

**16**

# **APONTAMENTOS**

*de Arqueologia e Património*

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# ***A*PONTAMENTOS**

*de Arqueologia e Património*

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## EDITORIAL



### 25 anos de ERA Arqueologia

A ERA Arqueologia faz este ano 25 anos. Ao longo deste quarto de século de existência o seu compromisso com a divulgação e publicação dos seus trabalhos e do conhecimento produzido traduziu-se numa intensa actividade editorial, na participação em inúmeras reuniões científicas nacionais e internacionais ou publicação regular de artigos em actas e revistas de especialidade. De entre todas estas realizações ganha particular relevo o esforço dedicado à actividade editorial, porque é diferenciador, representa a forma como a empresa pensa e vê a sua actividade e é demonstrativo desse mesmo compromisso.

De facto, tendo a ERA surgido em 1997, o primeiro número da revista em papel ERA Arqueologia, foi publicado em 2000. Até 2008 foram sucessivamente editados oito volumes, nos quais se publicaram trabalhos da empresa, artigos de investigação e teoria, se discutiram questões da organização da arqueologia e da profissão (Ensino, Divulgação, Ordem dos Arqueólogos, Cadernos de Encargos, etc.). Seguiu-se a revista online Apontamentos de Arqueologia e Património, que publica agora o seu 16º volume. A par, criaram-se as séries ERA Monográfica, já com seis volumes editados, e Perdigos Monográfica, com dois volumes publicados, às quais se soma a publicação das actas de um workshop.

Para utilizar uma expressão em voga: conhecer, debater, divulgar e comunicar fazem parte do “nosso ADN”

António Carlos Valera

# WOODLAND RESOURCES IN PERDIGÕES: ANTHRACOLOGICAL ANALYSIS OF CHALCOLITHIC AND EARLY BRONZE AGE CONTEXTS.

Patrícia Diogo Monteiro<sup>1</sup>

Artur Ribeiro<sup>2</sup>

António Carlos Valera<sup>3</sup>

## Abstract:

The gathering of woodland resources and their use as fuel were important activities for the 3<sup>rd</sup> millennium B.C. and Early Bronze Age communities at Perdigões. This is testified by wood charcoal that has been recovered in fieldwork campaigns, in several archaeological structures. This paper presents the anthracological analyses carried out in several contexts from Perdigões, which aims to characterize the acquisition modalities of wood by these communities during the occupation of the site. Based on the analyses of 610 charcoal fragments, we identified that in the 1<sup>st</sup> half of the 3<sup>rd</sup> millennium BC these communities seem to be targeting pine and oak wood. This pattern changes in the “Bell beaker” phase until the Early Bronze Age, with the exploitation of wood of oak and other shrub species, but with absence of pine. Although the expansion of shrub species in the landscape in this later phase is confirmed by pollen analyses, it is possible to consider that the different functionality of the contexts during the occupation might have played a role on the selection of wood resources.

## Resumo:

**Recursos florestais nos Perdigões: análise antracológica de contextos do 3º milénio AC e Idade do Bronze Inicial.**

A recolha da madeira e a sua utilização como combustível terão sido atividades importantes para as comunidades do III milénio AC e da Idade do Bronze Inicial que ocupação o sítio dos Perdigões, testemunhadas pelos carvões de madeira recolhidos ao longo das campanhas nas várias estruturas identificadas. Este artigo apresenta as análises antracológicas realizadas em vários contextos dos Perdigões, com objetivo de caracterizar as modalidades de aquisição de madeira destas comunidades ao longo da ocupação. Com base na análise de 610 fragmentos de carvão, identificamos que na 1ª metade do 3º milénio AC, estas comunidades estariam a selecionar madeira de pinheiro e azinheira. Este padrão altera-se a partir da fase Campaniforme até à Idade do Bronze Inicial, com a exploração de madeira de azinheira e de outras espécies arbustivas, estando ausente o pinheiro. Apesar de se verificar uma expansão de espécies arbustivas na fase mais tardia segundo as análises polínicas, é possível considerar que a diferente funcionalidade dos contextos durante a ocupação terá sido um fator na seleção de recursos lenhosos.

