Earth mortars use on neolithic domestic structures. Some case studies in Alentejo, Portugal

Argamassas de terra em estruturas domésticas do Neolítico. Alguns casos de estudo no Alentejo, Portugal

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Abstract
Earth mortars were constructively used since Ancient Neolithic in Southwest Iberia pre-historic habitat settlements. According to archaeological information, these materials were applied on Neolithic Period to render pits; latter, on Copper and Bronze Age, earth mortars were also used binding stone masonry, covering and filling vegetable structures, in mudbrick masonry and probably in massive walls. This paper aims to show some specific information about earth constructive traces obtained in interior Alentejo neolithic settlements of Defesa de Cima 2, Lajinha 8, Horta do Albardão 3, Valada do Mato (Évora district) and Toca da Raposa (Portalegre district). The analysed materials were composed by samples of burned clayish mortars coming from renderings or small thickness walls of probable storage bins and combustion structures. The samples descriptions include the drawing, measurement and photographic record of the chosen traces and also structural and granulometric analysis. The authors believe these analyses can contribute to deepen the knowledge of pre-historic domestic structures and constructive techniques, making possible technological reproduction of habitat settlements.

Keywords
Archaeological traces; characterisation; earth mortar; Neolithic habitat.

Resumo
O uso construtivo de argamassas à base de argila verificou-se no Sudoeste Peninsular desde o Neolítico Antigo. De acordo com os dados da arqueologia, estes materiais foram aplicados no Período Neolítico para revestimento de fossas; posteriormente, já na Idade do Cobre e do Bronze, as argamassas à base de argila foram utilizadas no assentamento de alvenarias de pedra, no revestimento de paredes compostas por engradados de materiais vegetais, na execução de adobes e, possivelmente, na construção de paredes maciças de terra. Esta comunicação tem por objectivo apresentar alguns dados mais específicos sobre os vestígios construtivos de terra detectados nos sítios de *habitat* neolíticos de Defesa de Cima 2, Lajinha 8, Horta do Albardão 3, Valada do Mato (distrito de Évora) e Toca da Raposa (distrito de Portalegre), essencialmente compostos por fragmentos de argamassas à base de argila, cozidos por fogo, provenientes do revestimento de fossas utilizadas como estruturas de combustão (lareiras e fornos) e de armazenagem (silos). A descrição das amostras incluiu a medição e o registo gráfico e fotográfico dos vestígios seleccionados. Foram também realizadas análises granulométricas e microestruturais. Julga-se que este tipo de estudos poderá contribuir para aprofundar o conhecimento das estruturas domésticas pré-históricas e das suas técnicas construtivas, possibilitando a reprodução tecnológica desses sítios de *habitat*.

Palavras-chave
Vestígios arqueológicos; caracterização; argamassa de terra; *habitat* neolítico.

Introduction

Archaeological materials exhumed in south Portugal settlements show that earth mortars were largely used on pre-historic domestic structures.

In a first stage of sedentariness – Neolithic –, clayish mortars were used to render ditches apparently used as storage bins or combustion structures. This technique seems to have been applied in Atafonas [1], Defesa de Cima 2 (Torre de Coelheiros, Évora) [2], Lajinha 8 [3], Horta do Albardão 3 (São Manços, Évora) [4], Xarez 12, Carraça 1 (Reguengos de Monsaraz, Évora) [5-7] and Salema (Santiago do Cacém, Setúbal), where renderings with 2.0 cm to 5.0 cm thicknesses were found *in situ*, covering pits with several shapes and dimensions [8].

In Xarez 12 some of the earth structures, interpreted as culinary ovens, seem to have moulded walls, with thickness until 30.0 cm, prolonged above the pits [7].

Later, on Copper Age, the presence of earth vestiges showing negative prints of ramifications is dominant. These materials, probably coming from covering and filling hut's vegetable structures, were found in São Pedro (Redondo, Évora) [9], Monte da Ponte (Nossa Senhora da Tourega, Évora) [10], Monte Novo dos Albardeiros [11], Torre do Esporão 3 (Reguengos de Monsaraz, Évora) [12], Porto das Carretas [13], Moinho de Valadares 1 [14], Mercador (Mourão, Évora) [15], Porto Torrão (Ferreira do Alentejo, Beja) [16], Cerro do Castelo de Santa Justa, Cerro do Corte João Marques (Alcoutim, Faro) [17] and Alcalar (Portimão, Faro) (figures 1 and 2) [18]. In some of these settlements, earth mortars were also used binding stone blocks of defensive walls and hut bases.

