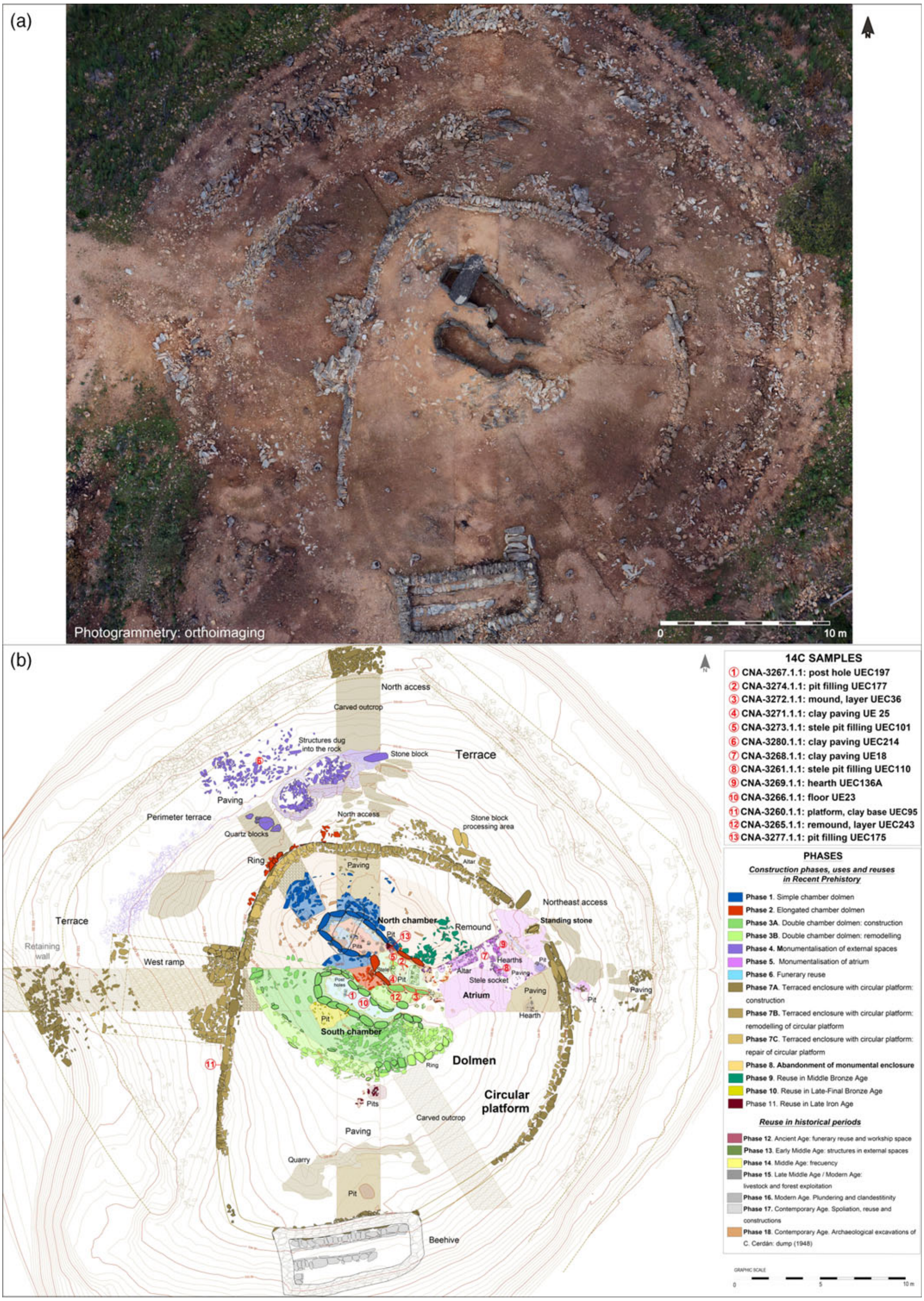

Figure 3 El Pozuelo 1: (a) photogrammetric survey; (b) plan with architectural phases, stratigraphic-structural sequence and location of ^{14}C samples.

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

dolmen (Figure 3a). The archaeological study determined a stratigraphic-structural sequence (Figure 3b) with the following phases:

- Phase 1: dolmen with an elongated oval chamber oriented to the SE (117º). It corresponds to half the structure of the north chamber, from its middle to the head. It is 3.75 m long, with a maximum width in the middle of 2.05 m and a height of up to 1.80 m. It is formed by large orthostats, the first of which rests on the headstone while the others are vertical. The floor is on the bedrock which was lowered with a slope down from the access, with a stele pit in the middle, aligned with the axis of the chamber. It is inside a circular mound 9 m in diameter.
- Phase 2: a dolmen with an elongated chamber that was formed by adding two curving walls of stones to prolong the original axis of symmetry. It reaches a length of 7 m. The axial stele was placed in the access section. The oval mound, with a kerb, reached 12.50 m in length on its long axis.
- Phase 3: dolmen with double parallel chambers and independent entrances. Two sub-phases can be differentiated. In Phase 3A, the work involved removing the southern half of the pre-existing mound, building the south chamber and its access vestibule, moving several stones, paving the north chamber with clay, and rebuilding the mound. This created a circular mound 12.60 m in diameter delimited by kerbstones. The south chamber, which was lower and built with smaller stones than the contiguous one, is curved and 6.50 m long. It has two headstones.
  In Phase 3B, the frontal façade was transformed and repairs were made to the south chamber. The work enlarging the mound formed an atrium with an open monumental façade including two access vestibules oriented generally towards the east (90°). The north wall of the south chamber was repaired by moving the orthostats and the entrance of the north chamber was transformed by removing the first two stones and replacing the axial stele.
- Phase 4: the outer area was monumentalized. The surrounding terrace and structures in the north and front were built.
- Phase 5: the outer frontal area was monumentalized by laying a pavement, several altars, circular structures and steles, with which ritual hearths in the atrium are associated.
- Phase 6: funerary reuse.
- Phase 7: the dolmen was partially dismantled and the area of terraces with a circular platform was built, which implied breaking and removing the capstones, orthostats and steles and digging out the mound for their reuse. The monumental enclosure includes two types of structures. First, a drystone wall platform 23.50 m by 20.50 m in size that surrounded the dolmen, between 0.50 and 1.0m high, which contained large stones and slabs from the dolmen. It had several accesses; one on the north-east side, segmented by an orthostat reused as a standing-stone, and a ramp on the west side. It was restructured and rebuilt on two occasions (Phases 7B and 7C). Second, two sub-quadrangular surrounding terraces were built lower down, delimited by drystone walls with the shape of an incline towards the outside.
- Phase 8: the terraced enclosure was abandoned.
- Phase 9: reuse in the Middle Bronze Age, when the mound of the dolmen was reshaped by partially emptying the north chamber, where a mining hammer with a central groove was found.

- Phase 10: reuse in the Late-Final Bronze Age, when a pit was dug in the mound.
- Phase 11: reuse in the Late Iron Age, as witnessed by the pit dug in the north chamber.

Dolmen 2 is a monument with double perpendicular chambers (Figure 4). Its circular mound is delimited by a prominent levelling platform and a ring of kerbstones with protruding oblique stones, created in four architectural projects (Figure 4a). The archaeological study (Figure 4b) has determined the following phases.

- Phase 1: dolmen with an elongated oval chamber. This is the west chamber formed by two walls and a headstone, on a northwest-southeast line. An old stele was reused with engravings on the extrados. It was 3.50 m long, with a maximum width of 1.70 m in the middle and a maximum height of 1.60 m. The floor was dug into the bedrock. The oval mound was 9.80 m long on its long axis.
- Phase 2: dolmen with an elongated chamber 5.25 m long. Its construction involved dismantling and partly rebuilding the north wall of the old chamber, as well as lengthening the structure and enlarging the mound by a metre on the eastern front, reaching up to 2 m in height. The chamber was rotated towards the east (90°), which was the axis of symmetry of the monument.
- Phase 3: dolmen with double perpendicular chambers. Its design involved partially digging out at least one orthostat and part of the old mound, as a hole was made for the south chamber. The mound and kerbstone ring were rebuilt next to the interior. The chamber, 3.30 m long, 1.50 m wide, and 1.40 m in maximum height, was oriented towards the north (10°). It was formed by a headstone and regular slender orthostats and was lower than the original one, with a floor of beaten clay over the bedrock. The elliptical mound was 12.75 m long on its axis of symmetry.
- Phase 4: the east front of the mound was enlarged by adding two sections of the ring and filling the mass of the mound, which reached 13.25 m in length.
- Phase 5: funerary reuse of the chambers.
- Phase 6: reuse of the space for a possible construction of a tholos-type structure in the eastern half. This meant the mound of the monument was reformed. The negative structure is characterized by a passage and the start of a circular chamber with slabs and stone walls, oriented towards the northeast (67°).
- Phase 7: the monument was partly dismantled, and the remains and materials were added to the surrounding ditch enclosure, which has only been delimited on the surface. The enclosure is elliptical, oriented on a northeast alignment (67°), formed by a discontinuous perimeter ditch dug in the substrate with an embankment towards the exterior. The ditch would have a U- or V-shaped cross-section, about 1.50 m wide and up to 0.80 m deep, delimiting an area of 36.50 m by 23 m. A "pincer-shaped" access in the northeast was flanked by a stele on each side. Another access would have been on the southwest side. On the inside there was a small perimeter ditch, and two groups of circular earthen structures were located on the outside.
- Phase 8: the monumental enclosure was abandoned.

Dolmen 3 is characterized by an internal structure formed by two parallel chambers 4.5 m in length connected by an antechamber and a converging passage (Figure 5), 2.60 m long. They were in a circular mound 16.50 m in diameter and up to 3.50 m high above the outer ground

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

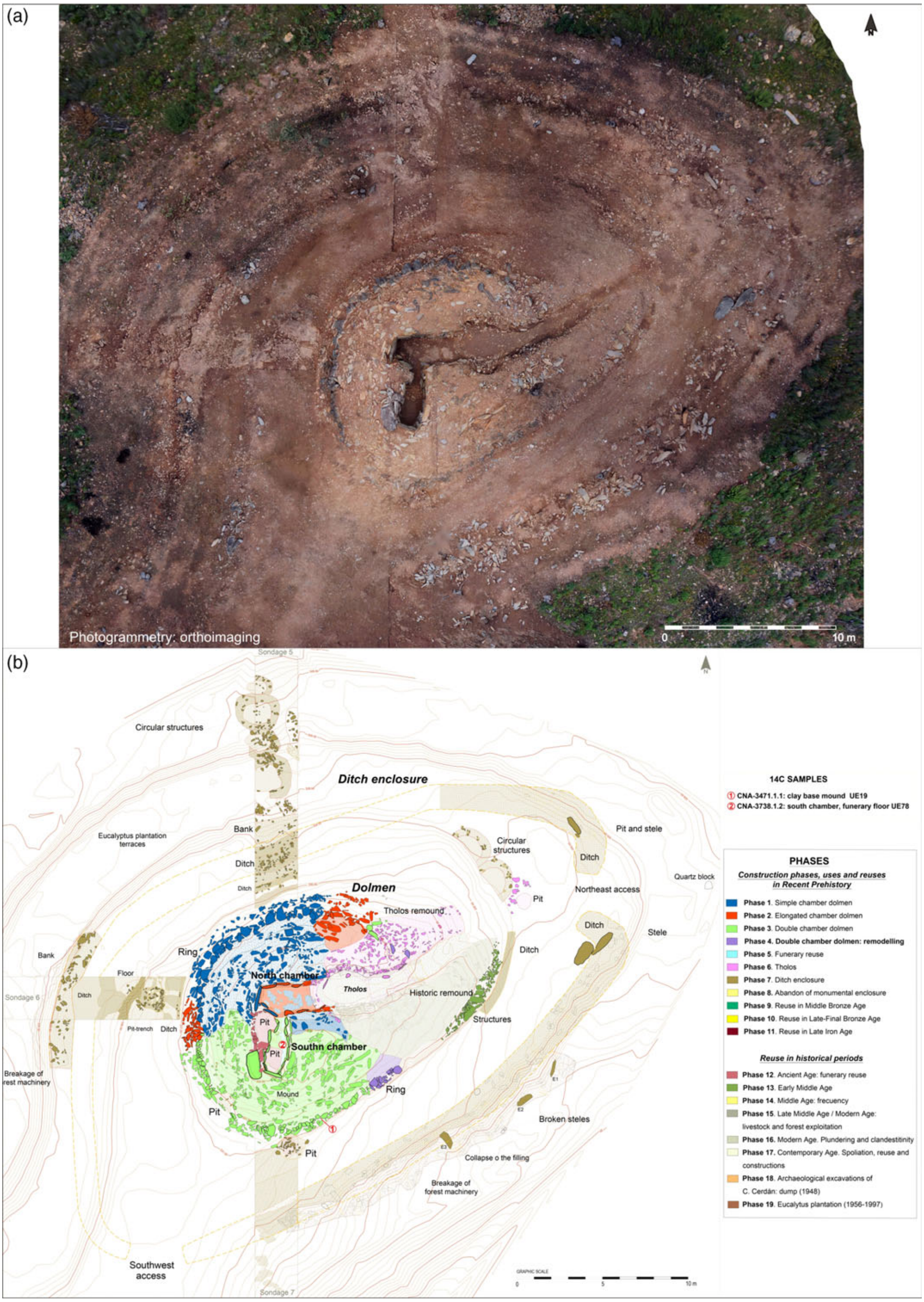

Figure 4 El Pozuelo 2: (a) photogrammetric survey; (b) plan with architectural phases, stratigraphic-structural sequence and location of ^{14}C samples.

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

level, delimited by a ring of kerbstones with a circumference of 50 m. Engraved and painted steles were recycled in the antechamber (Figure 5a). The following building phases in Later Prehistory have been determined by the archaeological study (Figure 5c).

- Phase 1: dolmen with an elongated oval chamber, corresponding to the north chamber, 4.60 m long, 2.10 m wide, and up to 2 m high, with an axis of symmetry on 124° (southeast). It has a headstone, walls with vertical stones placed regularly and a floor excavated into the substrate. It would have had axial steles. The chamber was inside a circular mound 11 m in diameter.
- Phase 2: dolmen with an elongated chamber formed by adding a trapezoidal antechamber in the access, 1.65 m long and 1.60 m high. The mound was enlarged and reached about 13 m in diameter.
- Phase 3: Dolmen with parallel double chambers and converging passage. Its construction involved partially dismantling the old mound, adding the south chamber and rebuilding the antechamber, the access passage and the wedge-shaped vestibule. The axis of symmetry was rotated towards the east (90°), marked by the projection of the axial steles in the antechamber with a free-standing stele in the access. The south chamber is elbow-shaped, with two headstones and more slender stones in the walls which partly overlap in the curved section. The trapezoidal antechamber, 2.30 m long, contains seven recycled steles with engravings in the places of transition: stele in the frontal closure, two jambs in the axis of symmetry, one in the access and the other three in the walls. The mound was enlarged and reached its maximum circular form, with a stone pavement around it.
- Phase 4: transformation of the front façade and the access, including the partial reconstruction of the passage wall on a 110° alignment (southeast). This created a narrow access and an enlargement of the façade with vertical slabs.
- Phase 5: the front access was monumentalized, conditioning the position of two altars: a stone and clay altar attached to the atrium and another one carved in the rock.
- Phase 6: funerary reuse of the interior of the dolmen.

Dolmen 4 consists of a covered gallery in a circular mound on a levelled platform, 15.50 m in diameter and reaching 3.50 m in height above the exterior ground level (Figure 5b). The structure of orthostats 10.25 m in length is segmented into three areas: open passage, antechamber with a transversal stone, and an elongated oval chamber with central pillars. Its height varies from 1.30 m to 1.80 m. The floor was dug into the bedrock. The dolmen was entered down steps carved into the rock, with a stele on the left-hand side. The stratigraphic and structural study has revealed the following phases in its construction (Figure 5c).

- Phase 1: construction of an elongated oval chamber, 6.75 m long and up to 3.60 m wide, with 6 or 7 central pillars. These supports may have been recycled steles, which marked the axis of symmetry on 110° (southeast). The regular orthostats were placed vertically. The floor sloped down from the access to the headstone. The structure was in a circular mound, 12.50 m in diameter on a foundation of hard compacted clay.
- Phase 2: dolmen with an elongated chamber 7.75 m long. It was created by adding a quadrangular antechamber at the end by placing three orthostats on both sides of the walls and the transversal position of a recycled slab. This support, with side grooves

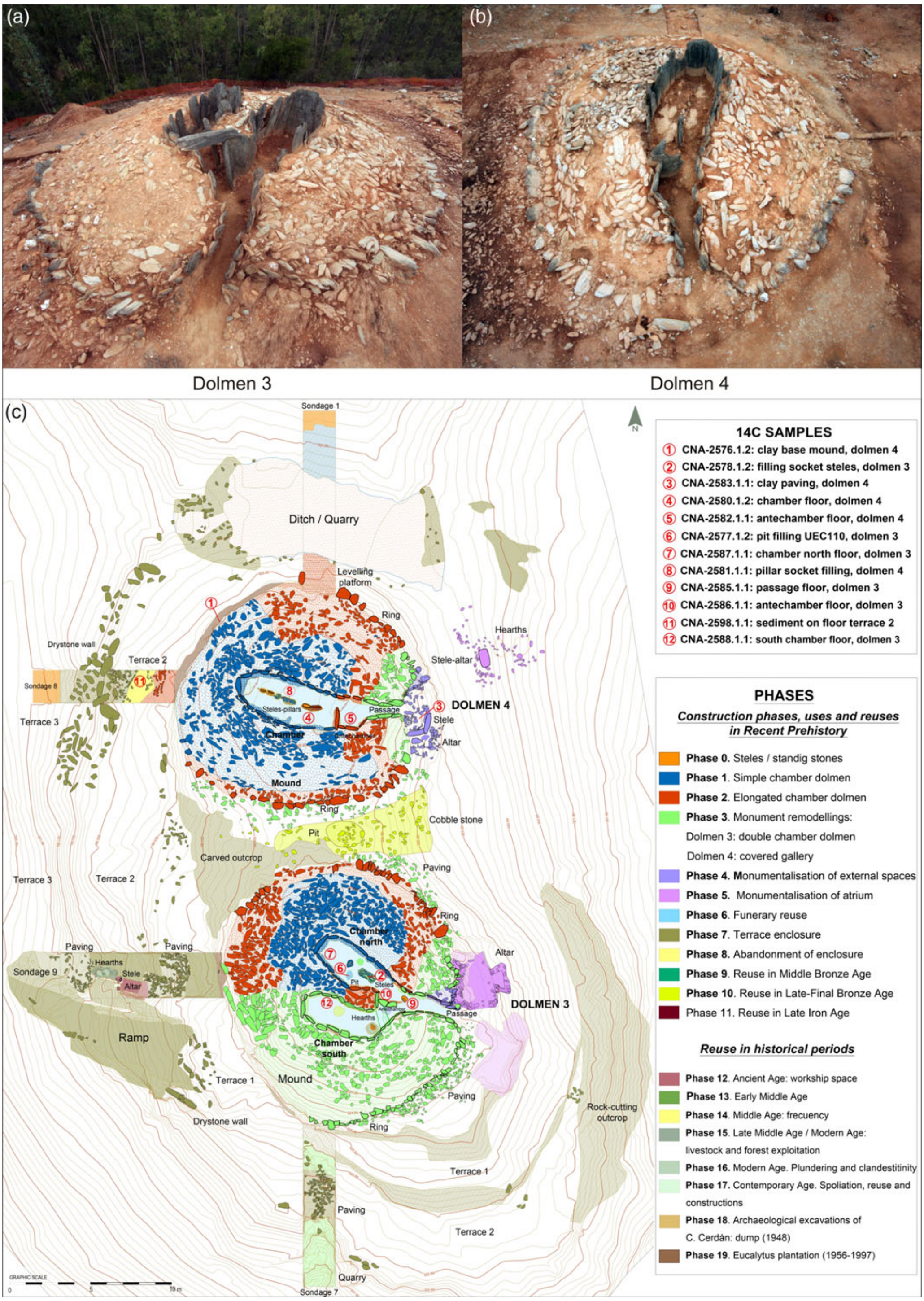

Figure 5 El Pozuelo 3–4: (a) aerial view of dolmen 3; (b) aerial view of dolmen 4; (c) plan with architectural phases, stratigraphic-structural sequence and location of ^{14}C samples.

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

for it to be fixed, was shortened so that it could be reused. The first pillar was replaced and rotated towards the east (90°), marking the new orientation of the axis of symmetry. The mound was enlarged, and made into an oval shape, with a length of 15 m on its long axis.

- Phase 3: covered gallery dolmen with an outer passage and façade with a stepped vestibule. The work involved lengthening the structure with three orthostats leaning at 30–45° on each side, with a rise from 0.90 to 1.40 m, reaching the full length of the structure. The mound was enlarged concentrically to reach its final size.
- Phase 4: the front façade was monumentalized and transformed. This involved placing the stones in the wedge-shaped vestibule and carving the access steps in the rock substrate.
- Phase 5: the external area was monumentalized with two actions. A stele was placed with a quadrangular altar at its foot, and a stone pavement was laid in the outer vestibule, while a stele-altar was associated with hearths in the front outer area.
- Phase 6: funerary reuse of the interior of the dolmen.

Phases 7–10 are the same in Dolmens 3 and 4, which were located in the same place. The following actions took place in each phase:

- Phase 7: partial dismantling to build the surrounding terraced enclosure, formed by three levels delimited by drystone walls and a ramp carved in the outcrop of rock on the southwest side. This project implied removing and breaking the capstones, orthostats, and pillars, as well as digging out the mound, etc.
- Phase 8: abandonment of the terraced enclosure.
- Phase 9: reuse in the Middle Bronze Age, both of the inner area without a cover and of the outer areas.
- Phase 10: reuse in the Late-Final Bronze Age, as evidenced by the find of miners' hammers with a central groove, and a funerary pit with a stele and a pavement between Dolmens 3 and 4.

The radiocarbon dates for the four monuments were obtained from samples of charcoal. This is the only type of organic macro-remain conserved in the dolmens and found in most of the stratigraphic and architectural units. No bones could be dated because no fragments have been preserved owing the high acidity of the clay. These unfavourable physical-chemical conditions destroy the osseous remains, as observed at other sites in the western Sierra Morena (Nocete et al. 2004). Therefore, in these dolmens, charcoal is the only organic material susceptible of being dated, as in the case of most sites in the Iberian Pyrite Belt and other southwestern regions, where highly acidic soils are common. As a result, during the excavation all the charcoal fragments were collected systematically when dry sieving the sediment from the stratigraphic units and hearths with concentrations of remains. In total, 644 charcoal remains were recorded, mostly from prehistoric contexts. The anthracological study succeeded in identifying each taxon and discriminated between the use of twigs and branches.

The presence of charcoal at megalithic sites may be due to different reasons and social practices, as wood was used in structures built during the construction of the monuments, to cremate individuals during the funerary activity, and in hearths and ritual fires (Zapata and Figuerial 2003). Its preservation depends on various taphonomic factors. It is therefore essential to determine the combustion processes derived from human activity and the natural and/or anthropic post-depositional processes resulting in its presence at archaeological sites (Théry Parisot et al. 2010).

A strategy was followed for the selective sampling of charcoal from building units, constructions and levels that enable the chronology of the phases to be established. Priority was given to apparently unaltered archaeological contexts displaying clear stratigraphic relationships of superimposition, succession, horizontality and/or continuity within the architectural sequence. In this way, 70 samples were chosen to be dated. The selection of charred wood samples was based on four criteria:

1. The presence and suitability to date levels of the constructions, other structures and the uses that mark the rhythm and diachronic development of the monuments.
2. The degree of alteration caused by the successive reuses of the site.
3. The preference for short-lived species, especially branches, in order to avoid the old-wood effect. Thus, fragments of bush branches (Rosaceae, Ericaceae, Olea, Arbustus sp.) were chosen in the case of charcoal dispersed in the sediment or present in the interior and exterior levels of the monuments, associated with either funerary or ritual activity. However, dates have also been obtained for long-life species (Quercus subgenus Quercus, Quercus ilex) in certain stratigraphic units or structures (pavements, ditches and foundation pits, postholes, and hearths) when short-lived charred wood samples were not available.
4. Their suitability to define the temporality of the constructions or levels and to establish short-duration events connected with specific ritual practices, such as the hearths.

The archaeological contexts and the chronometric results allow the dates to be sorted into two large temporal groups. Thus, 27 dates correspond to Later Prehistory, from the Late Neolithic to the Iron Age. The other 43 dates are correlated with different historical reuses, from Antiquity to the Contemporary Age. The number of prehistoric dates per dolmen is unequal: 13 for Dolmen 1, two for Dolmen 2, six for Dolmen 3, five for Dolmen 4 and one for the outer area around Dolmens 3 and 4 (Table 1; Figures 3–5). Priority was given to the selection of samples from:

- Construction levels and elements (n=12), of two types: (a) permanent structures, such as the foundations of the mounds and walls (3), mounds (2), ditches or foundation pits (5) and pavements (1); and (b) ephemeral structures, such as postholes (1), associated with the timber used during the construction of the megaliths, like the structural framework, tripods, and trestles. The charcoals were found in the sedimentary fill and in the stratigraphic levels sealed after the construction activity, remaining buried in the case of the post holes of wooden structures and/or under the structures in the case of durable architectural elements of stone and clay: mounds, foundation ditches, sockets, and clay base levels. Therefore, even assuming that some charcoals may be older residual remains incorporated into the construction levels, the samples provide a terminus post quem for the building and/or reform events in the monuments and the chronometric results will be very close to the time of the construction or modification of the architecture. Furthermore, we have sufficient guarantees that it is not charcoal from later activities.
- Floors and sediments over floors (n=9), differentiating between activity levels in the chambers (2) and sediment formed on surfaces and internal transit areas (7). These are pieces of charcoal deposited in those levels during the different activities and funerary

Table 1 Archaeological contexts of dated charcoal samples from the Los Llanetes cluster, El Pozuelo complex.

Elements	Units	Dolmen 1	Dolmen 2	Dolmen 3	Dolmen 4	Outer space D3-4	Total	
Building level	Clay base	1	1		1		3	12
	Mound	2					2	
	Post hole	1					1	
	Ditch-trench	2		2	1		5	
	Paving	1					1	
Internal floor and sediment	Funerary floor	1	1				2	9
	Sediment on the floor			4	3		7	
External structure	Hearth	1					1	5
	Paving	2					2	
	Stele pit	1						
	Terrace					1	1	
Pit	Reuse pit	1						1
		13	2	6	5	1	27	27

and ritual practices carried out in the dolmens. Again, these samples date specific events in the use of the structures.

