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THE RADIOCARBON CHRONOLOGY OF SOUTHERN SPAIN'S LATE PREHISTORY (5600–1000 CAL BC): A COMPARATIVE REVIEW

Summary. *This paper is the first updated review of the scope, depth and problems related to the current radiocarbon chronology of the late prehistory of southern Iberia. The aim is twofold. First, it critically analyses the quantity and quality of radiocarbon dates used to interpret the diverse trajectories of western Mediterranean societies throughout more than four millennia. Secondly, it reviews a set of three different and prominent archaeological phenomena from an inter-regional comparative perspective: primary and secondary burial practices, domestic stone architecture and ditched enclosures. Our long-term, geographically wide-ranging approach locates similarities while highlighting the effects of local and historical conditions in certain divergent circumstances.*

INTRODUCTION

The main aim of this paper is to examine comparatively the span and inter-regional and local dynamics of three of the most debated cultural phenomena of southern Spain's late prehistory: burial practices, domestic stone architecture and ditched enclosures. To achieve this aim, our approach relies on two basic methodological principles: the use of a comparative perspective and of radiocarbon chronology.

Regarding the first principle, as recent studies have successfully shown, comparative approaches do reveal insights into the scale and implications of the social and cultural processes observed at the local or intra-regional level (Chapman 2008; Lillios 2011). Our approach brings the weight of the research tradition to bear on a regional scale and assesses the possibility of establishing inter-regional comparison parameters. As for the second principle, it is our view that the analysis of long-term social processes in late prehistory (*c*.5600–850 cal BC in the case of southern Spain) can only be achieved through the statistical analysis of radiocarbon data. Therefore, our analysis is based on a critical discussion of the scope, depth and problems associated with the currently available radiocarbon chronology for the late prehistory of southern Spain, followed by the statistical modelling of selected subsets of the available dates.

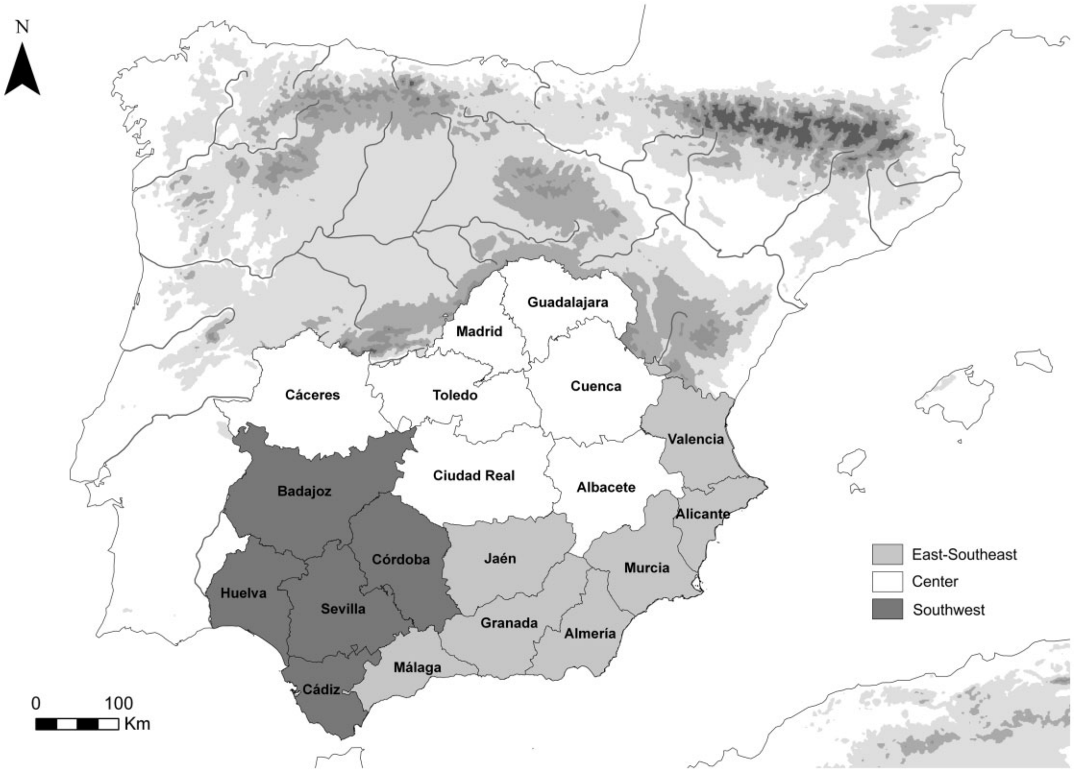

Figure 1
Map of the area under study.

This study stems from a joint project (2009–12) run by the Universities of Seville and Valencia and the Spanish National Research Council with the aim of establishing the basis for a comparative approach to the late prehistory of southern Spain. The scope and the extent of the analysis presented in this paper are in accordance with the limitations of the available space, both in terms of the data and the modelling. The geographical area involved comprises 42 per cent of the total surface area of the Iberian Peninsula and 50 per cent of mainland Spain: 244,591 km^2, almost the same size as the United Kingdom (Fig. 1). Roughly speaking, this is the most intensely studied area of Spain, with major research dating back to the late nineteenth century and, certainly, the one with the strongest international impact to date. For practical purposes, the area involved has been subdivided into three regions that are shown in Figure 1 with their respective demarcations: east–south-east (which covers the Mediterranean provinces and part of Jaen), centre (the upper and middle basins of the Rivers Tagus and Guadiana) and south-west (covering the middle and lower Guadalquivir and middle Guadiana basins).

A CRITICAL REVIEW OF SOUTHERN SPAIN'S RADIOCARBON DATASET

Over fifty years have passed since the first radiocarbon date for Iberian prehistory was published (Almagro 1959). It was not, however, until the mid-1990s that the 'first mature chronological synthesis' (Gilman 2003, 10) of Iberian and Balearic late prehistory was published (Castro *et al*. 1996), based on a total of 1862 absolute dates (compiled up to 1993) from the last 9000 years. While it is true that the quantity and quality of the currently available empirical base for the radiocarbon chronology of Iberian prehistory have significant limitations, it is fair to say that since the end of the 1950s, prehistorians working on Iberia have had an acceptable degree of success in integrating radiocarbon dating into their scientific interpretations.

