

## CHRONOLOGY OF THE S’HOSPITALET VELL NAVETA VILLAGE: AN EXAMPLE OF BRONZE AGE SETTLEMENT IN THE BALEARIC ISLANDS

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**ABSTRACT.** The Balearic Islands provide a good example of late human settlement in the context of the prehistoric Mediterranean. After what could be considered a period of colonization, the earliest autochthonous cultural manifestations occur in the Bronze Age. This study aims to outline a chronology for Balearic Bronze Age villages, based on the case study of S’Hospitalet Vell (Manacor). A wide radiocarbon record has been obtained from three different habitation structures at the site. By combining the available dates with the stratigraphical information, a chronological approach to the occupation dynamics of this site can be established.

### INTRODUCTION

The Balearic Islands were the last large land mass in the Mediterranean to be colonized by humans. The event occurred sometime within the 3rd millennium cal BC, while all the other large islands had already been settled since the early Holocene. In the Balearic Islands, the first manifestation of cyclopean domestic architecture is the habitation structure known as the *naveta* (from the Catalan for “small boat”; plural: *navetes*)—different from the burial *naveta*, which only exists in Menorca and is a later development. The domestic *naveta* consists of an apsidal construction with a horse-shoe-shaped layout. The walls, double-faced and constructed of large dry blocks with inner filling, are about 2 m wide. The more monumental examples reach about 20 m in length. The inner breadth of the chamber is typically about 3 m. Some of them are isolated, but usually they are grouped in villages without any “urban” order. Although they are mostly situated in flat areas in the lowlands, some of these villages have been also identified in the mountains and in locations with rough relief.

There is very limited knowledge about the origin and early development of *navetes* in the Balearic Islands. A further subject of debate is the precise chronology of the abandonment of these sites during the late Bronze Age, as well as their replacement by the Talayotic villages. Currently, chronological proposals (e.g. Micó 2005, 2006, Guerrero et al. 2007) rely on a very limited number of sites; moreover, in some cases there is a problematic (or unknown) association between dated samples and archaeological contexts.

One of the few Bronze Age villages that has been excavated in the last decades is the site of S’Hospitalet Vell (Manacor), located on the east side of Mallorca (Figure 1). At present, four apsidal dwellings have been identified. S’Hospitalet Vell is a complex site dating to different periods. The main assemblages correspond to a *naveta* village and a Talayotic site (mainly dated to the Iron Age), but it also contains remains of later reoccupations.

The excavations at S’Hospitalet Vell started in the 1970s, led by a team from the Museu de Mallorca. During the early 1980s, this team excavated two of the Bronze Age *navetes* (labeled here as Naveta 1 and 2; Figure 2). After 2 decades of abandonment, in 2002 the Museu d’Història de Manacor started the ongoing project involving excavation, restoration, and musealization. Two additional *navetes* (labeled Naveta 3 and 4; Figure 3) have been excavated and restored. In addition, the exterior side of Naveta 1 has been excavated as a part of this research. The global results obtained from the new survey allow for an examination of the chronology dynamics of the occupation of the *naveta* village.

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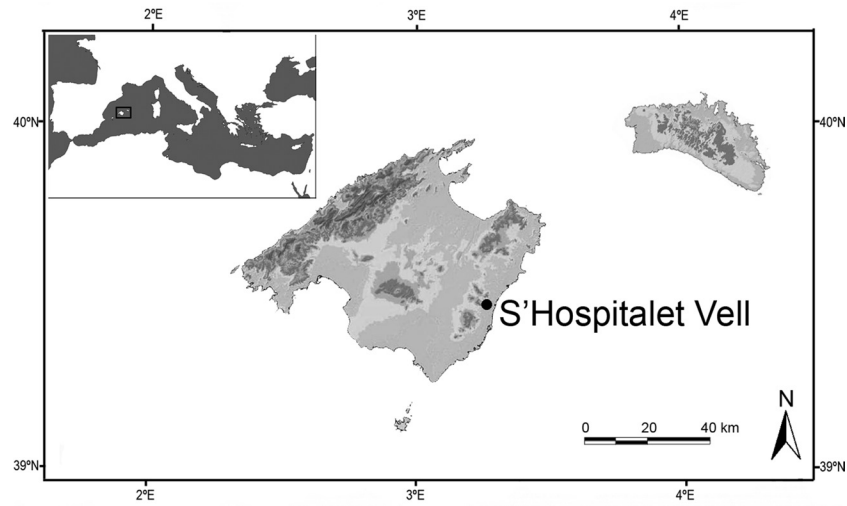


