

# A Bipartite Network Analysis of Bell Beaker Decoration Diversity in Camino De Las Yeseras (Madrid, Spain)

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**Abstract:** In Central Iberia, recent studies of Bell Beaker funerary contexts have revealed recurrent practices, such as the construction of funerary areas, artificial caves and deep hypogea sealed with heavy stone slabs. Otherwise, the extraction and movement of human bones and Beaker sherds is well known in the Camino de las Yeseras site. In a previous study, a unipartite network analysis based on a similarity index of ceramics' decorative patterns was able to establish the presumed intra-site relations between two female tombs from different funerary areas. In this contribution we compare and improve these results, using a bipartite network analysis, more suitable for visualizing diffusion phenomena and graves that sport associations of similar decorative patterns. The analysed vessels belong to eight more or less contemporaneous Bell Beaker tombs from the second half of the third millennium cal BC. The validation or otherwise of this initial protocol performed for the site provides useful data for further studies on a larger ceramic corpus, to shed new light on the geographical distribution of Bell Beaker decorative patterns and to gain a greater understanding of the social relations among these first metallurgical societies.

**Keywords:** Bell Beaker, burials, Bipartite Network Analysis, Madrid region.

## 1. The Camino de las Yeseras site: Bell Beaker tombs and grave goods for the network analysis of Bell Beaker decoration

Camino de las Yeseras, located in the NE of the town of Madrid, is a one of the largest Chalcolithic Iberian ditched enclosures (ca. 22ha) in Central Iberia (Ríos, 2011; García Sanjuán *et al.*, 2018).

Strategically located at the confluence of two important rivers, it was probably a central place in a favourable landscape and well-connected territory with control over two fertile valleys for livestock and farming activities, and close to a rich catchment area, where flint, salt, and clay resources were available (Ríos, 2011). Chalcolithic occupation starts at the end of the fourth millennium BCE and lasts until the first centuries of the second millennium BCE.

More than 8500 structures have been documented by surface scraping and more than 2000 were excavated: mainly pits, ditched enclosures, huts, and tombs (Blasco *et al.*, 2007, Blasco *et al.*, 2005, Blasco *et al.*, 2011, Liesau, 2017, Liesau *et al.*, 2008, Liesau *et al.*, 2013-2014, Ríos, 2011, Ríos, 2016). In fact, five fieldwork campaigns allowed us to conduct our survey, especially in the southern area where several Chalcolithic huts and tombs have been excavated, as well as hundreds of pits with a high variability in size and function. The Bell Beaker funerary contexts documented at this site are found in areas where non-Bell Beaker Chalcolithic remains also exist (Blasco *et al.*, 2011, 2019).

The first occurrence of Bell Beakers in large peninsular settlements such as Camino de las Yeseras seems to generally be around 2500 cal BCE (Liesau, 2017, Márquez and Jiménez, 2010, Mataloto and Boaventura, 2009, Valera, 2017, among others), although there are few places where the Bell Beaker impact and its role within domestic structures have been studied in detail. In the Madrid region, we know that Bell Beakers are present since 2500 cal BCE when the last enclosures were still in use. Aside from that, the Chalcolithic communities kept their traditions unchanged with collective burials in simple pits (Ríos, 2013; Blasco *et al.*, 2019).

Contemporary to the last enclosures, in the southern area of the site, the Bell Beaker tombs were arranged in three large hut-like structures with sunken floors (30-60 m<sup>2</sup>) incorporating graves of different morphology and size (artificial caves and hypogea) which we call 'Funerary Areas', FA1 (A-31), FA2 (A-35) and FA3 (F-5), in addition to another tomb as a double pit (A21) (Blasco *et al.*, 2011, Blasco *et al.*, 2019, Liesau, 2017, Olalde *et al.*, 2018, Olalde *et al.*, 2019).

In this contribution, we only refer to those characteristics that are relevant for network analysis; we summarise the general data in Figure 2.

Funerary Area 1 (30 m<sup>2</sup>), delimited by an oval sunken floor, contained two graves (see FA1 in Figure 1 and 3A-1). In its central area was a large, deep hypogeum with stepped access. The chamber was sealed with large flint slabs (Figure 3A-2 to 4). On the east side of the feature,

