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BALTIC AMBER IN HISPANIA DURING LATE ANTIQUITY. CONTACTS, NETWORKS AND EXCHANGE

Summary. *Amber is a material of great social value that has been identified at various archaeological sites on the Iberian peninsula dating to Late Antiquity. The objects, mostly necklace beads, have been discussed to date with limited results in relation to a small number of studies. This article presents the characterization by Fourier Transform Infrared Spectroscopy (FTIR) of 52 amber beads from four Late Antique necropolises in the province of Granada (south-eastern Iberian peninsula): Cortijo del Chopo (Colomera), El Castillón (Montefrío), Marugán (Atarfe) and Fuente Santa (Loja). The results obtained demonstrate the Baltic origin of the amber at these sites and advance our knowledge of this type of product in Hispanic Late Antique funerary contexts.*

INTRODUCTION

Amber is a fossil resin long used as a raw material in the production of personal ornaments and luxury items and has been traded over long distances since prehistory (Murillo-Barroso *et al*. 2023). Its exploitation is attested on the Iberian peninsula since the Upper Palaeolithic, with a notable presence in the Chalcolithic and the Iron Age (Murillo-Barroso *et al*. 2018). Amber objects documented in Roman times include figurines, rings, earrings, pendants, spindles, little boxes and a sphere (Vaquerizo 2010; Barrero and Morcillo 2016–17; Bustamante *et al*. 2021). However, in Late Antiquity, the finds were mostly beads whose characteristics varied greatly but for whose contexts little information is available (Mączyńska 1992, 145). The material, although not unknown to archaeologists and researchers, is often not differentiated in reports. In other words, amber beads are not distinguished from those made of glass or cornelian, which were all used in necklaces, bracelets and earrings, or even individually. This lack of distinction derives from both the context of the excavation itself and the easy degradation of the amber finds.

In the 1930s, Zeiss had already described finding amber beads in the necropolises of the sixth and seventh centuries at Pamplona, Deza and Uxama (both in Soria), Alarilla (Guadalajara), El Carpio de Tajo (Toledo) and Marugán (Granada) (Zeiss 1934, 64, pl. 26). However, it was not until the end of the twentieth century that Mączyńska (1992, 146–8) reviewed the state of research, compiling the finds from Herrera de Pisuerga (Palencia) (Martínez 1933), Castiltierra (Segovia)

(Menéndez 1940), El Carpio de Tajo (Toledo) (de Mergelina 1948–49; Ripoll 1985) and Duratón (Hübener 1970; Molinero 1971). In this, she offered the first typological classification and a proposed chronology, so establishing possible connections and places of origin for the glass and amber beads (Mączyńska 1992, 150–73). Later, in a study of the beads of Hispania and southern Gallia, Mastykova delved into the chronological evolution of these finds (Mastykova 2010, 466–71). Other studies have focused on the figure-of-eight amber pendants recorded in Vigo (Casal and Paz 1997; López Quiroga 2020). These pendants, attributed to female wear, were widespread in the second century and especially so in the fourth century, and seem to have performed a status-indicating function (Nüsse 2011, 240; Mastykova 2016, 181–2). The beads from funerary contexts in the south and east of the Iberian peninsula have also been dealt with, although it is worth drawing attention to those found in *Carthago Spartaria* (Cartagena) (Madrid and Vizcaíno 2007a) as they have been discussed in greater detail.

An important line of study has been recently initiated on the provenance and trade networks of the amber identified in archaeological contexts. The finds dated between the Neolithic and the Iron Age have been subjected to numerous analyses (e.g. Murillo-Barroso and Martinón-Torres 2012; Murillo-Barroso *et al*. 2018; 2023), while studies of pieces from Late Antiquity remain few and far between. By way of an example, until now the Baltic origin of only one amber bead from the necropolis of Cubillejo de la Sierra (Guadalajara) had been confirmed (Cerdeño *et al*. 2022, 214). Furthermore, there was no overall understanding of the volume or distribution of objects documented in Late Antique sites on the Iberian peninsula.

This present work has been carried out with the main objectives of obtaining more information on the Hispanic contexts in which amber was found and to confirm whether it came from northern Europe. We will discuss the results of the FTIR analysis made, thus providing new data to cover the existing analytical gap. We will also present the set of amber objects compiled for this research, giving information on any appropriate associated pieces. In view of the inherent interest in amber from a distant area such as the Baltic, a brief reflection on the appearance and circulation of articles made from the raw material is presented here at the end. This will have to be refined once more provenance analysis of other collections has been conducted, combined with typological and contextual studies of the pieces, and research has progressed.

CASE STUDIES

In the Granada province, amber beads are documented in the necropolises of Cortijo del Chopo (Colomera) (N= 78), Marugán (Atarfe) (N= 150), El Castillón (Montefrío) (N= > 57) and Fuente Santa (Loja) (N= 25). They are all kept in the Archaeological and Ethnological Museum of Granada (MAEGR) and the Municipal Historical Museum of the Alcazaba (MHA) (Table 1 and Fig. 1). Beads have also been identified in Túgui (Galera) (N= 216) and are preserved in the Juan Cabré Museum (Teruel) (Casanovas and Rovira 2011). The list of measurements and finds associated with the beads that have been analysed in this study can be found in Supporting Information 1.