Figure 1 Location of the S'Hospitalet Vell archaeological site in the Balearic Islands

## MATERIALS AND METHODS

The strategy followed to obtain an accurate and reliable approach to the chronological dynamics of the navetes of S'Hospitalet Vell was based on the radiocarbon dating of organic samples according to contextual precedence. All the samples consisted of domestic mammal bones. Collagen for dating was extracted using the Longin (1971) method. An extra NaOH cleaning was added. If no collagen was present due to bad preservation, bioapatite was dated. Those samples were pretreated as cremated bones (Van Strydonck et al. 2009) in order to avoid contamination. All samples analyzed within the framework of this paper were prepared at the Royal Institute for Cultural Heritage, Brussels (Van Strydonck and van der Borg 1991) and dated by accelerator mass spectrometry (AMS) in the Leibniz-Labor für Altersbestimmung und Isotopenforschung (Nadeau et al. 1998).

Regarding the selection of samples according to their provenance, the contexts related to features from architectural structures and the process of occupation and abandonment contain interesting potential information to analyze the site dynamics. In the Balearic Islands, it can be difficult to date construction events, because most structures were built directly onto the bedrock, with no possibility of dating any underlying remains. However, the use of clay as architectonic material—mainly to fill walls, build pavements, and cover roofs—means that some organic samples (especially animal bones) were included in the construction features, because they were mixed with the clay. In this sense, samples originating from architectonic elements can be considered as representative of the construction date. The inner filling of the cyclopean walls can be excavated in order to obtain organic material related to these architectonic features. Furthermore, collapse layers also represent the remains of architectonic features (wall, roof). Thus, samples from all these layers are of interest in order to obtain chronological references for these building elements.

In addition, the materials found on floor layers can be considered representative of the house occupation. Hearths are particularly important given that their ashes were frequently removed. For this reason, ashes found in a hearth during excavation constitute evidence left by the house inhabitants at the time of abandonment. Consequently, organic materials mixed within the ash provide good samples for testing the timeframe of house abandonment.

Based on the limited data available from navetes 1 and 2, and the excavation results from navetes 3

and 4, each of these structures contains diverse stratigraphical information. The general strategy outlined above was applied to each of the navetes, taking into account their individual traits.

### **Naveta 1**

This is one of the navetes excavated in the early 1980s. It is about 17 m long and 7.5 m wide; its inner space measures 16.5 m long and has a maximum width of 3.5 m (Figure 2). The excavation results from this structure have only been partially published. Naveta 1 contained a hearth with the characteristic oval shape recorded in other navetes previously excavated (Rosselló-Bordoy 1986–1989). Some metallurgical moulds had been reused as construction materials for the hearth (Rosselló-Bordoy 1987). Three different charcoal samples from the hearth were dated (Pons 1999).

After the first investigation carried out by the Museu de Mallorca, the new project undertaken by the Museu d'Història de Manacor started with the restoration of the previously excavated structures. The hearth was in bad condition, and while it was being restored, the clay preparation layer beneath it was excavated. A bone sample from this layer was selected for  $^{14}\text{C}$  dating, but it did not contain enough collagen to be analyzed. In addition, an exterior trench, attached to the west side of Naveta 1 was excavated. A bench attached to the outer wall of Naveta 1, as well as a soil pavement attached to that bench, were recorded (Ramis and Salas 2011, 2013). A domestic herbivore sample from this pavement underwent  $^{14}\text{C}$  dating. A second  $^{14}\text{C}$  analysis was tried on a sample from the layer deposited on top of the soil pavement. A possible date could have indicated the last usage of this space, but the lack of collagen did not allow an analysis.



Figure 2 S'Hospitalet Vell: Naveta 1 (upper), with attached exterior trench, and Naveta 2 (lower)

The new project initiated by the Museu d'Història de Manacor also tried to obtain organic samples from the structure of Naveta 1. A fragment of the inner filling from the west side wall was excavated. Unfortunately, no adequate samples for  $^{14}\text{C}$  dating were found.

### **Naveta 2**

There is no information in the literature about the excavation results of this structure (Figure 2). According to oral sources, it had been reused in modern times and the archaeological sediments removed.