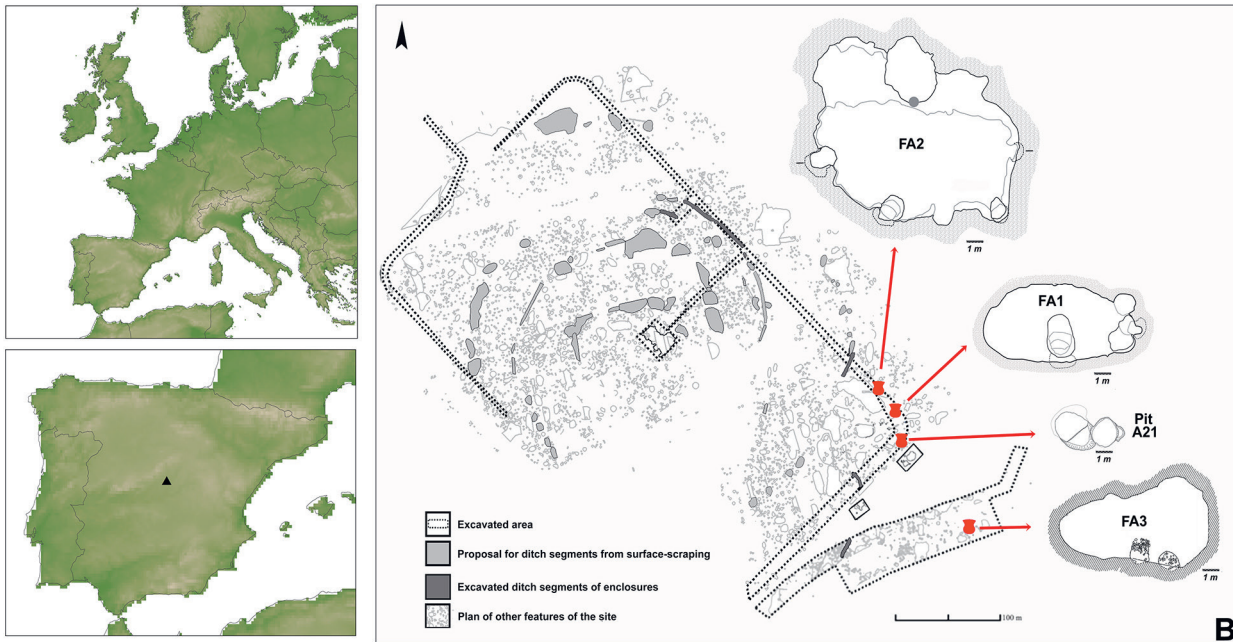


Figure 1: A: Situation of Camino de las Yaseras site; B: Plan of Camino de las Yaseras with the Bell Beaker Funerary areas (A1, A2, A3) and a Bell Beaker grave in a pit (A21) (Yaseras-UAM Research Group, Argea Consultores, S.L.y Gestión del Patrimonio Cultural S.L.).

another tomb in the form of an artificial cave with stepped access was documented (Figure 3A-7).

Funerary Area 2 (c. 60 m<sup>2</sup>), delimited by a quadrangular sunken floor feature, contained three graves (see FA2 in Figure 1). In the centre, a hypogeum with stepped access, sealed with a large flint slab, and another two artificial caves have been documented (Figure 3A-5). In addition, this area was surely used for funerary commensality rituals, and an excavated bench in the centre as well as a non-Bell Beaker large domestic pot were found *in situ* (Liesau and Blasco, 2015). Funerary Area 3 (c. 30 m<sup>2</sup>), delimited by an oval sunken floor (see FA3 in Figure 1), housed two more graves in the form of artificial caves (Figure 3A-6). Finally, the eighth Bell Beaker grave (see Pit A21 shown in Figure 1), was formed by two interconnected pits that contained a collective burial with a particularly complex sequence of deposits. As also evidenced by the radiocarbon dates, several openings and construction events took place over an extended period of time in this pit. Remarkable is the recovery of a high number of well manufactured pottery sherds with different Bell Beaker styles: international, geometric impressed, Ciempozuelos and plain (Blasco *et al.*, 2009; Ríos, 2011) (Figure 3B-3 to 5 and Figure 4).

Four of the eight Bell Beaker graves are collective and successive burials, the others are primary individual or double graves. Occasionally when further individuals or secondary burials were added, the pre-existing remains

were 'reduced', or simply displaced, in order to make room for the new internment (artificial cave A-35 VII from Funerary Area 2). What really characterizes these tombs, however, are secondary burials resulting from complex processes that involved the extraction and movement of human bones, as in the artificial caves A-31-II, F-5 C1 and F-5 C2 from Funerary Areas 1 (Figure 3B-1) and 3 (Figure 3A-6).

Alterations of the tombs – primary or secondary burials – were very probably made by the Bell Beaker communities themselves as a consequence or continuation of their so called 'funerary cycle' (Weiss-Krejci, 2011). This has affected the original structure of the tombs as well as the quality of the archaeological record. Frequently we are restricted to documenting different taphonomic categories and only the last sequence with limited remains of human bones and intentionally broken pottery sherds (Gómez Pérez *et al.*, 2011, Liesau *et al.*, 2020, Liesau *et al.*, 2014)

These manipulations are scarce in simple pit burials, which are sealed with sediment and stone tumuli, and in which decomposition occurs within a filled space. By contrast, they are frequent in pits with niche burials or in small artificial caves excavated into the wall of the funerary areas, where they tend to remain in empty spaces protected by a lithic or organic seal which could be reopened before the tomb was permanently closed by large and heavy slabs or stone mounds.

Figure 2: Characteristics of the Bell Beaker graves from Camino de las Yeseras site.

	BB grave	Characteristics of the buried individuals				BB vessels associated	Other grave goods	C14 dates
		Nº	sex	age	Ancient DNA	Nº & style	Objects & ritual materials	
1	Funerary Area 1 Hypogeum A-31 01-I	1	♂	senile	No data	2 Bell Beaker vessels	Small embossed and bent gold leaf; granite mill with the hand millstone; cinnabar.	-
		3	-	adult	No data	1 Bell Beaker carinated bowl		Ua 58525:
								3879 + 31 BP (Ind 1)
2	Funerary Area 1 Artificial cave A-31 01-II	1	♀	adult	Local	2 Bell Beaker bowls (Ciempozuelos style)	-	-
		1	♂	senile	No data	1 Bell Beaker bowl (Ciempozuelos style)	Cinnabar stripe on the skull	-
3	Funerary Area 2 Hypogeum A-35 E03-III-A	1	♀	adult	Steppe ancestry	1 Bell Beaker carinated bowl (Ciempozuelos style)	Cinnabar, ivory beads, gold beads	Ua 58523: 3895 + 30 BP
4	Funerary Area 2 Artificial cave A-35 E03-VII	1	♀	adult	Local ancestry	2 Bell Beaker bowl (Ciempozuelos style)	-	PSUAMS-2320 3875 + 20 BP Ua 58465: 3864 + 31 BP
		1	♀	infant	Steppe ancestry	1 small Bell Beaker bowl (Ciempozuelos style)	-	Ua 35021: 3525 + 40 BP
								Ua 58524:
								3894 + 30 BP
5	Funerary Area 2 Artificial cave A-35 E03-X	1	♂	adult	No data	1 Bell Beaker vessel and 1 bowl (Ciempozuelos style)	-	
6	Funerary Area 3 Artificial cave F-5 C1	1	♀	adult	Local ancestry	1 Bell Beaker vessel and 1 bowl (Ciempozuelos style)	-	-
		1	♀	adult	No data	-	-	-
		1	♂	adult	No data	-	-	-
7	Funerary Area 3 Artificial cave F-5 C2	1	♂	adult	North African origin	1 Bell Beaker vessel, 2 bowls and 1 carinated bowl (Ciempozuelos style)	A granite millstone, a sandstone mortar and a copper pin	PSUAMS-2119 3910 + 30 BP
		1	♀	senile	No data			PSUAMS-2120 3870 + 90 BP
		1	♂	adult	No data			-
8	Pits A-21	3	-	adult	No data	13 Bell Beaker: 2 Bell Beaker vessels (Maritime style), 4 impressed geometric bowls, 2 plain vessels, 1 plain bowl, and 2 bowls, 1 carinated bowl and 1 vessel of Ciempozuelos style.	A copper pin, a gold bead and a bone button (sperm whale bone) with lateral appendages, cinnabar.	Ua 39309: 3752 + 30 BP
		1	-	infant	No data			Ua 39310: 4004 + 30 BP*