Cortijo del Chopo Necropolis (Colomera)

The archaeological site is located in the south-western area of the Montes Orientales (Fig. 1). The recorded materials (rings, earrings, bracelets, pins and buckles), currently being

TABLE 1
Beads analysed for this study recovered from funerary contexts in Granada province

Necropolis	Grave	No. amber beads	No. of beads analysed	Museum	Figure
Cortijo del Chopo (Colomera)	47	36	6	MAEGR	2.A
	76	15*	4	MAEGR	2.B
	73	10	5	MAEGR	2.C
	94	13	5	MAEGR	2.D
	47	2	1	MAEGR	2.E
	47	1	1	MAEGR	2.F
	33	1	1	MAEGR	2.G
Marugán (Atarfe)	-	30	3	MAEGR	3.A
	-	28	4	MAEGR	3.B
	-	30	3	MAEGR	3.C
	-	33	3	MAEGR	3.D
	-	17	3	MAEGR	3.E
	-	5	1	MAEGR	3.F
	-	7	2	MAEGR	3.G
El Castillón (Montefrío)	51	57	5	MAEGR	4.A
Fuente Santa (Loja)	-	25	5	MHA	4.B
	TOTAL	**310**	**52 (17%)**		

* In addition to numerous small fragments.

studied, date to between the fifth and the early eighth centuries. The necropolis was excavated in 1986 (Pérez *et al.* 1987, 1065), 1988 and 1989. A total of 168 graves were identified, mostly pit burials covered with slabs. The review of the documentation concluded that five tombs (Nos. 33, 47, 73, 76, 94), i.e. 3% of the total, contained 78 beads and several amber fragments (Fig. 2).

Marugán Necropolis (Atarfe)

Before 1842 objects were turning up in numerous graves in the area known as Pago de Marugán (Fig. 1). These finds included bracelets, rings, pins, earrings, buckles and amber and glass beads (Moreno y Bernedo 1842, 130–1), and were studied by Peñalver and Lafuente Alcántara (Moya 2004, 361). At least 200 tombs were opened. They contained various items of personal adornment, many of which ended up in the hands of amateurs. The excavations continued thirty years later with finds similar to those mentioned (Gómez-Moreno 1888, 8; Moya 2004, 363). The diversity of objects found leads us to assume that the necropolis was used over a long period, from the Roman to the Islamic periods (Ripoll 1998, 37). The Archaeological and Ethnological Museum of Granada has records of pieces being brought from the municipality since 1880, among them a total of 150 amber beads arranged in seven strings (Fig. 3).

El Castillón Necropolis (Montefrío)

The necropolis (Fig. 1), dated to the sixth and seventh centuries, has been known since the nineteenth century and has been the subject of several excavation campaigns (Pedregosa 2017, 125), the most recent carried out between 1977 and 1983 (Torres 1981, 335–8). One hundred and thirteen

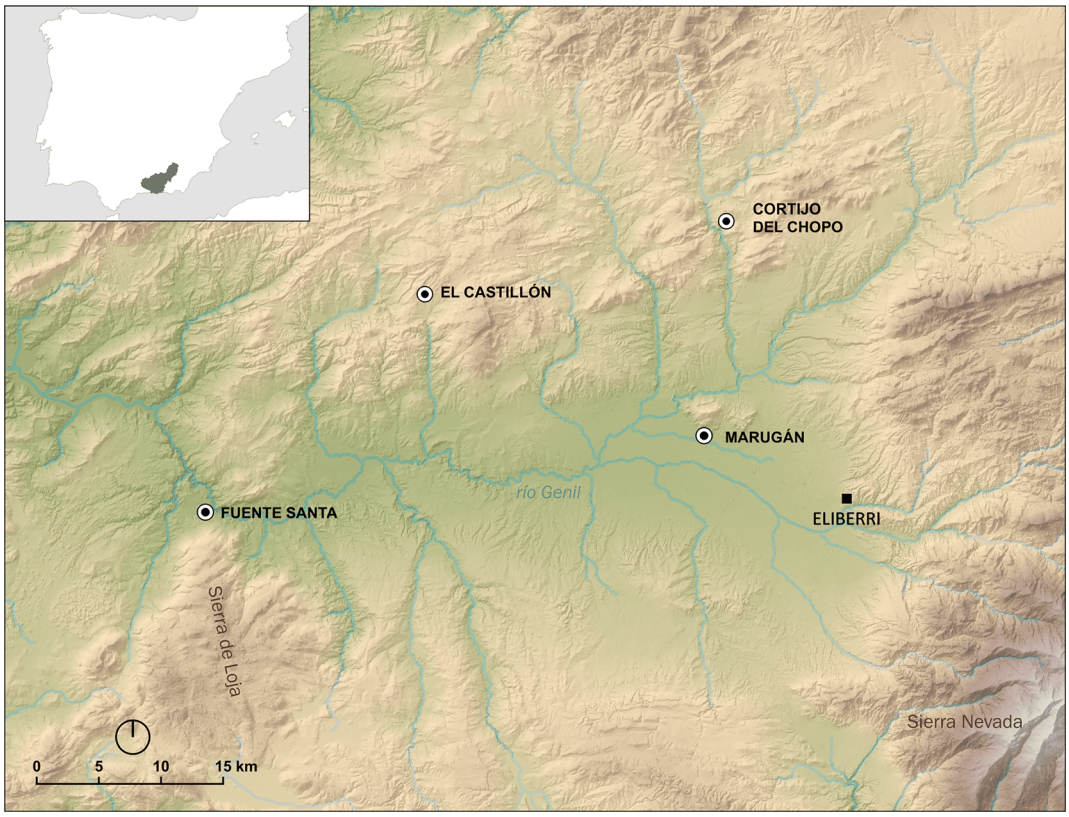

FIGURE 1
Location of the necropolises with amber beads analysed for this study and the city of *Eliberri*.

funerary structures have been identified, mainly graves lined and covered with slabs (Pedregosa 2017, 126–9). They contained various items that formed part of one's attire, such as beads, bracelets, earrings, rings, pins, belt plates, buckles and a fibula. However, not all the finds are in the Archaeological and Ethnological Museum of Granada and neither is it possible to match them to their specific tombs (Pedregosa 2017, 129–30). In the 1980s, several strings with amber beads were donated (Pedregosa 2017, 147–9), although we have only been able to access and analyse one of them with 57 beads (Fig. 4).

