08— Agriculture, gathering, and food processing in the 10th century in central-north Portugal

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Abstract

Archaeological excavations at several 10th century villages in the north-central region of Portugal have recovered large numbers of plant macroremains that have been preserved due to fires that affected the sites. The burned remains allow an approach to issues of the agriculture, collection and food consumption carried out by the rural communities that inhabited these sites.

This paper presents and discusses the results of the analysis of carpological and anthracological remains. It also discusses some questions of sampling methodology. In fact, different approaches to sample collection greatly affect the results and, consequently, the image that can be built of the consumption and production of food by early medieval rural populations.

The results are indicative of communities with a great diversity of cultivation solutions (cereals and legumes) that would be complemented by gathered products such as berries and fruits. The way in which food was stored and processed for consumption can also be detected by other archaeological indicators such as pottery and grinding elements. There is also evidence that points to the cultivation and working of flax. Some weaving elements recovered are thought to have been used to work flax and wool.

Keywords

Charcoal Analysis, Carpology, Early Middle Ages, Rural Communities, Food consumption.

1. Archaeological Contexts

Four sites in central-northern Portugal, excavated during the last twelve years, have yielded robust archaeological information revealing a little more about the economic strategies and consumption of early medieval rural communities (**Figure 1**). These sites were probably coeval and the distance between them varies from 12 km (São Gens – Soida) to 37 km (Soida – Senhora do Barrocal).

Penedo dos Mouros is located on a platform, surrounded by granitic *tors,* near the locality of Gouveia. A stone wall and palisade were built between *tors* to protect open sections of the settlement, which has an estimated area of around 0.6 ha. Several excavation seasons identified a settlement on a platform overlooking the fertile Boco stream valley. A few huge granite boulders on its eastern side supported a complex wooden superstructure, interpreted as a granary, given the find of large amounts of carbonized pulses. The choice for this location was determined not only by its invisibility in the surrounding landscape, but also by its proximity to the valley (Angelucci *et al.* 2004), which would have been exploited by the farming group established at the site.

The site of Soida was settled on a narrow plateau in the northern sector of the Estrela mountain range. From this location, it is possible to control the whole surrounding landscape, including the lowlands of the Mondego valley. In contrast, it should be noted that the site is not easily identifiable from below. Some huts built in perishable materials were identified, as well as the remains of a wall and a collapsed palisade. Given its location on a high mountain plateau, Soida probably specialized in the seasonal mountain grazing of sheep and goats (Fernández-Mier and Tente 2018; Tente and Fernández-Mier 2021).

São Gens is situated in the upper Mondego river basin, 2 km from the modern village of Celorico da Beira, in the Guarda district. Excavation of the settlement provided evidence for its occupation in the 10th century AD (Tente *et al.* 2018a) and revealed evidence of a complex archaeological landscape at the time, comprising a rock-cut grave cemetery, comprising 54 graves disposed in a non-patterned way, and a residential oval enclosure (with an internal area of about 0.7 ha). The close spatial association between these two complexes suggests they were contemporary and represent both the living and the dead in the Mondego river valley during the 10th century. Archaeological and ecological records at São Gens reflect the daily life of a sedentary agrarian community. In one of the excavated sectors, near the settlement's entrance, a medieval faunal assemblage was found, revealing the importance of hunting within this community, since it is dominated by wild animals (boar, red deer, and fallow deer) (Tente *et al.* 2018b). Faunal data also indicate that the São Gens community lived surrounded by forests. A spatial analysis of the necropolis layout was able to reveal a household organization and the identification of a particular group of tombs. Indeed, according to Brookes, Tente and Prata (2017) this was apparently a necropolis

