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ORIGINAL ARTICLE

# Plant macrofossils from the Roman settlement of Terronha de Pinhovelo, northwest Iberia

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**Abstract** Several samples were collected during the archaeological excavations at the proto-historic and Roman settlement of Terronha de Pinhovelo, northeast Portugal, in order to obtain plant macrofossils. The relevant archaeobotanical data gathered from the Roman structures of Sector B at the site allow a further understanding of the settlement and its community's daily life between the 4th and 5th centuries A.D. In the charcoal analysis, the main types recovered were *Pinus pinaster*, *Quercus pyrenaica* type, *Q. faginea* type, *Q. suber* type, *Arbutus unedo* and *Fraxinus angustifolia*. The shrubs, significantly less abundant in the samples, were represented by *Cistus* sp., Leguminosae and *Erica* spp. It must be stressed that the samples were taken from well-delimited domestic hearths and the botanical remains result from specific choices of firewood in short episodes of time, and therefore not the most appropriate for palaeoecological approaches, which usually cover a longer time span. The cereals are the most frequent group of plants represented in the fruit and seed assemblages. *Triticum aestivum/durum*, *T. compactum*, *T. spelta* and *Hordeum vulgare* were the dominant crops, followed by *T. dicoccum* and *Panicum miliaceum*. The only pulse identified was *Vicia faba* var. *minor*, in quite abundant quantity although it came almost exclusively from just one hearth. Two of the compartments sampled seem to be directly connected to plant processing, but the presence together of several plant taxa in the domestic structures makes their understanding quite difficult. These palaeoeconomic data are consistent with the records already available for northwest Iberia, and are significantly representative of a regular Romanised rural community.

**Keywords** Plant remains · Domestic hearth · Late Roman Empire · Northwest Iberia

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## Introduction

During the last decade, much archaeobotanical data has been collected and several regional studies have been made in northwest Iberia. However, they were mostly palynological studies which allowed the delineation of palaeoclimatic and palaeoecological models in regional approaches (Muñoz Sobrino et al. 2004, 2005). Unfortunately, these results have not been matched by an increase in the study of past land use from the macrofossil record.

In fact, archaeobotanical studies in northwest Iberia have been few and do not tend to deal with historical contexts. There seems to be a great contrast between the significant data available for what is assumed to be the Castros Culture, and the lack of assemblages attributed to the Roman period. In the syntheses available, the Castros Culture tends to be presented as a homogeneous cultural period generally identified as the Iron Age or proto-history, not often distinguishing the Roman phases that have been identified in the fortified settlements (Rodriguez Lopez et al. 1993). Therefore, it is frequently impossible to determine whether the plant remains come from proto-historic or Roman levels, generally between the first and second centuries A.D., where some novelties could already have been incorporated.

It must be added that most data result from sporadic recoveries, since only a little systematic field work has taken place in order to obtain significant plant remains from archaeological contexts.

Still, the existing data seem to support a perspective of continuity between the proto-historic and Roman agricultural choices (Ramil-Rego et al. 1996; Ramil-Rego 1993; Rodriguez Lopez et al. 1993). Nevertheless, in northeast Portugal, an area which somehow contrasts archaeologically and culturally with the typical Castros area, little archaeological work has been done and, until the present study, no archaeobotanical data from the Roman period have been available.

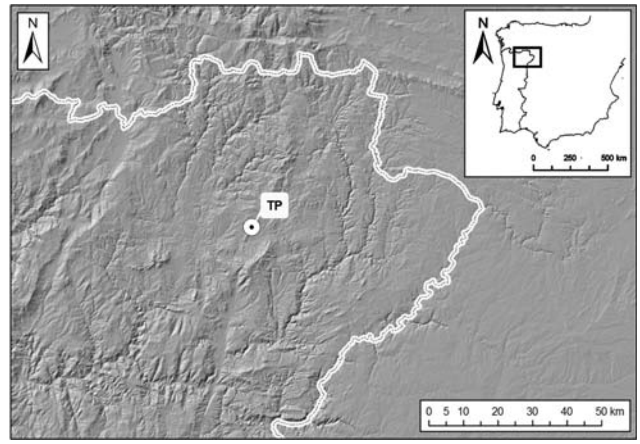

**Fig. 1** Location of Terronha de Pinhovelo

Terronha de Pinhovelo and the Zoelae

The present paper is a result of two excavation campaigns that took place between 2005 and 2006 in Terronha de Pinhovelo, Macedo de Cavaleiros, northeast Portugal (Fig. 1). The archaeological work was promoted by Associação Terras Quentes, and was co-directed by the author, Helena Barranhão, Lúcia Miguel and Carlos Mendes.

Terronha de Pinhovelo is a 3–4 ha hillfort settlement which was inhabited from the Iron Age until the fourth-fifth centuries A.D. In Roman times this settlement was part of the *Civitas Zoelarum*, in the *Conventus Asturum*. The Zoelae, the ethnic group which inhabited the region, are mentioned by several classical authors and their presence in the area is attested by epigraphic information (Redendor 2002). Although it seems clear from the existing data that they were fully integrated in the political, social and economic aspects of Roman life, the Zoelae territory, which included most of the current District of Bragança in northeast Portugal and the western part of the Spanish Province of Zamora, was a rural and peripheral region in the Roman Empire. It was noticeably distant from important urban stimulus, which makes it highly probable that the daily economy of these communities was markedly dependent on agriculture and grazing, somewhat complemented by minor commercial trade (Tereso 2007a, b, 2008a, b). Regionally, mining was certainly a very important economic activity, one which determined several aspects of the Roman presence in the territory, such as the location of the roads network and the establishment of certain settlements (Lemos 1993).

Although the earlier occupation phases of Terronha de Pinhovelo during the Iron Age and early Empire periods are still relatively poorly known in the current state of the project, several features attributed to the late Roman Empire were stratigraphically identified, namely in Sector B (Barranhão and Tereso 2006; Tereso 2008b). The typological study of the *Terra Sigillata* pottery, almost exclusively late Hispanic (Silva 2007), has allowed the attribution of this sector's Phases 3 and 4 to sequential moments between the third and the fifth centuries A.D. Both phases are mainly characterized by readjustments and renewals in space organization, and can be briefly summarized as follows (see plan in Fig. 2):

Phase III—a new and large compartment (Area II) was built in the central area of this sector with a small domestic hearth, a bed of small schist slabs with a well-levelled layer of burnt clay on top. 8 m to the North, in another compartment (Area V), a rectangular structure was built in one of its corners (1.10 m × 0.64 m). This structure is 0.5 m deep and has *opus signinum* on the bottom (Area IV).