### **Naveta 3**

This monument is set directly on the bedrock. It has an inner chamber measuring approximately 15 m long with a maximum width of 3 m (Figure 3). The stratigraphic excavation of this structure started with the remains of the collapsed walls. Beneath them was a thick layer consisting of an accumulation of heated clay with burnt wooden beam fragments, interpreted as a fallen roof. Two different bone samples from this layer were  $^{14}\text{C}$  dated. The remains of the roof were directly deposited onto the only occupation layer. Three more samples from different use contexts were dated. The occupation horizon of Naveta 3 also included a hearth with an elliptical shape. A new bone sample, from that hearth ash, was dated.

A fragment of the east wall of the naveta showed signs of repair. The first clue was that some blocks were out of alignment in the interior face of the wall. Secondly, the repaired section had been refilled with much smaller stones than those used in the original wall. The last dated sample comes from this part of the wall section.



Figure 3 S'Hospitalet Vell: Naveta 3 (left) and Naveta 4 (right)

#### Naveta 4

This structure is attached to the east wall of Naveta 3 (Figure 3), indicating that it has a later construction date. Naveta 4 was in very poor condition: most of its wall blocks had been removed for agricultural purposes. Most parts of the original shape of the naveta could be discerned because the outlines of the removed blocks were still identifiable during excavation. Its dimensions are roughly similar to those of Naveta 3. Fortunately, the sediment layers inside Naveta 4 were well preserved. Its stratigraphic dynamics are not very different to that of the neighboring structure Naveta 3.

Naveta 4 has a singular difference: the remains of an articulated human body, found in a grave excavated into the collapse layer of the naveta. A bone from this human skeleton was the first sample to be dated. This collapse layer covered a clay accumulation that was interpreted as the remains of a fallen roof, as in the case of Naveta 3. Naveta 4 contained two different overlaid occupation layers. Both of these layers were attached to the main architectural features inside the house: a round hearth and a lateral bench.  $^{14}\text{C}$  dating of each of these layers was based on single samples from domestic herbivore bones.

#### RESULTS AND DISCUSSION

The results of the  $^{14}\text{C}$  dating obtained from navetes 1, 3, and 4 at S'Hospitalet Vell are presented in Table 1 and Figure 4. All of these results were calibrated using the OxCal v 4.2.2 program (Bronk Ramsey 2009) and the IntCal09 curve (Reimer et al. 2009).

With regards to the origin of S'Hospitalet Vell, it must be noted that it has not been possible to date the moment of construction—or to obtain a *terminus ante quem*—for any of the navetes. The construction timeframe for each of these structures remains unknown. The excavation of a part of the Naveta 1 wall filling did not provide any organic sample.

The date for the collapsed roof of Naveta 3 (roughly placed in the 15th century cal BC) might seem indicative of the timeframe for the building of the house (Figure 5). However, the lower occupation layer for Naveta 4 dates to before 1500 cal BC. Consequently, the roof of Naveta 3 cannot be original and instead indicates a later repair. The roof chronology agrees with the  $^{14}\text{C}$  result obtained from its wall filling (1500–1410 cal BC), indicating that this wall section was a later repair. Nevertheless, it must be remembered that a bone sample from an architectonic structure may be much older than the construction event. It does not necessarily date the precise moment of construction. However, two arguments can be put forth against this interpretation of Naveta 3 roof. First, several datings from the same context overlap widely. Second, no pottery fragments or other archaeological materials belonging to earlier periods could be identified in that context. Consequently, this suggests that the available chronology corresponds to the moment of construction.

The evidence concerning the early occupation of each one of the S'Hospitalet Vell navetes is more solid. The soil pavement attached to Naveta 1 predates 1450 cal BC. Naveta 3 was repaired during the 15th century cal BC, and the lower occupation layer of Naveta 4 dates to 1620–1500 cal BC. Given that Naveta 4 is attached to Naveta 3, the construction of the latter has to be earlier than the former one. This means that Naveta 4 was built before 1500 cal BC. Consequently, the available record indicates that navetes 1, 3, and 4 were already built in approximately the 16th century cal BC.

In contrast to the question regarding the origin date for S'Hospitalet Vell, the chronology for the final occupation and abandonment of the navetes of this site has a solid basis. The Naveta 1 final occupation was dated using  $^{14}\text{C}$  analysis from three different charcoal samples (Pons 1999). It could be argued that these results are compromised by the old-wood effect. Nevertheless, two arguments

Table 1 Radiocarbon evidence from the S'Hospitalet Vell navetes.