- External structures (n=5), differentiating between a hearth (1), stele pit (1), sediments over pavements (2) and a terrace (1). The charcoals has been recorded in structures that were constructively backfilled (foundation pits), covered by sediment after use by natural and/anthropic processes (hearths) and deposited on the ground (pavements) as a result of fires or combustion practices carried out in the site. These samples can date particular activity phases, monumentalization processes and ritual practices carried out in the outer areas, sometimes of a short duration, as in the case of the hearths.
- Pit dug during the reuse of interior areas (n=1). The charcoal was buried in an intentional fill of the structure in Dolmen 1.

Bayesian Methods and Models

The radiocarbon dates were obtained from small charcoal fragments (less than 1 g in weight) analyzed in the Spanish National Accelerator Centre (CNA) in Seville. This laboratory follows rigorous protocols in the preparation, extraction of carbon dioxide by graphitization, treatment, and measurement of the samples by accelerator mass spectrometry (AMS) (Santos et al. 2009, 2015). All the samples provided a reliable radiocarbon age (Stuiver and Polach 1977) with percentages of radiocarbon concentrations (pM) suitable for the calculation of the age BP. The δ13 values are provided by measuring the graphite by AMS. The BP ages were calibrated with the IntCal20 curve (Reimer et al. 2020) using the OxCal 4.4 program (Bronk Ramsey 2001, 2009), using the ranges of dates with probabilities of 68.3% (1σ) and 95.4 % (2σ) for the calendar ages. Following Stuiver and Polach (1977), the dates have been rounded to the nearest 10 years, as the radiocarbon deviation is greater

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

than 25 years in all the samples (Table 2; Figure 6). The presentation of the dates follows the recommendations of Millard (2014).

Bayesian statistics are the best tools to establish the temporality of archaeological sites (Bronk Ramsey 2008, 2009). Despite the limitations implicit in the method, they are able to establish estimates and precise interpretations of chronological events (Buck et al. 1996). In the case of megalithic tombs with different processes of building, modification of the structures and a succession of collective burials, the application of Bayesian models can determine the chronology of the building phases, periods of funerary or ritual activity, times of the start and finish of activity, hiatuses or periods of disuse, and the duration of each phase.

Two control parameters must be met to construct robust chronological models. The first is the need for a correct and re-constructible archaeological record. At the Los Llanetes megalithic cluster, the stratigraphic-structural sequence is known exhaustively and the architectural changes in the monuments have been documented precisely. The second is to obtain Bayesian models with high correlation indices in order to reduce the probability intervals of the chronometric distribution of the dates.

The chronological sequence has been created with two Bayesian models using OxCal: models by phases and the probabilistic estimate of the duration of events. Thus, two models of phases have been made according to their stratigraphy, grouping the dates in the construction levels and different areas depending on architectural and/or activity phases. First, a model of phases in Dolmen 1 has been generated, since this is the monument with the largest number of dates for superimposed stratigraphic-structural contexts that has provided dates for all the phases, enabling a robust chronological sequence to be established. Second, a model of phases for the four monuments has been determined using the 26 dates that cover the chronological development of the megalithic group from the Late Neolithic to the Late-Final Bronze Age. The single date in the Iron Age has not been used as it is the only date for this phase and reflects a long discontinuity or hiatus after the older dates and does not provide a temporal range defined by start and finish boundaries.

In both models, correlation indices (A_{model}) of above 60% were obtained, as required by Bayesian statistics (Bronk Ramsey 1995). These statistical indices confirm the correct correlation of the intervals and probabilistic distribution of the dates with the stratigraphic sequences. This has enabled the determination of the chronological events of construction, transformation and funerary or ritual activity in the megalithic cluster, as well as the temporality and duration of the phases with the chronological boundaries of their start and finish.

The duration of the activity was obtained with the Span function in OxCal (Bronk Ramsey 2009) to determine the chronometric time in years of the phases of use of the megalithic structures. Complementary with this, the sum of probabilities (Bronk Ramsey 1995, 2009) has allowed the intensity and duration of the activity and the presence of hiatuses between the phases to be assessed. Finally, the contemporaneity test (χ 2 test) (Ward and Wilson 1978) has been performed by combining the three dates for Phase 5 in Dolmen 1 using the Combine function (Bronk Ramsey 2009) in order to verify if the activity in this period took place in close, short-duration time intervals.

The complexity of the architectural sequence at the megalithic site, the variety of contexts and uses, the type of sampling and the limited number of dates obtained in the present study mean that we must be prudent in the interpretation of the Bayesian models. It is not feasible to reach

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

Table 2 Calibrated radiocarbon dating of the Los Llanetes cluster, El Pozuelo complex (OxCal v.4.4 Bronk Ramsey [2021]; r: 5 IntCal20 atmospheric data from Reimer et al. [2020]).

Laboratory code	Context	Architecture, event and phase	Material and taxon	Short or long-lived nature	^{14}C (BP)	$\delta^{13}C$ AMS (‰)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC
CNA-3267.1.1	Dolmen 1, post hole filling UEC197	Single chamber dolmen: construction. Phase 1	Charcoal: Rosaceae	Short-lived: branche	5055 ± 35	-25.02 ± 1.50	3950-3790	3960-3710
CNA 2576.1.2	Dolmen 4, mound, clay base UEC64	Single chamber dolmen with central pillars: construction. Phase 1	Charcoal: Rosaceae	Short-lived: branche	5030 ± 35	-24.98 ± 1.50	3950-3770	3950-3710
CNA-3274.1.1	Dolmen 1, north chamber, pit filling UEC177-UE5	Elongated chamber dolmen: construction. Phase 3	Charcoal: Quercus subgenus. Quercus	Long-lived	4941 ± 34	-25.82 ± 1.50	3770-3650	3790-3640
CNA-3272.1.1	Dolmen 1, mound, layer UEC36 between chambers	Double chamber dolmen: construction. Phase 3	Charcoal: Ericaceae	Short-lived: branche	4764 ± 35	-24.70 ± 1.50	3630-3520	3640-3380
CNA-3271.1.1	Dolmen 1, north chamber, clay paving UE25	Double chamber dolmen: construction Phase 3	Charcoal: Ericaceae	Short-lived: branche	4764 ± 35	-24.78 ± 1.50	3630-3520	3640-3380
CNA-3471.1.1	Dolmen 2, mound, clay base UE19	Double chamber dolmen: construction. Phase 3	Charcoal: Arbustus sp.	Short-lived: branche	4711 ± 35	-24.43 ± 1.50	3630-3370	3630-3370

(Continued)

Table 2 (*Continued*)

Laboratory code	Context	Architecture, event and phase	Material and taxon	Short or long-lived nature	^{14}C (BP)	$\delta^{13}C$ AMS (‰)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC
CNA-3273.1.1	Dolmen 1, north chamber, filling UEC99-100-UE4 of the stele socket UEC101	Double chamber dolmen: remodeling Phase 3	Charcoal: Rosaceae	Short-lived: branche	4608 ± 34	-25.40 ± 1.50	3500-3350	3520-3130
CNA-2578.1.2	Dolmen 3, north chamber, socket filling steles UE106-UEC111/112	Double chamber dolmen: remodeling. Phase 3	Charcoal: not identified	–	4525 ± 35	-23.03 ± 1.50	3360-3100	3370-3090
CNA-3280.1.1	Dolmen 1, north-west terrace, clay paving UEC 214	Double chamber dolmen: surrounding external structures Phase 4	Charcoal: Olea	Short-lived: branche	4519 ± 35	-24.97 ± 1.50	3360-3100	3370-3090
CNA-2583.1.1	Dolmen 4, atrium, sediment (UE88) on clay paving UEC65	Covered gallery: access remodeling Phase 5	Charcoal: Olea	Short-lived: branche	4250 ± 35	-23.56 ± 1.50	2910-2780	2920-2700

Table 2 (*Continued*)

Laboratory code	Context	Architecture, event and phase	Material and taxon	Short or long-lived nature	^{14}C (BP)	$\delta^{13}C$ AMS (‰)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC
CNA-3268.1.1	Dolmen 1, external atrium, sediment UE18 on paving UEC94	Double chamber dolmen: external access structures. Phase 5	Charcoal: Rosaceae	Short-lived: branche	4152 ± 34	-21.76 ± 1.50	2880-2660	2880-2620
CNA-3261.1.1	Dolmen 1, external atrium, stele socket filling UEC130	Double chamber dolmen: external access structures. Phase 5	Charcoal: Quercus sp	Long-lived	4143 ± 34	-23.97 ± 1.50	2870-2630	2880-2580
CNA-3269.1.1	Dolmen 1, external atrium, hearth UEC136A	Double chamber dolmen: external access structures. Phase 5	Charcoal: Rosaceae	Short-lived: branche	4139 ± 35	-23.10 ± 1.50	2870-2630	2880-2580
CNA-2580.1.2	Dolmen 4, chamber, sediment UE98 on floor UEC72	Covered gallery: funerary reuse Phase 6	Charcoal: Rosaceae	Short-lived: branche	3950 ± 35	-24.76 ± 1.50	2570-2350	2580-2300
CNA-2582.1.1	Dolmen 4, antechamber, sediment UE100 on floor UEC72	Covered gallery: funerary reuse. Phase 6	Charcoal: Rosaceae	Short-lived: branche	3905 ± 35	-25.56 ± 1.50	2470-2340	2480-2230

(*Continued*)

Table 2 (*Continued*)

Laboratory code	Context	Architecture, event and phase	Material and taxon	Short or long-lived nature	^{14}C (BP)	δ^{13}C AMS (‰)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC
CNA-3738.1.2	Dolmen 2, south chamber, funerary floor UE78	Double chamber dolmen: funerary reuse Phase 6	Charcoal: Olea	Short-lived: branche	3834 ± 31	-26.20 ± 1.50	2350-2200	2460-2150
CNA 2577.1.2	Dolmen 3, north chamber, pit filling UEC110-UE10	Double chamber dolmen: reuse. Phase 6	Charcoal: Ericaceae and Olea	Short-lived: branches	3810 ± 35	-23.75 ± 1.50	2300-2140	2450-2130
CNA-2587.1.1	Dolmen 3, north chamber, sediment UE43 on floor	Double chamber dolmen: reuse in terrace enclosure. Phase 7	Charcoal: Rosaceae	Short-lived: branche	3770 ± 35	-22.74 ± 1.50	2290-2130	2300-2030
CNA-2581.1.2	Dolmen 4, chamber, socket filling pillars 3-4, UE99	Covered gallery: reuse in terrace enclosure Phase 7	Charcoal: Rosaceae	Short-lived: branche	3760 ± 35	-22.99 ± 1.50	2280-2060	2290-2030
CNA-3266.1.1	Dolmen 1, south chamber, floor UE23	Double chamber dolmen: reuse in terrace enclosure. Phase 7	Charcoal: Ericaceae	Short-lived: branche	3723 ± 34	- 22.16 ± 1.50	2200-2010	2280-1980
CNA-3260.1.1	Dolmen 1, clay base UE2-UEC95 of the circular ptatform, wall UEC73	Circular platform of the terrace enclosure: construction Phase 7	Charcoal: Rosaceae	Short-lived: branche	3706 ± 34	-24.98 ± 1.50	2150-2030	2210-1970

Table 2 (*Continued*)

Laboratory code	Context	Architecture, event and phase	Material and taxon	Short or long-lived nature	^{14}C (BP)	$\delta^{13}C$ AMS (‰)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC
CNA-2585.1.1	Dolmen 3, passage, sediment UE41 on floor	Double chambers dolmen: reuse in terrace enclosure. Phase 7	Charcoal: Rosaceae	Short-lived: branche	3660 ± 35	-24.87 ± 1.50	2140-1970	2150-1930
CNA-2586.1.1	Dolmen 3, antechamber, sediment UE42 on floor	Double chamber dolmen: reuse in terrace enclosure. Phase 7	Charcoal: Rosaceae	Short-lived: branche	3640 ± 35	-23.96 ± 1.50	2120-1940	2140-1890
CNA-2598.1.1	Dolmens 3-4, terrace 2, sediment UE35on floor UEC16	Terrace enclosure: abandoned. Phase 8	Charcoal: Quercus sp.	Long-lived	3437 ± 30	-22.19 ± 1.50	1870-1680	1880-1630
CNA-3265.1.1	Dolmen 1, mound, layer UEC243 behind slab 14 of the north chamber	Reuse in the Bronze Age. Phase 9	Charcoal: Legumino-sae	Short-lived	3303 ± 35	-23.50 ± 1.50	1620-1530	1680-1500
CNA-2588.1.1	Dolmen 3, south chamber, sediment UE44 on chamber	Late Bronze Age Reuse. Phase 10	Charcoal: Rosaceae	Short-lived: branche	3101 ± 30	-25.26 ± 1.50	1420-1300	1440-1270
CNA-3277.1.1	Dolmen 1, north chamber, pit filling UEC175	Reuse in the Late Iron Age. Phase 11	Charcoal: Olea	Short-lived: branche	2201 ± 33	-26.01 ± 1.50	360-190	380-170

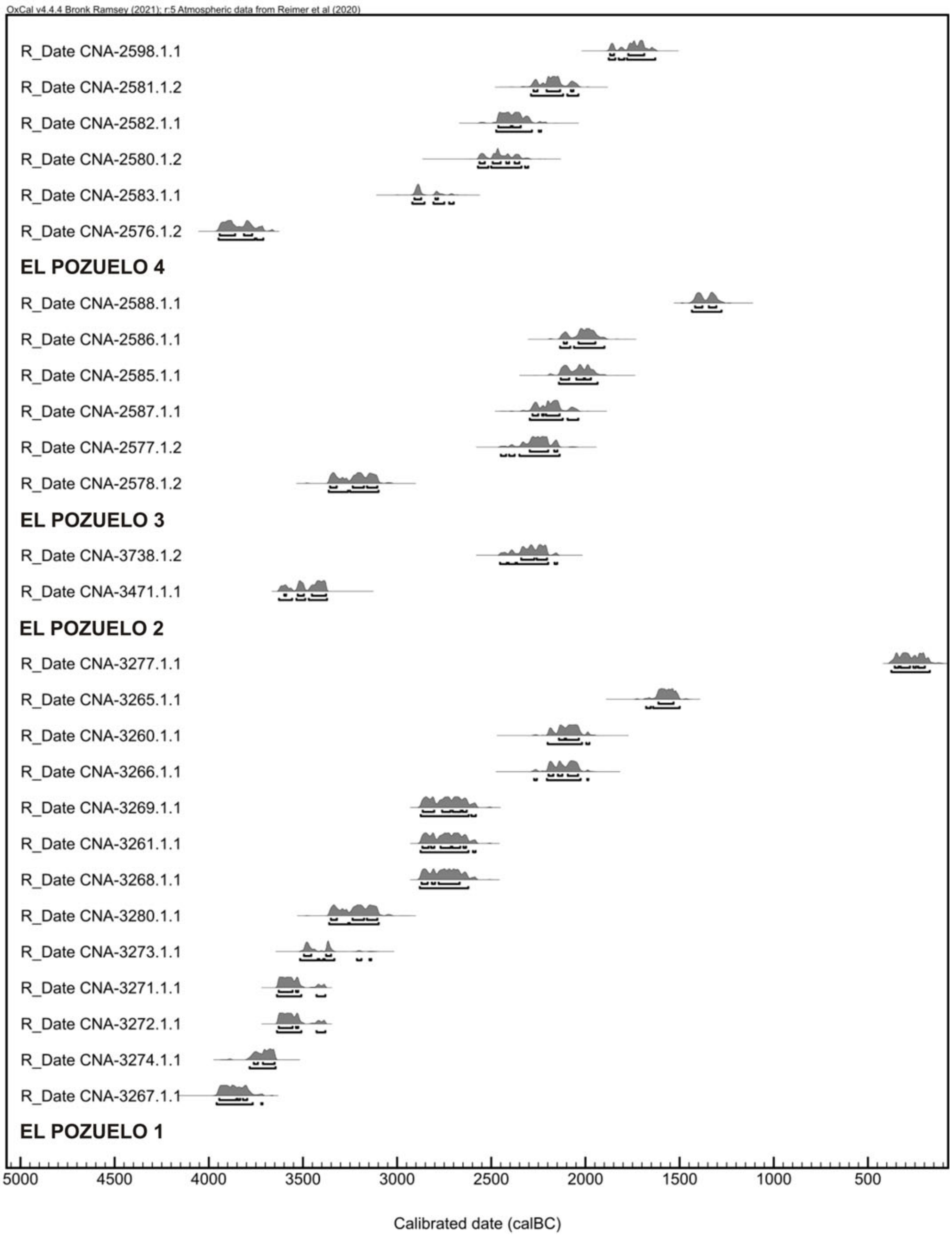

Figure 6 Calibrated radiocarbon dating of the Los Llanetes cluster: El Pozuelo 1–4 (OxCal v.4.4 Bronk Ramsey [2021]; r:5 IntCal20 atmospheric data from Reimer et al. [2020]).

definitive inferences about the chronologies owing to the limitations of the study as regards the record itself and the samples that were obtained. The first limitation is the impossibility of obtaining samples to date the full stratigraphic sequence in each tomb, as not all the phases could be dated. The second constraint is the low number of dates obtained corresponding to Prehistory, especially in Dolmen 2, which reduces the potential for the construction of solid Bayesian models and defining the temporal boundaries of the phases and hiatuses more precisely. The third reservation is determined by limitations of the statistical analysis itself, such as the sum of probabilities, because the results of the probabilistic estimates depend on the number of dated samples and the extension taken by the calibration curve (Michczyñski and Michczyñska 2006; William 2012).

The contextualized analysis of the El Pozuelo complex in relation to the diachronic sequence of dolmens in southwest Iberia has been carried out by calibrating the 152 radiocarbon dates, using the sum of probabilities and Bayesian models developed by architectural groups.

RESULTS

The El Pozuelo Dolmens

The series of dates for El Pozuelo 1 has been decisive to establish the chronological sequence of the group. At this monument, 13 dates were obtained for stratigraphic levels and structures that show the building development and part of the activity in the megalithic group. Most of the radiocarbon dating were obtained on samples from the fill of structures and superimposed and unaltered construction levels in which the charcoal had been buried (Figure 7). Thus, dates with very reliable chronometric intervals were obtained for the main phases of the stratigraphic sequence (Figure 7), allowing the reconstruction of their temporality.

The analysis of the calibrated dates and the Bayesian modeling (A_{model}: 109.4%) in relation to the stratigraphy is able to establish the sequence of changes to the monument and delimit the phases (Table 3; Figure 8). The dolmen with the simple chamber (Phase 1) would have been built in an interval of ca. 3960–3770 (95%) or 3950–3800 (68%) cal BC, as shown by the date (CNA-3267.1.1) from a posthole attributed to the use of a wooden tripod or trestle during the construction (Linares-Catela 2021). Its reconstruction as a dolmen with an elongated chamber (Phase 2) took place soon afterwards: 3780–3640 (95%) or 3760–3650 (68%) cal BC, as shown by the date (CNA-3274.1.1) from the fill in the foundation hole for the axial stele.

The architectural change into a monument with double chambers (Phase 3A) must have occurred in a specific time in the period 3700–3600 cal BC, according to the stratigraphic coherence and homogeneity of the chronometric results for the two dates. Thus, the samples for the two construction levels gave the same result: 4764 ± 35 BP, determining a calibrated age of 3640–3380 (95%) or 3630–3520 (68%). The date (CNA-3272.1.1) came from a layer in the mass of the mound between the two chambers deposited during the reconstruction of the dolmen. The date (CNA-3721.1.1) was obtained in the clay flooring inside the north chamber, which covered the hole that had held the original axial stele.

The stratigraphic sequence showed that work was carried out in the frontal façade, creating an open monumental atrium with two vestibules, as well as repairs to the structure of orthostats in the south chamber and the spatial reorganisation of the north chamber (Phase 3B). During the work in the north chamber, the position of the axial stele was moved. The date (CNA-3273.1.1)

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

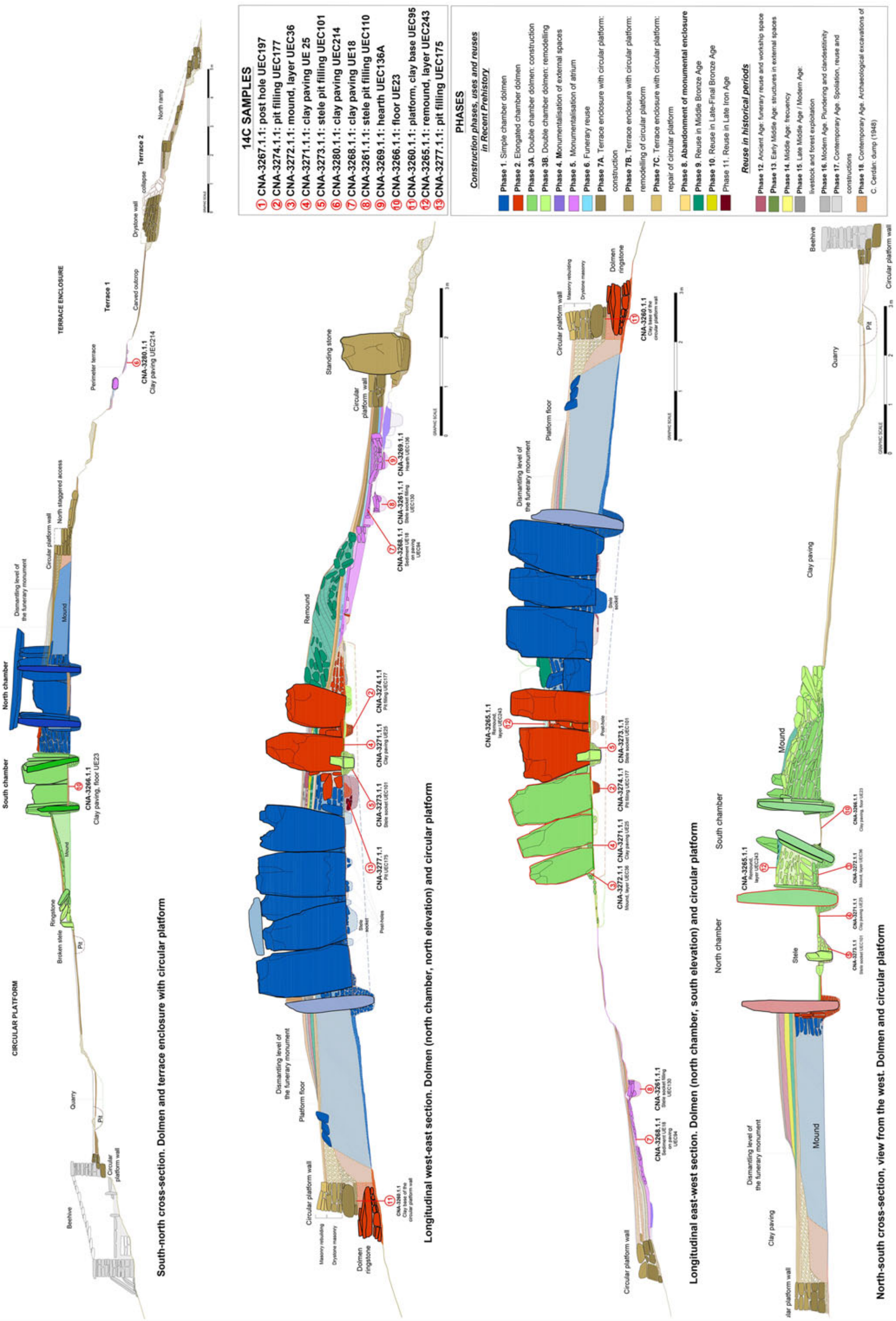

Figure 7 Cross-section and elevations of the El Pozuelo 1. Analysis of the stratigraphic-stuctural sequence and location of the radiocarbon dates.

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

Table 3 Bayesian modeling by phases of El Pozuelo 1, Los Llanetes cluster (OxCal v.4.4 Bronk Ramsey [2021]; r: 5 IntCal20 atmospheric data from Reimer et al. [2020]).