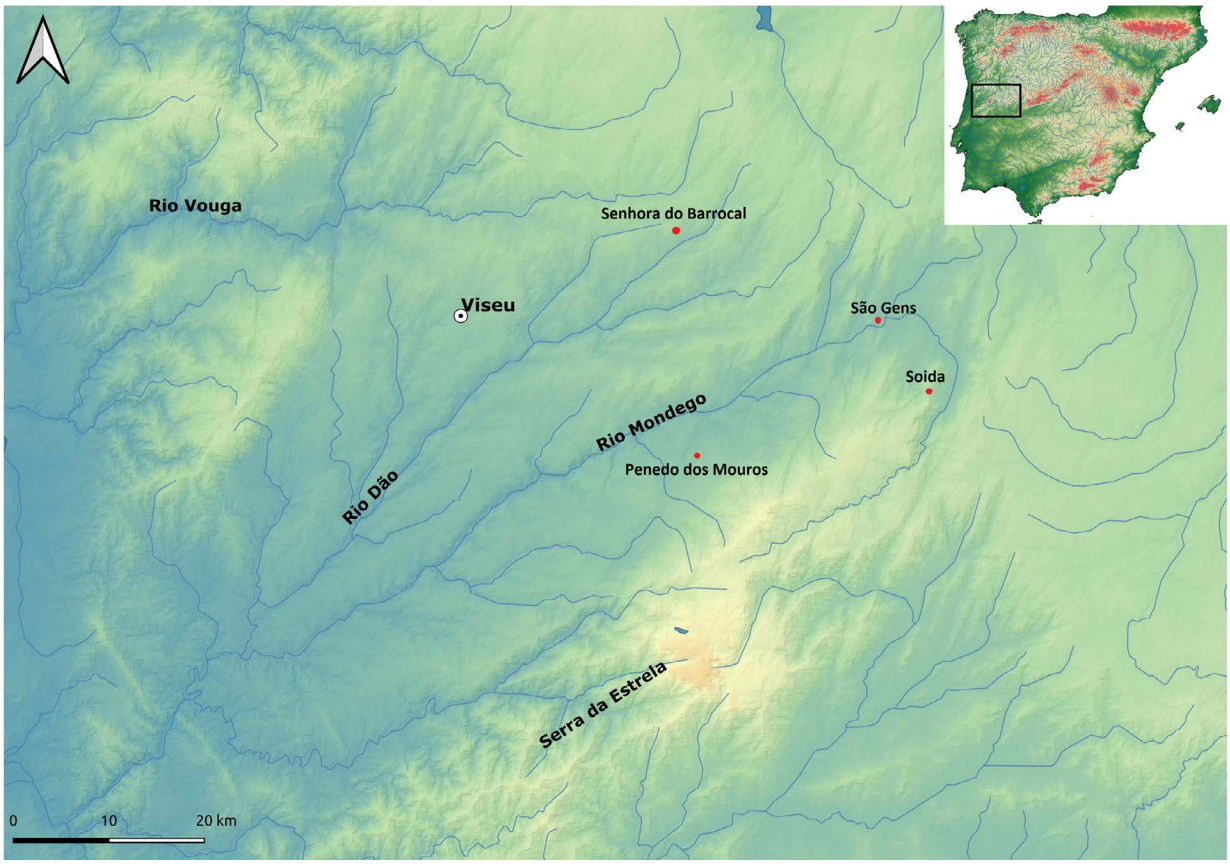

Figure 1: *Location of the sites mentioned in the text.*

community that comprised 3–4 self-identifying groups. It can be affirmed that, as at Penedo dos Mouros, there is a close relation with the neighboring valley, where pulses would have been cultivated.

Senhora do Barrocal is located in the basin of Coja Stream, a tributary of Dão River, about 30 km from the city of Viseu. This site enjoys a natural defensive position, which is created by the height of the granite platform and the boulders on which it was built. However, the likely effectively controlled territory is marked by the proximate valley, which would have been exploited agriculturally by the site's inhabitants. This location strategy seems to have been determined by the need of visual control and, at the same time, of going unnoticed in this hilly territory, in a very similar situation to that of Penedo dos Mouros. Excavations took place between 2014 and 2016 and permitted the identification of at least two domestic spaces. In both of them, granitic *tors* were used to support structures built with perishable materials but whose roofs, unlike the cases above, were made with half-pipe roof tiles.

These sites share some common features such as the position in discreet spots in the landscape, but normally near a small valley, the use of perishable materials to build domestic units and palisades; the pottery ware and the use of a wall/palisade to surround the settlement. At all the sites, a fire was identified and dated around the second half of the 10th century and the beginning of the following (Tente and Carvalho 2011; Tente 2018). With the exception of Senhora do Barrocal, most of the sites possess a single occupation level, which was destroyed by the fire that allowed the preservation of plant remains, which are presented and discussed below.

2. Methodologies in fieldwork and in laboratory

2.1. Fieldwork and sampling

Because of the fire events, all four sites preserved animal and plant remains. The charcoal and carpological remains that were studied were recovered using four different methodologies in field sampling: handpicking of individual remains; judgment sampling resulting from the knowledge and understanding of the stratigraphic record during the fieldwork; collection of all the sediment from particular contexts with abundant plant remains well recognized during fieldwork; and systematic sampling of most stratigraphic units (SU) using constant or varying volumes per SU and squares. These methodologies varied between sites and within different field seasons in specific sites, in relation to the characteristics of each site and the logistic constraints of each excavation. In the results section these specificities will be addressed, highlighting their impact on the interpretation of each site.

Although all these kinds of sampling were able to collect significant information, the most effective ways of sampling these sites were the systematic sampling and the collection of all sediment from specific contexts. In these cases, we stress the collection of a fixed volume, normally 10 L of sediment per 1 m^2 of a particular stratigraphic unit, as applied at São Gens; and the recovery of all the sediment of particular stratigraphic units, as at Senhora do Barrocal. Both strategies resulted in an immense volume of sediments to be processed.

The next step was sample processing. We used both manual and machine flotation, where the minimum mesh size was 0.5 mm. Some samples were floated during the fieldwork, such as the samples from Senhora do Barrocal, and others, like the samples from São Gens, were processed some years after, when the logistic conditions were appropriate.

2.2. In the laboratory

In the laboratory, light fractions resulting from flotation were sorted and seeds/fruits were identified using a stereoscopic microscope. Whenever the volume of these light fractions was too large, subsampling was carried out using a riffle box and calculations were made to estimate the real amount of remains present in the whole samples. Details regarding the original data and the extrapolations are available in the original publications of each carpological study. Here only estimations will be considered.

Units and fragments were differentiated but fragments with the embryo-concavity (in the case of cereals) or the hilum (in pulses and others) were considered units.

Wood charcoal fragments larger than 2 mm were manually fractured in order to obtain the three diagnostic sections (transverse, longitudinal, radial). These were observed and characterized using a reflected light microscope. Characterization often involved more information that the taxonomic diagnoses (e.g. ring curvature, signs of biological degradation, etc.) that will not be addressed here. The number of charcoal fragments studied per sample varied between sites and contexts, depending on the type of context, the amount of samples studied from each context and the taxonomic diversity of the samples.

Taxonomic diagnoses of both charcoal and carpological remains were performed by comparison with modern and archaeological material in reference collections at the two institutions involved (CIBIO and DGPC) as well as with anatomical and morphological atlases and other specialized bibliography (e. g. Schweingruber 1990; Hillman *et al.* 1996; Vernet *et al.* 2001; Jacomet 2006; Bojnanský and Fargašová 2007).

3. Results and discussion on carpological and charcoal remains

At Penedo dos Mouros the assemblage is dominated by broad beans (*Vicia faba*) (**Table 1**). However, these results are influenced by the sampling method during the fieldwork as explained above. Effectively, Penedo dos Mouros was the first site where carpological and charcoal remains were identified, but the sampling was limited to the context where the plant remains were visible during the process of excavation.

