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MATCHING DATA: ANALYZING THE CHRONOLOGICAL USE SEQUENCE IN THE IRON AGE NECROPOLIS OF THE STAGGERED TURRIFORM OF SON FERRER (BALEARIC ISLANDS, SPAIN)

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ABSTRACT. The Son Ferrer archaeological site presents a series of successive occupations spanning a long period of time. At the beginning of the Iron Age (~850 BC), a staggered turriform structure was built for a ritual purpose over an artificial hypogeum that had already been used as a collective necropolis during the Early Bronze Age (~1800–1500 BC). Later, in the post-Talayotic phase (Second Iron Age, 550–123 BC), the hypogeum was again reused as a collective burial place. The present work is focused on the chronological and functional analysis of this last phase, which began ~500 BC and ended ~180 BC with the saturation and sealing of the hypogeum. The excavation process revealed that significant removal of archaeological material has occurred as a result of complex funerary space management practices, which generated a secondary archaeological context. Given this situation, and in order to establish the different use phases of the post-Talayotic necropolis, a dual strategy of excavation and research was implemented. First, an extensive series of radiocarbon dates on human remains (18 dates) was obtained, which were later analyzed following Bayesian strategies. Second, a detailed spatial analysis was carried out, georeferencing the location of all the archaeological finds. This strategy allowed the reconstruction of the space management processes and movement patterns that took place in the burial space. Despite some initial difficulties, the combination of these research strategies embedded in a contextual analysis provided both material and chronological references that have contributed to define the various use phases of the hypogeum.

INTRODUCTION

The archaeological site of Son Ferrer (Calvià, Mallorca) shows a succession of occupations, which have been consistently associated with ritual and funerary contexts, dating from ~1800 BC to ~AD 50, as well as consecutive sporadic visits until ~AD 600 (Calvo et al. 2005; Albero et al. 2011), constituting an example of so-called *persistent places* (Schlanger 1992; Barton 1995).

The study presented here is focused on the chronological and functional analysis of the last prehistoric phase of this site, i.e. the collective necropolis of the post-Talayotic period (Calvo et al. 2006; Calvo 2009; Calvo and Guerrero 2011). It was evident during the excavation process that substantial secondary redeposition of material occurred as a result of complex interventions in the past due to the management of the funerary space.

Bearing this situation in mind, and aiming at defining the possible use phases of the necropolis, a twofold strategy of excavation and research was developed. First, a series of radiocarbon dates on human remains was established. Then, spatial analysis with GIS methodology was employed in order to georeference all the archaeological elements recovered in the site. This second strategy facilitated the reconstruction of the deposition sequence and phases of both inhumations and archaeological material. The study followed four analytical guidelines: the recording of the stratigraphic relations of the materials and the different stratigraphic units; the consideration of pottery refitting patterns; the analysis of postdepositional movement dynamics (Schiffer 1976); and, finally, the review of funerary space management strategies.

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In short, this study is the result of the fusion of both research guidelines (spatial analysis and ^{14}C datings) presented in a contextual analytical strategy combined with Bayesian statistics (Buck et al. 1991; Bronk Ramsey 1995; Bayliss et al. 2007). Despite some early difficulties, this framework allowed identifying the different use phases of the necropolis, as well as the relationship between materials and chronological references for each of the phases recorded.

ARCHAEOLOGICAL BACKGROUND

The studied site is located in the urban area of Son Ferrer (Calvià) and defined by a long and complex occupation covering the beginning of the Bronze Age to later Roman times, as well as subsequent sporadic visits until the 7th century AD (Figure 1). This extended use sequence gave rise to a variety of spaces and settings in each of the different occupational phases of the site.

The first event dates back to the Early Bronze Age (~1800–1500 BC). At the time, this site was part of a larger array of artificial funerary caves (Calvo et al. 2006), which would be intensively