Structure	Context		Age (BP)	Calibrated date (2σ)	Dated sample	Collagen (%)	C/N	δ <sup>13</sup> C (‰)	δ <sup>15</sup> N (‰)
Naveta 1	Pavement attached to external wall		KIA-38959: 3275 ± 30 BP	1626–1461 cal BC	Caprine bone (collagen)	4.11	3.4	-20.27	+7.86
			UBAR-388: 3070 ± 50 BP	1444–1134 cal BC	Charcoal	-	-	-	-
			UBAR-389: 3110 ± 50 BP	1495–1264 cal BC	Charcoal	-	-	-	-
			UBAR-390: 3140 ± 60 BP	1531–1261 cal BC	Charcoal	-	-	-	-
			KIA-41562: 3220 ± 30BP	1605–1421 cal BC	Cattle bone (bioapatite)	-	-	-12.84	-
Naveta 3	Collapsed roof (UE7)		KIA-41380: 3160 ± 25BP	1496–1400 cal BC	Goat bone (collagen)	1.7	3.4	-19.06	+4.78
			KIA-44552: 3180 ± 25BP	1499–1414 cal BC	Cattle bone (collagen)	2.14	3.2	-20.1	+6.3
			KIA-41548: 2825 ± 25BP	1048–912 cal BC	Cattle bone (bioapatite)	-	-	-14.86	-
			KIA-41549: 2850 ± 25BP	1115–926 cal BC	Goat bone (bioapatite)	-	-	-15.16	-
			KIA-41550: 2825 ± 25BP	1048–912 cal BC	Goat bone (bioapatite)	-	-	-15.40	-
Naveta 4	Intrusive (layer affected by roots)		KIA-41547: 2415 ± 25BP	732–402 cal BC	Pig bone (bioapatite)	-	-	-11.73	-
			KIA-44554: 3285 ± 25BP	1621–1501 cal BC	Goat bone (collagen)	2.70	3.2	-19.7	+3.5
			KIA-44553: 3225 ± 30BP	1606–1427 cal BC	Caprine bone (collagen)	0.95	3.2	-19.2	+4.1
			KIA-44551: 2465 ± 30BP	760–414 cal BC	Human bone (collagen)	4.59	3.1	-19.0	+11.0

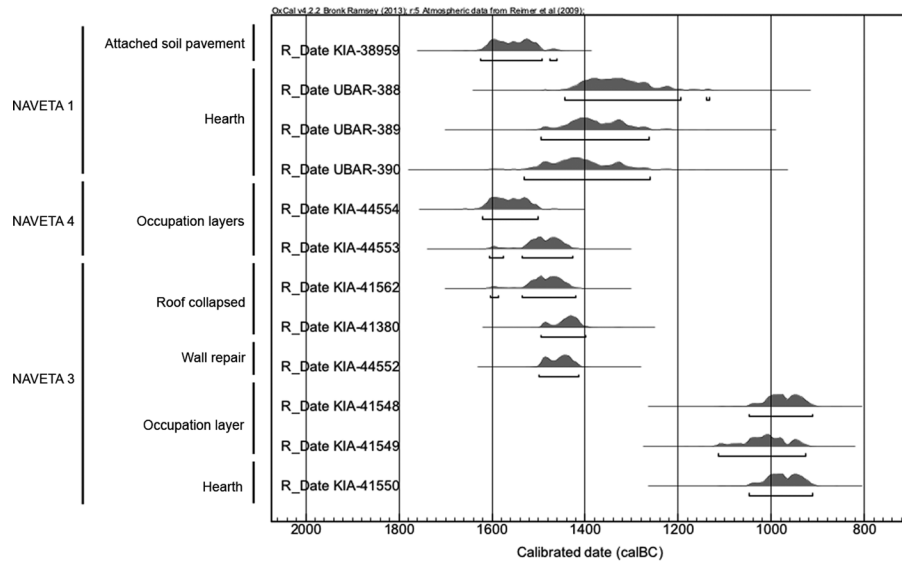


Figure 4 Radiocarbon dating for the navetes at S'Hospitalet Vell

dispute this assumption. First, the hearth from an open-air house is usually made with branches, and not with old and/or wide wooden trunks. Second, the three results obtained overlap very widely. This would seem to indicate that the hearth did not contain old pieces of wood. Consequently, the more logical interpretation is to view the charcoal <sup>14</sup>C dating as representative of the chronology for the last use of Naveta 1. It can thus be dated to roughly 1450–1250 cal BC.