## 1. Introduction

The environmental conditions deeply impacted prehistoric populations through time, being responsible for major cultural changes (Müller, Kirleis, 2019), as changes in ecological systems would have directly affected the economic activities of societies (Carrión, 2007). In the particular case of the end of the 3rd Millennium BC, the 4.2k BP climatic event is considered as a possible trigger or an accelerator factor for the

cultural changes witnessed in the archaeological record in the transition to the Early Bronze Age (Hinz *et al.*, 2019; Ribeiro *et al.*, 2019; Valera, 2021). This is a variable we must consider for the development of Perdigões occupation during this period. Considering the importance of woodland resources, such as for fuel and construction, assessing the modalities of woodland exploitation by Perdigões communities during the 3rd millennium and Early Bronze Age will allow us to understand 1) how these modalities changed through the occupation in the site and what relation they have with its functionality and 2) how they were affected by changes in the landscape in this transitional period. For that, anthracological analyses were carried out on 610 charcoal fragments recovered in several archaeological contexts of Perdigões' central area.

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## 2. Archaeological context

The sampled area corresponds to the centre of Perdigões' ditched enclosures, where there is a stratigraphic sequence that covers all the time span of the site. We focused on the 3rd millennium BC sequence. Dating from the first half of the millennium (mainly the second quarter) material from the ceremonial timber circle were selected from the two outer ditches and from several post holes of internal rows and from other peripheral post holes. These contexts are prior to the presence of Bell Beaker material in this central area. Another set of samples correspond to structures (Pit 92) and deposits that are associated to a phase where bell beakers are already present and that is dated from the middle / third quarter of the 3rd millennium BC. Finally, the last set of samples were collected in Pit 79 (that is part of the Cairn 1 structure – Basílio, Cabaço, 2019) and from the deposit [28] that covers a large stone cairn that ends the stratigraphic sequence over the timber circle. Both these contexts are dated from the last quarter of the 3rd millennium BC, which corresponds to the Early Bronze Age.

## 3. Materials and methods

The studied charcoal fragments were retrieved from sediment samples recovered in the site during the 2021 field excavation and processed by flotation. In addition, hand-picked and screen-sieved charcoal fragments recovered at other contexts of the site were also analysed and integrated in this report.

Table 1 – Chrono-cultural sequence and contexts of the deposits where charcoal fragments were retrieved from Perdigões.

Chrono-cultural sequence	Context	S.U.
Early Bronze Age	Pit 79	[440]
		[466]
		[488]
		[491]
	Profile	[28]
Chalcolithic	"Bell beaker" phase	Pit 92
		Pot 13692
	Profile	[926]
	Middle 3rd mil.	Post-hole
		[641]
	Profile	[1141]
	1st half / middle 3rd mil.	Post-holes east side
		[1150]
		[1160]
		[1167]
		[1169]
		[1171]
	1st half 3rd mil.	Timber Circle d1
		[676]
		Timber Circle d2
		[677]
		[702]
		Timber Circle Post-Holes
		[811]
		[1132]
		[1136]
		Timber Circle d3
		[911]
		Hearth
		[1154]

A total of 114 Litres of sediment were processed by flotation from the following contexts, where 293 charcoal fragments (>2mm) were separated for analyses.

Table 2 – Volume of sediment processed by flotation and number of charcoal fragments recovered from each context analysed from Perdigões.

Context	Volume (Litres)	Nr. Charcoal fragments (>2mm)
[28]	10	6
[31]	8	0
[926]	10	37
[1130]	4	0
[1132]	6	8
[1134]	2.5	0
[1136]	6	4
[1139]	7	0
[1141]	7	6
[1150]	0.5	1
[1154]	8	3
[1160]	8	14
[1167]	6	6
[1169]	5	1
[1171]	7	2
Pit 92	16	202
Post-hole	3	3
<b>Total</b>	<b>114</b>	<b>293</b>

A total of 317 hand-picked and screen-sieved charcoal fragments (>2mm) were collected from the following contexts.