As to mudbrick masonry, traces were found in Monte da Tumba (Torrão, Alcácer do Sal, Setúbal) [19] and Alto do Outeiro (Baleizão, Beja) (figure 3) [20].

Earth was probably used on the construction of massive walls, as it seems to be the case in Alcalar's hut from "Corte 5", still in excavation.

Clayish renderings covering underground structures (bins and a water tank) were also found in calcolithic settlements, like Alto do Outeiro [20] and Alcalar [21].

On Bronze Age, in spite of the lack of domestic structures vestiges, earth mortars seem to have been largely used, mostly covering and filling hut's vegetable structures; traces were found in Rocha do Vigio 2 (Reguengos de Monsaraz, Évora) (figure 4) [22, 23] and Castro dos Ratinhos (Moura, Beja) [24]. In Castro dos Ratinhos, archaeologists also found traces of earth renderings from a hut stone base.

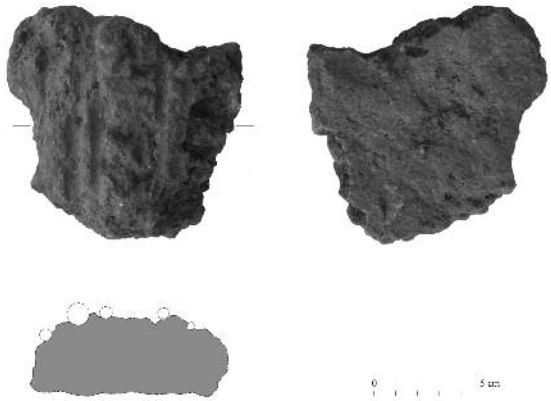

Fig. 1 Fragment of earth mortar with ramification traces from Alcalar calcolithic settlement.

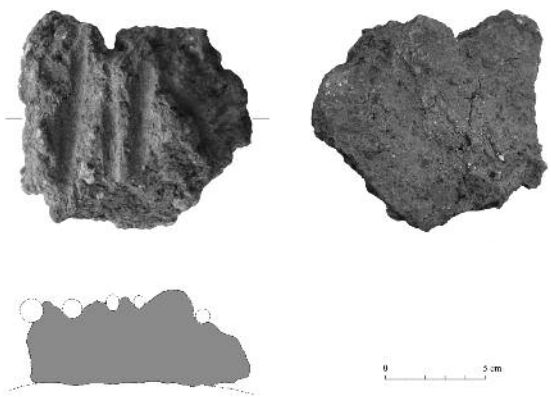

Fig. 2 Fragment of earth mortar with ramification traces from Alcalar calcolithic settlement.

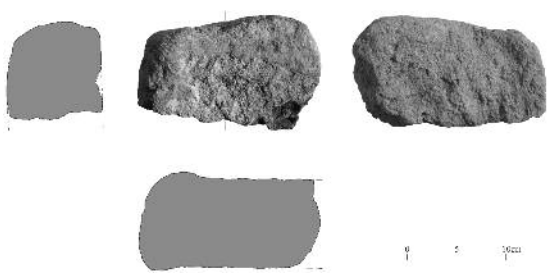

Fig. 3 Mudbrick fragment from Alto do Outeiro calcolithic settlement.

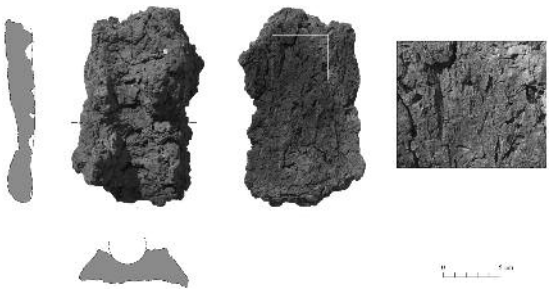

Fig. 4 Fragment of earth mortar with ramification traces from Rocha do Vigio 2 (Bronze Age settlement).