Besides the broad beans, it was also possible to identify coriander (*Coriandrum sativum*) and naked wheat (*Triticum aestivum/durum*) (Leeuwaarden and Queiroz 2003; Queiroz 2009a). The charcoal analysis permitted the identification of the wood of chestnut (*Castanea sativa*) and we can speculate that they also consumed the nuts. Although they were not detected during the excavations at Penedo dos Mouros, chestnuts were identified at São Gens and Senhora do Barrocal. The big granitic *tor* located in the south sector of the settlement (sector 4) supported a wooden structure with at least two stores, where the broad beans and the wheat were probably stored (Tente 2010: 139–202).

N = 813	
Broad bean — *Vicia faba* L.	99.2 %
Coriander — *Coriandrum sativum* L.	0.13 %
Wheat — *Triticum aestivum/durum*	0.13 %
Indeterminate seeds	0.41 %

Table 1: *Results from Penedo dos Mouros (Leeuwaarden and Queiroz, 2003; Queiroz, 2009a).*

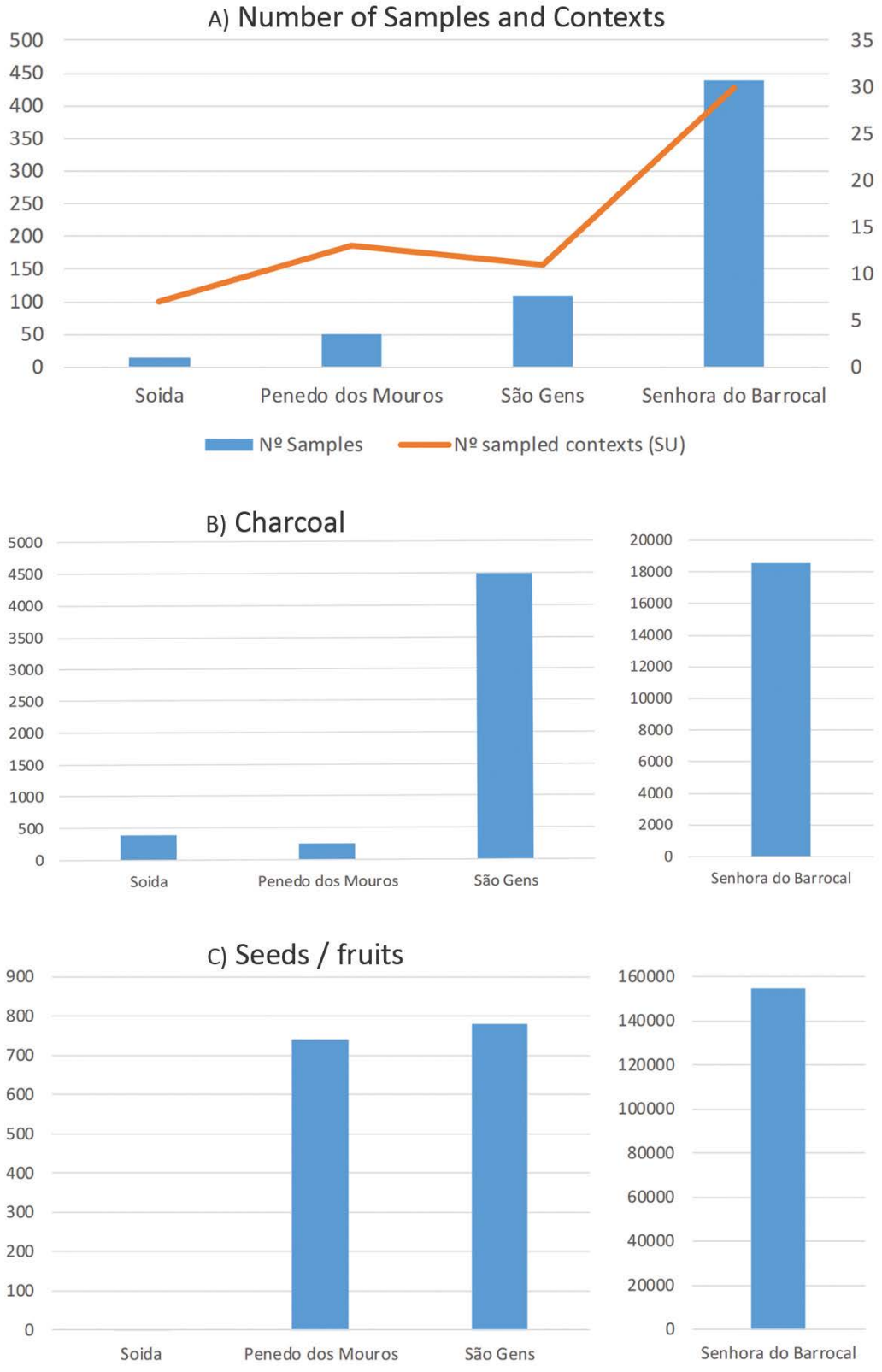

Figure 2: *Graphics with total samples (A), charcoal (B) and seeds/fruits (C) studied by site.*

