



**QUEEN'S
UNIVERSITY
BELFAST**

The "Ferradeira" individual burial of Herdade do Álamo (Beja): facets of social change in the late 3rd millennium BC in South Portugal

Valera, A. C., Do Pereiro, T., Nogueira, S., Evangelista, L. S., Maurer, A. F., Dias, C. B., Ribeiro, S., Santos, J. F., & Bottaini, C. (2022). The "Ferradeira" individual burial of Herdade do Álamo (Beja): facets of social change in the late 3rd millennium BC in South Portugal. *SPAL: Revista de Prehistoria y Arqueología*, 31(1), 92-112. <https://doi.org/10.12795/spal.2022.i31.04>

Published in:

SPAL: Revista de Prehistoria y Arqueología

Document Version:

Publisher's PDF, also known as Version of record

Queen's University Belfast - Research Portal:

[Link to publication record in Queen's University Belfast Research Portal](#)

Publisher rights

Copyright 2022 The Authors.

This is an open access article published under a Creative Commons Attribution-NonCommercial-NoDerivatives License (<https://creativecommons.org/licenses/by-nc-nd/4.0/>), which permits distribution and reproduction for non-commercial purposes, provided the author and source are cited.

General rights

Copyright for the publications made accessible via the Queen's University Belfast Research Portal is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy

The Research Portal is Queen's institutional repository that provides access to Queen's research output. Every effort has been made to ensure that content in the Research Portal does not infringe any person's rights, or applicable UK laws. If you discover content in the Research Portal that you believe breaches copyright or violates any law, please contact openaccess@qub.ac.uk.



Open Access

This research has been made openly available by Queen's academics and its Open Research team. We would love to hear how access to this research benefits you. – Share your feedback with us: <http://go.qub.ac.uk/oa-feedback>



The “Ferradeira” individual burial of Herdade do Álamo (Beja): facets of social change in the late 3rd millennium BC in South Portugal

EL ENTIERRO INDIVIDUAL “FERRADEIRA” DE HERDADE DO ÁLAMO (BEJA): FACETAS DEL CAMBIO SOCIAL A FINALES DEL III MILENIO A.C. EN EL SUR DE PORTUGAL



António Carlos Valera

Era Arqueologia SA. / ICArEHB Universidade do Algarve
Calçada de Santa Catarina, 9c, 1495-705, Cruz Quebrada – Dafundo, Portugal
antoniovalera@era-arqueologia.pt  0000-0001-5492-3810  AFP-3642-2022
(Responsable de correspondencia)



Tiago do Pereiro

Era Arqueologia SA.
Calçada de Santa Catarina, 9c, 1495-705, Cruz Quebrada – Dafundo, Portugal
tiagodopereiro@era-arqueologia.pt  0000-0003-2691-4583  AFQ-5827-2022



Sofia Nogueira

Era Arqueologia SA.
Calçada de Santa Catarina, 9c, 1495-705, Cruz Quebrada – Dafundo, Portugal
sofianogueira@era-arqueologia.pt  0000-0002-6587-6340  ABH-3323-2022



Lucy Shaw Evangelista

Era Arqueologia SA. / CIAS-Universidade de Coimbra / ICArEHB Universidade do Algarve
Calçada de Santa Catarina, 9c, 1495-705, Cruz Quebrada – Dafundo, Portugal
lucyevangelista@era-arqueologia.pt  0000-0002-8718-5612  AFP-7159-2022



Anne-France Maurer

Laboratory HERCULES – Évora University
Largo Marquês de Marialva, 8, 7000-809 Évora, Portugal
annefrance.maurer@gmail.com  0000-0002-4997-5357  ACT-2473-2022



Cristina Barrocas Dias

Laboratory HERCULES / Chemistry Department, School of Sciences and Technology – Évora University. Largo Marquês de Marialva, 8, 7000-809 Évora, Portugal
cmbd@uevora.pt  0000-0002-1707-2209  S-6824-2016



Sara Ribeiro

Geobiotec, Department of Geosciences, University of Aveiro.
Campus de Santiago, 3810-193 Aveiro, Portugal
sararibeiro@ua.pt  0000-0002-5074-5452  AFP-7048-2022

José Francisco Santos

Geobiotec, Department of Geosciences, University of Aveiro.
Campus de Santiago, 3810-193 Aveiro, Portugal
jfsantos@geo.ua.pt  0000-0003-4997-8264  M-7553-2017

Carlo Bottaini

Laboratory HERCULES – Évora University / CityUMacau Chair in Sustainable Heritage
Largo Marquês de Marialva, 8, 7000-809 Évora, Portugal
carlo@uevora.pt  0000-0003-2464-468X  P-3670-2016

Abstract The individual burial of the Herdade do Álamo, located in Beja municipality, South Portugal, is presented along with its bioanthropological study, radiocarbon dating and isotopic approaches on diet and mobility. The results show a male, with a terrestrial diet and youth mobility, dating from the last quarter of the 3rd millennium BC. The archaeometallurgical study of

Carlos Valera, A., do Pereiro, T., Nogueira, S., Evangelista, L. S., Maurer, A. F., Barrocas Dias, C., Ribeiro, S., Santos, J. F., Bottaini, C. (2022): “The ‘Ferradeira’ individual burial of Herdade do Álamo (Beja): facets of social change in the late 3rd millennium BC in South Portugal”, *Spal*, 31.1, pp. 92-112. <https://dx.doi.org/10.12795/spal.2022.i31.04>

the metal votive assemblage (one tongue dagger and three Palmela points) indicates a copper metallurgy with high values of Arsenic (As), typical of this period of transition. The burial is contextualized in a process of individuation of the funerary practices and in the “Ferradeira Horizon”, considered as a facet of the diversified funerary practices and of the complex social changes of the late 3rd millennium BC in the South of Portugal.

Keywords Chronology, Isotopic approach, Bronze Age transition, Bell beakers, Copper metallurgy.

Resumen Se presenta el entierro individual de la Herdade do Álamo, ubicada en el municipio de Beja, Sur de Portugal, junto con su estudio bioantropológico, datación por radiocarbono y enfoques isotópicos sobre dieta y movilidad. Los resultados muestran un varón, con dieta terrestre y movilidad juvenil, que data del último cuarto del 3^o milenio antes de Cristo. El estudio arqueometalúrgico del conjunto votivo metálico (un puñal de lengüeta y tres puntas de Palmela) indica una metalurgia del cobre con altos valores de Arsénico (As), propios de este período de transición. El entierro se contextualiza en un proceso de individuación de las prácticas funerarias y en el “Horizonte Ferradeira”, considerado como una faceta de las prácticas funerarias diversificadas y de los complejos cambios sociales de finales del III milenio antes de Cristo en el sur de Portugal.

Palabras clave Cronología, Enfoque isotópico, Transición a la Edad del Bronce, Campaniforme, Metalurgia del Cobre.

1. INTRODUCTION

The “Ferradeira Horizon” is a concept developed by H. Schubart in the early seventies of the last century (Schubart, 1971) to designate a social-cultural setting in South Portugal, defined in opposition to the models established for the Chalcolithic of Portuguese Estremadura at the time (Gonçalves, 1989; Mataloto *et al.*, 2013). In empirical terms, it is based on a type of funerary contexts identified in South Portugal and characterized by individual burials in different types of graves, with votive assemblages of polythetic nature comprising metal artefacts (usually weapons like tongue daggers and Palmela arrow heads or awls), undecorated pottery (when present) and sometimes archer wrist guards. In contrast, Estremadura burials from the same general period are mainly characterized by commingled, collective depositions within a diversity of funerary contexts, such as caves, hypogea or tholoi.

When absolute chronologies were unavailable, “Ferradeira” was ascribed to the second quarter of the 2nd millennium BC, and subsequently retreated to the late 3rd / beginning of the 2nd millennium BC (Parreira, 1995; Soares and Silva, 1995). In the last decades, with the advent of radiocarbon dating of several contexts and Bayesian statistical approaches, it was considered to cover all the second half of the 3rd millennium BC, and contemporaneous to Bell Beaker phenomenon (Mataloto *et al.*, 2013; Valera, 2014; Mataloto, 2017).

Due to its filiation in a historical culturalist theoretical framework, the concept was strongly criticised during the eighties (Gonçalves, 1989), but it remained in use and, destitute of its former cultural connotations, is still considered to be useful (Mataloto *et al.*, 2013; Valera, 2014). Its present utility rests, mainly, in the recognition of the strong identity of its empirical bases and in the fact that it seems to express a facet of the diversified and complex systemic changes that took place during the second half of the 3rd millennium BC in the Iberian Southwest, related to a breakdown of the social trajectory in course since the second half of the 4th millennium BC (Valera, 2015). Predominantly defined through mortuary contexts, it is the major expression of the re-emerging of individuation as a predominant practice in funerary rites in South Portugal (a practice that would prevail in the 2nd millennium BC), emphasizing the decay of the discourse of collectivism in death and expressing the social changes in course in the late 3rd millennium BC.

Nevertheless, the empirical bases of this trend still need a better characterization, as well preserved, adequately excavated, and dated burials, with bioanthropological and isotopic studies of the human remains, are still scarce. In this context, the recent excavation of an individual pit grave (Grave 1) in the Herdade do Álamo (Beja) with a votive assemblage typical of “Ferradeira” and its multidisciplinary approach (archaeological, bioanthropological, isotopic and archaeometallurgical studies) is an important addition to the knowledge and problematization of a still relatively obscure period of transition in the Iberian Southwest.

2. THE ARCHAEOLOGICAL CONTEXT

The Herdade do Álamo is located next to the Beja airport (Beja municipality and district), in the lower Alentejo region, South Portugal (fig. 1). The property was recently ploughed and planted with almond trees, affecting archaeological heritage. As mitigation measures, a set of surveys were carried out by Era Arqueologia SA.

