

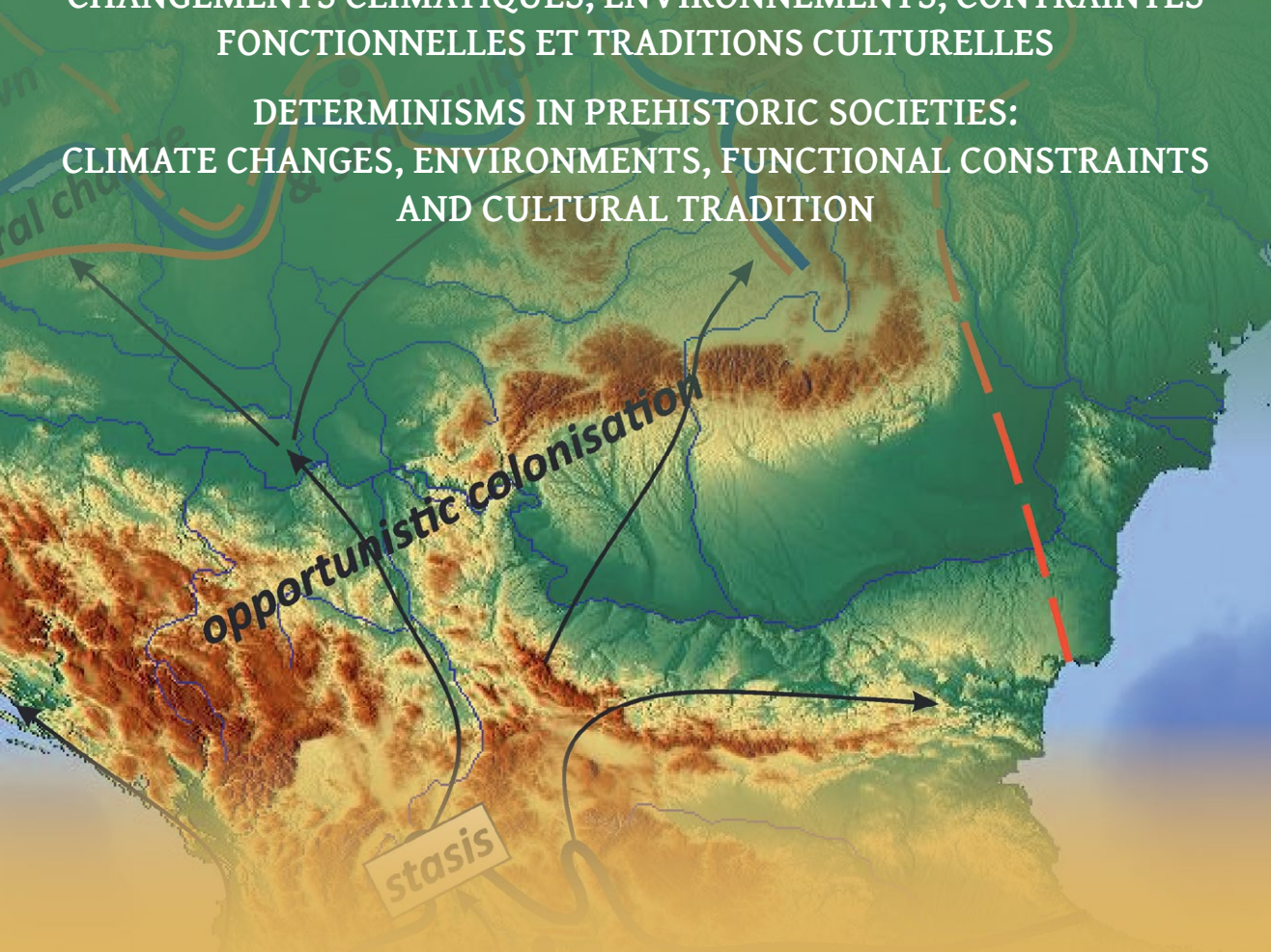
LES SOCIÉTÉS HUMAINES FACE AUX CHANGEMENTS CLIMATIQUES

HUMAN SOCIETIES FACING CLIMATE CHANGE

Volume 3

DÉTERMINISMES DANS LES SOCIÉTÉS PRÉHISTORIQUES :
CHANGEMENTS CLIMATIQUES, ENVIRONNEMENTS, CONTRAINTES
FONCTIONNELLES ET TRADITIONS CULTURELLES

DETERMINISMS IN PREHISTORIC SOCIETIES:
CLIMATE CHANGES, ENVIRONNEMENTS, FUNCTIONAL CONSTRAINTS
AND CULTURAL TRADITION



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COMPTES-RENDUS 2023 DE L'ACADÉMIE INTERNATIONALE DE
PRÉHISTOIRE ET DE PROTOHISTOIRE
2023 REPORTS OF THE INTERNATIONAL ACADEMY OF PREHISTORY AND
PROTOHISTORY

Textes collectés et révisés par François Djindjian

ARCHAEOPRESS ARCHAEOLOGY



ARCHAEOPRESS PUBLISHING LTD
13-14 Market Square
Bicester
Oxfordshire OX26 6AD
United Kingdom
www.archaeopress.com

ISBN 978-1-80327-891-9
ISBN 978-1-80327-892-6 (e-Pdf)

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Leceia, Moita da Ladra and Outeiro Redondo: Similarities and differences between three walled sites of Portuguese Extremadura

João Luís Cardoso

Abstract

The three major walled sites where the author conducted archaeological excavations - Leceia (Oeiras), between 1983 and 2002; Moita da Ladra (Vila Franca de Xira), between 2003 and 2006; and Outeiro Redondo (Sesimbra), between 2005 and 2016 - yielded a body of information of unquestionable relevance to our knowledge of architectures, stratigraphies and absolute datings. This data became essential for understanding the economy and social organisation of the populations that occupied this vast region, with its own cultural significance: the so-called 'Chalcolithic of Extremadura'. In addition to this remarkable wealth of information, the exhumed archaeological remains have been thoroughly studied and published in detail.

This paper will describe the main architectural features, both defensive and residential, of each site. Moreover, the archaeological assemblages will be enhanced based on the identification of artefacts that, given their typology, could provide objective information about the most relevant economic activities carried out by the sites' inhabitants. Such conclusions, combined with the sites' features, including their geographical location and size, led, for the first time, to conclusions on their functional nature and how they fitted into the demographic and economic fabric of the densely populated Lisbon/Setúbal peninsulas during the 3rd millennium BC.

Keywords: Leceia, Moita da Ladra, Outeiro Redondo; architectures; assemblages; functionalities; 'Chalcolithic of Extremadura'; Portugal.

Résumé

Les trois principaux sites fortifiés où l'auteur a mené des fouilles archéologiques - Leceia (Oeiras), entre 1983 et 2002 ; Moita da Ladra (Vila Franca de Xira), entre 2003 et 2006 ; et Outeiro Redondo (Sesimbra), entre 2005 et 2016 - ont fourni un ensemble d'informations d'une pertinence incontestable pour notre connaissance des architectures, des stratigraphies et des datations absolues. Ces données sont devenues essentielles pour comprendre l'économie et l'organisation sociale des populations qui occupaient cette vaste région, avec sa propre signification culturelle : ce que l'on appelle le « chalcolithique d'Estrémadure ». En plus de cette remarquable richesse d'informations, les vestiges archéologiques exhumés ont été étudiés en profondeur et publiés en détail. Cet article décrira les principales caractéristiques architecturales, à la fois défensives et résidentielles, de chaque site. De plus, les assemblages archéologiques seront enrichis sur la base de l'identification d'artefacts qui, compte tenu de leur typologie, pourraient fournir des informations objectives sur les activités économiques les plus pertinentes exercées par les habitants des sites. Ces conclusions, combinées aux

caractéristiques des sites, y compris leur situation géographique et leur taille, ont conduit, pour la première fois, à des conclusions sur leur nature fonctionnelle et leur intégration dans le tissu démographique et économique des péninsules densément peuplées de Lisbonne/Setúbal au cours du 3e millénaire av. J.-C.

Mots-clés : Leceia, Moita da Ladra, Outeiro Redondo ; Architectures ; assemblages ; Fonctionnalités ; « Chalcolithique d'Étrémadure » ; Portugal.