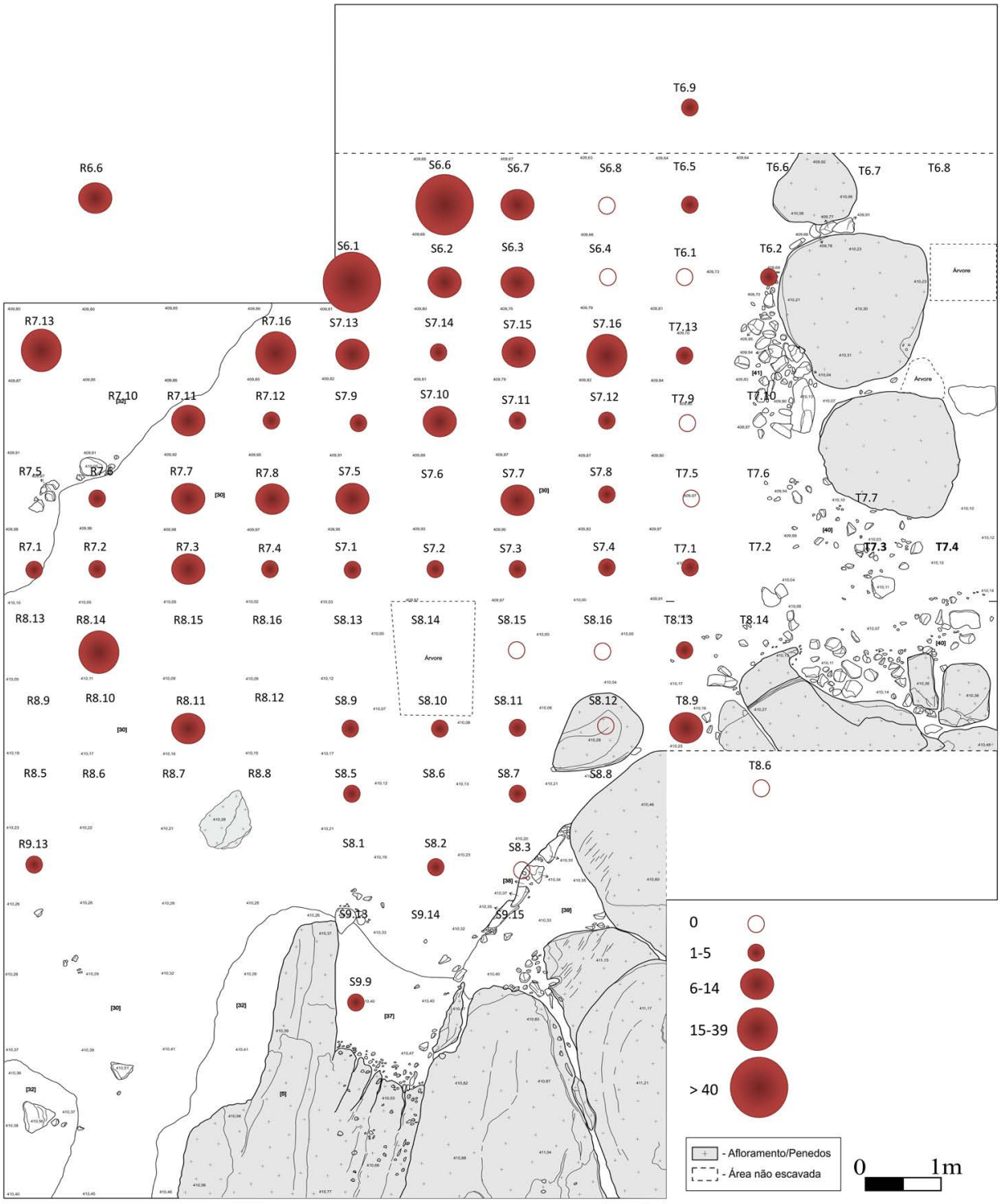

Figure 3: *Distribution of Panicum miliaceum remains at São Gens.*

The sampling at Soida was very similar to that at Penedo dos Mouros, and the results express this methodological option. Most plant remains are associated with a single oak trunk, which was used as a bench within the hut identified in this site. Other charcoal comes from firewood used in the domestic fireplaces and some was linked to the palisade (Queiroz 2009b; Tente 2010: 267–314). No seeds were identified here. However, this could be related to the sampling, which was not carried out in a systematic way because it was not expected to find storage evidences (as recorded at Penedo dos Mouros or Senhora do Barrocal), since Soida was probably a seasonal site used for the access to mountain pastures during the summer (Fernández-Mier and Tente 2018).

Several sampling strategies were applied at São Gens. In some areas, especially in Sector 10, the strategy was sporadic handpicking or judgment samples. It changed in Sector 4, next to the entrance of the enclosure where a massive sediment level [SU30], related to the fire, was recognized. This level had a thickness of between 5 cm and 30 cm. Here we collected 10 L of sediment from each 1 m^2, resulting in more than 540 L of sediment processed and analyzed.

The results obtained at São Gens show the predominance of cereals, mainly common millet (*Panicum miliaceum)*. However, it was possible to identify other cereals, like barley (*Hordeum vulgare*), rye (*Secale cereale*) and naked wheat. One of the characteristics of this assemblage was the fact that chaff is absent, which means the cereals were fully processed, prepared to be consumed. Remains from fruits are rare and restricted to single finds of blackberry/raspberry (*Rubus* sp.) and sweet cherry (*Prunus avium*).

Spatial distribution of carpological remains in Sector 4 is of great interest to understand the formation process of the assemblage and the remaining archaeological materials found there. Large-grained cereals are too sparse to detect patterns of distribution in the excavated area, but grains of millet are not. These show a differential distribution (**Figure 3**), with higher concentrations in the Northwest corner, diminishing to the Southeast. This pattern suggests that this assemblage originated from the fire and collapse of a building located on the granite tor northwest of the excavation area. Charcoal analysis suggests the structure was built mostly with timber from deciduous oak.

Despite the relevance of data obtained in the abovementioned sites, none provided the amount and diversity of plant remains as found at Senhora do Barrocal. In fact, a similar diversity of cereals and pulses, associated with fruits, an oil/fiber plant, and wild plants has never been recorded so far in Portuguese contexts of this kind. Results have been partly published (Tereso *et al.* 2016; Tente *et al.* 2018b), but a full analysis is still ongoing.