Neolithic earth vestiges

Methodology

The analysed materials were composed by fragments of burned clayish mortars coming from renderings of underground structures (Defesa de Cima 2, Lajinha 8 and Horta do Albardão 3) and a probable *combustion base* (Toca da Raposa). Materials from Valada do Mato came from a thrown down belonging to a probable domestic stone structure.

On a first stage, samples were measured, drawned and photographed; the second stage, still running, consists on laboratorial analyses (micro structural morphology by binocular glass observation, granulometry and mineralogical interpretation).

Defesa de Cima 2 (Torre de Coelheiros, Évora)

Chosen samples belonged to the renderings of two Ancient Neolithic pits, probably used as storage bins, both excavated in the granitic substrate.

These renderings, with about 2.0 cm to 3.0 cm thickness, were exposed to combustion by fire, after application in the pits walls (and, in some ditches, in the bases). According to archaeologists of Defesa de Cima 2, this procedure could be intentional, with the objective of waterproofing the bins interior [2].

Pit 5 (figure 5) had a circular plan, with a 90 cm diameter and a maximum preserved depth of 83 cm; inside, close to the basis, it contained imbricate stones with combustion vestiges. Clayish renderings were continuous, surfacing the lateral walls of the ditch (figure 6).

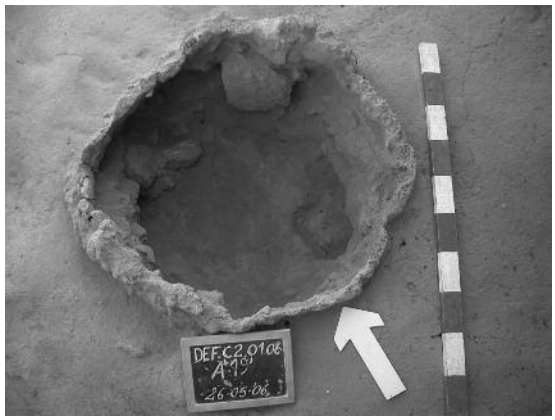

Fig. 5 Defesa de Cima 2: pit 5 after excavation (photo: Filipe Santos/ Arqueohoje).

Fig. 6 Defesa de Cima 2: detail of pit 5 interior renderings (photo: Filipe Santos/ Arqueohoje).

Pit 16 was too destroyed. It had a circular plan, with a 80 cm diameter and a maximum preserved depth from 40 cm to 50 cm. Only part of lateral renders was preserved.

Vestiges (figure 7) were composed by small nodules and plaques of various dimensions, with 3 cm maximum thickness. Concave faces of the plaques were smoothed and some of them had finger prints.

Pastes had brown-reddish colours and homogeneous compositions. As to the proportion between aggregates, fine elements (ilithic clays and sands) were dominant. Under binocular glass (figure 8), the presence of quartz and feldspar was observable.

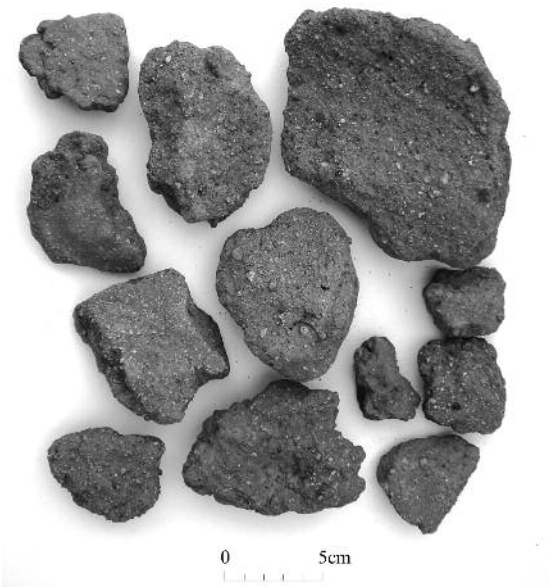

Fig. 7 Defesa de Cima 2: samples from pit 5.

