New preliminary data on the exploitation of plants in Mesolithic shell middens: the evidence from plant macroremains from the...
The 150th Anniversary of the Discovery of Mesolithic Shellmiddens—Volume 1

Edited by
Nuno Bicho, Cleia Detry, T. Douglas Price and Eugénia Cunha
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Abstract

Within the framework of the Sado Meso project, two shell middens (Poças de S. Bento and Cabeço do Pez) in the Sado valley, Portugal, have been exhaustively sampled for plant macro-remains, in an effort to overcome two problems in prehistoric research: firstly, the scarcity of direct data about plant use by the Mesolithic peoples of Atlantic Iberia,
and secondly, the neglect of sampling strategies for the recovery of plant macro-remains in the shell midden research tradition. The flotation technique has been applied to 100% of the sediment obtained during the new excavation campaigns and a considerable number of samples have been studied. We now have substantial data about the exploitation of a wide range of wild plants which might have played a role of economic importance within the human groups at the end of the Mesolithic.

**Introduction**

One of the concerns of prehistoric archaeology, no less for the Mesolithic and shell midden specialised research, is the exploitation of natural resources by past human groups. However, the view that is often obtained from most research projects on shell middens is biased towards specific types of resources. It is well known that the shell middeners ate abundant shellfish and even used shells for technological activities, many of them involving plants (Cuenca-Solana et al. 2011). But did they eat shellfish in green sauce? Were nettle fabrics on trend? The use of plants is scarcely known and is, for the most part, based on approximate indirect evidence or restricted to that of wood charcoal. The only known Mesolithic, non-woody plant, archaeological macro-remains (seeds and fruits) in Portugal come from Prazo, a northern site (Monteiro-Rodrigues 2012); wild olive fruits and acorns are reported from several unspecified Middle and Late Holocene sites (Queiroz & Mateus 2006). A site in the Muge shell midden complex, Cabeço da Amoreira, has been sampled for plant macro-remains but the actual results of seeds and fruits have never been published (Wollstonecroft et al. 2006). One of the sites presented here was partially floated for plant macro-remains in previous research projects (unpublished), but to no avail probably due to the very limited sampling (Larsson, pers. com.).

Plants must have equally been used for dietary and technological purposes, among others, but the study of plant remains is often excluded from research aims. Approaches to plant use from indirect sources, such as stable isotopes (e.g. Umbelino et al. 2007) or dental pathologies (e.g. Jackes 2009), are widespread and understandable for the study of restricted materials from old excavations. Nevertheless, this should not be the case for current excavations, as it is now known that plant remains are indeed preserved in most Holocene archaeological sites, and are found whenever they are appropriately looked for. The methodological vicious circle of not sampling and recovering carefully because it is supposed that nothing is going to appear, so nothing appears because appropriate
sampling and recovery methods have not been applied, should be disentangled. How is it possible to discuss the socioeconomic differences or continuities between Mesolithic and Neolithic populations if plant recovery strategies are omitted in research projects? Are plant remains really absent in shell middens? How can the absence of finds evidence of plant remains be differentiated from the cases where plants are truly absent, if reports do not specify the methodologies employed or whether specific plant recovery techniques existed at all?

**Materials and Methods**

Poças de S. Bento (PSB) and Cabeço do Pez (CPZ) are two open-air shell midden sites in the Sado valley, Portugal, discovered and excavated in the 1950s and 1980s (Arnaud 1989; Larsson 2010) and currently under study by the Sado Meso project (see Arias et al., this volume). They can be broadly characterized as extensive (about 4000 m²) but low (1.5 m thick) shell middens, which are areas of the accumulation of refuse of mostly shellfish remains, alternated with other domestic functional spaces (hearths, flint-knapping areas, etc...) and human and dog burials. Abundant archaeological remains, from mammal and fish bones, lithics, pottery fragments to charcoal, have been recovered and are under study (for further preliminary details see Araújo et al., Diniz & Cubas, Pimentel et al., Duarte et al., Stjerna, this volume).