Table 3 – Number of charcoal fragments recovered from each context analyzed from Perdigões.

Context	Nr. Charcoal fragments (>2mm)
[440]	15
[466]	29
[488]	8
[491]	5
[641]	6
[676]	123
[677]	88
[702]	18
[811]	19
[911]	6
<b>Total</b>	<b>317</b>

A total of 610 charcoal fragments (>2mm) were collected from microscopic analyses.

The sediment samples recovered in the field were processed in ERA Algarve laboratory by flotation. The flotation is a method of processing sediments that allows the total recovery of plant macroremains present in the sediment, by using water to separate the materials by their density (Struiver, 1968). The Bucket flotation was used to process the samples under study, allowing to separate a light fraction, composed of materials that floated in the water deposit in bucket with the sediment sample, which were collected in a net (0,25 mm mesh), from

the heavy fraction, which corresponds to the heavier archaeological materials that were deposited in the base of the bucket.

From the previously mentioned contexts, charcoal fragments larger than 2 mm (Chabal, 1992) were separated using the stereomicroscope and selected for microscopic observation under the microscope of reflected light (Olympus B201) at x100 and x200 magnification lenses. Carbonization allows the conservation of the wood anatomy cellular structure and through microscopic observation of three sections (transversal, longitudinal tangential and longitudinal radial) taxonomic identification is possible. The taxonomic identification was achieved through comparison with wood anatomy atlases (Schweingruber, 1990; Schoch *et al.*, 2004) and the reference collection of modern charcoal of LARC (Archaeosciences Laboratory of DGPC – Directorate General of Cultural Heritage).

The following taxonomic list describes the anatomical criteria observed for charcoal taxonomic determination (based on Schweingruber, 1999).

## Angiosperms

### ANACARDIACEAE

*Pistacia lentiscus* (Mastic tree)

Transversal: Ring-porous, pores in earlywood medium to large and in latewood pores smaller and arranged in radial files and clusters, in dendritic pattern. Presence of tyloses in earlywood vessels.

Tangential: Rays mostly bi- to triseriate rays, multiseriate rays up to 25 cells high.

Radial: Rays heterogeneous, spiral thickenings present. Perforation plates simple.

cf. *Pistacia lentiscus* corresponds to a lower degree of precision in the identification as it refers to fragments where several characters of *Pistacia lentiscus*, but not all, were observed, due to alterations or small size of the fragment.

### ERICACEAE

*Arbutus unedo* (Strawberry tree)

Transversal: Diffuse to semi-ring porous. Pores frequent, solitary or in short radial files or groups.

Tangential: Rays uni-, bi- and triseriate. Average height between 5 to 20 cells.

Radial: Rays heterogeneous, one to two rows of square and upright marginal cells, perforation plates simple. Spiral

thickenings conspicuous, present in all vessels, fibre tracheids. Presence of prismatic crystals.

cf. *Arbutus unedo* corresponds to a lower degree of precision in the identification as it refers to fragments where several characters of *Arbutus unedo*, but not all, were observed, due to alterations or small size of the fragment.

Fragments identified as “Ericaceae” correspond to those where only some characters common to several species of Ericaceae were observed.

### FAGACEAE

*Quercus* sp. evergreen (Oak)

Transversal: Diffuse porous, in radial and dendritic files. Apotracheal parenchyma in uniseriate diagonal and tangential bands. Broad multiseriate rays.

Tangential: Uni- and large multiseriate rays.

Radial: Rays homogenous, sometimes with square cells in uniseriate rays. Perforation plates simple.

*Quercus* sp. (Oak)

Fragments identified as “*Quercus* sp.” did not enable the observation of the pore distribution in the transversal section in order to determine between *Quercus* sp. evergreen and *Quercus* sp. deciduous.

### OLEACEAE

*Olea europaea* (wild olive tree)

Transversal: Diffuse porous. Pores thick-walled, in short radial groups of two to four pores, rarely solitary. Parenchyma mostly paratracheal.