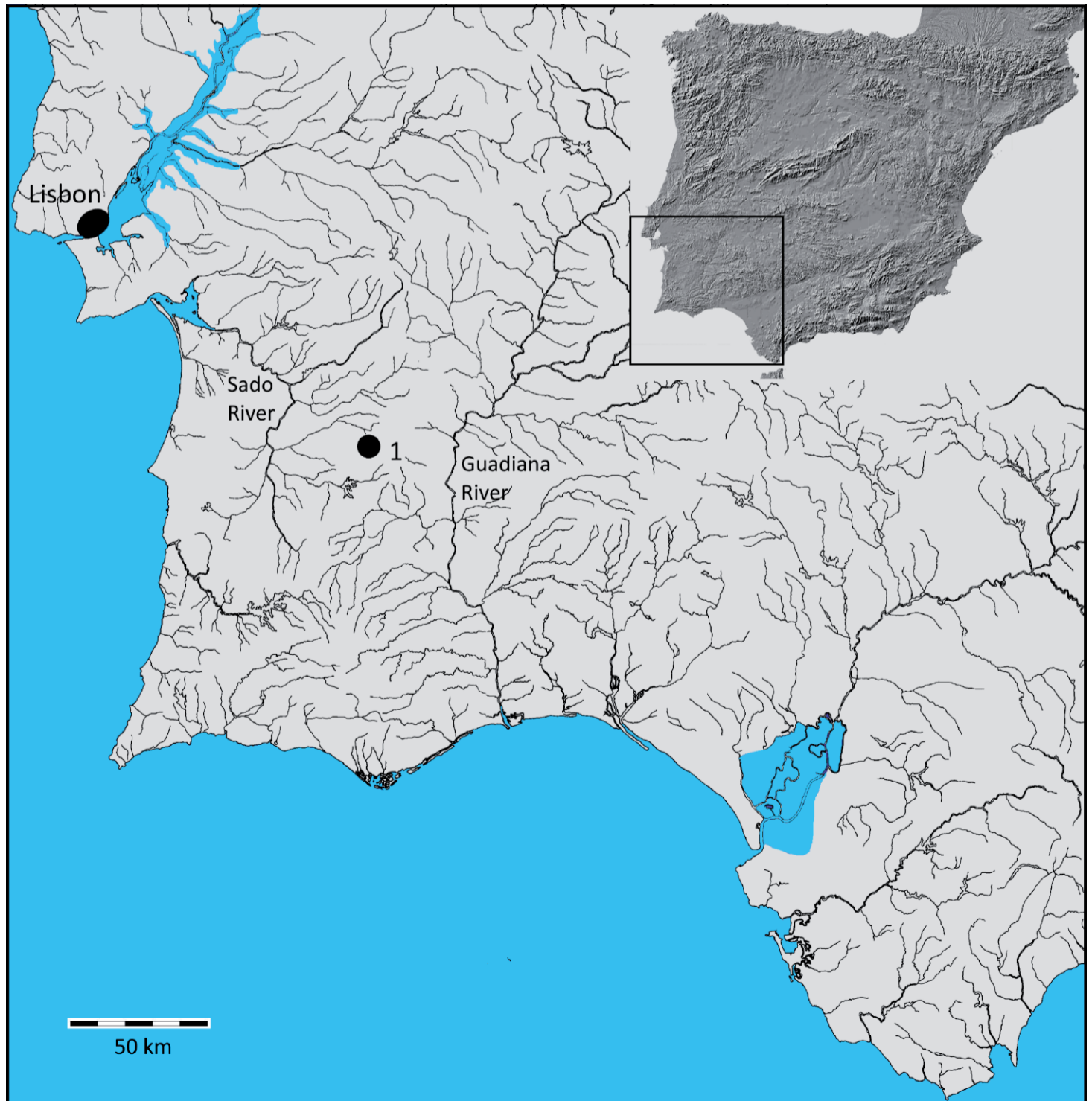


Figure 1. Location of Herdade do Álamo site in the Iberian Southwest (Map represented with the 3rd millennium coastline).

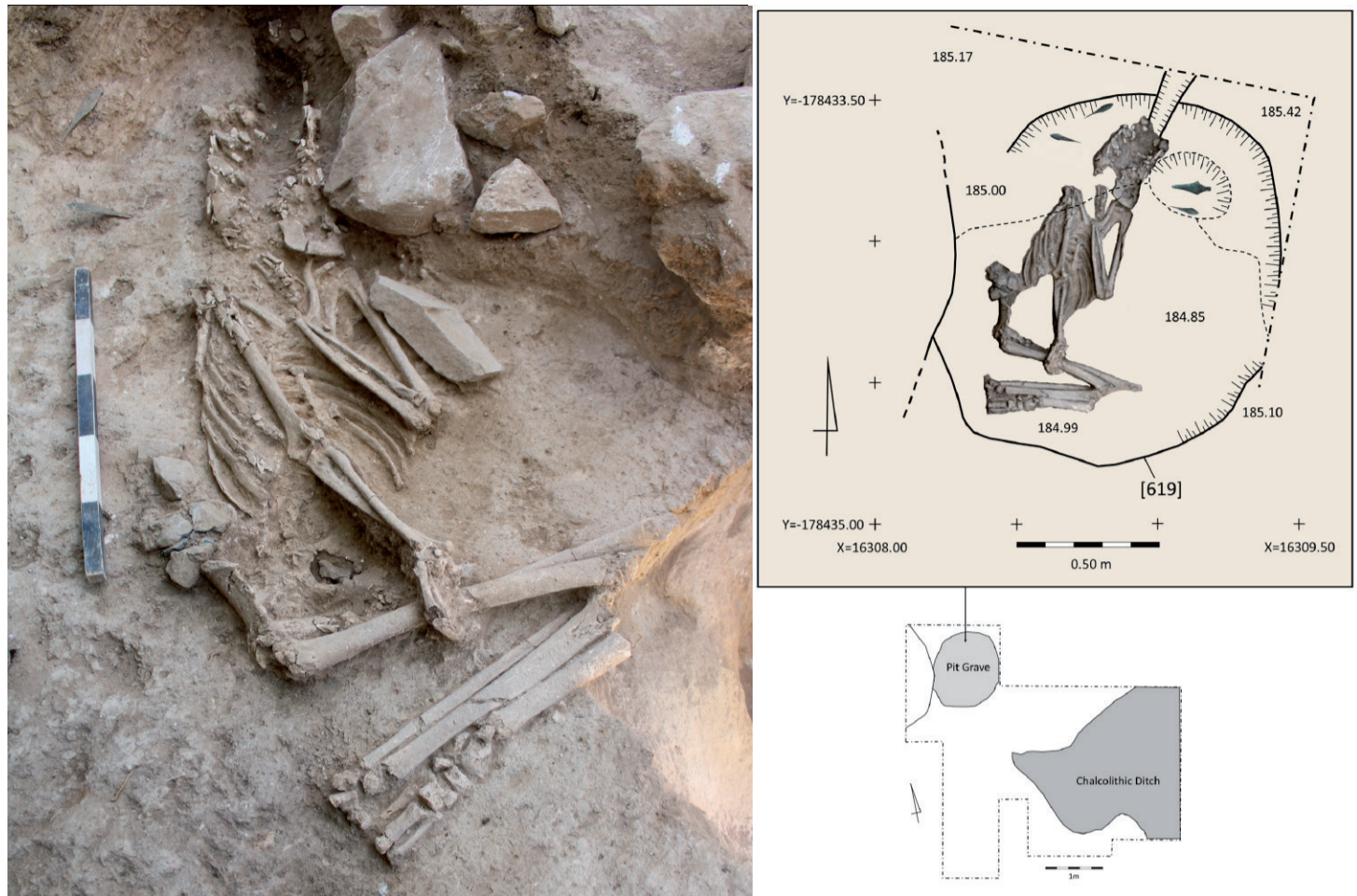


Figure 2. The pit grave context of Herdade do Álamo and its location at the possible entrance of the Chalcolithic ditched enclosure.

In one of those surveys, located at the edge of a platform overlooking the Álamo stream, a section of a ditch belonging to a Chalcolithic ditched enclosure was identified and excavated (Pereiro *et al.*, 2021). This section showed an interruption, possibly corresponding to a gate, where a pit grave was located, just next to the northern limits of the survey (fig. 2). The pit had an ellipsoidal shape, with 1,35m long, 1,10m wide and 0,40m of maximum depth. It was filled with one deposit and demarcated by a row of stones at NE. At the bottom, an individual was deposited in foetal position together with a set of metallic objects (one dagger and three arrowheads).

The infilling of this pit was partially cut by the ploughing that affected the skull of the individual, dividing it in two halves and bringing up some bone fragments. That same ploughing was responsible for the remobilization of another human skull that was deposited over the layer that filled the pit, suggesting that another grave might exist beyond the survey section.

3. BIOANTHROPOLOGICAL CHARACTERIZATION

The individual in the pit grave corresponds to a primary deposition orientated North – South (200°-200°), in foetal position and with the skull turned to the left side (East). The left upper limb was flexed over the chest and the right was extended along the chest, with the hand over the right femur. The lower limbs were flexed to the left.

This individual is a middle-aged adult (between 41 and 65 years old), based on the observation of changes in the auricular surface (Lovejoy *et al.*, 1985), and sex diagnosis revealed to be male, based on the morphology of the pelvis and skull (Ferbach *et al.*, 1980) and maximum talus length (Silva, 1995), Stature, measurements,

estimated from the left radius, showed this individual would be with a height around 173.23 (± 3.53) cm.

Dental analysis shows *ante-mortem* tooth loss of FDI 35, 45, 46 and 47. Regarding tooth wear, there is a great variability of degrees present in the dentition. This may be due to *ante-mortem* tooth loss, since the teeth that show greater wear are contiguous to those that were lost during this individual’s life, which may have caused an overload for them.

Regarding pathological analysis the right tibia showed a slight curvature of the diaphysis possibly as the result of an infectious process affecting the bone.

A slight case of osteoarthritis was identified on both extremities of the right ulna. Hand phalanges also showed slight bone growth on the lateral and medial surfaces of the diaphysis. An oval orifice with rounded edges and a diameter of 4 mm was identified on the medial surface of the distal end of the right radius. Around this orifice no porosity or new bone formation was observed, although taphonomical alterations of the periosteum hindered a more specific diagnosis.

No other pathological or morphological alteration were registered for this individual.

4. THE VOTIVE ASSEMBLAGE

The votive assemblage associated to this individual comprised a tongue dagger and three Palmela arrowheads (fig. 3, tab. 1). The dagger has a sub-triangular blade, with a “Eiffel Tower” shape, and presents a central vein that follows the general outline and the edges slightly marked. The peduncle has the edges slightly hammered, producing a rectangular section. The Palmela point (2) has an oval and elongated blade, with thin edges that follow the general shape. The peduncle is triangular with a rectangular section. The two other Palmela points are slightly different, but closer to each other. The shape of the head is ogival, with large and well demarcated edges. The rest of the body is triangular and undifferentiated from the peduncle, that is of rectangular section.

The dagger and one arrowhead were deposited inside a depression at the base of the pit in front of the face of the individual and covered by one of the stones that delimited the grave in the Northeast side. The other two arrowheads were deposited behind the head of the individual (fig. 2).

The metals were analysed to obtain their chemical composition. Analyses were carried out at the HERCULES Lab (University of Évora, Portugal), using a portable and handheld X-ray Fluorescence spectrometer, Bruker Tracer III SD model, equipped with a rhodium anode tube and a Silicon Drift Detector, according to the following working conditions; 60 second acquisition time; 40 kV, 12.5 μ A; Al/Ti filters (304.8 μ m aluminium/25.4 μ m titanium). Quantification was carried out through BCR-691 reference standards. Each object was analysed in two different areas, namely at both the extremities. Before being analysed, the metals were properly cleaned of surface corrosion.

As expected, the four objects are made up of arsenical copper (Cu+>2% As), with arsenic ranging from 2.38% and 5.22%, and low impurities of iron. Other elements than Cu, As, and Fe were not detected (tab. 2).