Fuente Santa Necropolis (Loja)

A necklace with 25 amber beads from a burial in the Fuente Santa necropolis, the result of a donation (Fig. 4), is on display in the Municipal Historical Museum of the Alcazaba in Loja. The only references we have to its findspot are from the historian Pascual Madoz, who alludes to the discovery of a cemetery in 1842 in the vicinity of the Fuente Santa spring (Fig. 1) (Madoz 1987, 233).

FIGURE 2
Amber beads found in Cortijo del Chopo necropolis (Colomera, Granada).

FIGURE 3
Amber beads found in Marugán necropolis (Atarfe, Granada).

FIGURE 4
On the left, amber beads documented in El Castillón necropolis (Montefrío), on the right, beads associated with the Fuente Santa necropolis (Loja).

MATERIALS AND METHODS

A total of 52 amber beads from the necropolises of Cortijo del Chopo (Colomera) (n= 23), Marugán (Atarfe) (n= 19), El Castillón (Montefrío) (n= 5) and Fuente Santa (Loja) (n= 5) have been analysed. This represents 17% of the total documented beads (to which we have had access) from

the aforementioned sites (N= 310). Small samples (< 0.1 g) were taken for Fourier Transform Infrared Spectroscopy (FTIR) characterization. This was performed at the University of Granada Department of Prehistory and Archaeology's Antonio Arribas Archaeometry Laboratory using a Jasco 6200 FTIR spectrometer coupled with an attenuated total reflectance system (ATR), making pellet preparation unnecessary. The samples were analysed 50 times in the 4000–400 cm^{-1} range with a resolution of 4 cm^{-1}. The spectra, which are presented in infrared transmission, were processed with the Spectra Manager v2 software.

RESULTS

The FTIR spectra obtained for the 52 amber samples are almost identical, showing in all cases the characteristic peaks of amber (Fig. 5, Supporting Information 2 and 3). In general, they present a broad band around 3400–3450 cm^{-1} due to the O–H stretching vibrations of the carboxylic acids and/or alcohols; two bands at 2924 and 2867 ± 5 cm^{-1} corresponding to the tensions of the alkyl groups, as well as the band at 1450 ± 5 cm^{-1} of the bending δ-CH2- and -CH3 and the peak at 1375 ± 5 cm^{-1}, in this case due only to the bending of -CH3. The acidic carboxylic groups are reflected in the band at 1702 ± 5 cm^{-1} and in a strong band at 1157 ±

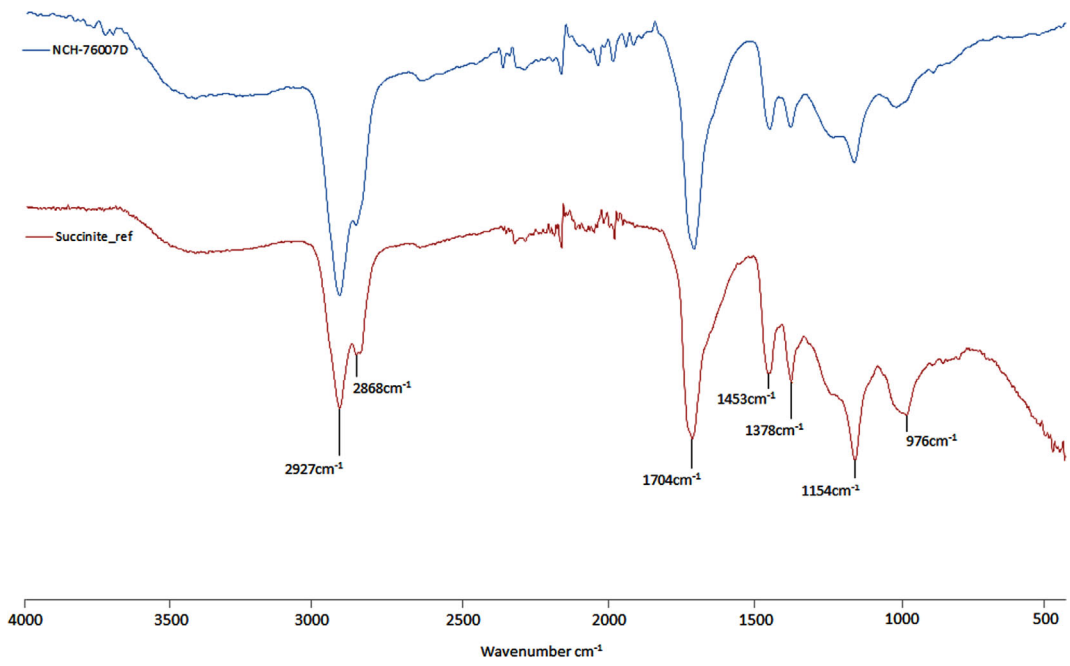

FIGURE 5
FTIR spectra of sample 76007D from Cortijo del Chopo in comparison to the reference spectra of Baltic Succinite. Sample 76007D is taken as an example of the 52 samples analysed which show identical spectra. FTIR spectra, main peaks and raw FTIR data of all samples analysed, are included in Supporting Information 2 and 3.

5 cm^{-1}, which can be attributed to the stretching of the single C–O bond of the ester. Finally, the peaks at 1020 and 974 ± 5 cm^{-1} can be assigned to different C–O bonds (Fig. 5, Supporting Information 2 and 3).

In the so-called 'fingerprint' area of the spectrum, the useful area for determining the origin of amber (broadly between 1300 and 900 cm^{-1}), all samples present an intense absorption peak at 1156 ±5 cm^{-1} due to the stretching of the C–O single bond of the ester. This is preceded by a flat horizontal band between 1250 and 1180 cm^{-1}, known as the 'Baltic shoulder'. Only sample 12264-4 presents an additional peak at 1574 cm^{-1} (Supporting Information 3), which has been put down to weathering processes (Murillo-Barroso *et al*. 2023).