\*: Charcoal

These types of burials imply that, in some cases, we cannot specify the association of the vessels and, therefore their decoration, to a specific individual in the tomb and the characteristics of the individuals in the group. But in some cases, this was possible as is shown in Figure 2 and Figure 3A-5 to 7.

Among the other four Bell Beaker burials, two are individual tombs and, therefore, we can associate grave goods with the buried persons (artificial cave A35-X and hypogeum A35-III). But in the other two tombs, hypogeum A31-I and Pit A21 (Figure 3B-2 to 4), only a few highly fragmented scattered human remains were



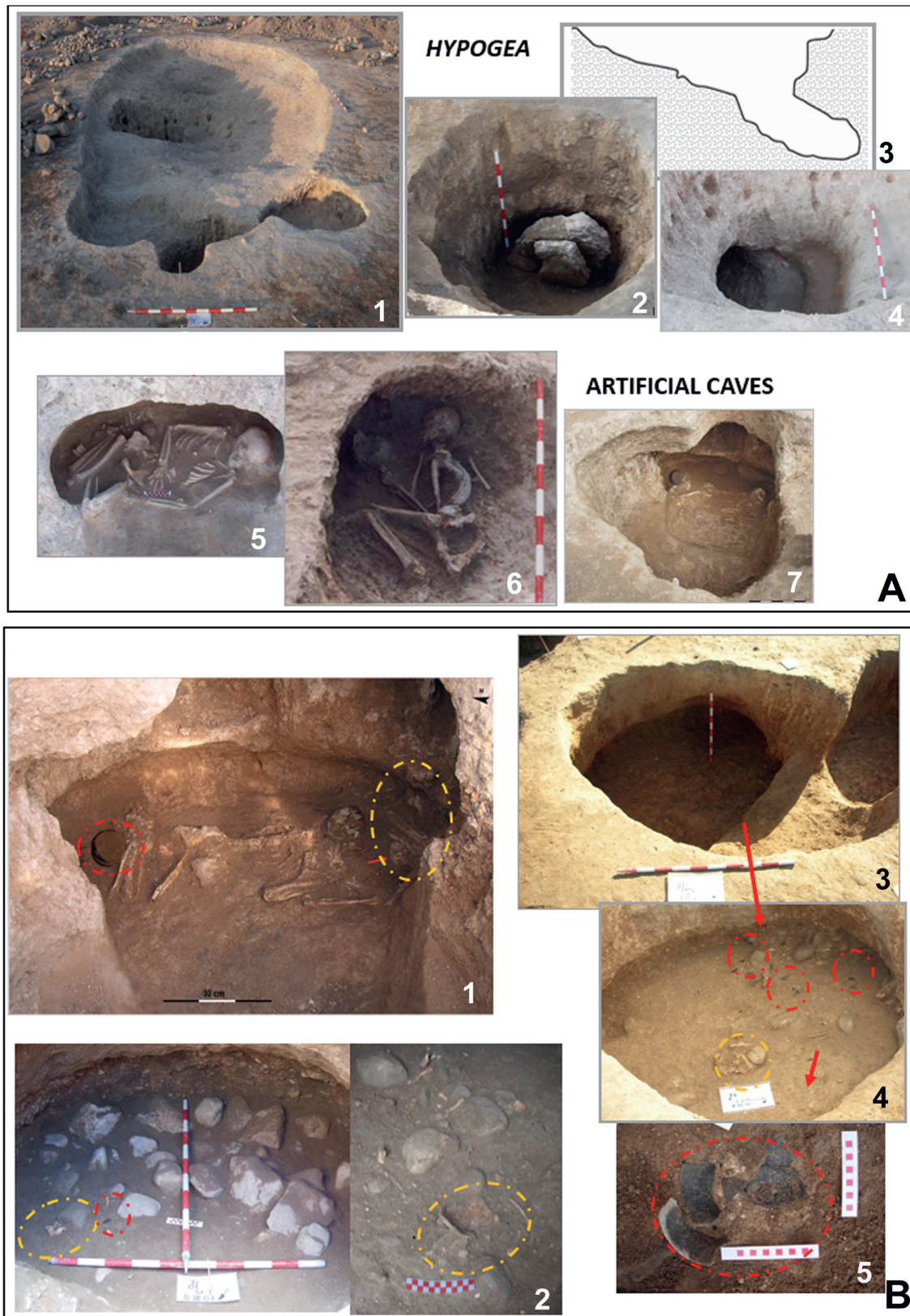


Figure 3: A - 1. General view of the Funerary Area 1 as an example of this type of pantheon type structures; 2. View of the flint slabs that sealed the hypogeum of Funerary Area 2; 3-4. Section and access of the hypogeum of Funerary Area 1; 5-7. Artificial caves of different Funerary Areas. B - Details of some tombs of Camino de las Yeseras indicating secondary burials with scattered human remains and pottery sherds (Argea Consultores, S.L.). 1. Grave goods between the legs of the primary individual and the area where the secondary individual was found; 2. Human and ceramic remains scattered inside the hypogeum chamber from Funerary Area 1; 3. Burial pits A21 with detail of the human and ceramic remains scattered (4) and an intentionally fractured Bell Beaker bowl (5).

recovered from the partly dismantled burials. Moreover, the associated Bell Beaker vessels were also intentionally fragmented (Liesau *et al.*, 2018, Liesau *et al.*, 2020) (Figure 3B-5).