As in other sites in the region, most plant remains are connected to a major fire which destroyed domestic contexts. In the case of Senhora do Barrocal, it corresponds to the largest habitat area identified up to now (Sector 1). The great abundancy of remains was, therefore, visible during the fieldwork, leading to a sampling effort with no parallels in the region. Some handpicking was made, but most plant remains came from the collection of all the sediment in selected contexts, such as the stratigraphic units related to the fire. Sediment was processed through flotation or, in some cases, through dry sieving, but the use of a flotation machine, in the 2016 season, allowed the recovery of a great volume of sediment. The vast amount of samples and plant remains required a selection of those to be studied; out of the 546 samples that were collected, 439 were analyzed, representing all squares and stratigraphic units.

Cereal grains represent most of the carpological remains collected (around 90 %). Rye and oat (*Avena* sp. and *Avena sativa/strigosa*) grains were dominant. Albeit in smaller amounts, significant concentrations of other cereal grains, such as hulled barley, common millet and naked wheat were also identified. Grains of foxtail millet (*Setaria italica*) are sporadic.

Chaff remains from all the above-mentioned cereals were systematically found, although in smaller amounts, and interpreting the proportion between grains and chaff was often difficult. It seems that rye and naked wheat were kept in the area as clean grain, since the number of grains is much higher than the chaff found. Besides, as free-threshing cereals, their processing was easily and quickly handled immediately after the harvest (e.g. Hillman 1981 and 1984; Peña-Chocarro 1999; Alonso *et al.* 2019). The remaining cereals require more time and labor to obtain clean grain (e.g. Hillman 1981 and 1984; Moreno-Larrazábal *et al.* 2015). Chaff from barley and common millet was often collected in association with the respective grains. In fact, in both cases, the amount of grains with partial or entire husks still attached was prevalent. Oat chaff was also frequent, but most remains correspond solely to grains. However, it is difficult to understand whether most grains were already dehusked prior to the fire or if chaff did not survive the event, since oat has very fragile panicles (Fenton 2011).

Pulses were of secondary importance. The carpological results showed a reasonable amount of peas (*Pisum sativum*) and broad beans (*Vicia faba*), whereas grass/red peas (*Lathyrus cicera/sativus*) and lentils (*Lens culinaris*) were more scarce.

Fruit remains were rare, but still display some variety. Pips, pedicles and two exceptional charred berries of grapevine (*Vitis vinifera*) were found (**Figure 4**). Chestnuts (*Castanea sativa*) and endocarps of sweet cherry (*Prunus avium*) were identified in the carpological record, and the same species were also recorded in the charcoal analysis. Bracts of cluster/stone pine (*Pinus pinaster/pinea*), *Quercus* sp. acorns, and a possible pear seed (*Pyrus* sp.), were also collected. Flax seeds (*Linum* sp.) were identified only in agglomerated form, adding an oil/fiber plant to the carpological record.

A significant range of wild plants was recovered, but always in small amounts, including corncockle (*Agrostemma githago*), cleavers (*Galium aparine*) or wild radish (*Raphanus raphanistrum*). They are common weeds in cereal fields but also frequent in other environmental contexts (Aguiar 2000). Their scarcity

Figure 4: *Grape (Vitis vinifera) from Senhora do Barrocal: rare find of fleshy mesocarp with seed.*

and the fact that they are found together with different cereals with, presumably, distinct sowing seasons does not allow many interpretations.

The extraordinary assemblage of cereal crops and its spatial distribution, especially in the area covered by stratigraphic units which were associated with the fire, suggests cereals were kept inside this habitation space. However, it is difficult to ascertain the type of facility where crops were stored, since during fieldwork no well-defined storage structure was identified. However, this may point to the use of structures or containers made with perishable materials, such as wood or textiles, which may have not survived the fire. It is impossible to exclude that some of the wood charcoal recovered came from such a container.

The information obtained also prompts the questions of how and why plant-food was stored. As mentioned above, different crops were kept in the area. Among cereals, which comprises the majority of the assemblage, free-threshing species were stored as clean grain — wheat and rye — while the others were still at least partially hulled — barley, common millet and possibly oat. Thus, although we cannot even exclude a mixed scenario in which the same species could have been kept in hulled and clean form, data suggests all cereals were stored directly after threshing/winnowing, independently of being free-threshing or not. The next processing stages would be different for each species, but they are found together in the same context. Even though different crops have been found in the same samples, and the storage of distinct crops, with different characteristics (size, taste, etc.), has been recorded in several regions and chronologies (Seabra *et al*. 2018; Tarongi *et al*. 2020), we cannot rule out that these were kept in distinct containers. They could have become mixed as a consequence of the destructive event that occurred, direct human actions related with the subsequent occupation phase, and post-depositional factors. These crops could have been destined for human and/or animal consumption or simply to be sown and provide a new harvest. The predominance of oat and rye is unsurprising considering Senhora do Barrocal is located in a mountainous area, with abundant rock outcrops and with only a few areas with significant depth of soil. These are undemanding cereals that have higher yields than free-threshing wheat in areas with poor soils and little insolation. Naked wheat, which requires more favorable conditions, could have been cultivated in small patches in the nearby valley.

5. Other evidence of agriculture, gathering and consumption

Other indirect evidence in the archaeological record provides further data, not only on agricultural production but also on food preparation and consumption. One of these elements is the millstones (**Figure 5**) that would certainly have been used to grind some of the cereals that we have identified. It is expected that these elements could have also been used to grind chestnuts and other nuts.

The only site where grinding elements were not identified was Soida, which, again, can be explained by the fact that this highland site could have been a summer seasonal settlement to access mountain pastures.