1 – Methodological aspects

Even though the areas excavated in each of the walled settlements addressed herein were very large, coherent patterns were observed in all of them in terms of their overall stratigraphic sequences. This was confirmed by the vertical distribution of the respective archaeological materials, which allowed us to devise a general model for the evolution of their occupation, from the earliest times until their final abandonment. The rigour and validity of this model, which was successively confirmed in the course of the excavations conducted at the sites, are based on the quality and representativeness of three distinct aspects, i.e.:

1. the execution of stratigraphic sections at carefully selected locations. Indeed, the sequences observed at locations featuring the greatest amount of information enabled establishing correlations between the various selected locations. This led to the definition of a standard stratigraphy corresponding to the area once occupied by each of the settlements;
2. the constructional sequences identified at each site, whose internal phasing was based on the vertical overlap or lateral juxtaposition (incorrectly referred to as 'horizontal stratigraphy') observed; it was deemed possible and even necessary to articulate these two aspects: the stratigraphic sequence and the constructional sequence, since both reflect, in their own ways, a single reality - the vicissitudes that characterised the human occupation of each of the sites, which are necessarily different;
3. the artefactual content of each of the previously identified layers, with particular emphasis on artefacts which, due to their abundance and rapid typological evolution, support the establishment of sequences with chronological and cultural implications for the Chalcolithic of Extremadura.

We must stress that the formation of all stratigraphic sequences recorded at the three sites was determined by different factors: some of an anthropogenic nature, which in some cases dominated the formation of the deposits themselves, with a purely local expression; and others of a post-depositional nature, determined by natural accumulation processes, spanning vast areas or even the entire archaeological site. Conversely, the observation of stratigraphic sequences pertaining to confined spaces, such

as the interior of a dwelling or a bastion, where the anthropic component was decisive, revealed particular sedimentation processes, which cannot be directly correlated with each other.

It is also important to bear in mind some considerations regarding requirements and limitations when it comes to relating stratigraphic sequences to their cultural dimensions. To do so, it is essential to take into account the artefactual content of each of the stratigraphic layers concerned. However, this is not a 'closed' concept, made up of a certain number of mutually exclusive, significant artefacts. The evolution of material culture has rarely taken the form of sudden, absolute and definitive substitutions: interpretation should be guided by the concept of statistical predominance, and it is true that the Chalcolithic of Extremadura has long been recognised as an ideal field for the application of such principles. In the specific case of Leceia, it was possible to relate each of the three main archaeological layers of the stratigraphic sequence, identified according to the aforementioned criteria, with certain ceramic productions, with well-defined shapes and decorations. The latter characterise each layer from the point of view of material culture, resulting in three well-differentiated chrono-cultural phases.

This exercise is neither theoretical nor preconceived, as it stems from the observed facts. The results obtained do not, of course, rule out the phenomena of real coexistence between different artefactual productions, configuring the continuum that has characterised, in the majority of cases, the succession of material cultures observed in a given geographical space.

As a matter of fact, the actual chrono-cultural correlation of the overall sequence was fully demonstrated by the series of radiocarbon dates obtained (Cardoso, 2000) for each of the layers. Thus, the sequence was easily and immediately connected to similar occupations identified in other Chalcolithic settlements of Extremadura, particularly Zambujal (Kunst 1966).

These were the methodological principles - and the limitations that were pointed out in due course - that were always present in the course of the vast and extensive excavations conducted. This supported the attribution of unequivocal and reliable chronological and cultural significance to the stratigraphic sequences thus defined. Actually, any and all the individually observed facts - stratigraphic and constructional sequences - were ultimately the result of a single cause: the presence of the human communities that, over a more or less extended period of time, successively occupied the three sites concerned. And, of course, the activities they carried out on a daily basis, which left traces represented by the remains of the artefacts recovered therein. It was therefore important to characterise the defensive architectures, on the one hand, and, on the other, to seek their connection with the domestic activities carried out in each case, expressed by the types of artefacts and their evolution over time at each of the sites concerned, also bearing in mind their original dimension. This is how we sought to

understand their importance and functionality as population centres, and how they would have fit into the regional demographic framework of which they were an integral part. This objective was only made possible by the fact that representative information was obtained in all of the three studied cases, which was only possible by conducting ambitious fieldwork programmes that began in 1983 and continued uninterrupted until 2016. These works are deemed essential for understanding the genesis of complex Chalcolithic societies in western Iberia.

2 – Terminological aspects

It is important to clarify the archaeological terminology used. Thus, while the term Early Chalcolithic has been established for a long time, corresponding, in Extremadura, to residential occupations characterised, in terms of the ceramographic record, by the dominant presence of fluted decorations, applied mainly to good quality cylindrical vessels (the well-known ‘copos canelados’ and ‘taças caneladas’), the term Full/Final Chalcolithic requires clarification. Indeed, as far as the phasing of the Chalcolithic of Extremadura is concerned, it is still common to consider that the Full Chalcolithic is characterised by the presence of the well-known ‘acacia leaf’ and ‘crucifera’ decorations, corresponding to folicles impressed onto the soft paste using a matrix, especially on large globular vessels, while the term Final Chalcolithic is reserved for the time span corresponding to the appearance of Bell Beaker ceramics. However, as clearly demonstrated in the region concerned, i.e. Lower Extremadura, the emergence of Bell Beaker productions coincided with the ‘acacia leaf / crucifera’ productions (Cardoso 2014 a; Cardoso 2017), which explains, in some cases, the total absence of Bell Beaker productions, despite the fact that the occupation dates of the sites where this occurs are fully compatible with the presence of such productions. This evidence is best documented at Outeiro Redondo, where Bell Beaker productions are vestigial and concentrated in the westernmost sector of the settlement. Yet, the chronology of its occupation coincided with the peak of these productions and the site is located in the area with the highest geographical Bell Beaker concentration in the Iberian Peninsula.

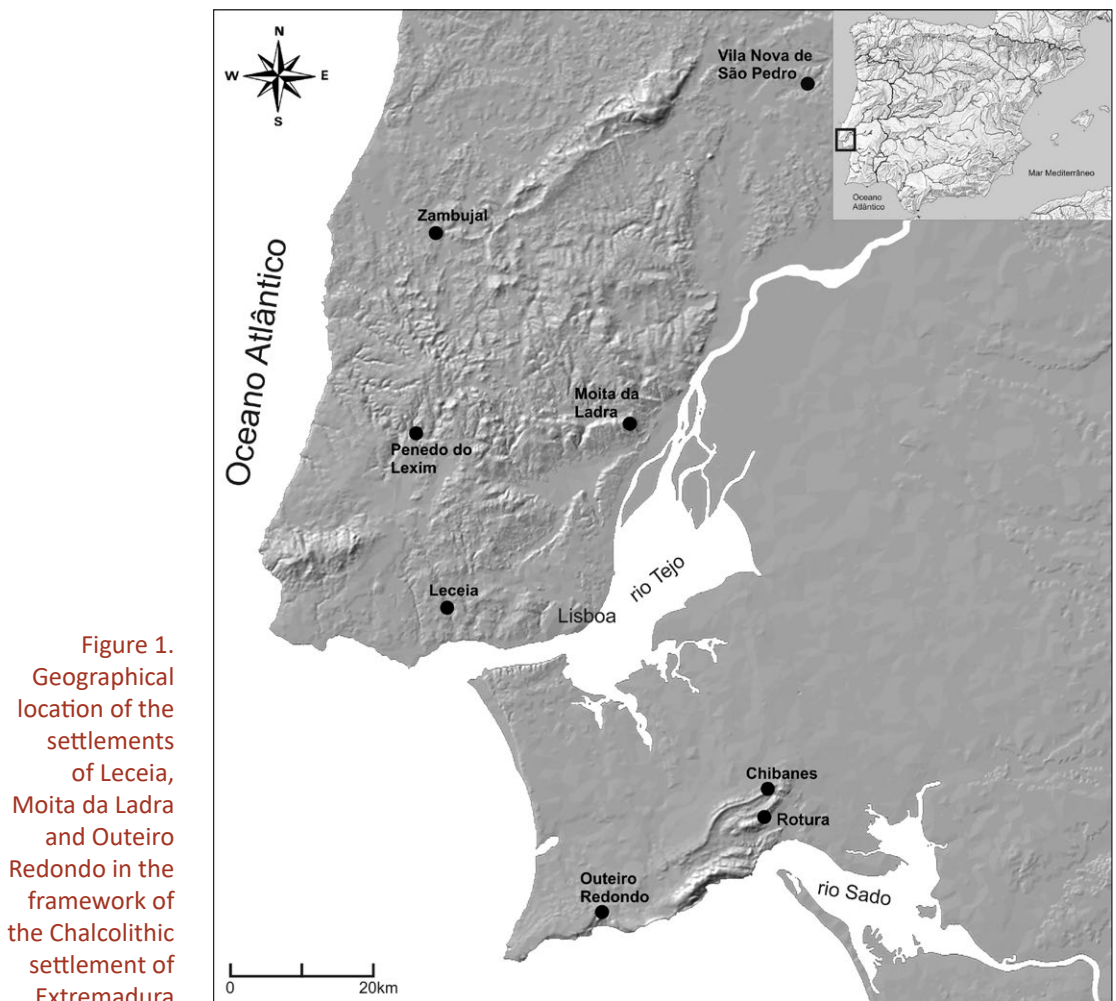
In other words, the presence/absence of Bell Beaker productions is not a discriminating factor in the phasing between occupations attributable to the Full Chalcolithic and the Final Chalcolithic of Extremadura. Therefore, by adopting a coherent criterion, based on absolute datings, all occupations postdating ca. 2500 BC recorded in Extremadura, whether or not they feature a Bell Beaker presence, should be associated with the Full/Final Chalcolithic, and not the Full Chalcolithic or the Final Chalcolithic, according to the absence/presence of Bell Beaker productions criterion, which until now has been common practice.