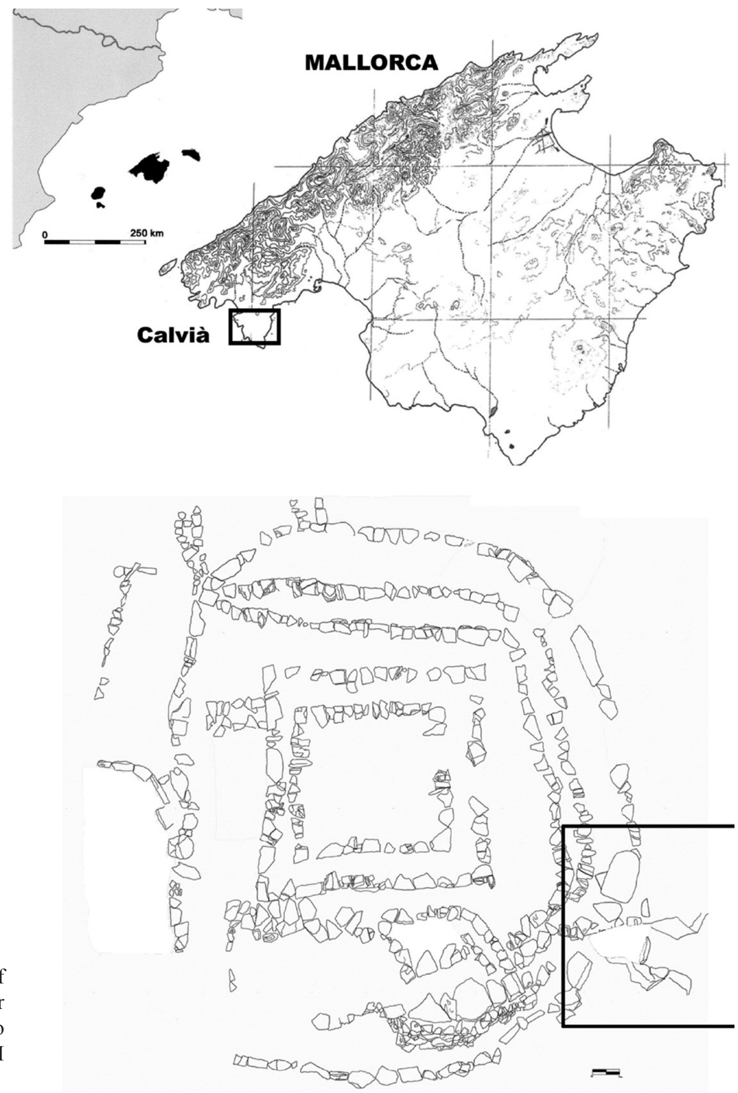

Figure 1 Map showing the location of the staggered turriform of Son Ferrer and plant of the site with reference to the location of the Funerary Context I in the ensemble.

reused in later phases. In the Late Bronze Age, a new architectural ensemble was built, now hardly recognized in the Talayotic buildings in which it was later incorporated. The building of this feature implied an intense architectural reconfiguration of the site, with the incorporation of a turriform[4] integrating the primeval structures from the Late Bronze Age (Figure 1). Furthermore, this new ensemble incorporated under its structure the Early Bronze Age artificial hypogeum,[5] which would be reused some centuries later. Both the contextual and stratigraphic analyses of the dates for this period evidenced that the building of the staggered structure should be placed around 900–700 BC (Calvo et al. 2005, 2006).

The Post-Talayotic Necropolis of the Staggered Turriform of Son Ferrer: Funerary Context I

Towards ~500–400 BC, the staggered turriform of Son Ferrer was reconceptualized and began to function as a necropolis. This implied the remodeling of certain areas in the structure. Among these, the reuse of the Bronze Age artificial cave beneath the turriform is compelling, as from this moment onwards it turned into a collective inhumation area (Funerary Context I). New funerary spaces were generated as well on the eastern slope of the turriform, reusing and emptying the structural filling to deposit infant inhumations inside, in discrete funerary sandstone containers and fractured amphorae (Funerary Context II). Opposing this funerary area, on the western side, series of quadrangular chambers were added to the external walls of the turriform, serving as storage and food processing areas.

This funerary use of the staggered turriform continued until approximately the end of the 2nd to beginning of the 3rd century AD, particularly in the case of Funerary Context II, as suggested by an infant occurring in a Punic amphorae type T-8.1.3.3 (Quintana 2010). However, the site continued being visited, at least sporadically, well into the 6th century AD, as seen in the deposition of a few finds dated between the 5th and 7th century AD (Albero et al. 2011).

The aim of this article is thus to provide a chronological analysis of Funerary Context I, which is made up of four spaces: the artificial hypogeum of the Bronze Age, which was reused in this period; the corridor giving access to the hypogeum; the area at the entrance of the corridor; and a small space inside the turriform, which may have been part of the corridor (Figure 2). This last area was limited by a rock-cut threshold, providing a horizontal corridor-like entrance to the chamber.

The hypogeum was divided into three spaces thoroughly described in Calvo et al. (2006). The first one comprised a small chamber of rather rectangular shape (Area 3A), which led to the main chamber of the cave by crossing a semicircular arch excavated into the sandstone. The main chamber (Area 3B), the most complex structure in the cave, presented an elongated plant and a rock-cut lancet vault. A trench or ditch ran in the center, with stands or steps on both sides to overcome the resulting unevenness. Around this ditch, a pair of long benches cut into the sandstone rested on the perimeter walls. They ended towards the middle of the chamber, where a platform leading to the end of the cave was also found. The cave was closed by a third chamber (Area 3C), which can be described as an absidial-shaped cubicle of reduced dimensions.

The last area associated with Funerary Context I comprised a small shelf-like projecting feature that entered into the architectural structure of the turriform of Son Ferrer, situated in the final area of the corridor that gave access to the cave (Area 4).

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4. Architectural type typical of the early Iron Age in the Balearic Islands (Talayotic period), characterized by a massive body covering a central platform and concentric rings of different heights, which confers the building a staggered appearance.
5. Artificial cave excavated in the rock, with a funerary use.