The discussion presented here is based on a significant upgrade of the compilation made by Castro and others in 1996, incorporating 805 newly published dates for the specified area (see below) and the period 5600–1000 cal BC.[1] Until July 2012, a total of 1257 dates had been gathered. Nevertheless, our results have been prepared from those with a standard deviation lower than, or equal to, 100 years: 1072 dates from 226 sites, a mean density of 0.004 dates and 0.0001 sites per km^2. The average of standard deviations in the 1072 dates selected is ±54. Variation in means by province is noteworthy, fluctuating between ±45 (Madrid) and ±65 (Albacete), depending on the number of dates and when they were obtained. Information regarding the dated material is available for 1020 of the 1072 dates used. A total of 43 per cent are short-lived samples, mostly bone (32 per cent), the most reliable of all possible samples (Dee *et al*. 2012), with a minority of charred short-lived plants (8 per cent). Most of the long-lived samples have been taken from charred material (45 per cent), especially on conglomerates used before AMS became widespread. The provinces where most dates have been obtained from short-lived samples, mainly bone, are Madrid, Granada and Alicante. This suggests that a larger number of researchers have become aware of the problems of the inbuilt age of wood and charcoal samples, consequently dating short-life samples.

The spatial distribution of this dataset is irregular, with a large difference between the western and eastern parts of Iberia (Fig. 2; Tables 1 and 2). This seems to be mainly attributable to two factors. On the one hand are the presence and continuing interest of certain research groups in some major social and cultural processes, such as the neolithization in the Levant, or the rise of complex societies in the south-east. On the other hand are the varying objectives of heritage policies laid down by different Spanish autonomous regions from the late 1980s and the effects of the construction bubble of the last decade, which particularly affected the eastern coastal provinces (Alicante, Valencia and Murcia) and Madrid, those that have grown most in regard to the total number of dated sites. Madrid and Alicante are, by far, the ones with the largest increase over the last 16 years. However, this must be weighted by the distribution of the number of dates per site: in Madrid, for example, almost half of the dates are concentrated in three out of 28 sites. Thus, up to 46 per cent of the dates considered here are concentrated in four of the 19 provinces assessed (Alicante, Almería, Granada and Madrid), which cover only 14 per cent of the area under study, while a large part of the central zone and the middle of the Guadalquivir valley have almost no dates at all. All these issues make difficult the building of trans-regional interpretations of comparative character.

The percentage of dates by period is almost identical in the central and east–south-east areas, whereas the south-east has more dates from the Copper Age than any other period (Table 1). When examined through a summed calibrated date probability distribution (SCDPD) (Figs. 3 and 4), the most noticeable result is the very low frequency of samples (5 per cent) dated from what is usually considered the Middle and Late Neolithic (between *c*.4400 and 3200 cal

1 To consult the data, see online Supporting Information.

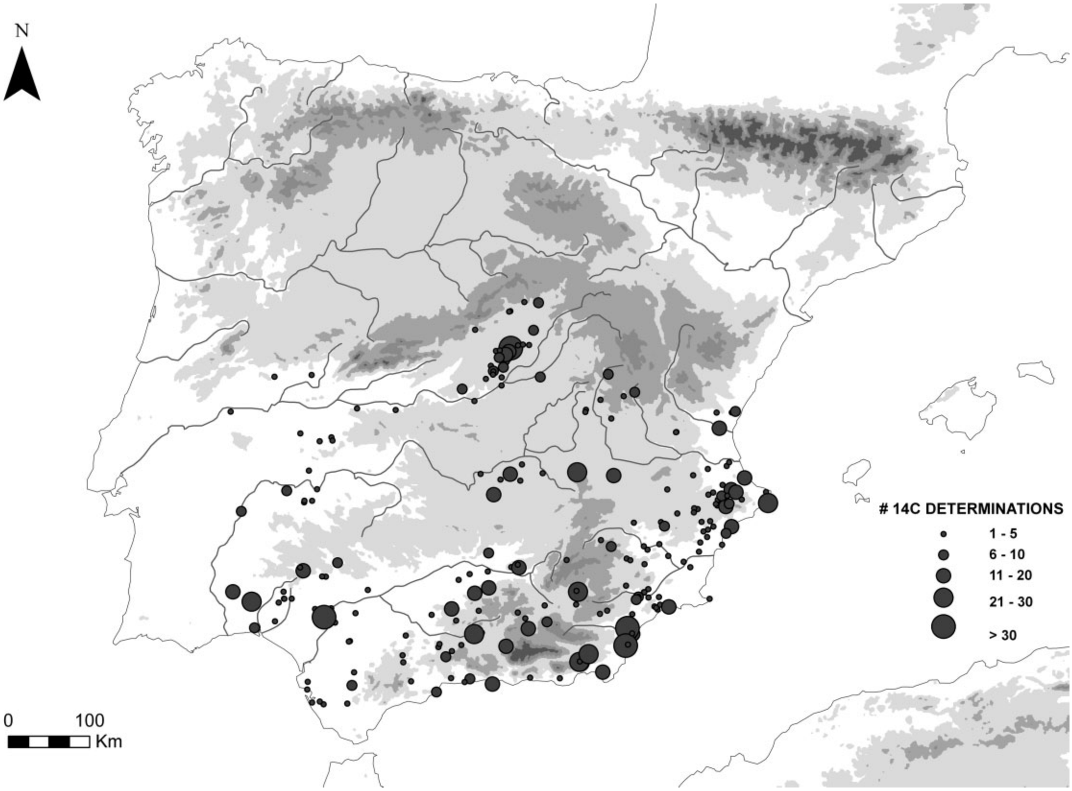

Figure 2
Spatial and quantitative distribution of radiocarbon dates.