Tangential: Rays bi- to triseriate, up to 12 cells high.

Radial: Ray heterogeneous. Intervessel and ray vessel pits numerous and small. Perforation plates simple.

### Monocotyledons

Fragments were vascular bulbs and grouped cells were observed with no evidence of growth rings.

### Dicotyledon

Fragments were determined as “Dicotyledon” when vascular cells such as pores were observed, but with limitations when observing other identifying characters, due to alterations such as vitrification that causes a melting of the cellular structure.



## Gymnosperms

### PINACEAE

*Pinus pinea/pinaster* (Stone pine/Maritime pine)

*Pinus pinea* and *Pinus pinaster* are distinguished by a character in the radial section that was not possible to observe clearly. Therefore, the charcoal fragments analysed that presented the following characters were determined as “*Pinus pinea/pinaster*”

**Transversal:** Growth ring boundaries often distinct. Thin-walled epithelial cells. Resin canals present.

**Tangential:** Rays between 8 to 20 cells height. Rays with resin canals.

**Radial:** Rays heterocellular, with pits (2 to 4) in cross-fields. Occasionally dentate rays were observed.

*Pinus* sp. (Pine)

Fragments identified as *Pinus* sp. were the only ones where it was possible to observe the transversal section, with presence of resin canals, or where the radial section did not allow the observation of the rays to further determination.

### Indeterminate gymnosperm

Fragments were determined as “Indeterminate gymnosperm” when alterations and size of the fragments did not allow observation of resin canals or other identifying characters.

### Indeterminate

The indeterminate fragments are those where the alterations did not allow the observation of any characters of wood cellular structure that enable other identification.

## 4. Results

The analyses of 610 charcoal fragments allowed the identification of the following taxa: *Arbutus unedo*, cf. *Arbutus unedo*, *Ericaceae*, *Olea europaea*, *Oleaceae*, *Pinus pinea/pinaster*, *Pinus* sp., *Pistacia lentiscus*, cf. *Pistacia lentiscus*, *Quercus* sp. (evergreen), *Quercus* sp., Dicotyledon, Monocotyledon and indeterminate Gymnosperm.

The overall results show that *Pinus pinea/pinaster* is the most frequent taxa, followed by *Quercus* sp. A higher frequency of pine (*Pinus pinea/pinaster* and *Pinus* sp.) and oak wood (*Quercus* sp. evergreen and *Quercus* sp.) has been confirmed in charcoal assemblage when compared with other taxa such as *Arbutus unedo*/cf. *Arbutus unedo*, *Ericaceae*, *Pistacia lentiscus*/cf. *Pistacia lentiscus*.

Table 4 – Results of taxonomic identification in absolute numbers of charcoal fragments from Perdigoões.

Taxa	Nr. fragments
<i>Arbutus unedo</i>	18
cf. <i>Arbutus unedo</i>	14
<i>Ericaceae</i>	14
<i>Olea europaea</i>	1
<i>Oleaceae</i>	1
<i>Pinus pinea/pinaster</i>	140
<i>Pinus</i> sp.	70
<i>Pistacia lentiscus</i>	3
cf. <i>Pistacia lentiscus</i>	1
<i>Quercus</i> sp. (evergreen)	86
<i>Quercus</i> sp.	115
Dicotyledon	104
Monocotyledon	2
Indeterminate gymnosperm	32
Indeterminate	9
	610

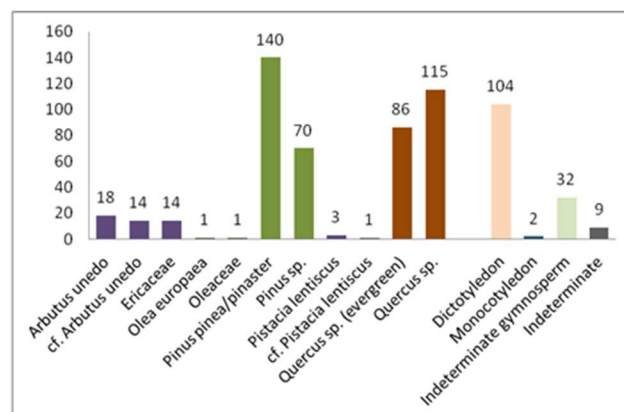


Figure 1 – Results of the taxonomic identification of charcoal from Perdigoões contexts.