Architectural Sequence	ID	Calibrated dates				Modeled dates: phases with start and end boundaries Amodel= 109.4/Aoverall= 107.4		
Phase		Laboratory code	^{14}C age (BP)	Calibrated date (68% confidence cal BC)	Calibrated date (95% confidence cal BC)		Posterior density estimate (68% probability cal BC)	Posterior density estimate (68% probability cal BC)
Phase 1						Boundary Start 1	3990-3800	4210-3770
Simple chamber dolmen	DP-1	CNA-3267.1.1	5055 ± 35	3950-3790	3960-3710		3950-3800	3960-3770
						Boundary End 1	3890-3760	3940-3710
Phase 2						Boundary Start 2	3790-3680	3850-3650
Elongated chamber dolmen	DP-1	CNA-3274.1.1	4941 ± 34	3770-3650	3790-3640		3760-3650	3780-3640
						Boundary End 2	3730-3620	3770-3570
Phase 3						Boundary Start 3	3660-3540	3710-3380
Double chamber dolmen	DP-1	CNA-3272.1.1	4764 ± 35	3630-3520	3640-3380		3610-3520	3640-3410
	DP-1	CNA-3271.1.1	4764 ± 35	3630-3520	3640-3380		3580-3510	3620-3370
	DP-1	CNA-3273.1.1	4608 ± 34	3500-3350	3520-3130		3510-3450	3520-3340
						Boundary End 3	3500-3350	3520-3270
Phase 4						Boundary Start 4	3380-3180	3450-3110
Monumentalisation of external spaces	DP-1	CNA-3280.1.1	4519 ± 35	3360-3100	3370-3090		3340-3100	3360-3090
						Boundary End 4	3230-2960	3340-2830
Phase 5						Boundary Start 5	2910-2720	3050-2650
Monumentalisation of atriums	DP-1	CNA-3268.1.1	4152 ± 34	2880-2660	2880-2620		2880-2690	2880-2660
	DP-1	CNA-3261.1.1	4143 ± 34	2870-2630	2880-2580		2850-2660	2880-2630
	DP-1	CNA-3269.1.1	4139 ± 35	2870-2630	2880-2580		2760-2540	2860-2580
						Boundary End 5	2760-2540	2860-2370

(Continued)

Table 3 (*Continued*)

Architectural Sequence	ID	Calibrated dates				Modeled dates: phases with start and end boundaries Amodel= 109.4/Aoverall= 107.4		
Phase		Laboratory code	^{14}C age (BP)	Calibrated date (68% confidence cal BC)	Calibrated date (95% confidence cal BC)		Posterior density estimate (68% probability cal BC)	Posterior density estimate (68% probability cal BC)
Phase 7						Boundary Start 7	2290-2060	2560-2040
Terrace	DP-1	CNA-3266.1.1	3723 ± 34	2200-2010	2280-1980		2200-2050	2210-2030
enclosure	DP-1	CNA-3260.1.1	3706 ± 34	2150-2030	2210-1970		2140-2030	2200-1980
						Boundary End 7	2130-1930	2190-1730
Phase 9						Boundary Start 9	1780-1540	2000-1510
Middle Bronze	DP-1	CNA-3265.1.1	3303 ± 35	1620-1530	1680-1500		1620-1530	1740-1500
Age reuse						Boundary End 9	1590-1470	1630-1380

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

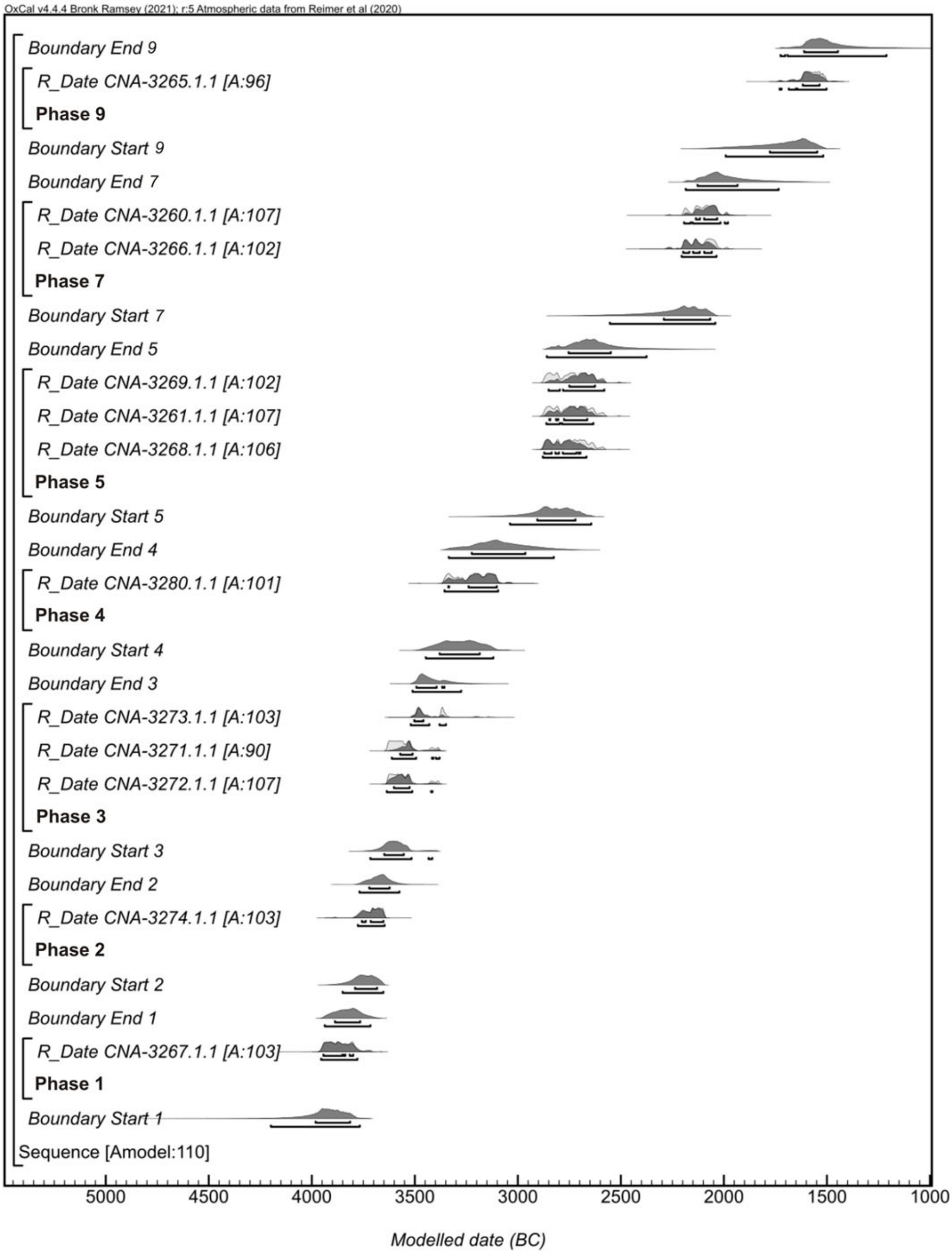

Figure 8 Chronological model of the El Pozuelo 1. Bayesian modeling by phases (OxCal v.4.4 Bronk Ramsey [2021]; r:5 IntCal20 atmospheric data from Reimer et al. [2020]).

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

of the hole for the foundation of the stele, which cut through the previous clay floor, shows that this was a later event, carried out ca. 3520–3340 (95%) or 3510–3450 (68%).

Several samples from the outer areas provide time ranges that are able to establish the chronology of ritual activity at the site in later chronologies. On one hand, the date for the pavement in the outer perimeter terrace (CNA-3280.1.1) demonstrates that the outer areas were monumentalized ca. 3360–3090 (95%) or 3340–3100 (68%) cal BC (Phase 4). In turn, the three dates from the outer area at the front of the dolmen show that the atrium was intensively used between 2900 and 2600 cal BC, as these dates are very similar obtained for the pavement (CNA-3268.1.), foundation pit of a stele (CNA-3261.1.1) and hearth (CNA-3269.1.). The $\chi 2$ test (Acomb 117; df=2 T=0.091(5% 5.991)) of the three dates gives a combined chronometric result of 2880–2630 (95%) or 2870–2660 (68%) (Table S3.1; Figure S3.2). This attests the possible contemporaneity of the dates and the relative short duration of ritual activity in that phase. The use of the area may have been associated with different practices and ceremonies worshipping the ancestors, as indicated by the presence of structures in this area outside the front of the dolmen: hearths, altars, hoard of votive objects, etc.

Two dates have established the chronology of the emergence and conversion of the site into a terraced enclosure with a circular platform in the Early Bronze Age (Phase 7). The first date (CNA-3266.1.1), obtained in the south chamber, marks a reuse event in the chamber in connection with activity in the terraced enclosure: 2280–1980 (95%) or 2200–2010 (68%) cal BC. The second date (CNA-3260.1.1), from the base of the clay foundation of the wall in the upper platform, situates its construction and the monumentalization of the enclosure in a slightly later time: 2200–1980 (95%) or 2140–2030 (68%) cal BC.

Two dates have been obtained for later contexts and phases of reuse. One of them (CNA-3265.1.1) corresponds to changes to the mound following the partial emptying of the north chamber in the Middle Bronze Age (Phase 9), ca. 1680–1500 cal BC (95%). The other (CNA-3277.1.1) reflects a short-duration reuse event in the Late Iron Age (Phase 10), ca. 380–170 cal BC (95%).

A smaller number of dates have been obtained for the other three dolmens. They correspond to specific stratigraphic phases but are unable to reconstruct the full chronological sequence. Nonetheless, these 14 dates complement the series of dates for this megalithic cluster.

Only two prehistoric dates were obtained for El Pozuelo 2. One (CNA-3471.1.1) comes from the clay level at the base of the southern side of the mound, arranged as the first construction level of the dolmen with double clambers. Its chronometric result suggests that the rebuilding of the monument may have taken place ca. 3630–3370 cal BC (95%), with the construction of the south chamber and the enlargement of the mound. The other, which is more recent, correlates with the funerary reuse of the south chamber ca. 2460–2150 cal BC (95%), an episode prior to the probable construction of the tholos and the surrounding ditched enclosure.

In El Pozuelo 3, the six radiocarbon dates correspond to four different phases. The earliest date (CNA-2578.1.2), from the deliberate backfilling of the pit after the removal of the axial stelae from the north chamber, correlates with the reconstruction work on the monument as a large dolmen with double chambers, which probably took place ca. 3370–3090 cal BC (95%). Another date (CNA-2577.1.2) marks the last episode of the funerary and votive use as a collective burial ca. 2450–2130 cal BC (95%). Three dates (CNA 2587.1.1, CNA 2585.1.1,

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

and CNA 2586.1.1) demonstrate the temporality of activity inside the dolmen during the time of the terraced enclosure, in the last quarter of the third millennium cal BC. The last date (CNA-2588.1.1) is correlated with the occasional reuse of the monument in the Late Bronze Age, ca. 1440–1270 cal BC (95%).

Five radiocarbon dates, corresponding to four phases, were obtained for El Pozuelo 4. The oldest (CNA-2576.1.2), from the base of the mound, indicates a terminus post quem for the construction of the dolmen with a simple chamber ca. 3950–3710 cal BC (95%). Another date (CNA-2583.1.1) from the floor of the atrium, is associated with the reforms to the access to the monument, consisting of placing a stele and a quadrangular altar and laying a pavement, which would have occurred between 2920 and 2700 (95%) cal BC. Two dates (CNA-2580.1.2 and CNA-2582.1.2) situate the funerary reuse between 2600–2200 cal BC (95%). The date CNA-2581.1.2, obtained in the fill of the holes left when the pillars were removed from the chamber, date the dismantling of the structure ca. 2290–2030 cal BC (95%), when the terraced enclosure was built.

A radiocarbon date (CNA-2598.21.1) from the floor of Terrace 2, to the west of Dolmen 4, may be related to the abandonment of the monumental enclosure, which probably took place ca. 1880–1630 cal BC (95%).

The Los Llanetes Cluster

The stratigraphic study and joint analysis of the dates for the four monuments is able to trace out the chronological sequence of the megalithic cluster. In this regard, the development of the Bayesian modeling by phases and the model of the sum of probabilities establish probabilistic estimates for the duration and start and end boundaries of each phase (Tables 4 and 5; Figures 9 and 10) and architectural model (Figure 11).

The megalithic cluster is noteworthy for the long duration of its use, in which building work and discontinuous activity has been established for the period between the early fourth millennium to the early second millennium cal BC, in addition to different reuse actions during the second millennium cal BC (Figure 10). The full duration of activity covers the period of ca. 4050–1120 (95%) or 3970–1270 (68%), with an estimated complete length of 2380 to 2850 years (Table 5).

The necropolis of Los Llanetes began with the construction of the single chamber dolmens in the early fourth millennium cal BC, as shown by the two modeled dates for Dolmens 1 and 4, with very close chronometric results. It is highly likely that Phase 1 took place ca. 4050–3710 (95%) or 3970–3760 (68%), with a maximum duration of 90 years. Therefore, the single chamber dolmens may have been built during a short length of time, in a building phase and a use of less than a century, during the first two centuries of the fourth millennium cal BC. However, some evidence suggests a possible greater antiquity of the megalithic site. First, recycled steles have been documented in the chambers, mostly reused as headstones. Second, pits and/or steles-pillars have been recorded on the central axis, as in Dolmen 4, and these may correspond to previous alignments of standing-stones that conditioned the design of the dolmens. This corresponds to the Late Neolithic (4200–3600 cal BC) in the southern Iberia sequence.

Phase 2 corresponds to the construction of dolmens with an elongated chamber. Only one date has been obtained, from Dolmen 1, situated in the third and fourth centuries of the fourth

Table 4 Bayesian modeling by phases of the Los Llanetes cluster, El Pozuelo complex (OxCal v.4.4 Bronk Ramsey [2021]; r:5 IntCal20 atmospheric data from Reimer et al. [2020]).

Architectural Sequence	ID	Calibrated dates				Modeled dates: phases with start and end boundaries Amodel= 121.4/Aoverall= 119.3		
Phase		Laboratory code	^{14}C age (BP)	Calibrated date (68% confidence cal BC)	Calibrated date (95% confidence cal BC)		Posterior density estimate (68% probability cal BC)	Posterior density estimate (95% probability cal BC)
Phase 1						Boundary Start 1	3970-3800	4050-3770
Simple chamber dolmens	DP-1	CNA-3267.1.1	5055 ± 35	3950-3790	3960-3710		3950-3790	3960-3780
	DP-4	CNA 2576.1.2	5030 ± 35	3950-3770	3950-3710		3930-3770	3950-3760
						Boundary End 1	3900-3760	3930-3710
Phase 2						Boundary Start 2	3790-3680	3850-3650
Elongated chamber dolmens	DP-1	CNA-3274.1.1	4941 ± 34	3770-3650	3790-3640		3760-3650	3780-3640
						Boundary End 2	3730-3620	3780-3540
Phase 3						Boundary Start 3	3660-3540	3710-3380
Double chamber dolmens	DP-1	CNA-3272.1.1	4764 ± 35	3630-3520	3640-3380		3620-3520	3640-3380
	DP-1	CNA-3271.1.1	4764 ± 35	3630-3520	3640-3380		3580-3380	3640-3380
	DP-2	CNA-3471.1.1	4711 ± 35	3630-3370	3630-3370		3530-3370	3540-3360
	DP-1	CNA-3273.1.1	4608 ± 34	3500-3350	3520-3130		3490-3350	3510-3330
	DP-3	CNA-2578.1.2	4525 ± 35	3360-3100	3370-3090		3370-3320	3490-3220
						Boundary End 3	3360-3260	3480-3170
Phase 4						Boundary Start 4	3280-3140	3350-3100
Monumentalisation of external spaces	DP-1	CNA-3280.1.1	4519 ± 35	3360-3100	3370-3090		3220-3100	3310-3030
						Boundary End 4	3200-3100	3280-2870

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

Table 4 (*Continued*)

Architectural Sequence	ID	Calibrated dates				Modeled dates: phases with start and end boundaries Amodel= 121.4/Aoverall= 119.3		
Phase		Laboratory code	^{14}C age (BP)	Calibrated date (68% confidence cal BC)	Calibrated date (95% confidence cal BC)		Posterior density estimate (68% probability cal BC)	Posterior density estimate (95% probability cal BC)
Phase 5						Boundary Start 5	2980-2770	3060-2700
Monumentalisation of atriums	DP-4	CNA-2583.1.1	4250 ± 35	2910-2780	2920-2700		2910-2780	2920-2700
	DP-1	CNA-3268.1.1	4152 ± 34	2880-2660	2880-2620		2880-2730	2890-2690
	DP-1	CNA-3261.1.1	4143 ± 34	2870-2630	2880-2580		2870-2680	2880-2660
	DP-1	CNA-3269.1.1	4139 ± 35	2870-2630	2880-2580		2850-2630	2870-2510
						Boundary End 5	2820-2580	2870-2510
Phase 6						Boundary Start 6	2530-2350	2650-2310
Funerary reuse	DP-4	CNA-2580.1.2	3950 ± 35	2570-2350	2580-2300		2490-2340	2560-2300
	DP-4	CNA-2582.1.1	3905 ± 35	2470-2340	2480-2230		2430-2300	2470-2290
	DP-2	CNA-3738.1.2	3834 ± 31	2350-2200	2460-2150		2400-2270	2450-2230
	DP-3	CNA 2577.1.2	3810 ± 35	2300-2140	2450-2130		2340-2230	2430-2190
						Boundary End 6	2300-2180	2400-2140
Phase 7						Boundary Start 7	2230-2140	2290-2050
Terrace enclosure	DP-3	CNA-2587.1.1	3770 ± 35	2290-2130	2300-2030		2210-2140	2270-2040
	DP-4	CNA-2581.1.2	3760 ± 35	2280-2060	2290-2030		2190-2130	2210-2040
	DP-1	CNA-3266.1.1	3723 ± 34	2200-2010	2280-1980		2160-2040	2180-2030
	DP-1	CNA-3260.1.1	3706 ± 34	2150-2030	2210-1970		2150-2030	2150-2020
	DP-3	CNA-2585.1.1	3660 ± 35	2140-1970	2150-1930		2140-2010	2140-1980
	DP-3	CNA-2586.1.1	3640 ± 35	2120-1940	2140-1890		2130-1980	2140-1980
						Boundary End 7	2120-1940	2130-1880

(*Continued*)

Table 4 (*Continued*)

Architectural Sequence	ID	Calibrated dates				Modeled dates: phases with start and end boundaries Amodel= 121.4/Aoverall= 119.3		
Phase		Laboratory code	^{14}C age (BP)	Calibrated date (68% confidence cal BC)	Calibrated date (95% confidence cal BC)		Posterior density estimate (68% probability cal BC)	Posterior density estimate (95% probability cal BC)
Phase 8						Boundary Start 8	1930-1730	2040-1680
Abandonment	DP3-4	CNA-2598.1.1	3437 ± 30	1870-1680	1880-1630		1880-1690	1880-1640
						Boundary End 8	1770-1620	1870-1590
Phase 9						Boundary Start 9	1660-1540	1750-1510
Middle Bronze	DP-1	CNA-3265.1.1	3303 ± 35	1620-1530	1680-1500		1620-1530	1670-1490
Age reuse						Boundary End 9	1590-1470	1630-1380
Phase 10						Boundary Start 10	1480-1330	1550-1300
Late Bronze								
Age reuse	DP-3	CNA-2588.1.1	3101 ± 30	1420-1300	1440-1270		1430-1310	1440-1280
						Boundary End 10	1410-1270	1440-1120

Table 5 Duration of activity in the Los Llanetes cluster in the Later Prehistory, according to probabilistic estimates from Bayesian modeling (OxCal v.4.4.2 Bronk Ramsey [2021]; r:5 IntCal20 atmospheric data from Reimer et al. [2020]).

Architectural sequence	Modeled dates: phases with start and end boundaries Amodel = 121.4/Aoverall = 119		
Phase		Posterior density estimate (68% probability cal BC)	Posterior density estimate (68% probability cal BC)
Phase 1	Start Phase 1	3970-3800	4050-3770
Simple chamber	End Phase 1	3900-3760	3930-3710
dolmens	Span Phase 1	0-30	0-90
Phase 2	Start Phase 2	3790-3680	3850-3650
Elongated chamber	End Phase 2	3730-3620	3780-3540
dolmens	Span Phase 2	—	—
Phase 3	Start Phase 3	3660-3540	3710-3380
Double chamber	End Phase 3	3360-3260	3480-3170
dolmens	Span Phase 3	50-300	20-360
Phase 4	Start Phase 4	3280-3140	3350-3100
Monumentalization	End Phase 4	3200-3100	3280-2870
of external spaces	Span Phase 4	—	—
Phase 5	Boundary Start 5	2980-2770	3060-2700
Monumentalization of atriums	Boundary End 5	2820-2580	2870-2510
	Span Phase 5	10-170	0-260
Phase 6	Start Phase 6	2530-2350	2650-2310
Funerary reuse	End Phase 6	2300-2180	2400-2140
	Span Phase 6	50-220	0-270
Phase 7	Start Phase 7	2230-2140	2290-2050
Terrace enclosure	End Phase 7	2120-1940	2130-1880
	Span Phase 7	20-200	0-250
Phase 8	Start Phase 8	1930-1730	2040-1680
Abandonment	End Phase 8	1770-1620	1870-1590
	Span Phase 8	—	—
Phase 9	Start Phase 9	1660-1540	1750-1510
Reuse in the Middle	End Phase 9	1590-1470	1630-1380
Bronze Age	Span Phase 9	—	—
Phase 10	Boundary Start 10	1480-1330	1550-1300
Reuse in the Late Bronze Age	Boundary End 10	1410-1270	1440-1120
	Span Phase 10	—	—
Llanetes cluster,	Start Llanetes	3970-3800	4050-3770
El Pozuelo complex	End Llanetes	1410-1270	1440-1120
	Span Llanetes	2460-2680	2380-2850

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

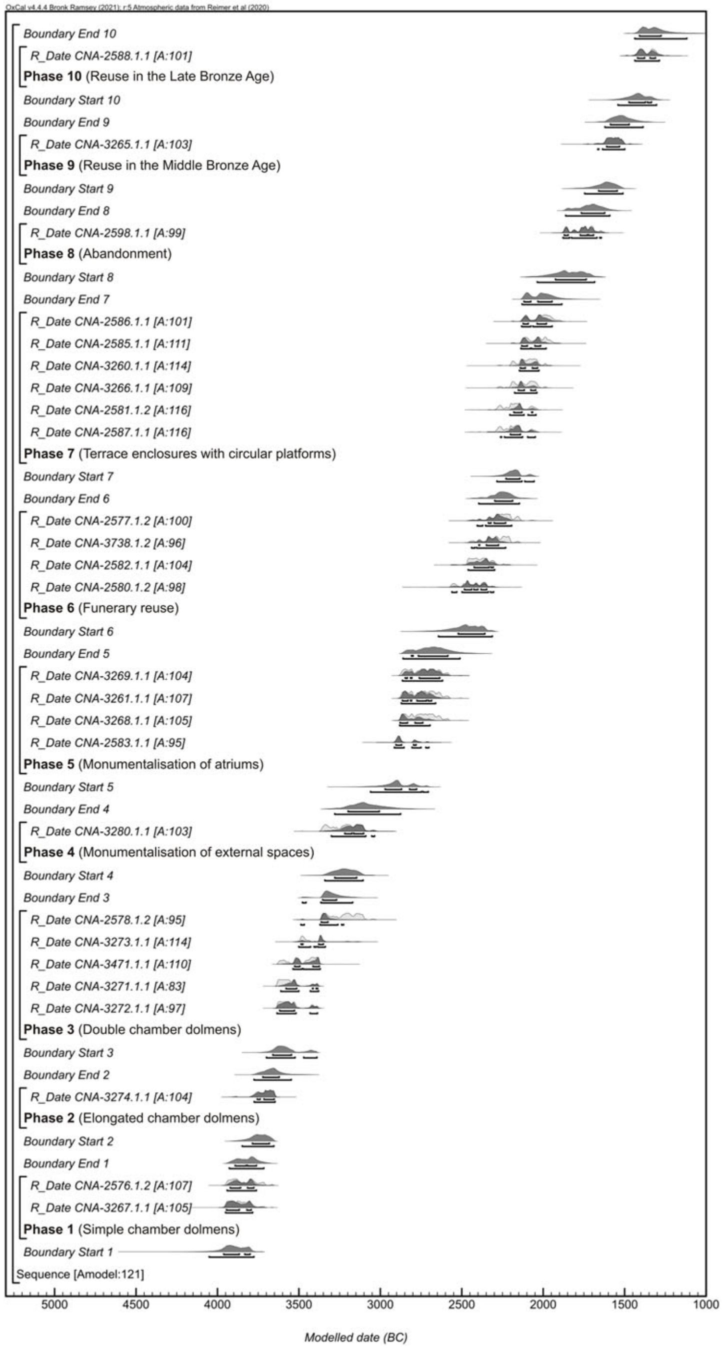

Figure 9 Chronological model of the Los Llanetes cluster, El Pozuelo complex. Bayesian modeling by phases (OxCal v.4.4 Bronk Ramsey [2021]; r:5 IntCal20 atmospheric data from Reimer et al. [2020]).

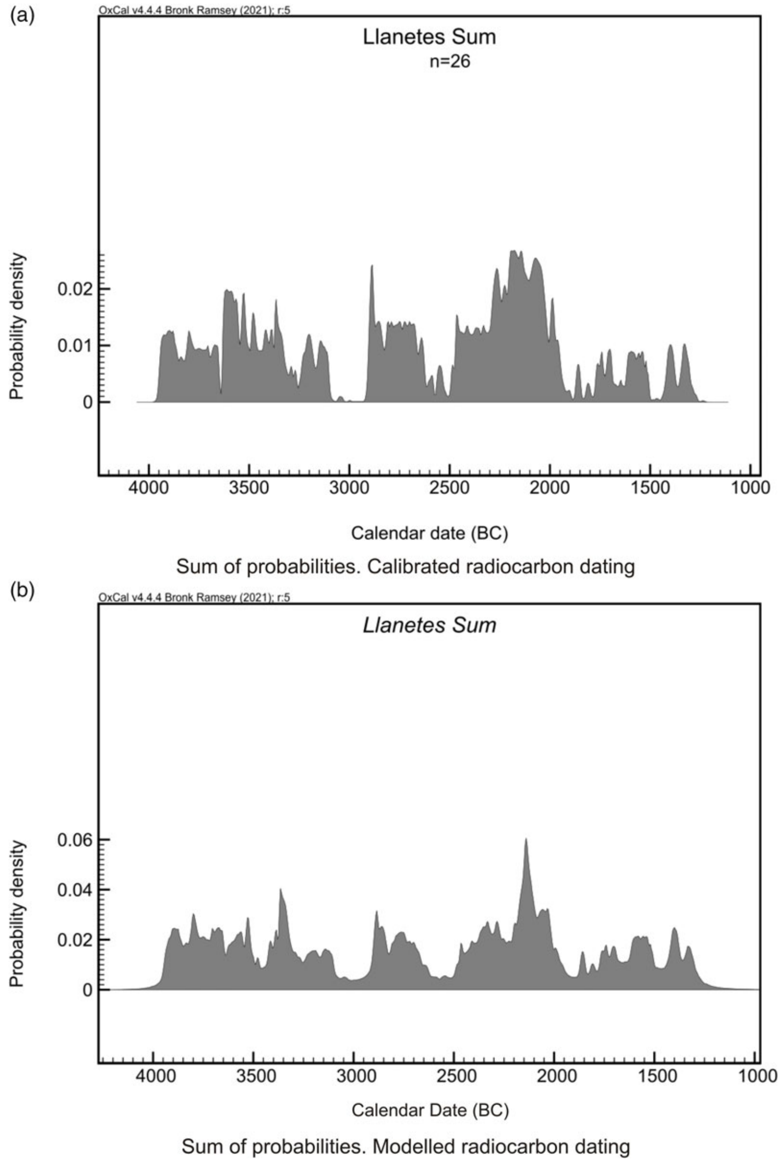

Figure 10 Sum of probabilities of the Los Llanetes radiocarbon determinations (n: 26): (a) calibrated dates; (b) modeled dates.

millennium cal BC. The process could be extended to the other monuments. It is plausible that the dolmens were converted into elongated monuments ca. 3850–3540 (95%) or 3790–3620 (68%). The architectural projects of lengthening the chambers and enlarging the mounds in this phase may have taken place in a relatively short period of time.