The genetic results of a large study carried out on Bell Beaker and non-Bell Beaker individuals from central Iberia have been analysed. Thanks to an initial connection of our research team to several international projects led by Kurt Alt (Szécsényi-Nagy *et al.*, 2017) and Kristian Kristiansen, it has been possible to advance within a research framework of European projects, later developed on a greater scale with David Reich's team (Liesau *et al.*, 2020, Olalde *et al.*, 2018, Olalde *et al.*, 2019).

With this extensive sampling, it has been possible to obtain mitochondrial and nuclear DNA from several individuals. For Camino de las Yeseras, the information obtained to date with good results corresponds to a total of 37 individuals, 13 of which belong to Bell Beaker burials.

The results show, in addition to the expected local origin of a series of Bell Beaker individuals, the presence of other Bell Beaker individuals with recent ancestors from central and Eastern Europe. The confirmation of the existence of a Bell Beaker migrant with 100% North African ancestry should be highlighted. This genetic profile is a unique case among the almost two hundred peninsular Chalcolithic individuals analysed to date (Liesau *et al.*, 2020).

Anthropological studies carried out by J.L. Pérez and G. Tranco are based on the classic parameters of physical anthropology on the buried remains. But genetic analyses have also been able to determine some family relationships and biological sex.

Radiocarbon dates for this set of Bell Beaker tombs (Figure 2 and Figure 4) are dispersed throughout the second half of the 3rd millennium BCE, with the majority being centred around 2450/2300 cal BCE. The Bell Beaker vessels associated with these burials should not exceed the change of millennium. We have detected a second Bell Beaker phase in the site in the first centuries of the second millennium cal. BC (Blasco *et al.*, 2019), but without a clear connection with the contexts under study in this contribution. However, one of the dates obtained in the F-5 C2 burial from Funerary Area 3 (PSUAMS-2120 3870 ± 90 BP) could belong to this final moment of the Bell Beaker in Camino de las Yeseras.

## 2. A bipartite network analysis protocol

### 2.1. Main issues

In a previous work (Caraglio *et al.*, Accepted), we carried out a Similarity Network Analysis with a corpus of 31 vessels distributed in 8 graves and 3 funerary areas and a funerary pit, based on the Jaccard coefficient, a very commonly used index in archaeology studies (Besse, 1996; Cauliez, 2011; Vaquer and Remicourt, 2008). By collecting data in a simple binary database, it was easy to calculate this Jaccard coefficient (similarity index matrices or abstract distance) between the assemblages'

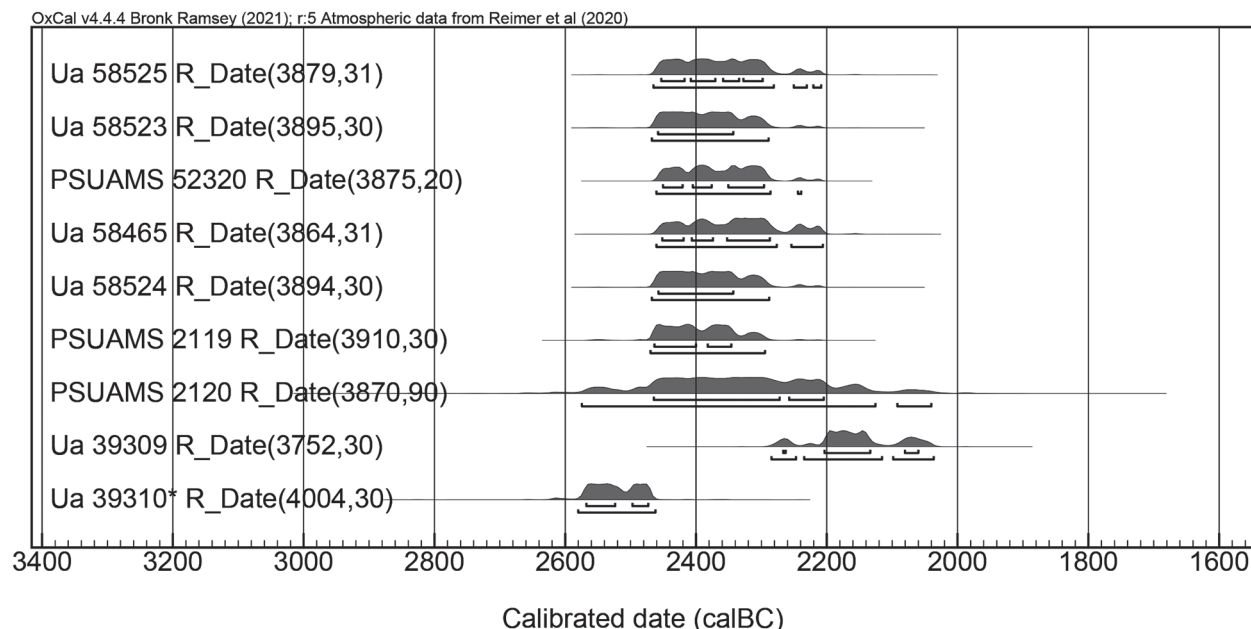


Figure 4: Multiple plot of the Bell Beaker dates in Camino de las Yeseras site (Yeseras-UAM Research Group). See figure 2 for the associated structures.