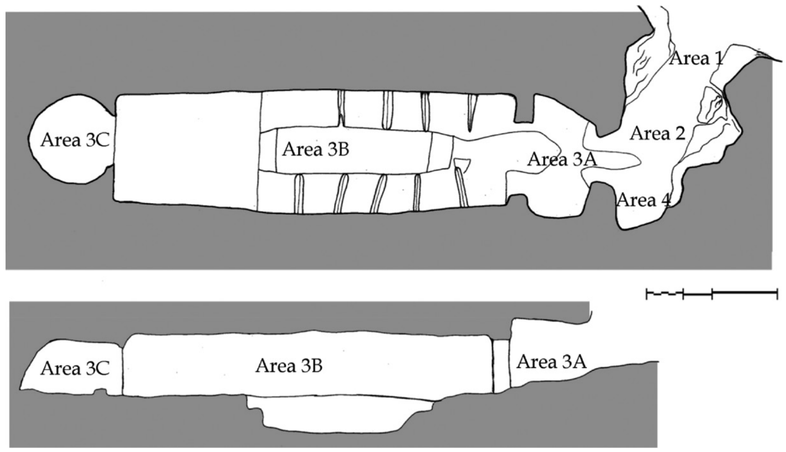

Figure 2 Plan of the Funerary Context I indicating the areas mentioned in the text

Funerary Context I, built during the Early Bronze Age, was reused from the beginning of the Late Iron Age (post-Talayotic period) as a collective inhumation necropolis. To achieve this function, the contents of the cave had been previously emptied out, with only a small number of pottery sherds deposited in secondary position representing the period previous to the post-Talayotic funerary use of the hypogeum. During this earlier stage, only the inside of the hypogeum (Area 3) was used for the deposition of both adult and infant inhumations, the latter dominating the assemblage (Alesan and Malgosa 2005). From then on, a single stratigraphic unit was documented (UE 9), composed of disaggregated sandy sediments, in which all the inhumations and associated archaeological materials deposited as grave goods were found. In subsequent occupations, the cave, which must have been saturated by the inhumations, was eventually abandoned. A final group of inhumations (I4, I5, and I6) were placed in primary position. Inhumation I4 can be highlighted as it was located transversally to the entrance of the cave, sealing the access. This was the last use of the cave, and from that moment onwards, both funerary and votive practices would take place in the corridor. Thus, this new space was prepared with two areas divided by a large transversal calcareous slab (UE 92) and later paved with stones (UE 93–97). In the space nearer the cave (Area 2, UE 101), only perinatal inhumations were placed in either sandstone containers or indigenous pottery (Alesan and Malgosa 2005; Garcías and Gloaguen 2003). The second area, the one further away from the corridor (Area 1, UE 62), yielded a large amount of highly fragmented pottery. This important pottery assemblage was interpreted as an archaeological event associated with a burial ritual taking place at the time. Next to this access corridor, a flat combustion structure (UE 64) was identified, lacking any definition or specific preparation, but also seemingly associated with the funerary rituals.

The human remains recovered inside the cave were found in secondary position except for three inhumations (two adults and one infant: I4, I5, and I6), which appeared articulated as they were the last three individuals to be deposited, just before the cave was sealed. The anthropological analysis of the remains (Alesan 2008) reported a minimum number of individuals (MNI) of 60, whereas the probable number of individuals may be up to 101. From them, 49% were fetuses or perinatal individuals, most probably stillborn or the result of miscarriages. Infants up to 14 yr old comprised 38% of the total, whereas adults accounted for only 13%. Among the latter, 61% were aged between 20 and 35. It was possible to identify the sex only in 58 perinatal and 10 adult inhumations. Among infants, both sexes were evenly represented, whereas in the case of adults, four were women and six were men. Thus, the anthropological assemblage recovered indicated an important infant mortality rate in a highly fertile group. The osteological analysis attested that these inhumations had been primarily deposited and, following the natural flesh decay, a secondary deposit of disarticulated remains was generated as a result of significant disturbance.

ANALYTICAL STRATEGIES

Previous Concerns

The interpretation of the archaeological deposit of Context I presented mainly three difficulties. First, the series of ^{14}C dates (Table 1) available for this context evidenced a long use between the ~540 BC and ~AD 70 chronological range. Second, except for the last inhumations (I4, I5, and I6) and funerary urns and vessels (353, 352, 592, and 238) deposited, pottery material was extremely fragmented and highly dispersed. Furthermore, bone remains were not articulated. Third, the anthropological studies evidenced that the inhumations had been originally deposited in primary position to be later disarticulated as a result of the reorganization of the funerary space. Despite this manipulation, no intentional selection, extraction, or relocation processes of the bones were detected. Additionally, the pottery refitting analysis revealed that these sherds, while highly fragmented when retrieved, were also originally present in this funerary context. Thanks to the important refitting ratio, it was possible to subsequently reconstruct a significant number (100 pottery vessels) of complete or partially refitted profiles. Finally, the microspatial analysis of the cave also shed light on the dynamics of other processes at play. Among these, the significance of clearance episodes is noteworthy, occurring in a lengthwise direction, causing no regroupings or any intentional patterning for either pottery or bone after their primary deposition. These distributional patterns were interpreted as the result of movements into and out of the cave through time, following the dynamics of the different burial events witnessed in the artificial hypogeum of Son Ferrer.

Methods

Considering the concerns cited in the previous section and with the intention of inquiring into the possible depositional sequence of the inhumations and their grave goods, an analytical strategy combining three different research lines was proposed.

Pottery Spatial Analysis

Aiming at thoroughly documenting the geospatial location of the remains deposited in the cave, an excavation strategy consisting in the aerial projection of a 25 × 25 cm grid was used. This grid functioned as a framework for georeferenced digital photographs that facilitated the later photogrammetric recording of the data. Thus, these photographs were used as reference for the spatial identification of each individual remain (i.e. bones, pottery vessels, charcoal, etc.) uncovered during the excavation. Furthermore, in order to coordinate this excavation strategy with the stratigraphic and sedimentary sequence of the deposits, the excavation was made by artificial levels following the deposition sequence of the archaeological materials. After the excavation stage, all the material was vectorially digitized from the photographs, providing the spatial information needed to be later analyzed as part of a GIS project. These data, already georeferenced, were matched with the available databases generated by the different analyses carried out on the materials, including the ^{14}C determinations. Special interest was placed on recording the pottery refitting analysis. For this, a georeferenced database was developed for each individual sherd where the physical connections among the refitted sherds were established. This strategy resulted in a visual pattern of the spatial dispersion of the sherds originally making up a single vessel.