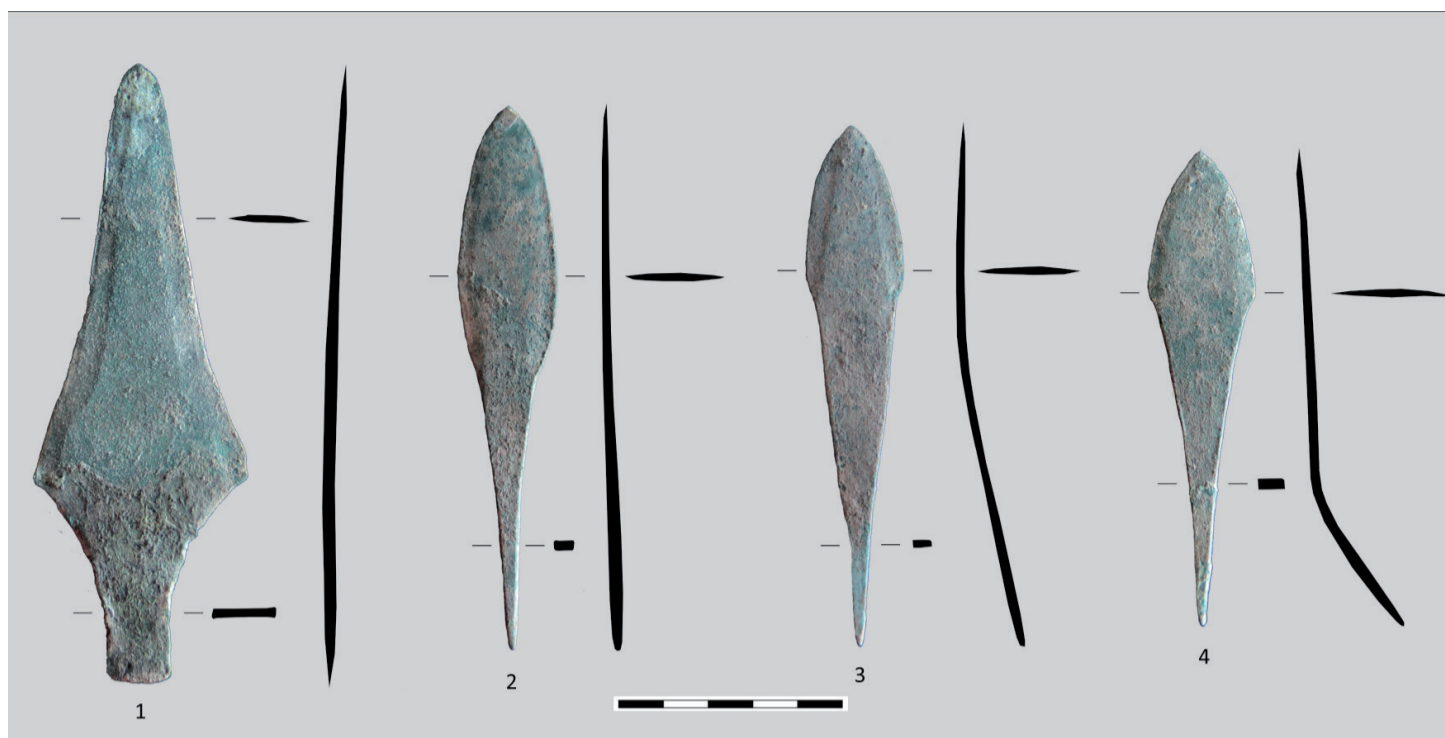


Figure 3. The metal assemblage present at the grave of Herdade do Álamo.

Table 1. Measures (in cm) of the metal artefacts.

Object	Maximum Length	Maximum width	Maximum thickness	Stalk/Tongue thickness	Tongue width	Weight (g)
Dagger	13.9	4.8	0.3	4.5	1.5	48
Arrowhead 2	12.1	2.2	0.3	5.9	x	17
Arrowhead 3	11.7	2.2	0.2	8.7	x	16
Arrowhead 4	11.1	.4	0.2	7.9	x	16

Table 2. Chemical composition of the metal artefacts (wt%); n.d: not detected.

Object	Lab ID	Cu	As	Fe
Dagger	DAG-01-PED	97.46	2.49	0.05
	DAG-01-PON	97.40	2.57	0.03
Arrowhead 2	ARR-02-PED	96.34	3.63	0.03
	ARR-02-PON	94.74	5.22	0.04
Arrowhead 3	ARR-03-PED	97.46	2.54	n.d.
	ARR-03-PON	97.60	2.38	0.02
Arrowhead 4	ARR-04-PED	95.12	4.88	n.d.
	ARR-04-PON	95.33	4.67	n.d.

5. RADIOCARBON DATING AND ISOTOPIC DATA ON DIET AND MOBILITY

A bone sample (left ulna) from the individual of Herdade do Álamo burial was dated at the Radiocarbon Dating Laboratory of University of Waikato. As pre-treatment, the sample was cleaned, grounded, and decalcified in 2% HCl, rinsed and dried. Then it was gelatinised at pH=3 with HCl at 90 degrees for 4 hours, ultrafiltered and freeze-dried. The

obtained result was 3739 ± 17 BP, 2204-2041 cal BC 2σ , situating this individual in the last quarter of the 3rd millennium BC (tab. 3).

Table 3. Radiocarbon date for the individual of Herdade do Álamo.

Lab. Ref.	Date BP	Cal 2σ	$\delta^{13}C$	$\delta^{15}N$	C%	N%	C:N
Wk52161	3739 ± 17	2204-2041	-19.22	9.69	43.47	15.39	3.27

Calibration curve IntCal20 (Reimer *et al.*, 2020)

The obtained results for $\delta^{13}C$ (-19.2‰) and $\delta^{15}N$ (9.7‰) are the expected for protein obtained mainly from a terrestrial C3-based diet (the radiocarbon result was calibrated accordingly – see Table 3). In fact, humans with a terrestrial C3 based diet generally yield $\delta^{13}C$ values around -20/-21‰ and $\delta^{15}N$ values between 5 and 12‰, while those with a maritime diet present $\delta^{13}C$ and $\delta^{15}N$ values around -11/-12‰ and 12 to 22‰ respectively, depending on the amount and trophic level of the marine protein consumed by the individual (Lee-Thorp, 2008). Results obtained from the individual of Herdade do Álamo are in accordance with the image provided by the data set available for individuals from inner Alentejo (South Portugal) dated from the second half of the 3rd millennium BC (tab. 4 and fig. 4).

To approach the level of mobility of this individual, two mandibular teeth (M2-FDI 37 and M3-FDI 38) were analysed for $^{87}Sr/^{86}Sr$. The samples were analysed at Laboratory of Isotope Geology of the University of Aveiro, Portugal. Around 20 mg of enamel from each tooth was collected using a drill with a diamond bit, in a lengthwise fashion from the crown tip to root in order to incorporate enamel from the entire time of crown formation. Samples were pre-treated with 1M Li acetate-acetic acid for 12 h to remove any secondary carbonates that might have introduced diagenetic strontium (Hoppe *et al.*, 2003). Samples were then rinsed with Milli-Q water, vortexed and centrifuged for 5 min at 5000 rpm for four times or until the pH was neutral. Afterwards, they were dried overnight in an oven at 70 °C. The complete pre-treatment led to some sample loss. The results are expressed in Table 5.

To define the local range, we resort to available isotopic data for two neighbouring sites: Bela Vista 5 (Valera, 2014), a ditched enclosure with the exact same chronology of the individual of Herdade do Álamo and distancing only 3 km to SW, and Monte da Cegonha (Saragoça *et al.*, 2016), a roman *villae*, located 16.5 km East (tab. 5). The geology of Bela Vista 5 is the same as in Herdade do Álamo (Beja gabbro's) and the geology around Monte da Cegonha is mainly constituted by diorites, being both formations integrated in the Beja old massif.

The local range is mainly defined by water and plant samples from Monte da Cegonha, established between 0.70826 and 0.71247 (2σ). The analysed humans from this roman site fell inside this range, as well as two of the three analysed animals and the human of Bela Vista 5, although this individual yields a $^{87}Sr/^{86}Sr$ value near the upper limit of the local range (fig. 5). The individual of Herdade do Álamo shows a value of 0.71523 for his m2 tooth, significantly distant from the local range, and a value of 0.71067 for his M3 tooth, fully integrated within the local range. This data suggests that the individual from Herdade do Álamo was living outside this area in his childhood (M2 is formed around 11-13 years), but, when M3 was formed (M3 is completely formed around 18-25 years) this individual was already living in Herdade do Álamo or in a region with a similar geological basement.

Table 4. $\delta^{13}\text{C}$ / $\delta^{15}\text{N}$ values of collagen from individuals of the second half of the 3rd millennium BC in inner Alentejo region.

Site	Structure	SU.	Sample	Lab. Ref.	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	Bib. Ref.
Her. do Álamo	Pit burial	[618]	Ulna	Wk52161	-19.2	9.7	This study
Perdigões	Tomb 4	UE658	Lef tibia	Beta-514884	-19.4	8.7	Valera, 2020a
		UE640	Left humerus	Beta-514883	-19.1	8,8	
		UE642	Left tibia	Beta-514881	-19.7	8.2	
		UE644	Left tibia	Beta-514880	-19.8	8.4	
		UE647	Fibula	Beta-517339	-19.4	8.5	
		UE644	Right femur	Beta-517338	-19.7	8.3	
	Tomb 2	UE445	Left humerus	S5 (E)	-19.6	9.4	
		UE429	Left humerus	S10 (J)	-20.1	9.5	
		UE429	Left humerus	S11 (K)	-19.6	10.2	
		UE231	Right humerus	S13 (M)	-19.9	9.8	
		UE231	Left femur	73632	-20.4	9.5	
		UE261	Left femur	73633	-20.9	9.2	
Cardim 6	Tholos	[415]	Inferior pre molar	SANU-53101	-18.8	10.7	Valera et al., 2019a
		[415]	Left femur	SANU-53106	-18.9	9.9	
		[410]	Mandible	SANU-53039	-20.9	10.0	
		[412]	Left femur	SANU-53513	-19.3	10.1	
		[412]	Left femur	SANU-53512	-20.6	10.2	
		[412]	Mandible	SANU-53514	-19.1	9.0	
		[407]	Upper pre molar	SANU-53038	-18.5	7.7	
[408]	Left femur	SANU-53037	-18.9	8.5			