Phase IV—a new compartment was built in the interior of the previously described one (Area II), and partly above the hearth mentioned before. This new compartment (Area I) had a line of three hearths. One of them consisted of a rectangular area paved with schist and quartz slabs with some traces of clay still visible between the slabs; the second was an area defined by two stone alignments and the third one, next to one of the alignments, had an irregular and elongated area paved with small schist and quartz stones which also had some traces of clay in between them. In the north area, the compartment and the structure described above were still in use, while at the eastern limit of the sector a large feature interface with clear evidence of fire was delimited.

## Materials and methods

The archaeological excavations followed the stratigraphical principles defined by Harris (1989), and the sampling strategy was based on the models defined by Martínez et al. (2003), Badal et al. (2003) and Buxó (1997). All of the sediments from the well-defined domestic hearths (units 63,

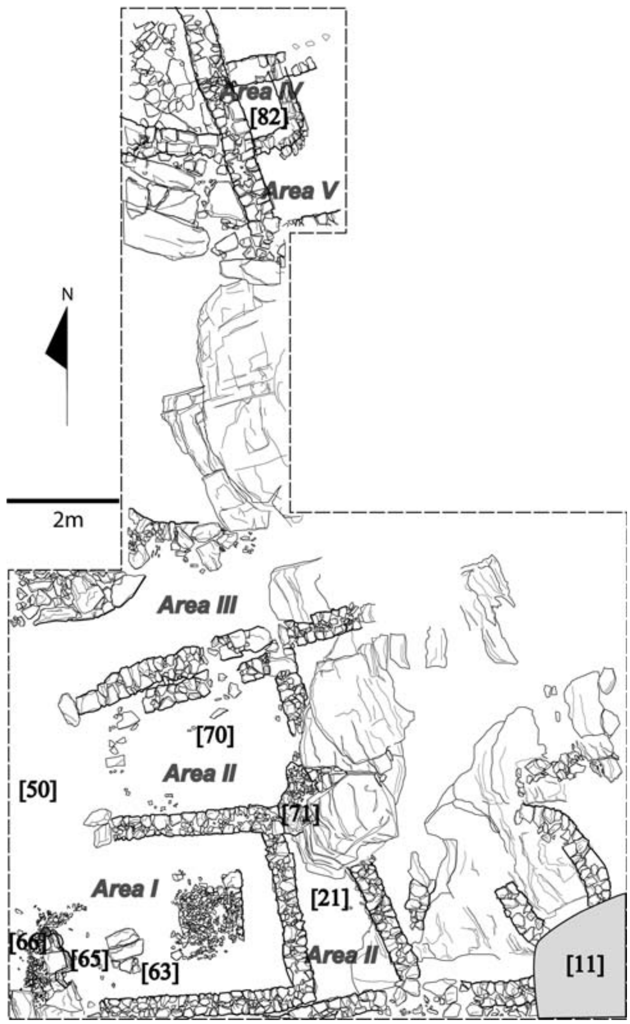


**Fig. 2** Archaeological plan of Sector B showing the position of the sampled contexts (adapted from an original illustration of Helena Barranhão)

65, 66 and 71—see amounts in Table 1) were collected, while some random samples were taken from sediments with the visible presence of macrofossils. In some contexts with no obvious presence of archaeobotanical material, test-sampling was carried out in order to confirm its absence.

At the same time, some macrofossils were picked out by hand during the excavation. All the non-floated sediments were dry-sieved during the field work.

Due to the large amount of sediment recovered, sub-sampling had to be done in the laboratory (see Table 1). Therefore, depending on the total amount of archaeological sediment, sub-samples were taken for the water hand flotation and the subsequent bulk sieving with 2, 1, 0.5 and 0.25 mm meshes.

Figure 2 shows an archaeological plan with the position of the sampled contexts. They are named according to the number of their units of stratification, and they all belong to the fourth Occupation Phase of Sector B dating from the fourth/fifth century A.D. The origins of the samples and their archaeological contexts are as follows:

Samples from Area I:

- [63] was near the paved hearth and was fully recovered;
- [65] and [66] represent the second and third domestic hearths mentioned above, and both sediments were fully recovered;
- [20] is a abandonment level, the samples taken were directly associated with [65];
- [3] is a dispersed layer, but the samples studied were taken during the definition of [66], and were directly associated with this hearth.

Samples from Area II:

- [71] represents this compartment's hearth. It was all sampled;
- [22] was collected during the definition of the hearth [71];
- [70] and [21] are deposits dispersed inside the compartment. [70] was in the central part, and [21] in the eastern part. Random samples of both were taken.

Sample from Area IV:

- [82] is an abandonment level inside this rectangular structure. Only one sample was studied.

Samples taken outside the compartments:

- [11] is the deposit which filled the large feature interface in the south-eastern corner of Sector B, as mentioned above. Random samples were taken;
- [50] is a deposit in front of Area II.

## Botanical identification

The analysis of the charred material was done in the Laboratory of Palaeoecology and Archaeobotany of

**Table 1** Sediment studied from each context

| Unit of stratification | Total sediment (kg) | Samples studied (kg) |
|---|---|---|
| 3 | – | 9 |
| 11 | – | 2 |
| 20 | – | 10 |
| 21 | – | 4 |
| 22 | – | 2 |
| 50 | – | 2 |
| 63 | 9.1 | 2 |
| 65 | 84.52 | 12 |
| 66 | 66.29 | 6 |
| 70 | – | 6 |
| 71 | 4.95 | 2 |
| 82 | – | 1 |

IGESPAR (formerly IPA) in Lisbon, with the supervision of Dr. Paula Queiroz.

The charcoal pieces from the 2 mm mesh were hand sectioned according to the three diagnostic sections, transverse, radial and tangential, which were observed using a reflected light microscope. The identification of the taxa was achieved through comparisons with the reference collection of the laboratory, wood atlases (Schweingruber 1990; Vernet et al. 2001) and specific studies for the identification of the genera *Quercus* (Van Leeuwarden in preparation) and *Erica* (Queiroz and Van der Burgh 1989).

The morphological types identified in the charcoal analysis illustrate the selection of certain types for firewood by the Romanized communities. Therefore, the obtained results reflect both this choice of what firewood was being gathered, as well as the presence of certain vegetation types around the settlement.

Nevertheless, the small amount of charcoal analysed coupled with the difficulty in distinguishing different *Quercus* species constrains further considerations.