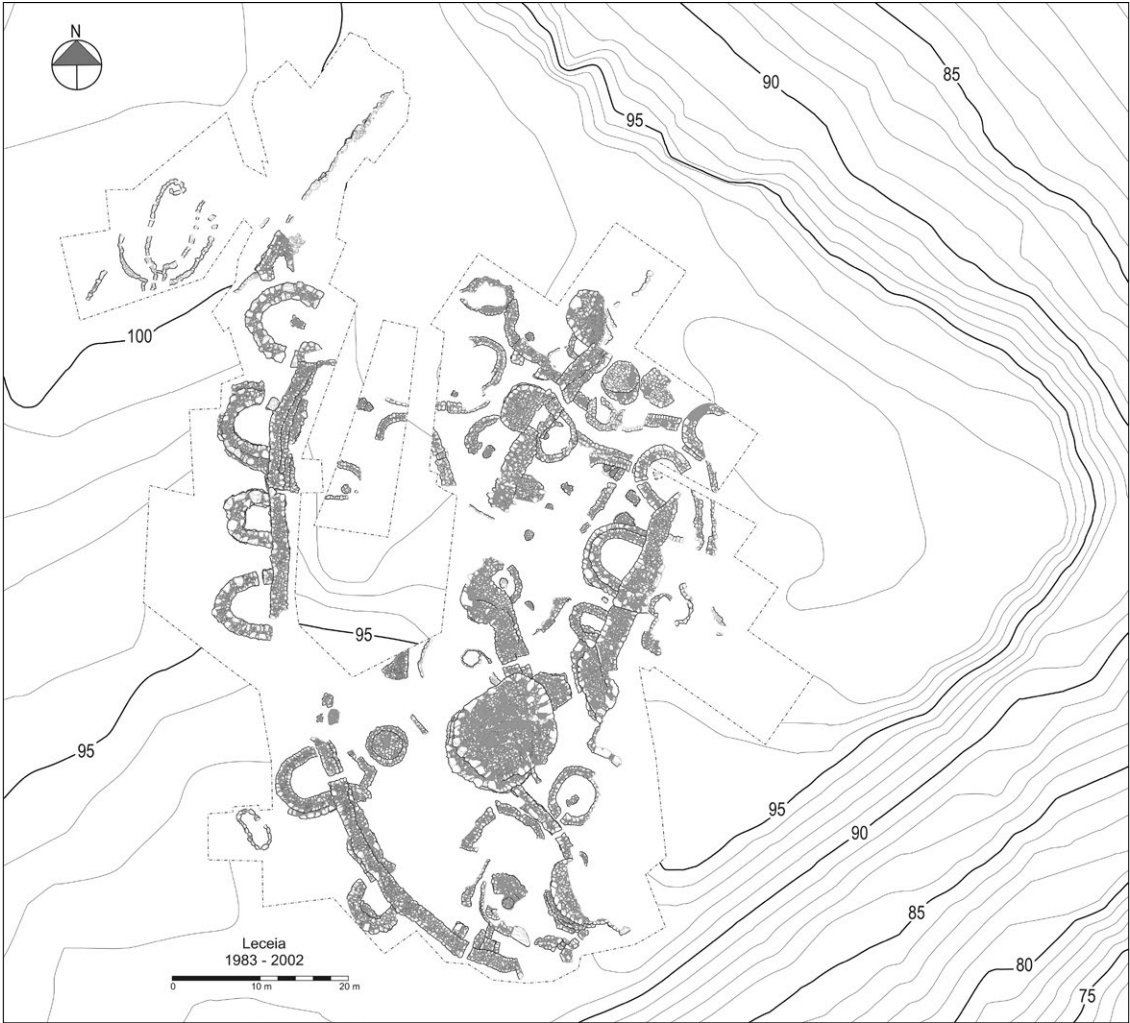
3 – The sites: architectural and stratigraphic aspects; recovered materials

The geographical location of the three sites studied below is shown in Figure 1, along with the most important comparable sites of Extremadura.

3.1 – Leceia

At Leceia, a site excavated over the course of twenty annual excavation field seasons between 1983 and 2002, four cultural phases and five construction phases were identified, beginning in the Late Neolithic and ending in the Full/Final Chalcolithic; thus, the final stage coincides with the outbreak of the Bell Beaker ‘phenomenon’. This is directly linked to the recorded stratigraphic sequence, according to the aforementioned methodological criteria (Cardoso 2010).





The first cultural phase corresponds to the establishment of a vast open settlement on the rocky platform of Leceia (Cretaceous reef limestone benches). Wherever the excavation reached bedrock, there was a reddish-brown layer - Layer 4 - directly on top of it, with abundant Late Neolithic materials, particularly ceramics, including the characteristic vessels with indented rims, carinated ceramics and, exceptionally, ceramics decorated with plastic (raised cordons, symbolic lugs), incised or impressed motifs, which can be considered reminiscent of the so-called Early Evolved Neolithic of Extremadura.

Only one construction phase was identified in association with this cultural phase. It is represented by small segments of rectilinear walls, corresponding to residential structures, which had already been razed to the ground when the first defensive line was built at the beginning of the Early Chalcolithic period. However, most of the materials were found in

Figure 2.
Ground plan
of the fortified
Chalcolithic
settlement of
Leceia (acc. J. L.
Cardoso).

secondary position, filling the most depressed areas of the bedrock, where they naturally accumulated.

At the very beginning of the Early Chalcolithic period, around 2800 BC and after an abandonment that may not have exceeded a few dozen years, a complex defensive structure was built, organised in three curving lines and reinforced by bastions on the outside. This defensive structure enclosed a sub-triangular rocky spur overlooking the Barcarena stream from the top of its right bank (Figure 2).

From a constructional point of view, this cultural phase, which is well defined both in stratigraphic and archaeographic terms, is related to three construction phases: the second, third and fourth phases respectively. The second phase, which can be dated back to the beginning of the Early Chalcolithic period, features the construction of a complex defensive system consisting of three walled lines, curvilinear and sub-parallel, defended and reinforced on the outside by mostly hollow, semicircular bastions. This construction programme, which was probably completed within a short time span, reflects a prior conception of how the available space was to be occupied, according to a plan that was rigorously implemented. The resulting structure is formally comparable to other fortified sites in the Portuguese territory, starting with the two most remarkable and closest parallels, also belonging to the district of Lisbon, the prehistoric settlements of Zambujal (Torres Vedras) and Vila Nova de S. Pedro (Azambuja), whose evident 'family resemblance' denotes comparable characteristics, extendable to the whole of the rich territory of Portuguese Extremadura.

One can clearly see the defensive concerns of the builders, as they closed off the platform by means of the three walled lines, erected on the most vulnerable side, taking advantage of a natural escarpment on the other two sides (south and east). This escarpment is actually a spur overlooking the valley of the Barcarena stream, generally reaching a height of around 10 m and delimiting the inhabited platform.

Such concerns are also evidenced by the successive reinforcements, which have also been carried out in accordance with broad programmes involving the entire defensive system, which has been subject to periodic and internally coherent refurbishments.

Several architectural units of a communal nature can be traced back to the final, Early Chalcolithic construction phase, e.g. the foundations of three threshing floors. It is worth mentioning that all of them are located within the defended area, a fact that illustrates the climate of social instability that prevailed at the time. Another communal structure is a slabbed path, partly overlapping the aforementioned round hut and thus postdating it: it actually belongs to construction Phase 4. Besides being a unique case in Portuguese prehistory, this path has the particularity of being fitted with several steps to overcome the slope on the southern side of the settlement, connecting two entrances, located on the first and second defensive lines respectively.

Some structures, due to their size, were also in common use by the settlement's inhabitants. This is the case of a vast slabbed area between the first defensive line and the large massive tower that connects the second and third defensive lines (see Figure 1). This could be an open area, but it is also possible that it was a covered space, taking advantage of the support provided by the two aforementioned structures. It could serve multiple purposes, such as bringing people and livestock together in more conflictive situations.