The characterization of the Baltic amber FTIR spectrum is due to studies undertaken by Beck and his team, who analysed more than 120 reference samples using FTIR, including 69 samples from the Baltic coast and 51 from other sources (Beck *et al*. 1964; 1965; 1971; Langenheim and Beck 1965; Beck 1982). They found that 68 of the 69 Baltic samples showed the same feature: an intense absorption peak at 1160–1150 cm^{-1} that was invariably preceded by a flat band between 1250 and 1180 cm^{-1}, henceforth named the 'Baltic shoulder' (Fig. 5). As previously mentioned, the 1160–1150 cm^{-1} peak is due to the tension of the simple C–O bond of the ester group, while its intensity and precise location on the cm^{-1} axis vary depending on the influence exerted by the ester C=O double bond (Guiliano *et al*. 2007). Even though the 1160–1150 cm^{-1} absorption peak has been observed in samples from different sources, the so-called 'Baltic shoulder' has only been documented in European samples from this region, hence providing an excellent criterion for provenance studies, discriminating Baltic succinite from other sources such as the cretaceous Iberian amber, the Sicilian simetite and other amber and fossil resin species.

As can be seen in Fig. 5 and Supporting Information 3, the resemblance of the samples analysed and the succinite spectra is almost complete, and therefore we propose that this is the raw material for all the beads studied.

DISCUSSION

Amber can be found almost everywhere in the world. The largest quantity exploited was collected and extracted from the southern, south-eastern and eastern coasts of the Baltic Sea. Particularly noteworthy in Antiquity was that of the Sambia peninsula, in the present-day Russian province of Kaliningrad. It is also found on the coasts of the North Sea, in inland areas such as Poland, western Belarus and south-western Ukraine, as well as in Sicily (Bliujienė 2011, 5–8; Quast 2017, 59; Langbroek 2018, 106) and on the Iberian peninsula (Murillo-Barroso *et al*. 2018). However, the amber quality of all of these sources is not the same and/or it is not suitable for working into objects. Regarding the formation and geographical and mythical origins of the resin, a considerable number of Classical sources offer information of various kinds. They include Pliny (*Nat. Hist*. 37.11), Herodotus (*Hist*. 3.115), Apollonius (*Argonautica* 4.611–18), Ovid (*Metamorphoses* 1.750–2.380), Claudian (*Panegyric on the Sixth Consulship of the Emperor Honorius*) (Causey 2012, 31–5, with references) and Isidore of Seville (*Etym*. XVI.8, 6–8).

In Antiquity, amber was more than just an ornament and was worked into very varied forms. Its use has been documented for toys, decorative items, sculptures, amulets, incense burners, fumigators, burnt offerings and interior lighting. There are also references to its prophylactic and

apotropaic properties, although these are practically invisible in the archaeological record (Causey 2012, 42). There is no doubt, however, that it was a high-cost item since, according to Pliny (*Nat. Hist.* 37.12) a tiny human effigy made of amber cost more than a slave (Quast 2017, 59).

In relation to the demand for products made of amber and specifically on trade and exchange, especial interest has been paid to the routes taken during prehistory and the Iron Age (Palavestra 2006, 34–5, with references). For the Roman period, the Classical sources provide important information on its circulation and sale. For example, Pliny's account of the expedition undertaken by a Roman *eques* from Carnuntum along the amber route in the time of Nero (*Nat. Hist.* 37.12), which, together with the evidence of the archaeological record, has allowed researchers to formulate various hypotheses on existing routes (e.g. Todd and Eichel 1976, 330; Jovaiša 2001, 151, fig. 1; Curta 2007; Bliujienė 2011; Neumayer and Nüsse 2016; Quast 2017, 63, fig. 5; Bustamante *et al*. 2021).

Of note are the workshops for making amber objects that operated during the first centuries of the Roman Empire in Aquileia (Udine, Italia). Here – where around 1000 carved amber objects, raw material and production waste are known – there was an active amber market and centres specialized in its carving, as well as those of gem cutters (Bliujienė 2011, 82; Buora and Seidel 2014, 56–7; Quast 2017, 62–3, fig. 5). Also, important are the ateliers of Cologne (Germany), an area where tombs with good quality amber artefacts are concentrated (Nüsse 2011, 238). As to how long these centres were in operation, considerations have been expressed on the effects of the Marcomannic Wars (AD 167–180) and the changes they caused in the so-called Amber Route (Nüsse 2011, 239–40; Bliujienė 2011, 84).

According to Neumayer and Nüsse (2016, 380, with references), research into its management in the sixth and seventh centuries has generated several models on how the fossilized resin arrived in Frankish and Alemannic territories. The proposed distribution mechanisms are controversial and, due to the unequal amount of documented finds, two different models are proposed for sixth century Europe: one western and the other eastern.

In Late Antiquity, amber was available in large quantities in the markets of the North Sea coast (Nüsse 2011, 245). In fact, several authors have investigated the importance of the local resources accessible on the Jutland peninsula (Przybyła and Rydzewska 2019, 165–8) or those on the coasts of the Frisian islands, where amber continues to be found today (Mastykova 2016, 184–6, with references). In this area knowledge is increasing of the amount of amber in circulation drawn from numerous necropolises in southern Sweden, Bornhold (Nüsse 2011, 245, with references), northern Gallia (Langbroek 2018) and Britannia (Brugmann 2004, fig. 64). To this we can add the data concerning the Alemannic and Bavarian zone and the middle Danube basin (Neumayer and Nüsse 2016). On the Italian peninsula, contexts with the resin are known too, as for example in several necropolises of Cividale (Udine) (Ahumada Silva 2010, 47). Beads also turn up in other more remote areas, such as the port city of Hippo (Algeria) in North Africa (Quast 2006, 245).