Phase 3 was the time of the most intense building and funerary activity in the cluster, as shown by the study of the stratigraphic-structural sequence, the five dates obtained and grave goods documented, most of which can be attributed to the chrono-cultural period of the Final

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

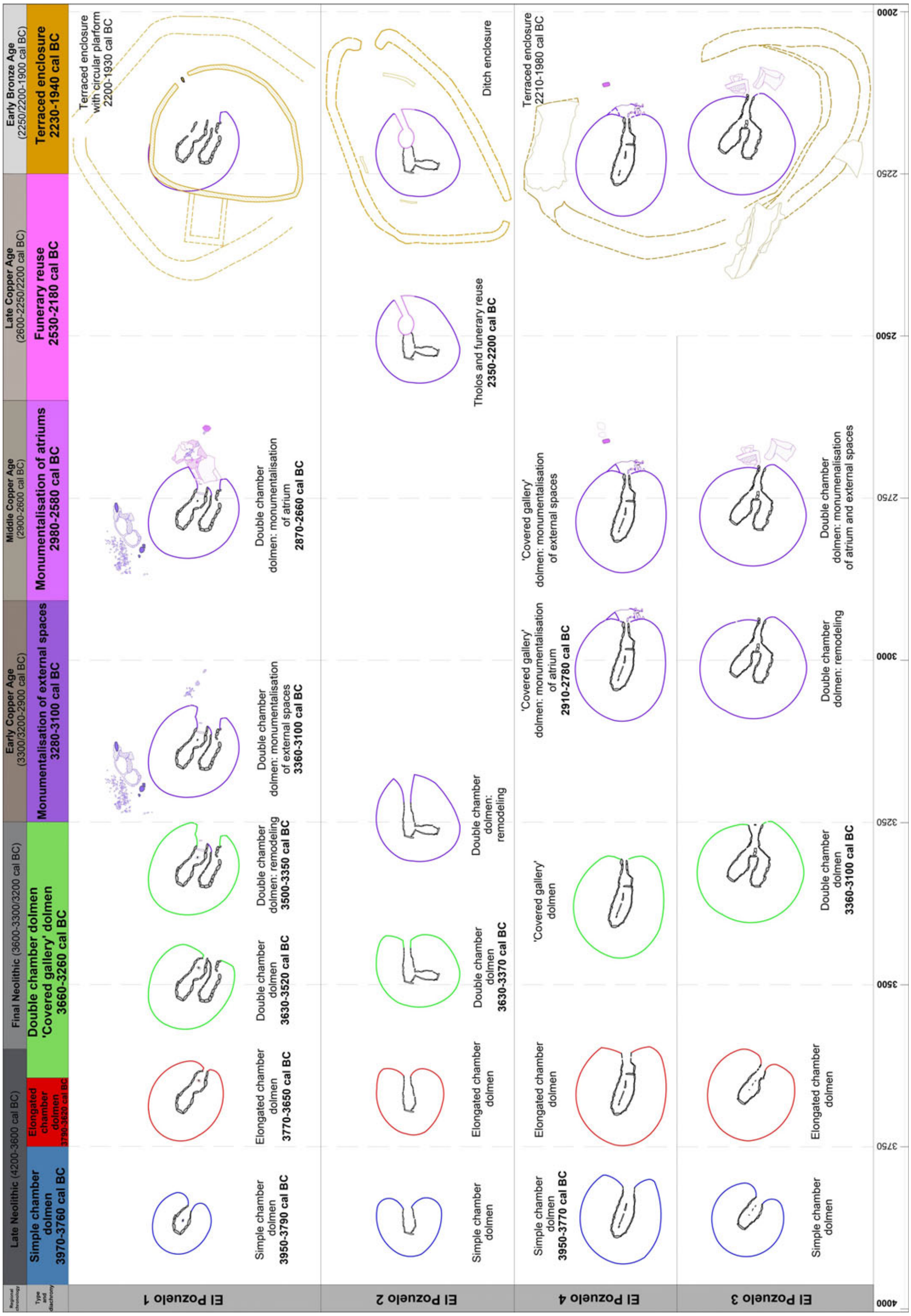

Figure 11 Architectural sequence and temporality of the Los Llanetes cluster in Later Prehistory. Chronologies and radiocarbon dates expressed at 68% of probability (1σ).

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

Neolithic (3600–3300/3200 cal BC) in the south of the Iberian Peninsula. The double chamber dolmens were built in this time over the older architectures and the façades of the dolmens were monumentalized. This phase took place ca. 3710–3170 (95%) or 3660–3260 (68%), with a probable maximum duration of 360 years, within the second third of the fourth millennium cal BC. During the three centuries, each monument underwent its own building sequence with a specific temporality.

The oldest dates come from Dolmen 1, marking the emergence of monuments with multiple chambers. The two dates for construction levels show that the conversion into a dolmen with parallel double chambers with independent accesses may have occurred ca. 3640–3380 (95%) or 3620–3520 (68%). In a later time, ca. 3510–3330 (95%) or 3490–3350 (68%), a series of remodeling works were carried out: the façade was refurbished, the axial stele was moved, the north chamber was repaved and the north wall of orthostats in the south chamber was repaired.

Monuments 2 and 3 may have been reconstructed as dolmens with multiple chambers later. Dolmen 2, with perpendicular double chambers, was reformed in the middle of the fourth millennium, ca. 3540–3360 (95%) or 3530–3370 (68%). Dolmen 3 was probably rebuilt with parallel chambers, antechamber, and convergent passage at the start of the last third of the fourth millennium, ca. 3490–3220 (95%) or 3370–3320 (68%).

In the case of Dolmen 4, it is likely that the open passage was built, the mound was enlarged and the stepped access was carved into the bedrock in the second half of the fourth millennium BC. These works meant that the monument was converted into a segmented covered gallery with an open part, the passage, and a covered space with two sectors separated by the transversal slab: antechamber and chamber with central pillars.

Phase 4 corresponds to the time of the first outer structures, such as the paved perimeter terrace on the north side of Dolmen 1, where the radiocarbon dates indicate activity in this area in the last third of the fourth millennium cal BC: 3310–3030 (95%) or 3220–3100 (68%).

After this time, a period of disuse or apparent inactivity at the turn of the fourth to the third millennia cal BC may have lasted about two centuries, as shown by the graphs with the sum of probabilities (Figure 10). This hiatus coincides with the emergence of complex societies in the Early Copper Age (3300/3200–2900 cal BC) in the southern Iberian Peninsula, when new ideological and social patterns were introduced. In the funerary sphere, new collective burials were developed, such a hypogea with passages and circular chambers, and new architectural models appear, like the tholoi (Lozano Medina and Aranda Jiménez 2017; Aranda Jiménez et al. 2021).

The dates indicate that activity restarted at the site in the first third of the third millennium cal BC, at the time of the Middle Copper Age (2900–2600 cal BC). Phase 5 represents the building of structures outside the front of the dolmens, where the atria were monumentalized. This occurred in the time of ca. 3060–2510 (95%) or 2980–2580 (68%), with an estimated maximum duration of 260 years. To be precise, the radiocarbon results suggest that the activity took place in two cycles of short duration. In Dolmen 4, the reform of the access and the position of the stele may have occurred in a specific interval of ca. 2920–2700 (95%). In Dolmen 1, the three combined dates attest the contemporaneity and short duration of activity in this phase, between 2880–2630 (95%).

After another hiatus of at least a century in the middle of the third millennium cal BC, the interior of the dolmens were used once more (Phase 6). Dates from Dolmens 2, 3, and 4 situate this phase at the end of the second third of the third millennium, ca. 2650–2140 (95%) or 2530–2180 (68%). It cannot be determined whether the funerary activity was continuous or, more probably, took place in occasional episodes, as suggested by the few grave goods belonging to that time. The dates for this phase are affected by the limitations of calibrated radiocarbon dating, as the curve intersects long temporal ranges. It is thus plausible that a short period of disuse followed this phase.

Activity restarted in the last three centuries of the third millennium and the first century of the second millennium cal BC, in the chrono-cultural period of the Early Bronze Age in south Iberia. The six modeled dates for Phase 7 establish its boundaries ca. 2290–1880 (95%) or 2230–1940 (68%), with a probable maximum duration of 250 years. The terraced enclosures with circular platforms emerged in the phase. This new form of monument was based on the re-appropriation of the place of the ancestors and the deliberate partial dismantling and recycling of the materials in the dolmens to create large open-air stepped structures that were prominent in the landscape. These monuments were built with reused materials from the dolmens. They consist of two or three levels of terracing around the dolmens, delimited by drystone walls, access ramps and even structures around the dolmens, like the circular platform around Dolmen 1. The old funerary monuments were integrated as architectural elements, like large open stone skeletons, while their interior areas were reused.

The enclosure around Dolmen 1 consists of a circular stone platform on the top level, with several stepped accesses and a ramp, and two terraces on a lower level. The two dates place the construction of the enclosure in the 22nd–21st centuries cal BC. The two surrounding terraces may be slightly older, as their alignment and design are different from the platform, and also because of the older dates obtained for similar contexts in Dolmens 3 and 4.

The enclosure around Dolmens 3 and 4 might have been built during the second half of the 23rd century cal BC, as suggested by the first two dates for this phase. Three dates for the interior of Dolmen 3 reveal the continuity of activity in these monumental enclosures during the transition from the third to the second millennia cal BC.

Phase 8, the abandonment of the monumental enclosures, must have taken place in the second century in the second millennium cal BC, probably in the interval of ca. 1880–1640 (95%) or 1880–1690 (68%).

The monuments were reused later in the Bronze Age, in two phases separated by long hiatuses or discontinuities that confirm a more sporadic or occasional use of the site. Phase 9 corresponds to a short event in El Pozuelo 1 in the Middle Bronze Age, when the mound was rebuilt, and the north chamber was partially emptied in the middle centuries of the second millennium cal BC: 1670–1490 (95%). Phase 10 is correlated with the presence of ditches with or without a pavement and possible steles in the mound of Dolmen 1 and the space between Dolmens 3 and 4, ca. 1440–1280 (95%).

Diabase hammers with a central groove, identical to those found in the proximate copper mines at Chinflón have been found in the stratigraphic levels and structures associated with both phases. Therefore, the reoccupation of the monuments for activities and the restart of practices might be related to mining work, although at the moment no coetaneous dates

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

have been obtained at Los Llanetes. Four radiocarbon dates define the temporality of the two occupation phases of that site (Rothenberg and Blanco Freijeiro 1980; Burleigh et al. 1982) (Table S4.1; Figure S4.2). The first must have taken place in the second third of the second millennium cal BC, in the Middle Bronze Age: ca. 1700–1400 (95%). The second phase was the time of most intense mining activity and occupation of the settlement, in the Late Bronze Age: ca. 1200–700 (95%).

After that time, a long hiatus is seen in the use of the monuments. Only sporadic visits to the site have been recorded in the Late Iron Age, between the 4th–2nd centuries cal BC.

DISCUSSION

The chronological data obtained at El Pozuelo acquire greater value in the context of the architectural sequences and dynamics of use of dolmens in southwest Iberia. This new information changes certain conceptions about the genesis of the first funerary monumentality and at the same time support the diachronic sequence of megalithism in the region. The establishment of the architectural sequence of the Los Llanetes group and the dating of the different architectural types has served to verify the greater antiquity of the simple chamber dolmens, to establish the temporality of formation, appearance, and transformation of the other funerary monuments (elongated chamber dolmens, covered galleries and multiple chamber dolmens) and attest to the permanence of the megalithic monumentality during the Early Bronze Age. Thus, the contextualized study of the results compared with dates obtained at analogous monuments is able to suggest several aspects for discussion and propose new interpretations about the emergence, consolidation, diversification, reuse and abandonment of dolmens in Later Prehistory.

The recent study of the Campo de Hockey necropolis with protomegalithic tombs proposes the beginning of funerary megalithism on the Atlantic Coast in relation to the maritime distribution networks of exotic goods from 4300 cal BC (Vijande-Vila et al. 2022). Dolmens with access from outside appear in the Iberian southwest at the beginning of the fourth millennium cal BC, synchronically with other funerary monuments in different parts of western Europe, including the northwest of the Iberian Peninsula and the British Isles (Schulz Paulsson 2017). A study of the radiocarbon dates has posited that the spread of the megalithic phenomenon across the Atlantic seaboard of Europe occurred by maritime routes, through an expansion from northwest France, where megalithic tombs have been dated to the second half of the fifth millennium cal BC, to the other areas (Schulz Paulsson 2019). This expansion process coincides with the 5.9 kyr climatic event, which brought an abrupt and widespread climate change in Europe from humidit to dry conditions and intense aridity in several regions (Wang et al. 2013). This consequently must have caused transformations in the different spheres of Neolithic societies.

This phenomenon of temporal convergence and the simultaneous emergence of megalithic monuments in the various regions has been interpreted in different ways. Radiocarbon dates in southwest Iberia prior to this study demonstrate that the spread of funerary megalithism is related to the emergence of collective mortuary practices in that region around 3800 cal BC, resulting in the appearance of new funerary architectures, morturary rituals, and dynamics of burial functions (Carvalho and Cardoso 2015). However, this process cannot be directly correlated with a demographic increase and the consolidation of agricultural societies with intensive economic systems, as has been traditionally held. In fact, recent studies suggest that during the expansion of megalithism in southern Portugal there may have been a decrease in population (Pardo-Gordó and Carvalho 2020). In this sense, it has been interpreted that these communities developed an extensive economic system based on a model of mobile exploitation of the territory through ovicaprid livestock farming (Carvalho 2015).

The chronological analysis will be performed with the dates from El Pozuelo and with the radiocarbon dataset published for the dolmens in the Iberian southwest (Table 6; Figure 12). These Bayesian tests have excluded 9 radiocarbon dates from levels beneath the mounds, as these mostly belong to previous Neolithic phases of occupation, in which dwellings, hearths and/or domestic objects have been documented, as in the case of the dolmens of Tremedal (Ruiz Gálvez 2000), Cabeçuda 1 (Oliveira 1997a), Castelhanas (Rocha 2020), Figueira Branca (Oliveira 1997b), Azután (Bueno Ramírez et al. 2002, 2005), Joaniña (Oliveira 1997a), Alberite (Ramos Muñoz and Giles Pacheco 1996) and Casas de Don Pedro (Gavilán Ceballos and Más Cornella 2021) (Table S2).

The 152 dates have been analyzed and presented in accordance with the 95% confidence (2σ). They have been placed in architectural groups to carry out the sum of probabilities and the Bayesian models of protomegalithic tombs, dolmens (passage graves, simple chambers, elongated chambers and covered galleries, multiple chambers) and megalithic cists. This has enabled the duration of the activity of the different architectural types (Figure 13) to be observed in addition to identifying the temporalities of the construction, funerary activity, reuse, etc.

Protomegalithic Tombs

In the current state of our knowledge, the first funerary monuments built with stone in the southwest of the Iberian Peninsula seem to have been the protomegalithic tombs, found in southern Portugal and western Andalusia. The six dates obtained at the necropolis of the Campo de Hockey and Arroyo Saladillo, associated with settlements, range from the last third of the fifth millennium to the first two centuries in the fourth millennium cal BC (ca. 4300–3800 cal BC) (Figures 13b and 14). These are small structures with a chamber or interior pits without an outer access, covered by circular mounds formed by stone slabs, 2 or 2.50 m in diameter, which precede megalithic monuments. Tomb 11 at the Campo de Hockey, a pit covered by a mound delimited by a perimeter ditch, dated in 4060–3950 and 4036–3669 cal BC, contained the remains of two individuals and occupied the central place in the necropolis. Eleven individual or double burials were arranged around it. Tomb 3 was a covered pit formed by large and middle size stones, dated in 4335–4070 cal BC. Tomb 4 was a pit dug into a platform closed on its northern side by two large stone slabs, dated in 4045–3820 cal BC. Tomb 7 was a cist with an individual burial dated in 4060–3665 cal BC (Vijande Vila 2009; Vijande-Vila et al. 2015, 2022). At Arroyo Saladillo, four pits were covered by a stone slab and a small mound. The individual burial S-94 was dated in 4040–3800 cal BC (García Sanjuán et al. 2020).

Dolmens

At a slightly later time, from the beginning of the fourth millennium BC, dolmens with a system of access from outside functioned as collective tombs. They possessed a method of closing them to guarantee access, the preservation of the remains and continuity of burials.

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

Table 6 Radiocarbon dating of dolmens from the southwest of the Iberian Peninsula. Samples analyzed in this study: 152 dates, 66 sites. Calibrated dating by OxCal v.4.4 Bronk Ramsey (2021); r: 5 IntCal20 atmospheric data from Reimer et al. (2020).

Site	Laboratory code	Architecture	Context	Sample	^{14}C (BP)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC	Reference
Campo de Hockey (Tomb 3)	BETA-564528	Proto-megalihic tomb	Individual pit burial	Human bone,4% marine	5410±30	4330-4170	4335-4060	Vijande-Vila et al. 2022
Campo de Hockey (Tomb 4)	BETA-569324	Proto-megalihic tomb	Individual pit with slabs	Human bone, 25% marine	5250±30	4160-3985	4045-3820	Vijande-Vila et al. 2022
Campo de Hockey (Tomb 11)	ETH-88972	Proto-megalihic tomb	Double burial in grave with mound	Human bone, 40% marine	5364±24	4040-3950	4060-3950	Vijande-Vila et al. 2022
Campo de Hockey (Tomb 7)	CNA-833	Proto-megalihic tomb	Individual cist burial	Seashell (*Murex Brandaris*), 100% marine	5665±50	4040-3810	4060-3665	Vijande-Vila et al. 2015; Vijande-Vila et al. 2022
Campo de Hockey (Tomb 11)	CNA-664	Proto-megalihic tomb	Double burial in grave with mound	Seashell (*Phorcus Lineatus*), 100% marine	5650±40	3990-3810	4036-3669	Vijande Vila 2009; Vijande-Vila et al. 2022
Arroyo Saladillo (S-94)	CNA-3336	Proto-megalihic tomb	Individual chamber burial	Human bone (femur/tibia)	5137±32	3990-3810	4040-3800	García Sanjuán et al. 2020
Alberite	Beta-80600	Covered gallery	Hearth in external space. Construction level	Charcoal	5110±140	4050-3760	4230-3650	Ramos Muñoz and Giles Pacheco 1996
Azután	UGRA-288	Passage grave	Chamber funerary level	Charcoal	5060±90	3970-3710	4050-3640	Bueno Ramírez 1991; Bueno Ramírez et al. 2005
El Pozuelo 1	CNA-3267.1.1	Simple chamber dolmen	Post hole UEC197, infill	Charcoal (Rosaceae)	5055±35	3950-3790	3960-3710	This article

(Continued)

Table 6 (*Continued*)

Site	Laboratory code	Architecture	Context	Sample	^{14}C (BP)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC	Reference
El Pozuelo 4	CNA-2576.1.2	Simple chamber dolmen	Mound, clay base UEC 64	Charcoal (Rosaceae)	5030±35	3950-3770	3950-3710	This article
Alberite	Beta-80598	Covered gallery	Chamber, burial level on ochre paving	Charcoal	5020±70	3950-3710	3960-3650	Ramos Muñoz and Giles Pacheco 1996
Tremedal	Gra-15903	Passage grave	Chamber funerary level	Charcoal	5000±60	3940-3650	3950-3650	Ruiz-Gálvez 2000
Vale de Rodrigo 3	KIA-31381	Simple chamber dolmen	Infratumular level. Previous occupation	Charcoal	4996±30	3900-3700	3950-3650	Armbruester 2006
El Pozuelo 1	CNA-3274.1.1	Elongated chamber dolmen	Chamber north, pit fill UEC177-UE5	Charcoal (Quercus su. Quercus)	4941±34	3770-3650	3790-3640	This article
Vale de Rodrigo 2	Ua-10830	Simple chamber dolmen	Infratumular level. Previous occupation	Charcoal	4905±70	3780-3630	3940-3520	Larsson 2000
Menga	Ua-24582	Covered gallery	Atrium. Structure E-9, infill	Charcoal	4935±40	3770-3640	3800-3640	García Sanjuán and Lozano Rodríguez 2016
El Palomar	Beta-75067	Covered gallery	Chamber funerary level	Human bone (diaphysis)	4930±50	3770-3640	3910-3630	Cabrero et al. 1997
Menga	Ua-24583	Covered gallery	Atrium. Structure E-9, infill	Charcoal	4865±40	3710-3540	3770-3520	García Sanjuán and Lozano Rodríguez 2016
Pedras Grandes	OxA-36001	Short passage grave	Chamber funerary level	Human bone (right femur)	4812±28	3650-3530	3650-3520	Silva et al. 2021
Pedras Grandes	OxA-35898	Short passage grave	Chamber funerary level	Human bone (right femur)	4796±30	3640-3530	3640-3520	Silva et al. 2021

Table 6 (*Continued*)

Site	Laboratory code	Architecture	Context	Sample	^{14}C (BP)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC	Reference
Cabeceira 4	Beta-196094	Short passage grave	Chamber funerary level	Human bone (femur)	4780±40	3640-3520	3650-3380	Rocha 2005; Rocha and Duarte 2009
Carrascal	Beta-228577	Short passage grave	Chamber funerary level. Burial 2	Human bone (right femur)	4770±40	3640-3520	3650-3380	Boaventura 2009
Sobreira 1	Beta-233283	Simple chamber dolmen	Funerary level	Human bone (left femur)	4770±40	3640-3520	3650-3380	Boaventura et al. 2013
Carrascal	OxA-359000	Short passage grave	Chamber funerary level. Burial 1	Human bone (right femur	4766±30	3630-3520	3640-3380	Silva et al. 2019
El Pozuelo 1	CNA-3272.1.1	Multiple chamber dolmen	Mound between chambers. Layer UEC36	Charcoal (Ericaceae)	4764±35	3630-3520	3640-3380	This article
El Pozuelo 1	CNA-3271.1.1	Multiple chamber dolmen	Chamber north, clay paving (UE25)	Charcoal (Ericaceae)	4764±35	3630-3520	3640-3380	This article
Menga	Ua-36216	Covered gallery	Mound, base level (survey 1)	Charcoal	4760±30	3630-3520	3640-3380	García Sanjuán and Lozano Rodríguez 2016
Cabeceira 4	Wk-17084	Short passage grave	Chamber funerary level	Human bone (long bone)	4759±41	3640-3520	3640-3370	Rocha 2005; Rocha and Duarte 2009
Carrascal	OxA-359001 OxA-35900	Short passage grave	Chamber funerary level. Burial 1	Human bone (right femur)	4752±31	3630-3520	3640-3380	Silva et al. 2019
Cabeceira 4	Wk-41086	Short passage grave	Funerary level	Human bone (cranial calotte)	4742±20	3630-3510	3640-3380	Carvalho and Rocha 2016
El Pozuelo 2	CNA-3471.1.1	Multiple chamber dolmen	Mound, clay base (UE19)	Charcoal (Arbustus sp.)	4711±35	3630-3370	3630-3370	This article

(*Continued*)

Table 6 (*Continued*)

Site	Laboratory code	Architecture	Context	Sample	^{14}C (BP)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC	Reference
Pedras Grandes	OxA-35899	Short passage grave	Chamber funerary level	Human bone (right femur)	4671±29	3520-3370	3520-3370	Silva et al. 2021
Soto	CNA-3488.1.1	Covered gallery	External space. Infill sediment (UE 1) from post hole (UEC110)	Charcoal (Quercus subgenus Quercus)	4660±34	3510-3370	3520-3360	Linares Catela and Mora Molina 2018
Cabeço da Areia	Beta-196091	Simple chamber dolmen	Funerary level	Human bone	4650±50	3520-3360	3630-3340	Rocha 2005; Rocha and Duarte 2009
Rabuje 5	Beta-191133	Elongated chamber dolmen	Funerary level	Charcoal (Arbustus unedo L.)	4650±50	3520-3360	3630-3340	Boaventura 2009
Carrascal	Beta-225167	Short passage grave	Chamber funerary level. Burial 4	Human bone (left femur)	4640±40	3510-3360	3530-3350	Boaventura 2009
Azután	Beta-145277	Passage grave	Chamber funerary level	Charcoal	4620±40	3500-3350	3530-3190	Bueno Ramírez et al. 2002, 2005
Pedra Branca	ICEN-1040	Passage grave	Level funerary II, togheter slab 1	Human bone	4620±60	3520-3340	3630-3100	Soares 2010
El Pozuelo 1	CNA-3273.1.1	Multiple chamber dolmen	North chamber, stele socket filling (UEC100-UE4, UEC 99)	Charcoal (Rosaceae)	4608±34	3500-3350	3520-3130	This article
Pedras Grandes	Beta-205946	Short passage grave	Chamber funerary level	Human bone (right femur)	4590±40	3500-3140	3520-3100	Boaventura 2009
Azután	Ly-4500	Passage grave	Chamber funerary level	Charcoal	4590±90	3520-3100	3630-3020	Bueno Ramírez 1991; Bueno Ramírez et al. 2005

Table 6 (*Continued*)

Site	Laboratory code	Architecture	Context	Sample	^{14}C (BP)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC	Reference
Viera	GrN-1606	Passage grave	Chamber funerary level	Human bone	4550±140	3500-3020	3630-2910	Ferrer Palma 1997
Pedras Grandes	Beta-234136	Short passage grave	Chamber funerary level	Human bone (right femur)	4530±40	3360-3100	3370-3090	Boaventura 2009
Soto	CNA-3489.1.1	Covered gallery	Hipogeum infill sediment UEC67 -CE20	Charcoal (Quercus subgenus Quercus)	4532±35	3360-3100	3370-3100	Linares Catela and Mora Molina 2018
El Pozuelo 3	CNA-2578.1.2	Multiple chamber dolmen	North chamber, stele socket filling UE106-UEC111/112	Charcoal	4525±35	3360-3100	3370-3090	This article
El Pozuelo 1	CNA-3280.1.1	Multiple chamber dolmen	External space. Northwest terrace, clay paving UEC214	Charcoal (Olea)	4519±35	3360-3100	3370-3090	This article
Currais do Galhordas	S416C/0308	Passage grave	Chamber, headstone base	Charcoal (Quercus perinnifolia)	4480±30	3330-3090	3350-3030	Monteiro Rodrigues and Oliveira 2018
Horta	Beta-194313	Passage grave	Chamber funerary level	Human bone	4480±40	3340-3090	3360-3020	Oliveira 2006
Cuesta de los Almendrill-os	GrN-25302	Elongated chamber dolmen	Funerary level	Human bone	4450±20	3320-3020	3330-3010	Fernández Ruiz and Márquez Romero 2001
Trigache 4	Beta-228583	Passage grave	Chamber funerary level	Human bone	4450±50	3330-3020	3350-2920	Boaventura 2009
Bola da Cera	ICEN-67	Passage grave	Chamber funerary level II	Human bone	4420±45	3290-2920	3340-2910	Oliveira 1997a
Pardais 3	Beta-590466	Passage grave	Chamber, phase 1 of funerary activity (UE4)	Human bone (coxal)	4410±40	3100-2930	3320-2910	Valera and Pereiro 2022

(*Continued*)

Table 6 (*Continued*)