In fact because of the difficulty in distinguishing *Quercus* species from the morphology of the xylem, usually deciduous species are gathered into one morphological type, while *Q. suber* type and sometimes also *Q. ilex* type are usually distinguished from the general *Quercus* evergreen type (Figueiral and Sanches 2003; Figueiral 1996). Still, there have been some attempts to reach more accurate morphological ascriptions (Vernet et al. 2001; Van Leeuwarden, in preparation).

During the laboratory work, five morphological types were recognised, but the traditional deciduous/evergreen distinction model has been used for cases that pose more uncertainty. These types reflect the identification of several specific patterns in the distribution of the vessels and their sizes in transverse section, and the characteristics of their growth rings.

- *Quercus coccifera*: Diffuse-porous; pores infrequent, arranged in a radial or diagonal pattern. Large rays infrequent.
- *Quercus ilex:* Diffuse-porous; pores frequent, arranged in a radial pattern. Large rays frequent.
- *Quercus faginea:* Ring-porous; 3–4 lines of pores diminishing in size, disposed in an approximately triangular pattern in the beginning of the growth ring, forming a discontinuous ring. Transition from earlywood to latewood is mostly gradual.
- *Quercus pyrenaica:* Ring-porous; earlywood with one, rarely two, lines of big pores. Latewood pores in radial dendritic groups. Abrupt reduction in pore size between earlywood and latewood.
- *Quercus suber*: Semi-ring to ring-porous; pores in earlywood sometimes arranged in small dendritic groups with two to four big pores at the beginning of the growth ring; pores infrequent, arranged in long radial or diagonal lines.

Each morphotype was named according to the species which most resembled it, by comparison with the reference collections and anatomical atlases (Fig. 5). It is thus assumed that each charcoal assigned to one morphotype is likely to belong to the species of that name.

The fruits and seeds were observed using a stereoscopic microscope and identified by comparisons with the laboratory's reference collection and atlases (Berggren 1981). The identification of cereals followed essentially S. Jacomet's criteria (Jacomet 2006), complemented by several other studies, namely Renfrew (1973), Buxó (1997), Murphy (1989) and Van der Veen (1987). The nomenclature used was the one proposed by Zohary and Hopf (2000), incorporating some changes from other archaeobotanical studies and manuals (Buxo 1997; Jacomet 2006). Abbreviation forms of the morphological types were employed to simplify the text:

- *Hordeum vulgare*: *H. vulgare* L. ssp. *vulgare*
- *Triticum aestivum*: it matches Buxó's *T. aestivum/durum* (Buxó 1997) and it includes *T. aestivum* ssp. *vulgare* (Vill) Mackey, *T. turgidum* conv. *durum* (Desf.) Mackey, and *T. turgidum* conv. *turgidum* (L.) Mackey
- *Triticum compactum*: it matches Buxó's *T. aestivum/durum* type *compactum* (Buxó 1997) and Jacomet's *T. nudum* "short stubby grains" (Jacomet 2006). This designation refers to grains with a particular form—short and roundish—rather than a different subspecies.
- *Triticum dicoccum*: *T. turgidum* L. ssp. *dicoccum* (Schrank) Thell.
- *Triticum monococcum*: *T. monococcum* L. ssp. *monococcum*
- *Triticum spelta*: *T. aestivum* ssp. *spelta* (L.) Thell.

## Results

### Charcoal analysis

We present here the results from the charcoal analysis and considerations concerning the significance of some morphological types. Since few charcoal fragments were recovered and analysed, we chose to present the data in absolute amounts, with no percentage calculations (Table 2). Therefore, the differences in the total weight of sediment analysed in each context have to be taken into account.

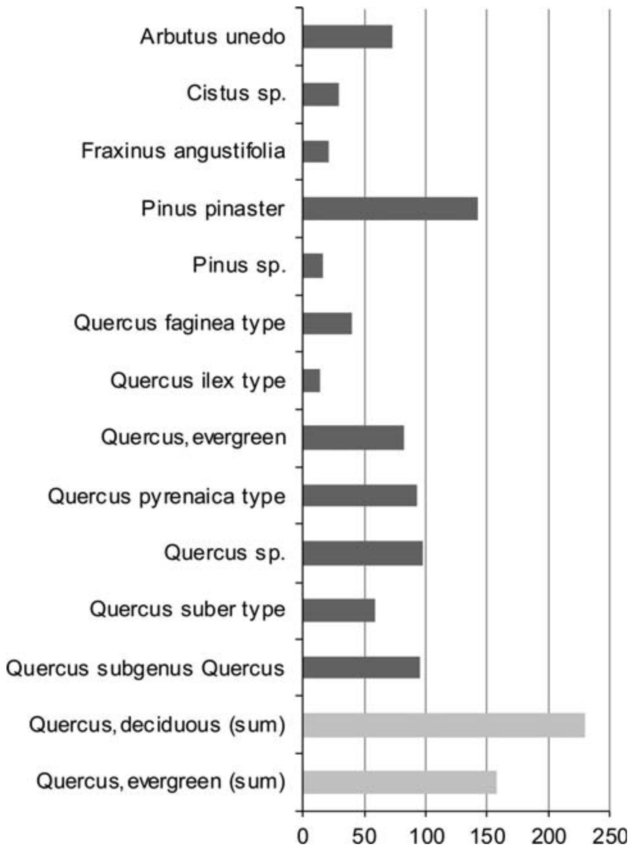


**Fig. 3** Representation of charcoal types with more than ten fragments

A total of 17 taxa were identified from charcoal, but no pattern of spatial distribution of the taxa on the site has been identified. There is a clear predominance of *Quercus* spp., *Pinus pinaster*, *Arbutus unedo* and *Cistus* sp. (Fig. 3). Other taxa, such as *Erica* spp. and shrubby Leguminosae, are less significant in the studied samples. In fact, although several vegetation types are represented in the charcoal record, most taxa come from the deciduous oak woods and the evergreen wood types of vegetation (Fig. 4).

*Pinus pinaster* appears in Table 2 included with the deciduous oak wood vegetation type because this was observed in the site's surroundings, where sub-spontaneous maritime pine appears in recovering *Q. pyrenaica* and *Q. faginea* vegetation formations. Nevertheless, one cannot exclude the possibility that some pine formations may have existed in the area.