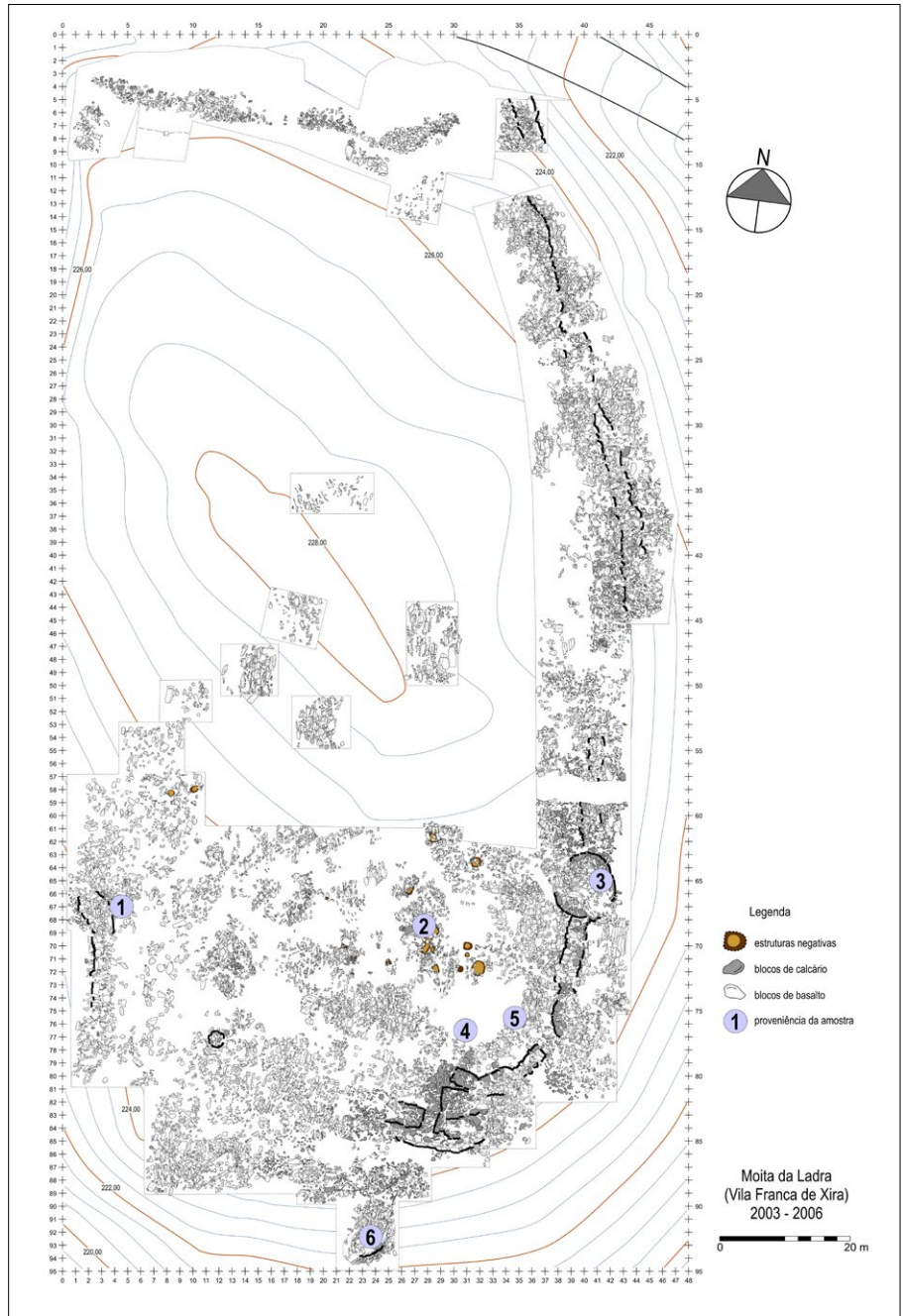
The fifth and final construction phase corresponds to the Full/Final Chalcolithic, during which there was a contraction of the occupied space, with a consequent decrease in the number of inhabitants, while the defensive structures reached a stage of almost total degradation. Contrary to what one might believe, the disinvestment in the construction or maintenance of walls and bastions was not coupled with a decline in the quality or quantity of domestic production, quite the opposite in fact: it actually seems to be during this phase that the population based in Leceia reached its greatest economic growth, as evidenced by the rich and varied coeval utensils recovered. On the other hand, the presence of large domestic spaces suggests that the construction investment was transferred to these community buildings, given their size. A number of them have been identified between the second and third walled lines. They feature ellipsoidal floor plans, with a long axis exceeding 10 m and entrances marked by thresholds on both the external and internal sides. Besides the former, two Bell Beaker huts were identified in the extramural area. These huts have demonstrated the antiquity of the emergence of the Bell Beaker phenomenon in the Tagus estuary region (Cardoso 2019 a), supporting its attribution to a population group distinct from the one that inhabited the intramural space and with which it did not initially mix, although both groups did establish close relations, as evidenced by the fact that these two huts are adjacent to the fortified site (Cardoso 2014 a).

The last construction phase also includes a communal structure with a subcircular and closed layout, defined by small upright slabs. It may have originally been a silo, but it was abandoned and reused as a rubbish dump: this is indicated by its infilling, which includes abundant faunal and archaeological remains, including Full Chalcolithic ceramics, along with some human remains. Its dating proves that this small enclosure was reused as a funerary deposit during the Bronze Age, towards the middle of the 2nd millennium BC (Kunst, Cardoso, Waterman 2014).

3.2 - Moita da Ladra

The fortified Chalcolithic settlement of Moita da Ladra was located on top of a basalt chimney of Late Cretaceous age, belonging to the Lisbon-Mafra Volcanic Complex. The works conducted here enabled the extension of the area of archaeological interest to be determined, resulting in the execution of an extended excavation, covering an area of approximately 1000 m². (Cardoso

Figure 3.
Ground plan
of the fortified
Chalcolithic
settlement
of Moita da
Ladra (acc. J. L.
Cardoso)



2014 b). The existence of a defensive system surrounding the highest part of the hill was confirmed; this consisted of a simple wall with a ca. 80 m-long major axis, roughly orientated north-south, and a ca. 44 m-long minor axis, which was unearthed along its entire preserved length (Figure 3). This corresponds to a single occupation, related to the formation of a single archaeological layer with a maximum thickness of no more than 0.60 m, resting directly on

the bedrock, whose chronology is essentially centred on the last quarter of the 3rd millennium BC (Cardoso, Soares, Martins 2013).

Within the enclosure thus delimited, several negative structures of varying contours, depths and dimensions were identified, located next to each other.

The wall is continuous and is intersected halfway along its extent, on the east side, by a massive subcircular tower. Just like the adjacent wall, this tower is externally clad with limestone blocks of considerable size and has an internal filling made up of smaller angular basalt blocks. From this point onwards, the wall curves to the west and is interposed by another massive tower, in poorer condition than the previous one, which makes it difficult to accurately define its floor plan (see Figure 3).

On the south-facing section of the wall, there is an entrance with a clearly defined corridor delimited by two parallel, limestone block side walls and a slabbed floor. It is worth mentioning that in other places where limestone is entirely absent, such as here, similar defensive systems, also featuring bastions, were built using basalt rocks, e.g. the Chalcolithic fortification of Penedo do Lexim, Mafra, similarly built on top of a volcanic chimney, according to the results of the excavations conducted by A. C. Sousa (Sousa 2021). This proves that the use of limestone elements was not essential to ensure the stability of defensive structures. Thus, there must be other reasons for the systematic use of limestone elements, which involved considerable efforts, given the several tonnes of limestone blocks transported to the site. Indeed, the nearest outcrops only occur at the foot of the elevation, on the west side, where they are exposed in the existing natural escarpment. The most prominent and exposed sector of the enclosure, facing south and clearly visible to anyone travelling along the Tagus or in the adjacent lowlands, is the one with the highest concentration of limestone blocks. This can only be justified by the deliberate intention of the enclosure's inhabitants to make it immediately and easily recognisable as an unmissable landmark in the landscape. Moreover, the existing relationship with the Tagus estuary is underlined by the very position and orientation of the aforementioned entrance, facing the estuary, despite being located on the side of the steepest and most unfavourable slope for accessing it.

Even though these structures are reduced to their foundations, the whiteness of the limestone blocks that compose them, contrasting strongly with the black colour of the surrounding basalt rocks, made them easily identifiable from afar, at the top of the hill. Just imagine what the walled enclosure would have looked like at the time, with the towers and its entrance dominating the landscape from the top of the hill, particularly on the south side - the floodplain and the Tagus estuary. This was the kind of situation in which the defensive functionality of the walled enclosure was combined with another aspect, associated with its importance as a place of reference, due to the deliberate visibility assigned to it, both for the people living along the Tagus, directly related to it, and for the outsiders who visited the region.