TABLE 1
Chronological and spatial distribution of radiocarbon dates

Area	Neolithic	Copper Age	Bronze Age
Centre	40 (15%)	104 (39%)	120 (45%)
East–south-east	116 (18%)	238 (38%)	278 (44%)
South-west	17 (10%)	117 (66%)	42 (24%)

BC), both in the combined distribution for all three regions involved as well as in the individual distributions of each region. Interestingly, all four curves display a sharp increase beginning around the last third of the fourth millennium BC (beginning of the Copper Age, which spans *c*.3200–2200 cal BC). If we accept that this dataset is a quasi-random sample for the area under analysis, it would be tempting to consider these observations as proxies of large-scale patterns resulting from major economic and social processes: first, a substantial decrease in population densities occurring a millennium after the beginning of an agro-pastoral economy; later, a sharp demographic growth perhaps connected with the generalization of some technologies on a European scale (Greenfield 2010), in line with what was called 'the secondary products

TABLE 2
Quantitative evolution of dated sites and radiocarbon dates: 1996 and 2012

Area	Province	km^2	# dates 1996	# dates 2012	# dated sites 1996	# dated sites 2012
SO	Badajoz	21,766	1	23	1	7
	Huelva	10,128	8	80	3	13
	Córdoba	13,771	19	16	3	3
	Sevilla	14,036	14	65	5	15
	Cádiz	7436	7	23	2	8
SE	Valencia	10,806	17	55	6	18
	Alicante	5817	16	138	8	31
	Murcia	11,313	35	96	17	39
	Jaén	13,489	17	67	6	12
	Granada	12,647	49	131	15	16
	Almería	8775	146	191	14	20
	Málaga	7308	25	54	6	14
Centre	Cáceres	19,868	0	14	0	9
	Toledo	15,370	5	28	2	6
	Ciudad Real	19,813	36	37	6	7
	Madrid	8022	9	146	3	28
	Guadalajara	12,167	8	16	1	3
	Cuenca	17,141	12	26	5	7
	Albacete	14,918	34	51	2	5
Total		244,591	486	1257	105	261

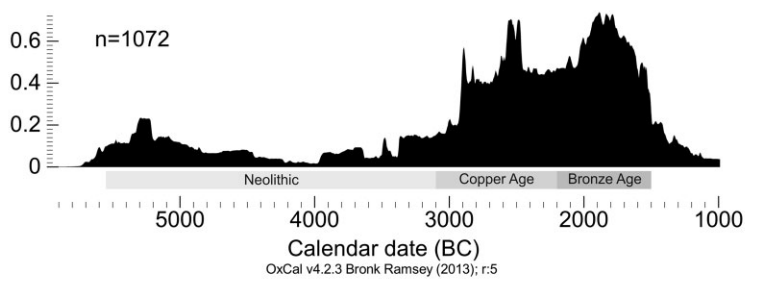

Figure 3
Comparative summed probability distribution of the whole dataset of radiocarbon dates.

revolution' (Harrison 1985). However, caution must be taken before reading these distributions as a direct reflection of social and cultural processes: taphonomic loss, sampling biases and the effects of the calibration curve may lie behind what may appear as social patterns. As Bamford and Grund (2012, 1773) have pointed out, 'largely unrecognized problems in interpreting sequences of radiocarbon dates make it extremely difficult to use sets of such dates as proxies for human population'.

INTER-REGIONAL COMPARISON: THREE CASE-STUDIES

The three cases presented here have been chosen in order to observe regional variations in time of phenomena which may be of interest when compared on a European

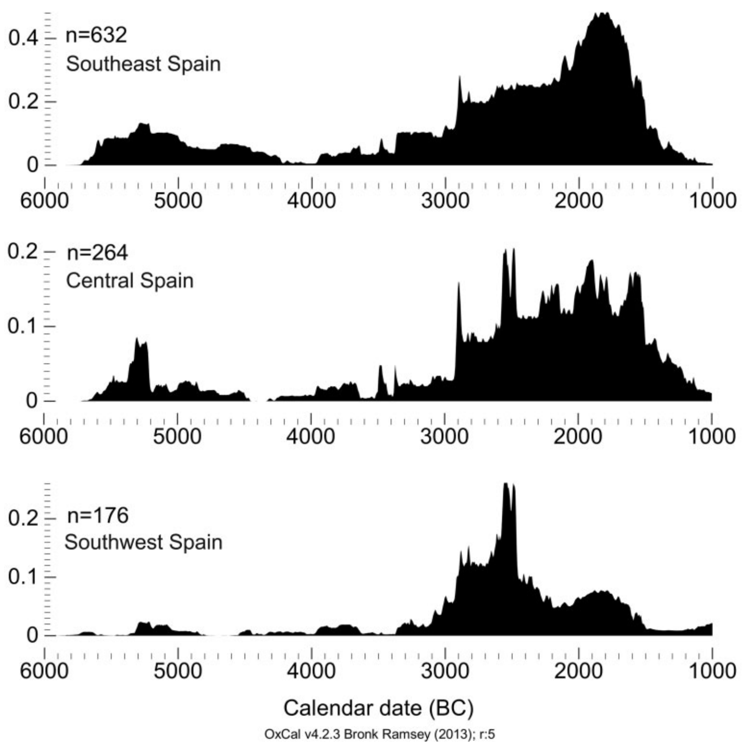

Figure 4
Summed probability distribution of the whole dataset of radiocarbon dates by region.

scale: the mortuary treatment of the deceased (especially the dichotomy of collective vs individual), domestic stone architecture and ditched enclosures. Methodologically, this is achieved through SCDPD and Bayesian modelling. Work done on the time variation of summed probabilities suggests that their powers of representation are tightly dependent on sample size which, in turn, is associated with the mean standard deviation of the samples and the length of time (Bamford and Grund 2012). On the other hand, Bayesian modelling has been successfully applied to produce high-resolution interpretations of various cultural phenomena (Whittle *et al.* 2011). In addition, these three are the only possible cases that, within our dataset, combine more than 100 radiocarbon dates and a distribution throughout most of southern Spain. The sample size is highly variable: 488 radiocarbon dates for stone-walled sites, 173 for ditched enclosures, and 116 and 130 respectively for collective and individual burials.