Besides *Quercus* subgenus *Quercus* and evergreen *Quercus*, five other *Quercus* morphotypes were identified: *Quercus coccifera, Q. ilex, Q. suber, Q. faginea* and *Q. pyrenaica* (Fig. 5). *Q. coccifera* is not present in the area nowadays since it is characteristic of southern and coastal areas. Due to its wood anatomical resemblances one may suggest the possibility that the only two *Q. coccifera* fragments identified belong in fact to *Q. suber*. The main feature used to distinguish the two morphotypes is the existence in cork oak wood of a semi-porous zone in the beginning of the growth ring, but this is not always clearly visible (Vernet et al. 2001).

Among the deciduous taxa, the absence of *Q. robur* from the area and the fact that it is usually associated with Eurosiberian, rather than Mediterranean areas, makes it more likely that *Q. pyrenaica* type actually represents this charcoal type, since typical *Q. faginea* and *Q. pyrenaica* are easily distinguished by their wood anatomy. Moreover, *Q. pyrenaica* type from Terronha de Pinhovelo is similar to that described by I. Figueiral (1990) when trying to distinguish this from typical *Q. robur*.

## Seed study

Seeds from domestic and wild plants were recovered. Domestic crops, cereals and pulses, are the most common seed remains in the archaeological contexts studied. The results are presented here.

### *Cereals*

Caryopses and chaff from several cereal species were found in the same Roman structures, causing some difficulties in interpreting the data and raising some questions about the morphological and biometric criteria used in this study. The general results are presented in Table 3.

Although *Triticum* is slightly predominant, there is not a great difference between the amounts of hulled and naked varieties.

The presence together of grain and chaff of hulled and naked wheats in the same archaeological context, especially the domestic hearths, shows a complex scenario, since it is well known that naked and hulled cereals need different processing techniques. One can suggest the possibility that the results were flawed due to some overlapping of the morphological and biometric criteria used in the identification of the grains. In fact, several studies have pointed out the great difficulties in distinguishing different *Triticum* species by the morphology of their caryopses (Jacomet 2006). In addition, the charring tends to make caryopses which are already quite similar while fresh look more alike when charred (Braadbaart 2008).

The biometric study was not very conclusive (Tereso 2007a). Although only the few *T. monococcum* fully measurable caryopses seem to be well distinguishable from the rest, the fact is that there seems to be a great resemblance between the morphotypes *T. dicoccum* and *T. spelta*, and also between *T. aestivum/durum* and *T. dicoccum*. These latter were recently the subject of a thorough laboratory study by Braadbaart (2008) which concluded that despite the great morphological variability of both species,

**Table 2** Charcoal types recovered from Terronha de Pinhovelo

| Morphotype | Area I | | | | | Area II | | | | Area IV | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | [3] | [20] | [63] | [65] | [66] | [21] | [22] | [70] | [71] | [82] | [11] | [50] | Sum |
| Deciduous oak woodland | | | | | | | | | | | | | |
| *Pinus pinaster* | 9 | 13 | | 12 | 18 | 31 | 3 | 37 | 13 | 2 | 2 | 3 | 143 |
| *Pinus* sp. | 3 | | | 1 | | 3 | | 7 | 2 | 1 | | | 17 |
| *Quercus faginea* type | 1 | 2 | | 2 | 1 | 15 | 2 | 9 | | 2 | 6 | | 40 |
| *Quercus pyrenaica* type | 7 | 11 | | 29 | 5 | 14 | 2 | 1 | 17 | 1 | 7 | | 94 |
| *Quercus* subgenus *Quercus* | 1 | 16 | 1 | 28 | 7 | 20 | 4 | 6 | 3 | 1 | 7 | 1 | 95 |
| *Sorbus* sp. | | | 1 | | | | | | | | | | 1 |
| Evergreen woodland | | | | | | | | | | | | | |
| *Arbutus unedo* | 3 | 8 | | 15 | 2 | 16 | | 1 | 24 | 3 | | | 72 |
| cf. *Arbutus unedo* | 1 | | | 1 | | | | | | | | | 2 |
| *Quercus coccifera* type | | | | | | | | | | | 2 | | 2 |
| *Quercus ilex* type | | 3 | | | | | 1 | | | 2 | 8 | | 14 |
| *Quercus*, evergreen | 7 | 10 | 2 | 3 | 12 | 7 | 2 | 14 | 1 | 6 | 10 | 9 | 83 |
| *Quercus suber* type | 2 | 5 | 1 | | 1 | 8 | | 24 | 3 | 3 | 7 | 5 | 59 |
| Scrub | | | | | | | | | | | | | |
| *Cistus* sp. | | 3 | | 14 | 2 | 2 | | | 6 | | 2 | | 29 |
| cf. *Cistus* sp. | | | 3 | 4 | 1 | 13 | 2 | 7 | 8 | 6 | 2 | | 46 |
| *Cytisus/Genista/Ulex* | | | 1 | | | 4 | | | | 2 | 1 | | 8 |
| *Erica australis/arborea* | | 2 | | 1 | | 2 | | 1 | | 2 | 2 | | 10 |
| *Erica scoparia/umbellata* | | | | 1 | 1 | 5 | | | | 1 | 1 | | 9 |
| *Erica* sp. | | | | | 1 | | | 1 | | | 1 | | 3 |
| cf. *Erica* sp. | 1 | 1 | | | | 8 | | 1 | | | | | 11 |
| Riverside vegetation | | | | | | | | | | | | | |
| *Alnus glutinosa* | | 1 | | | | | | | | | | | 1 |
| *Corylus avellana* | | 1 | | | | | | | | | | | 1 |
| *Fraxinus angustifolia* | 1 | 3 | | 2 | | 1 | 1 | 11 | 1 | | 1 | | 21 |
| cf. *Fraxinus angustifolia* | 1 | | | | 2 | | | | | | 1 | | 4 |
| *Ulmus minor* | 2 | | | | | | | | 2 | | | | 4 |
| Cultivated | | | | | | | | | | | | | |
| cf. *Juglans regia* | | | | | | | | | | 1 | | | 1 |
| *Quercus* sp. | 20 | 24 | 7 | 43 | 10 | 18 | 12 | 14 | 3 | 4 | 10 | 4 | 169 |
| Bark | | | | | | 2 | | | | 1 | 2 | | 5 |
| Dicotyledon | 3 | 2 | | | | 5 | 3 | 1 | | 2 | 1 | | 17 |
| Undetermined | 8 | 5 | 1 | 10 | 17 | 17 | 1 | 7 | 16 | 10 | 11 | 3 | 106 |
| Sum | 70 | 110 | 17 | 166 | 80 | 191 | 33 | 142 | 99 | 50 | 84 | 25 | 1,067 |

the 100 L/W measurements of assemblages with a minimum of 30 grains can be used to achieve fairly reliable distinctions. Braadbaart's 100 L/W values for *T. dicoccum* vary from 155 to 290, never reaching lower values even with increasing temperatures of charring, while in samples from Terronha de Pinhovelo, emmer varies from 167 to 205 (Mode 179) (Braadbaart 2008, Fig. 2). In Terronha de Pinhovelo 100 L/W from *T. aestivum/durum* varies from 152 to 171 (Mode 160), in contrast to a variation of 100–170 in Braadbaart's experience. This can question our *T. aestivum/durum* caryopsis classifications but not the presence of naked wheat in the samples, since *T. compactum* 100 L/W values in Terronha de Pinhovelo vary from 115 to 154 (Mode 146), making very unlikely the possibility of being, in fact, emmer. They must be *T. aestivum/durum* grains, as defined by Braadbaart (2008), whether from its *T. compactum* morphotype or not.