3.3 – *Outeiro Redondo*

The fortified Chalcolithic settlement of Outeiro Redondo is located on an isolated rise of hard white, Upper Jurassic limestone ('Calcários de Azóia'), reaching an elevation of 210 m. Along with the Sesimbra Castle hill and the Moinho da Forca hill, these three rises form a line of limestone reliefs with a north-east to south-west orientation. The north-west facing slopes are abrupt, forming a vertical escarpment over 20 m high, while on the other sides they are invariably very steep.

For those arriving from the sea, the settlement would be a visible landmark, emphasised by the fortified enclosure, which is particularly well-developed on the south side, sitting on top of the hill. Besides the geomorphological conditions provided by the location, the establishment of the settlement was determined by the existence of fresh water at the base of the elevation, where there is a catchment dating back to the 19th century intended for public supply.

The different excavation field seasons conducted between 2005 and 2016 revealed the existence of a defensive system consisting of a single walled line, surrounding the highest part of the elevation and associated with a series of defensive and residential structures (Figure 4).

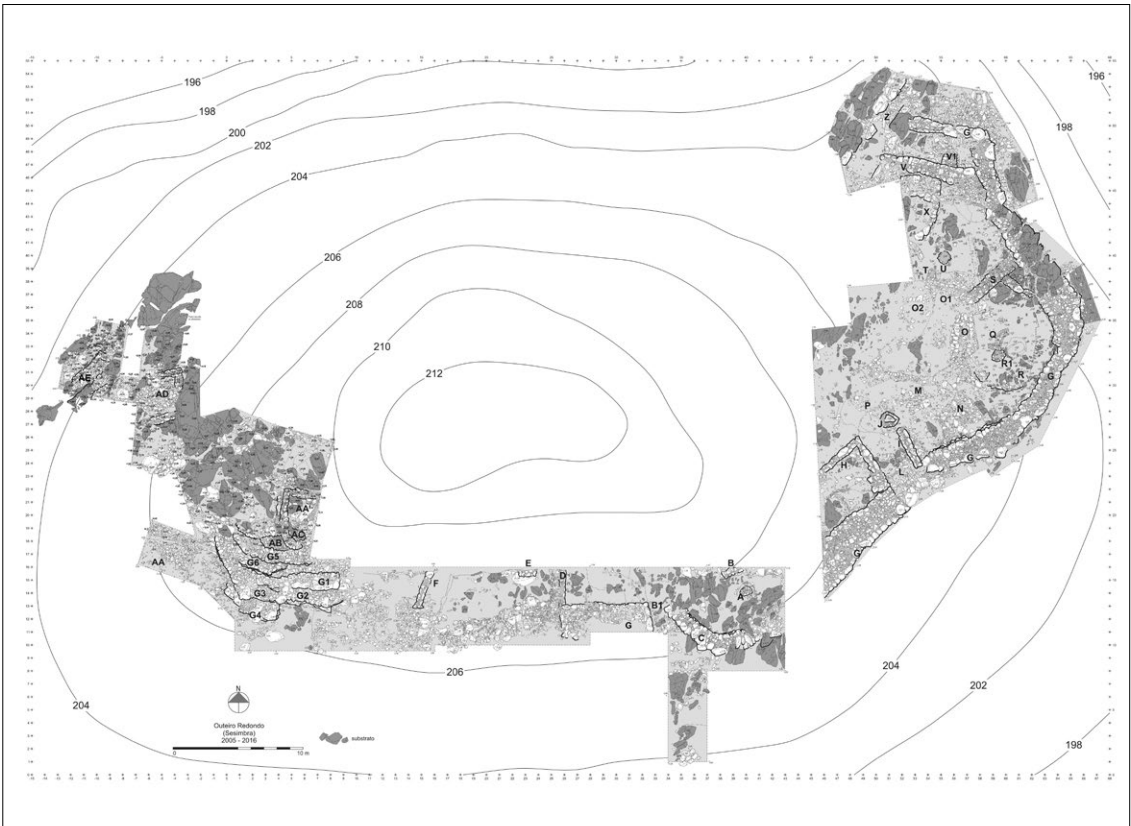
The existence of an important stratigraphic sequence was demonstrated, covering a first period of occupation between 2610-2460 cal BC at 2 σ , corresponding to the Early Chalcolithic, and between 2440-2110 cal BC at 2 σ , corresponding to the Full/Final Chalcolithic, according to the statistical treatment of the results of absolute radiocarbon datings (Cardoso, Soares, Martins 2010/2011).

On the front of the south-facing elevation, a curvilinear bastion stands out, in an advanced position in relation to Wall G, constituting a barbican-type structure.

The north-eastern sector of the settlement features a large entrance, facing south-west, delimited by two more modern rectilinear walls, whose characteristics appear to be more symbolic than functional, given their size, disproportionate in strictly defensive terms. This sector also features a wall, which flanked the main wall on the inner side, creating an empty and closed space between the two, which could have served as a barbican. This situation is comparable to the one observed in the fortified Chalcolithic settlement of Zambujal (Torres Vedras).

The first construction phase, by the end of the Early Chalcolithic period, prior to the construction of the defensive enclosure, includes several domestic structures. We would highlight a circular hut, built on the bedrock, which featured a structured hearth inside, located in its north-eastern section.

The second construction phase, contemporaneous with the construction of the wall surrounding the entire highest part of the hill, belonging to the Full/Final Chalcolithic period, is also represented by several residential



structures. Two orthogonal huts identified in the north-eastern sector belong to the later stage of this last construction phase. These are the oldest architectures of this type recorded so far in western Iberia, although they may have antecedents in the Final Neolithic of Leceia. Lastly, two negative structures embedded in the structure of the wall itself are worth mentioning and may correspond to silos.

4 – Comparative essay between some groups of artefacts represented in the three settlements addressed herein

In order to objectively assess the importance of the domestic activities carried out in each of the three settlements addressed herein, during the course of their existence, we used the quantification of different sets of selected artefacts - both lithic, ceramic and metallic -, deemed to be the most representative of the various domestic activities carried out at the sites. The aim was to characterise the main features of the domestic economy at the three sites in question, with a view to identifying similarities and differences in terms of their functionality and complementarity.

Figure 4.
Ground plan
of the fortified
Chalcolithic
settlement of
Outeiro Redondo
(acc. J. L.
Cardoso)

4.1 - Lithic industry

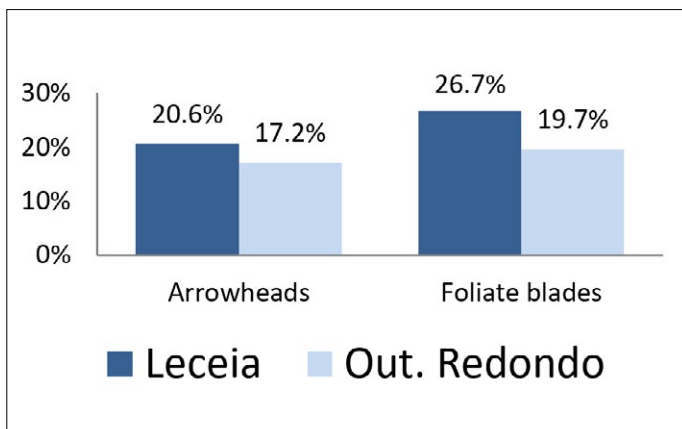
Two groups of utensils of a complementary nature were chosen from the assemblage of lithic industries, one related to the wider exploitation of territories - which required their effective domination -, consisting of arrowheads, related to hunting activities and, concurrently, to warfare, associated with the need for territorial domination. The second group of utensils, corresponding to foliate blades, is mainly associated with cereal farming (Cardoso, Gibaja 2019; Clemente, Mazzucco, Soares 2014), whose abundance implied stable and permanent communities within a given territory. It was therefore assumed that the weighing of the relative presence at each site of these two groups of utensils would reflect the nature and characteristics of the very community that settled there.

4.1.1 - Early Chalcolithic arrowheads and foliate blades

At Leceia, foliate blades were the most common type of tool during the Early Chalcolithic, accounting for 26.7% of the total lithic industry, followed by the arrowhead group (20,6%).

The existence of a large number of preforms and blanks reveals that these items were knapped on site; however, the possibility that some blanks were imported and only finished at the settlement cannot be ruled out, as evidenced by the reddish flint specimens, probably originating from the Rio Maior region. Indeed, while the previous layer - Layer 4 - was dominated by items made from local greyish flint, there is an increase in exogenous flint in Layer 3. From a metric point of view, comparing the two layers reveals a tendency towards an increase in the length and width of the items. Foliate blades with bifacial knapping/covering retouch and an ellipsoidal contour predominate in both cultural stages.