In terms of the Iberian peninsula, an area peripheral to the region where succinite originates, the documentation available until now has been partial. A review of the accessible and published literature on Late Antiquity sites in Hispania has identified a total of 65 contexts with amber products (Fig. 6 and Table 2). They are mainly funerary places, although the resin has also been detected in urban areas, such as Recópolis (1 bead) and Vigo (95 beads) (Gómez 2006, 127; López Quiroga and Martínez 2018, 278–9). The largest number of these objects, at least to date, is recovered in burials from between the fifth and seventh centuries. In other geographical areas

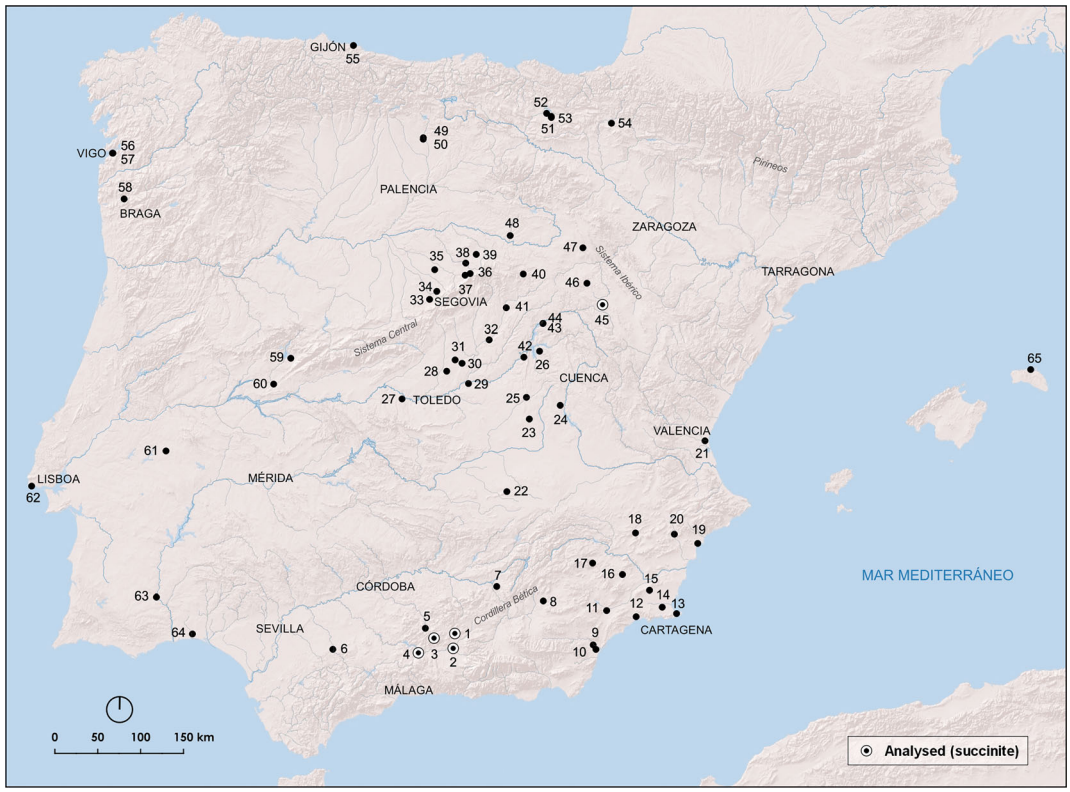

FIGURE 6
Funerary contexts with amber at the Iberian peninsula (fifth to seventh centuries AD). Detailed information on each necropolis can be found in Table 2.

too of the same date, a noteworthy quantity or an increase in these objects over previous phases has also been detected (Morris 2010, 99; Bliujiene 2011, 52–3, fig. 8.1; Bagužaitė-Talačkienė 2016, 51–2; Langbroek 2018, 107, with references).

Based on the information available from the case studies analysed, it can be seen that the percentage of graves with the resin is low compared to the total number excavated. Usually less than 12% of the tombs in a necropolis contain amber objects, rising in exceptional cases to 20–25%. Several sites around the Meseta (Cuenca, Palencia and Segovia) stand out. They are necropolises made up of a large number of tombs in which amber has been found in greater amounts (as many as 1105 beads in Castiltierra, Segovia). However, the proportion of tombs with amber beads remains similar (Table 2).

The high concentration of beads recorded in the Meseta could be from several reasons. Their elucidation requires a more detailed study of the contexts in which they were recovered, as well as the placing of the beads from each necropolis in their various chronological phases. In this way, it will be possible to see whether they arrived in the peninsula with a greater intensity at any given moment, or if they came more regularly and continuously over time. We must take into consideration the people that moved and settled in Hispania throughout the fifth and sixth

TABLE 2

Funerary contexts with amber at the Iberian peninsula (fifth to seventh centuries AD), with an indication of the volume of beads documented and analysed