Table 1 Radiocarbon dates from post-Talayotic phase with Bayesian information (see also Table 3).

Lab code	% collagen	Stratigraphic unit context	Bone type, inventory nr and weight[a]	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C/N	^{14}C age (BP)	Calibrated date (95.4%)[b]	Posterior density (95.4% prob.)
Phase I									
KIA-30643	16.1	Context 9, Burial	Radius. Inv. nr E7-03-9-26377. ~35 g.	−19.8	10.1	3.3	2355 ± 25	508 (1.6%) 500 cal BC 491 (93.8%) 385 cal BC	*411–379 cal BC*
KIA-30644	13.5	Context 9, Burial	Fibula. Inv. nr E7-03-9-25489. ~55 g.	−19.4	12.5	3.3	2355 ± 30	516 (95.4%) 379 cal BC	*411–376 cal BC*
KIA-30635	11.3	Context 9, Burial	Humerus. Inv. nr E7-03-9-29212. ~65 g.	−18.8	10.9	3.2	2355 ± 35	702 (0.3%) 698 cal BC 541 (95.1%) 368 cal BC	*411–371 cal BC*
KIA-30641	11.1	Context 9, Burial	Radius. Inv. nr E7-03-9-25793. ~38 g.	−19.0	12.4	3.2	2300 ± 30	407 (79.6%) 356 cal BC 287 (15.8%) 234 cal BC	*403–363 cal BC*
KIA-30639	11.5	Context 9, Burial	Ulna. Inv. nr E7-03-9-28058. ~41 g	−19.6	10.1	3.3	2300 ± 30	407 (79.6%) 356 cal BC 287 (15.8%) 234 cal BC	*403–363 cal BC*
KIA-30647	9.0	Context 9, Burial	Fibula. Inv. nr E7-03-9-29770. ~34 g.	−19.6	10.8	3.2	2290 ± 30	405 (70.9%) 353 cal BC 292 (24.5%) 231 cal BC	*401–360 cal BC*
KIA-30653	15.1	Context 9, Burial	Child humerus. Inv. nr E7-03-9-25193. ~20 g.	−19.4	10.5	3.3	2285 ± 40	406 (51.9%) 348 cal BC 316 (43.5%) 208 cal BC	*402–357 cal BC*
KIA-30640	14.0	Context 9, Burial	Vertebrate. Inv. nr E7-03-9-29865.	−19.4	12.0	3.3	2270 ± 30	400 (49.3%) 351 cal BC 304 (46.1%) 210 cal BC	*398–357 cal BC*
KIA-30638	12.8	Context 9, Burial	Juvenile radius. Inv. nr E7-03-9-25932. ~41 g.	−19.3	11.5	3.2	2260 ± 40	400 (35.5%) 345 cal BC 322 (59.9%) 206 cal BC	*399–353 cal BC*
KIA-30651	14.2	Context 9, Burial	Tibia. Inv. nr E7-03-9-9773. ~193 g.	−19.7	10.3	3.2	2245 ± 25	390 (27.9%) 348 cal BC 317 (67.5%) 208 cal BC	*392–352 cal BC*
KIA-30634	13.7	Context 9, Burial	Radius. Inv. nr E7-03-9-28033. ~46 g.	−19.6	12.2	3.3	2240 ± 25	388 (24.3%) 347 cal BC 320 (71.1%) 206 cal BC	*391–351 cal BC*
KIA-30646	13.5	Context 9, Burial	Tibia. Inv. nr E7-03-9-25126. ~121 g.	−19.4	10.8	3.2	2235 ± 25	385 (21.1%) 346 cal BC 322 (74.3%) 206 cal BC	*390–350 cal BC*
KIA-30642	9.4	Context 9, Burial	Humerus. Inv. nr E7-03-9-29445. ~43 g.	−19.4	11.2	3.3	2185 ± 30	361 (95.4%) 172 cal BC	*388–342 cal BC*
Phase II									
KIA-30649	10.8	Context 9, Burial	Tibia from I5. Inv. nr E7-03-9-31686. ~122 g.	−19.0	11.1	3.3	2280 ± 30	403 (60.1%) 352 cal BC 297 (33.5%) 228 cal BC 221 (1.8%) 211 cal BC	*401–303 cal BC*
KIA-30650	7.2	Context 9, Burial	Juvenile femur from I4. Inv. nr E7-03-9-29883. ~323 g.	−19.5	11.3	3.2	2190 ± 25	360 (95.4%) 184 cal BC	*364–294 cal BC*
KIA-30632	5.4	Context 9, Burial	Rib from I6. Inv. nr E7-03-9-30023. ~14 g.	−19.2	11.3	3.3	2175 ± 30	361 (94.7%) 163 cal BC 128 (0.7%) 121 cal BC	*376–307 cal BC*

(Continued)

Table 1 Radiocarbon dates from post-Talayotic phase with Bayesian information (see also Table 3).