The earlier context analysed in this assemblage represents a hearth [1154] at the base of the sequence that covers the central Timber Circle and that may be attributed to the first half of the 3<sup>rd</sup> millennium BC. Only 3 charcoal fragments were analysed from this deposit, identifying *Pinus* sp. and indeterminate Gymnosperm.

Also from the 3<sup>rd</sup> millennium BC are four different phases of occupation, which correspond to the 1<sup>st</sup> half, the 1<sup>st</sup> half and middle, middle and 3<sup>rd</sup> quarter of the millennium (the “Bell beaker” phase).

The contexts analysed from the 1<sup>st</sup> half of the 3<sup>rd</sup> millennium BC correspond to the Timber Circle – internal [676] and external [677] ditches, post-holes [702], [811], [1132], [1136]

Table 5 – Results from charcoal analyses of Chalcolithic and Early Bronze Age contexts of Perdigões, in absolute numbers.

Chrono-cultural sequence		Context	S.U.	<i>Arbutus unedo</i> / cf. <i>Arbutus unedo</i>	Ericaceae	<i>Olea europea</i>	Oleaceae	<i>Pinus pinea</i> / <i>pinaster</i>	<i>Pinus</i> sp.	<i>Pistacia lentiscus</i> / cf. <i>Pistacia lentiscus</i>	<i>Quercus</i> sp. (evergreen)	<i>Quercus</i> sp.	Dicotyledon	Monocotyledon	Indeterminate gymnosperm	Indeterminate	Total						
Early Bronze Age		Pit 79	[440]	1	3						6	9					15						
			[466]								2	4					5	29					
			[488]								1	1					2	8					
[491]	1		1								5												
	Profile	[28]						3		1	1						6						
Chalcolithic	"Bell beaker" phase	Pit 92	[641]	29	11		1			1	37	38	41	2		6	166						
			Pot 13692									36					36						
		Profile	[926]									3	24				10						
	Middle 3rd mil.	Post-hole	[641]					3	1					2		1	6						
		Profile	[1141]														1		1	3	6		
	1st half / middle 3rd mil.	Post-holes east side	[1150]	2					1	1		1			3			1					
			[1160]															2	3	2		14	
			[1167]															2		3			6
			[1169]																1			1	
			[1171]															1	1			2	
	1st half 3rd mil.	Timber Circle d1	[676]						82	22		4	3			12		123					
		Timber Circle d2	[677]						45	31		2	5						5	88			
		Timber Circle Post-Holes	[702]						7	8									1	2	18		
			[811]										7						12			19	
			[1132]							1									3	1	1	8	
[1136]									1												4		
Timber Circle d3		[911]	1						1	1			3							6			
Hearth	[1154]		2				1		3														
Total				32	14	1	1	140	70	4	86	115	104	2	32	9	610						

and inside ditch [911]. A total of 266 charcoal fragments were observed in these contexts and *Pinus pinea/pinaster*, *Pinus* sp. are the more frequent taxa, followed by *Quercus* sp. (evergreen), *Quercus* sp., Dicotyledon and indeterminate Gymnosperm.

The post-holes located in the East side – [1150], [1160], [1167], [1169], [1171] - dated from 1st half / middle of the 3rd millennium BC had fewer charcoal fragments retrieved from its deposits, a total of 27 fragments. Similar to the previous phase, *Pinus pinea/pinaster*, *Pinus* sp., *Quercus* sp. (evergreen), *Quercus* sp., Dicotyledon, indeterminate Gymnosperm were identified but also two fragments of *Arbutus unedo*/cf. *Arbutus unedo* and a fragment of *Olea europaea* were present.