One hundred percent of the excavated sediment (except the topsoil level) has been processed with two Syraf-type flotation machines (at approximately 7 minutes per sample of about 10dm³ of sediment). Flotation produces two fractions that are sorted separately, a light one (flot) containing all charred plant material and floating soil components above 250 μm in size, and a heavy one, containing other archaeological remains and dense soil components above 1 mm in size. Sorting the archaeological materials from the heavy fraction was quicker and more precise than sorting from dry-screened fractions, as everything was clean and easy to catch. A representative sample of flots from the Late Mesolithic layers has been studied to this date and is here presented. PSB samples from excavation area nº 1, extensively excavated from 2010 to 2013 (12 m²), have been chosen for study: all flots from the dog burial (SU8, n=13), plus 50 of each shell midden layer (n=100 total flots from the two shell midden layers, SU3=7 and SU12). Still under study are samples from the upper layer which are probably Neolithic. CPZ samples from the test pit of 2010 come from SU2, and samples from underlying layers await further study. Flot samples have been screened with 2 mm to
250 μm meshes and sorted, the smaller fractions under a Leica S8APO binocular microscope. Only charred plant material has been analysed; several uncharred seeds are likely part of the modern natural seed rain, so have been rejected from the study as recent intrusions introduced by bioturbation or added during excavation or processing. Quantification is based on whole individuals or quantifiable fragments (e.g. embryos in grasses). An example of each taxa has been photographed with a Canon EOS450D photo camera, photo-stacking has been carried out with the software Helicon Focus and final processing (background cleaning and scaling) with GIMP. Some of the plant macro-remains identified have been chosen for 14C dating, and results are still awaited.

Results

Surprisingly (or not really), plant macro-remains do really exist in shell middens! So far, a series of species has been consistently recovered (Fig. 25.1; Table 25.1): there are no obvious differences between the different archaeological units of PSB, while the repertoire at CPZ is small (only 1 sample from SU2 provided determinable plant macro-remains other than wood charcoal) but considerably different. The potential uses for the different taxa have been proposed according to ethnographic sources (Fern 1992-2010).

Discussion

The studied samples have given a probable representative group of plant macro-remains arising from different potential activities of plant-resource exploitation, from food and drink procurement to other domestic activities (dyeing, fibre weaving, medicine preparation, etc...). Charred plant macro-remains do not represent all the plant resources exploited by past human groups; there are other types of plant remains that complement the information. There can be sites where plants might not be preserved in a specific way (but most certainly they will probably be preserved in at least one of the other many types of preservation forms: charred macro-remains, phytoliths, starch grains, pollen, etc...). Shell middens, because of the high level of calcium carbonate, are not ideal deposits for the preservation of charred plant macro-remains which become easily eroded in that ambient (Braadbaart et al. 2009). Fortunately, at the PSB and CPZ shell middens at least, charred plant remains are preserved in considerable quantities and relatively good preservation so as to allow for a
consideration of the potential activities in which plant resources were used.

It is important to note that all remains were scattered along the different archaeological units: this is a typical tertiary deposition context (Fuller et al., 2014) in which the assemblage of plant remains probably arises from different activities of carbonization and it is not in the original position where they were charred. This means that it is very difficult to recognise assemblages of remains arising from single specific processing activities. This mixing and redepositioning of by-products from different activities probably accounts for the high presence (of hundreds of fragments) of non-woody plant charred material which is extremely fragmented and eroded so as to be morphologically or anatomically unrecognisable.

The most plausible explanation for plant parts being carbonised is during accidents in hearths (López-Dóriga 2012); the reasons why these plants or plant parts are brought into contact with fire (mainly at discarding or processing, as de-insecting, drying, cooking...) are another matter and they might vary according to each plant part and its uses and properties. Charred plant remains are not usable any more: their presence in the midden layers is probably a result of sweeping hearths and processing areas and discarding the sweep in this area of accumulation of domestic refuse (Miksicek 1987). The possibilities of the charred remains arising from “natural” causes unrelated to human activities is extremely small.
Table 25.1. Identified plant macroremains from PSB and CPZ (+ indicates non-quantifiable remains).