Among the pottery assemblages we can find evidence of the storage and preparation of food. The closed forms are the most recurrent vessels recovered in these sites, namely jars (**Figure 6, D–E**) and medium/large pans/pots (**Figure 6, A–C**). In this last case the pans/pots were used indistinctively to cook and to store food. There is also an open form present in all sites: a large bowl (*alguidar*) that was multi-functional (**Figure 6, G–J**). The presence of scarce small bowls is also noteworthy. Among the rare open forms, there are some big flat dishes that we assume were used to cook the bread. We have identified two of those at Penedo dos Mouros (**Figure 6, H**) and one at Senhora do Barrocal. Frying pans, casseroles, and more open pans in general are absent in the archaeological record. Boiled, stewed

Figure 5: *Millstone from São Gens.*

and cereal porridge, as well as baked goods (which do not require fire containers) would likely be the preferred way of cooking most of the food.

Small pieces for individual use, such as cups, plates or small bowls, are also absent. This leads us to assume that this type of equipment would be made with wood and/or cork, which is also present in most of the sites that have been studied.

Although we have no direct evidence of honey, the presence of honey pots at São Gens and Senhora do Barrocal (**Figure 6, I**) document the collection of honey and its consumption.

Flax (*Linum* sp.) was also identified at Senhora do Barrocal. The seeds were found aggregated which suggests that the flax was not yet worked or it was stored to enable future planting. The presence of flax directly documents the use of linen, which must have been spun in all rural villages at this time, along with the spinning of wool. Effectively, with the exception of Soida, spindle whorls in ceramic and stone (**Figure 6, F**) were recognized in all the archaeological contexts studied.

6. Conclusion

Based on the data that has been obtained, it may be concluded that these 10th century communities practiced a highly diversified agriculture and consumption. Even though cereals are dominated mainly by rye and oats, species better adapted to harsh environmental conditions; such other species as millet, barley and some wheat varieties have also been identified. Although most of the cereals would be consumed by humans, it is also possible that oats and barley were grown to feed animals.

Communities in the region were cultivating autumn/winter-sown and spring-sown cereals. The latter surely included common millet and foxtail millet, but we cannot exclude that spring varieties of other cereals that are usually winter crops, such as naked wheat or hulled barley, were also cultivated. Data from weeds are insufficient to support or reject this possibility because in the assemblages that were studied it is not possible to ascribe each crop to a particular set of wild taxa. Still, rye is rarely a spring

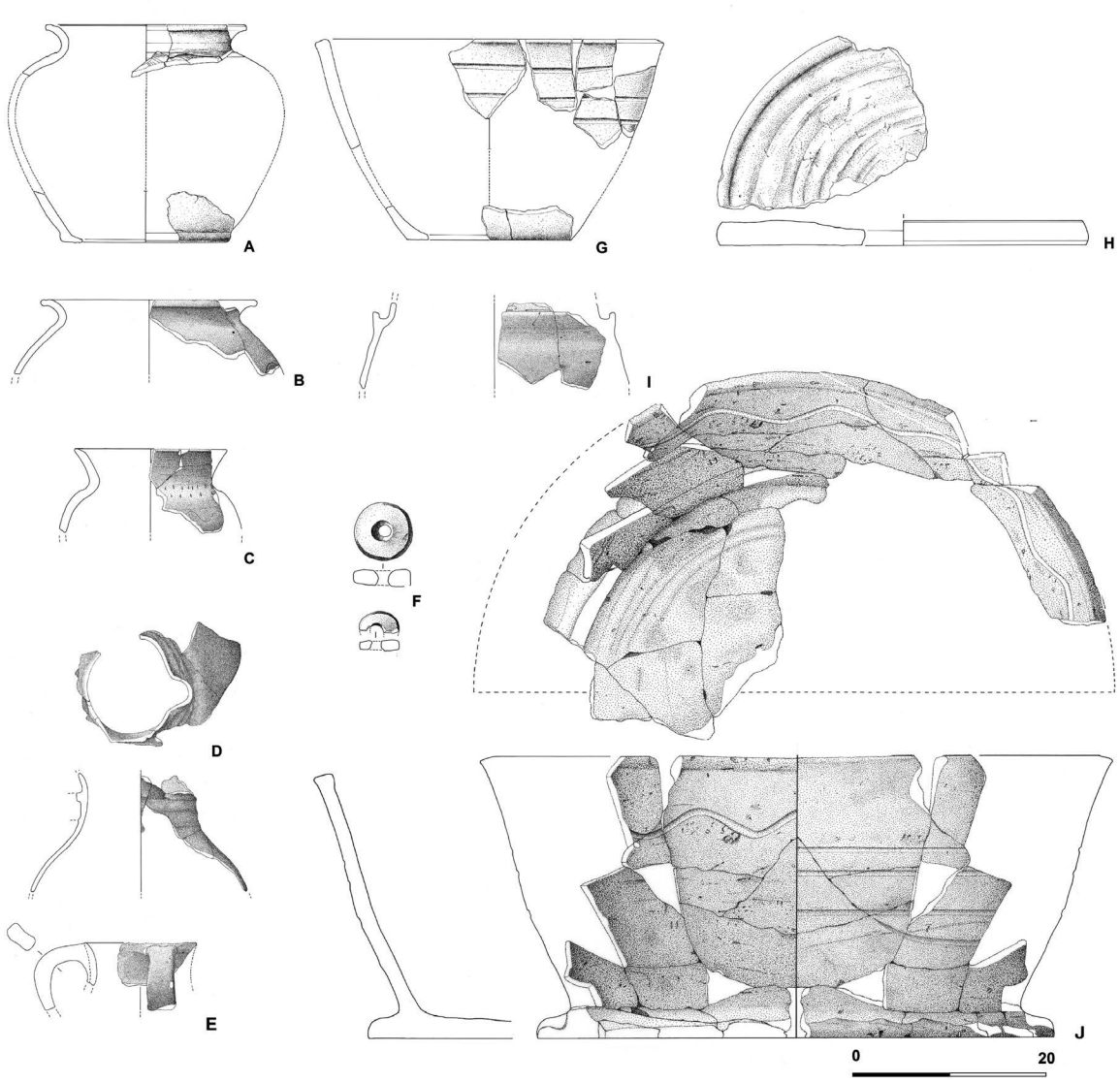

Figure 6: *Ceramics from Penedo dos Mouros (H) and São Gens (A–G, I–J).*

crop and it was more likely sown in the autumn or winter. On the other hand, oat is frequently a spring crop, although winter cultivation may have also occurred (Moore-Colyer 1995).