In the next phase, middle 3rd millennium BC, the post-hole [641] and [1141] Profile deposit have 12 charcoal fragments, where *Pinus pinea/pinaster*, *Pinus* sp., Dicotyledon and indeterminate Gymnosperm were identified.

The "Bell beaker" phase corresponds to the deposits in Pit 92, in which there is a deposit inside of a vessel (13692) and the S.U. [926] from the Profile. A total of 239 charcoal fragments were analysed from these deposits. The Pit 92, also probably due to the larger assemblage, is the context with most taxonomic diversity, with 8 different taxa identified: *Arbutus unedo*/cf. *Arbutus unedo*, Ericaceae, Oleaceae, *Pistacia lentiscus*/cf. *Pistacia lentiscus*, *Quercus* sp. evergreen, *Quercus* sp., Dicotyledon and Monocotyledon. Although, *Quercus* (*Quercus* sp. evergreen and *Quercus* sp.) represent together the most frequent taxa. Dicotyledon and *Arbutus*

*unedo* are also frequent in the assemblage. In the case of the deposit inside the vessel (13692) no further identification other than unidentified Dicotyledon was achieved given that all fragments were highly affected by vitrification, which limited the analyses. The [926] deposit shows a similar pattern with *Quercus* sp. (evergreen), *Quercus* sp. and Dicotyledon. In this phase, shrubs wood charcoal (*Arbutus unedo*, Ericaceae, *Pistacia lentiscus*) is more frequent than in previous phases, where these taxa were absent (apart from a very low representation in [1160]). In this phase, the main taxa are *Quercus* and unidentified Dicotyledon. *Pinus*, the main taxa in the 1<sup>st</sup> half of the 3<sup>rd</sup> millennium, is a residual species.

In the contexts of the Early Bronze Age occupation – S.U. [440] [466] [488] [491] from Pit 79 and [28] from the Profile – a total of 63 charcoal fragments were analysed and the results show that *Quercus* sp. (evergreen) and *Quercus* sp. are the most frequent taxa in all these contexts, with exception of [28] where *Pistacia lentiscus* is the most frequent taxon. *Pinus*, like in the “Bell beaker” phase, is absent in all Early Bronze Age deposits analysed.

## 5. Discussion

### 5.1 Paleoenvironmental input of the charcoal assemblage

The charcoal assemblage demonstrates the presence of traditional species from a Mediterranean thermophilous zone - *Quercus* sp. (evergreen), *Pinus pinea/pinaster*, *Arbutus unedo*, *Pistacia lentiscus*, Ericaceae and *Olea europaea* – present in the Alentejo landscape (Capelo, Vila-Viçosa, 2021). The presence of *Quercus* sp. (evergreen) and *Olea europaea* suggest the presence of sclerophyllous vegetation in the Guadiana valley slopes, and *Pinus* forest were widely dispersed in the territory since the Holocene, even in more inland schist soils. The presence of these taxa in the landscape during the occupation of the site was also established by the pollen analyses carried out in deposits of several structures (Danielsen, Mendes, 2015). Even though post-depositional factors limited the conservation of pollen at the site, it was possible to identify the majority of the taxa observed in the charcoal assemblage, plus taxa that provide evidence of agricultural practices (presence of Brassicaceae, Poaceae and Plantaginaceae).

The charcoal assemblage shows some diachronic variations on the species present (e.g. *Pinus* is more frequent in earlier phases of the site and that trend changes in the “Bell beaker” phase, where *Quercus* and the presence of other shrub taxa is more prominent) and although that could contribute to interpretations on the evolution of the landscape in the surroundings, one must be aware of the limitations that charcoal has in providing paleoenvironmental reconstruction, especially when charcoal is associated with anthropic deposits and is thus strongly biased by human selection of the available species in the landscape (Chabal, 1992).