wares of each burial deposit and it allowed us to identify the attributes that are mutually null for each entity compared to one another (Habiba *et al.*, 2018). This network analysis approach, which is quite common in archaeology, helps to visualise the similarity links between the assemblages and to highlight which are the most similar assemblages (Brughmans, 2013; Mills *et al.*, 2013; Bernabeu Aubán *et al.*, 2017). But as recommended by J. L. Munson (2019), *'it is important to emphasize that ties based on similarity should not be construed as evidence for direct social interaction. Rather, similarity ties represent conditions or states that increase the probability of forming other kinds of ties such as [social relations, interactions and flows]. While this means that archaeologists need to be careful when interpreting these types of network ties, the upshot is that archaeological networks based on similarity have the potential to explain the formation of more meaningful social relations, past interactions, or information flows if modeled and evaluated using proper methods.'* Furthermore, the small samples easily influence this kind of network analyses based on these similarity indexes by preventing the detection of homogeneous subsets and reducing too much the richness of the raw data collected. Indeed, the totality of possible hardware connections are generally displayed and the interpretation of the results is often difficult. In our previous study, we highlighted the presumed intra-site relations between two women and a girl buried in different funerary areas of this site (Caraglio *et al.*, Accepted, fig. 9 and 10). In this present paper, we would like to compare these results based on Unipartite Network Analysis and the new results, produced by a Bipartite Network Analysis.

## 2.2. Some principles of Bipartite Network Analysis

Bipartite Network (or '2-mode network') Analyses are normally more suitable for visualizing diffusion phenomena (Feugnet *et al.*, 2017). In this type of network, there are two types of nodes (Feugnet *et al.*, 2017, fig. 3); in this study, one type corresponds to Bell Beaker burials, the other type to the ceramic decorations and shapes present in the burials. Links cannot be established between nodes of the same type, but only between two different types of nodes, i.e., between burials and ceramic decoration types, but never between two burials or between two types of decoration. This '2-mode' network can then be projected into two '1-mode' networks: a network of burials, connecting deposits with the same ceramic decoration types and a network of decorations, connecting motifs present in these deposits. It is then possible to attribute weight to the links. For the network of burials, the weight refers to the number of decorations in common between two burials, which highlights similar burials. For the decorations network, the weight refers to the number of burials where pairs of decorations are present, which can highlight the most commonly associated motifs.

To sum up, these Bipartite Network Analyses allow us to take into account the number of patterns in each vessel and in each grave, to have a better reading of the combinations of patterns and to detect homogeneous subsets because they show all possible material connections in a quantitative way.

## 2.3. Proposal for analysis protocol

The analysis protocol is simple enough. Indeed, the purpose is to transform a simple contingency table of decorations and forms by vessel to a simple contingency table of decorations and forms by grave, because our interest is in comparing the assemblages of each burial. All in all, each burial has been described, recording the presence/absence of different variables, grouped into 3 shape variables and 94 decoration variables (all the motifs of the different Bell Beaker styles known in Central Iberia). The code names of ceramic decorations and forms are based on R. Garrido Pena's typology (Garrido Pena, 2000). For a visual summary of the corpus, we can refer to Caraglio, 2020 (fig. 7), Liesau *et al.*, 2020 (fig. 4, 7, 8, 9) and Caraglio *et al.* (Accepted). Several attempts to radiocarbon date all individuals failed, but from the dating obtained we assume that the graves are more or less contemporaneous, except one dating of Pit A21 with a long-term use and another dating for an individual from a double burial in Funerary Area 2 (Figure 1 and 4). In this contribution, we do not use directed networks. The aim is, first, to highlight the main connections between burials, on one hand, and between the different types of ceramic shapes and decorations, on the other hand.

Then, we have to format the simple contingency table of decorations and forms by grave in a simple 'text document' which can be read by the Pajek 5.10 program. This document is a frame of a '2-mode network' with two types of nodes: graves and ceramics variables. The Pajek program permits us to divide this '2-mode network' in two '1-mode networks': one with the links between the graves and one with the links between the ceramics' variables. Lastly, the Pajek program can draw a graphic representation for these two networks and allows a complementary reading of the data.

## 3. Results and comparison with similarity network analysis

### 3.1. Results of Bipartite Network Analysis

As explained in sections 2.2. and 2.3., Bipartite Network Analysis firstly shows a network with two types of nodes. Figure 5 presents this 2-mode network with the Camino de las Yeseras' Bell Beaker burials and all the ceramic decorations and shapes observed (Figure 5): the high decoration variability by grave and the most commonly used ceramic decorations and forms are easily discerned