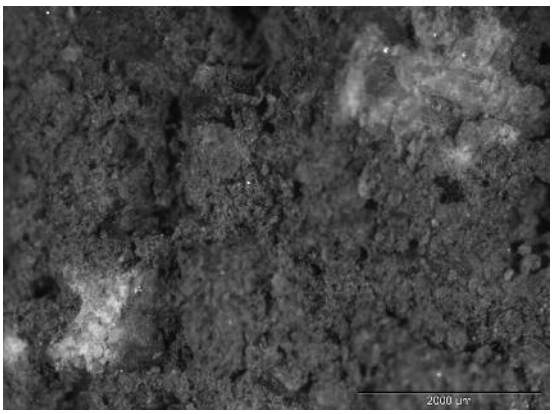

Fig. 8 Defesa de Cima 2: binocular glass photo of a sample from pit 5, 20x amplified.

Different layers on the renderings, negative traces of organic materials, animal or vegetable fibbers were not detected.

Pastes presented little pores, with diameters until 1.0 mm; micro fissures were also rare, with apertures until 0.2 mm.

Results from granulometry tests are presented on Table 1.

Table 1 Granulometry of pastes from Defesa de Cima 2.

Fraction	Ø (mm)	% - pit 5	% - pit 16
Large pebbles	60-20	0	0
Medium pebbles	20-6	0	0.2
Small pebbles	6-2	7.2	1.5
Coarse sand	2-0.6	21.7	25.7
Medium sand	0.6-0.2	50.6	41.0
Fine Sand	0.2-0.06	12.2	19.0
Silt + clay	<0.06	8.2	12.5

Lajinha 8 (São Manços, Évora)

Samples from Lajinha 8 Ancient Neolithic settlement came from combustion structure L8.1, apparently a kind of oven [3].

Structure L8.1 (figures 9 and 10) was made upon a pit with 90 cm of diameter and 20 cm of depth. Clayish renderings surfaced the walls and the base of the ditch; inside archaeologists found thermoclasts.

The structure was probably arched covered by clayish materials, thrown down above the pit's fill (figure 9).

Samples were collected from the walls and the base renderings. Vestiges were composed by small plaques of various dimensions, with 1.5 cm to 3.0 cm maximum thickness. Concave interior faces of the plaques were smoothed. Pastes had brown-reddish colours and homogeneous compositions. Fine elements were dominant.

Fig. 9 Combustion structure L8.1 of Lajinha 8 before dismounting, with vestiges from the probable covering.

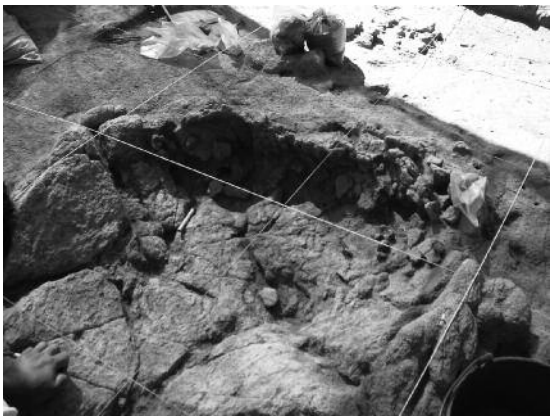

Fig. 10 Combustion structure L8.1 of Lajinha 8 after excavation, with renderings vestiges in situ.

Some sands (mostly quartzes) were found, with diameters until 1.0 mm.

Negative traces of organic materials, animal or vegetable fibbers were not detected. Pastes presented some pores, with diameters until 1.0 mm; micro fissures were also rare, with apertures until 0.5 mm.

Horta do Albardão 3 (São Manços, Évora)

Earth vestiges from Early Neolithic settlement of Horta do Albardão 3 probably belonged to a combustion structure made upon a pit, excavated in the granitic substrate. This artificial concavity had an oval plan, measuring 76 cm x 89 cm and was 39 cm to 44 cm deep.

Materials were collected from the interior of the ditch, above a stone layer with traces of combustion; archaeologists think that they probably belonged to the structural walls or an arched covering [4].

Vestiges (figure 11) were composed by plaques of burnt clayish pastes, with 5.0 cm to 6.5 cm thickness, smoothed in one of the faces. Only one sample presented ramification traces (in the opposite face of the one that seem to have been smoothed).

Pastes had brown-reddish colours and homogeneous compositions. Fine elements quantities were superior to larger aggregates; sands were mostly composed by quartz, with diameters until 0.5 mm (figure 12).