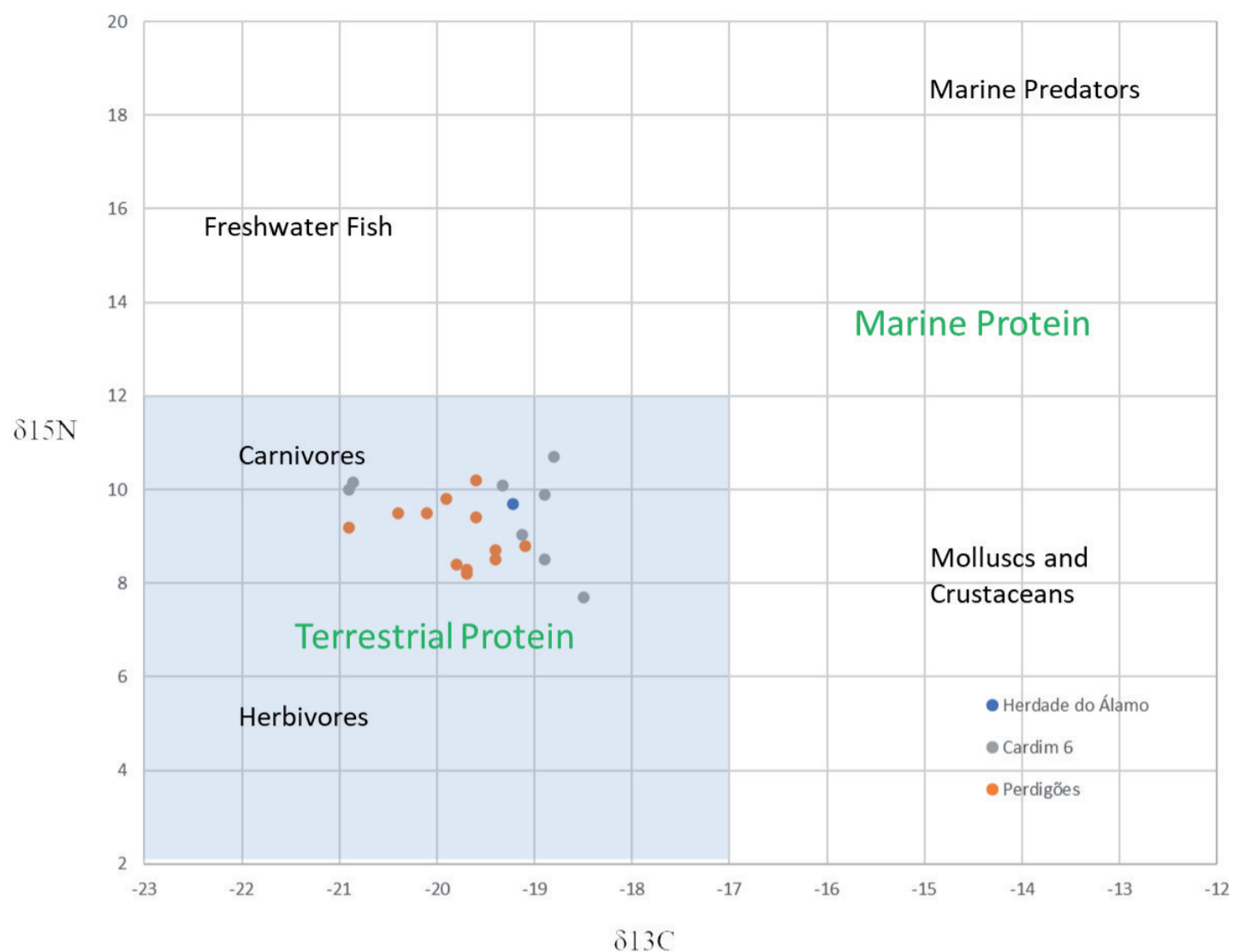


Figure 4. Plot of the $\delta^{13}\text{C}$ / $\delta^{15}\text{N}$ values of collagen from individuals of the second half of the 3rd millennium BC in inner Alentejo region.

Table 5. Teeth $^{87}\text{Sr}/^{86}\text{Sr}$ data for the individual of Herdade do Álamo and for local area (teeth, plants, and water).

Site	Lab.Ref.	Sample	$^{87}\text{Sr}/^{86}\text{Sr}$	Error (2 σ)
Herdade do Álamo	21/100	Individual [618] M2	0.715228	0.000019
	21/101	Individual [618] M3	0.710672	0.000024
Bela Vista 5*	20/154	Human M2	0.712553	0.000014
	20/151	<i>Ovis / Capra</i>	0.707181	0.000016
	20/152	Medium size animal	0.709426	0.000021
	20/153	<i>Equus sp.</i>	0.710207	0.000021
Monte da Cegonha**	HMC7	Human enamel	0.7111	–
	HMC8	Human enamel	0.7108	–
	HMC11	Human enamel	0.7097	–
	HMC13	Human enamel	0.7109	–
	14/259	Water	0.712385	0.000021
	14/260	Water	0.712449	0.000030
	14/261	Plant	0.710874	0.000031
	14/272	Plant	0.710840	0.000026
	14/262	Plant	0.711051	0.000023
	14/263	Plant	0.710076	0.000018

Site	Lab.Ref.	Sample	$^{87}\text{Sr}/^{86}\text{Sr}$	Error (2σ)
Monte da Cegonha**	14/264	Plant	0.708358	0.000021
	14/265	Plant	0.708260	0.000017
	14/267	Plant	0.712465	0.00002
	14/268	Plant	0.710905	0.000021

* Unpublished data; ** Data published in Saragoça *et al.*, 2016.

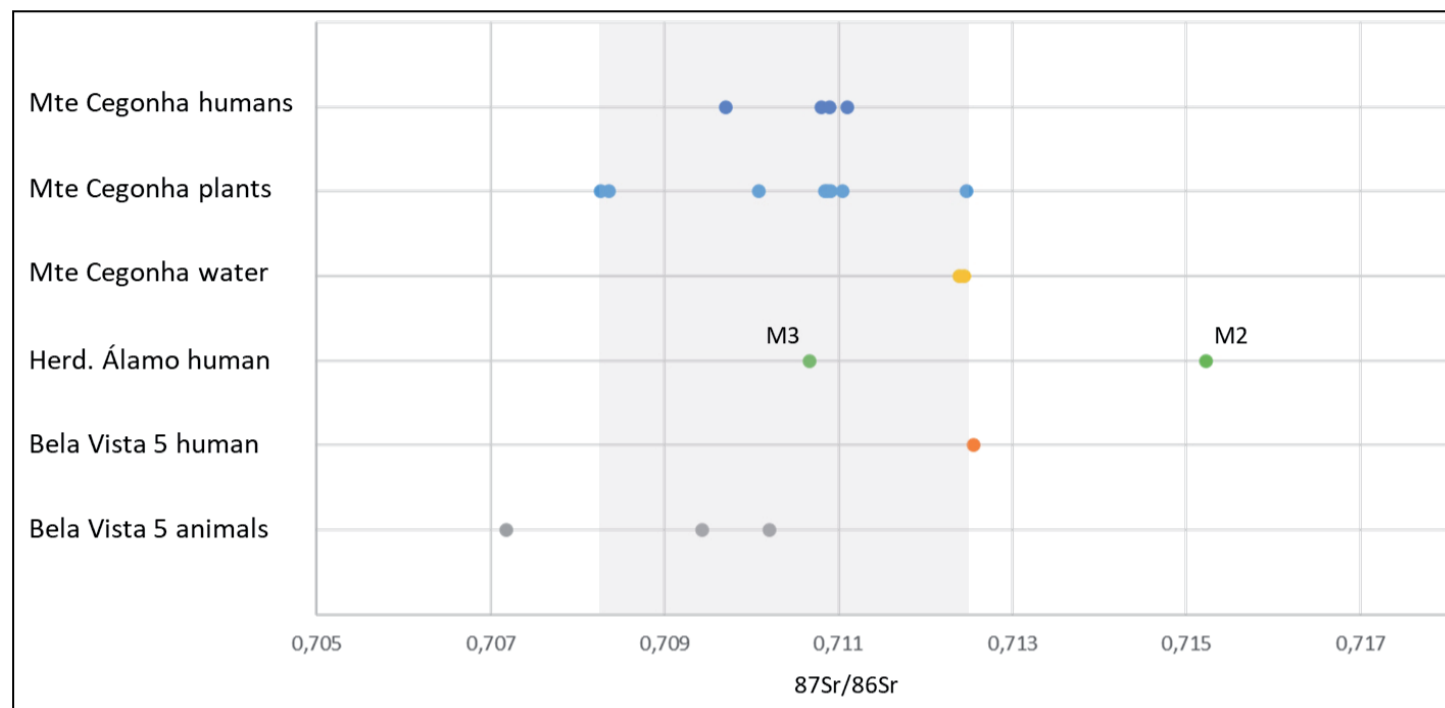


Figure 5. Plot of the $^{87}\text{Sr}/^{86}\text{Sr}$ data for the individual of Herdade do Álamo and for local area (grey area).

6. DISCUSSION

In South Portugal, as in other Iberian regions, the second half of the 3rd millennium BC is a period of contradictions in social, ideological, and cosmological terms, indicating a process of structural changes that seems to have been accelerated in the last quarter of the millennium. Recent approaches using radiocarbon dates as proxy, suggest a demographic decline from the third quarter of the millennium forward (Lillios *et al.*, 2016; Blanco González *et al.*, 2018). By the last quarter, large scale interaction networks of exotic materials are collapsing, the production of iconographic materials declined, the investments in monumentality became less monumental, construction of enclosures became residual (Valera, 2015), changes in the technological and economic subsystems are occurring (for instance, at a large ditched enclosure like Perdigões the percentage of hunted animals increased while the domestic ones decreased in the faunal record indicating changes in the pattern of animal management and consumption - Almeida and Valera, 2021) and social and ideological transformations are suggested by the funerary rituals. In this context, the Herdade do Álamo burial allow us to address some of these changes in several variables of the social system, such as developments in copper metallurgy, the emerging tendency for individual burials, which gains increasing visibility in the archaeological record, the reuse of earlier context of social relevance as stages for these individual burials and issues related to mobility.

Regarding metallurgy, the chemical composition analysis revealed that the four artefacts were produced with arsenical copper. The content of As, in particular, appears to be in line with the results known for metals from the Late Chalcolithic and ascribed to “Ferradeira” (tab. 6). In fact, copper-based alloys from the last quarter of the 3rd millennium BC onwards show higher levels of arsenic compared to artefacts from the Full Chalcolithic, which are almost pure copper/low arsenical copper metals, and are gradually abandoned to be replaced by arsenical copper (Soares *et al.*, 1996; Valério *et al.*, 2016; Bottaini *et al.*, 2018a; Valério *et al.*, 2020).

Table 6. Composition (wt%) of the copper-based metals attributed to the Ferradeira Horizon, according to Schubart, 1971, and others, namely: [1] Junghans *et al.*, 1960; [2] Bittel *et al.*, 1968; [3] Junghans *et al.*, 1974; [4] Henriques *et al.*, 2013; [5] Valério *et al.*, 2020. (**) The data in the table are unpublished. For previous data obtained by EDS in SEM, see Bottaini *et al.*, 2014.