No.	Necropolis	Amount (Min. number of beads)	% of tombs with amber objects (No. of graves excavated)	Analysis and ID	References
1	Cortijo del Chopo (Colomera, Granada)	78 and fragments	3% (168)	FTIR, succinite	This paper
2	Marugán (Atarfe, Granada)	150		FTIR, succinite	Peñalver 1842, 157; Archaeological and Ethnological Museum of Granada
3	El Castillón (Montefrío, Granada)	>64 and fragments		FTIR, succinite	Pedregosa 2017, 149; Archaeological and Ethnological Museum of Granada
4	Fuente Santa (Loja, Granada)	25		FTIR, succinite	Municipal Historical Museum of the Alcazaba
5	El Ruedo (Almedinilla, Córdoba)	66	5% (139)		Carmona 1998, 188
6	La Vega del Retamal (Cazalla, Sevilla)	2	8% (13)		Fernández and Martín 2013, 103–5
7	Cerro de la Horca (Peal de Becerro, Jaén)[a]		12% (8)		Fernández-Chicarro 1953, 80
8	Túgi (Galera, Granada)	216			Casanovas and Rovira 2011, 54–62
9	Baria, Villaricos (Cuevas de Almanzora, Almería)				Menasanch 2007, 136
10	Almizaraque (Almería)				Siret 1906, 89
11	La Jarosa (Lorca)	9			Martínez 1991, 457, 467
12	La Mezquita (Mazarrón, Murcia)		25% (4)		Ramallo 1986, 144–5
13	El Corralón (Los Belones, Cartagena)				Ramallo 1986, 147–8; Vicente and Antolinos 2000, 325–31
14	Sector oriental y occidental de Carthago Spartaria (Cartagena)				Madrid and Vizcaíno 2006, 89, 110; 2007b, 41
15	Los Villares (Baños y Mendigo, Murcia)	5 of amber and 38 of "resin"	1% (104)		García and Vizcaíno 2008, 247–50
16	Cerro de la Almagra (Mula, Murcia)	37			Ramallo 1986, 143, 148
17	La Puerta (Moratalla, Murcia)	1 of amber and 37 of "similar material"	7% (15)		Pozo 1993, 263–4, 272
18	La Rinconada de Olivares (Jumilla, Murcia)		20% (5)		Pozo and Hernández 1999, 422, 429
19	Tossal de les Basses (Alicante)				Rosser and Fuentes 2008, 120–1
20	Camino de El Monastil (Elda, Alicante)	67	20% (10)		Segura and Tordera 1999, 547
21	Almoina (Valencia)				Escrivá and Soriano 1989, 104
22	Las Eras (Alhambra, Ciudad Real)		8% (24)		Serrano and Fernández 1990, 50–1
23	Graves inside the mine "La Condenada" (Osa de la Vega, Cuenca)				Hierro 2011, 375
24	Belmontejo (Cuenca)				Monco 1986, 255
25	Segóbriga (Saelices, Cuenca)	292	5% (234)		Almagro 1975, 116–17
26	Ercávica (Caraviñuelas, Cuenca)		3% (29)		Monco 1986, 251, 253
27	Carpio de Tajo (Toledo)	>214	4% (275)		Ripoll 1985, 32; 1993; Sasse 2000, 78
28	Santa María de Abajo (Carranque, Toledo)	>65 and fragments	2% (81)		García-Entero *et al*. 2017, 200; V. García Entero (pers. comm.)

(Continues)

TABLE 2
(Continued)

No.	Necropolis	Amount (Min. number of beads)	% of tombs with amber objects (No. of graves excavated)	Analysis and ID	References
29	Cacera de las Ranas (Madrid)	120	3% (150)		Ardanaz 2000, 273
30	Tinto Juan de la Cruz (Pinto, Madrid)	7	3% (80)		Barroso *et al*. 2006, 556
31	Loranca A y B (Fuenlabrada, Madrid)				Oñate 2009, 214–19
32	Camino de los Afligidos (Alcalá de Henares, Madrid)	28	4% (56)		Fernández-Galiano 1975, 16, 41
33	Madrona (Segovia)	442	10% (351)		Molinero 1971, 51–59; Jepure 2006, Katalogband
34	Espirdo-Veladiez (Segovia)	34	2% (49)		Molinero 1971, 66; Jepure 2004, 39–41
35	Santa Lucia (Aguilafuente, Segovia)		7% (198)		Esteban 2007, 133–57
36	Síguero (Segovia)				Almagro 1953, 155–6
37	Ventosilla y Tejadilla (Segovia)		6% (16)		Molinero 1955, 164; 1971, 65
38	Duraton (Segovia)		3% (666)		Almagro 1953, 155–6; Molinero 1971, 26–45
39	Castiltierra (Segovia)	1.105 and fragments	11% (459)		Almagro 1953, 155–6; Arias and Balmaseda 2017, 36
40	Alcallate (Atienza, Guadalajara)				Daza and Catalán 2009, 135
41	Alarilla (Guadalajara)				Zeiss 1934, 64
42	Bolarque (Almonacid de la Zorita, Guadalajara)	4 and 5 fragments			National Archaeological Museum
43	Trillo (Guadalajara)	6			Izquierdo and Izquierdo 1977, 263
44	Cerro de San Martín (Trillo, Guadalajara)	35			Cristóbal 1981, 427
45	Cubillejo de la Sierra (Guadalajara)	30 beads and hoops	5% (22)	FTIR succinite	Cerdeño *et al*. 2022, 94, 214
46	Villel de Mesa (Guadalajara)				Martín and Elorrieta 1947, 56
47	Deza (Soria)		12% (33)		Taracena 1927, 24–5
48	Uxama Argaela (Osma, Soria)				Zeiss 1934, 64; García 2000, 156
49	Herrera de Pisuerga (Palencia)	>357	21% (52)		Martínez 1933, 15-26
50	c/Victorio Macho (Herrera de Pisuerga, Palencia)	13	3% (33)		Arribas and Pérez 2018, 303–5
51	San Martín de Dulantzi (Alegría-Dulantzi, Álava)		3% (31)		Loza and Nizo 2016, 104, 109
52	Aldaieta (Nanclares de Gamboa, Álava)	275			Azkarate 1999
53	San Pelayo (Alegría-Dulantzi, Álava)	26			Azkarate 1997, 169
54	Argaray (Pamplona, Navarra)	15			Mezquíriz 1965, 122
55	San Llorente (Rodiles, Asturias)	1			González 1976, 228–9
56	Rúa do Hospital (O Areal, Vigo)	13	1% (75)		Casal and Paz 1997, 315; Valle 2019, 160–1
57	C/Rosalía de Castro (O Areal, Vigo)	41	2% (52)		López and Martínez 2018, 94–5
58	Beiral do Lima (Ponte de Lima, Portugal)	21			Rigaud 1979, 296
59	Zarza de Granadilla (Cáceres)		12% (8)		Donoso and Burdiel 1970, 332–3
60	Paraje de La Jarilla (Galisteo, Cáceres)	6			Fernández 1974, 197

(Continues)

TABLE 2
(Continued)

No.	Necropolis	Amount (Min. number of beads)	% of tombs with amber objects (No. of graves excavated)	Analysis and ID	References
61	Alter do Chão (Portugal)	40	5% (20)		António and Pinto 2008, 358
62	Talaíde (Cascais, Lisboa, Portugal)		3% (29)		Arezes 2017, 247
63	Mosteiro (Mértola, Beja, Portugal)	2	4% (24)		Lopes *et al.* 2011, 17, 37
64	Las Reliquias (Cartaya, Huelva)[a]	4	3% (32)		López *et al.* 2009, 1708
65	Sanisera (Es Mercadal, Menorca)[b]	21			Olivares 2015, 8; C. Olivares Marín (pers. comm.)