Pulses were also very important in the diet of the early medieval communities. The bioarchaeological study has identified broad beans (probably cultivated between October and November and picked in April), peas (sown in December and harvested also in April), grass/red pea (sown between February and April and collected between May and July) and lentils although in smaller quantities.

As mentioned above, besides the cereals and pulses, they also cultivated some fruits such as chestnuts or grapes. Another documented crop is flax. Although it was not possible to identify linen it seems obvious that the production of linen was the reason for growing flax. Finally, other wild and cultivated plants were likely consumed by these communities but did not survive combustion or simply were kept in other areas of the settlement.

Thus, when considering the seasonal activities of these people, this means that cereals implied at least two sowing and harvesting moments. To this we must add the maintenance of gardens where pulses were probably cultivated and harvested at different moments, as well as the managing of fruit trees and the gathering of cultivated and wild fruits. Sweet cherries were collected in the late spring or early summer, while chestnuts and grapes would be gathered in the autumn. Autumn and spring varieties of flax could have existed, the latter possibly demanding irrigation. Although it is not possible to know the sowing time of those that were found, we cannot exclude the possibility that both varieties were cultivated by the same community, as happened in recent times. The year was busy with agricultural work, but this allowed for greater food success, as it minimized the impact of possible poor harvests of certain crops on the provision of food.

The communities were well engaged with the environment and also explored the woods and forests. The presence of gathered species, such as pine nuts, arbutus and probably blackberries, were recorded. Sweet cherry was probably consumed; however, it was not possible to determine if it was cultivated or gathered. Honey was similarly consumed and gathered in the woods and forests, where the communities would also collect wood and cork for buildings and artefacts.

It is more difficult to acquire data about beverages, but certainly they must have had wine, since we have documented grapes and there are several documental mentions of wine in the followed centuries. They may also have made mead and beer; clearly they had the cereals for the fermentation of beer and honey is indirectly documented by the presence of honey pots. We can also suppose that they could have produced arbutus brandy, since arbutus is also documented in the archaeological record.

It is interesting that 12th century *foral* charters granted to settlements near Senhora do Barrocal mentioned some of the products that were cultivated in the territory and these have now been identified in the archaeological record. A charter for Ferreira de Aves, dated in 1126[1], mentioned wheat, millet and barley, wine, linen, and honey. The charter for Sátão[2] refers again to wine, linen, and broad beans, which are not usually mentioned in 12th century charters in Beira Alta. Although over 100 years had elapsed between the archaeological sites near Senhora do Barrocal and the charters, most of the cultivated products recorded are basically the same.

Finally, we must underline the importance of the more systematic sampling strategies to achieve a wide image of agricultural and gathering practices.

Bibliography

Aguiar, C. (2000): *Flora e Vegetação da Serra de Nogueira e do Parque Natural de Montesinho*. Lisboa: Instituto Superior de Agronomia, Universidade Técnica de Lisboa,

Alonso, N. (2019): "A first approach to women, tools and operation sequences in traditional manual cereal grinding". *Archaeological and Anthropological Sciences,* 11: pp. 4307–4324. [<https://doi.org/10.1007/s12520-019-00791-x>]

1 See *Portugalliae Monumenta Historica a saeculo octavo post Christum usque ad quintumdecimum: Leges et Consuetudines*. Lisboa: Academia das Ciências, 1856-1868. V. I, p. 621-622.

2 The date from this charter is not clear. It is dated from 1111 to 1218. See *Portugalliae Monumenta Historica a saeculo octavo post Christum usque ad quintumdecimum: Leges et Consuetudines*. Lisboa: Academia das Ciências, 1856-1868. V. I, p. 354-355.

ANGELUCCI, D.; TENTE, C. and MARTINS, A. R. (2004): "O Penedo dos Mouros e a sua integração paisagística". *Revista Portuguesa de Arqueologia,* 7 (1): pp. 467–481.

BOJNANSKÝ, V. and FARGAŠOVÁ, A. (2007): *Atlas of Seeds and Fruits of Central and East-European Flora. The Carpathian Mountains Region*. Dordrecht: Springer.

BROOKES, S.; TENTE, C. and PRATA, S. (2017): "Interpreting Rock-Cut Grave Cemeteries: the early medieval necropolis and enclosure of São Gens". *Medieval Archaeology*, 61 (2): pp. 215–238.

FENTON, A. (2011): "Threshing the grain". In Fenton, A. and Veitch, K. (eds): *Scottish life and society: a Compendium of Scottish ethnology.* Volume 2: Farming and the land. Edinburg: John Donald Short Run Press, pp. 717–732.

FERNÁNDEZ-MIER, M. and TENTE, C. (2018): "Transhumant herding systems in Iberia". In Costello, E. and Svensson, E. (eds): *Historical archaeologies of transhumance across Europe*. London: Brepols, pp. 219–232.

HILLMAN, G. (1981): Reconstructing crop husbandry practices from charred remains of crops. In: Mercer, R. (ed.): *Farming practice in Prehistoric Britain*. Edinburgh: University Press, pp. 123–162.

HILLMAN, G. (1984): "Traditional husbandry and processing of archaic cereals in recent times: the operations, products and equipment which might feature in Sumerian texts. Part I — the glume wheats". *Bull Sumerian Agriculture,* 1: pp. 114–152.

HILLMAN, G.; MASON, S.; MOULINS, D. de and NESBITT, M. (1996): "Identification of archaeological remains of wheat: the 1992 London workshop". *Circaea,* 12: pp. 195–210.