Site	Type	As	Ni	Sb	Fe	Ag	Bi	Pb	Sn	Ref.
Lousal	arrowhead	5.0	n.d.	vest	0.03	0.01	n.d.	n.d.	n.d.	[1] p.699
Odemira	flat axe	0.50	n.d.	n.d.	n.d.	<0.01	n.d.	n.d.	n.d.	[1] p.704
Alcalar 4	arrowhead	1.90	n.d.	vest	n.d.	<0.01	n.d.	n.d.	n.d.	[2] p.1400
Aljezur	dagger	2.10	<0.01	n.d.	n.d.	0.035	0.001	n.d.	n.d.	[2] p.1462
	arrowhead	3.50	n.d.	n.d.	n.d.	0.013	n.d.	n.d.	n.d.	[2] p.1511
Anta do Assobiador	arrowhead	2.70	0.27	n.d.	n.d.	0.015	0.035	n.d.	n.d.	[2] p.1401
	arrowhead	5.60	0.36	n.d.	n.d.	<0.01	0.028	n.d.	0.01	[2] p.1402
Ameixal	dagger	2.20	n.d.	n.d.	n.d.	0.046	0.003	n.d.	n.d.	[2] p.2464
Ameixal	dagger	2.20	n.d.	n.d.	n.d.	0.046	0.003	n.d.	n.d.	[2] p. 2464
Mt. do Outeiro	awl	2.80	n.d.	0.06	n.d.	<0.01	0.004	n.d.	n.d.	[3] p.16562
Centirã	arrowhead	4.20±0.40	n.d.	n.d.	0.09±0.04	n.d.	n.d.	n.d.	n.d.	[4]
	arrowhead	3.40±0.10	n.d.	n.d.	0.07±0.03	n.d.	n.d.	n.d.	n.d.	[4]
Bela Vista 5	arrowhead	3.05	n.d.	n.d.	0.03	n.d.	n.d.	n.d.	n.d.	(**)
	awl	1.81	n.d.	n.d.	0.02	n.d.	n.d.	n.d.	n.d.	(**)
Anta do Malhão	arrowhead	2.17	n.d.	n.d.	<0.05	n.d.	n.d.	n.d.	n.d.	[5]
	dagger	3.40	n.d.	n.d.	<0.05	n.d.	n.d.	n.d.	n.d.	[5]

Despite the fact that the number of “Ferradeira” metal artefacts already analysed is small, the available data shows As values ranging from 0.5% to 5.6%, with an average value of about 2.9%. The evolution of metallurgy from Plane to Late Chalcolithic/Early Bronze Age in the South of Portugal towards a richer As production is clearly perceptible in Figure 6.

Among the metals ascribed to the Ferradeira Horizon, of particular interest is the occurrence of an awl and an arrowhead found at Bela Vista 5, a contemporary enclosure located not more than 3 km away from Herdade do Álamo. The analyses of the two artefacts were firstly obtained by EDS in SEM (Bottaini *et al.*, 2014). More recently, in order to make data comparable, analyses were repeated by XRF, using the same equipment and methodology as used to analyse the metals from Herdade do Álamo. Despite the fact that the new data are slightly different in relation to those values published in Bottaini *et al.*, 2014, they show an amount of As that is consistent with the values expected for “Ferradeira”, i.e. 3.05% As in the arrowhead, and 1.81% As in the awl.

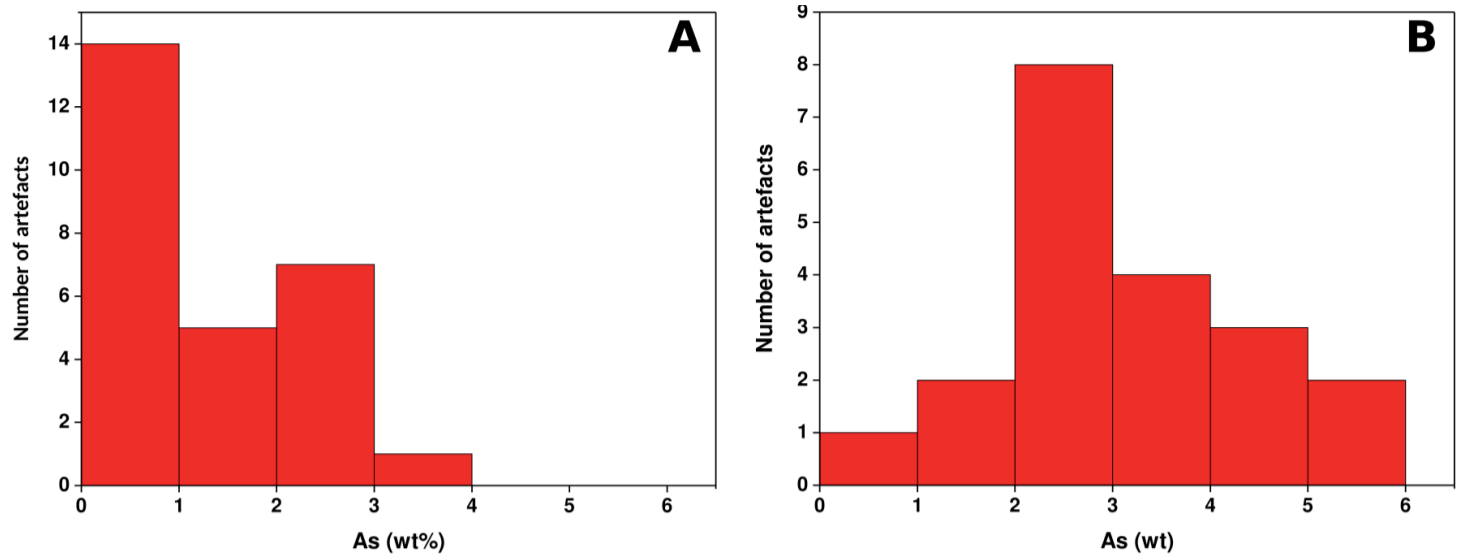


Figure 6. Comparison between the As content in the metals from Perdigões (A) (middle-third quarter of the 3rd millennium BC) (Bottaini *et al.*, 2018b; Valera *et al.*, 2020a) and from Ferradeira (B) (last quarter of the 3rd millennium BC).

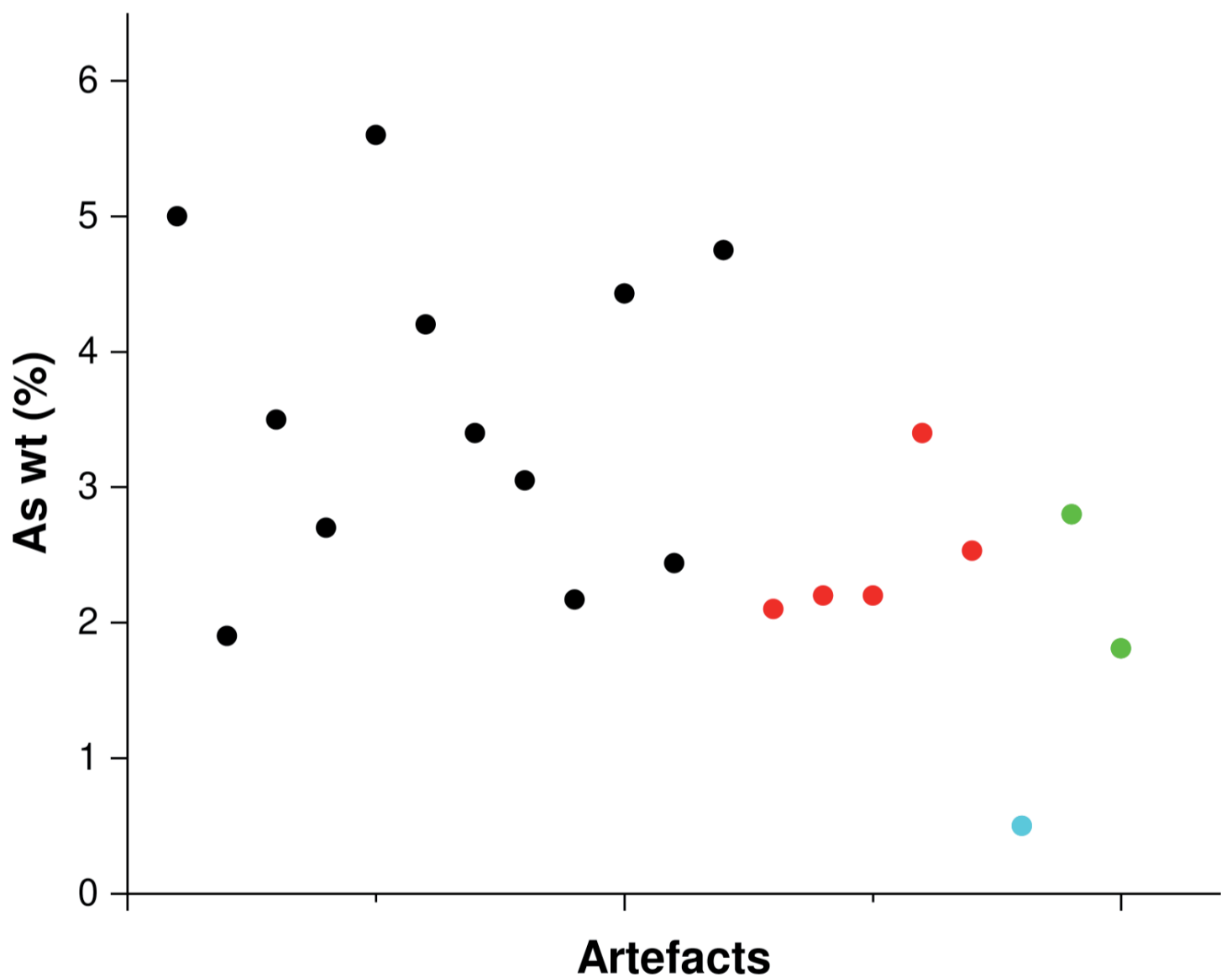


Figure 7. Plot showing the As content variability with respect to the typology of the artefacts (black dot: arrowheads; red dot: daggers; blue dot: flat axe; green dot: awls).

The reason why As content increases from Late Chalcolithic onwards is still to be fully understood. For example, Figure 7 shows that based on the data so far available for “Ferradeira”, arrowheads seem to contain averagely higher amounts of As when compared with other types of metal objects, namely with tools (e.g. flat axe and awls). As some

scholars have highlighted, the final colour of arsenical copper objects – determined by the quantity of As in the alloy – could have played a major role to produce a certain type of object instead of another (Pereira *et al.*, 2013; Radivojević *et al.*, 2018; Valério *et al.*, 2019). However, the correlation between As content and artefact typology within metals from this period requires more analyses to be proven, being considered, at the moment, a mere hypothesis to further investigate.

The funerary ritual at Herdade do Álamo integrates the tendency for the individuation of the burials with associated copper weapons that can be observed in the second half of the 3rd millennium BC, though this specific association of a dagger and three Palmela points is a rare occurrence in the Alentejo region. A similar occurrence is the published assemblage of the Paes Teles Foundation (Ervedal, Alto Alentejo, Portugal), that, nevertheless, has no guarantees of constituting a depositional unit (Mataloto, 2006). A similar situation occurs with the dagger and three Palmela points collected in the corridor of the *tholos* of Praia das Maças, in the neighbouring region of Estremadura, for which there is a date (Sousa, 1998) that is compatible with the one obtained for the individual of Herdade do Álamo. In fact, although the individual burials never cease to occur after collectivism took the lead in the funerary practices of Alentejo region (which seems to happen during the middle / third quarter of the 4th millennium BC – Valera, 2020b), it is during the late 3rd millennium BC that they start to become more frequent in the archaeological record of South Portugal. Associated to copper weapons, this re-emergence of the individual in the funerary discourse expresses, while inducing, the social and ontological changes that are in course.