In sum, even though some overlapping may have occurred, the caryopses of *T. compactum* are unlikely to be mistaken for those of the hulled species, due to its specific morphological and biometric features, hence showing the presence of naked wheat in the samples. On the other hand,

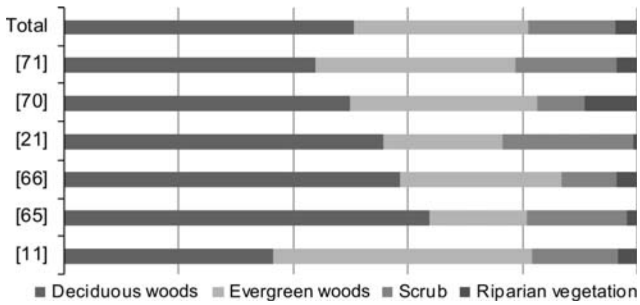


**Fig. 4** Percentage of each vegetation type in the structures and occupation levels

the chaff demonstrates the presence of well identified hulled wheat varieties. Therefore it is almost certain that both hulled and naked cereals were present in the domestic hearths.

The complexity of the two major hearths is also indicated by other data, such as the general equilibrium between the amount of hulled and naked varieties found in each, as well as the presence of hulled barley and millet in both and horse bean in one of the hearths of Area I.

Among the naked wheats, there is a notable preponderance of *Triticum aestivum/durum*, closely followed by *T. compactum* (Fig. 6). The scenario with the hulled wheats is more complex, since three caryopsis morphotypes were identified. *T. dicoccum* is the most abundant, followed by *T. spelta*. The presence of *T. monococcum* is residual, since only three caryopses were found.

However, considering the differentiation between emmer and spelt, we need to take into account the well known difficulties already stressed by Jacomet (2006). This author suggests the impossibility of distinguishing these two wheat varieties by the morphology of their caryopses when spelt grains are charred inside the spikelets. This may have occurred in Terronha de Pinhovelo, as suggested by the spikelet bases and glumes, and also some grains still inside the spikelets which were found in the hearths. The chaff identification is quite distinct from that of the caryopses, since spelt was evidently more frequent than emmer in every context, particularly in the hearths from Area I and the deposits to which they are related (see Table 4).

Therefore it is highly probable that the overlapping between the morphological and biometric criteria from

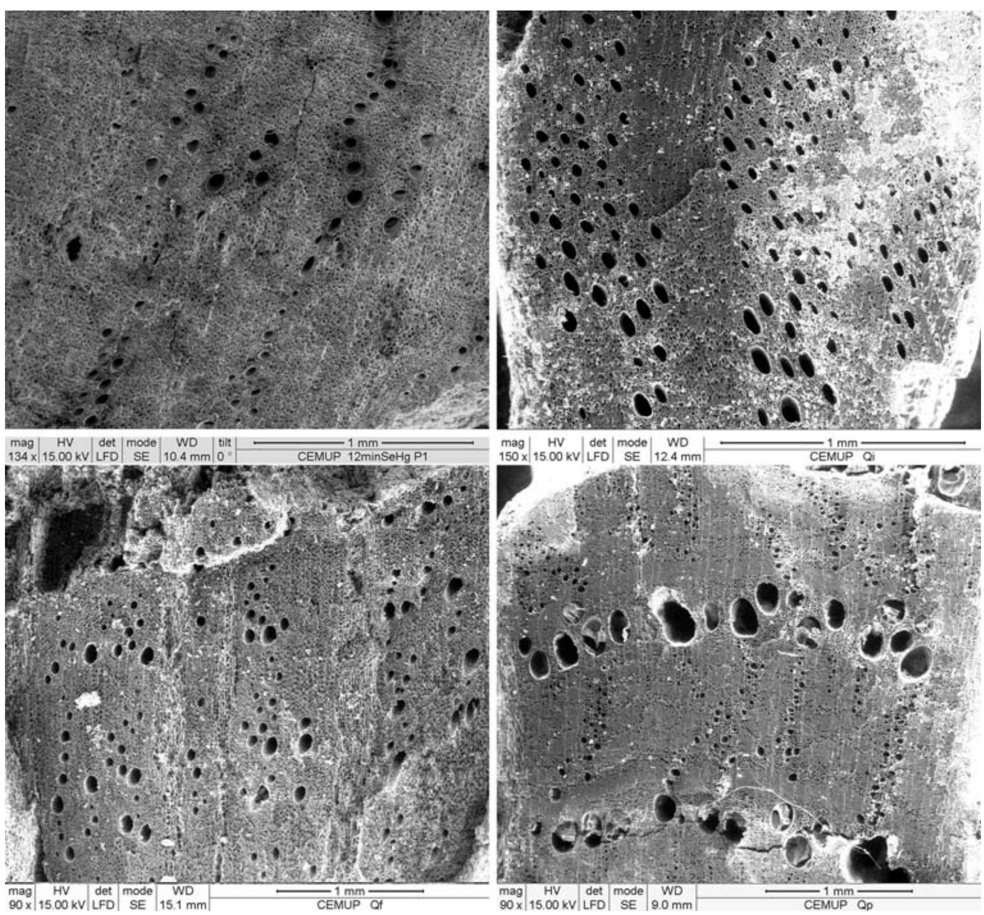


**Fig. 5** Transverse sections of *Quercus* morphotypes: *Q. suber* (above, *left*), *Q. ilex* (above, *right*), *Q. faginea* (below, *left*), *Q. pyrenaica* (below, *right*)