[a] It is not specified that the material is amber; however, an image of the bead(s) is available, which suggests that it is.
[b] In addition, according to the information provided by the National Archaeological Museum, amber beads from 'Campillo De Arenas/Mogón' (Jaén) are kept in the museum. In the Archaeological Museum of Barcelona, there are 63 beads from the necropolis of Durantón, Siguero or Castiltierra, 71 probably from Castiltierra, as well as 39 amber beads of unknown provenance (Almagro 1953, 155–57). In the Juan Cabré Museum (Teruel), there is also a string of 66 amber beads of unknown provenance (Casanovas and Rovira 2011, 53).

centuries who, in their place of origin, were in contact with amber products. As well as, for example, the importance that Toledo acquired in the sixth century as the definitive *urbs regia*. The influence that all these matters could have had on the concentration of such beads is something that we cannot answer now. Furthermore, there remains the dearth of quantitative information regarding the origin of the specimens. Materials of earlier date, such as a fragment of a pendant of the first century found in Numancia (Soria), has been identified as siegburite, whose deposits are in Germany (Dietz *et al.* 2014). Therefore, analyses are needed to determine the provenance of the amber, as the results could also influence the perception of what beads arrived where and when.

According to the data consulted, the pieces are generally found associated with earrings, rings and bracelets, alongside beads made of glass paste, carnelian, metal and jet, among other materials. However, notable differences can be seen regarding the typology and presence (or not) of objects such as, for example, the brooches and belt buckles from the graves of the centre and south-east of the Iberian peninsula. In some cemeteries, in addition to amber, items made of noble metals such as silver (considered to be of high-status) were also part of the grave goods, indicating the high social position of the deceased in their lifetime.

The value allocated to amber in societies is also attested at times by the finds' contexts. For example, the grave containing it is associated with a building of a religious nature, or the individuals buried show a different dietary pattern, and so were of a differentiated social rank. This latter is the case for tomb 236 of the necropolis of San Martín de Dulantzi (Álava): here an adult woman was buried, inside the basilica. Nitrogen and carbon isotope analyses carried out on several inhumations in the cemetery suggested that they, or at least some of them, belonged to a local elite that used the temple as a privileged burial site (Quirós *et al.* 2013, 228; Loza and Niso 2016, 104). Similar circumstances apply to grave 18b of the necropolis of Cubillejo de la Sierra (Guadalajara), in which a woman had a diet close to that of the other women analysed, but with a higher protein intake (Cerdeño *et al.* 2022, 100, 105).

More specifically, the available anthropological studies on burials accompanied by resin beads from various necropolises show that they were mostly women and children. The results of the analyses conducted on the funerary sites of Santa María de Abajo (García-Entero *et al*. 2017, 200), Tinto Juan de la Cruz (Barroso *et al*. 2006, 543), Camino de los Afligidos (Fernández-Galiano 1975, 16, 41), Cubillejo de la Sierra (Cerdeño *et al*. 2022, 64–5), c/Victorio Macho of Herrera de Pisuerga (Arribas and Pérez 2018, 303), San Martín de Dulantzi (Loza and Niso 2016, 104) and Alter do Chão (Portugal) (António and Pinto 2008, 358) all indicate that the inhumed were females in the juvenile and adult age categories. In the cases of the Cartagena necropolis (Madrid and Vizcaíno 2006, 96–8; 2007b, 62, 71), Aldaieta (Azkarate 1999, 344) and Cortijo del Chopo, the analyses revealed that there were infants too (Fig. 6 and Table 2). Finally, it is worth highlighting the Aldaieta cemetery, because amber beads associated with males were also found (e.g. graves 56, 59, 61, 77, 91, 94) (Azkarate 1999).

Studies exist that address the link between the resin and women and children in various geographical areas (e.g. Swift 2003; Gáll and Mârginean 2021, 212; Dalceggio 2022, 172–3). In the Anglo-Saxon context – where the number of beads in the tombs increases with the age of the deceased, it has been proposed that it was the women themselves who made the necklaces in their life-times by collecting and assembling the beads (Klevnäs 2015, 178). This is a possibility to be considered, since in the Hispanic necropolises the number of beads recovered from each burial site varies, and sometimes only a few specimens are documented. In this line of thinking, a microwear analysis conducted on a collection of amber and glass beads from two burials of a Merovingian woman and child, for example, has revealed that some pieces in the set were once part of another necklace or passed down as heirlooms (McGloin 2021, 107–8). The biography of the beads themselves can thus be useful in approaching the ways in which they were acquired. Performing this type of analysis on the Hispanic assemblage would allow us to know, among other things, whether the amber objects had been passed down through several generations or if they were acquired more recently and directly through trade circuits.

The information available on how products made from Baltic amber reached Hispania is restricted to the archaeological evidence in the territory, since the textual sources do not provide specific data in this regard. The resin has been documented both in inland areas and on the coast, and its dispersion and quantity – although not known in all cases – provide very useful data when analysing the possible circulation and distribution routes used.

Currently, the existence of succinite has been verified in all the five necropolises on the Iberian peninsula in which FTIR analyses have been carried out (Cerdeño *et al*. 2022, 214 and this study). The remaining cemeteries have not been studied and, although a similar origin of amber is expected, it is yet to be confirmed (Fig. 6). Around the North Sea numerous sites and a high volume of pieces have been identified for the Late Antiquity period; some workshops are also known (Neumayer and Nüsse 2016, 384, fig. 19; Langbroek 2021, 284). In the absence of greater knowledge of the distribution patterns and percentages existing in other areas of Gallia, such as the north, the Atlantic coast and the south, there could have been several routes that brought amber products to Hispania.