The only occupation layer detected in Naveta 3 has been dated from about 1050 and 900 cal BC, based on three different bone samples (Figure 5). A fourth sample, from the inner layers of this structure, gave a very young result (750–400 cal BC). There is a clear lack of synchronicity between this date and the materials found inside the naveta. This younger result has been interpreted as an intrusive sample in a context affected by roots; consequently, it has been discarded. It is interesting to note that there is an important gap between the moment of the roof construction and the repair of the wall (~15th century cal BC) and the occupation chronology (~1050–900 cal BC). This means that the later inhabitants of Naveta 3 completely removed the earlier occupation layers and cleaned the inner space down to the bedrock. Finally, the upper occupation layer of Naveta 4 is dated to a very early moment in the middle 2nd millennium (1610–1420 cal BC).

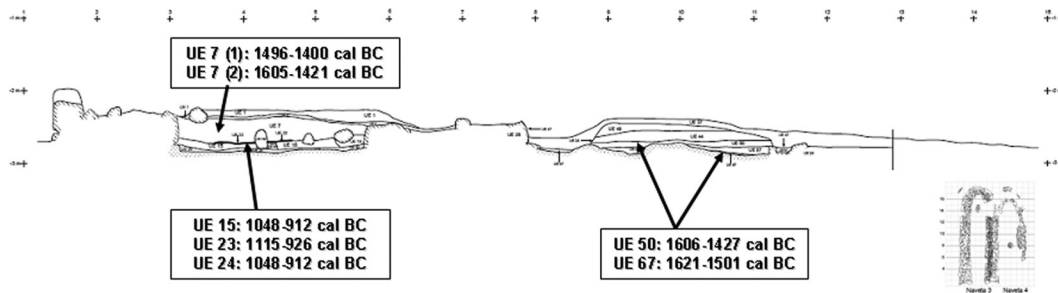


Figure 5 Cross-section of navetes 3 and 4

A side note to Naveta 4 was the presence of a human inhumation in a grave excavated into the collapse layer. It consisted of an articulated male skeleton buried without any grave gifts. It dates to the second quarter of the 1st millennium cal BC and is a good example of the Talayotic culture funerary practices in the early Iron Age, which included the wide reuse of older monuments (Coll 1995).

The S'Hospitalet Vell results can be compared to reliable chronological evidence from other naveta dwellings on the islands of Mallorca and Menorca (Table 2, Figures 6 and 7). For Mallorca, the comparable data comes from Son Oms (Rosselló-Bordoy 1979), Canyamel (Pons 1999), Naveta 1 from the village of Es Closos de Can Gaià (Salvà 2001), and S'Arenalet de Son Colom (Ramis et al. 2007). For Menorca, the evidence comes from Clariana, Cala Blanca (Plantalamor and Van Strydonck 1997), and the navetes of the coastal promontory of Cala Morell (unpublished data).

Son Olesa is the most widely dated naveta village in the Balearic Islands (Waldren 1986). Unfortunately, the Son Olesa evidence cannot be relied upon because the stratigraphic position of the dated samples and their relation with the architectonic structures is very unclear (e.g. Coll 2000). While <sup>14</sup>C dating series do exist for similar sites in Mallorca and Menorca (Son Baduia and Sa Creu den Ramis), the related excavation data and information about the relationship between the dated samples and associated structures is unavailable. Consequently, evidence from the aforementioned sites will not be considered in the present analysis.

The early evidence for cyclopean domestic architecture in the Balearic Islands comes from the S'Arenalet de Son Colom site (Ramis et al. 2007; Ramis 2010). This site provides a culturally homogeneous material assemblage belonging to a single occupation horizon. It dates to approximately 2150–1950 cal BC. The pottery types from S'Arenalet de Son Colom are characteristic of the late 3rd millennium cal BC, including incised Beaker fragments.

It is widely accepted that early Mallorcan settlers dwelled in huts built mostly of nondurable materials. However, none of these structures have ever been adequately recorded. The so-called megalithic tombs of Son Olesa (Waldren 2001) and other open-air sites with Beaker pottery but no recorded architectural remains—such as the lower level of Ca na Cotxera (Cantarellas 1972)—are probably related to such impermanent huts. However, in the light of the work at S'Arenalet de Son Colom, both impermanent and cyclopean habitat types coexisted in Mallorca during the late 3rd and early 2nd millennia BC, as had been previously proposed (Plantalamor 1991). Nonetheless, it should be noted that currently there is no clear data concerning the open-air domestic architecture for the early third of the 2nd millennium cal BC. There are no known dwelling structures dated to this interval.