Site	Laboratory code	Architecture	Context	Sample	^{14}C (BP)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC	Reference
Arruda	Beta-229584	Passage grave	Level funerary, next to the headstone	Human bone (right radius)	4410±40	3100-2920	3330-2910	Boaventura 2009
El Casullo	CNA-346	Elongated chamber dolmen	Vestibule floor (US5)	Charcoal	4410±50	3270-2920	3340-2900	Linares Catela and García Sanjuán 2010
Santa Margarida 2	Beta-153911	Short passage grave	Level under the enclosure structure	Charcoal (Erica umbellate)	4410±60	3310-2910	3340-2900	Gonçalves 2001
Horta	Beta-AH-O10	Passage grave	Chamber funerary level	Human bone	4390±40	3090-2920	3320-2900	Oliveira 2006
Bola da Cera	ICEN-66	Passage grave	Chamber funerary level I	Burnt human bone	4360±50	3080-2900	3320-2880	Monge Soares and Peixoto Cabral 1993; Oliveira 1997b
Trigache 2	Beta-239755	Passage grave	Passage funerary level	Human bone (skull)	4340±40	3020-2900	3090-2880	Boaventura 2009
Santa Margarida 3	Beta-176897	Passage grave	Chamber funerary level Cm-8 deposit	Human bone (long bone)	4290±40	3010-2870	3030-2770	Gonçalves 2003a
Serrinha	Beta-507395	Passage grave	Chamber funerary level, phase I	Burnt human bone	4290±30	2920-2880	3020-2870	Rocha and Morgado 2020
Serrinha	Beta-516220	Passage grave	Chamber funerary level, phase I	Burnt human bone	4290±30	2920-2880	3020-2870	Rocha y Morgado 2020
Casal do Penedo	Beta-229585	Passage grave	Undeterminated funerary level	Human bone (right femur)	4280±40	2930-2870	3020-2700	Boaventura 2009
Casal do Penedo	Beta-234134	Passage grave	Undeterminated funerary level	Human bone (right femur)	4280±40	2930-2870	3020-2700	Boaventura 2009

Table 6 (*Continued*)

Site	Laboratory code	Architecture	Context	Sample	^{14}C (BP)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC	Reference
Santa Margarida 3	Beta-166416	Passage grave	Chamber funerary level, Cm-1group	Human bone	4270±40	2920-2780	3020-2700	Gonçalves 2003a
Santa Margarida 3	Beta-166422	Passage grave	Chamber funerary level, Cm-7 deposit	Human bone (skull)	4270±40	2920-2780	3020-2700	Gonçalves 2003a
Carcavelos	Beta-208518	Passage grave	Funerary level U34	Human bone (femur)	4270±40	2920-2780	3020-2700	Boaventura 2009
El Pozuelo 4	CNA-2583.1.1	Covered gallery	Atrium, sediment (UE88) on clay paving UEC65	Charcoal (Olea)	4250±35	2910-2780	2920-2700	This article
Coureleiros 4	ICEN-976	Passage grave	Passage	Charcoal	4240±150	3030-2580	3340-2470	Oliveira 1997b
Pardais 3	Beta-590464	Passage grave	Chamber, phase 1 of funerary activity (UE23)	Human bone (right tibia)	4230±30	2900-2770	2910-2690	Valera and Pereiro 2022
La Paloma	Beta-150153	Elongated chamber dolmen	Chamber funerary level (US5)	Charcoal	4220±40	2900-2700	2910-2660	Nocete et al. 2004
Pedra dos Mouros	Beta-228582	Passage grave	Undeterminated funerary level	Human bone (jaw)	4210±50	2900-2690	2910-2630	Boaventura 2009
La Venta	Beta-150157	Elongated chamber dolmen	Chamber funerary level (US5)	Charcoal	4200±70	2900-2670	2920-2570	Nocete et al. 2004
Horta	Beta-AH-M11	Passage grave	Funerary level	Human bone	4190±50	2890-2670	2900-2620	Oliveira 2006
Estanque	Wk-17091	Passage grave	Funerary level	Human bone	4182±39	2890-2690	2890-2630	Rocha 2005; Rocha and Duarte 2009

(*Continued*)

Table 6 (*Continued*)

Site	Laboratory code	Architecture	Context	Sample	^{14}C (BP)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC	Reference
Monte Abraão	Beta-228580	Passage grave	Undeterminated funerary level	Human bone (right femur)	4180±40	2890-2670	2890-2630	Boaventura 2009
Estria	Beta-208950	Passage grave	Undeterminated funerary level	Human bone (humerus)	4180±50	2890-2670	2900-2580	Boaventura 2009
Santa Margarida 3	Beta-176896	Passage grave	Chamber funerary level, Cm-5 deposit	Human bone (skull)	4170±40	2880-2670	2890-2620	Gonçalves 2003a
El Pozuelo 1	CNA-3268.1.1	Multiple chamber dolmen	Atrium, level (UE18) on paving (UEC94)	Charcoal (Rosaceae)	4152±34	2880-2660	2880-2620	This article
Casainhos	Beta-225168	Passage grave	Chamber funerary level, C2, Cam05	Human bone (femur)	4150±40	2880-2630	2880-2580	Boaventura 2009
El Pozuelo 1	CNA-3261.1.1	Multiple chamber dolmen	Atrium, stele socket filling UEC130	Charcoal (Quercus sp)	4143±34	2870-2630	2880-2580	This article
El Pozuelo 1	CNA-3269.1.1	Multiple chamber dolmen	Atrium, hearth UEC136A	Charcoal (Rosaceae)	4139±35	2870-2630	2880-2580	This article
Carcavelos	Beta-225170	Passage grave	Funerary level (U44)	Human bone (jaw)	4130±40	2870-2620	2880-2570	Boaventura 2009
Pedra Branca	ICEN-1041	Passage grave	Passage funerary level, beside the slab 7	Human bone	4120±60	2870-2580	2890-2490	Soares 2010
Estria	Beta-228578	Passage grave	Undeterminated funerary level	Human bone (jaw)	4110±40	2850-2580	2880-2500	Boaventura 2009
Santa Margarida 3	Beta-166423	Passage grave	Chamber funerary level, Cm-6 deposit	Human bone (skull)	4100±40	2850-2570	2870-2490	Gonçalves 2003a

Table 6 (*Continued*)

Site	Laboratory code	Architecture	Context	Sample	^{14}C (BP)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC	Reference
Viera	Beta-353820	Passage grave	Funerary chamber	Bone (macro-mammal needle)	4090±30	2850-2570	2860-2490	Aranda Jiménez et al. 2013
La Paloma	Beta-150154	Elongated chamber dolmen	Chamber funerary level (US5)	Charcoal	4070±70	2850-2490	2880-2460	Nocete et al. 2004
Pedra Escorregad-ia	ICEN-844	Passage grave	Funerary level	Human bone	4060±70	2850-2470	2880-2460	Gomes 1994
Tesorillo de la Llaná	GrA-37339	Passage grave	Funerary level under the collapsed antechamber	Human bone (skull)	4055±35	2670-2490	2850-2470	Fernández Ruiz and Márquez Romero 2008; Márquez Romero et al. 2009
Pedras da Granja	Beta-225171	Passage grave	Funerary level, burial H45	Human bone (jaw)	4050±40	2630-2480	2850-2460	Boaventura 2009
Puerto de los Huertos	CNA-342	Elongated chamber dolmen	Chamber funerary level (US10)	Charcoal	4050±50	2670-2470	2860-2460	Linares Catela and García Sanjuán, 2010
Monte Abraão	Beta-228579	Passage grave	Undeterminated funerary level	Human bone (left femur)	4040±40	2630-2470	2850-2460	Boaventura 2009
Soto	Beta-394495	Covered gallery	Megalithic gallery. Pit UEC444-UE1, next to headstone	Human bone	4020±30	2580-2470	2630-2460	Linares Catela and Mora Molina 2018
El Pozuelo 4	CNA-2580.1.2	Covered gallery	Chamber, sediment (UE98) on the floor	Charcoal (Rosaceae)	3950±35	2570-2350	2580-2300	This article

(*Continued*)

Table 6 (*Continued*)

Site	Laboratory code	Architecture	Context	Sample	^{14}C (BP)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC	Reference
Currais do Galhordas	S416C/0440	Passage grave	Chamber, base level	Charcoal (Quercus sp).	3950±40	2570-2340	2580-2300	Monteiro Rodrigues and Oliveira 2018
Puerto de los Huertos	CNA-344	Elongated chamber dolmen	Vestibule floor (US11)	Charcoal	3940±45	2560-2340	2580-2290	Linares Catela and García Sanjuán 2010
Soto	CNA-3487.1.1	Covered gallery	Atrium. Deposition level UE3-UEC117 from votive structure CE23	Charcoal (cf. Olea)	3932±34	2480-2340	2570-2290	Linares Catela and Mora Molina 2018
Los Gabrieles 4	Beta-185649	Multiple chamber dolmen	Chamber 2, funerary level I (US4)	Charcoal	3920±50	2480-2300	2570-2200	Linares Catela 2006
Anta Grande de Zambujeiro	Beta-243693	Passage grave	Vestibule pit	Charcoal	3910±40	2470-2340	2560-2210	Soares and Silva 2010
El Pozuelo 4	CNA 2582.1.1	Covered gallery	Antechamber, sediment (UE100) on the floor (UEC72)	Charcoal (Rosaceae)	3905±35	2470-2340	2480-2230	This article
Vale de Rodrigo 2	Ua-10831	Simple chamber dolmen	Infratumular level. Previous occupation	Charcoal	3905±75	2480-2210	2580-2140	Larsson 2000
Cebolinhos 2	Beta-176899	Passage grave	Chamber, funerary deposit. Phase 4	Human bone (radius)	3900±40	2470-2310	2480-2200	Gonçalves 2003b
Pardais 3	Beta-590465	Passage grave	Chamber, phase 1 of funerary activity (UE18)	Human bone (radius)	3870±30	2460-2290	2470-2200	Valera and Pereiro 2022

Table 6 (*Continued*)

Site	Laboratory code	Architecture	Context	Sample	^{14}C (BP)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC	Reference
Los Gabrieles 4	Beta-185648	Multiple chamber dolmen	Chamber 2, funerary level II (US3)	Charcoal	3850±40	2450-2200	2470-2200	Linares Catela 2006
Cebolinhos 2	Beta-177471	Passage grave	Chamber, funerary deposit. Phase 4	Human bone (humerus)	3840±40	2410-2200	2460-2150	Gonçalves 2003b
Joaniña	Sac-1381	Simple chamber dolmen	Funerary level	Charcoal	3840±170	2570-2030	2870-1820	Oliveira 1997b
El Pozuelo 2	CNA-3738.1.2	Multiple chamber dolmen	South chamber, funerary floor (UE78)	Charcoal (Olea)	3834±31	2350-2200	2460-2150	This article
Soto	Ua-35665	Covered gallery	Atrium, smelting area, Cu slag	Charcoal (Quercus ilex)	3830±35	2350-2200	2460-2140	Nocete et al. 2011
La Venta	Beta-150158	Elongated chamber dolmen	Entrance floor (US 4)	Charcoal	3820±50	2400-2140	2460-2130	Nocete et al. 2004
El Pozuelo 3	CNA-2577.1.2	Multiple chamber dolmen	North chamber, pit filling (UE105-UEC110)	Charcoal (Ericaceae and Olea)	3810±35	2300-2140	2450-2130	This article
Pedra Escorregad-ia	ICEN-1028	Passage grave	Chamber funerary level	Human bone	3800±100	2460-2050	2560-1950	Gomes 1994
Santa Margarida 3	Beta-166418	Passage grave	Chamber funerary level, Cm-3 deposit	Human bone (right kneecap)	3780±40	2290-2140	2350-2030	Gonçalves 2003a

(*Continued*)

Table 6 (*Continued*)

Site	Laboratory code	Architecture	Context	Sample	^{14}C (BP)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC	Reference
El Pozuelo 3	CNA-2587.1.1	Multiple chamber dolmen	North chamber, sediment UE43 on floor	Charcoal (Rosaceae)	3770±35	2290-2130	2300-2030	This article
El Pozuelo 4	CNA 2581.1.2	Covered gallery	Chamber, fillling socket pillars 3-4 (UE99)	Charcoal (Rosaceae)	3760±35	2280-2060	2290-2030	This article
Nª Sra. Conceição dos Olivais	Wk-17089	Passage grave	Chamber, individual burial undetermined	Human bone	3758±36	2280-2060	2290-2030	Rocha and Duarte 2009
Cortijo El Tardón (Tomb B)	GrN1-16066	Megalithic cist	Burial level	Human bone	3745±25	2210-2060	2280-2030	Fernández Ruiz et al., 1997
Santa Margarida 3	Beta-166417	Passage grave	Chamber funerary level, Cm-2 deposit	Human bone (right tibia)	3730±40	2200-2030	2290-1980	Gonçalves 2003a
Santa Margarida 3	Beta-166421	Passage grave	Chamber funerary level, Cm-4 deposit	Human bone	3730±50	2210-2030	2300-1970	Gonçalves 2003a
El Pozuelo 1	CNA-3266.1.1	Multiple chamber dolmen	South chamber, floor UE23	Charcoal (Ericaceae)	3723±34	2200-2010	2280-1980	This article
Cabeçuda 1	ICEN-979	Passage grave	Passage, sediment under slabs	Charcoal (cork oak acorn)	3720±45	2200-2030	2290-1970	Oliveira 1997a
Santa Margarida 3	Beta-166420	Passage grave	Chamber funerary level, Cm-3 deposit	Dog bone	3720±50	2200-2030	2290-1960	Gonçalves 2003a
El Pozuelo 1	CNA-3260.1.1	Multiple chamber dolmen	Circular platform base (UE2-UEC95)	Charcoal (Rosaceae)	3706±34	2150-2030	2210-1970	This article

Table 6 (*Continued*)

Site	Laboratory code	Architecture	Context	Sample	^{14}C (BP)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC	Reference
Los Gabrieles 4	Beta-185650	Multiple chamber dolmen	Chamber 2, funerary level III (US2)	Charcoal	3700±50	2200-1980	2280-1940	Linares Catela 2006
Puerto de los Huertos	CNA-341	Elongated chamber dolmen	Destruction trench filling (US18-UE15)	Charcoal	3680±50	2140-1970	2210-1920	Linares Catela and García Sanjuán 2010
El Pozuelo 3	CNA-2585.1.1	Multiple chamber dolmen	Passage, sediment (UE41) on the floor	Charcoal (Rosaceae)	3660±35	2120-1940	2140-1890	This article
Cabeçuda 1	ICEN-977	Passage grave	Chamber, circular concavity. Votive deposit, end of use	Charcoal	3650±110	2200-1880	2410-1690	Oliveira 1997a
El Pozuelo 3	CNA-2586.1.1	Multiple chamber dolmen	Antechamber, sediment UE42 on floor	Charcoal (Rosaceae)	3640±35	2120-1940	2140-1890	This article
Trincones I	Beta-197160	Simple chamber dolmen	Funerary level	Charcoal	3600±60	2120-1880	2140-1770	Bueno Ramírez et al. 2004
Viera	Beta-353822	Passage grave	Funerary chamber	Bone, deer antler	3580±30	2010-1880	2030-1780	Aranda Jiménez et al. 2013
El Pozuelo 6	Teledyne-19080	Multiple chamber dolmen	Floor passage	Charcoal	3580±120	2130-1750	2290-1610	Nocete et al. 2004
Tapada do Castelo	Beta-506380	Passage grave	Funerary level	Ovicaprid bone	3560±30	1960-1820	2020-1770	Rocha 2021
Cortijo El Tardón (Tomb A)	UGRA-260	Megalithic cist	Burial level	Human bone	3530±60	1950-1760	2030-1690	Fernández Ruiz et al., 1997

(*Continued*)

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

Table 6 (*Continued*)

Site	Laboratory code	Architecture	Context	Sample	^{14}C (BP)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC	Reference
La Traviesa (cist 20)	RCD-2110	Megalithic cist	Burial level	Charcoal	3520±60	1930-1750	2030-1680	García Sanjuán 1998
Cerro de la Corona	Beta-93020	Simple chamber dolmen	Funerary level, ossuary	Human bone	3490±120	1960-1630	2140-1510	Recio Ruiz et al.1998
El Pozuelo 3-4	CNA-2598.1.1	Covered gallery and multiple chamber dolmen	Terrace 2, sediment (UE35) on paving (UEC 16)	Charcoal (Quercus sp.)	3437±30	1870-1680	1880-1630	This article
La Traviesa (cist 20)	RCD-2111	Megalithic cist	Burial level	Charcoal	3420±60	1870-1620	1890-1540	García Sanjuán 1998
Barrocal das Freiras 3	Wk -17086	Passage grave	Chamber, individual burial undetermined	Human bone	3355±35	1730-1540	1740-1530	Rocha and Duarte 2009
El Pozuelo 1	CNA-3265.1.1	Multiple chamber dolmen	Mound, layer UEC243 behind slab 14 of the north chamber	Charcoal (Leguminosae)	3303±35	1620-1530	1680-1500	This article
Currais do Galhordas	S416C/0441	Passage grave	Chamber-passage, level on paving	Charcoal (Quercus caducifolia)	3300±40	1620-1510	1690-1460	Monteiro Rodrigues and Oliveira 2018
Tesorillo de la Llaná	GrN-26488	Passage grave	Chamber, upper funerary level	Human bone	3250±40	1600-1440	1620-1430	Fernández Ruiz and Márquez Romero 2008; Márquez Romero et al. 2009

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

Table 6 (*Continued*)

Site	Laboratory code	Architecture	Context	Sample	^{14}C (BP)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC	Reference
Tesorillo de la Llaná	GrN-26475	Passage grave	Chamber, upper funerary level	Human bone	3250±50	1610-1440	1630-1420	Fernández Ruiz and Márquez Romero 2008; Márquez Romero et al. 2009
Castelhanas	OxA-5432	Passage grave	Chamber, funerary level	Human bone	3220±65	1600-1410	1670-1300	Rocha 2020
El Pozuelo 3	CNA-2588.1.1	Multiple chamber dolmen	South chamber, sediment on floor (UE 44)	Charcoal (Rosaceae)	3101±30	1420-1300	1440-1270	This article
Zambujeiro 4	Beta-196093	Simple camber dolmen	Chamber, individual burial undetermined	Human bone	3040±40	1390-1220	1420-1130	Rocha and Duarte 2009
Soto	CNA-3485.1.1	Covered gallery	External space. Level of combustion structure (UE2-UEC111)	Charcoal (Quercus subgenus Quercus)	2931±33	1210-1050	1230-1010	Linares Catela and Mora Molina 2018
Soto	CNA-3486.1.1	Covered gallery	External space. Level of combustion structure (UE3-UEC111)	Charcoal (Quercus subgenus Quercus)	2882±33	1120-1010	1210-930	Linares Catela and Mora Molina 2018
El Casullo	CNA-345	Elongated chamber dolmen	Chamber floor (US3)	Charcoal	2890±50	1200-1000	1220-920	Linares Catela and García Sanjuán 2010
La Venta	Beta-150152	Elongated chamber dolmen	Chamber floor (US4)	Human bone	2820±40	1020-910	1120-840	Nocete et al. 2004

(*Continued*)

Table 6 (*Continued*)

Site	Laboratory code	Architecture	Context	Sample	^{14}C (BP)	Calibrated date (68% confidence) cal BC	Calibrated date (95% confidence) cal BC	Reference
El Pozuelo 6	Teledyne - 19078	Multiple chamber dolmen	Passage funerary floor	Charcoal (Quercus ilex)	2595±75	840-550	920-470	Nocete et al. 2004
Lagunita I	Beta-281366	Simple chamber dolmen	Tomb 2, funerary urn	Human bone (long bone)	2480+40	760-540	780-420	Barroso et al. 2012
Currais do Galhordas	S416C/0442	Passage grave	Chamber. Organic sediment from vessel 10	Organic sediment	2270±40	400-230	410-200	Monteiro Rodrigues and Oliveira 2018
El Pozuelo 1	CNA-3277.1.1	Multiple chamber dolmen	North chamber, pit filling UEC175	Charcoal (Olea)	2201±33	360-190	380-170	This article

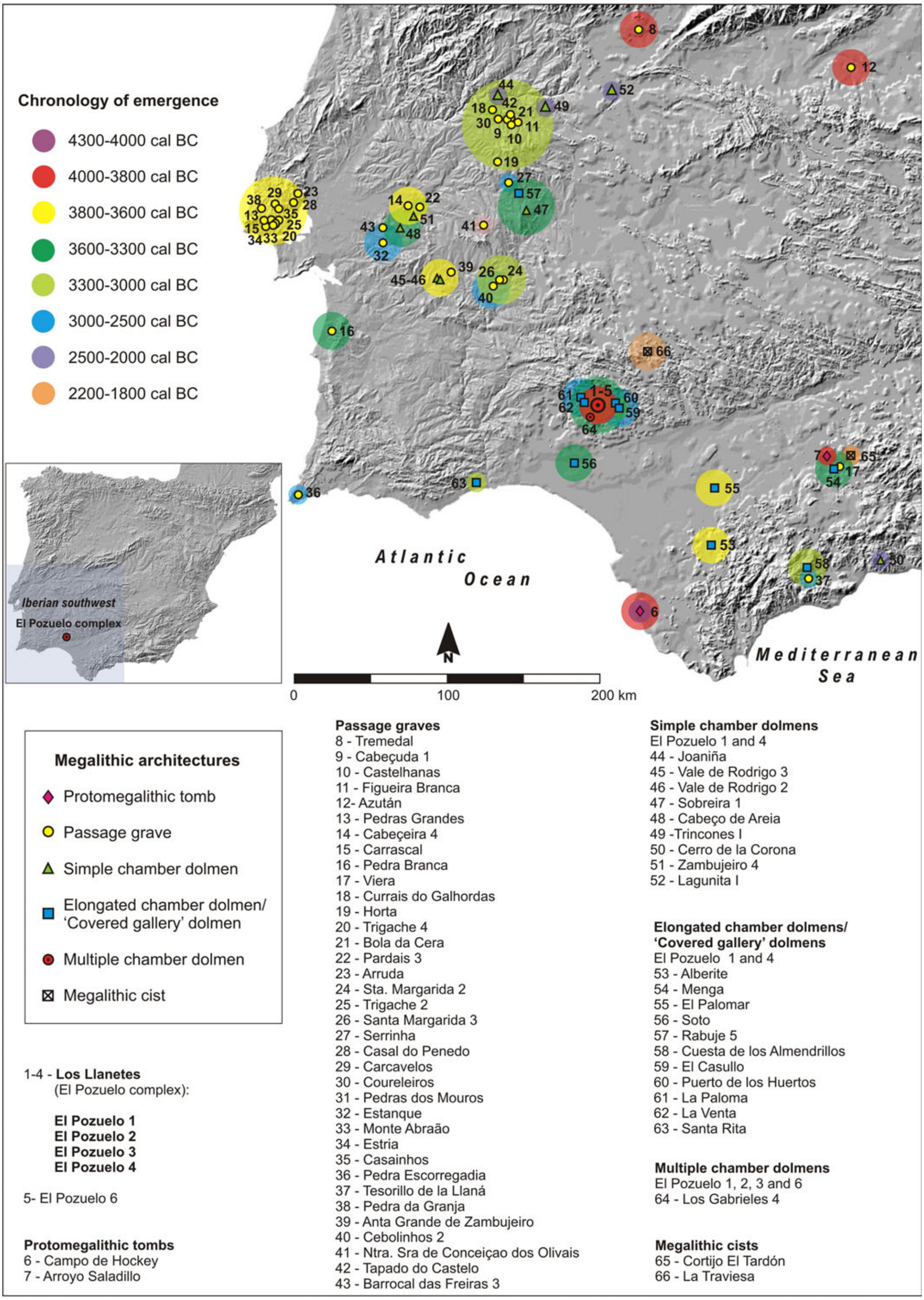

Figure 12 Dolmens with radiocarbon dates in the Iberian southwest. Architectural groups and chronologies of emergence.

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

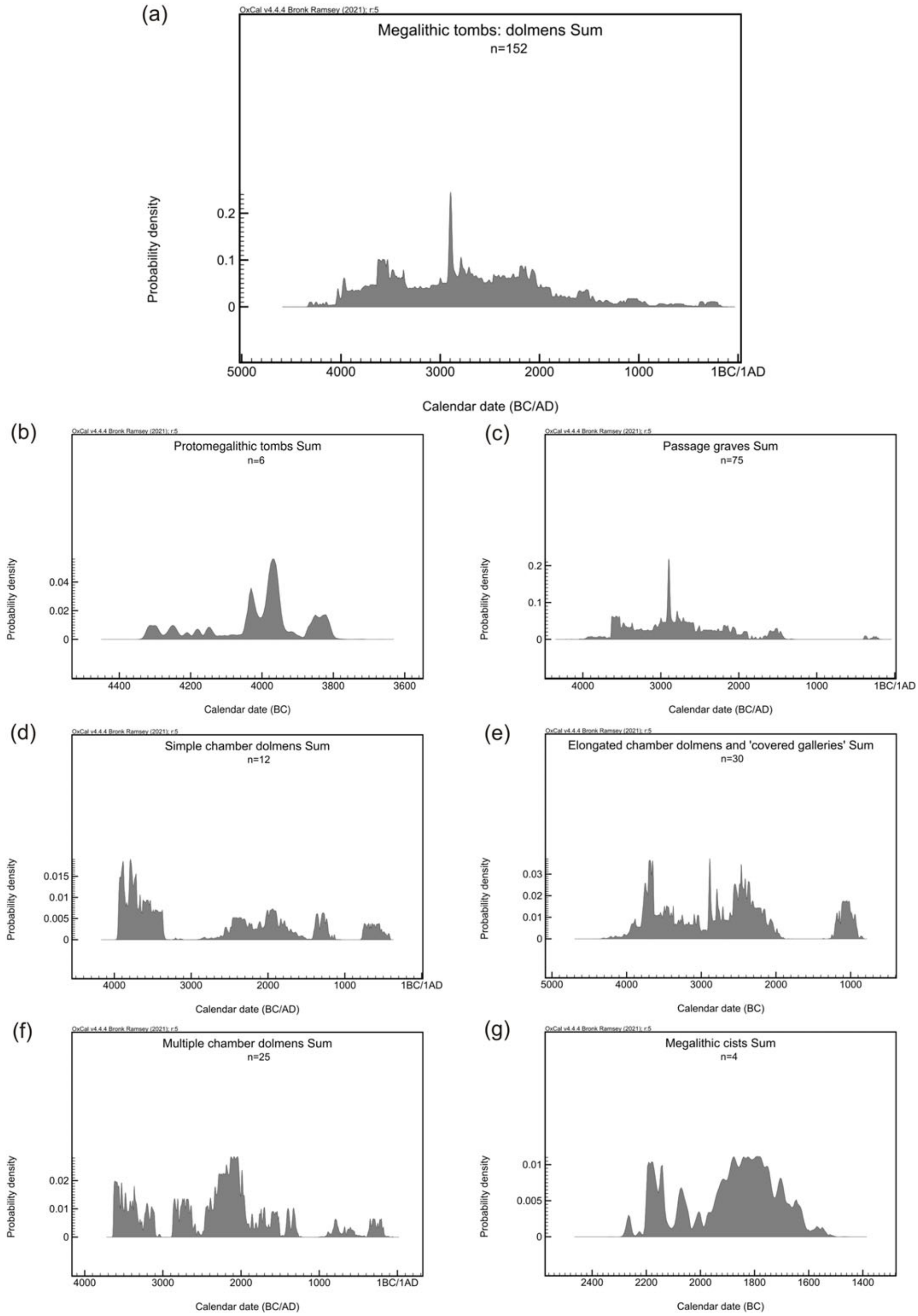

Figure 13 Sum of probabilities of the dolmens in the Iberian southwest: (a) in total (152 dates). By architectural groups: (b) protomegalithic tombs (n: 6); (c) passage graves (n: 75); (d) simple chamber dolmens (n: 12); (e) elongated chamber dolmens/covered galleries (n: 30); (f) multiple chamber dolmens (n: 25); (g) megalithic cists (n: 4).