<table>
<thead>
<tr>
<th>Taxa (plant part)</th>
<th>Common name (EN, P, ES)</th>
<th>Known uses</th>
<th>Nº of items per context</th>
<th>PSB 3=7 (shell midden)</th>
<th>PSB 8 (dog burial)</th>
<th>PSB 12 (shell midden)</th>
<th>Total PSB</th>
<th>CPZ 2 (shell midden)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Anagallis arvensis</em> L. / <em>monelli</em> L.</td>
<td>Pimpernel, morrião, muraje</td>
<td>Food, medicine, soap</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brassicaceae [Cruciferæ] (seed)</td>
<td>Cabbage family, crucifers</td>
<td>Food, oil</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><em>Chenopodium album</em> L. (seed)</td>
<td>Fat hen, catassol, cañizo</td>
<td>Food, medicine, dye</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cf. <em>Ficus carica</em> L. (seed fragment and fruit flesh fragment)</td>
<td>Common fig, figo, higo</td>
<td>Food, medicine</td>
<td>1</td>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cf. <em>Geranium</em> L. sp.(seed)</td>
<td>Cranesbill, pampilho, geranio</td>
<td>Many, depending on the species</td>
<td>4</td>
<td></td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Linaria</em> Mill. sp. (seed)</td>
<td>Toadflax, ansarina, gallito</td>
<td>Food, medicine, dye, insecticide</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant Family</td>
<td>Common Name(s)</td>
<td>Uses</td>
<td>References</td>
<td></td>
<td></td>
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<tr>
<td><em>Lolium</em> L. sp. (seed)</td>
<td>Ryegrass, joio, ballico</td>
<td>Cereal: food, fodder</td>
<td>4 26 30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Malva</em> L. sp. (seed)</td>
<td>Mallow, malva, malvavisco</td>
<td>Food, oil, medicine, fibre, dye</td>
<td>1 1 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Medicago</em> L. sp. (seed)</td>
<td>Medick, luzerna, alfalfa</td>
<td>Food, fodder, medicine</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><em>Pinus pinea</em> L. (cone bract-escala fragment)</td>
<td>Umbrella-pine, pinheiro manso, pino piñonero</td>
<td>Food, oil, fuel</td>
<td>36 6 25 67 1</td>
<td></td>
<td></td>
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<tr>
<td><em>Pinus pinea</em> L. (nutshell fragment)</td>
<td></td>
<td></td>
<td>1 1</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Poaceae [Gramineae] (seed)</td>
<td>Grasses, gramas, gramineas</td>
<td>Many, depending on the species</td>
<td>2 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Polygonaceae (seed)</td>
<td>Knotweed family, centidonas</td>
<td>Many, depending on the species</td>
<td>2 2</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><em>Rumex</em> L. sp. (seed)</td>
<td>Docks and sorrels, labaça, acedera</td>
<td>Food, medicine, dye, curdling agent</td>
<td>1 1 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant Description</td>
<td>用途</td>
<td>1</td>
<td>2</td>
<td></td>
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<tr>
<td>Urtica L. sp. (seed)</td>
<td>Nettle, urtiga, ortiga</td>
<td>Food, drink, oil, medicine, dye, fibre, insect repellent</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Vicia L. / Lathyrus L. (seed)</td>
<td>Vetches/vetchlings, ervilhacas/chicharos, vezas/guijas</td>
<td>Food, fodder</td>
<td>1</td>
<td></td>
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<tr>
<td>cf. Viola L. sp. (seed)</td>
<td>Wild pansy, amor perfeito bravo, pensamiento silvestre</td>
<td>Food, drink, medicine, perfume</td>
<td>5</td>
<td>1</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indeterminate seed</td>
<td></td>
<td>5</td>
<td>5</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indeterminate fruit fragment</td>
<td></td>
<td>4+</td>
<td>3+</td>
<td>15+</td>
<td>22+++</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indeterminate non-woody plant tissue (among which possible parenchymae)</td>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td>+</td>
<td></td>
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<tr>
<td>Indeterminate stalk or pedicel</td>
<td></td>
<td>2</td>
<td>2</td>
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<tr>
<td>Fungal sclerotia tp.</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><em>Cenococcum geophilum</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Termite faecal pellets</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total nº of remains</td>
<td>55+</td>
<td>17+</td>
<td>84+</td>
<td>156+++</td>
<td>9+</td>
<td></td>
<td></td>
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</tbody>
</table>
Within the flotation samples, other types of ancient and modern remains have been recovered. On the one hand, uncharred items, such as seeds, mycorrhizal fungi sclerotia (tp. *Cenococcum geophilum*) and termite and rodent coprolites (very abundant in some layers), are all probably modern biological remains. On the other hand, charred items, such as dead-wood termite faecal pellets and fungi sclerotia are quite likely ancient remains that were accidentally charred when dead wood and roots were used as fuel or cooked. Termites themselves might have been cooked for eating. Two types of sources of bioturbation can thus be differentiated, accounting for some of the apparently non-anthropic negative structures discovered upon excavation: plant roots (evidenced in the presence of fungi sclerotia and the fragments of plant roots) and furrowing animals (evidenced in the rodent coprolites). Both of these probably explain the introduction of uncharred seeds in the archaeological layers, as bioturbation activity can cause displacement of plant parts both up and down in soils (Miksicek 1987). The excavation and flotation processes can also account for the introduction of uncharred seeds and insects. The possibility that the charred plant macro-remains are of recent introduction is very small: on the one hand, furrowing animals transport uncharred seeds for their consumption, but not charred unpalatable ones (Miksicek 1987); on the other hand, there is not a correlation between the uncharred seeds and the charred ones: although some taxa appear in both states of preservation, most uncharred seeds are not preserved in a charred form and vice-versa.