Subsequent to the aforementioned time gap, evidence of naveta occupation in Mallorca and Menorca occurs in the second quarter of the 2nd millennium (mainly in the 16th century) cal BC. The three dated S'Hospitalet Vell navetes were in use before ~1500 cal BC. The Menorcan cases of Cala Blanca and Naveta 11 from Cala Morell fit well within this chronological framework of the second quarter of the 2nd millennium cal BC.

More intense naveta occupation evidence is found in the third quarter of the 2nd millennium cal BC. All the dated navetes in Mallorca and Menorca were in use at some moment during this timeframe. Only the charcoal-based chronology from the Son Oms hearth may be slightly later, but the result covers a wide range (1310–920 cal BC) because of its wide standard deviation. Navetes 1 and 4 were abandoned before 1200 cal BC, which agrees with most of the chronological evidence from other Mallorcan and Menorcan similar sites.



Table 2 Radiocarbon evidence for occupation of habitation navetes in Mallorca and Menorca.

Site	Context	Age (BP)	Calibrated result (2σ)	Dated sample	
<b>Mallorca</b>	S'Arenalet de Son Colom	SU 13	KIA-26215: 3670 ± 35 BP	Caprine bone	
		SU 10	KIA-26226: 3660 ± 35 BP	Cattle bone	
	Es Closos de Can Gaià (Naveta 1)	Layer IIIb	KIA-11231: 2960 ± 25 BP	1262–1059 cal BC	Bones
		Layer Va	KIA-11242: 2890 ± 35 BP	1207–976 cal BC	Bones
		Layer IV	UIC-8144: 2876 ± 39 BP	1193–930 cal BC	Charcoal
		Layer Va	UIC-8145: 2926 ± 44 BP	1261–1003 cal BC	Charcoal
		Layer Va	UIC-8146: 2865 ± 41 BP	1192–918 cal BC	Charcoal
		Layer IIIb	UIC-8141: 2775 ± 41 BP	1016–827 cal BC	Charcoal
	<b>Menorca</b>	Layer III	KIA-11229: 2740 ± 30 BP	971–816 cal BC	Bones
		Layer III	KIA-11232: 2790 ± 40 BP	1042–836 cal BC	Bones
Son Oms		QL-20: 2920 ± 60 BP	1282–932 cal BC	Charcoal	
Canyamel		UBAR-387: 3060 ± 50 BP	1434–1132 cal BC	Bones	
Clariana (Naveta 3)		Layer 1	IRPA-1172: 3070 ± 40 BP	1421–1226 cal BC	Bones
		Upper layer	IRPA-1124: 3100 ± 40 BP	1449–1260 cal BC	Bones
		Upper layer	IRPA-1123: 3320 ± 40 BP	1691–1504 cal BC	Bones