Burial patterns

Figure 5 shows the summed probability distributions for the whole area analysed for two phenomena: collective and individual burials. All graves with fewer than four individuals have been considered as individual graves, given that reductions and simultaneous burial of three

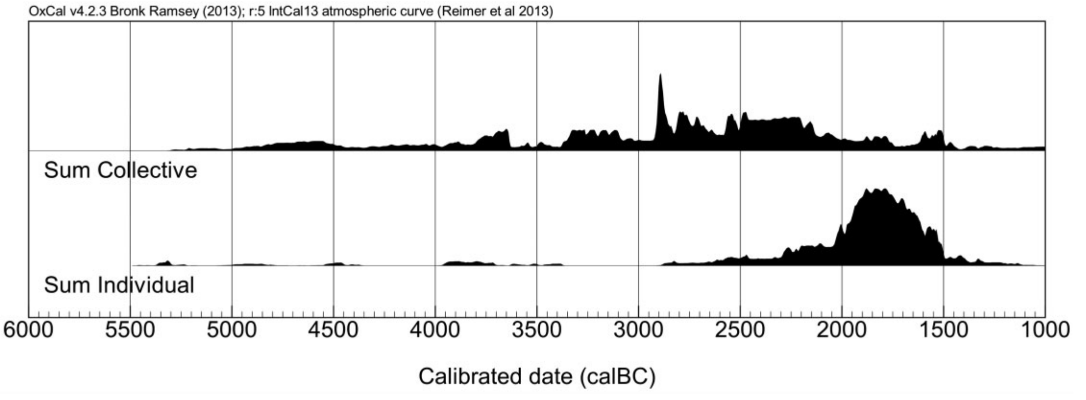

Figure 5
Summed probability distribution for burial patterns: individual vs collective.

individuals following the formal patterns for single burials are not infrequent. Within this dataset, 67 per cent of the dates are from the east–south-east (especially Argaric), 16 per cent from the central region and only 5 per cent for the south-west.

The distribution of the SCDPD for collective burials displays a remarkable diachrony, extending almost throughout the five millennia studied in this project. Similarly, dates obtained from megalithic monuments appear quite regularly spread out between the end of the fifth and end of the second millennia BC, as previously observed (García Sanjuán *et al*. 2011). When all dated human bones are introduced (51), the resulting horizontal tendency of the probability distribution suggests that the use and reuse of collective burial spaces remain somehow constant throughout the analysed sequence.

Individual burials show a chronologically compact probability distribution. Although they have been dated from the Early Neolithic onward, the overwhelming number of radiocarbon determinations of Argaric burials in the dataset generates a peak that mainly coincided with the Early Bronze Age. The study of individual burial practices, and especially grave goods, has played a key role in the construction of the Argaric sequence. As a result, researchers who have worked in south-eastern Spain have reasonably chosen individual funerary contexts from which to obtain absolute dates. These conditions do not apply to the Bronze Age of other regions studied here: in the east, there is a generalized lack of individual burials, while in central Spain there has been scant interest in dating the many existing pit burials, and in the south-west (like throughout the Atlantic seaboard of Iberia) soil acidity has severely hampered the preservation of datable materials, notably human remains.

However, even noting that the majority of the available dates for individual burials come from the south-east, it is also true that some of their manifestations – as for example burials inside *pithoi* – are somehow culture-specific and appear in the Argaric group and only occasionally in central Iberia (La Mancha and the upper Tagus valley), all disappearing rather abruptly as a result of the *collapse* that took place in the sixteenth century BC. In addition, not only are individual burials less frequent in other Iberian regions, but there is growing evidence that within the Argaric group previous megaliths were widely used (Aranda Jiménez 2013). Interestingly, by the Late Bronze Age in the post-Argaric south-east, when individual burials had disappeared entirely, old collective burials such as megalithic monuments were again intensely reused (Lorrio Alvarado and Montero Ruiz 2004).

The implications of the above observations point towards the existence of a long-term form of cultural continuity that Iberian archaeology has hitherto failed to recognize. Focusing on the definition of archaeological *cultures* and period-specific markers (for the relative periodization), the epistemological focus of Iberian late prehistoric archaeology for most of the twentieth century was on cultural *change*. Graphically synthetized series of radiocarbon dates bring out the importance of cultural *continuities* such as the use of collective burials between the Neolithic and the Late Bronze Age. This also puts into perspective the significance of the Argaric group within the larger picture of Iberian late prehistory as a whole: with the help of a comparative long-term approach, the most defining traits of El Argar appear as time-specific and geographically restricted, thus highlighting the remarkable historicity of the Argaric group.

Finally, another interesting feature of this dataset is the chronology of the bell-beaker phenomenon. Only 13 dates are directly associated with bell-beaker pottery, four of which are individual burials: two in the central region (Camino de las Yeseras, Madrid) and two in the Levant (La Vital, Valencia). These radiocarbon determinations extend throughout the second half of the third and into the second millennia cal BC, that is, covering both the Late Copper and the Early Bronze Ages. Consequently, the wide chronological distribution and contextual variety of bell-beakers would suggest that diverse historical backgrounds and regional trajectories should be taken into account in order to explain its social role in Iberian prehistory.

Domestic stone architecture

Figure 6 shows the development over time of settlements with large-scale stone-wall architecture. The generalization of collective architecture in stone represents an increase in fixed capital investments, frequently correlated with an increase in social complexity. In this case, settlements with large stone infrastructures and buildings have been treated as a single category, regardless of variations in aspects such as floor space, plan, layout, technique or function. This means that no distinction has been made between, for example, fortified villages or walled enclosures of the Copper Age, and the settlements with large terraces or walls that are more common throughout the Bronze Age.

The most noticeable feature about the SCDPDs is the substantial regional variability that can be seen in the rise of this cultural phenomenon across the three regions under study.

The SCDPDs of all the 488 dates for settlements with some form of stone architecture in all three regions suggest that the phenomenon as a whole began toward the very end of the fourth and beginning of the third millennia, with Copper Age settlements with walled enclosures. Then it increased sharply in the last two centuries of the third millennium, with the founding of the Bronze Age settlements that characterize the south-east, La Mancha (*motillas*) and the Levant. This synthetic curve is biased by the high number of dates (350) from the south-east area, and shows a development more similar to this than those in the south-west and centre.