Regarding palaeoenvironment and resource procurement strategies, these plant remains tell us that the past human groups that brought them to the site exploited several different ecological environments: meadows with grasses (*Poaceae, Lolium* sp.) and other herbs and possibly scattered umbrella pines (*Pinus pinea*); and nutrient rich soils such as those in which nettle (*Urtica* sp.), chenopods (*Chenopodium album*), docks and sorrels (*Rumex* sp.) thrive.

Aside from informing about past plant resource exploitation and environment, plant remains can help an understanding of the general taphonomy of deposits and allow an insight into chronology; e.g. at one of our excavation areas from 2010 at PSB, cereal seeds were observed during the flotation of samples of deep origin; further laboratory examination concluded they were naked wheat grains, and this fact helped with the decision to exclude this pit (with intrusive remains) from further excavation. Coprolites identified in flotation samples help to determine the character of pits that are suspected to be potential post-holes. Plant
remains also help to establish the chronology of the site and calibrate the reservoir correction for aquatic or aquatic-based-diet individuals.

Conclusions

Charred plant remains might be recovered in most Holocene archaeological sites if adequate sampling and recovery strategies are applied, regardless of open-air conditions, geology, etc... Studies of plant remains are a keystone for the reconstruction of past human activities, particularly, but not exclusively, concerning the exploitation choices of the natural resources in the environment. This study has proven that plant remains can be relatively abundant and diverse in Mesolithic open-air shell midden sites and have a high informative potential in regard to diverse human activities, from food procurement to the development of technological activities. The study of plant remains could and should be an ineludible part of research projects, as they are relevant to an understanding of both the “Mesolithic adaptations” and the nature of continuities and discontinuities in the Mesolithic-Neolithic transition.

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