**Table 3** Seed data: caryopses and seeds from cultivated plants

| Morphotype | Area I | | | | | | | | | | | | Area II | | | | | | | Area IV | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | [3] | | [20] | | [65] | | | [66] | | | [21] | | [22] | | [70] | | [71] | | | [82] | | [50] | |
| | Obs. | kg | Obs. | kg | Obs. | kg | Poten. | Obs. | kg | Poten. | Obs. | kg | Obs. | kg | Obs. | kg | Obs. | kg | Poten. | Obs. | kg | Obs. | kg |
| *Triticum monococcum* | | | | | | | | 1 | 0.2 | 11 | | | 2 | 1 | | | | | | | | | |
| *T. dicoccum* | 28 | 3.1 | 17 | 1.7 | 31.0 | 2.6 | 218.3 | 25 | 4.2 | 276.2 | 8 | 2 | | | 8 | 1.3 | 2 | 1 | 5 | | | | |
| *T.* cf. *dicoccum* | 1 | 0.1 | | | 6.0 | 0.5 | 42.3 | 2 | 0.3 | 22.1 | | | | | | | 1 | 0.5 | 2.5 | | | | |
| *T. dicoccum/aestivum* | 1 | 0.1 | | | 4.0 | 0.3 | 28.2 | 6 | 1 | 66.3 | | | | | | | | | | 1 | 1 | 1 | 0.5 |
| *T. dicoccum/spelta* | 1 | 0.1 | | | | | | 4 | 0.7 | 44.2 | 1 | 0.3 | | | | | | | | | | | |
| *T. spelta* | 1 | 0.1 | 2 | 0.2 | 4.0 | 0.3 | 28.2 | 4 | 0.7 | 44.2 | | | | | 3 | 0.5 | 1 | 0.5 | 2.5 | | | | |
| *T.* cf. *spelta* | | | | | 1.0 | 0.1 | 7 | | | | | | | | | | | | | | | | |
| *T. aestivum/durum* | 24 | 2.7 | 10 | 1 | 24.0 | 2.0 | 169 | 20 | 3.3 | 221.0 | 1 | 0.3 | 1 | 0.5 | 7 | 1.2 | 1 | 0.5 | 2.5 | | | | |
| *T.* cf. *aestivum/durum* | 1 | 0.1 | 1 | 0.1 | 1.0 | 0.1 | 7 | 3 | 0.5 | 33.1 | | | | | 1 | 0.2 | | | | | | | |
| *T. aestivum/durum/compactum* | | | | | 2.0 | 0.2 | 14.1 | | | | | | | | | | | | | | | | |
| *T. compactum* | 14 | 1.6 | 6 | 0.6 | 16.0 | 1.3 | 112.7 | 10 | 1.7 | 110.5 | 8 | 2 | | | 6 | 1 | 1 | 0.5 | 2.5 | | | | |
| *T.* cf. *compactum* | | | | | 1.0 | 0.1 | 7 | 1 | 0.2 | 11.0 | | | | | | | | | | | | | |
| *Triticum* sp. | 57 | 6.3 | 14 | 1.4 | 21.0 | 1.8 | 147.9 | 55 | 9.2 | 607.7 | 2 | 0.5 | | | 15 | 2.5 | 4 | 2 | 9.9 | 2 | 2 | 4 | 2 |
| *H. vulgare* | 14 | 1.6 | 19 | 1.9 | 44.0 | 3.7 | 309.9 | 8 | 1.3 | 88.4 | 22 | 5.5 | 3 | 1.5 | 26 | 4.3 | 4 | 2 | 9.9 | 2 | 2 | 4 | 2 |
| *Hordeum* sp. | | | | | | | | 1 | 0.2 | 11 | 1 | 0.3 | | | | | | | | | | 2 | 1 |
| *Panicum miliaceum* | | | | | 1.0 | 0.1 | 7 | 1 | 0.2 | 11 | 1 | 0.3 | 1 | 0.5 | 2 | 0.3 | 2 | 1 | 5 | 2 | 2 | | |
| *Setaria italica* | | | | | 1.0 | 0.1 | 7 | | | | | | | | | | | | | | | | |
| Caryopses, unidentified | | | | | 2.0 | 0.2 | 14.1 | 1 | 0.2 | 11 | | | | | | | | | | | | | |
| *Vicia faba* var. *minor* | 1 | 0.1 | 8 | 0.8 | 47.0 | 3.9 | 331 | | | | 2 | 0.5 | | | 1 | 0.2 | | | | | | | |
| Total caryopses/seeds | 143 | 15.9 | 77 | 7.7 | 206.0 | 17.2 | 1450.9 | 142 | 23.7 | 1568.9 | 46 | 11.5 | 7 | 3.5 | 69 | 11.5 | 16 | 8 | 39.6 | 7 | 7 | 11 | 5.5 |

*Obs* observed numbers of remains found in the sub-samples, *kg* remains per kg, *poten* potential quantities of remains in the well delimited contexts


**Fig. 6** Grains of *Triticum aestivum/durum* (*left*) and *Hordeum vulgare* (*right*)

emmer and spelt has led to an overrepresentation of *T. dicoccum*, when, in fact, spelt was the most frequent hulled wheat in the samples. A similar situation has led to the same conclusions in the study of Cortaillod/Sur les Rochettes-est, in Switzerland by Akeret (2005).

Concerning barley, only the hulled variety was identified. It has greater importance than wheat in Area II and it is the most abundant cereal in hearth [65] from Area I (see Table 3). In fact, in the total amount of samples studied from Terronha de Pinhovelo, only the emmer/spelt grains are more abundant than those of barley. Only one barley rachis fragment was found in the samples, in hearth [66].

Few millet grains were found. Although ten grains were identified as *Panicum miliaceum* (broomcorn millet), only one grain was considered to be *Setaria italica* (Italian millet). Still, millet is always uncommon in the contexts where it is found (see Table 3).

### *Pulses*

The only pulse identified in the assemblages was *Vicia faba* var. *minor* (see Table 3; Fig. 7). It was found in five units of stratification, although it seems clear that its main association was with one of the hearths in Area I. In fact, 91.5% of the horse beans collected were found in deposits [65] and [20], where they were more abundant than any other species. In Area II only three horse beans were found scattered throughout the compartment.

### *Wild plants*

Wild plant remains were found, although there were no significant concentrations in any of the particular contexts under analysis. The results are presented in Table 5. Due to the small number of remains, we present the raw data, instead of presenting numbers according to weight of sediment. Therefore, as in the charcoal analysis, the differences in the total weights of sediment analysed in each context have to be taken into account.