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

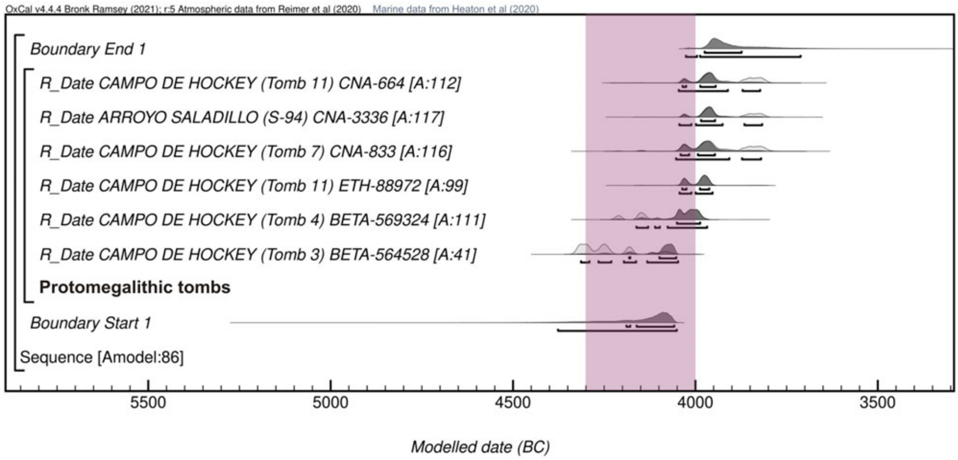

Figure 14 Bayesian modeling of the protomegalithic tombs in Iberian southwest. Purple stripe: emergence chronology (OxCal v.4.4 Bronk Ramsey [2021]; r:5 IntCal20 atmospheric data from Reimer et al. [2020] and Heaton et al. [2020]).

Passage Graves

Most dates in southwest Iberia correspond to these passage graves, as 36 sites have provided 75 radiocarbon determinations (Figures 13c and 15). These monuments differ in their form, building techniques and chronology depending on the region. The oldest dates have been obtained in the dolmens in the middle Tagus basin, where they may have been built from the early fourth millennium cal BC, as at Azután, ca. 4050–3640 (Bueno Ramírez 1991; Bueno Ramírez et al. 2005) and Tremedal, ca. 3950–3650 (Ruiz Gálvez 2000).

Most of the dated passage graves are in Portugal, in Alentejo and Estremadura, where they are called antas. The first phase of activity took place ca. 3750–3030 cal BC (Boaventura 2011), at the same time as other forms of collective burials: small antas, hypogea, corbelled tombs, pits, and burial caves (Boaventura and Mataloto 2013). A large part of the dates are concentrated in that period, reflecting the generalisation and territorial expansion of those constructions. The oldest dates come from antas with a polygonal chamber and short passage, which originated in the second quarter of the fourth millennium, in about 3750 cal BC, as at Pedras Grandes (Boaventura 2009; Silva et al. 2021) and Carrascal (Boaventura 2009; Silva et al. 2019) in the Lisbon region, and Cabeceira 4 (Rocha 2005; Carvalho and Rocha 2016) in central Alentejo. The large antas with a polygonal chamber and longer passage have yielded slightly later dates, mostly in the middle or last third of the fourth millennium cal BC, as demonstrated by the antas of Pedra Branca (Soares 2010), Currais do Galhordas (Monteiro Rodrigues and Oliveira 2018), Horta (Oliveira 2006), Bola da Cera (Monge Soares and Peixoto Cabral 1993; Oliveira 1997b), Pardais 3 (Valera and Pereiro 2022), Santa Margarida 2 (Gonçalves 2001), Trigache 4 and Arruda (Boaventura 2009). Intense collective funerary activity has been documented in all of them although some of them might correspond to mortuary events with a short duration.

The medium-sized antas and the large ones with a polygonal chamber and long passage continued to be built and used for sustained funerary activity in the first half of the third millennium cal BC, as indicated by the dates at Santa Margarida 3 (Gonçalves 2003a), Serrinha (Rocha and Morgado 2020), Coureleiros 4 (Oliveira 1997b), Pardais 3 (Valera and

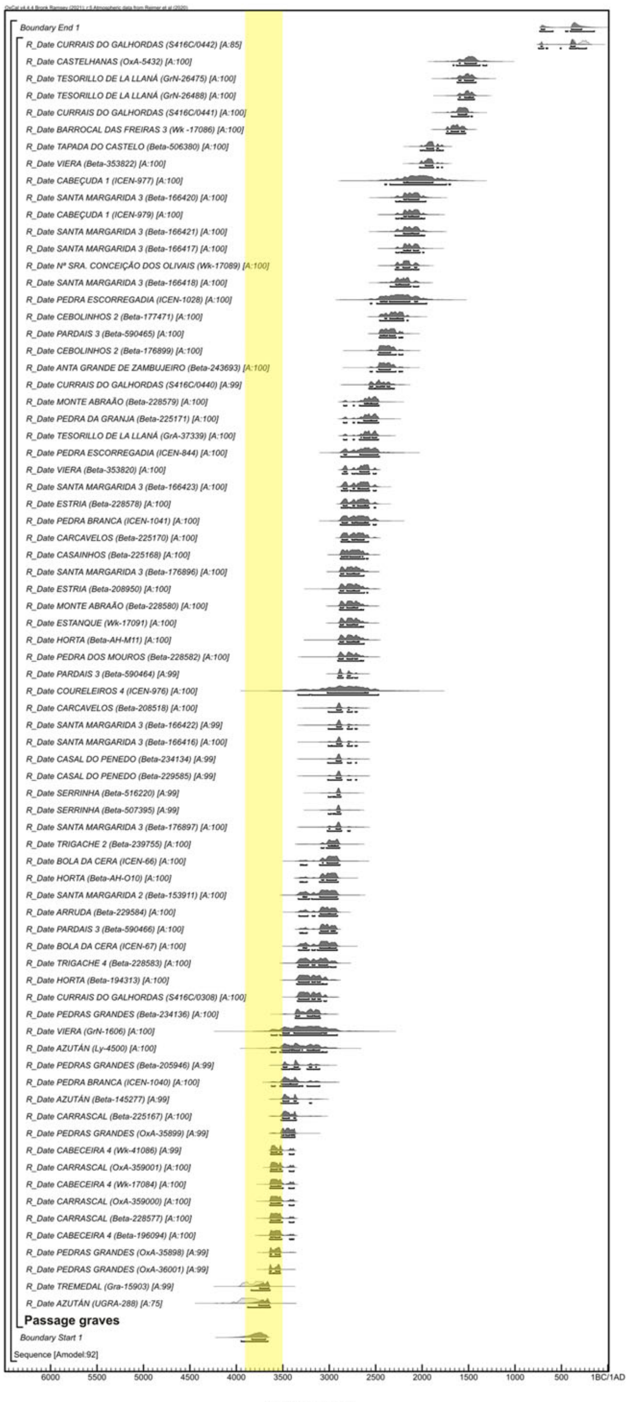

Figure 15 Bayesian modeling of the passage graves in Iberian southwest. Yellow stripe: emergence chronology (OxCal v.4.4 Bronk Ramsey [2021]; r:5 IntCal20 atmospheric data from Reimer et al. [2020]). (Please see online version for color figures.)

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

Pereiro 2022), Horta (Oliveira 2006), Estanque (Rocha 2005; Rocha and Duarte 2009) and Pedra Branca (Soares 2010) in Alentejo and at several dolmens in the Lisbon region: Trigache 2, Casal do Penedo, Carcavelos, Estria, Pedra dos Mouros, Casainhos and Pedras da Granja (Boaventura 2009). In Spain, analogous chronologies have been recorded at the dolmen of Viera (Ferrer Palma et al. 1997; Aranda Jiménez et al. 2013) and Tesorillo de la Llaná (Fernández Ruiz and Márquez Romero 2008; Márquez Romero et al. 2009). Indeed, as many as a third of all the dates lie within that chronology, corresponding to the high density of funerary activity in the Chalcolithic. These tombs were reused in the second half of the third millennium cal BC. A first cluster of dates is concentrated in the third quarter, correlated with inhumations with grave goods or votive deposits consisting of Late Copper Age and/or Bell Beaker materials, like those dated in the dolmens of Currais do Galhordas (Monteiro Rodrigues and Oliveira 2018), Anta Grande de Zambujeiro (Soares and Silva 2010), Cebolinhos 2 (Gonçalves 2003b), Pardais 3 (Valera and Pereiro 2022), and Pedra Escorregadia (Gomes 1994). A second cluster corresponds to the last quarter of the third millennium and first two centuries of the second millennium cal BC. These were mostly obtained for representative Early Bronze Age individual burials or deposits, such as Santa Margarida 3 (Gonçalves 2003a), Nª Sra. Conceiçao dos Olivais (Rocha and Duarte 2009), Cabeçuda 1 (Oliveira 1997a) and Tapado do Castelo (Rocha 2021).The funerary reuse of passage graves continued during the period, as Middle Bronze Age individual burials have been dated to between 1700–1400 cal BC at the sites of Barrocal das Freiras 3 (Rocha and Duarte 2009), Currais do Galhordas (Monteiro Rodrigues and Oliveira 2018), Tesorillo de la Llaná (Fernández Ruiz and Márquez Romero 2008; Márquez Romero et al. 2009) and Castelhanas (Rocha 2020).

Simple Chamber Dolmens

Dolmens with a simple chamber are characterized by the relative small size of the mounds and the diverse shapes of the chambers (trapezoid, pseudo-oval, rectangular, etc.), the small burial area and a front access system. They had traditionally been considered the oldest monuments, based on the morphological simplicity and lesser technical complexity. Few sites have been dated with which to explore exhaustively the origin and duration of this type of funerary construction. Eleven sites have provided 12 dates (Figures 13d and 16), which limits the development of a robust diachronic sequence.

The two dates at Los Llanetes (El Pozuelo 1 and 4) are quite coherent, as they situate the appearance and development of simple chamber dolmens in the first two centuries of the fourth millennium cal BC, ca. 4050–3710 (95%) or 3970–3760 (68%). These are currently the oldest dates for simple chamber dolmens in southwest Iberia and probably mark the origin of these megalithic funerary monuments in western Andalusia. These dolmens are characterized by elongated oval chambers with axial steles or central pillars, from 3.5 to 6.75 m long, with maximum widths of 1.70 to 2.60 m and heights varying from 1.50 to 2.10 m. They were built with orthostats consisting of a headstone and symmetrical curved walls, formed by stones fitted vertically in deep foundation trenches. They were inside circular or oval mounds with a maximum diameter of between 9 and 14.5 m, whose orientation and main axis of symmetry is towards the southeast.

Simple chamber dolmens are common in other parts of the southwest of the Iberian Peninsula, like Alentejo. The dates for levels under the mounds at Vale de Rodrigo 3, ca. 3950–3650 cal BC (Armbruester 2006) and Vale Rodrigo 2, ca. 3940–3520 cal BC (Larsson 2000), establish a terminus post quem, after which the monuments were built. In this regard, it has been proposed

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

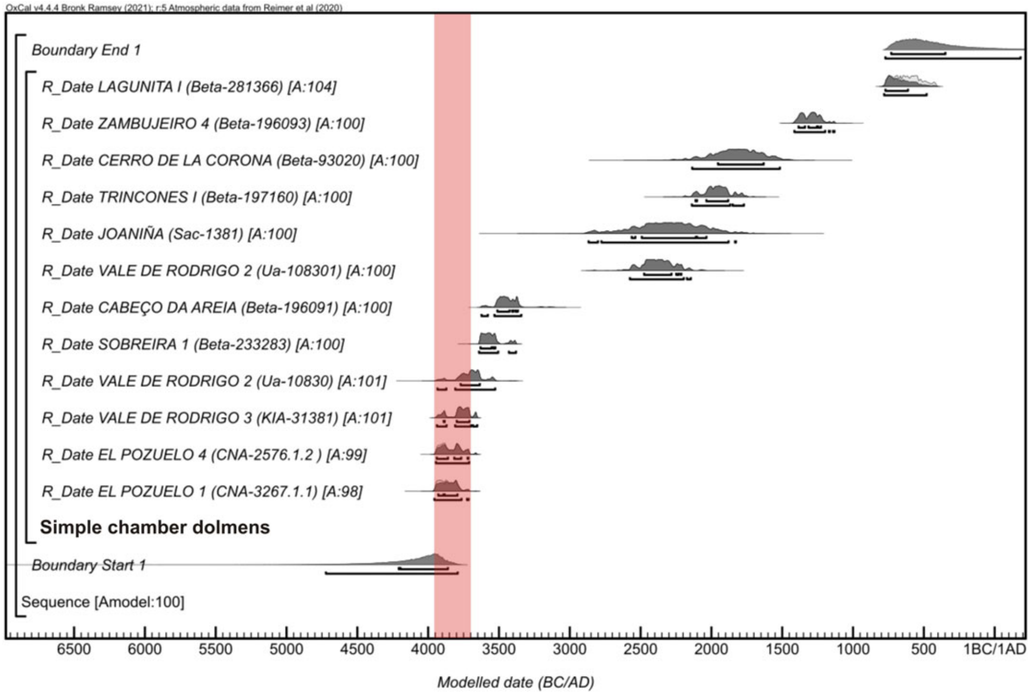

Figure 16 Bayesian modeling of the simple chamber dolmens in Iberian southwest. Red stripe: emergence chronology (OxCal v.4.4 Bronk Ramsey [2021]; r:5 IntCal20 atmospheric data from Reimer et al. [2020]).

that these dates of Vale Rodrigo group mark the initial time of the construction of the first megalithic tombs in the region and 3700 cal BC has been established as the time of the emergence of funerary megalithism (Boaventura 2011; Boaventura and Mataloto 2013). The similarity in the form of the Vale Rodrigo dolmens and the first phase at El Pozuelo is clear, as they are constructions with trapezoid or oblong chambers with a central pillar or stele, up to 8 m long, 3 m wide and 2.5 m high, inside circular mounds (Kalb 2013). However, the dates for the dolmens of the first phase at Los Llanetes indicates that they are probably one or two centuries older than the Alentejo dolmens, marking the emergence of the simple chamber monuments in the Iberian southwest ca. 3950 cal BC.

Small antas with chambers (rectangular, trapezoid, circular, polygonal, oblong and oval) between 1 and 3 m long inside mounds of variable diameters (4-10 m), with or without a kerb, are also common in Alentejo. The two radiocarbon dates available for Sobreira 1, ca. 3650–3380 cal BC (Boaventura et al. 2013), and Cabeço de Areia, ca. 3630–3340 cal BC (Rocha 2005), support the expansion of this architectural model in the second third of the fourth millennium. It has therefore been proposed that the main period for the construction and funerary use of the small Alentejo antas occurred in the Late Neolithic, between 3700 and 3300 cal BC (Mataloto et al. 2017).

The other dates obtained in simple chamber dolmens are grouped in three periods: the first, in the second half of the third millennium cal BC, according to the dates at Vale de Rodrigo 2 (Larsson 2000), Joaniña (Oliveira 1997b) and Trincones I (Bueno Ramírez et al. 2004). These results could be interpreted in two ways: either a funerary reuse or the late construction of these small chambers, as proposed in the case of Trincones 1 (Bueno Ramírez et al. 2004). The other two intervals refer to different reuses in the Late Bronze Age, as at Zambujeiro 4, ca. 1420–1130 cal BC (Rocha and Duarte 2009), or Cerro de la Corona, ca. 2140–1510 cal BC (Recio Ruiz et al. 1998), and in the Early Iron Age, in the case of Lagunita I, ca. 780–420 cal BC (Barroso et al. 2012).

Dolmens with an Elongated Chamber and Covered Galleries

Elongated monuments are characteristic and most common in western Andalusia (Leisner and Leisner 1956), where they are called covered galleries. They also appear less frequently in some parts of the Algarve and Alentejo. They are dolmens of different sizes and varied structures: oblong, longitudinal, elbowed and right-angles. The largest ones possess pillars and/or transversal slabs that segment the internal spaces into several sections or rooms of diverse widths and height. So far, only 12 sites have been dated by 30 radiocarbon determinations (Figures 13e and 17).

The distribution of the radiocarbon dates shows that the elongated monuments must have been developed in the last part of the Late Neolithic, with their construction continuing in the Final Neolithic and their re/construction and funerary reuse during the Copper Age.

The comparative study of the Los Llanetes cluster with other dated dolmens in western Andalusia is able to propose a diachronic sequence in four stages:

- Stage 1. Emergence and construction of the first elongated monuments, in about the 3800–3600 cal BC, as indicated by the dates at El Pozuelo 1, Alberite, Menga, El Palomar and Soto. The large monuments were built with recycled supports (standing-stones and steles) from previous open structures located at the site, as demonstrated in the sequences of Soto (Bueno et al. 2018) and Casas de Don Pedro (Gavilán Ceballos and Mas Cornellá 2021).
- Stage 2. Consolidation in the second third of the fourth millennium cal BC and territorial spread of the necropolises with elongated chambers or/and covered galleries in the last third of the fourth millennium cal BC, as suggested by the dates for monuments in the sierras of Huelva and Málaga.
- Stage 3. Construction, reconstruction, maintenance of funerary activity and reuse of dolmens during the third millennium cal BC. Twelve dates in the Copper Age are available for dolmens in the areas of eastern Andévalo and Tierra Llana in Huelva.
- Stage 4. Dismantling, closure and/or reuse during the Bronze Age.

The date of Phase 2 at El Pozuelo 1 establishes the chronology of this architectural model between 3800 and 3600 cal BC, as the Bayesian model marks the chronological boundaries for the construction and funerary activity ca. 3850–3540 (95%) or 3790–3620 cal BC (68%). In the Los Llanetes cluster it has been verified that these monuments were developed by rebuilding previous dolmens, by means of two main actions: (a) elongating the chamber by adding orthostats to the walls and ceiling (Dolmens 1 and 2) or building antechambers with transversal slabs (Dolmens 3 and 4); and (b) the concentric enlargement of the mounds. The monuments are characterized by elongated structures with two interior sectors, by which the chamber is differentiated from one that precedes it, either an antechamber or a space with a different size and shape and a marked bend in the left wall. The length varies from 5.5 to 7.75 m. The circular or oval mounds range from 11 to 15 m in their maximum diameter.

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

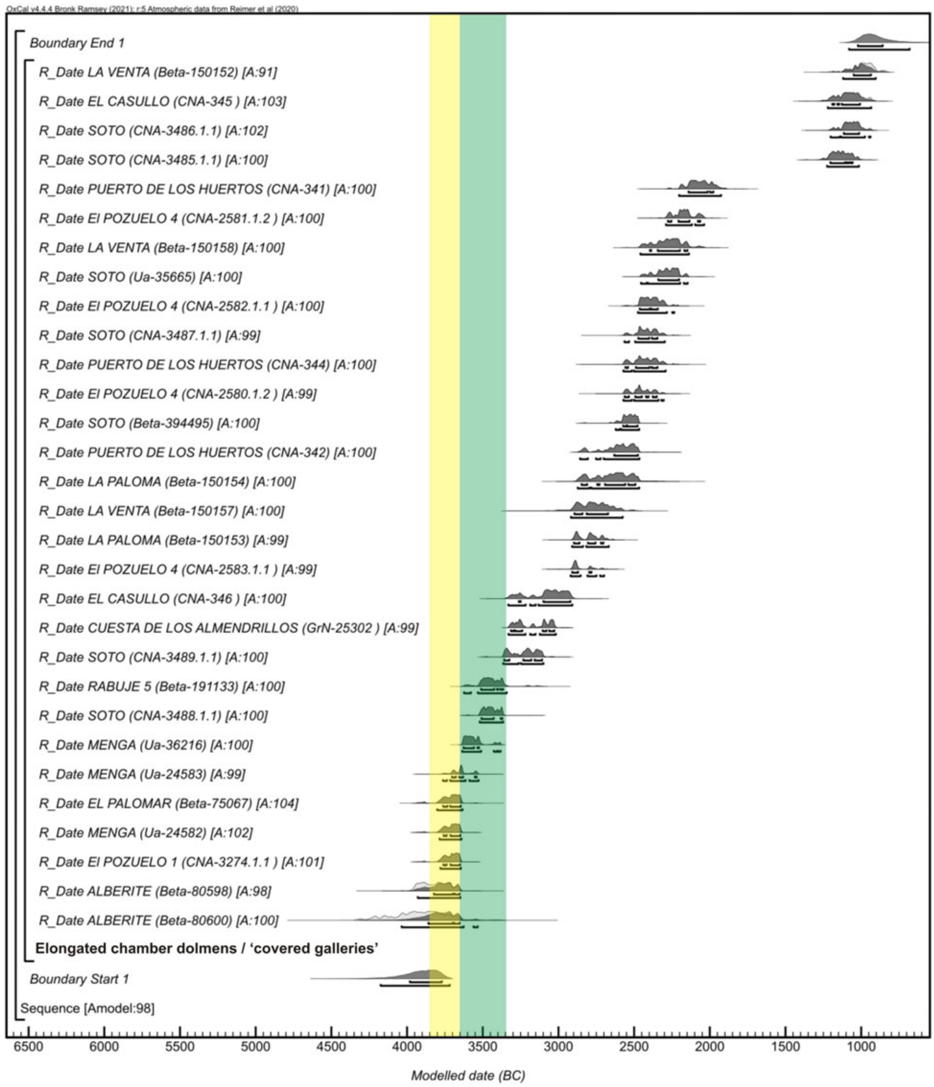

Figure 17 Bayesian modeling of the elongated chamber dolmens and covered galleries in Iberian southwest. Yellow stripe: emergence chronology. Green stripe: consolidation chronology (OxCal v.4.4 Bronk Ramsey [2021]; r:5 IntCal20 atmospheric data from Reimer et al. [2020]).

Later, probably in the second third of the fourth millennium cal BC, another building project was carried out in El Pozuelo 4 (Phase 3). This reproduced the spatial enlargement and segmentation. The monument was converted into a covered gallery divided into three areas of varying width and height: open corridor, antechamber, and chamber.

The architectural patterns and building sequence at Los Llanetes are equally seen in numerous elongated monuments in southern Iberia, from the largest constructions (Menga, Alberite, Soto and La Casilla) to most of the dolmens in the western Sierra Morena (Casas de Don Pedro, La Lancha, Los Gabrieles 4 and 6, La Cantina, among others), Guadalquivir valley

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

(El Palomar), mountains of Málaga (Cruz Blanca, Tajillo del Moro, Encinas Borrachas 1, Chaperas 1), areas in Cádiz (El Juncal, Las Rosas) and even the Algarve (Santa Rita) and Alentejo (Anta das Cabeças, Rabuje 5).

Published radiocarbon dates indicate that the emergence of dolmens with elongated chambers and covered galleries in this geographic area would have occurred ca. 3800–3700 cal BC (García Sanjuán et al. 2011). The oldest dates come from the large monuments (Alberite, Menga and Soto) and other dolmens, such as El Palomar, dated ca. 3910–3630 cal BC (Cabrero et al. 1997).

The date for Phase 2 at El Pozuelo 1 is coetaneous with the dates of Alberite, for which two dates come from different contexts: (a) a combustion level associated with the ochre floor in the last part of the chamber, ca. 4340–3970 cal BC; and (b) a hearth in the outer area associated with the dolmen construction level, ca. 4230–3650 cal BC (Ramos Muñoz and Giles Pacheco 1996). These chronometric results propose, at first sight, an early chronology for the origin of the elongated monuments, as they are the oldest dates in Andalusia. However, it is likely that Alberite is a more complex monument than previously thought and encompasses a building sequence like that of El Pozuelo 4. The structural and stratigraphic evidence of the superimposition of foundation trenches and additions to the lines of orthostats suggests that the morphology of the dolmen is the result of the concatenation of three projects, which correspond to the three spaces: (a) Phase 1, trapezoidal chamber 11 m long, with a transversal slab in the right wall and three steles-jambs next to the south wall; (b) Phase 2, addition of a longitudinal covered passage, 7m long; and (c) Phase 3, access and atrium between the mounds. It is therefore feasible that the two dates are correlated with the first of these architectural phases, and they are similar to the dates obtained at El Pozuelo 1 and 4.

The dates for other large elongated monuments, such as Menga and Soto, equally indicate a complex diachronic process and attest the consolidation of the architectural model in the southwest of Andalusia in the second third of the fourth millennium cal BC. Two dates in Menga come from Structure E-9 in the atrium, belonging to an earlier occupation phase very close to the construction of the dolmen: the results are 3800–3640 cal BC and 3770–3520 cal BC. Another date from the level and the base of the construction of the mound ratifies that the monument was built ca. 3640–3380 cal BC (García Sanjuán and Lozano Rodríguez 2016). We consequently believe that this large monument would have been built in at least three phases, in accordance with the clearly differentiated parts: elongated chamber with central pillars, antechamber and open atrium.

Two dates for areas in Soto dolmen attest a sequence coherent with the process identified at El Pozuelo in the second half of the fourth millennium cal BC. The first, from a posthole in the outer frontal area shows that structures existed in the surroundings coetaneously with the dolmen, ca. 3520–3360 cal BC. The second date, from a level of an intentional fill of a hypogeum, marks a *terminus post quem* for the work that transformed the access and monumentalized the outer area, by the creation of an ambulatory, ca. 3370–3100 cal BC (Linares-Catela and Mora Molina 2018).

The radiocarbon date for the dolmen of Rabuje 5, ca. 3630–3340 cal BC (Boaventura 2009), is related to the addition of the open corridor and the enlargement of the mound, forming an elbowed elongated chamber 5 m long inside a structure 11 m in diameter (Mataloto et al. 2017). This site therefore confirms the presence of elongated chambers in Alentejo from the mid-fourth millennium cal BC, probably coetaneous with analogous processes in other dolmens in southern Portugal. The determinations of the Santa Rita dolmen attests to the presence of elongated chambers in the Algarve from ca. 3200 cal BC (Emslie et al. 2022).

The dates at other sites confirm the expansion and abundance of dolmens with elongated chambers of small covered galleries in necropolises in different areas during the last third of the fourth millennium cal BC; for examples the dolmen of the Cuesta de Los Almendrillos in Sierra de las Nieves in Málaga (Fernández Ruiz and Márquez Romero 2001) and El Casullo in eastern Andévalo in Huelva (Linares-Catela and García Sanjuán 2010).