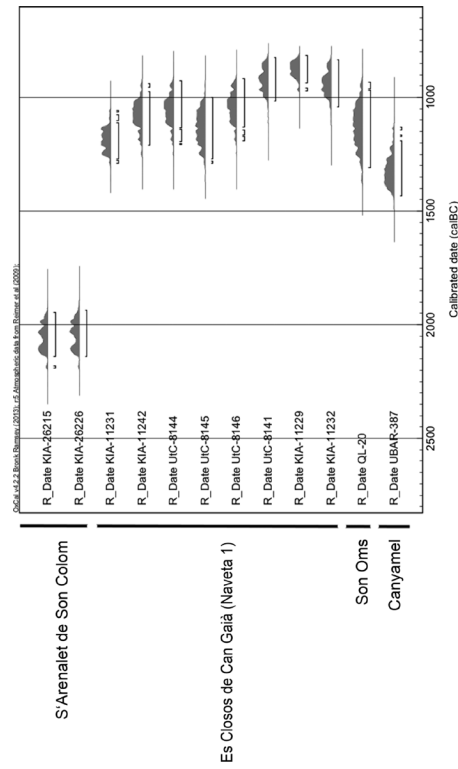


Figure 6 Radiocarbon dates for habitation navetes in Mallorca

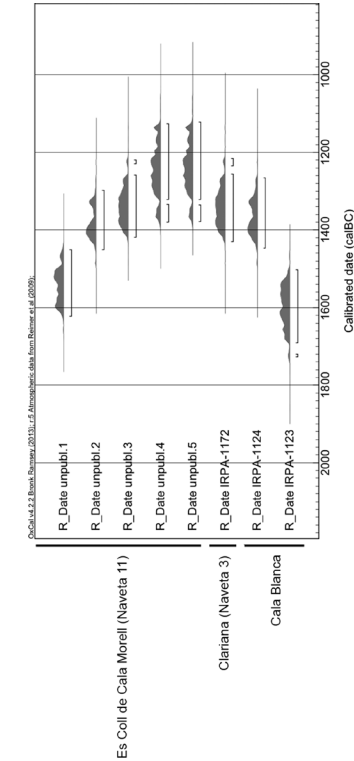


Figure 7 Radiocarbon dates for habitation navetes in Menorca

The occupation evidence for navetes after the 12th century cal BC is very scarce. The  $^{14}\text{C}$  results from the late 2nd or early 1st millennia cal BC decrease significantly. Only two of the dated navetes, both from Mallorca, seem to be in use during this later timespan. The last use of S'Hospitalet Vell Naveta 3 is dated to the late 11th or 10th century cal BC, while the Es Closos de Can Gaià Naveta 1 seems to be abandoned between the 10th and 9th centuries cal BC.

## CONCLUSION

The analysis of  $^{14}\text{C}$  evidence from the naveta village of S'Hospitalet Vell combined with the stratigraphic data from the excavation has revealed substantial information about its chronology dynamics. The S'Hospitalet Vell navetes were in use from at least the 16th century cal BC. It is possible that they were constructed not long before the initial available dating, but this assertion remains speculative, because it is mainly based on the lack of older evidence in the excavations. It has not been possible to establish a *terminus ante quem* for any of the three navetes analyzed. However, it is clear that all of them were in use during some moment of the third quarter of the 2nd millennium cal BC. On the other hand, the final abandonment of each naveta did not occur at the same time. The final occupation of Naveta 1 is dated ~1450–1250 cal BC; Naveta 3 was in use up to ~1050–900 cal BC; and the last occupation for Naveta 4 is older than 1400 cal BC.

From a general point of view, a comparison between the S'Hospitalet Vell results and other similar sites in Mallorca and Menorca leads to two final interpretations about the last stage of this cultural period characterized by naveta villages. First, the more intense evidence of the occupation of the navetes occurred in the third quarter of the 2nd millennium cal BC. The use of navetes after this interval seems to be residual. The diachronic abandonment of navetes suggests a gradual transition from naveta villages to Talayotic villages. Second, the last use of domestic navetes in Menorca dates to approximately the third quarter of the 2nd millennium cal BC. There is no evidence of further occupation beyond this timeframe. Consequently, it can be suggested that this cultural period ended earlier in Menorca than in Mallorca.

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## REFERENCES

- Bronk Ramsey C. 2009. Bayesian analysis of radiocarbon dates. *Radiocarbon* 51(1):337–60.
- Cantarellas C. 1972. Excavaciones en “Ca Na Cotxera” (Muro, Mallorca). *Noticiario Arqueológico Hispánico-Prehistoria* 1:179–226.
- Coll J. 1995. Aproximación a la sistematización y cronología de las estructuras funerarias de la cultura talaiótica en Mallorca. In: Waldren WH, Ensenyat JA, Kennard RC, editors. *Ritual, Rites and Religion in Prehistory. IIIrd Deya International Conference of Prehistory*. BAR International Series 611. Oxford: Archaeopress. p 296–310.
- Coll J. 2000. Excavación arqueológica del coval Simó. Estado actual y perspectivas de futuro. In: Guerrero VM, Gornés S, coordinators. *Colonización humana en ambientes insulares. Interacción con el medio y adaptación cultural*. Palma: Universitat de les Illes Balears. p 371–400.
- Guerrero V, Calvo M, García J, Gornés S. 2007. *Prehistoria de las Islas Baleares: Registro arqueológico y evolución social antes de la Edad del Hierro*. BAR International Series 1690. Oxford: Archaeopress.
- Longin R. 1971. New method of collagen extraction for radiocarbon dating. *Nature* 230(5291):241–2.
- Micó R. 2005. *Cronología absoluta y periodización de la prehistoria de las Islas Baleares*. BAR International Series 1373. Oxford: Archaeopress.
- Micó R. 2006. Radiocarbon dating and Balearic prehistory: reviewing the periodization of the prehistoric sequence. *Radiocarbon* 48(3):421–34.
- Nadeau M-J, Grootes PM, Schliecher M, Hasselberg P, Rieck A, Bitterling M. 1998. Sample throughput and data quality at the Leibniz-Labor AMS facility. *Radiocarbon* 40(1):239–45.
- Plantalamor L. 1991. *L'arquitectura prehistòrica i protohistòrica de Menorca i el seu marc cultural*.