Figure 5. Percentages of Early Chalcolithic arrowheads and foliate blades observed at both sites.



At Outeiro Redondo, all the arrowheads recovered from Layer 3 are made of predominantly greyish flint. A total of 21 items were recovered, representing 17.2% of all the knapped stone industry (Figure 5), making it the third most abundant typological group in the settlement (Cardoso 2019 b, Table 7).

The foliate blades, more representative than the arrowheads in this layer, reaching 19.7%, are represented by 24 items.

4.1.2 - Full / Final Chalcolithic arrowheads and foliate blades

At Leceia, the most numerous group in Layer 2 corresponds to the foliate blades (31.6%), followed by the arrowheads (18.5%), based on the absolute number of items shown in Table 1. This layer yielded the greatest variety of flint tones chosen for the manufacture of foliate blades, with a high percentage of arguably exogenous flint (pinkish and reddish tones), which is consistent with the importance of raw material imports, as either blanks or preforms. Layer 2 also yielded the largest number of items with traces of rejuvenation of damaged cutting edges, indicating a greater concern with the reuse of this type of utensil, perhaps due to the intensification of cereal production, which required the availability of an increasing number of functional items. The diversity of foliate blade types remains the same as in the previous layer but there is an increase in the total amount of items.

Concerning arrowheads, there is an increase in the number of items made on local, greyish or brownish flint, as well as the presence of four jasperoid schist items. The mitriform pieces, dominant in Layer 3, are clearly outnumbered by concave base and straight edge pieces in Layer 2 (Cardoso – Martins 2013).

Moita da Ladra yielded 142 arrowheads, corresponding to 47.2% of all lithic utensils. This is the dominant lithic utensil; 134 of them are complete (94.4%). The dominant raw materials are flint, reaching 133 items, and jasperoid schist, with nine complete items.

Albeit less frequent, foliate blades, both complete and fragmented, were identified, reaching 11.6% of the total assemblage of lithic utensils. Four pieces correspond to blanks (11.4%), 25 are preforms (71.4%) and only six pieces appear to be in a final use stage (17,1%).

At Outeiro Redondo, among the total lithic industry recovered in Layer 2, arrowheads are the most abundant typological group - 110 items, representing 24.4%; we would highlight the presence of 11 items made on jasperoid schist (Cardoso 2019 b).

At all three sites, the presence of items on jasperoid schist, despite their different absolute importance - a situation that can be explained by the different geographical location of each of them in relation to the Alentejo territory - illustrates the exchange relations kept with this region, from which amphibolites and particularly copper (Ossa/Morena Zone) originated. These arrowheads arguably arrived at the three settlements already manufactured, judging from the lack of jasper knapping remains, unlike flint items: the presence of preforms indicates that the latter were, at least partly, locally knapped (Cardoso 2019 b).

Foliated blades account for 18% of the total knapped stone industry in Layer 2 (Figure 6). Out of 81 items, five are blanks, 41 are preforms and/or end fragments (representing 50.6% of the set) and 35 are complete. The diversity of foliate blade types increases in relation to the Early Chalcolithic (Layer 3).

Figure 6. Percentage of arrowheads and foliate blades within the entire Full/Final Chalcolithic industry at each of the indicated sites.

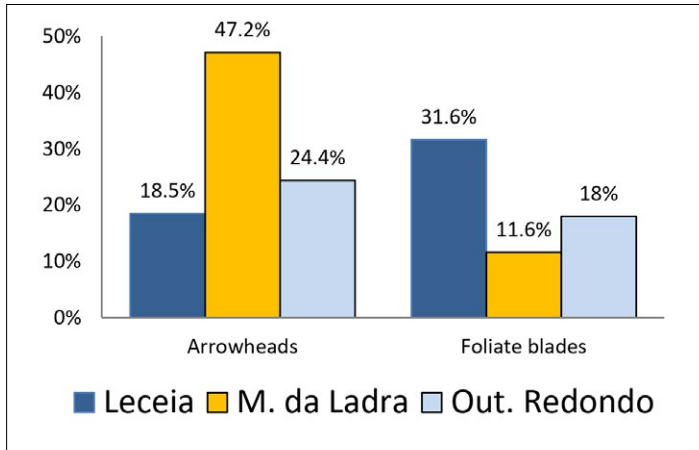


Figure 7. Evolution of the presence of arrowheads at the three archaeological sites concerned

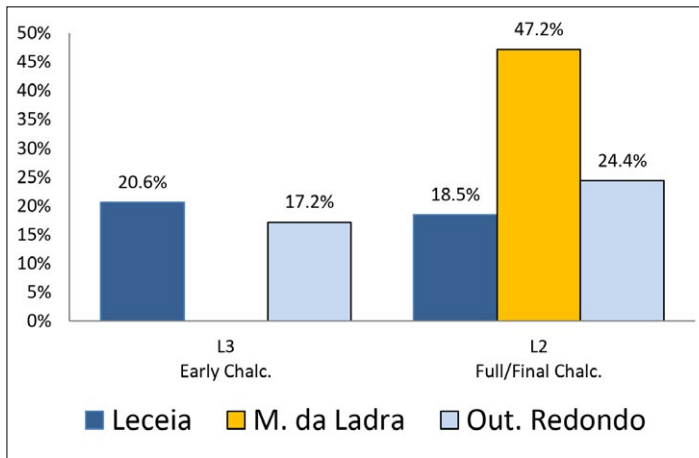
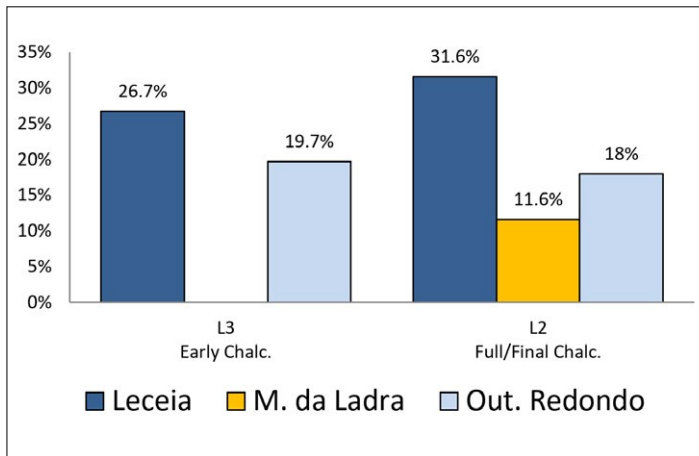


Figure 8. Evolution of the presence of foliate blades at the three archaeological sites concerned



Comparing the results obtained for arrowheads and foliate blades in the different layers recorded at the three settlements under analysis (Table 1; Figs. 5 to 8), with regard to the Early Chalcolithic occupations only recorded at Leceia and Outeiro Redondo, it seems possible to conclude that both

Site	Knapped stone	L3 Early Chalc.		L2 Ful/Final Chalc.		Total		References
		No.	%	No.	%	No.	%	
Leceia	Arrowheads	88	20,6%	93	18,5%	195	17%	Cardoso & Martins, 2013 (Table 2)
	Foliate blades	114	26,7%	159	31,6%	288	25,1%	Cardoso & Martins, 2013 (Table 2)
M. da Ladra	Arrowheads	-	-	142	47,2%	142	47,2%	Cardoso, 2014 (Table 1)
	Foliate blades	-	-	35	11,6%	35	11,6%	Cardoso, 2014 (Table 1)
Out. Redondo	Arrowheads	21	17,2%	110	24,4%	131	22,9%	Cardoso, 2019 (Table 7)
	Foliate blades	24	19,7%	81	18%	105	18,4%	Cardoso, 2019 (Table 7)

settlements featured activities of similar importance. We are referring to the activities directly involving these two types of utensils, one of which was related to hunting/warlike activities and the other to food production, bearing in mind the quantities observed.

Regarding the Full/Final Chalcolithic occupations recorded at the three settlements concerned, Leceia shows the lowest percentage of arrowheads in relation to all the lithic tools recovered from the same layer. On the other hand, this is also the site with the largest number of foliate blades. Therefore, out of these three sites, Leceia is the one where productive activities related to cereal farming would be the most important, as opposed to activities related to hunting/warfare. This is indicative of a stable population settled in a continuously and exhaustively exploited territory.

Conversely, arrowheads are more significant at Moita da Ladra, which is also the site where foliate blades are less important in terms of the overall lithic assemblage. The conclusion to be drawn is that this population was not particularly focused on the exploitation of the land. Still, this does not mean that they were less concerned with the control of their territory, as evidenced by the relatively high number of arrowheads, related to hunting/warfare. This is consistent with the settlement's role as a trading hub, receiving products from the Alentejo region and distributing them via the circulation routes of the Lisbon peninsula, whose security and stability had to be assured.