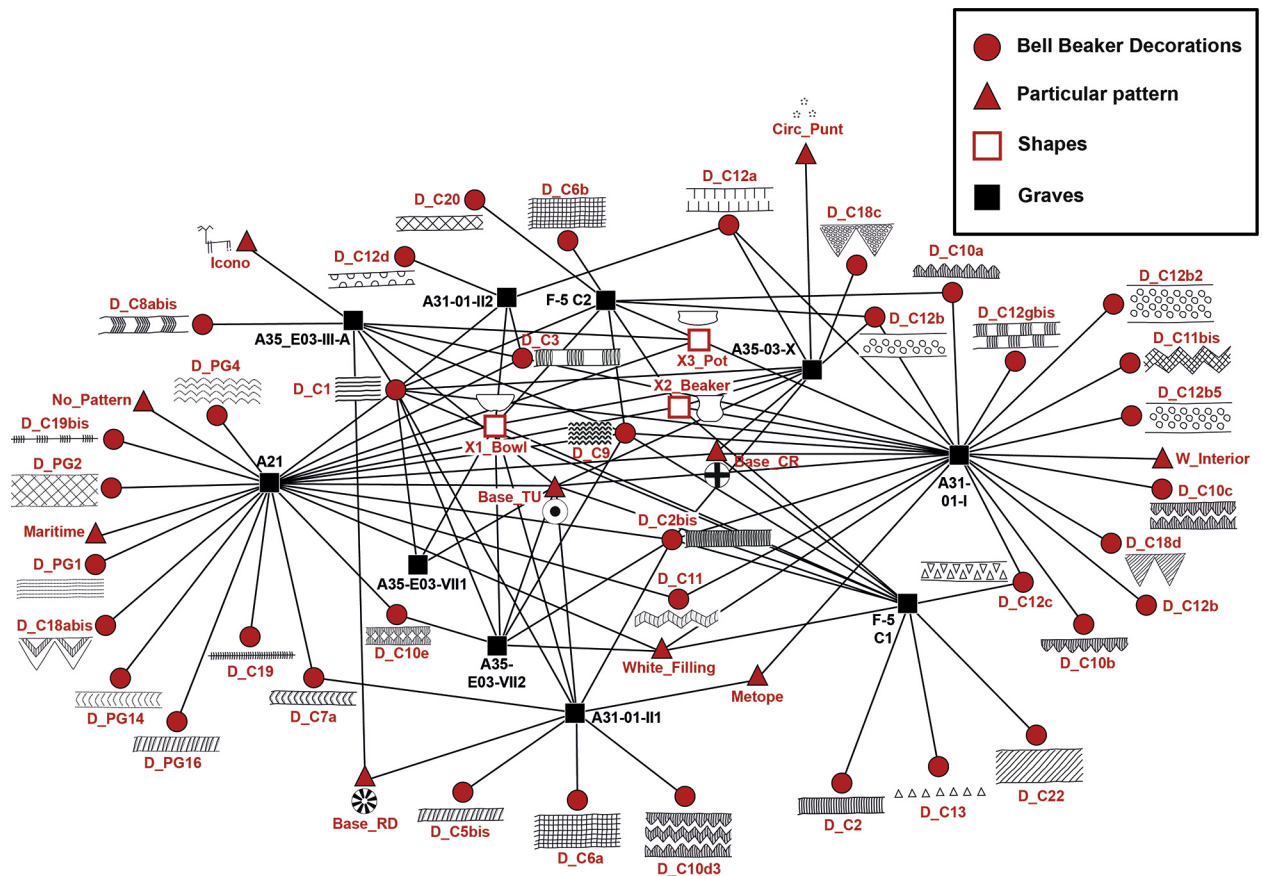


Figure 5: 2-mode network with the Bell Beaker burials and the ceramic decorations and shapes observed, as a demonstration of the variety of Bell Beaker decorations in Camino de las Yeseras Site (San Fernando de Henares, Madrid).

here. Then, from this original network, the Pajek program produces one graph with the graves' network (Figure 6) and one graph with the ceramics' variables network (Figure 7).

### 3.1.1. The graves network

In the graves network, only the ties corresponding to more than three shared ceramics variables have been displayed (see Figure 6). We can observe that no individual seems to have 'privileged position' for the diffusion of patterns and forms of ceramics, maybe because of the high diversity of ceramics in the collective burials (pit A21, hypogeum A-31-01-I from Funerary Area 1, artificial cave F-5 C2 from Funerary Area 3). The graves network seems to demonstrate strong links between the ceramics from Pit A21 and those of the three other Funerary Areas.

Indeed, collective burial A21 with male dominant individuals shares more than 9 ceramics variables with four different burials (the female burials A-35 E03-VII2 from Funerary Area 2 and F-5 C1 from Funerary Area 3 and the collective burials A-31 01-I from Funerary Area 1 and F-5 C2 from Funerary Area 3) and 6 to 8 ceramics

variables with three other burials (the female burials A-35 E03-III-A from Funerary Area 2 and A-31 01-II1 from Funerary Area 1 and the male burial A-35 E03-X from Funerary Area 2). The collective burial A-31 01-I from Funerary Area 1 and the female burial F-5 C1 from Funerary Area 3 share more than 9 ceramics variables.

The collective burial A-31 01-I from Funerary Area 1 and the female burial F-5 C1 from Funerary Area 3 also share together more than 9 ceramics variables, and A-31 01-I and F-5 C1 share 6 to 8 ceramics variables with three (the girl burial A-35 E03-III-A from Funerary Area 2, the male burial A-35 E03-X from Funerary Area 2 and the collective burial F-5 C2 from Funerary Area 3) and two (the female burial A-35 E03-VII2 and the male burial A-35 E03-X from Funerary Area 2) other burials, respectively.

To sum up, the results display a strong triad between Pit A21, collective burial A-31 01-I from Funerary Area 1 and female burial F-5 C1 from Funerary Area 3. However, despite the diversity of ceramics decorations and biological origins of the deceased, a general and strong 'cohesion' can be read, thanks to different ties which correspond to four or five shared ceramics variables between several graves.