However, and contrary to many Iberian and other European regions where this trend for individuation of burials comprises the inclusion of classic bell beaker decorated pottery in the funerary assemblages, South Portugal presents a different scenario. Although the last decades have documented a presence of decorated beaker pottery in Alentejo region with a number previously unsuspected, its association to funerary contexts is quite rare, with only four occurrences: the *tholos* of Cardim 6, the passage graves of Bencafede and Casas do Casal and the pit grave of Quinta do Castelo 1, and only the later can be undoubtedly considered an individual burial (Valera, Basílio 2017; Valera *et al.*, 2019b). In fact, the individual burials that can be ascribed to the second half of the 3rd millennium BC are mostly matching the “Ferradeira” pattern, that includes beaker shaped vessels, but always undecorated. Chronologically, although the number of available radiocarbon dates is still scarce (tab. 7, fig. 8) in face of the tens of sites ascribed to “Ferradeira”, they now clearly put these individual funerary contexts in the second half of the 3rd millennium BC, mainly in the last quarter, contemporary to decorated beaker pottery in the region (Mataloto *et al.*, 2013; Valera, 2014; Valera *et al.*, 2019b). Integrating other elements of the traditional beaker funerary assemblage, like the tongue daggers, the Palmela points, the awls or wrist guards, what “Ferradeira” seems to represent is a version of how the beaker phenomenon was expressed in this region, which deliberately excludes the beaker decoration (but not the beaker shapes) from the funerary ideological discourse. Yet, recent evidence from Perdigões ceremonial central area seems to indicate that the deposition of material assemblages typical of “Ferradeira” (undecorated beaker pots, troncoconic pots, tanged dagger) may have been done in non-funerary contexts and in a context where decorated bell beakers were also deposited (Valera, 2021). This would be a “crossing of the borders” for “Ferradeira” assemblages, that were considered to be mainly funerary expressions and impermeable to Bell Beaker contexts (or even as some sort of social resistance – Soares, 2017), indicating a more complex

scenario, and more difficult to typify in archaeological terms. In fact, if at South of the Beja region decorated beakers continue to be absent and “Ferradeira” assemblages are well known, in the central Alentejo they occur in parallel and sometimes integrated, as it seems to be the case of the central area of Perdigões.

Table 7. Radiocarbon dates for individualized “Ferradeira” burials in Alentejo region.

Site	Sample	Context	Lab. Ref.	Date BP	Cal 2σ	Bib. Ref.
Herdade do Álamo	Male	Pit Burial	Wk52161	3739±17	2204-2041	This study
Bela Vista 5	Female	Pit Burial	Beta-330091	3740±30	2277-2035	Valera, 2014
Monte da Velha 1	Male	Tholos reuse	Beta-194027	3900±40	2474-2209	Soares, 2008
Estremoz 7	Male	Dolmen reuse	Wk-17089	3758±36	2290-2037	Rocha, Duarte, 2009
Cardim 6	Child	Tholos reuse	SANU-53037	3795±26	2337-2139	Valera et al., 2019a

Note: To this set of dated contexts, we may add Centirã 2, a *tholos* tomb where two undecorated beakers, two wrist guards, a Palmela arrowhead and a copper awl were recorded (Henriques et al., 2013). However, due to disturbances and the collapse of the vaulted roof, it is not clear if these materials constituted a single deposit and were associated to specific individuals. For this reason, the available dates were not included in Table 6 and in the Bayesian model (fig. 8). But, with the exception of a date for a late reuse of the tomb (Late Bronze Age), they cover the exact same time span (third and fourth quarters of the 3rd millennium BC).

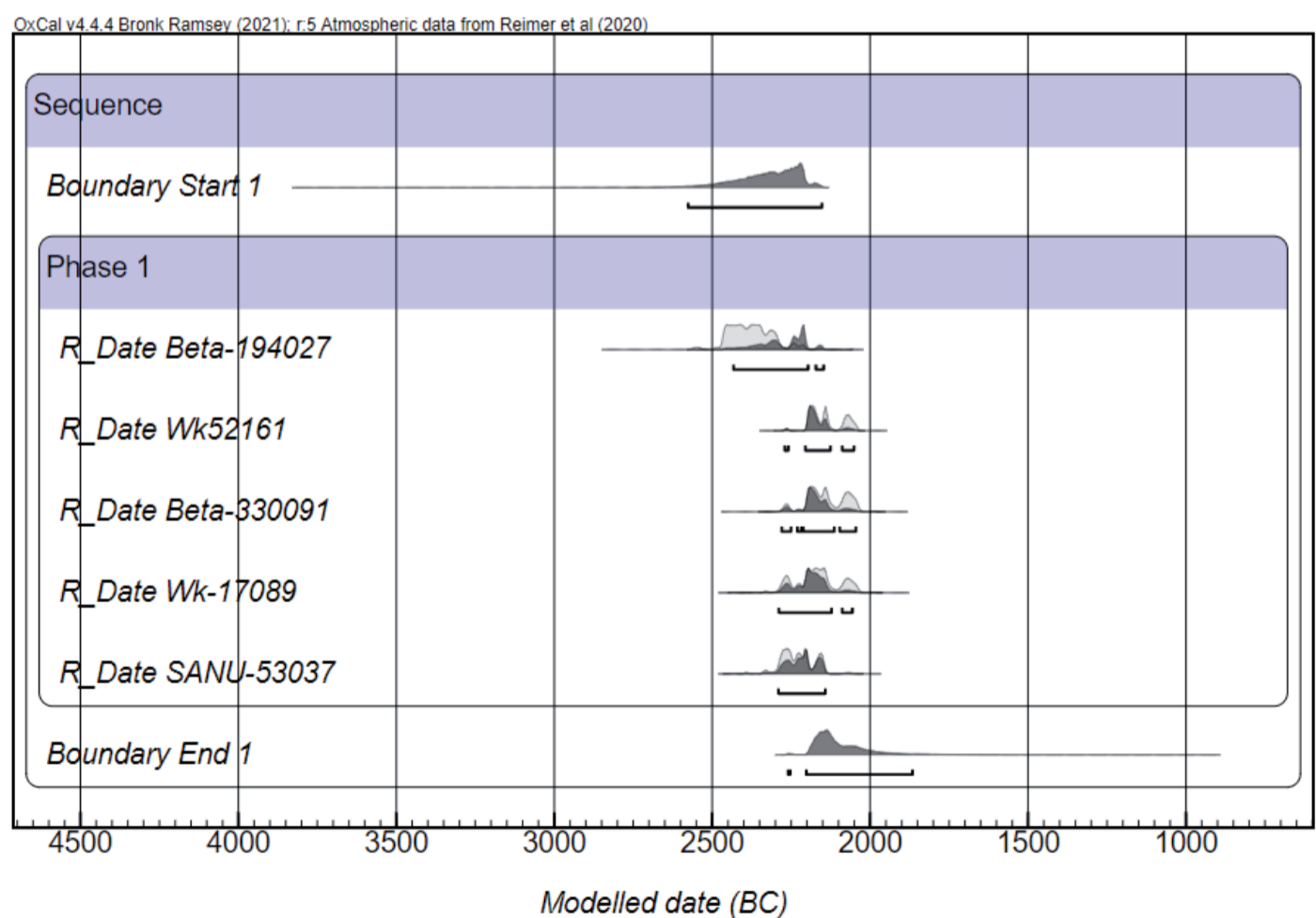


Figure 8. Bayesian model for the available radiocarbon dates of “Ferradeira” funerary contexts (dates were modelled as one phase).

Another contemporaneity is the one between these “Ferradeira” individual burials and collective burials, that also cover the second half of the 3rd millennium BC (for instance in tombs 2 and 4 of Perdigões, Cardim 6, Centirã 2 or Anta de Santa Margarida), showing that the process of individuation in funerary practices was not abrupt, but progressive and possibly contradictory, with the later collective contexts possibly representing processes of resistance in this period of social change. Nevertheless, it should be noted that the dated “Ferradeira” contexts show a concentration in the last quarter (fig. 8) and that only one date (the one for Monte da Velha 1) covers the third quarter, suggesting an increase of that tendency by the end of the millennium.

But this tension (or dialogue) between individuation and collectivism, and between the old and the new, can also be seen in the choices for the location of these individual burials.

Since the initial formulation of the “Ferradeira” concept, the diversity of the graves and their locations have been increasing. We now have cists (Ferradeira – Schubart, 1971), pits (Bela Vista 5, Herdade do Álamo – Valera, 2014), the reuse of megalithic monuments (Monte da Velha 1, Anta do Malhão and several monuments in Central Alentejo – Soares, 2008; Cardoso, Gradim, 2010; Mataloto, 2017) and the reuse of *tholoi* (Cardim 6, Centirã 2 – Valera *et al.*, 2019a; Henriques *et al.*, 2013). Its regional distribution has also expanded through the central Alentejo.

The reutilization of older monuments during the transition to the Bronze Age and during its plain development has been debated for some time now, not just regarding the Alentejo region (Mataloto 2006; 2010; 2017; Valera, 2020a), but also in the Andalucía (García Sanjuán, 2005; Aranda Jiménez, 2014; 2015; Aranda Jiménez, Lozano Medina 2014; Aranda Jiménez *et al.*, 2017; Lozano Medina, Aranda Jiménez 2017), with interpretation varying between processes of social resistance, social legitimation and the use of the past in the formulation of new ideologies and cosmologies, showing that similar situations in different regions may traduce diverse social roles (Valera, 2020a, pp.148-149). This reuse of the old by “Ferradeira” burials, though, is not restricted to previous funerary contexts, as Bela Vista 5 (Valera, 2014) and now Herdade do Álamo show, although in different ways. If in Herdade do Álamo the data indicates the reuse of the entrance of a previous ditched enclosure, in the neighbouring Bela Vista 5, just 3 km away, the building of the enclosure seems to be associated to the grave. Being Bela Vista 5, so far, the latest ditched enclosure built in Alentejo, dated from the last quarter of the 3rd millennium BC and integrating a “Ferradeira” burial contemporary of the Herdade do Álamo one, it represents the *reuse of the past by actually building it*.

However, the use or reuse of the past during this transition period of the late 3rd millennium BC in Alentejo, in the sense that older monuments or older abandoned habitats were reactivated through new funerary depositions, is not exclusive of the “Ferradeira” burials. It is also present, in contexts that cannot be assigned to “Ferradeira”, such as the megalithic monument of Santa Margarida (Gonçalves, 2003) and several others in the North of Alentejo (Oliveira, 1997), or the abandoned settlements of Monte Novo dos Albardeiros (Gonçalves, 1988-89) and Mercador (Valera, 2013), to mention only dated contexts, or in the singular reuse of the chamber of the Tomb 4 of Perdigões for the construction of a mound (Valera, 2020a).

The burial of Herdade do Álamo is, therefore, framed within the final phase of a period in which funeral practices assume a significant diversity, even within the contexts that can be ascribed to “Ferradeira”. Since the Schubart initial proposal for

the definition of “Ferradeira Horizon”, based in assemblages and materials present in around two tens of sites in the South of Portugal (Schubart, 1971), several other contexts have been ascribed to this concept, independently of its historical culturalism background. Being mostly funerary contexts that show or suggest individual burials, they occur in cist type tombs and in reused passage graves, but more rarely in pits. In this context, the Herdade do Álamo and Bela Vista 5 burials represent a higher diversification of the funerary architectonic solutions associated to this kind of votive assemblages. As to other aspects of the ritual, information is still scarce, namely regarding the human remains. In many situations they are absent or anthropological studies were not done, so general patterns cannot be deduced now, for instance, regarding age or sex. Even so, if “Ferradeira” appears to be a new funerary formalism under construction regarding individuality and votive assemblages, the available data show that the position of the body may vary (strait, as in Ferradeira graves, and in foetal position, as in Bela Vista 5 or Herdade do Álamo, following a Neolithic tradition that would be maintained during the Bronze Age) and that both man and woman are present and with weapons associated (as again Bela Vista 5 and Herdade do Álamo document). On the other hand, the permanence of collectivist practices and a multiplicity of contextual situations using “the old” can be observed. A situation that seems to reflect the progressive de-structuring of the old Neolithic social, cosmogonic and ontological frameworks and a transitional context, where what is fading away and what will become dominant coexist in the funerary world. In this context, the individuality of the “Ferradeira” contexts represents what would become the dominance in the second millennium BC, expressing, in the funerary rituals, the social changes occurred in the late 3rd millennium BC.