Outeiro Redondo, on the other hand, reflects a situation with intermediate characteristics, i.e. a settlement with a degree of control over its surroundings, embodied by the presence of arrowheads. Consequently, it dominated the route leading towards the interior of the territory, namely the valley it overlooks from the top of its right slope. Notwithstanding, this settlement also featured specialised agricultural production, as evidenced by the remarkable amount of foliate blades recovered.

Table 1. Comparative table showing the number of arrowheads and foliate blades and their percentage in relation to the total knapped stone industry at each of the three archaeological sites under analysis.

The following table supports these considerations in quantitative terms.

As far as the diachronic evolution of the functionality of the two settlements is concerned, as reflected by the two groups of utensils considered, there are no obvious changes. Nevertheless, at Leceia the relative decrease in the number of arrowheads is consistent with the increase in the number of foliate blades. Conversely, at Outeiro Redondo, the exact opposite can be observed in the transition from the Early to the Full Chalcolithic. In these terms, it can be concluded that Leceia strengthened its essentially domestic status, with an increase of agricultural practices in the fields surrounding the settlement, while at Outeiro Redondo there was a tendency to increase the exploitation of hunting resources, involving the extension of the effective domain of its catchment area.

4.2 -Ceramic artefacts

Among the artefacts likely to expressively characterise the economic activities developed in Chalcolithic residential contexts, certain groups usually referred to as ‘industrial ceramics’ stand out, since they are directly related to production. Thus, and given their greater or lesser presence in the archaeological record, they are important indicators of the practices prevailing at each site, thereby contributing to our assessment of the possible specialisation of the local production activities.

4.2.1 -Foundry crucibles and loom weights recovered from Early Chalcolithic contexts

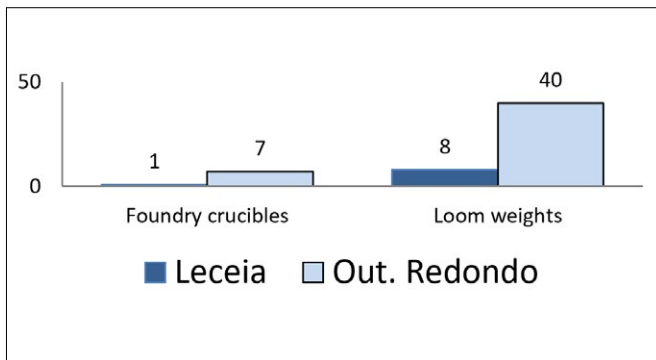


Figure 9. Number of foundry crucibles and loom weights recovered from Layer 3, assigned to the late Early Chalcolithic, at the three sites concerned.

A single crucible fragment was recovered at Leceia (Cardoso *et al.*, 2020, Fig. 8); this is the only unequivocal evidence of the existence of metallurgical practices during the Early Chalcolithic at Leceia (Figure 9).

Loom weights are represented by just eight specimens (only one decorated) at Leceia, in Layer 3 and mostly fragmented (Cardoso 2007).

Seven fragments of foundry crucibles were recovered from Early Chalcolithic contexts (Layer 3) at Outeiro Redondo (Cardoso 2019 b).

With regard to loom weights, 40 items were recovered, 15 of which are decorated (Cardoso 2019 b).

These results show that, despite the inhabited area of Outeiro Redondo, metallurgical activities were much more important than at Leceia; the same applies to another specialised domestic production, weaving. Thus, whereas a small demographic centre hosted a population that was

very clearly dedicated to certain specialised domestic activities, a large demographic centre would host a population that mainly consumed those products, which they obtained through exchange with external sources. As we shall see, this tendency was intensified during the most recent phase of the Chalcolithic period.

4.2.2 -Foundry crucibles, tuyères, loom weights and cheese presses from the Full / Final Chalcolithic (Layer 2)

At Leceia, no crucible fragments were recovered from this layer. As far as loom weights are concerned, only six plain specimens (either complete or fragmented) were recovered (Figure 10).

Only one crucible fragment was recovered at Moita da Ladra. This is an almost complete, ellipsoidal item (Cardoso 2014 b, Fig. 51, no. 12), which was lying *in situ*, in a horizontal position, next to a combustion structure.

Another artefact directly related to metallurgy, and much rarer than foundry crucibles, are the tuyères; a distal end has been recovered at this site (Cardoso, 2014 b. Fig. 51, no. 11). The loom weight group (Cardoso 2014 b, Figs. 47 and 48) is represented by 14 items (nine plain and five decorated). (Figure 10).

Nineteen crucible fragments were recovered from Layer 2 of Outeiro Redondo. In some cases, they tended to be ellipsoidal to sub-circular and shallow, while others tended to be sub-rectangular and deeper, like those from Layer 3. But all had flat bases and lacked external support legs.

With regard to loom weights, 61 items were recovered, 18 of which were decorated.

Cheese presses were only recovered from Layer 2 at all three settlements: 25 fragments from Leceia, 22 fragments from Moita da Ladra and 9 fragments from Outeiro Redondo. These results are summarised in Table 2.

The absolute distribution of these artefactual groups across the three sites concerned reflects their differences in functional terms. Thus, Outeiro Redondo's specialisation in textile production is strengthened, as evidenced by the high number of loom weights recovered at the site, despite the fact that its area is approximately 0.5 ha, less than half the built-up area of Leceia (around 1.2 ha), where the number of such items is residual and even lower than in Early Chalcolithic contexts. The metallurgical activities evidenced by the recovered crucible fragments

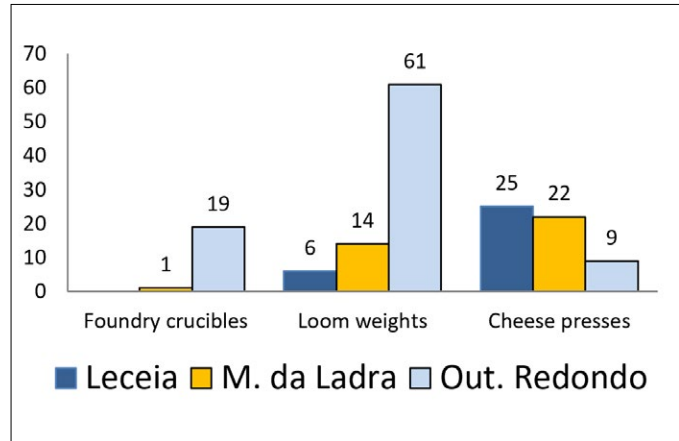


Figure 10. Number of foundry crucibles, loom weights and cheese presses recovered from Full/Final Chalcolithic contexts at the three sites concerned.

Site		L4 Final Neolithic	L3 Early Chalc.	L2 Full/Final Chalc.	Total	References
Leceia	Foundry crucibles	-	1	-	1	Cardoso, <i>et al.</i> 2020 (Fig. 8)
	Tuyères	-	-	-	-	Cardoso, <i>et al.</i> 2020
	Loom weights	-	8	6	14	Cardoso, 2007
	Cheese presses	-	-	25	25	Cardoso, 2007
M. da Ladra	Foundry crucibles	-	-	1	1	Cardoso, 2014 (Fig. 51, no. 12)
	Tuyères	-	-	1	1	Cardoso, 2014 (Fig. 51, no. 11)
	Loom weights	-	-	14 (5 dec.)	14	Cardoso, 2014 (Fig. 48 and 49)
	Cheese presses	-	-	22	22	Cardoso, 2014 (Fig. 50 and 51, nos. 1 to 5)
Out. Redondo	Foundry crucibles	-	7	19	26	Cardoso, 2019 (Quadro 34)
	Tuyères	-	3	3	6	Cardoso, 2019 (Fig. 149)
	Loom weights	-	40 (15 dec.)	61 (18 dec.)	101	Cardoso, 2019 (Table 28)
	Cheese presses	-	-	9	9	Cardoso, 2019 ((Table 30)

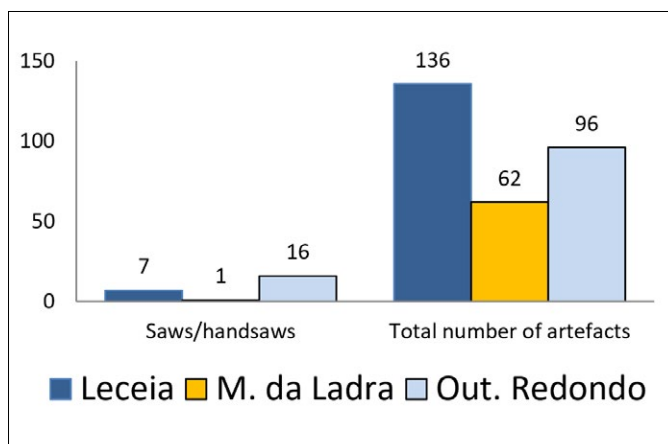
Table 2. Diachronic distribution of the absolute number of casting crucibles, tuyères, loom weights and cheese presses at each of the three archaeological sites under analysis; layers are indicated.

are surprisingly non-existent or residual in two of the studied contexts from this period, with the exception of Outeiro Redondo. This enhances the metallurgical tendency of the latter, inherited from Early Chalcolithic times - a remarkable set of tuyères was also recovered here, strengthening this specialised aspect. This abundance contrasts with the scarcity of cheese presses, much more abundant at Leceia, which emphasises the agro-pastoral nature of this site, as previously evidenced by the relative abundance of foliate blades. Conversely, the small number of items from Outeiro Redondo reveals the scarce agro-pastoral activities carried out at this site, also suggested by the relative scarcity of foliate blades, as previously mentioned. Moita da Lara diverges from this pattern, however, because despite having the lowest relative amount of foliate blades, it features a significant number of cheese presses, reflecting an agro-pastoral economy in which cereal farming had little importance.