Lab code	% collagen	Stratigraphic unit context	Bone type, inventory nr and weight[a]	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C/N	^{14}C age (BP)	Calibrated date (95.4%)[b]	Posterior density (95.4% prob.)
Phase III									
KIA-30659	10.3	Context 11, Access of burial cave	Tibia. Inv. nr E7-00-9-8021. ~217 g.	−19.5	11.4	3.3	2155 ± 30	357 (35.4%) 282 cal BC 258 (1.3%) 245 cal BC 236 (58.7%) 95 cal BC	*320–113 cal BC*
KIA-25223	15.5	Context 62, Access of burial cave	Sesamoid from ovicaprin. Set nr 6406-C.	−18.8	—	3.2	2225 ± 30	380 (95.4%) 203 cal BC	*304–186 cal BC*
Phase IV									
KIA-30633	7.8	Context 11, Access of burial cave	Perinatal remains. Inv. nr from E7-00-7865 to 7905. ~23 g.	−18.0	12.5	3.3	2015 ± 30	95 cal BC (95.4%) 61 cal AD	*164 cal BC–AD 50*

[a]All samples were human bones, except KIA-25223.
[b]Calibration was conducted using OxCal v 4.2.3 software (Bronk Ramsey 2009) and the InCal13 calibration curve (Reimer et al. 2013).

Table 2 Pottery sherds found in the Funerary Context I according to their majoritarian and minoritarian location.

	Area 1		Area 2		Area 3		Even distribution	
	Nr of sherds	Percentage	Nr of sherds	Percentage	Nr of sherds	Percentage	Nr of sherds	Percentage
Area 1 Context 62	1678	91.64	14	2.51	16	1.03	8	21.06
Area 2 Context 101	76	4.16	342	61.40	310	19.82	19	50.00
Area 3 Context 9	77	4.20	201	36.08	1238	79.15	11	28.94
Total	1831	100	557	100	1564	100	38	100

Pottery Refitting Analysis

A series of models for the use of the funerary space were proposed from the spatial analysis of pottery refittings. Two main strategies were followed here. The first one was centered in the spatial analysis of the location of mass sherd assemblages. This strategy followed the distributional patterns indicated by the location and the density of large numbers of sherds originated from an individual vessel. According to this proposal, the higher density indicated the probable depositional locus of the pottery. The second strategy considered the dispersion diagrams and the distance existing among the sherds, which refitted into complete vessels by using descriptive statistical methods based on measures of central tendency. Thus, three large groups of dispersion distances were defined: less than 150 cm, between 150 and 250 cm, and more than 250 cm. Finally, the dispersion distances of the sherds were combined with the dispersion pattern they follow (e.g. star-shaped or with a lengthwise trend).

Radiocarbon Analysis

Along with the stratigraphic and spatial analysis, a large set of samples was selected and sent to the Dating Laboratory at the Royal Institute for Cultural Heritage, KIK-IRPA (Brussels, Belgium) for ^{14}C dating. The collagen extraction from the bones followed Longin (1971) with a supplementary NaOH (1%) wash. Part of the sample was combusted, transformed into graphite (Van Strydonck and van der Borg 1990–1991), and dated by accelerator mass spectrometry (AMS) (Nadeau et al. 1998). Another part of the sample was used for C/N ratio and stable isotope measurements using a ThermoFlash EA/HT elemental analyzer, coupled to a Thermo DeltaV Advantage isotope ratio mass spectrometer via a ConfloIV interface (all supplied by Thermo Fisher Scientific, Bremen, Germany).

In order to provide stronger evidence for the use sequence generated from the stratigraphic and spatial analyses and, at the same time, establish its correlation with the chronological intervals derived from the ^{14}C determinations available, a series of studies based on Bayesian statistics were applied. This technique presents the main advantage of providing a comprehensive reading of long series of ^{14}C dates and the possibility of improving the accuracy of the results by combining two types of independent data: stratigraphic sequences and ^{14}C datings (Buck et al. 1991; Bronk Ramsey 1995; Bayliss et al. 2007). For the development and implementation of the Bayesian models, the OxCal v 4.2.3 program was used here (Bronk Ramsey 2009).

RESULTS

Individual Dates

A total of 19 ^{14}C dates were obtained for Funerary Context I, of which 18 were on human bones and 1 on ovicaprid bone (Table 1). The dates were calibrated using the OxCal v 4.2.3 program (Bronk Ramsey 2009) and IntCal13 calibration curve (Reimer et al. 2013). All samples contained good quality bone collagen with high yields (between 5–16% collagen), no aberrant stable isotope data, and a C/N ratio between 3.2 and 3.3. The data are in agreement with previous studies on the Balearic Islands (Van Strydonck et al. 2005) (Figure 3).

This series of ^{14}C determinations confirmed the sequence observed in the stratigraphic analysis, and supported the idea that each area represented a different stage of usage:

a) For **Area 3**, or the interior of the cave, a large series of dates were produced (n = 16), covering a wide chronological interval from 720 (1.1%) 690 BC and 540 (94.3%) 370 BC (KIA-30635) to 370 (94.2%) 160 BC to 130 (1.2%) 110 BC (KIA-30632).