Changes in the landscape through time could also be observed in the pollen diagram in Sanja 11, corresponding to the Chalcolithic occupation; in an earlier phase there is the presence of *Pinus* and *Quercus* and less to no representation of shrubs, suggesting the presence of forest, that in later period changes to a larger representation and diversity of shrubs (*Daphne*, *Rhamnus*, Ericaceae, Rosaceae, *Ulex* / *Genista*) indicating a more open landscape.

Some species like *Quercus* were not identified in the later phase in the pollen analyses, but the charcoal assemblage could confirm that oak was in fact present in the landscape even in these later phases of the Chalcolithic and Early Bronze Age occupation of the site, since it was exploited for fuel. Human impact on the landscape, such as the clearance of forest for farming, is also a possibility for the lack of representation of *Quercus* in the pollen diagram in the later period, something that would also justify the increase of use of this resource for fuel, however, further analyses are necessary to confirm this hypothesis.

The presence of shrubs taxa in the charcoal record from the later phases of the Chalcolithic onwards corresponds to the availability of these species in the landscape, as indicated in the pollen record. Although the absence of shrub species in the charcoal assemblage in the earlier phase of the Chalcolithic is also corroborated by pollen diagram, suggesting that the possible scarcity of these resources in the landscape existed and might have influenced the wood exploitation modalities, the fact is that the absence of shrubs in the charcoal record in this phase could be strongly linked with the functionality of the structures of the Timber Circle, reason why tree species could have been targeted.

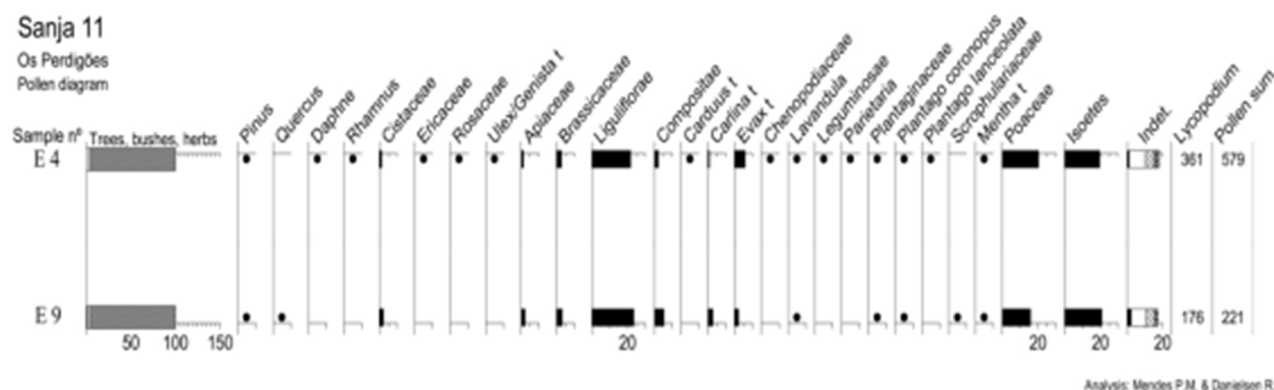


Figure 2 - Pollen diagram of Sanja 11 of Perdigões. Samples E9 and E4 are from the second half of the 3rd millennium BC.

The potential effects on vegetation caused by the 4.2k BP event are hard to associate with the data here presented. The transition to a more open landscape and the increase of some indicators of dryness (Chenopodiaceae and Poaceae) observed in the E4 sample (Figure 2), that represents a period of the second half of the 3<sup>rd</sup> millennium BC, could be changes associated to this event, nevertheless these changes are mild compared to the E9 sample. Furthermore, the previously mentioned limitations in preservation of these samples and the anthropic influence in the landscape disallowed us to achieve further conclusions on this matter. It is more likely that the samples here considered are reflecting anthropogenic behaviour towards the landscape and therefore offering only a partial image of it.

## 5.2. Paleoeconomical interpretation of Perdigões charcoal assemblage

Charcoal, as a result of the exploitation and selection of woodland and use of fire is an important source of information to assess the importance of these activities for these past societies and their relevance during the occupation of the site (Piqué i Huerta, 1999).