Finally, the issue of mobility. In face of the present available data it is hard to value the isotopic results obtained for the male of Herdade do Álamo and the female of Bela Vista 5, both adults, buried 3 km away and providing radiocarbon dates practically identical. They are the only individuals analysed for ⁸⁷Sr/⁸⁶Sr for the late 3rd millennium BC in South Portugal. If the female of Bela Vista 5 seems to be local, the results for the male of Herdade do Álamo shows mobility in youth, indicating a possible foreign origin to the local area. A movement, though, that might not have represented a grate displacement, since the values that fell out of the local range are, for instance, within the local range of Perdigões enclosure (Valera *et al.*, 2020b), just 50km northwest. However, only with much more individuals analysed for this period and region these results may be properly valued. The approach to regional human mobility in the Late Prehistory of the South of Portugal has just recently started, with a first study of 69 individuals of Perdigões and some from local megalithic monuments (Valera *et al.*, 2020b). A high degree of short and medium range mobility was detected for Perdigões during the Chalcolithic (second and third quarter of the 3rd millennium BC), results that must be valued having in consideration the nature of the site, interpreted manly as ceremonial aggregation centre, integrated in a large-scale interaction network, and with a significant capacity of attraction of people.

Theoretically, it is expectable that, by the end of the 3rd millennium BC, the disruption of the Chalcolithic settlement networks in South Portugal and its substitution by more disperse and transitory sites, difficult to identify in the archaeological record, corresponded to an increase in the patterns of regional and local mobility. But that assumption remains to be tested.

CONCLUSIONS

The study of the Herdade do Álamo grave joins a set of analytic studies that provide new relevant data for the approach to the social and cultural settings of the late 3rd millennium BC in South Portugal.

This burial integrates a “version” of the funerary practices of the period, formalized by a renewed concept of “Ferradeira”, destitute from its original historical culturalist theoretical framework, and restricted to designate specific assemblages, mainly (but not exclusively) of funerary nature. These practices are characterized by individual burials, associated to a polythetic assemblage comprising copper tools (daggers, arrow heads, awls), wrist guards, and undecorated pottery (some with beaker shapes). The assemblage present in the Herdade do Álamo burial was composed exclusively by weapons (a dagger and three Palmela points). Their chemical analysis is consistent with the known data for metallurgy from the second half of the 3rd and the beginning of the 2nd millennium BC, confirming that this is a period that can be considered a transition step between purer copper-based metallurgy, typical of the earlier Chalcolithic contexts, and a more accentuated arsenical copper production from the Middle Bronze Age.

Its placement at the entrance of an earlier Chalcolithic ditched enclosure follows a pattern of reuse of past meaningful places and monuments, that seems to be an important aspect of the funerary practices of this period of accelerated social change, with contradictory tendencies that characterize the complexity of the process. It expresses a new ideological discourse associated to the individuation and to the specificities of the votive assemblages, where the intentional exclusion of the beaker decoration must be intended as a statement and not just as a simple cultural particularism.

Founding and acknowledgements

To NIA-ERA Arqueologia for research support. To the Interdisciplinary Center for Archaeology and Evolution of Human Behaviour (ICArEHB) for financing the radiocarbon dating. To Rui Mataloto, for his comments on a preliminary version of the paper. Archaeometallurgical analyses were funded by the Portuguese Foundation for Science and Technology (FCT) under the project UIDP/04449/2020(HERCULES Laboratory). To the reviewers for their comments to improve the paper.

BIBLIOGRAPHIC REFERENCES

- Almeida, N. and Valera, a.C. (2021) “Animal consumption and social change: the vertebrates from Ditch 7 in the context of a 2diachronic approach to the faunal remains at Perdigões enclosure (3400-2000 BC)”, *Archaeofauna. International Journal of Archaeozoology*, 30. <https://doi.org/10.15366/archaeofauna2021.30.005>
- Aranda Jiménez, G. (2014) “La memoria como forma de resistencia cultural. Continuidad y reutilización de espacios funerarios colectivos en época argárica”, In: E. García Alfonso (ed.), *Movilidad, contacto y cambio. II Congreso de Prehistoria de Andalucía*, Sevilla, pp. 255-77.
- Aranda Jiménez, G. (2015) “Resistencia e involución social en las comunidades de la Edad del Bronce del sureste de la península ibérica”, *Trabajos de Prehistoria*, 72(1), pp. 126-144. <https://doi.org/10.3989/tp.2015.12147>.

- Aranda Jiménez, G. and Lozano Medina, A. (2014) “The chronology of megalithic funerary practices: a Bayesian approach to Grave 11 at El Barranquete necropolis (Almería, Spain)”, *Journal of Archaeological Science*, 50, pp. 369-382. <https://doi.org/10.1016/j.jas.2014.08.005>.
- Aranda Jiménez, G., Lozano Medina, A., Díaz-Zorita Bonilla, M., Sanchez Romero, M. and Escudero Carrillo, J. (2018) “Cultural continuity and social resistance; the chronology of megalithic funerary practices in Southern Iberia”, *European Journal of Archaeology*, 21(2), pp. 192-216. <https://doi.org/10.1017/eea.2017.42>.
- Bittel, K., Junghans, S., Otto, H., Sangmeister, E. and Schröder, M. (1968) *Studien zu den Anfängen der metallurgie*. Band 2, Teil 3, Berlin: Gebr. Mann Verlag.
- Blanco-González, B., Lillios, K., López-Sáez, J.A. and Drake, B.L. (2018) “Cultural, Demographic and Environmental Dynamics of the Copper and Early Bronze Age in Iberia (3300–1500 BC): Towards an Interregional Multiproxy Comparison at the Time of the 4.2 ky BP Event”, *Journal of World Prehistory*. <https://doi.org/10.1007/s10963-018-9113-3>.
- Bottaini, C., Brunetti, A., Bordalo, R., Valera, A. and Schiavon, N. (2018a) “Non-destructive characterization of archeological Cu-based artifacts from the early metallurgy of southern Portugal”, *Archaeological and Anthropological Science*, 10 (8), pp. 1903-1912. <https://doi.org/10.1007/s12520-017-0501-x>.
- Bottaini, C., Brunetti, A., Montero-Ruiz, I., Valera, A., Candeias, A. and Mirão, J. (2018b) “Use of Monte Carlo Simulation as a Tool for the Nondestructive Energy Dispersive X-ray Fluorescence (ED-XRF) Spectroscopy Analysis of Archaeological Copper-Based Artifacts from the Chalcolithic Site of Perdigões, Southern Portugal”, *Applied Spectroscopy*, 72 (1), pp. 17-27. <https://doi.org/10.1177/0003702817721934>.
- Bottaini, C., Manhita, A., Dias, C., Miguel, C., Beltrame, M., Mirão, J., Candeias, A., Oliveira, M.-J. and Carvalho, G. (2014) “Uma abordagem multi-disciplinar na caracterização arqueométrica de uma ponta de seta e de um estilete procedentes do sítio de Bela Vista 5 (Mombeja, Beja), In: Valera, a.C. (ed.), *Bela Vista 5. Um recinto do final do 3º milénio a.n.e. (Mombeja, Beja)*. Lisboa: Núcleo de Investigação Arqueológica – NIA, pp. 47-57.
- Cardoso, J.L. and Gradim, A. (2010) “A anta do Malhão (Alcoutim) e o “Horizonte de Ferradeira”, *XELB*, 10 pp. 1-22.
- Ferembach, D., Schwidetzky, I. and Stloukal, M. (1980) “Recommendations for age and sex diagnoses of skeletons”, *Journal of Human Evolution*, 9(7), pp. 517-549. [https://doi.org/10.1016/0047-2484\(80\)90061-5](https://doi.org/10.1016/0047-2484(80)90061-5).
- García Sanjuán, L. (2005) “Las piedras de la memoria. La permanencia del megalitismo en el Suroeste de la península ibérica durante el II y I milenios ane”, *Trabajos de Prehistoria*, 62(1), pp. 85-109. <https://doi.org/10.3989/tp.2005.v62.i1.57>.
- Gonçalves, V.S. (1988/89) “A ocupação pré-histórica do Monte Novo dos Albardeiros (Reguengos de Monsaraz)”, *Portugália*, NS, Vol.IX-X, pp. 49-61.
- Gonçalves, V.S. (1989) *Megalitismo e metalurgia no Alto Algarve Oriental: uma aproximação integrada*, Lisboa: UNIARQ/INIC
- Gonçalves, V.S. (2003) *STAM-3, a Anta 3 da Herdade de Santa Margarida (Reguengos de Monsaraz)*, *Trabalhos de Arqueologia*, 32. Lisboa: IPA.
- Henriques, F.J.R., Soares, A.M.M., António, T.F.A., Curate, F., Valério, P. and Rosa, S.P. (2013) “O Tholos Centirã 2 (Brinches, Serpa) – construtores e utilizadores; práticas funerárias e cronologias”, *VI Encuentro de Arqueología del Suroeste Peninsular*. Ayto. de Villafranca de los Barros, pp. 320-355.
- Hoppe, K.A., Koch, P.L. and Furutani, T.T., (2003) “Assessing the preservation of biogenic strontium in fossil bones and tooth enamel”, *International Journal of Osteoarchaeology*, 13, pp. 20–28. <https://doi.org/10.1002/oa.663>.
- Junghans, S., Sangmeister, E. and Schröder, M. (1960) *Metallanalysen kupferzeitlicher und früh-bronzezeitlicher Bodenfunde aus Europa*, Berlin: Verlag Gebr. Mann.
- Junghans, S.; Sangmeister, E. and Schröder, M. (1974) *Kupfer und Bronze in der frühen Metallzeit Europas*, Katalog der Analysen Nr. 10041-22000, Berlin: Gebr. Mann Verlag.