However, when the individual regional curves are examined, interesting differences appear. In the south-west, as in the south-east, domestic stone buildings start at the end of the fourth millennium BC (early Copper Age villages). From then on, however, the intensity of this practice seems to take rather different trajectories. In the south-west it peaks between *c.*2800 and 2400 cal BC, before experiencing a rather sharp and abrupt decrease, with little development during the second millennium (Bronze Age). The only settlement with fairly large stone

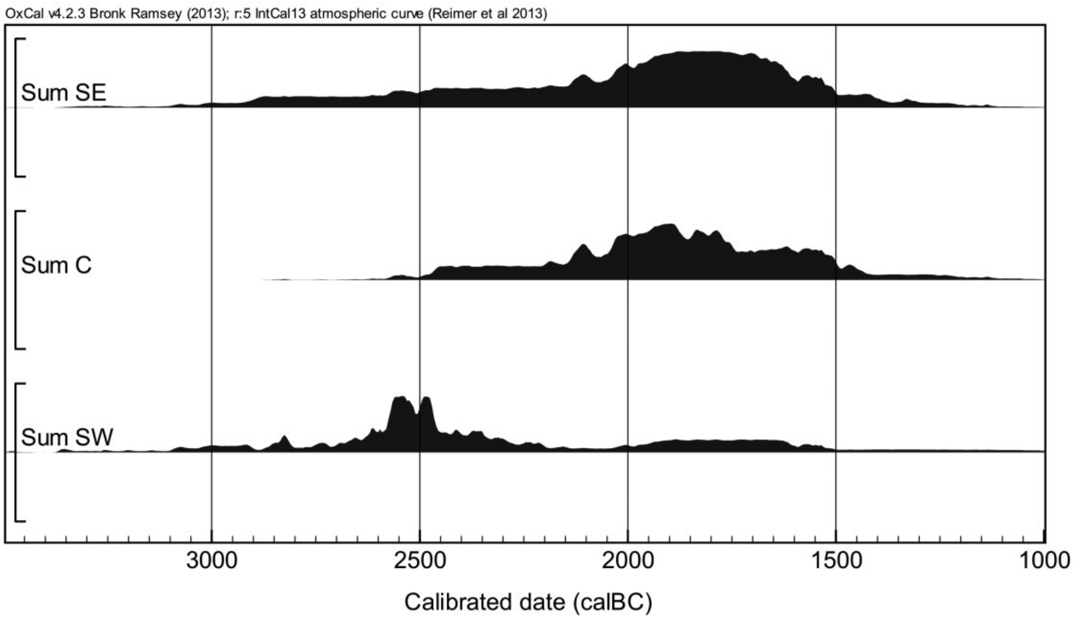

Figure 6
Summed probability distribution for settlements with stone architecture.

architecture known in the whole of the south-west for the first half of the second millennium is El Trastejón (Huelva), and its radiocarbon dating is basically that shown in the second millennium part of the curve (García Sanjuán and Hurtado Pérez 2011). As a consequence, results for this region must be taken with caution. In the east–south-east, on the other hand, the increase in distribution during the first half of the third millennium is more gradual and less 'explosive' than in the south-west, but then the distribution grows very significantly during the first half of the second millennium (first part of the Bronze Age), owing to the large number of Argaric settlements with major radiocarbon-dated walled structures (Peñalosa, Fuente Álamo, Cerro del Castellón Alto, etc.). Finally, the curve for the central region is shaped more like that of the east–south-east than that of the south-west, although the phenomenon starts rather later, with the first walled structures appearing in the second half of the third millennium cal BC. In fact, the most noticeable factor is that all these dates from central Spain, except for two, belong to the Bronze Age of La Mancha (Martín *et al*. 1993). In other words, the largest inter-regional difference throughout the sequence of late prehistory is the almost complete absence of stone buildings in the middle and upper Tagus valley, compared with their widespread presence across southern Spain, and the fact that, at the same time, stone buildings characteristic of the La Mancha Bronze Age – *morras, motillas* and *castillejos* (forts on the plain and in the hills) – began with the first Argaric constructions.

If the practice of building stone-walled structures is correlated with increasing social complexity, then these distributions provide interesting reading. Starting at the same time both in the south-west and the south-east, in the former this phenomenon reaches a relatively short-lived peak of *c*.400 years throughout the middle of the third millennium, then fades away during the late third and most of the second millennia BC. In the latter, in turn, the development of this phenomenon is more gradual, but when it gains momentum in the late third millennium it shows a powerful development throughout the first half of the second millennium BC, lasting for around 700–800 years. This raises the interesting question as to why early social complexity, having started at around the same time, peaked at different times and was of different duration in the south-west and the south-east. The obvious differences in environmental settings – Atlantic south-west vs Mediterranean and arid south-east, spring to mind as a potential causal background to account for the differences of these trajectories. Given the limitations of space, it is not our intention to engage in a full discussion of an issue that has been hotly debated for the past 30 years (Chapman 2008). The evidence presented here is simply meant as a contribution for a more empirically informed discussion.

Ditched enclosures

Ditches and ditched enclosures are frequent from the sixth millennium BC onward in most of Europe, from the lower Danube to the British Isles, and from Scandinavia to southern Italy. Iberia is also included in this trend. From the 1980s, and especially in the last 20 years, sites with ditches have been found over almost all southern and central parts of Iberia (Díaz-del-Río 2004a; Márquez-Romero and Jiménez-Jáimez 2010). The variability in morphology, layout, dimensions and contextual details creates obvious difficulties in defending exclusive functions. Although the term ‘ditched enclosures’ has become common in recent literature, it should be emphasized that not all Iberian ditches enclose places. Some seem to be enclosing habitation areas, as suggested for the 100 ha or so ditched and walled enclosure of Marroquíes Bajos (Jaén) (Díaz-del-Río 2004b). Others, such as the early Neolithic ditch at Mas d’Is (Alicante) (Bernabeu *et al*. 2003; 2006), are clearly separated from living areas and do not constitute an enclosure. Many may well include a combination of living and ceremonial spaces, with substantial alterations over time, as for example might be the case of Valencina de la Concepción (Sevilla), the largest of all the sites recorded so far (Costa Caramé *et al*. 2010). It is here where radiocarbon chronology can play an important role, as recently demonstrated for Britain and Ireland (Whittle *et al*. 2011).

In order to achieve a more in-depth examination of this cultural phenomenon, we have used a three-tier approach: a comparison between summed probability dates of enclosed sites and ditch infill, a modelled sequence of all ditch infill dates, and a Bayesian modelling of a specific case-study, the ditched enclosure of Camino de las Yeseras (San Fernando de Henares, Madrid) (Blasco *et al*. 2007; Liesau *et al*. 2008). The intention is to combine these three approaches in order to observe potential variability in the specific use-life, tempo and overall span of the Iberian expression of this cultural phenomenon, so that it can be compared with its other European counterparts.