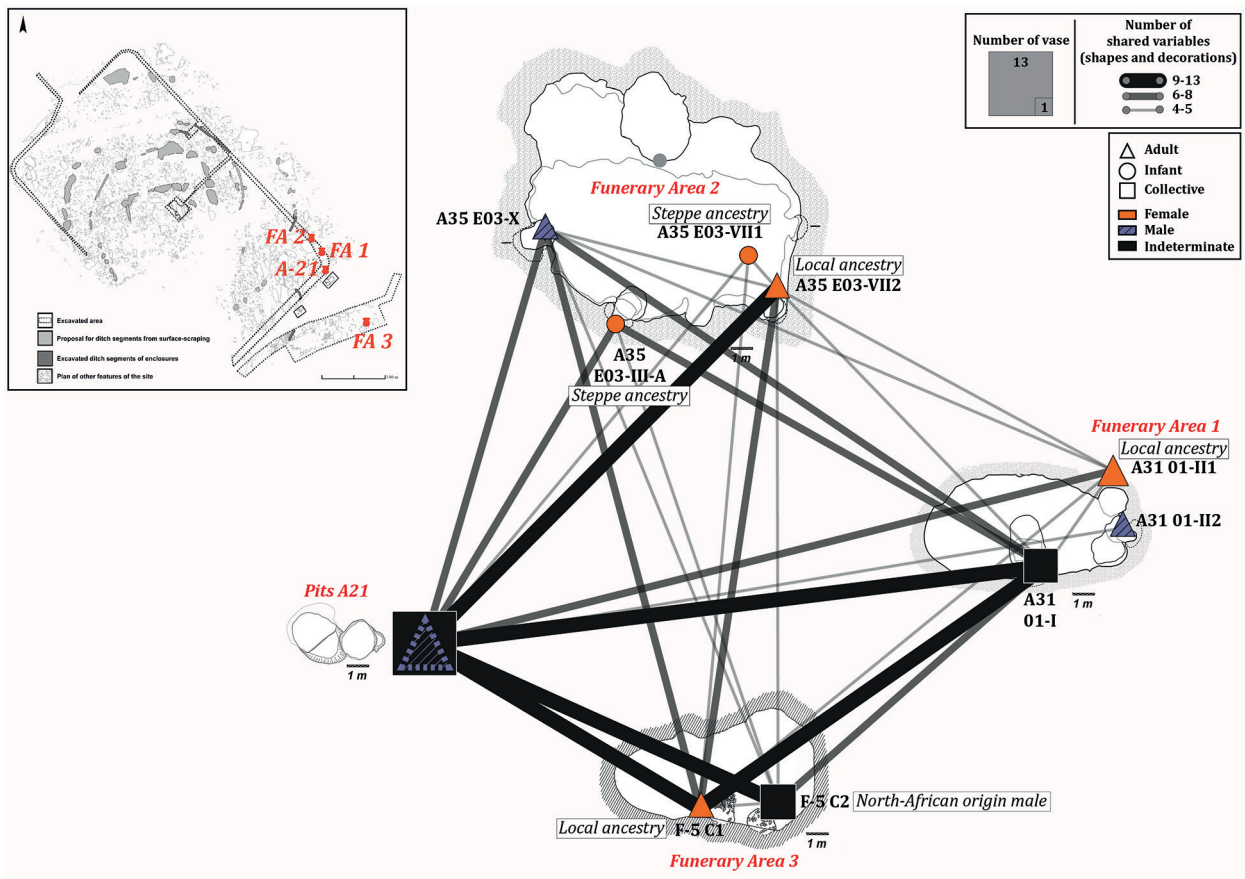


Figure 6: Map of 1-mode graph with the graves' network. The thickness of the lines expresses the number of shared variables between two graves and the size of the nodes is linked to the number of vessels in the graves.

### 3.1.2. The decorations network

In the decorations network, only the ties corresponding to more than three ceramic variables shared between two burials have been displayed (see Figure 7).

The most recurrent associations are those between bowls (X1) and horizontal stripe motifs (D\_C1) and between horizontal stripe motifs (D\_C1) and bases with omphalos (Base\_TU). These associations are recorded in eight pairs of burials, respectively.

Then, a strong connection can be read between horizontal stripe motifs (D\_C1), vertical stripe motifs (D\_C2bis), wave motifs (D\_C9), bases with omphalos (Base\_TU), bowls (X1) and beakers (X2). These associations are recorded in four to six pairs of burials.

Three ceramic variables are a little bit less common: pots (X3), cruciform bases (Base\_CR) and white fillings.

To sum up, some trends for each ceramic shape could be highlighted. Indeed, bowls (X1) seem to mainly be associated strongly to horizontal stripe motifs (D\_C1), generally to vertical stripe motifs (D\_C2bis) and bases with omphalos (Base\_TU), and less strongly to wave

motifs (D\_C9) and beakers (X2). Beakers (X2) generally match with horizontal stripe motifs (D\_C1) and less strongly with vertical stripe motifs (D\_C2bis), wave motifs (D\_C9), bases with omphalos (Base\_TU), cruciform bases (Base\_CR) and bowls (X1). Finally, pots (X3) basically present horizontal stripe motifs (D\_C1) and wave motifs (D\_C9).

### 3.2. Comparison with Similarity Network Analysis and discussion

The Similarity Network Analysis we carried out previously (Caraglio *et al.*, Accepted) has firstly shown that the different network global index seemed to illustrate a strong cohesion between all the different Bell Beaker graves, despite a high diversity of ceramic shapes and decorations, and by extension between all funerary areas. The local index of this Similarity Network Analysis highlighted, secondly, the privileged position in the 'network' of some subjects: the two local women (A-35 E03-VII2 from Funerary Area 2 and F-5 C1 from Funerary Area 3) and a man (the A-35 E03-X from Funerary Area 2) (Figure 2).

With the Bipartite Network Analysis in this present study, the heterogeneity of Bell Beaker ceramics' shapes