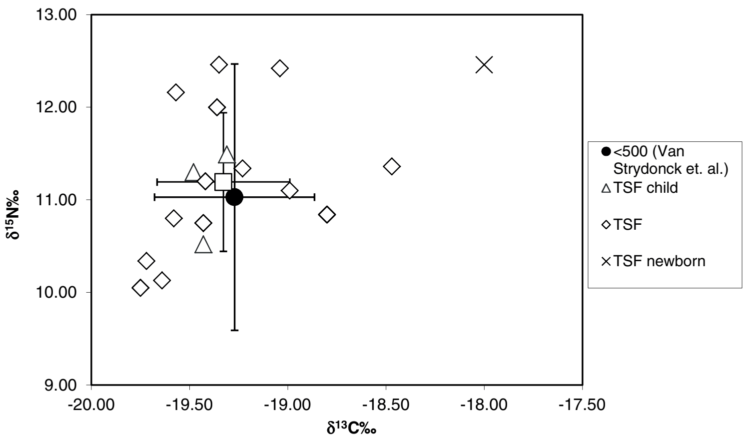

Figure 3 Stable isotope measururements and the average value (±1σ) in comparison with the average value of all human bones from the late Iron Age of the Balearic Islands (between 500 BC and the beginning of our era). As expected, the newborn is about 1 trophic level higer than the other humans.

Twelve of the dates produced for this area corresponded to human remains dispersed along the cave without any documented anatomical connection. The sampling strategy considered the tridimensional projections of the remains, trying to include a proportional selection of the different settings and levels of Area 3. The aim of this sampling strategy was to determine if the spatial distribution found for the human remains followed any spatial pattern regarding the depositional event. The results were, however, unproductive, reporting a considerable movement of remains in this area.

The stratigraphic analysis, however, allowed for a more accurate determination of the final use sequence of this area in particular. As mentioned above, in stratigraphic terms, individuals I4, I5, and I6 were the last to be buried, all of them in articulated condition. ^{14}C dates were obtained on samples from each of them and, although the date on I6 (KIA-30632) presented a wider probabilistic interval, the dates yielded by I5 (KIA-30649) and I4 (KIA-30650) were particularly interesting. If it is considered that individual I4 stratigraphically sealed the entrance to the cave, it is possible to set the interval defined by this burial as the most probable *ante quem* date for the saturation of this area.

The situation of the remains suggested a double depositional dynamic. First, the materials deposited were subject to substantial clearance events originating a secondary depositional context. Secondly, and coinciding with the final moments of use of the cave, the materials appeared in primary position with hardly any movement recorded.

b) From **Area 2**, or the part of the corridor nearest the entrance to the cave, two dates were obtained. The first one (KIA-30659) was placed in the 360 (35.5%) 280 BC to 260 (59.9%) 90 BC interval and the second (KIA-30633), between 100 BC (95.4%) AD 70. Despite the long span, both dates may reflect a common situation: the use of Area 2 as a funerary space once the cave was saturated and sealed.

c) For **Area 1** or the more external part of the corridor, a single date (KIA-25223) was available, placing its use in the 390 (95.4%) 200 BC chronological interval. This date would indicate that during the final use phase of the cave, or the beginning of the use of Area 2 with a funerary function, this place had already been used to deposit materials. However, further analysis was hampered due to the scarcity of datable bone samples. Nonetheless, the wheel-made pottery recorded in this area supported the idea of a continuous use of this space. This fact also attested an intimate connection between the funerary ritual in both areas (1 and 2). However, whereas in Area 2 the infants were deposited in funerary urns, the complete pottery seemingly associated with the funerary rituals was placed in Area 1.

Pottery Spatial and Refitting Analysis

The mass-sherd location analysis (Table 2) documented that the largest group of pottery fragments making up complete vessels (*n* = 1831) was located in Area 1. Most of this material was not moved to the different areas as the refitting evidenced that 91.65% of the sherds were found inside Area 1. The second largest refitting sherd concentration (*n* = 1654) was restricted to Area 3. Nevertheless, contrary to the situation for Area 1, in this area the movement of refitting sherds into different spaces was more common. Some 79.15% of the fragments refitted with material found exclusively in Area 3 and 18.74% with the ones in Area 2. Area 2 concentrated the smallest number of refitting sherds (*n* = 557). Furthermore, the material from this area was more disperse, as only 61.4% of the fragments refitted with sherds from the same space. On the other hand, 36.08% of the sherds were associated with pieces from Area 3.

The dispersion analysis indicated a general dominance of star-shaped distributional patterns for small dispersions that did not exceed 150 cm and were frequently even shorter than 1 m (9 out of 13). Most of these star-shaped distributions were located in areas 3A and 1. Regarding the sherds presenting a lengthwise distributional pattern, the distribution was more varied: less than 150 cm (18 out of 45), from 150 to 250 cm (16 out of 45), and more than 250 cm (11 out of 45). These models were typical of areas 3B and 3C.

As a result, both analyses—the spatial description and the dispersion of refitting sherds—basically indicated postdepositional movements between the inner part of the cave (Area 3) and the nearest part of the corridor (Area 2), reporting a funerary use for both areas. On the one hand, this pattern showed that once the cave was no longer used with a burial function—which was indicated by the primary deposition of pottery and bone remains in Area 3a—the part of the access corridor nearer the cave (Area 2) started its use as a funerary context. Part of the archaeological material (both pottery sherds and bones) deposited in the upper levels of this area spread towards the inside of the burial cave by the ramp at the entrance, where it was eventually found. On the other hand, the movements towards Area 1 were always more limited, coinciding with the absence of inhumations in this area and a lower activity index. This area may have fulfilled a double function throughout its use life in Funerary Area I, first acting as part of the corridor giving access to the cave, so some of the materials from the inside of the cave would have ended up here. Subsequently to the saturation and sealing of the cave, this area would have been used for pottery deposition, in association with the funerary rituals taking place in the nearby Area 2.