Southern Spain’s radiocarbon dates for ditched enclosures do not always report the exact context of the sample. Contextual details are critical in cases such as enclosures, frequently a combined palimpsest of pits and ditches. Out of the 173 available dates, only 39 from 15 sites are reported to come from ditch infills, and barely two from south-west Spain. Consequently, our approach to the life-span of southern Spain’s enclosures is tightly limited by both sample size and the arbitrariness of a variety of intra-site sampling choices. Taken as a whole, the 173 dates from ditched sites extend over almost all the sequence dealt with in this paper, although intermittently. Regionally, although having a similar number of radiocarbon dates, the distribution of south-east samples is substantially different from the rest. This is due to the fact that all samples pre-dating *c*.3500 BC were recovered from only three sites, all in the Alicante province, including Mas d'Is, the oldest ditch (but not enclosure) reported in Iberia. We are thus inclined to consider this pattern as a result of research bias, although from the second half of the fourth millennium radiocarbon-dated enclosures and ditches become widespread throughout the whole of southern Iberia.

In order to increase this particular dataset, we have integrated a recently published series of 32 radiocarbon dates for ditch enclosures from southern Portugal (Valera 2013). Thus, in respect of certain specific points, the discussion presented in this section refers to the south of Iberia as a whole, rather than the south of Spain in particular. Taking into account only the Spanish dates, probability distributions suggest that the construction of ditched enclosures began in 3190–3050 cal BC (1 σ), while its end occurred by 2140–2020 cal BC. When Portuguese dates are included, probability distributions suggest a start in 3260–3180 cal BC and an end by 2010–1890 cal BC (1 σ) (with an overall agreement of 403). This suggests that the oldest archaeological evidence for the beginning of enclosure building is in south-west Iberia, and that such activity lasted longer here than in other regions. This is in marked contrast with what was discussed above concerning the comparatively shorter life of settlements with stone-walled structures.

It should be noted that the suggested cessation of enclosures falls well beyond the currently accepted standard limits for the end of the Iberian Copper Age (Lull *et al*. 2010). However, only six enclosures have dates falling within the Early Bronze Age, including four in southern Portugal (Perdigões, Horta do Albardao, Bela Vista and Porto Torrao), one in the upper Guadalquivir valley (Marroquíes Bajos, Jaén) and, finally, another in the Levant (Arenal de la Costa, Alicante). The still limited evidence would suggest caution should be exercised as to the potential late end of enclosures throughout southern Iberia. It has been claimed that there is substantial archaeological evidence to suggest a crisis involving Copper Age societies some time around 2200 cal BC (Lull *et al*. 2010, 90). Nevertheless, the diversity of social and cultural trajectories triggered at the beginning of the Bronze Age suggests differential regional responses and perhaps tempos in solving the contradictions of this generalized large-scale social and political crisis.

Although overall estimates for the duration of enclosure building suggest 1190 to 1300 years, there is both previous and later occupation at many of these ditched enclosure sites, and their dynamics seem to be regionally or even locally variable. Certain regional cycles seem particularly obvious. The chronological model carried out for southern Portuguese dates (Fig. 7) assumes the existence of two sequential phases with an interval, and proves to be robust given its agreement (A = 103.8). The chronology suggested for the first construction phase spans 140 to 310 years (3280–3140 to 3010–2900 cal BC), while the second lasted for 380–490 years (2610–2520 to 2130–2050 cal BC). This model offers an interval of 310 to 450 years with no building activity (or rather, no radiocarbon dates); that is, a minimum of 12 generations between the first and second construction phases.

An assessment of detailed regional dynamics would require a biographical approach, something not always feasible given the general lack of radiocarbon dates from individual sites. We fortunately have a good example that allows us to approach in certain detail the dynamics of ditch construction in a recently discovered site from central Iberia: Camino de las Yeseras (San Fernando de Henares, Madrid).

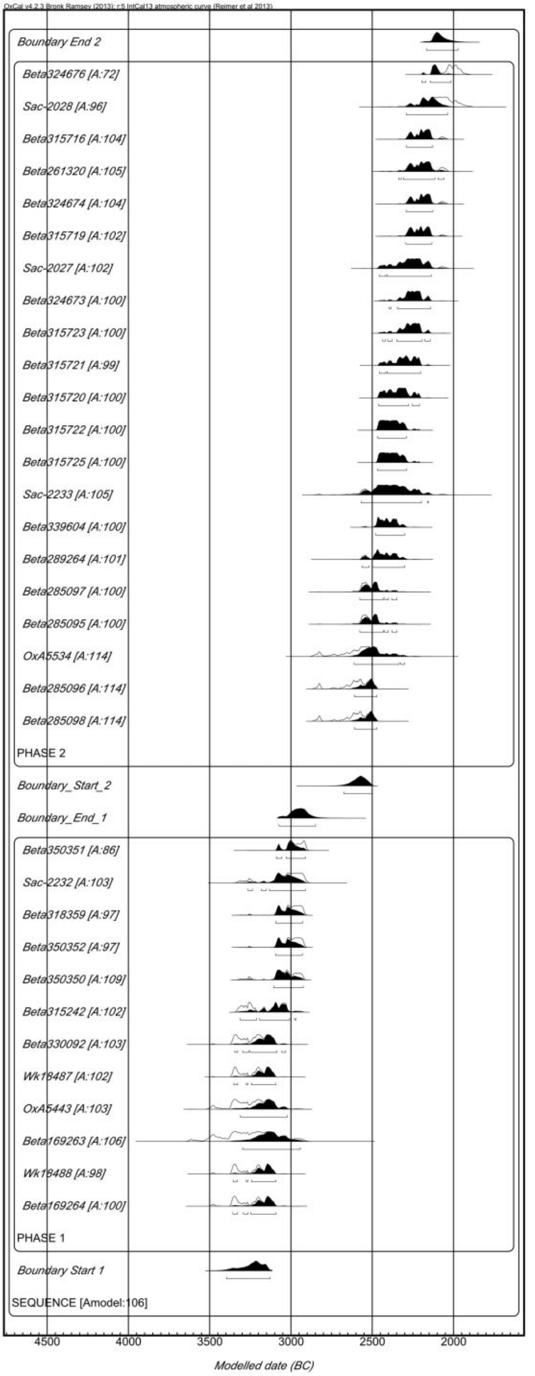

Figure 7
Bayesian model for southern Portuguese ditch enclosures.