4.3- Metallurgy

All three sites feature a remarkable number of artefacts made from copper alloys. However, only the processing of copper imported in the form of ingots produced at the mining areas themselves, both in the upper and lower Alentejo regions, along with fragments of discarded objects (scrap), has been demonstrated. This requires remelting, in the latter case, or simply cold or hot cutting, followed by hammering, in the case of the

Figure 11. Number of saw/handsaw specimens and the total number of metal artefacts recovered from Full/Final Chalcolithic contexts at Leceia, Moita da Ladra and Outeiro Redondo.



Site	Metallurgy	L3 Early Chalc.		L2 Full/Final Chalc.		Total	References
		No.	%	No.	%		
Leceia	Saws/handsaws	-	-	7	5,1%	7	Cardoso, Bottaini, Mirão & Bordalo, 2020
	Total number of artefacts	8	100%	136	100%	144	Cardoso, Bottaini, Mirão & Bordalo, 2020
M. da Ladra	Saws/handsaws	-	-	1	1,6%	1	Cardoso, 2014 (Fig. 52, No. 4)
	Total number of artefacts	-	-	62	100%	62	Cardoso, 2014 (Fig. 52 and 53)
Out. Redondo	Saws/handsaws	-	-	16	16,7%	16	Cardoso, 2019 (Table 34)
	Total number of artefacts	13	100%	96	100%	109	Cardoso, 2019 (Table 34)

original ingots. Leceia yielded ingots that bear witness to the process of separation into portions, intended for manufacturing small utensils such as borers, awls and punches. Given the great abundance of this type of pieces, related to tasks that their flint counterparts could not fulfil, they do not appear to be relevant for differentiating the activities carried out at the three settlements concerned. The saw/handsaw group is more relevant to this purpose, as it is only recorded in the layers corresponding to the Full/Final Chalcolithic of the settlements under analysis, as shown in Figure 11 and Table 3.

These tools are thought to be essentially related to the specialised manufacture of wooden objects, without overlooking their possible use as sickles. Their remarkable presence at Outeiro Redondo, where the abundance of metal artefacts is proportionally much higher than

Table 3. Distribution of saws/handsaws in relation to the total number of metal artefacts, according to the indicated layers.

at the other two settlements, could be explained by a specialised activity related to wood processing, perhaps the manufacture of fishing gear, or even shipbuilding (log or monoxyulous boats). In this regard, it is worth highlighting the large number of copper hooks recovered at the site; the different hook sizes suggest specialised fishing, a fact that was demonstrated here for the first time (Cardoso 2019). The absence (Moita da Ladra) or scarcity (Leceia) of fishhooks at the other two settlements reflects this fact, suggesting a correlation between the two types of utensil, which deserves to be studied in more detail.

5 – Discussion and concluding synthesis

An attempt at correlating the characteristics of each of the fortified sites with their archaeological content, as reflected by the relative importance of some of the artefacts exhumed therein, has now been conducted for the first time. The following general conclusions, to be refined as more diversified information becomes available, including faunal data, can thus be drawn.

Leceia is a site of considerable size (ca. 1.2 ha of built-up area). It stands on a rocky platform forming a spur over the valley of the Barcarena stream. Right from an early stage, this site revealed an organisation of the inhabited space, including the pre-definition of a defensive system, which was integrally built in a single stage, at the beginning of the Early Chalcolithic period. Afterwards, it underwent successive reinforcements and adaptations, closely linked to the various communal residential structures that were built here throughout the 3rd millennium BC. It is within this framework that one should integrate the information provided by the typology of some of the utensils deemed most significant for characterising the activities that took place at the settlement and, consequently, understanding the very nature and context of this archaeological site on a regional scale. The scarce relevance of domestic activities such as weaving and metallurgy shows that these products were obtained by exchange and originated from the locations where they were produced. The low intensity of hunting activities was balanced by a considerable agricultural production, evidenced by the importance of foliate blades, related to cereal farming, carried out in areas adjacent to the settlement, which thus acted as a ‘central place’, to which people and products essential to their daily lives flocked.

Moita da Ladra, given its position on the landscape and the architectural features and building materials used, was a visual reference point for those travelling along the Tagus River and, above all, for those travelling to the Lisbon peninsula from territories across the Tagus. In view of the above, it seems reasonable to think that Moita da Ladra’s defensive system, built during the last quarter of the 3rd millennium BC, was related to the economic intensification of the region, as can be deduced from the increase in the

trade of amphibolites originating from the Alentejo region (Cardoso 2004). More than just locally controlling navigation in the adjacent estuary, the settlement's role was linked to the movement of goods and people between the Alentejo and the Atlantic coast of Extremadura, close to Torres Vedras, where, in addition to the settlement of Zambujal, there are several other important Chalcolithic settlements whose inhabitants required a regular supply of amphibolites from the Alto Alentejo for their daily tasks: once the Tagus estuary had been crossed, the easiest way to get there would be via the waterways that run obliquely through Lower Extremadura, thus avoiding a more time-consuming cabotage journey around the coast of the Lisbon peninsula. Many other known settlements in this region, densely populated during the second half of the 3rd millennium BC, located halfway between the sites on the Atlantic coast and the Tagus estuary, such as Penedo do Lexim, could also benefit from these distribution networks for amphibolites and other raw materials from across the Tagus, such as copper, already in the form of ingots. The site's function would therefore be to control the inflow of products and raw materials, especially copper and amphibolites, which would then be redistributed to settlements throughout the region. Moreover, due to its location, and taking advantage of the streams, it facilitated the connection to the Atlantic coastline, which could be related to the location of the settlement of Zambujal, situated at the other end of this route. The need to control this circulation route explains the importance of arrowheads within the overall knapped stone assemblage and, conversely, the scarcity of foliate blades, related to cereal farming. Thus, its population was essentially focused on commercial intermediation and coordination at a regional level, in the surrounding territory, through the circulation routes that crossed it. Nonetheless, domestic production is represented by the processing of dairy products (cheese presses) and weaving, along with metallurgy, aimed at meeting the local needs of its inhabitants.

Finally, Outeiro Redondo, comparable in size to Moita da Ladra (ca. 0.5 ha), and fortified, like the latter, only at an advanced stage of the Full/Final Chalcolithic, stands out due to its remarkable metallurgical activity, evidenced by the high number of crucibles recovered, along with tuyères. Among the metal utensils, saws/handsaws are particularly important, which could be related to maritime activity, including shipbuilding, in addition to the importance of weaving, which could also be related in some way to such activities. The importance of metallurgy and weaving contrasts with the limited processing of dairy products (scarcity of cheese presses), although as far as agricultural and hunting practices are concerned, the available data indicates an intermediate situation between what was observed at Leceia and Moita da Ladra. This seemingly reflects a community where activities related to farming were more important than at Moita da Ladra, but less so than at Leceia, counterbalanced by hunting and land control practices that were less relevant than those associated with the former site, but more important than those pertaining to the latter. This would therefore be a site

with mixed characteristics, revealing a community that was less attached to the land than to the sea, where hunting was an important part of the diet, with the sea playing a very significant economic role in the daily lives of this community.

As a result of this study, it was possible to demonstrate the interest of exploring different types of information, based on the archaeological record: one intrinsic to the characteristics of the sites themselves, including the nature of their location, geographical setting and extent, and others concerning the characteristics of the recovered lithic tools and ceramic productions. It is therefore important to extend this exercise to the sites of Extremadura where information has been published in an exhaustive and credible manner, on the basis of reliable stratigraphic data. Only then can we obtain a substantiated and credible perspective of the rich and diverse social, cultural and economic circumstances that characterised the whole of the 3rd millennium BC in Lower Extremadura.

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