First, the high concentration of amber attested in Britannia, the Netherlands and Belgium (Brugmann 2004, fig. 64; Langbroek 2018, fig. 1) leads to the proposal of a maritime route that, via the English Channel and the Atlantic Ocean, could have brought the objects to the Iberian peninsula. In northern Iberia, sites with amber are known (Fig. 6 and Table 2): not far from them, in Late Antiquity contexts on the Cantabrian coast and the north-west, the presence of Gallic pottery (DSP A and EWare) has been confirmed (Fernández 2014, fig. 226; Duggan 2018,

appendix H4, H9). Fernández's studies based on the circulation of pottery finds on the Atlantic coast emphasized the role played by Vigo as a port of departure or arrival for merchant ships transporting goods from the North Atlantic that would be re-exported to the Mediterranean. The Aquitaine, Breton, Saxon or Baltic products 'brought down' included items made from tanned leather, wood, marble or metals (Fernández 2014, 461–9, fig. 236; Duggan 2018, 13). A detailed study that analysed the occurrence of such objects from these places associated with amber could allow us to determine whether the return cargoes of the vessels heading to the Mediterranean included the beads recovered in areas such as south-eastern and eastern Spain and the Balearic Islands.

Second, a high volume of amber beads from funerary contexts is known from the upper and middle course of the Rhine and its tributaries, as well as the Danube as it flows through the south of ancient Germany. These pieces, which follow a north-south circulation direction (Neumayer and Nüsse 2016, 384, fig. 19), i.e. from the North Sea to the source of the Rhine, could have continued down the Rhône waterway towards other zones distant from the source of origin, such as the southernmost area of Gallia (Salin 1958, 79) and, from there, to Hispania. They could also have circulated to areas like the Italian peninsula, for example.

From East to West, the routes used in Antiquity to bring in a variety of materials are known (Pieri 2002, fig. 2). The opportune connections the different ports offered between themselves, particularly those coming from the western territories, is attested by the late DSP Provencal and Narbonne pottery finds documented in the south of the Iberian peninsula, the Levant and the Balearic Islands (Fernández 2014, 271, with references), in addition to the materials from Italy (Siclari 2019) and the East identified in various areas of the Hispanic coast (García Vargas 2011, with references). Thus amber may have been included in the cargos of the vessels that circumnavigated the Mediterranean and that, thanks to the ports, penetrated inland, either along the rivers or the overland routes. Indeed, we know of numerous oriental merchants located at strategic river and maritime locations who facilitated the distribution of diverse products (García Moreno 1972, 146; Pieri 2002, fig. 11; Duggan 2018, 14).

The amber bead discoveries in the territory under discussion reveal that natural passages and waterways were fundamental for the distribution and supply of the resin throughout the Iberian peninsula. Moreover, the Roman road system was still in use in Late Antiquity, or at least partially so in many areas, and some survived even beyond that. Take the case for the road from Carmona to Narbonne, according to the testimony of the tenth-century Andalusian author Ahmad al-Razi (Gozalbes 1996, 87). On the other hand, it is also important to take into account the role of itinerant merchants, intermediaries and markets, the *nundinae* (Arce 1993) in the dispersion of this type of personal adornment.

Finally, it is noteworthy that these amber pieces are similar to those found in other regions, suggesting that they arrived already in their final form. So far, at least, no sites have been excavated to indicate otherwise. Here, it is necessary to study the Hispanic bead assemblage in detail and determine its typology. Thus, one may relate it to the corpus of the Frankish, Central European, Scandinavian and British territories, to identify similarities and differences in production. In fact, hypothesizing that the beads arrived in Hispania in their finished form, the workshops in which the raw amber was processed and whence the products were released into the commercial and exchange circuits must have had an influence in establishing these distribution channels. An in-depth research that identifies these places would provide data of great importance for investigating the circulation of manufactured objects. In northern Gallia, in particular, several amber

bead production centres are known, such as Utrecht-Leidsche Rijn, Widjnaldum and Oegstgeest (all in the Netherlands) (Langbroek 2021, 284).

CONCLUSIONS AND FUTURE RESEARCH

The scientific output concerning the use of amber in Antiquity is very extensive. However, the Iberian peninsula had been omitted from this research and the involvement of this substance in exchange and trade networks remains unknown for Late Antiquity. Thanks to (FTIR) analyses, the results of this study confirm the presence of Baltic amber in Hispania and, although the research is still in its infancy, it opens up new avenues for reflection. The identification of contexts with amber artefacts, mostly necropolises, has made it possible to see how they were distributed along the coast, with a strong concentration in the centre. In addition, according to the anthropological analysis conducted, the people most closely associated with this material were women and children.

To understand the volume, distribution and biographies of beads in the Hispanic terrain, it is essential to carry out studies of provenance, microwear and typology, as well as to analyse the context of the beads and to be more precise about their chronology. We do not know if they arrived gradually over time, or were regularly traded. It is unclear whether some pieces could have been passed down over several generations (or recycled from earlier chronological stages), if they were acquired through purchase or exchange or if their presence reflects other processes not directly linked to trade.

There is a relatively good understanding of amber finds from certain areas, such as Britain and the Rhineland. However, more information is needed to specify the route or routes that were used in Late Antiquity to deliver the resin to Hispania. The beads could have been part of the cargoes of vessels coming via the Atlantic and the Mediterranean, or they could have arrived by land, across the Pyrenees.

The set of data collected for this study reveals the networks of contacts between both neighbouring and very distant territories, as well as the value and significance that Late Antique society attributed to amber, which led to its demand. Further research will help to answer many of the outstanding questions surrounding this interesting material.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Supporting Information 1. Detailed information of the amber beads.

Supporting Information 2. Raw FTIR data of the samples analysed.

Supporting Information 3. Main absorbance peaks of all samples analysed and FTIR spectra of all samples in the range 2000-500 cm^{-1}.