This 80 ha multiphase prehistoric site is located on the lower terrace of the Henares River, near the city of Madrid. The site saw human activity throughout most of the third and second millennia BC. As is the case with many contemporary sites in southern Iberia, Camino de las Yeseras is a complex palimpsest of underground pit structures in between which are five concentric ditched enclosures. The external ditch is estimated to cover 15 ha, with yet another external ditch (the so-called 'eccentric' ditch) apparently unrelated to the main ditch system. It has 45 available radiocarbon determinations, all with contextually detailed reports, one of the largest collections for a ditched enclosure in Iberia (Blasco *et al*. 2007; Liesau *et al*. 2008).

Four of the six ditches have been dated (ditches 3, 4, 5 and 'eccentric'). According to the interpretation posed by the team in charge of the excavations (Ríos Mendoza 2011, 74–80), the enclosures were designed and built in several phases, increasingly expanding the size of a site that is interpreted as a permanent settlement. The fourth and fifth enclosures would have been built and later filled almost simultaneously after the abandonment of the three internal ditches (not excavated and thus not dated). Finally, the 'eccentric' ditch, which lacks any connection with the previous concentric pattern, was excavated and subsequently filled. This not unreasonable interpretation is based on a direct observation of the radiocarbon determinations. Nevertheless, margins of uncertainty allow for several alternative interpretations for the internal dynamics of the site, interpretations that can now be modelled in order to determine their likelihood.

We have constructed three alternative models using eight of the ten radiocarbon determinations for different ditch fills and stratigraphically related structures (Fig. 8). As there are no available dates for the two interior ditches, the oldest radiocarbon date belongs to ditch 3 (Ua-36111). The fourth enclosure has five determinations dating a foundational deposit excavated at the base of the ditch, and the upper fill underlying the floor of a circular hut. The filling of the fifth ditch has two dates that are statistically identical to those dating enclosure 4. Finally, out of the two radiocarbon dates from the 'eccentric' ditch fill only the short-lived sample has been used (Beta-236610), thus avoiding the so-called 'old wood effect'. Models are as follows:

Model 1: Ditch enclosures and a superimposed hut are built and filled in subsequent phases, increasing the size of the enclosed area. Finally, the 'eccentric' ditch is built and filled (Ditch 3/Ditch 4/Hut/Ditch 5/'Eccentric' ditch).
Model 2: Ditches 4 and 5 were simultaneously built and filled before the construction of a hut over ditch 4 fills (Ditch 3/Ditches 4 and 5/Hut/'Eccentric' ditch).
Model 3: The hut was built after the complete abandonment of all concentric ditches (Ditch 3/Ditch 4/Ditch 5/Hut/'Eccentric' ditch).

The three proposed models were processed as sequential phases including the probability of time intervals in between all phases, while statistically identical dates from a multiple dog burial were combined. The overall results suggest that all models are possible (M1 Amodel = 107; M2 Amodel = 98; M3 Amodel = 78) (Fig. 8). Considering model 1, the sequence actually suggested by the excavators, the third enclosure was already filled by 2780 BC (68% probability), while ditch 5, the last of all the concentric ditches, was filled in 2490–2430 cal BC (68% probability). Results suggest that none of the ditches were in use for more than 40 years (95% probability), with probable substantial time intervals in between: up to 210 years between ditches 3 and 4, and up to 70 years between the construction of a hut over ditch 4 and the fill of

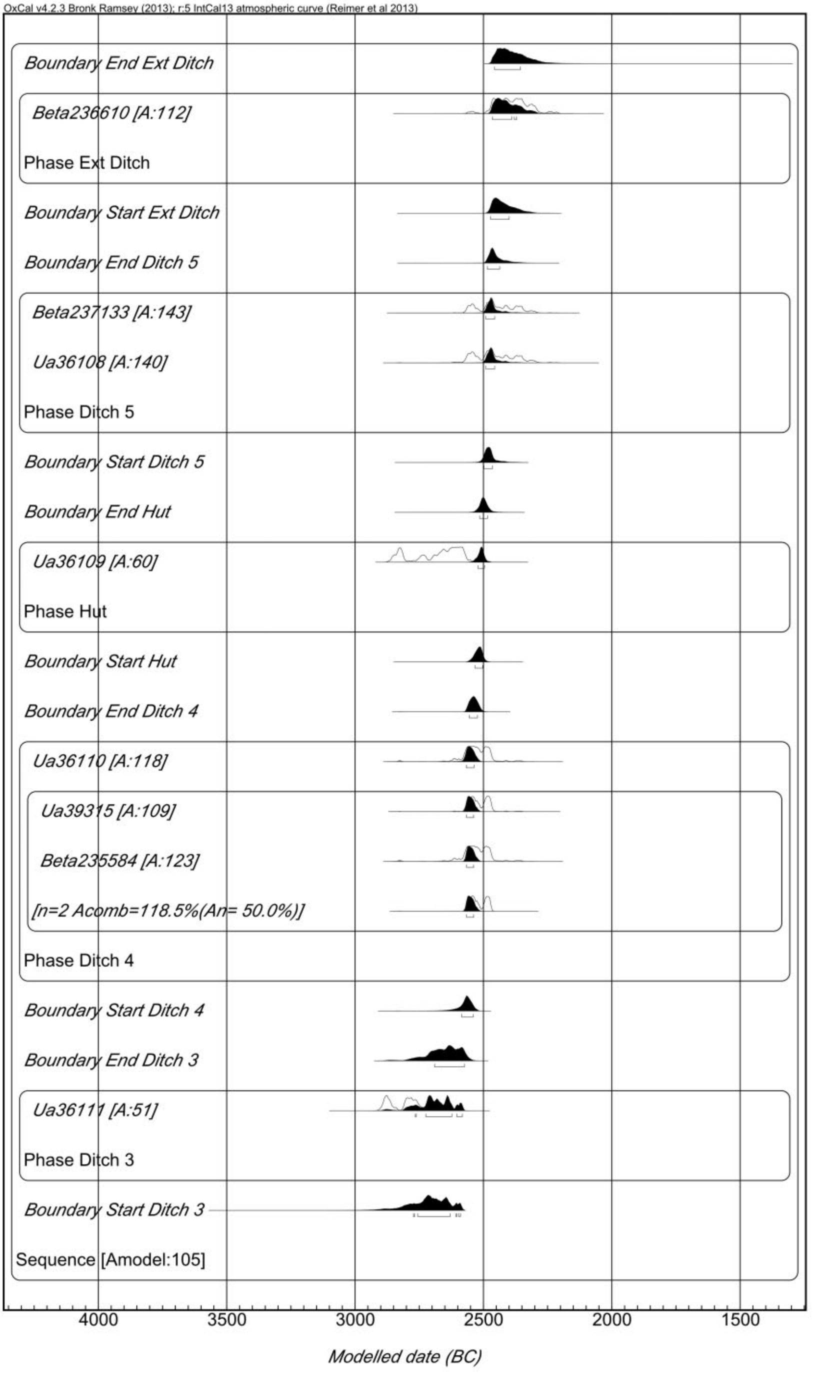

Figure 8
A Bayesian model for ditched enclosure phases at Camino de las Yeseras (San Fernando de Henares, Madrid).