The more frequent taxa and also the ones which appear in more contexts are *Portulaca oleracea* and cf. *Lolium* sp. *P. oleracea* is characteristic of ruderal contexts and gardens; *Lolium* sp., as well as *Polygonum aviculare* are ordinary weeds which are common in cereal fields.

One damaged seed of *Brassica* sp. may suggest its cultivation; however one cannot exclude the possibility that it belongs to a wild plant, as *B. barrelieri* is common in the area (Aguiar 2001). Although the seed size points to a cultivated crop, more and better preserved seeds would be necessary to be sure.

The identification of several acorns indicates the collection and use as food of *Quercus*, a reality clearly regular in all northwest Iberia during proto-historic and Roman times (Ramil-Rego et al. 1996). All the acorns were found in Area II and, although they were not very abundant, it must be stressed that in context [22] an addition of 26 acorn fragments, not mentioned in Table 5, were hand-picked during excavation.

## Discussion

### The archaeological contexts

The macrofossils studied were mainly recovered from Areas I and II, where four hearths were found, three of them with visible plant remains. The structures that had the most abundant remains were the two hearths in Area I. Considering these structures, we can point out significant differences between both, namely:

- In [65] horse bean is the more abundant species, and barley is the most frequent cereal, followed by emmer/spelt; naked wheat is also common.

**Table 4** Chaff recovered from Terronha de Pinhovelo

| | | Area I | | | | | | | | | | | | | Area II | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | [3] | | [20] | | 63 | | [65] | | | [66] | | | [21] | | [70] | | [71] | | | [50] | |
| | | Obs. | kg | Obs. | kg | Obs. | kg | Obs. | kg | Poten. | Obs. | kg | Poten. | Obs. | kg | Obs. | kg | Obs. | kg | Poten. | Obs. | kg |
| *T. monococcum* | Fork | | | | | | | 1 | 0.1 | 7 | 2 | 0.3 | 22.1 | | | | | | | | | |
| *T. dicoccum* | Glume base | 2 | 0.2 | | | | | 1 | 0.1 | 7 | 2 | 0.3 | 22.1 | 2 | 0.5 | 1 | 0.2 | | | | 1 | 0.5 |
| | Fork | | | | | | | 2 | 0.2 | 14.1 | | | | | | | | | | | | |
| *T. spelta* | Glume base | 12 | 1.3 | 8 | 0.8 | | | 13 | 1.1 | 91.6 | 18 | 3 | 198.9 | 4 | 1 | 4 | 0.7 | 1 | 0.5 | 2.5 | | |
| | Fork | 1 | 0.1 | 4 | 0.4 | | | 3 | 0.3 | 21.1 | 6 | 1 | 66.3 | | | | | | | | 1 | 0.5 |
| Dubious | Fork | | | | | | | 2 | 0.2 | 14.1 | 7 | 1.2 | 77.3 | 2 | 0.5 | 1 | 0.2 | 1 | 0.5 | 2.5 | | |
| | Glume base | 2 | 0.2 | | | 1 | 0.5 | 3 | 0.3 | 21.1 | 8 | 1.3 | 88.4 | 3 | 0.8 | 1 | 0.2 | 1 | 0.5 | 2.5 | | |

*Obs* observed number of remains found in the sub-samples, *kg* remains per kg, *Poten* potential quantities of remains in the well delimited contexts

- In [66], there is no horse bean and barley is a much less abundant cereal—only einkorn is less frequent than barley. Emmer/spelt and *T. aestivum/durum* are quite abundant. One must stress that neither einkorn nor Italian millet were found in the previous hearth [65]. Still, more than 38% of the remains from this structure are damaged wheat grains which could not be identified beyond the genus level.

The presence together of such different plant remains, naked and hulled wheat grains, wheat chaff, barley, millet and horse bean in the same hearths is difficult to explain. It is possible that different activities could have successively taken place in the compartment right before the abandonment of the site. The presence of three hearths and the absence of faunal remains in the same archaeological level suggests that Area I was used for different phases in the processing of plants, some of them prior to cooking, for example the dehusking of hulled wheat. The remains from these activities might have accumulated in that specific place, even though its original function was not directly related to the disposal of waste. The abandonment of the site in the mean time would have prevented the cleaning of the area for future uses, and the stones from the fallen walls would have ended up sealing the plant remains, keeping them in situ until the archaeological excavation. Still, the interpretation of these contexts is made even more difficult since it is not clear why the site was abandoned. The archaeological record does not provide clear signs of a violent ending to this site's latest phase, although these unclean domestic structures may suggest that possibility. One must stress that this phase is chronologically attributed to the 5th century A.D., a time of disturbance and changes in the northwest Iberia, coincident with the arrival of the Suebi.

Area II had only one hearth, with few plant and no faunal remains. The presence of acorns in [71] and mainly in [22] is a distinguishing feature. Still, the other deposits that were excavated in the compartment, [21] and [70] had far more plant macrofossils than the ones found in the hearth. In the deposits outside the hearth, barley grains were clearly the commonest remains.

The other two contexts, a possible storage structure inside of which [82] was excavated, and the feature interface filled with [11] did not provide significant plant remains.

## Economic features

A previous archaeological and regional approach has assumed that this medium-sized settlement at the southern limit of the territory of the Zoelae was probably characterized by a self-sufficient economy based on agriculture,


**Fig. 7** *Vicia faba* var. *minor* (*left*) and *Portulaca oleracea* (*right*)

**Table 5** Fruits and seeds of wild plants found in the samples in absolute amounts; the differences in the total weight of sediment analysed in each context have to be taken into account

| Morphotype | Area I | | | | Area II | | | | Area IV | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | [3] | [66] | [20] | [65] | [21] | [70] | [22] | [71] | [82] | [11] | [50] |
| *Anthemis cotula* | 1 | | | | | | | | | | |
| cf. *Aquilegia* sp. | 1 | | | | | | | | | | |
| *Brassica* sp. | 1 | | | | | | | | | | |
| cf. *Cerastium* sp. | | | | | 1 | | | | | | |
| *Cistus* sp. | | | | | | 1 | | | | | |
| *Erica scoparia,* leaves | | | | | | 3 | | | | | |
| *Erica* sp., leaves | | | | | | 2 | | | | | |
| *Euphorbia helioscopia* type | | | | | | | | | 1 | | |
| Poaceae, unidentified | | | | | | 3 | | | | | |
| cf. *Lolium* sp. | 1 | 4 | 1 | | 1 | 1 | | | 1 | | 1 |
| cf. *Lolium* sp. fragment | | 4 | 2 | | | | | | | | |
| *Polygonum aviculare* | | 1 | | 2 | | 1 | | | | | |
| *Polygonum* sp. (lens shaped) | | | 1 | | | | | | | | |
| *Portulaca oleracea* | 8 | 3 | 6 | 4 | | 1 | | | | | |
| *Quercus* sp., cotyledon fragment | | | | | 5 | | 1 | 1 | | | |
| *Sambucus* cf. *ebulus* | | | | | | | | | 1 | | |
| Fruit, unidentified | | | | | 1 | | | | | | |
| Unidentified | 1 | | | | 1 | 1 | | | 1 | | |
| Unidentified, fragment | 1 | | | | | 1 | 5 | 4 | | 3 | |