- Treballs del Museu de Menorca 12. Mahon: Conselleria d'Educació, Cultura i Esports del Govern Balear.
- Plantalamor L, Van Strydonck M. 1997. *La cronologia de la prehistòria de Menorca (Noves datacions de <sup>14</sup>C)*. Treballs del Museu de Menorca 20. Mahon: Conselleria d'Educació, Cultura i Esports del Govern Balear.
- Pons G. 1999. *Anàlisi espacial del poblament al Pretalaiòtic final i al Talaiòtic I de Mallorca*. Monografies de Patrimoni Històric, Col·lecció La Deixa 2. Palma: Consell de Mallorca.
- Ramis D. 2010. From colonisation to habitation: early cultural adaptations in the Balearic Bronze Age. In: Van Dommelen P, Knapp AB, editors. *Material Connections in the Ancient Mediterranean. Mobility, Materiality and Mediterranean Identities*. London: Routledge. p 64–84.
- Ramis D, Salas M. 2011. Resultats preliminars de la intervenció a la naveta 1 de S'Hospitalet Vell (Manacor). In: Gual J, coordinator. *III Jornades d'Arqueòlegs de les Balears*. Llibres del Patrimoni Històric i Cultural 4. Consell Insular de Menorca. p 35–41.
- Ramis D, Salas M. 2013. Estudi de la fauna dels nivells exteriors de la naveta 1 de S'Hospitalet Vell. *VII Jornades d'Estudis Locals de Manacor*. Manacor: Ajuntament de Manacor. p 105–12.
- Ramis D, Plantalamor L, Carreras J, Trias M, Santandreu G. 2007. S'Arenalet de Son Colom (Artà) i l'origen de l'arquitectura ciclòpia a les Balears. *Bolletí de la Societat Arqueològica Lulliana* 63:295–312.
- Reimer PJ, Baillie MGL, Bard E, Bayliss A, Beck JW, Blackwell PG, Bronk Ramsey C, Buck CE, Burr GS, Edwards RL, Friedrich M, Grootes PM, Guilderson TP, Hajdas I, Heaton TJ, Hogg AG, Hughen KA, Kaiser KF, Kromer B, McCormac FG, Manning SW, Reimer RW, Richards DA, Southon JR, Talamo S, Turney CSM, van der Plicht J, Weyhenmeyer CE. 2009. IntCal09 and Marine09 radiocarbon age calibration curves, 0–50,000 years cal BP. *Radiocarbon* 51(4):1111–50.
- Rosselló-Bordoy G. 1979. *La cultura talaiòtica en Mallorca*. Palma: Cort.
- Rosselló-Bordoy G. 1983. *El poblado prehistòric de Hospitalet Vell (Manacor)*. Palma: Institut d'Estudis Balearics.
- Rosselló-Bordoy G. 1986–1989. El hogar parrilla en las navetas mallorquinas. *Empúries* 48–50:260–7.
- Rosselló-Bordoy G. 1987. Metalurgia en el pretalaiòtic final de Mallorca. *Archivo de Prehistoria Levantina* 17:147–53.
- Salvà B. 2001. *El pretalaiòtic al llevant mallorquí (1700–1100 AC)*. Anàlisi territorial. Palma: Documenta Balear.
- Van Strydonck M, van der Borg K. 1990–1991. The construction of a preparation line for AMS-targets at the Royal Institute for Cultural Heritage Brussels. *Bulletin of the Royal Institute for Cultural Heritage* 23:228–34.
- Van Strydonck M, Boudin M, De Mulder G. 2009. <sup>14</sup>C dating of cremated bones: the issue of sample contamination. *Radiocarbon* 51(2):553–68.
- Waldren WH. 1986. *The Balearic Pentapartite Division of Prehistory. Radiocarbon and other Age Determination Inventories*. BAR International Series 282. Oxford: Archaeopress.
- Waldren WH. 2001. A new megalithic dolmen from the Balearic island of Mallorca: its radiocarbon dating and artefacts. *Oxford Journal of Archaeology* 20(3):241–62.