ditch 5. Finally, this model suggests an interval of up to 100 years between the fill of ditch 5 and the so-called 'eccentric' ditch. In any case, when considering ditch 4, the only structure for which we have a complete set of radiocarbon determinations from the first to the last deposition, the model suggests a maximum life-span of up to 40 (95% probability) or 20 years (68% probability), that is, during the lifetime of one generation.

The probable scenario suggested by this model clarifies the construction dynamics at Camino de las Yeseras, while suggesting a likely pattern for many other Iberian enclosures. It points to a generational involvement in the collective excavation of each one of the enclosures, distanced in time by several generations that were apparently not involved in this kind of activity at the site. Nevertheless, it should be stressed that only a few radiocarbon determinations from small segments of each circuit are available, and that only a representative sampling strategy would allow further discussion.

If our analysis is correct, it would suggest that this enclosure 'system' was not a monumental aggregate of multiple enclosures to be seen ('experienced') as a whole, but the result of a generationally intermittent deployment of collective labour. The substantial increase in the diameter of each ditch circuit would have required an increase in the amount of mobilized labour. This dynamic seems to have escalated to its climax during the construction of the 1.4 km long ditch 5, but had no continuity beyond 2500–2460 cal BC. Instead of further large-scale collective work, evidence suggests an intensification of funerary activity throughout the site.

The radiocarbon determinations do not allow any assessment of whether people lived permanently at the site, as suggested by its excavators (Liesau *et al*. 2008), or merely visited it during these collective works: the eight determinations dating houses cover most of the third millennium BC. Certainly, the high density of pits at the site suggests intense human activity, but does not solve the issue of temporality and internal dynamics. Again, only problem-oriented sampling would allow these issues to be addressed.

CONCLUSIONS

Archaeologists working on Spain's late prehistory have developed an increased confidence in radiocarbon dating as a procedure for ordering the conventional archaeological record and understanding major cultural phenomena. Accordingly, they have spent substantial resources on it, especially over the last two decades. Nonetheless, our review of the available radiocarbon chronology has revealed the predominantly non-systematic character, with notable exceptions, of the selection processes for dated samples in the 50 years or so that have elapsed since the first date was published. As a result, there is a serious problem of non-determination when drawing well-founded comparisons based on carbon dating series, both among the various regional sequences and in various archaeological phenomena which, as we know, are trans-regional. All three case-studies examined in this paper, although clearly that of the ditch enclosures in particular, suggest that further efforts should be directed towards improving the selection quality of samples dated in the future. As part of this effort, the characteristics of the samples, as well as their contextual and material relationships, should be made explicit in sufficient detail, along with the reasons behind their selection. In addition, it is noticeable, but difficult to assess to what extent, that the dataset used in this study may be biased by local and regional research traditions – and their associated preferences in terms of the excavation and dating of some site types as opposed to others.

If these factors are held constant, however, some interesting issues emerge regarding the examined cultural phenomena. Firstly, in terms of regional variability, there appear to be grounds for expecting some cultural phenomena to operate with variable tempos, cycles and time-scales. Our analysis reveals that a statistically robust comparative archaeology of Spanish late prehistory can be achieved but careful consideration should be given to the effect that local conditions and local trajectories may have had on the development of processes and phenomena that were otherwise similar throughout southern Spain. The observations made in this paper throw up new questions in terms of the diachronic unfolding of burial patterns: normality and exceptionality of burial practice and social organization come to the fore when the temporal development of megalithic and individual containers (such as cists or urns) is compared and visible differences arise. The data used in this study also highlight the need for new thinking on the balance between change and continuity across the five millennia or so of cultural evolution encapsulated in what we call late prehistory.

Our analysis of ditched enclosures reveals pressing questions about the tempos of major cultural phenomena and their regional variability. Modelled dates for ditched enclosures perhaps reflect a more regional sequential 'collapse' of Copper Age societies than hitherto assumed, with *c.*2200–2000 being the time-frame in which regional Early Bronze societies are known to be emerging throughout southern Spain. The results of the Bayesian modelling of Camino de las Yeseras reveal that, as noted in other regions of Europe, social practices leading to monumentality are neither the result of planned 'final' projects nor the product of orchestrated 'one-event' operations. Camino de las Yeseras also raises interesting questions in terms of long-held interpretations about southern Iberian 'fortified' or 'walled' Copper Age settlements, offering substantial insights into the ways and timings in which collective labour may have been mobilized by Copper Age societies. If we generalize the observed pattern, it would seem that major cycles in the construction of large ditch enclosures were followed by centuries with no obvious collective labour investments or, perhaps, a shift to investments in other collective arenas. When these cycles are observed in detail, as the analysis of Camino de las Yeseras suggests, the construction of large enclosures was a generational event followed by decades of inactivity in enclosure construction. Although probably motivated by a common political–economic background, these cycles occurred with different rhythms and tempos depending on diverse regional circumstances. Can these observations be translated to 'fortified' or 'walled' Copper Age settlements? To what extent is the notion of cyclical building observed with ditches applicable to walled enclosures? And if such notions are applicable, what do they tell us about the roles that those sites allegedly played in controlling the territories and resources around them?

With notable exceptions (e.g. Chapman 2008; Lull *et al.* 2010), our geographically wide-ranging and comparative approach has rarely been attempted for Iberian late prehistory, the epistemological focus of which is usually at local and regional level. Limited as they are by various factors, our results suggest that interesting observations can be made by comparing data from different regions. The ongoing dialogue between the similarities in the cultural background and the diversities of their regional expressions will be better understood from a comparative approach, perhaps leading to a true *Iberian* prehistory.

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SUPPORTING INFORMATION

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List of radiocarbon determinations