grazing and some trade (Tereso 2008b). Although focusing on specific structures such as hearths, we consider that this study is of much relevance for the understanding of the economy of this community. One of the reasons why we focused on hearth structures is due to the fact that the only probable storage structure identified until this moment did not provide significant data.

The analyzed plant macro-remains from Terronha de Pinhovelo show important features about the agricultural choices of the community that inhabited the site in the late Empire period. In general, these features resemble the data available for the Roman period in northwest Iberia (Ramil Rego et al. 1996; Ramil-Rego 1993; Rodríguez Lopez et al. 1993): the cereals, wheat and barley are the more important cultivated plants but the horse bean is also quite relevant; millet assumes a secondary role.

Both hulled and naked wheat varieties were cultivated in the surroundings of the site. It is known that different hulled varieties can be planted in the same fields, since the processes that follow the sowing are similar to both (Peña-Chocarro 1999). The same is not true for the naked varieties that would necessarily have had to be planted elsewhere.

Millet, particularly *Panicum miliaceum*, appears regularly in the settlements of northwest Iberia from protohistoric times (Ramil-Rego 1993). Despite its secondary role, millet may have had some importance as a catch crop sown in springtime, assuming, therefore, a complementary character. The same happened with the collection of acorns for food for humans, roasted or milled and transformed into bread, which is known to have happened from prehistoric to contemporary times (Ramil-Rego 1993; Oliveira et al. 1991; Salgueiro 2005). In fact, in the 20th century acorns were still used sporadically by poor people in times of need.

### Palaeoecological approach

Terronha de Pinhovelo lies in a transition area between a cold mountainous area, considered to be the *Quercus pyrenaica* domain, and a warm area with more continental influence, where evergreen oaks and *Q. faginea* are more common. The present vegetation within 30 min walking distance around Terronha de Pinhovelo, defined according to spatial analysis traditional tools (Tereso 2007a), gives evidence of such a bioclimatic condition. The higher slopes are dominated by *Quercus pyrenaica*, *Q. faginea*, *Q. suber* and *Pinus pinaster*. In lower areas, *Q. ilex* and *Q. suber* are more abundant. *Arbutus unedo* can only be found on the southern and southwestern slopes of the archaeological site itself.

The charcoal study seems to indicate the presence of deciduous oak woods, however due to the limitations inherent in the charcoal analyses, and made greater by the characteristics of the studied contexts, it is not possible to know whether those woods still existed at the time of the late Roman Empire. Still, the pollen data from northwestern Iberia, from Lago de Sanabria (Muñoz Sobrino et al. 2004), which is the closest such site to Terronha de Pinhovelo, suggests otherwise. It is plausible that small uncultivated areas would have remained wooded as they do today. In the same way, mixed cork oak and holm oak woods, with *Arbutus unedo*, would have persisted in other places.

The abundance of *Pinus pinaster* (maritime pine) which was present in all samples is consistent with other charcoal data (Figueiral 1995) that emphasizes that it may have had a greater ecological significance in ancient times than was suspected until recently for this area of inland Portugal.

*Cistus* sp., *Erica* spp. and, in clearly fewer quantity, shrubby Leguminosae (*Cytisus*/*Genista*/*Ulex*) testify the presence of scrub. Nowadays, the Leguminosae clearly dominate the agricultural fields around the site, followed closely by *Cistus* spp.

Riverside contexts are currently characterized by a clear predominance of *Fraxinus angustifolia*, which seems to have also been the case in Roman times, according to the results of this study. *Alnus glutinosa*, *Corylus avellana* and *Ulmus minor*, which were almost absent from the charcoal record, may had been occasionally present in the landscape. One fragment of charcoal may have come from *Juglans regia* (walnut), although a clear identification could not be achieved. Walnut trees are still sometimes cultivated next to small rivers in the area.

The predominance of cereals in the record in Terronha de Pinhovelo and the data available from other palaeoecological studies in northwest Iberia (Muñoz Sobrino et al. 1997, 2004, 2005) enhances the idea that the surroundings of the settlement would have been heavily occupied in Roman times. In fact, besides the predominance of cereals, the seeds revealed several ruderal plants such as *Anthemis cotula* and *Polygonum aviculare,* and others typical of eutrophic habitats such as *Sambucus* cf. *ebulus*.

## Conclusions

The archaeobotanical approach to the plant macrofossils recovered from Terronha de Pinhovelo has allowed a further understanding of the Romanized communities which inhabited the settlement in its later phase, during the time of the late Roman Empire. The agricultural choices of the community were characterized by a predominance of different wheat varieties and barley. Horse bean was also an important crop, while millet assumed a secondary and complementary role.

The plant remains were preserved in different hearths and scattered in two compartments. The finding together of Leguminosae with naked and hulled cereals and the significant differences in the plant compositions within the several structures testify to a complex situation which is not completely understandable at this point. However, at least in its later moments of use, these contexts are likely to have been related to several phases of food processing—exclusively vegetable. Dehusking of hulled wheats may also have occurred.

Overall, the palaeoecological data are scarce, especially due to the characteristics of the contexts studied. Several kinds of vegetation were used to provide firewood for domestic activities, deciduous oak woods, evergreen woods, scrub and riparian woodland. *Pinus pinaster*, *Fraxinus angustifolia*, *Quercus pyrenaica*, *Q. faginea*, *Q. suber*, *Arbutus unedo*, *Cistus* sp. and *Erica* spp. are the main morphotypes.

Further research is still necessary in order to reach a more complete understanding of the palaeoethnobotanical and palaeoecological context at Terronha de Pinhovelo. This can be achieved with the enlargement of the excavation area at the site and the possibility of recovering more samples from different archaeological contexts. The excavation of the area surrounding the contexts presented in this paper is also crucial to their proper understanding.

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