Modeling Stratigraphic and Spatial Depositional Sequences

Despite the many postdepositional movements in the tumulus, the spatial analysis based on pottery refitting and distributional models, together with the sequence of areas and elements, defined four depositional sequences:

a) Phase I: It was mainly defined by the use of the cave (Area 3, UE-9) as a collective container for inhumations that were initially deposited in primary position. However, they were later subject to important movements, especially in a lengthwise direction, as a consequence of the management of the internal space. In this phase, the corridor leading to the cave (areas 2 and 1) functioned only as a space that gave access to the interior of the hypogeum.

b) Phase II: It corresponded with the last inhumations deposited inside the cave. At this moment, neither space management nor significant movements were recorded in the funerary context. Thus, inhumations and funerary urns, as well as related grave goods, were found in primary position and rarely moved. During this phase, the cave was sealed with the deposition of the last three inhumations. The individuals I5 and I6 were deposited in the corridor leading to the vestibule of the main chamber, impeding in this way the access to that area. The last inhumation, I4, was transversally placed crossing the cave entrance, also sealing its access. Additionally, some pottery vessels (353, 352, 592, and 238) were deposited in primary position in Area 3A.

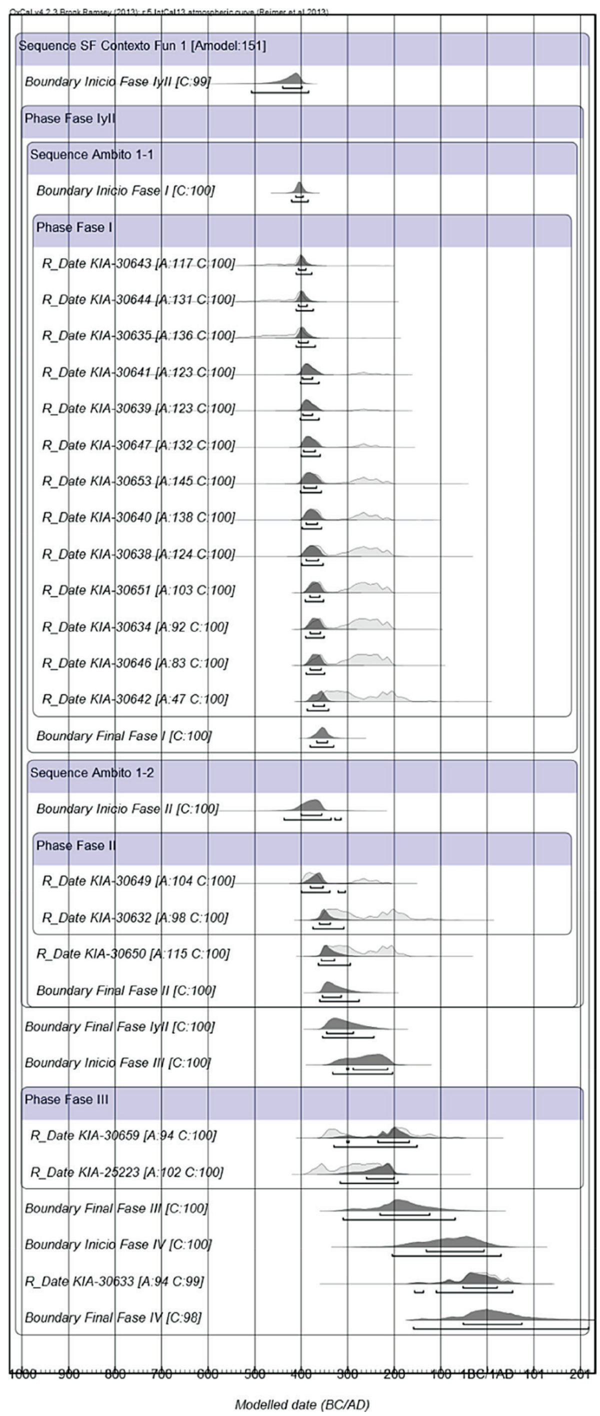

Figure 4 Bayesian model from Funerary Context I

c) Phase III: At this moment, the cave was saturated and abandoned, whereas the access corridor started to be used as a new funerary space. This space was divided into two areas: Area 2, where both grave goods deposits and burials took place, and Area 1, where most of the pottery associated with the ritual-votive events was left. Both areas were separated by a large slab that was transversally placed (UE 92).

d) Phase IV: This phase corresponded with the last moment of the deposition and was located in a small area inside the aerial structure of the staggered turriform.