- Lee-Thorp, J.A. (2008) “On isotopes and old bones”, *Archaeometry*, 50(6), pp. 925-950. <https://doi.org/10.1111/j.1475-4754.2008.00441.x>
- Lillios, K., Blanco-González, B., Drake, B.L. and López-Sàez, J.A. (2016) “Mid-late Holocene climate, demography, and cultural dynamics in Iberia: A multi-proxy approach”, *Quaternary Science Reviews*, 135, pp. 138-153. <https://doi.org/10.1016/j.quascirev.2016.01.011>.
- Lovejoy, C.O., Meindl, R.S., Pryzbeck, T.R. and Mensforth, R.P. (1985) “Chronological metamorphosis of the auricular surface of the ilium: A new method for the determination of skeletal age at death”, *American Journal of Physical Anthropology*, 68, pp. 15-28. <https://doi.org/10.1002/ajpa.1330680103>.
- Lozano Medina, A. and Aranda Jiménez, G. (2017) “La temporalidad de las sepulturas megalíticas tipo tholos del sur de la península ibérica”, *Spal*, 26, pp. 17-31. <https://doi.org/10.12795/spal.2017i26.01>.
- Mataloto, R. (2006) “Entre Ferradeira e Montelavar: um conjunto artefactual da Fundação Paes Teles (Ervedal, Avis)”, *Revista Portuguesa de Arqueologia*, 9(2), pp. 83-108.
- Mataloto, R. (2010) “Paisagem, memória e identidade: tumulações megalíticas no pós-megalitismo alto-alentejano”, *Revista Portuguesa de Arqueologia*, 10(1), pp. 23-140.
- Mataloto, R. (2017) “We are ancients, as ancient as the Sun: campaniforme, antas e gestos funerários nos finais do III milénio AC no Alentejo central”, In: V. Gonçalves (ed.), *Sinos e Taças. Junto ao oceano e mais longe. Aspectos da presença campaniforme na península ibérica*, Estudos e Memórias, 10, Lisboa: UNIARQ, pp. 58-81.
- Mataloto, R., Martins, J.M.M. and Soares, A.M. (2013) “Cronologia absoluta para o Bronze do Sudoeste. Periodização, base de dados, tratamento estatístico”, *Estudos Arqueológicos de Oeiras*, 20, Oeiras: CMO, pp. 303-338.
- Oliveira, Jorge de (1997) *Monumentos Megalíticos da Bacia Hidrográfica do Rio Sever*, 1^o Vol. – edição bi-lingue, patrocinada pelas Câmaras de Marvão, C. de Vide, Nisa, V. de Alcântara, Herrera de Alcântara e Cedillo e pela Delegação Regional do Ministério da Cultura, Ed. Colibri, Lisboa.
- Parreira, R. (1995) “Aspectos da Idade do Bronze no Alentejo Interior. In: S. Jorge (ed.), *A Idade do Bronze em Portugal – discursos de poder*, Lisboa: IPM/Museu Nacional de Arqueologia, pp. 131-134.
- Pereira, F., Silva, R.J.C., Soares, A.M.M. and Araújo, M.F. (2013) “The role of arsenic in Chalcolithic copper artefacts – insights from Vila Nova de São Pedro (Portugal)”, *Journal of Archaeological Science*, 40, pp. 2045-2056. <https://doi.org/10.1016/j.jas.2012.12.015>
- Pereiro, T., Almeida, N. and Valera, a.C. (2021) “O recinto de fossos calcolítico da Herdade do Álamo (São Brissos, Beja)”, *Apontamentos de Arqueologia e Património*, 15, pp. 28-35.
- Reimer, P., Austin, W., Bard, E., Bayliss, A., Blackwell, P., Bronk Ramsey, C., Butzin, M., Cheng, H., Edwards, R., Friedrich, M., Grootes, P., Guilderson, T., Hajdas, I., Heaton, T., Hogg, A., Hughen, K., Kromer, B., Manning, S., Muscheler, R., Palmer, J., Pearson, C., van der Plicht, J., Reimer, R., Richards, D., Scott, E., Southon, J., Turney, C., Wacker, L., Adolphi, F., Büntgen, U., Capano, M., Fahrni, S., Fogtmann-Schulz, A., Friedrich, R., Köhler, P., Kudsk, S., Miyake, F., Olsen, J., Reinig, F., Sakamoto, M., Sookdeo, A., and Talamo, S. (2020) “The IntCal20 Northern Hemisphere radiocarbon age calibration curve (0–55 cal kBP)”, *Radiocarbon*, 62(4), pp. 725-757. <https://doi.org/10.1017/RDC.2020.41>
- Rocha, L., Duarte, C. (2009) “Megalitismo funerário no Alentejo Central: os dados antropológicos das escavações de Manuel Heleno”, In: M. Polo Cerdá, E. García-Prósper (Eds.), *Investigaciones histórico-médicas sobre salud y enfermedad en el pasado, Actas del IX Congreso Nacional de Paleopatología*, Morella, Castelló: Grupo Paleolab & Sociedad Española de Paleopatología, pp. 763-781.
- Saragoça, P., Maurer, A.-M., Šoberl, L., Lopes, M.C., Alfenim, R., Leandro, I., Umbelino, C., Fernandes, T. Valente, M.J., Ribeiro, S., Santos, J.F., Janeiro, A.I. and Barrocas, C.D. (2016) “Stable isotope and multi-analytical investigation of Monte da Cegonha: A Late Antiquity population in southern Portugal”, *Journal of Archaeological Science: Reports*, 9, pp. 728–742. <http://dx.doi.org/10.1016/j.jasrep.2016.07.010>

- Schubart, H. (1971) “O Horizonte de Ferradeira. Sepulturas do Eneolítico final no Sudoeste da península ibérica”, *Revista de Guimarães*, 81, pp. 189-215.
- Silva, A.M. (1995) “Sex assessment using calcaneus and talus”, *Antropologia Portuguesa*, 13, pp. 85-97.
- Soares, A.M. (2008) “O monumento megalítico Monte da Velha 1 (Vila Verde de Ficalho, Serpa)”, *Revista Portuguesa de Arqueologia*, 11:1, Lisboa: IPA, pp. 33-51.
- Soares, A.M.M., Araújo, M.F., Alves, L. and Ferraz, M.T. (1996) “Vestígios metalúrgicos em contextos do Calcolítico e da Idade do Bronze no Sul de Portugal”, *Miscellanea em Homenagem ao Professor Bairrão Oleiro*, Lisboa: Ed. Colibri, pp. 553-579.
- Soares, J. (2017) “Para uma leitura sociopolítica do Campaniforme do Guadiana. Longas viagens com curta estada no Porto das Carretas”, In: V. Gonçalves (ed.), *Sinos e Taças. Junto ao oceano e mais longe. Aspectos da presença campaniforme na península ibérica*, Estudos e Memórias, 10, Lisboa: UNIARQ, pp. 38-57.
- Soares, J. and Silva, C.T. (1995) “O Alentejo litoral no contexto da Idade do Bronze do sudoeste peninsular, In: S. Jorge (ed.), *A Idade do Bronze em Portugal. Discursos de Poder*. Lisboa: IPM/Museu Nacional de Arqueologia, pp. 136-139.
- Valera, a.C. (Coord.) (2013) *As comunidades agropastoris na margem esquerda do Guadiana. 2ª metade do IV aos inícios do II milénio AC*, Memórias d’Odiária, 6, 2ª Série, Évora: EDIA/DRCALLEN.
- Valera, a.C. (Coord.) (2014) *Bela Vista 5. Um recinto do Final do 3º milénio a.n.e. (Mombeja, Beja)*, Era Monográfica 2, Lisboa: Nia-Era.
- Valera, a.C. (2015) “Social change in the late 3rd millennium BC in Portugal: The twilight of enclosures”, In: H. Meller/R. Risch/R. Jung/H. W. Arz (eds.), *2200 BC – A climatic breakdown as a cause for the collapse of the old world?*, 7th Archaeological Conference of Central Germany October 23-26, 2013 in Halle (Saale), Tagungen des Landesmuseums für Vorgeschichte Halle 13(1-2), Halle [Saale], pp. 409-427.
- Valera, a.C. (Ed.) (2020a) *O Sepulcro 4 dos Perdigões. Um Tholos da segunda metade do 3º milénio AC*, Perdigões Monográfica 2, Lisboa: NIA-ERA.
- Valera, a.C. (2020b) “Absolute chronology of Vale de Barrancas 1 necropolis and the transition to collective burials in the neolithic of South Portugal”, In: a.C. Valera, T. Nunes (eds.), *Vale de Barrancas 1. A necrópole de hipogeus neolítica (Mombeja, Beja)*, Era Monográfica 4, Lisboa: Nia-Era, pp. 31-43.
- Valera, a.C. (2021) “Uma possível deposição de tipo “Ferradeira” na área central dos Perdigões?”, *Notas Curtas*, www.perdigoes.org, consulted at 16/08/2021.
- Valera, a.C. and Basílio, a.C. (2017) “Approaching bell beakers at Perdigões enclosures (South Portugal): site, local and regional scales”, In: V.S. Gonçalves (ed.), *Bells and bowls near the ocean and far away. About beakers in the Iberian Peninsula*, Estudos e Memórias, 10, Lisboa: UNIARQ, pp. 82-97.
- Valera, A., Bottaini, C. and Basílio, a.C. (2020a) “A deposição de uma alabarda em contexto campaniforme na área central do recinto dos Perdigões (Reguengos de Monsaraz)”, *Apontamentos de Arqueologia e Património*, 14, pp. 41-49.
- Valera, A.C., Figueiredo, M., Lourenço, M., Evangelista, L.S., Basílio, a.C. and Wood, R. (2019a) *O Tholos de Cardim 6, Porto Torrão, Ferreira do Alentejo (Beja)*, Era Arqueologia 3, Lisboa: NIA-ERA.
- Valera, A.C., Mataloto, R. and Basílio, a.C. (2019b) “The South Portugal perspective. Beaker sites or sites with beakers?”, In: Alex M. Gibson (ed.), *Bell Beaker Settlement of Europe. The Bell Beaker phenomenon from a domestic perspective*, Prehistoric Society Research Paper nº9, Oxford: Oxbow, pp. 1-23.
- Valera, A., Žalaitė, I., Maurer, A.F., Grimes, V., Silva, A.M., Ribeiro, S., Santos, J.F. and Barrocas Dias, C. (2020b) “Addressing human mobility in Iberian large prehistoric ditched enclosures: the case of Perdigões (South Portugal)”, *Journal of Archaeological Sciences Reports*, 30, p.102264. <https://doi.org/10.1016/j.jasrep.2020.102264>
- Valério, P., Silva, R.J.C., Soares, A.M.M., Araújo, M.F. and Cardoso, J.L. (2020) “Compositional and microstructural outlook of grave goods from Anta do Malhão and Soalheironas (Portugal):

- The diachronic use of arsenical copper in southwestern Iberian Peninsula”, *Journal of Archaeological Science: Reports*, 33, p. 102527. <https://doi.org/10.1016/j.jasrep.2020.102527>.
- Valério, P., Soares, A.M.M. and Araújo, M.F. (2016) “An overview of Chalcolithic copper metallurgy from Southern Portugal”, *Menga*, 7, pp. 31-50.
- Valério, P., Soares, J., Araújo, M.F., Alves, L.C. and Silva, C.T. (2019) “The composition of the São Brás copper hoard in relation to the Bell Beaker metallurgy in the South-Western Iberian Peninsula”, *Archaeometry*, 61(2), pp. 392-405. <https://doi.org/10.1111/arcm.12422>.

Authors' contributions

- António Carlos Valera (PI): conceived and designed the analysis, interpreted the data and wrote the paper.
- Tiago do Pereiro & Sofia Nogueira: collected the data.
- Lucy Shaw Evangelista, Anne-France Maurer, Cristina Barrocas Dias & Carlo Bottaini: performed the analysis and interpreted the data.
- Sara Ribeiro & José Francisco Santos: performed the analysis.