Twelve Copper Age dates are available for dolmens in the areas of eastern Andévalo and Tierra Llana in Huelva, confirming continuity in the building and rebuilding of the monuments and intense funerary activity in the third millennium cal BC. These dolmens are clustered in necropolises with a predominance of longitudinal elongated chambers about 7.5–10 m long, oriented towards the east, inside circular or oval mounds about 12–20 m in diameter. These radiocarbon dates come from the dolmens of La Ploma and La Venta in the necropolis of El Villar (Nocete et al. 2004) and Puerto de los Huertos in the El Gallego-Hornueco group (Linares-Catela and García Sanjuán 2010). They confirm the funerary use and reform of the façades, including the addition of ritual structures in the outer areas at the front, in the same way as in the older large covered galleries, as documented in Phases 5 (2920–2700 cal BC) and 6 (2580–2230 cal BC) in El Pozuelo 4. In Soto Dolmen, the dates are related to funerary activity (2630–2460 cal BC), votive contexts (2570–2290 cal BC) and areas with metallurgical activity (2460–2140 cal BC) outside the dolmen (Linares-Catela and Mora Molina 2018; Nocete et al. 2011).

The other dates for elongated monuments come from various stratigraphic contexts and stages of the Bronze Age and establish the time of social practices such as the dismantling, closure and reuse of the sites. Two of them are correlated with different re-appropriation actions in the Early Bronze Age, in the last two centuries of the third millennium and the first century of the second millennium cal BC. The date for El Pozuelo 4 (2290–2030 cal BC) reflects the process of the dismantling of the dolmens to build the surrounding terraced enclosure (Phase 7). The date of the ditch that destroyed the dolmen at Puerto de los Huertos (2210–1920 cal BC) marks an event for the intentional closure of the monument by dismantling and concealing it (Linares-Catela and García Sanjuán 2010). Four dates correspond to the reuse of the dolmens of Soto, El Casullo and La Venta in the Final Bronze Age, between 1200 and 900 cal BC. In Soto Dolmen, two dates for a structure in the outer access area at the front situate ritual fire practices ca. 1230–930 cal BC (Linares-Catela and Mora Molina 2018), which is an interval coherent with the weapons engraved on stones in the passage during this time and which is similar to the intervals for the deposit in the Ria of Huelva, ca. 1050–950 cal BC (Ruiz Gálvez 1995). Other dates from the dolmens of El Casullo (Linares-Catela and García Sanjuán 2010) and La Venta (Nocete et al. 2004) equally support the reuse of the inner areas in that time.

Dolmens with Multiple Chambers

The dolmens with multiple chambers are outstanding monuments in the context of the Iberian Peninsula. They are only found in the western Sierra Morena, mostly in eastern Andévalo and its periphery. The sites of El Pozuelo, Las Huecas, Los Gabrieles, El Labradillo and Lapa del Moro are the most important (Linares-Catela 2017). They display great structural variety and spatial composition, including dolmens with double parallel chambers or perpendicular

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

chambers, elbowed structures and dolmens with four asymmetrical chambers or five parallel chambers. These complex architectures are inside circular mounds 20–25 m in diameter.

Five sites have been dated by a total of 25 radiocarbon determinations, allowing an analysis of their chronological distribution (Figures 13f and 18). The sequence at Los Llanetes is crucial to establish the temporalities of their origin, transformation and reuse, through 21 dates. Modeling the five dates connected with construction and spatial restructuring provides a range of ca. 3710–3170 BC (95%) or 3660–3260 (68%), with greater intensity in the second third of the fourth millennium. Several phases associated with different uses and practices followed that time:

- The appearance of the dolmens with multiple chambers ca. 3650–3600 cal BC, as suggested by the two oldest dates of Phase 3 at El Pozuelo 1.
- Construction of the first structures in the outer area in the last third of the fourth millennium, ca. 3310–3030 cal BC, at El Pozuelo 1.
- Proliferation of structures in the atria in the first half on of the third millennium, ca. 3060–2510 cal BC. In the case of El Pozuelo 1, the ritual activity may have been concentrated in a time of less than a century.
- Continuity of the funerary activity in the second half of the third millennium, ca. 2650–2140 cal BC, probably concentrated between 2500 and 2200 cal BC. This has also been documented in Chamber 2 at Los Gabrieles 4, with two dates situating activity ca. 2570–2200 cal BC (Linares Catela 2006).
- Partial dismantling of the monuments and reuse of the dolmens in connection with the emergence of terraced enclosures in the last quarter of the third millennium, ca. 2290–1880 cal BC. The reuse of the inner spaces was usual in the Early Bronze Age, as confirmed by the dates at Los Llanetes and the date for the upper level in Chamber 2 in Los Gabrieles 4, ca. 2280–1940 cal BC (Linares Catela 2006).
- Reuse of the monuments in events with a short duration in the Middle and Late Bronze Age.

Terraced Enclosures and Megalithic Cists

The documentation of terraced enclosures with circular platforms at El Pozuelo introduces several aspects referring to the significance, complexity and temporality of megalithism in the Early Bronze Age. They were built and used ca. 2290–1800 cal BC and abandoned in the interval of ca. 1880–1640 cal BC. The initial radiocarbon dates for these monuments coincide with the 4.2 kyr event, from 2200 cal BC. This event involved a change in the environmental conditions, with increasing aridity and cultural collapse of southern Iberian societies (Blanco-González et al. 2018). In connection with this process, some authors have described a progressive decline in architectural monumentality and the end of the megalithic phenomenon, with a reduction in the size of the structures and a decrease in the use of the megalithic tombs (García Sanjuán et al. 2011). Nonetheless, the existence of terraced enclosures attests the emergence of a new model of monument and the permanence of megalithic architecture in the Early Bronze Age. This form of monument was based on the re-appropriation of the ancient structures, the integration of the dolmens as central elements, and technical continuity in building with orthostats. Similar patterns have been identified at other sites in southwest Iberia, as in the necropolis of La Orden-Seminario, where funerary monuments developed ca. 2300–1900 cal BC, characterized by the reuse of the space containing collective Chalcolithic burials for the introduction of individual tombs. These

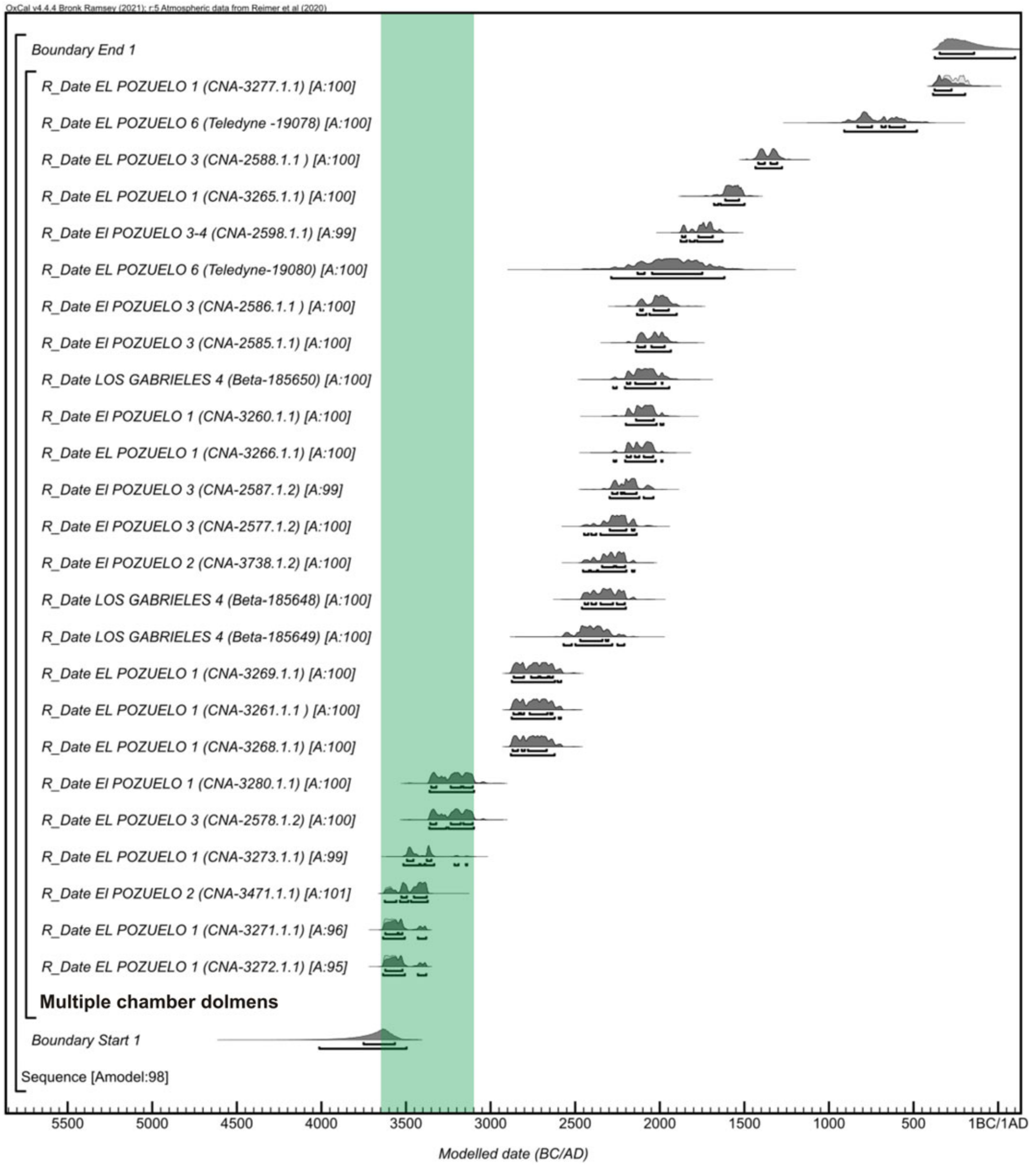

Figure 18 Bayesian modeling of the multiple chamber dolmens in Iberian southwest. Green stripe: emergence and consolidation chronology (OxCal v.4.4 Bronk Ramsey [2021]; r:5 IntCal20 atmospheric data from Reimer et al. [2020]).

burials involved the perpetuation of the building models in the megalithic tradition together with inegalitarian funerary patterns and rituals (Linares-Catela 2020).

The persistence of certain building models and funerary patterns in the megalithic cists might equally be understood within this line of continuity of the phenomenon. The available dates show that they existed in the transition from the third to the second millennium cal BC (Figures 13g and 19), as in the cases of Tombs A and B at Cortijo de El Tardón (Fernández Ruiz et al. 1997) and Cist 20 at La Traviesa (García Sanjuán 1998).

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

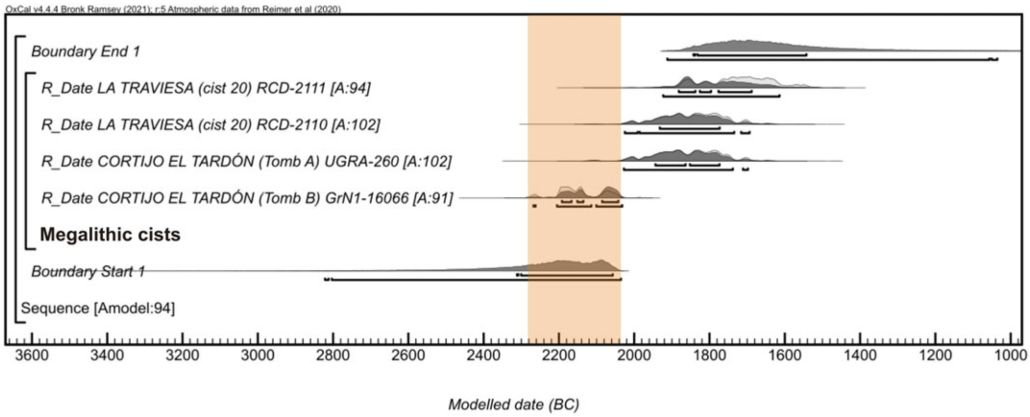

Figure 19 Bayesian modeling of the megalithic cists in Iberian southwest. Orange stripe: emergence chronology (OxCal v.4.4 Bronk Ramsey [2021]; r:5 IntCal20 atmospheric data from Reimer et al. [2020]).

CONCLUSIONS

The chronological study of the megalithic complex at El Pozuelo has been based on the detailed knowledge of the complex architectural sequences, the stratigraphic contextualisation of the samples and the Bayesian modeling of the radiocarbon results. This methodology allows us to assign a chronology to specific events (building, remodeling, activities, and uses) and establish the temporal boundaries of the different phases at the site.

The radiocarbon dates at Los Llanetes cluster reveal the oldest age of dolmens in the area and the long duration of the megalithic site during Later Prehistory, from the early fourth to the early second millennia cal BC. The chronometric results reflect aspects in the rhythm, activity and intensity of use analogous with other architectural models and regions, and thus add new data supporting the determination of the chronological sequence of megalithism in the southwest of the Iberian Peninsula.

The greatest intensity in the construction and use of the dolmens at El Pozuelo occurred in the fourth millennium cal BC, when several models of dolmens followed one another, apparently without hiatuses. The first dolmens with access from outside were built in in the form of simple chambers from the beginning of the fourth millennium, ca. 3950 cal BC. Their chronology is similar to that of the some protomegalithic tombs (ca. 4300–3800 cal BC) and the first elongated dolmens in western Andalusia and to the passage graves in the Tagus basin.

The expansion and diversity of monuments in southwest Iberia coincide with the generalized change in the realm of death ca. 3800 cal BC, as consequence of the emergence and consolidation of collective burials in the megalithic tombs. Around 3800–3600 cal BC, various regions witnessed the asynchronic proliferation of dolmens in different forms and building techniques. The architectural polymorphism of the monuments might be connected with the existence of building styles, technical traditions and cultural identities in the different megalithic territories.

The development of elongated monuments in western Andalusia, from ca. 3750 cal BC onwards, can be understood in this context. The covered galleries consolidated in the second third of the fourth millennium cal BC and continued to be built throughout the second half of the millennium. Short and long passage dolmens appeared in the Lisbon and

https://doi.org/10.1017/RDC.2022.48 Published online by Cambridge University Press

Alentejo regions from 3700 cal BC, and co-existed with small simple-chamber antas until 3000 cal BC. Dolmens with multiple chambers developed ca. 3650 cal BC, as shown by the dates at El Pozuelo and that form of building activity lasted until the end of the millennium.

Intense funerary and ritual activity has been documented in all the architectural models during the third millennium cal BC. This is shown by the monumentalization and addition of structures in the outer areas and the use/reuse of the inner spaces. In the Huelva area, the dates even show that the dolmens with elongated chambers and small covered galleries continued to be built in the first half of the third millennium cal BC.

In the last quarter of the third millennium cal BC, a new form of monument developed: the terraced enclosures with circular platforms. In this way, El Pozuelo demonstrates the continuity of megalithism in the Early Bronze Age. Evidence of later reuses in the Middle and Late Bronze Age is frequent in most of the dolmens in the Iberian southwest.

FUNDING AND ACKNOWLEDGMENTS

This study has been carried out within the framework of the R+D+i Project "MEGA-LITHOS. Geo-archaeological study methods for the investigation of the Huelva megalithisms" (UHU-1263153) at the University of Huelva, funded by the Operative Programme ERDF 2014-2020 and the Department of Economy and Knowledge in the Government of Andalusia. The radiocarbon dates were commissioned at the CNA by the Culture Department in the Government of Andalusia within the Exceptional Archaeological Activity under our direction. The funding of the open access charge has been assumed by the University of Huelva, thanks to the agreement established with Cambridge University Press. I am grateful to Coronada Mora Molina for her invaluable participation in the excavation and research of the Los Llanetes cluster. Juan Carlos Vera-Rodríguez and Luc Laporte, supervisors of my doctoral thesis, for their guidance and observations for the investigation. Mónica Ruiz Alonso has contributed to the anthracological study of the charcoal samples. Thanks to the reviewers for their comments and suggestions, which have improved several aspects of the work.

SUPPLEMENTARY MATERIAL

To view supplementary material for this article, please visit https://doi.org/10.1017/RDC.2022.48.

REFERENCES

Aranda Jiménez G, Díaz-Zorita Bonilla M, Hamilton D, Milesi L, Sánchez Romero M. 2020a. A radiocarbon dating approach to the deposition and removal of human bone remains in megalithic monuments. Radiocarbon 2020:1–16. doi: 10.1017/RDC.2020.67.

Aranda Jiménez G, Díaz-Zorita Bonilla M, Hamilton D, Milesi L, Sánchez Romero M 2020b. The radiocarbon chronology and temporality of the megalithic cemetery of Los Millares (Almería, Spain). Archaeological and Anthropological Sciences 12: 104. doi: 10.1007/s12520–020–01057-7.

Aranda Jiménez G, García Sanjuán L, Lozano Medina A, Costa Caramé ME. 2013. Nuevas dataciones radiométricas del dolmen de Viera (Antequera, Málaga). La colección Gómez-Moreno. Menga, Revista de Prehistoria de Andalucía 4:235–249.

Aranda Jiménez G, Camalich Massieu MD, Martín Socas D, Díaz-Zorita Bonilla M, Hamilton D, Milesi L. 2020c. New Insights into the radiocarbon chronology of Iberian Megalithic societies: the tholos-type tombs of Mojácar (Almería, Spain). European Journal of Archaeology 24(1):4–6. doi: 10.1017/eaa.2020.41.

Aranda Jiménez G, Lozano Medina A. 2014. The chronology of megalithic funerary practices: a Bayesian approach to Grave 11 at El

Barranquete necropolis (Almería, Spain). Journal of Archaeological Science 50:369–382. doi: 10.1016/j.jas.2014.08.005

Aranda Jiménez G, Lozano Medina A, Camalich Massieu MD, Martín Socas D, Rodríguez Santos FJ, Trujillo Mederos A, Santana Cabrera J, Nonza-Micaelli A, Clop García X. 2017c. La cronología radiocarbónica de las primeras manifestaciones megalíticas en el sureste de la Península Ibérica: las necrópolis de Las Churuletas, La Atalaya y Llano del Jautón (Purchena, Almería). Trabajos de Prehistoria 74(2): 257–277. doi: 10.3989/tp.2017.12194.

Aranda Jiménez G, Lozano Medina A, Díaz-Zorita Bonilla M, Sánchez Romero M, Escudero Carrillo J. 2017a. Cultural continuity and social resistance: the chronology of megalithic funerary practices in southern Iberia. European Journal of Archaeology 2017:1–25. doi: 10.1017/eaa.2017.42.

Aranda Jiménez G, Lozano Medina A, Sánchez Romero M, Díaz-Zorita Bonilla M, Hervé B. 2017b. Chronology of megalithic funerary practices in southeastern Iberia: the necrópolis of Panoría (Granada, Spain). Radiocarbon 2017:1–19. doi: 10.1017/RDC.2017.96.

Aranda Jiménez G, Milesi García L, Díaz-Zorita Bonilla M, Sánchez Romero M. 2021. The radiocarbon chronology of tholos-type megalithic tombs in Iberia: exploring diverse social trajectories. Trabajos de Prehistoria 78(2):277–291. doi: 10.3989/tp.2021.12276.

Aranda Jiménez G, Milesi García L, Hamilton D, Díaz-Zorita Bonilla M, Vílchez Suárez M, Robles Carrasco S, Sánchez Romero M, Benavides López JA. 2022. The tempo of the Iberian megalithic rituals in the European context: The cemetery of Panoría. Journal of Archaeological Science 140:105579. doi: 10.1016/j.jas.2022.105579.

Armbruester T. 2006. Before the monument? Ceramics with a line below the rim (A preliminary report from Vale de Rodrigo 3, Évora). In: Bicho N, coord. Simbolismo, arte e espaços sagrados na Pré-História da Península Ibérica. Actas do 4º Congresso de Arqueologia Peninsular. Faro: Universidade do Algarve. p. 53–67.

Barroso Bermejo R, Bueno Ramírez P, Balbín Berhmann R, Vázquez Cuesta A, González Cordero A. 2012. Agregaciones protohistóricas a megalitos prehistóricos: el dolmen de Lagunita I, Santiago de Alcántara (Cáceres). In: Deus M, editor. Actas do V Encontro de Arqueologia do Sudoeste peninsular. Almodôvar, 18 a 20 de novembro de 2010. Almodôvar: Município de Almodôvar. p. 99–111.

Bayliss A, Beavan N, Bronk Ramsey V, Delgado Huertas A, Díaz-Zorita Bonilla M, Dunbar E, Fernández Flores A, García Sanjuán L, Hamilton D, Mora González A, Whittle A. 2016. La cronología radiocarbónica del tholos de Montelirio. In A. Fernández Flores A., García Sanjuán L, Diaz-Zorita Bonilla M, editors. Montelirio, Un gran monumento megalítico de la Edad del Cobre. Monografías Arqueología. Sevilla: Junta de Andalucía. p. 485–502.

Bayliss A, Bronk Ramsey C, van der Plicht J, Whittle A. 2007. Bradshaw and bayes: towards a timetable for the Neolithic. In: Bayliss A, Whittle A, editors. Histories of the dead: building chronologies for five southern British long barrows. Cambridge Archaeological Journal 17(1) supplement 1:1–28. doi: 10.1017/S0959774307000145.

Bayliss A, Whittle A, editors. 2007. Histories of the dead: building chronologies for five southern British long barrows. Cambridge Archaeological Journal 17(1), supplement 1. doi: 10.1017/S0959774307000145.

Blanco Freijeiro A and Rothenberg B. 1981. Exploración Arqueometalúrgica de Huelva (EAH). Barcelona: Labor/Río Tinto Minera.

Blanco-González A, Lillios KT, López-Sáez JA, Drake BL. 2018. Cultural, demographic and environmental dynamics of the Copper and Early Bronze Age in Iberia (3300–1500 BC): towards an interregional multiproxy comparison at the time of the 4.2 ky BP event. Journal of World Prehistory 31:1–79. doi: 10.1007/s10963-018-9113-3.

Boaventura R. 2009. As Antas e o Megalitismo da Região de Lisboa [PhD thesis]. Lisboa: Universidad de Lisboa. Available from: http://hdl.handle.net/10451/587.

Boaventura R. 2011. Chronology of megalithism in south-central Portugal/Cronología en el centro-sur de Portugal. In: García Sanjuán L, Scarre C, Weathley D, editors. Exploring time and matter in prehistoric monuments: absolute chronology and rare rocks in European megaliths. Proceedings of the 2nd European Megalithic Studies Group Meeting (Sevilla, España 2008). Junta de Andalucía. Sevilla. Menga, Revista de Prehistoria de Andalucía, Monographic 1:159–190.

Boaventura R, Mataloto R. 2013. Entre mortos e vivos: nótulas acerca da cronología absoluta do sul de Portuga. Revista Portuguesa de Arqueologia 16:81–101. Available from: http://www.patrimoniocultural.gov.pt/static/data/publicacoes/rpa/rpa16/04_81–101.pdf.

Boaventura R, Ferreira MT, Silva AM. 2013. Perscrutando espólios Antiguos: a anta de Sobreira 1 (Elvas). Revista Portuguesa de Arqueologia 16:63–79. Available from: http://www.patrimoniocultural.gov.pt/static/data/publicacoes/rpa/rpa16/03_63-79.pdf.

Bronk Ramsey C. 1995. Radiocarbon calibration and analysis of stratigraphy: the OxCal program. Radiocarbon 37:425–430. doi: 10.1017/S0033822200030903.

Bronk Ramsey C. 2001. Development of the radiocarbon calibration program. Radiocarbon 43(2):355–363. doi: 10.1017/S0033822200038212.
Bronk Ramsey C. 2008. Radiocarbon dating: revolution in understanding. Archaeometry 50(2):249–275. doi: 10.1111/j.1475-4754.2008.00394.x
Bronk Ramsey C. 2009. Bayesian analysis of radiocarbon dates. Radiocarbon 51(1):337–360. doi: 10.1017/S0033822200033865.
Bronk Ramsey C. 2021. OxCal 4.4. Available from: https://c14.arch.ox.ac.uk/oxcal.html.
Buck CE, Cavanagh WG, Litton CD. 1996. Bayesian approach to interpreting archaeological data. Chichester: Wiley.
Bueno Ramírez P. 1991. Megalitos de la Meseta Sur: los dólmenes de Azután y La Estrella (Toledo). Excavaciones Arqueológicas en España, 159. Madrid: Ministerio de Cultura.
Bueno Ramírez P, Balbín Berhmann R, Barroso Bermejo R. 2005. El dolmen de Azután (Toledo). Áreas de habitación y áreas funerarias en la cuenca interior del Tajo. Alcalá de Henares: Universidad de Alcalá.
Bueno Ramírez P, Barroso Bermejo R, Balbín Berhmann R. 2004. Construcciones megalíticas avanzadas de la cuenca interior del río Tajo. El núcleo cacereño. SPAL Revista de Prehistoria y Arqueología 13:83–112.
Bueno Ramírez P, Linares-Catela JA, Balbín Berhmann R, Barroso Bermejo R, editors. 2018. Símbolos de la muerte en la Prehistoria Reciente del sur de Europa. El dolmen de Soto, Huelva. España. Arqueología Monografías. Sevilla: Junta de Andalucía.
Bueno Ramírez P, Barroso Bermejo R, Balbín Behrman R, Campo Martín M, Etxeberría Gabilondo F, González Martín A, Herrasti Erlogorri L, Juan Treserras J, López García P, López Sáez JA, Matamala JC, Sánchez B. 2002. Áreas habitacionales y funerarias en el Neolítico de la cuenca interior del Tajo: la provincia de Toledo. Trabajos de Prehistoria 59(2):65–79. doi: 10.3989/tp.2002.v59.i2.198.
Burleigh R, Matthews K, & Ambers J. 1982. British Museum natural radiocarbon measurements XIV. Radiocarbon 24 (3):229–261. doi: 10.1017/S0033822200005142.
Cabrero García R, Ruiz Moreno MT, Blas Cuadrado L, Sabaté I. 1997. El poblado de Amarguillo II en Los Molares (Sevilla) y su entorno inmediato en la campiña: últimas analíticas realizadas. Anuario Arqueológico de Andalucía/1993 (II): 131–141.
Carvalho AF. 2015. A two-stage economic succession at the inception of farming in Central Portugal. Preliminary examination of posible causes and consequences. Vegueta. Anuario de la Facultad de Geografía e Historia 15:89–109. Available from: https://revistavegueta.ulpgc.es/ojs/index.php/revistavegueta/article/view/297/544.
Carvalho AF, Cardoso, JL. 2015. Insights on the changing dynamics of cemetery use in the Neolithic and Chalcolithic of Southern Portugal. Radiocarbon dating of Lugar do Canto cave (Santarém). SPAL, Revista de Prehistoria y Arqueología 24:35–63. doi: 10.12795/spal.2015i24.02.
Carvalho AF, Rocha L. 2016. Datação direta e análise de paleodietas dos indivíduos da Anta de Cabeceira 4ª (Mora, Évora). DigitAR: Revista Digital de Arqueologia, Arquitectura e Artes 3:53–61. doi: 10.14195/2182-844X_3_7.
Cerdán C, Leisner G, Leisner V. 1952. Los sepulcros megalíticos de Huelva. Informes y Memorias de la Comisaría de Excavaciones Arqueológicas, 26. Madrid: Ministerio de Educación Nacional.
Chambon P, Blin A, Bronk Ramsey C, Kromer B, Bayliss A, Beavan N, Healy F, Whittle A. 2017. Collecting the dead: temporality and disposal in the Neolithic hypogée of Les Mournouards II (Marne, France)". Germania 95:93–143.
Emslie SD, Silva AM, Valera A, Vijande Vila E, Melo L, Curate F, Fidalgo D, Inácio N, Molina Moreno M, Cambra-Moo O, González Martín A, Barroso-Bermejo R, Montero Artús R, García Sanjuán L. 2022. The use and abuse of cinnabar in Late Neolithic and Copper Age Iberia. International Journal of Osteoarchaeology 32 (1): 202–214. doi: 10.1002/oa.3056.
Fernández Ruiz J, Márquez Romero JE. 2001. Megalitismo en la cuenca media del río Grande (Málaga). Málaga: Universidad de Málaga.
Fernández Ruiz J, Márquez Romero JE. 2008. Nuevos datos sobre la cronología del sepulcro megalítico del «Tesorillo de la Llaná» (Alozaina, Málaga). Mainake XXX: 345–354.
Fernández Ruiz J, Marqués Merelo I, Ferrer Palma JE, Baldomero Navarro A. 1997. Los enterramientos colectivos de El Tardón (Antequera, Málaga). In: Balbín Berhmann R, Bueno Ramírez P, editors. II Congreso de Arqueología Peninsular Neolítico, Calcolítico y Bronce, vol. II (Zamora, Septiembre de 1996). Zamora: Fundación Rei Afonso Henriques. p. 371–380.
Ferrer Palma JE. 1997. Proyecto de reconstrucción arquitectónica y medioambiental en la necrópolis megalítica de Antequera (1985–1991): aspectos metodológicos. In: Martín Ruiz JM, Martín Ruiz JA, Sánchez Banderas PJ, editors. Arqueología a la Carta: relaciones entre teoría y método en la práctica arqueológica. Málaga: Diputación Provincial de Málaga. p. 119–144.
García Sanjuán L, editor. 1998. La Traviesa. Ritual funerario y jerarquización social de una comunidad de la Edad del Bronce de Sierra Morena occidental. SPAL Monografías 1. Sevilla: Universidad de Sevilla.