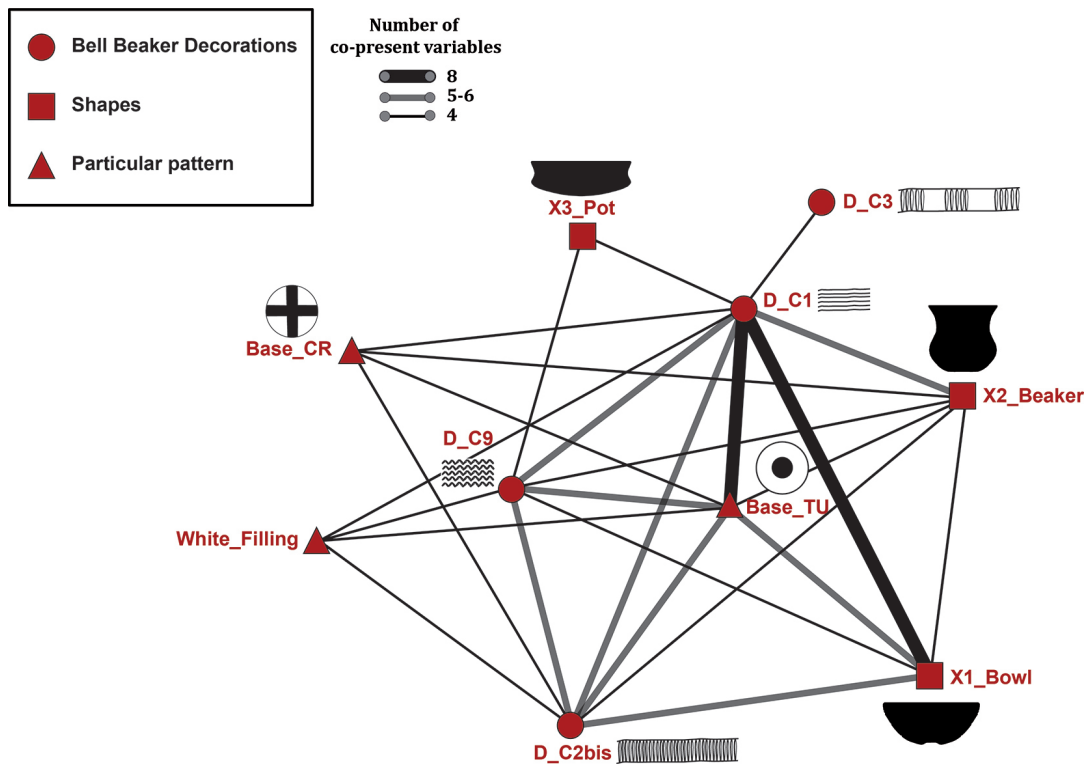


Figure 7: 1-mode graph with the ceramics' variables network. The thickness of the lines expresses the number of cases, where the association of two ceramic variables is found in one grave.

decorations in Camino de las Yeseras site is brought out too. On one hand, we have observed the clear and strong relations between the ceramics associated with the three different Funerary Areas and the collective double Pit A21, and it helps to support the idea of 'cohesion' at necropolis scale. It could reinforce the hypothesis, already put forward by studying bone remains, of specific Bell Beaker funerary practices involving the moving and the extraction of human remains and grave goods as 'relics' inside the site (Liesau *et al.*, 2020). On the other hand, beyond this high diversity, the Bipartite Network Analysis allowed us to determine, in a more easy and direct way, a common background for the Bell Beaker ceramics' elements inside the site: the recurrent association between horizontal stripe motifs (D\_C1), vertical stripe motifs (D\_C2bis), wave motifs (D\_C9) and bases with omphalos (Base\_TU) on bowls (X1) and beakers (X2). This is not surprising and confirms what is already known, as it is commonly observed in Central Iberia (Garrido Pena, 2000, fig. 48 p. 212 and fig. 15, p. 124 ; Garrido-Pena *et al.*, 2019, p. 161-193). If this kind of analysis does not reveal, as in Similarity Network Analysis, some prominent individuals, it is maybe a sign of the better reliability of Bipartite Network Analysis for these data, as it brings to a better reading of the direct data and the combinations of ceramics' patterns in a quantitative way. However, the higher number of vessels (13, highly fragmented) in Pits A21, could introduce a bias, but could also speak in favour of a 'house of the dead' hypothesis, where commemorative practices,

removal and relocation of human remains or reopening and closing events of the grave, could have taken place (Liesau *et al.*, 2020, Liesau, 2017).

As this last analysis appears to highlight, each type of vessel (bowls, beakers or carinated bowls) might be assumed to have specific decoration diversity, which could be analysed with Bipartite Network Analyses, individualised by type of vessel. But it would be interesting, then, to go even further and apply this methodology to the technological data of these ceramics, as is exposed in the study of Kroon *et al.* (2019), for instance, by soliciting data about investment in ceramic building technic (Favrel, this volume, Favrel, 2020) and about the direction of the fitting of the coils' joins, the use of beating or polishing (Derenne *et al.*, 2020).

#### 4. Conclusions

The Similarity and Bipartite Network Analyses of Bell Beaker decorations in Camino de las Yeseras ceramics suggest several remarkable aspects.

Despite the extraordinary richness of some tombs, none of them are relevant for the diffusion of pottery types and patterns. The obtained graves network demonstrates strong links between the ceramics from Pit A21 and those of the three other Funerary Areas. Without discarding that this result may be the result of the high diversity of ceramics in this pit, it reinforces the 'house of the dead'

hypothesis, due to the long-term chronology, dispersed bones of several individuals, the ritual sealing of this structure and the beginning of the process of breaking the ceramics into halves.

These kinds of analyses could probably also reflect some kind of ‘métissages’, that is to say, the acceptance of cultural ‘oscillations’ (Capanema *et al.*, 2015) which neither establishes patterns for individual identities, nor creates standards. Without ‘celebrat[ing] fluidity and hybridity over belonging and solidarity’, the idea is ‘to distinguish instances of strongly binding, vehemently felt groupness from more loosely structured, weakly constraining forms of affinity and affiliation’ (Brubaker and Cooper, 2000, p. 20-21). To some extent, if ‘the world of death was a place of broad social expression’, we need to identify what should exist between the ‘devoir-faire’ (what must be done), and the ‘pouvoir-faire’ (what can be done) (Bocquentin *et al.*, 2010).

These first tests could also evoke the idea of ‘Communities of practice’ (Wenger, 1998) inside a site, where each individual can learn, take part, coordinate actions and identify itself within a specific and symbolic world, no matter their biological origins. Thus, Camino de las Yeseras is a unique site for Bell Beaker burials, including in several cases in the same tomb individuals with local, Steppe and/or North-African origin. In such an ‘open minded’ society the ceramic decorations seem to go beyond ‘ethnic identity’ and rather testify to potential personal or apprenticeship relationships (Dietler and Herbich, 1994), as well as a mutual engagement, a joint enterprise and a shared repertoire (Wenger, 1998, p. 73).

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