In the 1<sup>st</sup> half of the III millennium, the deposits related with the Timber Circle show the presence of charcoal of pine (*Pinus pinea/pinaster*, *Pinus* sp.) and oak (*Quercus* sp. (evergreen), *Quercus* sp.) and also indeterminate Dicotyledon and Gymnosperm. It is worthy of note that in the identified wood charcoal there is the presence of tree species and absence of shrub species. Although the deposition conditions do not allow us to relate this charcoal with *in situ* burning, the fact is that these results might suggest the exploitation of wood for a specific purpose of targeting species that could provide a higher calibre timber and specifically pine and oak were being used as timber to the Timber circle. This hypothesis needs further research for confirmation. One could also argue that considering the pollen record for this earlier phase of the Chalcolithic occupation there is no evidence of shrub species in the landscape and, for that, the charcoal assemblage might reflect an exploitation of the available species and not a selection for a specific function, but again we must consider the limitations in the pollen conservation as possible bias.

The next phases (1<sup>st</sup> half to half/ middle to 3<sup>rd</sup> quarter) few charcoal fragments were retrieved in the post-holes, but they reflect a similar pattern of wood used as fuel, like the previous phase. Besides pine and oak, also strawberry tree (*Arbutus unedo*) and wild olive tree (*Olea europaea*) were used as fuel in this phase. Similar to the previous phase, the diversity of species present in each post-hole suggests that these fragments are probably a result of secondary deposition. Nevertheless, they indicate that wood was gathered and used for fuel during this occupation phase.

It is in the “Bell beaker” occupation phase that charcoal assemblage testifies a difference in the exploitation of wood, where the absence of pine is noted, and the most frequent species is oak. Also, an increase of charcoal fragments of strawberry tree and Ericaceae and mastic tree (*Pistacia lentiscus*) is documented, which indicates the use of shrub

species as fuel. This same pattern also seems to occur in the later phases of Early Bronze Age.

Given that the secondary deposits may reflect the discard of charcoal fragments from several burning events in the site, these deposits may reflect a wide range of activities related with wood exploitation and use of fire (Chabal, 1992). In the case of the later phases, it seems that these communities were focusing on gathering oak and some of the available species in the landscape.

## 6. Conclusions

This paper presented the study of 610 charcoal fragments recovered in several contexts of Perdigões from the 3<sup>rd</sup> millennium BC to Early Bronze Age to address the questions concerning how the modalities of gathering woodland resources changed through time and how they were affected by changes in the landscape during this period. The anthracological results indicate the exploitation of pine, oak, strawberry tree, mastic tree and wild olive tree.

- 1) About how the gathering of woodland resources modalities changed through the occupation: there were some differences in the exploitation of woodland resources during the occupation of Perdigões, with an earlier phase related to the Timber Circle context, associated to the use of tree species (pine and oak) and a later “Bell Beaker” phase, associated to an absence of pine and an increase of shrub species, suggesting that the functionality might have been a criteria for woodland resource selection.
- 2) About how woodland resources modalities were affected by changes in the landscape: the results show that these communities were exploiting a typical species from a Mediterranean thermophilous zone with presence of sclerophyllous vegetation in the Guadiana valley slopes. The anthracological data is also consistent with the pollen diagram of the site that shows mild changes during the occupation of Perdigões. Neither the anthracological or palinological data from Perdigões here presented have successfully identified the impact of 4.2k event in these communities, specifically concerning their woodland exploitation modalities. However, the 4.2k event could have influenced these communities in a more slow and indirect manner, which could have led to lifestyle changes. With that being said, the results are more consistent with the hypothesis, in the present case, that the differences spotted are related with cultural/functional aspects.

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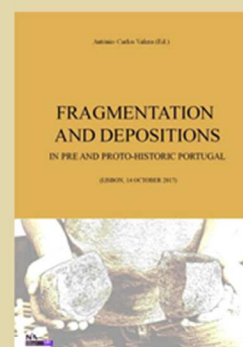


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