García Sanjuán L, Lozano Rodríguez JA. 2016. Menga (Andalusia, Spain): biography of an exceptional megalithic monument. In: Laporte L, Scarre C, editors. The megalithic architectures of Europe. Oxford: Oxbow Books. p. 3–16.

García Sanjuán L, Weathley DW, Costa Caramé M. 2011. The numerical chronology of the megalithic phenomenon in southern Spain: progress and problems. In: García Sanjuán L, Scarre C, Weathley D, editors. Exploring Time and Matter in Prehistoric Monuments: Absolute Chronology and Rare Rocks in European megaliths. Proceedings of the 2nd European Megalithic Studies Group Meeting (Sevilla, España 2008). Junta de Andalucía. Sevilla. Menga, Revista de Prehistoria de Andalucía, Monographic 1:121–157.

García Sanjuán L, Vargas Jiménez JM, Cáceres Puro LM, Costa Caramé, ME, Díaz-Guardamino Uribe M, Díaz-Zorita Bonilla M, Fernández Flores A, Hurtado Pérez V, López Aldana PM, Méndez Izquierdo E, Pajuelo Pando A, Rodríguez Vidal J, Wheatley D, Bronk Ramsey C, Delgado-Huertas A, Dunbar E, Mora González A, Bayliss A, Beavan N, Hamilton D, Whittle A. 2018. Assembling the dead, gathering the living: radiocarbon dating and bayesian Modelling for Copper Age Valencina de la Concepción (Seville, Spain). Journal of World Prehistory 31(2):179–313. doi: 10.1007/s10963-018-9114-2.

García Sanjuán L, Fernández Rodríguez LE, Balsera Nieto V, Mora Molina C, Cisneros García M, Rodríguez Ariza O, Lozano Rodríguez JA, Pérez Díaz S, Luelmo Lautenschlaeger R, López Sáez JA. 2020. Builders of Megaliths: society, monumentality and environment in 4th millennium cal BC Antequera. Journal of Archaeological Science: Reports, 102555. doi: 10.1016/j.jasrep.2020.102555.

Gavilán Ceballos B, Mas Cornellá M. 2021. Casas de Don Pedro (Belmez, Córdoba): menhires y cronología. Sagvntum. Papeles del Laboratorio de Arqueología de Valencia 53:239–244. doi: 10.7203/SAGVNTVM.53.20969

Gomes MV 1994. O sepulcro colectivo de Pedra Escorregadia (Vila do Bispo, Faro)— notícia da escavação de 1991. V Jornadas Arqueológicas 2:79–91.

Gonçalves VS 2001. A Anta 2 da Herdade de Santa Margarida (Reguengos de Monsaraz). Revista Portuguesa de Arqueologia 4(2):115–206. Available from: http://www.patrimoniocultural.gov.pt/media/uploads/revistaportuguesadearqueologia/4_2/6.pdf.

Gonçalves VS. 2003a. STAM-3, a Anta 3 da Herdade de Santa Margarida (Reguengos de Monsaraz). Trabalhos de Arqueologia 32. Lisboa: Instituto Português de Arqueologia. Available from: http://www.patrimoniocultural.gov.pt/pt/publications/trabalhos-de-arqueologia-32-stam-3-a-anta-da-herdade-da-santa-margarida-reguengos-de-monsaraz.

Gonçalves VS. 2003b. A Anta 2 da Herdade dos Cebolinhos (Reguengos de Monsaraz, Évora): sinopse das intervenções de 1996–97 e duas datações de radiocarbono para a última utilização da Câmara ortostática. Revista Portuguesa de Arqueologia 16 (2): 143–166. Available from: http://www.patrimoniocultural.gov.pt/static/data/publicacoes/rpa/rpa6_2/05_143_166.pdf

Heaton T., Köhler P, Butzin M, Bard E, Reimer R, Austin W, Bronk Ramsey C, Grootes P, Hughen K, Kromer K, et al. 2020. Marine20-The Marine Radiocarbon Age Calibration Curve (0–55,000 cal BP). Radiocarbon 62(4):779–820. doi: 10.1017/RDC.2020.68.

Kalb P. 2013. Vale de Rodrigo. A case study in early technology and building material management in the megalithism of southern Portugal. In Guyodo JN, Mens E, dirs., Les premières architectures en pierre en Europe occidentale du Ve au IIe millénaire avant J.-C. Rennes: Presses Universitaires de Rennes. p. 123–131.

Larsson L. 2000. Symbols in stone: ritual activities and petrified traditions. In: Jorge VO, coord. 3º Congresso de Arqueología Peninsular, vol. 3, Neolitizaçao e megalitismo da Península Ibérica, Villa Real, Portugal, septiembre de 1999. Porto: ADECAP. p. 445–458.

Leisner G, Leisner V. 1956. Die Megalithgräber der Iberischen Halbinsel. Der Westen. Madrider Forschungen Band 1. Berlín: Walter de Gruyter & Co.

Leisner G, Leisner V. 1959. Die Megalithgräber der Iberischen Halbinsel. Der Westen. Madrider Forschungen Band 1/2. Berlín: Walter de Gruyter & Co.

Linares-Catela JA. 2006. Documentación, consolidación y puesta en valor del Conjunto Dolménico de Los Gabrieles (Valverde del Camino, Huelva). 2ª Fase. Anuario Arqueológico de Andalucía/2003 (III):200–214.

Linares-Catela JA. 2016. The megalithic architecture of Huelva (Spain): typology, construction and technical traditions in eastern Andévalo. In: Laporte L, Scarre C, editors. The megalithic architectures of Europe. Oxford: Oxbow Books. p. 111–126.

Linares-Catela JA. 2017. El megalitismo en el sur de la Península Ibérica. Arquitectura, construcción y usos de los monumentos del área de Huelva, Andalucía occidental [PhD thesis]. Huelva: Universidad de Huelva. Available from: http://hdl.handle.net/10272/15504.

Linares-Catela JA. 2020. Monumentalidad funeraria del Bronce en el sur de la península ibérica: la necrópolis de La Orden-Seminario (Huelva)". Spal, Revista de Prehistoria y Arqueología 29(1): 13–39. doi: 10.12795/spal.2020.i29.01.

Linares-Catela JA. 2021. « Chaînes opératoires mégalithiques » : construction et transformation des architectures funéraires dans la région de Huelva (Espagne). Dolmens de Los Llanetes, ensemble d'El Pozuelo. In: Ard V, Mens E, Gandelin M, editors. Mégalithismes et monumentalismes funéraires. Passé, présent, futur. Leiden: Sidestone Press. p. 203–224.
Linares-Catela JA, García Sanjuán L. 2010. Contribuciones a la cronología absoluta del megalitismo andaluz. Nuevas fechas radiocarbónicas de sitios megalíticos del Andévalo oriental (Huelva). Menga, Revista de prehistoria de Andalucía 1:135–151.
Linares-Catela JA, Mora Molina C. 2018. Capítulo 7. El dolmen de Soto 1, Huelva. Arqueología del monumento. In: Bueno Ramírez P, Linares-Catela JA, Balbín Berhmann R, Barroso Bermejo R, editors. Símbolos de la muerte en la Prehistoria Reciente del sur de Europa. El dolmen de Soto, Huelva. España. Arqueología Monografías. Sevilla: Junta de Andalucía. p. 98–130.
Linares-Catela JA, Vera-Rodríguez, J C. 2021. La cronología de la necrópolis de La Orden-Seminario (Huelva). Temporalidades de la actividad funeraria en las sepulturas del III milenio cal BC. Trabajos de Prehistoria 78(1):67–85. doi: 10.3989/tp.2021.12265.
Lozano Medina A, Aranda Jiménez G. 2017. La temporalidad de las sepulturas megalíticas tipo tholos del sur de la península ibérica. SPAL Revista de Prehistoria y Arqueología 26:17–31. doi: 10.12795/spal.2017i26.01.
Lozano Medina A, Aranda Jiménez G. 2018. Longlasting sacred landscapes: The numerical chronology of the megalithic phenomenon in southeastern Iberia. Journal of Archaeological Science: Reports 19:224–238. doi: 10.1016/j.jasrep.2018.02.038.
Márquez Romero JE, Fernández Ruiz J, Mata Vivar E, editors. 2009. El sepulcro megalítico del Tesorillo de la Llaná, Alozaina (Málaga). Una estructura funeraria singular en la cuenca media del Río Grande. Málaga: Universidad de Málaga.
Mataloto R, Andrade MA, Pereira A. 2017. O Megalitismo das pequenas antas: novos dados para um velho problema. Estudos Arqueológicos De Oeiras 23:33–156.
Meadows J, Rinne C, Immel A, Fuchs K, Krause-Kyora B, Drummer C. 2020. High-precision bayesian chronological modeling on a calibration plateau: the Niedertiefenbach gallery grave. Radiocarbon 2020:1–24. doi: 10.1017/RDC.2020.76.
Michczyñski A, Michczyñska DJ. 2006. The effect of pdf peaks' height increase during calibration of radiocarbon date sets. Geochronometria. Journal on Methods and Applications of Absolute Chronology 25:1–4.
Millard A 2014. Conventions for reporting radiocarbon determinations. Radiocarbon 56(2): 555–559. doi: 10.2458/56.17455
Molina F, Mederos A, Delgado-Huertas A, Cámara JA, Peña V, Martínez RM, Esquivel FJ, Granados A, Jiménez-Brobeil S, Esquivel JA. 2020. La necrópolis calcolítica de Los Millares: dataciones radiocarbónicas y valoración de la dieta y del medio ambiente a partir del análisis de isótopos estables. Trabajos de Prehistoria 77(1):67–86. doi: 10.3989/tp.2020.12247.
Monge Soares AM, Peixoto Cabral JMP. 1993. Cronología absoluta para o Calcolítico da Estremadura e do Sul de Portugal. In: Jorge VO, coord. I Congresso de Arqueologia Peninsular, vol. 3–4. Trabalhos de Antropologia e Etnologia, 32. Porto: SPAE. p. 217–235.
Monteiro Rodrigues S, Oliveira C. 2018. A Anta dos Currais do Galhoradas (Castelo de Vide, Alto Alentejo, Portugal): análise química de residuos orgánicos identificados em recipientes cerámicos. In: Senna-Martinez JC, Diniz M, Carvalho AF, editors. De Gibraltar aos Pirenéus: Megalitismo, Vida e Morte na Fachada Atlântica Peninsular. Nelas: Fundação Lapa do Lobo/UNIARQ. p. 453–480. Available from: http://hdl.handle.net/10451/35835.
Nocete F, Lizcano R, Nieto, JM, Sáez R, Linares JA, Orihuela A, Rodríguez MO. 2004. El desarrollo del proceso interno: el territorio megalítico en el Andévalo oriental. In: Nocete F, coord. Odiel. Proyecto de investigación arqueológica para el análisis del origen de la desigualdad social en el Suroeste de la Península Ibérica Monografías Arqueología. Sevilla: Junta de Andalucía. p. 47–77.
Nocete F, Sáez R, Rodríguez Bayona M, Peramo A, Inacio N, Abril D. 2011. Direct chronometry (14C AMS) of the earliest copper metallurgy in the Guadalquivir Basin (Spain) during the third millennium BC: first regional database. Journal of Archaeological Science, 38 (12):3278–3295. doi: 10.1016/j.jas.2011.07.008.
Oliveira J. 1997a. Datas absolutas de monumentos da Bacia hidrográfica do río Sever. In: Balbín Berhmann R, Bueno Ramírez P, editors. II Congreso de Arqueología Peninsular Neolítico, Calcolítico y Bronce, vol. II (Zamora, Septiembre de 1996). Zamora: Fundación Rei Afonso Henriques. p. 229–239.
Oliveira J. 1997b. Monumentos megalíticos da Bacia hidrográfica do rio Sever. Lisboa: Ibn Maruán.
Oliveira J. 2006. Património Arqueológico da Coudelaria de Alter e as primeiras comunidades agropastoris. Lisboa: Colibrí/Universidade de Évora.
Pardo-Gordó S, Carvalho AF. 2020. Population dynamics during the Neolithic transition and the onset of megalithism in Portugal according to summed probability distribution of radiocarbon determinations. Archaeological and

Anthropological Sciences 12(2020):129. doi: 10.1007/s12520–020–01086-2
Piñón Varela F. 1987. Constructores de sepulcros megalíticos en Huelva: problemas de una implantación. In: El Megalitismo en la Península Ibérica. Madrid: Ministerio de Cultura. p. 45–72.
Piñón Varela F. 2004. El horizonte cultural megalítico en el área de Huelva. Monografías Arqueologia. Sevilla: Junta de Andalucía.
Ramos Muñoz J, Giles Pacheco F, editors. 1996. El dolmen de Alberite (Villamartín). Aportaciones a las formas económicas y sociales de las comunidades neolíticas en el noroeste de Cádiz. Cádiz: Servicio de Publicaciones de la Universidad de Cádiz. Available from: https://tiendaeditorial.uca.es/gb/sales-catalog/2883-el-dolmen-de-alberite-villamartin-aportaciones-a-las-formas-economicas-y-sociales-de-las-comunidades-neoliticas-en-el-nor.html.
Recio A, Martín E, Ramos Muñoz J, Domínguez Bella S, Macías M. 1998. El dolmen de "Cerro de la Corona" de "Totalán". Contribución al estudio de la formación económico-social tribal en la Axarquía de Málaga. Málaga: Servicio de Publicaciones de la Diputación de Málaga.
Reimer PJ, Austin W, Bard E, Bayliss A, Blackwell PG, Bronk Ramsey C, Butzin M, Cheng H, Edwards, RL, Friedrich M, Grootes PM, Guilderson TP, Hajdas I, Heaton TJ, Hogg AG, Hughen KA, Kromer B, Manning SW, Muscheler R, Palmer JG, Pearson C, Van der Plicht J, Reimer RW, Richards DA, Scott EM, Southon JR, Turney CSM, Wacker L, Adolphi F, Büntgen U, Capano M, Fahrni SM, Fogtmann-Schulz A, Friedrich R, Köhler P, Kudsk S, Miyake F, Olsen J, Reinig F, Sakamoto M, Sookdeo A, Talamo S. 2020: The IntCal20 Northern Hemisphere radiocarbon age calibration curve (0–55 cal kBP). Radiocarbon 62(4):725–757. doi: 10.1017/RDC.2020.41.
Robles F, Monge Soares A, Alves TF, Curate F, Valério P, Peleja, S. 2013. O Tholos Centirã (Brinches, Serpa). Constructores e utilizadores; práticas funerárias e cronologías". In: Jiménez Ávila J, Bustamante M, García Cabezas M, editors. VI Encuentro de Arqueologia del Suroeste Peninsular (Villafranca de los Barros 2012). Villafranca de los Barros (Badajoz). p. 319–356.
Rocha L. 2005. Estudo do megalitismo funerário no Alentejo Central: a contribuição de Manuel Heleno [PhD thesis]. Lisboa: Universidad de Lisboa. Available from: http://hdl.handle.net/10174/2237
Rocha L. 2020. Datações absolutas para contextos funerários do Sul de Portugal: algumas reflexões em torno das arquiteturas e dos espólios. Scientia Antiquitatis 4 (2):81–104. Available from: http://www.scientiaantiquitatis.uevora.pt/index.php/SA/article/view/277
Rocha L. 2021. Anta da Tapada do Castelo (Santo António das Areias, Marvão) no quadro das paisagens megalíticas do Norte Alentejano. Memórias das Freguesias de Santo António das Areias e Beirã. Marvão.
Rocha L, Duarte C. 2009. Megalitismo funerário no Alentejo Central: os dados antropológicos das escavaçoes de Manuel Heleno. In: Polo M, García-Prósper E, editors. Investigaciones histórico-médicas sobre salud y enfermedad en el pasado. Valencia: Grupo Paleolab/SEP. p. 763–781.
Rocha L, Morgado P. 2020. Duas novas datações para contextos funerários do Sul de Portugal: a Anta da Serrinha (Monforte). Scientia Antiquitatis 4(2):105–116. Available from: http://www.scientiaantiquitatis.uevora.pt/index.php/SA/article/view/283
Rothenberg B, Blanco Freijeiro, A. 1980. Ancient copper mining and smelting at Chinflón (Huelva SW, Spain). In: Craddock PT, editor. Scientific studies in early mining and extractives metallurgy. Paper 20. London: British Museum Occasional. p. 41–62.
Ruiz Gálvez ML. 1995. Cronología de la Ría de Huelva en el marco del Bronce Final de Europa Occidental. In: Ruiz Gálvez M, editor. Ritos de Paso y Puntos de paso. La Ría de Huelva el Mundo del Bronce Final Europeo. Complutum Extra 5. Madrid. p. 79–84.
Ruiz Gálvez ML. 2000. El conjunto dolménico de la Dehesa Boyal de Montehermoso. In: Jiménez Ávila J, Navascués JJ, editors. El Megalitismo en Extremadura (homenaje a Elías Diéguez Luengo). Extremadura Arqueológica VIII. Badajoz: Junta de Extremadura. p. 187–207.
Santos FJ, Agulló L, Diéguez A, Gómez Martínez I. 2015. Datación radiocarbónica y arqueología: la experiencia del Centro Nacional de Aceleradores (Sevilla). Menga, Revista de Prehistoria de Andalucía 6:95–111.
Santos FJ, Gómez Martínez I, García León, M. 2009. Radiocarbon measurement program at the Centro Nacional de Aceleradores (CNA), Spain. Radiocarbon 51(2):883–889. doi: 10.1017/S0033822200056198.
Scarre C. 2010. Rocks of ages: tempo and time in megalithic monuments. European Journal of Archaeology 13(2):175–193. doi: 10.1177/1461957110370731.
Schulz Paulsson B. 2017. Time and stone: the emergence and development of megaliths and megalithic societies in Europe. Oxford: Archaeopress.
Schulz Paulsson B. 2019. Radiocarbon dates and Bayesian modeling support maritime diffusion model for megaliths in Europe. Proceedings of the National Academy of Sciences 116(9):3460–3465. doi: 10.1073/pnas.1813268116.
Silva AM, Sousa AC, Boaventura R, Scarre C. 2019. The forgotten bones of the dolmen of Carrascal

(Agualva, Sintra, Portugal). Examining old human remains. Trabajos de Prehistoria 76(2):345–356. doi: 10.3989/tp.2019.12242.
Silva AM, Catarina Sousa A, Scarre C. 2021. A closer look at the forgotten bones of the Dolmen of Pedras Grandes (Odivelas, Portugal). Examining old human remains 7. SPAL, Revista de Prehistoria y Arqueología (30.2): 20–46. doi: 10.12795/spal.2021.i30.16.
Soares J. 2010. Dolmen da Pedra Branca. Datações radiométricas. Musa 3:70–82. Available from: http://maeds.amrs.pt/informacao/PUBLICACOES/2010/pedra_branca.pdf.
Soares J, Silva CT. 2010. Anta Grande do Zambujeiro, arquitectura e poder: intervenção arqueológica do MAEDS, 1985–87. Musa 3: 83–129. Available from: http://maeds.amrs.pt/informacao/PUBLICACOES/2010/anta_grande_zambujeiro_.pdf.
Steuri N, Siebke I, Furtwängler A, Szidat S, Krause J, Lösch S, Hafner A. 2019. Multiple radiocarbon dating of human remains: clarifying the chronology and sequences of burials in the late Neolithic Dolmen of Oberbipp (Switzerland). Radiocarbon 61(6):1697–1709. doi: 10.1017/RDC.2019.96.
Stuiver M, Polach HA. 1977. Reporting of ^{14}C Data. Radiocarbon 19:355–363. doi: 10.1017/S0033822200003672.
Théry Parisot I, Chabal L, Chrzavzez J. 2010. Anthracology and taphonomy, from wood gathering to charcoal analysis. A review of the taphonomic processes modifying charcoal assemblages in archaeological contexts. Palaeogeography, Palaeoclimatology, Palaeoecology 291(1–2):142–153. doi: 10.1016/j.palaeo.2009.09.016.
Valera AC, Figuereido M, Lourenço M, Shaw Evangelista L, Basilio AC, Wood R. 2019. O tholos de Cardim 6. Porto Torrão, Ferreira do Alentejo (Beja). ERA Monográfica 3. Lisboa: NIA-Era Arqueologia.
Valera AC, do Pereiro T. 2022. Conologia absoluta da anta de Pardais 3. In: Valera AC, do Pereiro T, editors. A Anta de Pardais 3 no contexto do megalitismo do vale do Raia (Cabeção, Mora). Lisboa: NIA/Era Arqueologia. p. 33–35.
Valera AC, Wood R. 2020. Cronologia absoluta do sepulcro 4 e sua relação com outros contextos do 3º milénio AC nos Perdigões. In: Valera AC, editor. O sepulcro 4 dos Perdigões. Um tholos da segunda metade do 3º milénio AC. Perdigões Monográfica 02. Lisboa: NIA/Era Arqueologia. p. 37–44.
Vijande Vila E. 2009. El poblado de Campo de Hockey (San Fernando, Cádiz): resultados preliminares y líneas de investigación futuras para el conocimiento de las formaciones sociales tribales en la Bahía de Cádiz (tránsito V-IV milenios a.n.e.). RAMPAS, Revista Atlántica-Mediterránea de Prehistoria y Arqueología Social 11:265–284. Available from: https://revistas.uca.es/index.php/rampas/article/view/1357.
Vijande-Vila E, Díaz-Zorita Bonilla M, Morell-Rovira B, Olalde I, Sánchez-Barba Muñoz LP, Domínguez-Bella S, Emslie SD, Becerra-Martín S, Rubio-Salvador A, Fernández-Sánchez DS, et al. 2022. At the beginnings of the funerary Megalithism in Iberia at Campo de Hockey necropolis. Scientific Reports 12:9431. doi: 10.1038/s41598-022-13014-6.
Vijande-Vila E, Domínguez-Bella S, Cantillo Duarte JJ, Martínez López J, Barrena Tocino A. 2015. Social inequalities in the Neolithic of southern Europe: the grave goods of the Campo de Hockey necropolis (San Fernando, Cádiz, Spain). Comptes Rendus Palevol 14 (2): 147–161. doi: 10.1016/j.crpv.2014.11.004.
Wang S, Ge Q, Wang F, Wen X, Huang J. 2013. Abrupt climate changes of Holocene. Chinese Geographical Science 23(1):1–12. doi: 10.1007/s11769-013-0591-z.
Ward GK, Wilson SR. 1978. Procedures for comparing and combining radiocarbon age determinations. Archaeometry 20(1):19–31. doi: 10.1111/j.1475-4754.1978.tb00208.x.
Whittle EH, Arnaud JM. 1975. Thermoluminescent dating of Neolithic and Chalcolithic pottery from sites in central Portugal. Archaeometry 17(1):5–24. doi: 10.1111/j.1475-4754.1975.tb00112.x.
Whittle A, Barclay A, Bayliss A, Mcfayden L, Schulting R, Wysocki, M. 2007. Building for the dead: events, processes and changing worldviews from the thirty-eight to the thirty-fouth centuries cal. BC in Southern Britain. In: Bayliss A, Whittle A, editors. Histories of the dead: building chronologies for five southern British long barrows. Cambridge Archaeological Journal 17(1):S1:123–147. doi: 10.1017/S0959774307000145.
Whittle A, Bayliss A, Healy F. 2008. The timing and tempo of change: examples from the fourth millennium cal. BC in southern England. Cambridge Archaeological Journal 18(1):65–70. doi: 10.1017/S0959774308000061.
William AN. 2012. The use of summed radiocarbon probability distributions in archaeology: a review of methods. Journal of Archaeological Science 39(3):578–589. doi: 10.1016/j.jas.2011.07.014.
Zapata L, Figueiral I. 2003. Carbones y semillas en los yacimientos dolménicos: posibilidades y límites del análisis arqueobotánico. In: Buxó R, Piqué R, editors. La recogida de muestras en arqueobotánica: objetivos y propuestas metodológicas. La gestión de los recursos vegetales y la transformación del paleopaisaje en el Mediterráneo occidental. Barcelona: Museu d'Arqueologia de Catalunya. p. 55–65.