JACOMET, S. (2006): *Identification of cereal remains from archaeological sites*. [2ª ed.] Archaeobotany Lab IPAS, Basel University.

LEEWAARDEN, W. van and QUEIROZ, P. (2003): *Estudos de arqueobotânica no Penedo dos Mouros II*. Lisbon: IPA. [Unpublished report].

MOORE-COLYER, R. J. (1995): "Oats and oat production in history and pre-history". In Welch, R.W. (ed.): *The Oat Crop: Production and Utilization*. Dordrecht: Springer Netherlands, pp. 1–33.

MORENO-LARRAZÁBAL, A.; TEIRA-BRIÓN, A.; SOPELANA-SALCEDO, I.; ARRANZ-OTAEGUI, A. and ZAPATA, L. (2015): "Ethnobotany of millet cultivation in the north of the Iberian Peninsula". *Vegetation History and Archaeobotany,* 24 (4): pp. 1–14. [<https://doi.org/10.1007/s00334-015-0518-y>]

OLIVEIRA, C.; JESUS, A.; TENTE, C. and TERESO, J. P. (2017): "Estudo arqueobotânico do povoado alto-medieval de S. Gens: perspetivas sobre a exploração de recursos lenhosos e agrícolas". In *II Congresso da Associação dos Arqueólogos Portugueses – Arqueologia em Portugal. 2017 O Estado da questão*. Lisbon: AAP, pp. 1463–1476.

PEÑA-CHOCARRO, L. (1999): *Prehistoric agriculture in Southern Spain during the Neolithic and the Bronze Age. The application of ethnographic models*. British Archaeological Reports International Series, nº 818. Oxford: Archaeopress.

QUEIROZ, P. (2009a): *Novos dados arqueobotânicos do Penedo dos Mouros (Gouveia).* Lisbon: Terra Scenica, Terra Antiga. [Unpublished report].

Queiroz, P. (2009b): *Estudo arqueobotânico do povoado medieval da Soida, Celorico da Beira*. Lisbon: Terra Scenica, Terra Antiga. [Unpublished report].

Schweingruber, F. H. (1990): *Anatomy of European woods*. Bern: Verlag Paul Haupt.

Seabra, L.; Tereso, J.; Bettencourt, A. and Dinis, A. (2018): "Crop diversity and storage structures in the settlement of Crastoeiro (Northwest Iberia): new approaches". *Trabajos de Prehistoria,* 75: pp. 361–378.

Tarongi, M., Prats, G. and Alonso, N. (2020): "The storage of pulses during the Bronze and Iron Ages in the East of the Iberian Peninsula: Examining the archaeological data through the lens of ethnography". *Journal of Archaeological Science: Reports*, 30: pp. 102–174.

Tente, C. (2010): *Arqueologia Medieval Cristã no Alto Mondego. Ocupação e exploração do território nos séculos V a XI.* Lisbon: Nova University. [Unpublished PhD dissertation].

Tente, C. (2019): "No smoke without fire. Burning and changing settlements in 10th-century central-northern Portugal". In Brady, N. and Theunet-Vogt, C. (eds): *Ruralia XII Settlement Change across Medieval Europe. Old paradigms and new vistas*. Leiden: Sidestone Press Academics, pp. 395–403.

Tente, C. and Carvalho, A. F. (2011): "The establishment of radiocarbon chronologies for early medieval sites: a case study from the upper Mondego Valley (Guarda, Portugal)". *Munibe,* 62: pp. 461–468.

Tente, C. and Fernández-Mier, M. (2021) "Archaeological research on seasonal settlement in the Iberian Peninsula - an overview". In Dixon, P. and Theune-Vogt, C. (eds): *Seasonal Settlement in the Medieval and Early Modern Countryside*. Ruralia 13. Leiden: Sidestone Press Academics, pp. 35–44.

Tente, C.; Prieto, P. and Lantes, O. (2014): "A produção cerâmica dos séculos IX a XI da região do Alto Mondego (Portugal)". In De Man, A. and Tente, C. (coords.): *Estudos de Cerâmica Medieval. O Norte e o Centro de Portugal. Séculos IX a XII*: Lisbon: IEM, pp. 110–139.

Tente, C.; Prata, S.; Brookes, S.; Moreno-García, M.; Souza, G. and Cuesta-Gómez, F. (2018a): "Povoamento e modos de vida no limite oriental do território viseense durante o século X. O Povoado de S. Gens". In Tente, C. (ed.): *Do Império ao Reino. Viseu e o território entre os séculos IV a XII*. Viseu: C. M. Viseu, pp. 197–229.

Tente, C.; Baptista, H.; Tereso, J. P.; Cércio, M.; Veloso, J. L.; Oliveira, C.; Seabra, L.; Meira, C.; Souza, G.; Cordero Ruiz, T. and Real M. L. (2018b): "Senhora do Barrocal (Sátão) na viragem do milénio. Primeira abordagem". In Tente, C. (ed.): *Do Império ao Reino. Viseu e o território entre os séculos IV a XII*. Viseu: C. M. Viseu, pp. 263–295.

Tereso, J. P.; Tente, C. and Baptista, H. (2016): "O sítio da Senhora do Barrocal (Sátão, Viseu): vestígios das práticas agrícolas e de exploração dos recursos agrários no século X". In *International Conference Old and New Worlds: the global challenges of Rural History* (January 2016, Lisbon). <https://lisbon2016rh.files.wordpress.com/2015/12/onw-0168.pdf> [Last accessed: 04/2021]

Vernet, J. L.; Ogereau, P.; Figueiral, I.; Machado Yanes, C. and Uzquiano, P. (2001): *Guide d'identification des charbons de bois préhistoriques et récents. Sud-ouest de l'Europe : France, Péninsule ibérique et Îles Canaries*. Paris: CNRS Editions.