

# Charcoal analysis from Porto das Carretas: the gathering of wood and the palaeoenvironmental context of SE Portugal during the 3rd millennium

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**Summary:** Charcoal analysis from the Chalcolithic and Bell Beaker period/early Bronze Age settlement of Porto das Carretas (southeast Portugal) suggests the presence of three distinct ecological and physiographic units used by human communities as source areas for wood gathering: the alluvial Guadiana margins, where *Fraxinus angustifolia* was present, probably as a component of the riparian forests; the valley slopes, dominated by sclerophyll species such as *Quercus* - evergreen and *Olea europaea*; and the interfluves where *Pinus pinea* might have been present. The anthracological spectra identified at Porto das Carretas suggest a palaeovegetation mosaic compatible with a Mediterranean type of climate. Previous archaeobotanical investigation in the area suggests the existence of significant environmental changes since the 3rd millennium onwards. Data from Porto das Carretas in general fits well into these local models.

**Key words:** Porto das Carretas, charcoal analysis, third millennium BC, wood gathering, palaeoecology.

## INTRODUCTION

Porto das Carretas (Mourão, southern Portugal) is a settlement in the left margin of Guadiana River. The archaeological excavation took place between 1997 and 2000 under the supervision of part of the authors (Tavares da Silva and Soares, 2002). Two major phases were identified and their chronology was confirmed by a series of <sup>14</sup>C dates. During the Chalcolithic (Phase I - ca. 2900-2500 cal. BC) the site was fortified and during the Bell Beaker period/early Bronze Age (Phase II - ca. 2500-2200 cal. BC) a monumental architectural ensemble was built (Soares *et al.*, 2007; Soares and Tavares da Silva, 2010).

Charcoal analysis was done in order to get information on the plant resources used by the human communities, mainly wood gathering strategies, and also to assemble relevant information on the palaeovegetation regional mosaic and related palaeoenvironmental conditions.

## MATERIALS AND METHODS

All Phase I charcoal assemblages were recovered in non-structured fireplaces. Phase II anthracological assemblages were gathered inside structured fireplaces as well as scattered in the surrounding of those structures.

All laboratory work was done in the Laboratory of Paleocology and Archaeobotany (exIPA). Charcoal fragments were hand sectioned in order to obtain the three diagnostic sections. They were observed and identified under the microscope; identification was assisted by wood and charcoal reference material and atlases (e.g. Schweingruber, 1990).

The tentative discrimination of *Quercus* species was done using new criteria. Being conservative, these criteria allowed us to define different morphological types. Their correspondence with the eponymous species is discussed.

## RESULTS

A total of 403 charcoal fragments were studied. The assemblage is significant although not very rich. Results are summed in Table 1 and Figures 2 and 3.

According to the morphological criteria used, different *Quercus* morphological types are included in the samples: *Quercus faginea*, *Quercus ilex* subsp. *ballota*, *Quercus coccifera* and/or *Quercus suber*. The significant presence of *Quercus* sp. is a result of abundant small sized fragments.

Charcoal	Phase I		Phase II	
	Conc.	Sca.	Conc.	Sca.
<i>Fraxinus angustifolia</i>		8		
<i>Olea europaea</i>	36	22	14	
<i>Pinus pinea</i>	37	26	31	
<i>Pinus pinea</i> / <i>pinaster</i>			1	
Rosaceae cf. <i>Pyrus</i> sp.	5	3	2	
<i>Quercus</i> - evergreen	27	61	6	
<i>Quercus</i> - deciduous		1	1	
<i>Quercus</i> sp.	54	35	16	
Undetermined	5	2	10	
<b>Total</b>	164	158	81	
<b>Fruits and seeds</b>				
<i>Vicia faba</i> var. <i>minuta</i> (frag.)	41			
<i>Pinus pinea</i> (cone scales)		2	2	

TABLE 1. Results from the charcoal analysis (Sca.- Scattered; F. - fireplace)

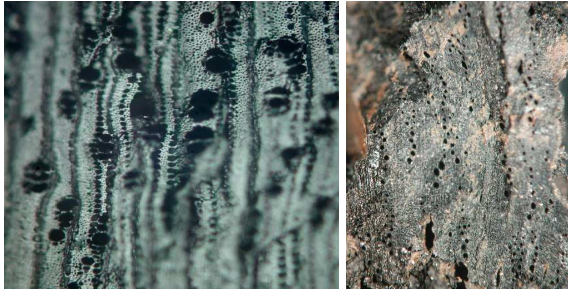


FIGURE 1. *Olea europaea* (left) and *Quercus* evergreen (right)

## DISCUSSION AND CONCLUSIONS

The results from both occupation phases are very similar —the only significant difference being the exclusive presence of *Fraxinus angustifolia* and *Quercus faginea* in Phase II.

Three main ecological and physiographic units on the regional territory zonation were probably used by the human communities, during the Chalcolithic, as source areas for wood gathering: the Guadiana River alluvial planes, the valley slopes and the interfluves. This is suggested by the anthracological spectra, assuming for the past the same ecological preferences of the plant species as shown in the present-day.

Riparian forests, probably bordering the low alluvial terraces, are represented in the samples by sparse charcoal fragments of *Fraxinus angustifolia* (ash). The Guadiana valley slopes were covered by sclerophyllous vegetation types, probably represented by the presence of *Quercus ilex* subsp. *ballota* (holly-oak), *Q. faginea* (portuguese-oak), *Q. coccifera* (kermes-oak) and *Q. suber* (cork-oak), *Olea europaea* (most probably wild olive-tree) and one Rosaceae (cf. *Pyrus*). Probably on the interfluves, with poorer acid soils, stone-pine formations were present, as testified by the frequent presence of *Pinus pinea* wood and cone scales.

The occurrence of *Vicia faba* var. *minuta* seeds suggests its cultivation. On the other hand, the wood types more abundant in the anthracological spectra correspond to tree species with edible fruits: stone-pine, holly-oak and olive-tree. Although these trees were probably part of the natural vegetation at that time, they could also have had a prominent role in the human diet, perhaps also being selectively maintained.

The anthracological spectra identified at Porto das Carretas suggest a palaeovegetation mosaic compatible with a Mediterranean type of climate, probably not much different from the present-day theoretical schematic biogeographic zonation proposed for the region. Although palaeoecological and archaeobotanical studies in the region are not abundant, nearby palynological and anthracological studies suggest the existence of environmental change since the 3rd millennium cal BC (4360±50 BP). The local

anthracological signal of such changes is the increasing relevance of *Q. ilex*, *Olea europaea* and *Pistacia lentiscus*, while *Q. faginea* and *Q. suber* became more sporadic (Espino, 2004). This change is considered both anthropogenic and natural, as humidity seems to have decreased while temperatures rose. In the Portuguese southwest coast, on the other hand, palynological investigations suggest a drier climatic phase for the Late Chalcolithic, although a temperature signal is not clearly revealed from the data (Mateus and Queiroz, 2000).

The charcoal data from Proto das Carretas is not different from data obtain in other sites, but one must argue its suitability to validate palaeoenvironmental hypotheses. The sclerophylly of the vegetation testifies to a response to humidity-stress and does not correlate directly to temperature. Besides, the data refer just to the occurrence of species and does not give information about vegetational trends which could be correlated to climatic shifts. To achieve palaeoecological and palaeoenvironmental reconstructions we must have sustainable data from time-series with a suitable significant quantitative approach to address the issue of the relative spatial shifts of the main Mediterranean vegetation domains in the region.

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