Bayesian Model Dating

Based on the results of both spatial and stratigraphic analyses, a complex multiphase model was selected that articulates the several kinds of relations inferred for the different sets of events (Figure 4). Hence, some overlapping was indicated to have occurred between phases I and II, considering that individuals I4, I5, and I6 were found in anatomical connection but they were incomplete, probably due to postdepositional processes related to the defleshing of the bodies and the slope of the cave. Thus, it is not possible to rule out the possibility that some of their remains (particularly in the case of I5 and I6) ended up as part of the assemblage found in Area 1. On the other hand, a sequential relationship was modeled between these phases (I and II) and Phase III, implying a hiatus in between evidenced by the pottery analysis. Finally, the relationship existing between phases III and IV was determined by a multiphase sequential model based on the premise that there was no hiatus between them, which is also supported by the pottery analysis.

Furthermore, the results of the Bayesian model applied here (Table 3) were highly satisfactory (A_{model}: 151.1; $A_{overall}$ 138), with just a single date (KIA-30642) reporting agreement irregularities. A number of possibilities were proposed to explain this problem, from which the provenance of this bone from I5 or I6 seemed the most feasible. Nevertheless, as specific data regarding both spatial distribution and anthropological analysis was still missing, it was advisable to include it in the first phase, considering the overall appropriate soundness of the resulting model.

Table 3 Bayesian results.

Funerary context I Son Ferrer $A_{overall}$: 136.8; A_{model}: 151.2		Posterior density estimation (68.2% probability)	Posterior density estimation (95.4% probability)
PHASE I & II	Start	*444–399 cal BC*	*522–386 cal BC*
	End	*345–287 cal BC*	*354–245 cal BC*
PHASE I	Start	*412–397 cal BC*	*421–386 cal BC*
	End	*366–345 cal BC*	*381–331 cal BC*
	Duration	*30–57*	*11–68*
PHASE II	Start	*401–356 cal BC*	*441–311 cal BC*
	End	*354–314 cal BC*	*361–275 cal BC*
	Duration	*0–68*	*0–122*
INTERVAL I&II–III		*0–58*	*0–106*
PHASE III	Start	*292–217 cal BC*	*331–204 cal BC*
BOUNDARY III–IV		216–82 cal BC	290 cal BC–3 cal AD
PHASE IV	Start	*88 cal BC–98 cal AD*	*165 cal BC–335 cal AD*

CONCLUSIONS

The combined strategy of stratigraphic analysis, spatial dynamics, and Bayesian models to coherently integrate the ^{14}C series improved the determination of the chronological use sequence of Funerary Context I of the turriform of Son Ferrer at two levels:

1. The first one refers to the methodological possibilities for analyzing levels in a secondary position with important postdepositional dynamics. In this sense, the stratigraphic analysis and, particularly, the analysis of the pottery dispersion patterns and sherd refitting contributed:
   - To unveil the postdepositional movement dynamics existing in Funerary Context I, generating a thorough taphonomic knowledge of the archaeological sequence documented; and
   - To determine the original depositional areas of the pottery vessels and, consequently, the outline of different depositional sequences.
2. On a second level, and given the complexities dealt with when defining the depositional sequences, the Bayesian analysis of the ^{14}C series obtained for Funerary Context I provided the boundaries for each phase, determining the initial and final moments for each and establishing their time span. Finally, it was possible to make an exploratory analysis of the temporal distance that may have existed between each of the phases identified (Table 3).

The Bayesian analysis was particularly useful for Phase I due to the large number of dates available. For the rest of the phases, the reduced amount of dates prevented a more precise definition, generating as well some overlapping between phases. In order to solve the problems regarding chronological definition, further ^{14}C dates were needed. Once combined with the chronological definition provided by the pottery as a fossil guide, they could establish the accuracy of the chronological intervals proposed for the different phases by the Bayesian analysis. Hence, the model presented here should be reviewed in future works incorporating the time determinations, which the study of wheel-made pottery, currently in process, may provide.

To conclude, the application of this analytical protocol (recording strategies, long series of accurately contextualized datings, a thorough analysis of depositional sequences and postdepositional movements and, finally, their integration with Bayesian strategies) has significantly improved the determination of the most probable interval of use for this funerary context. These determinations reduced the previous estimation of 300 yr for the use of Phase I according to the interpretation of the probabilistic boundaries to an interval between 11 and 68 yr with the application of Bayesian statistics. The new situation opened several interpretative possibilities regarding the cultural use of the cave, the depositional dynamics, and the character of the groups involved through the demographic and population analysis available from the anthropological study of the human remains buried in the tumulus of Son Ferrer.

First, it must be evaluated if this short-duration sequence was an isolated or generalized dynamic in the post-Talayotic funerary dynamics. This requires reviewing the stratigraphic sequences of the different sites as well as interpreting available ^{14}C dates with Bayesian strategies in order to compare and evaluate the representativity of the situation identified in Son Ferrer. Second, the anthropological information from this funerary context has to be revised to determine if this short sequence for the deposition of the bodies may be interpreted as the result of events implying a high mortality rate or should be related to specific cultural behaviors that have not been documented so far in this phase of Balearic prehistory. This suggestion is reinforced by the important representation of infantile individuals, an age group identified with a particular funerary treatment, who are comparatively more numerous in this necropolis than in contemporary ones. Finally, it is also important to consider the possibility that these dynamics were connected with a second peculiar phenomenon recorded in this burial place, the complete absence of metallic elements both as adornment or related to the funerary ritual, which tend to be abundant in nearby necropolis.

In sum, this article demonstrated that the methodological strategies used to study the spatial dispersion of materials and the definition of phases and use sequences of complex archaeological contexts can provide new information that in the future would enlarge the explanations proposed for these kinds of archaeological records.

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