Negative traces of organic materials, animal or vegetable fibbers were not detected. Pastes had some

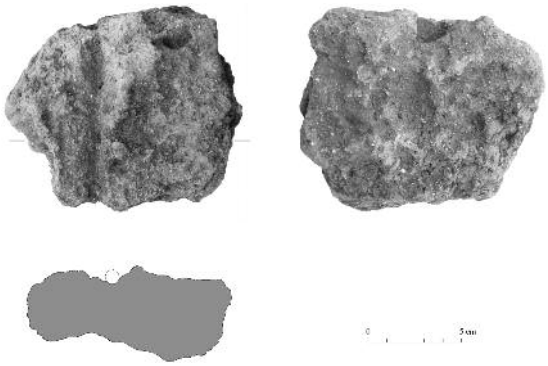

Fig. 11 Horta do Albardão 3: sample H.ALB.3.01.06 (3).

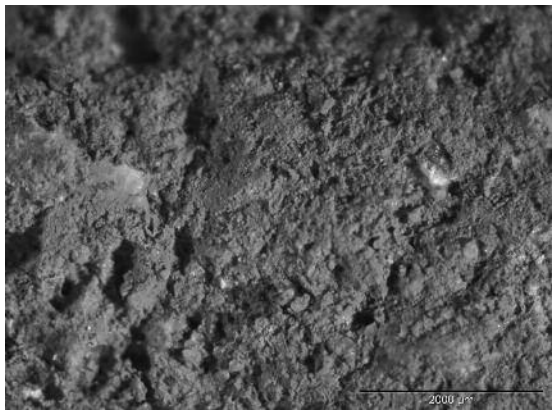

Fig. 12 Horta do Albardão 3: binocular glass photo of sample H.ALB.3.01.06 (3), 20x amplified.

porosity, with circular and oval pore, no larger than 0.5 mm diameter; fissures had apertures until 0.2 mm.

Valada do Mato (São Matias, Évora)

Materials from the Ancient Neolithic settlement of Valada do Mato were collected from a thrown down, mixed with many stone blocks, that probably belonged to an oval plan domestic structure [25].

Vestiges (figure 13) were composed by small plaques of burnt clayish pastes, with 1.0 cm to 2.5 cm thickness, smoothed in one face and irregular on the other.

Pastes had brown-reddish colours and revealed some homogeneity on composition. As to the proportion between aggregates, it was possible to observe the dominance of fine elements and the presence of quartz sands, with diameters until 0.5 mm (figure 14).

Fig. 13 Valada do Mato materials, from unit 9/19.

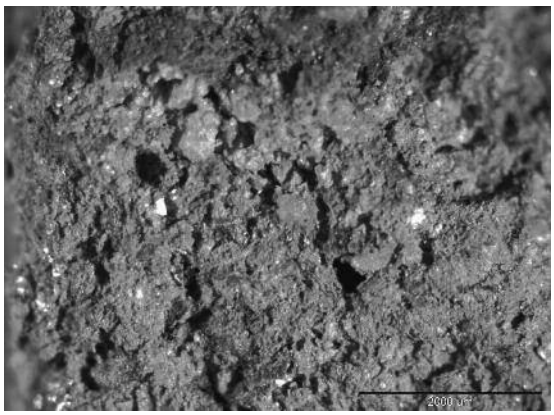

Fig. 14 Valada do Mato: binocular glass photo of a sample from unit 9/10, 20x amplified.

Negative traces of organic materials, animal or vegetable fibbers were not detected. Pastes had some porosity, with elongated pores (like pore-fissures), with diameters until 1.0 mm; rare fissures were detected, with apertures until 0.1 mm.

Toca da Raposa (Alter do Chão, Portalegre)

A sample from the Ancient Neolitic settlement of Toca da Raposa was collected from a probable combustion base made of clayish paste, with an elongated form (like a plaque), with about 2.0 cm thickness (figure 15) [26].

The paste had ochreous colour and revealed some homogeneity in its composition. As to proportion between aggregates, fine elements were in larger quantity. Some larger aggregates (small pebbles) were detected,

Fig. 15 Toca da Raposa possible combustion base (photo: Jorge Oliveira).

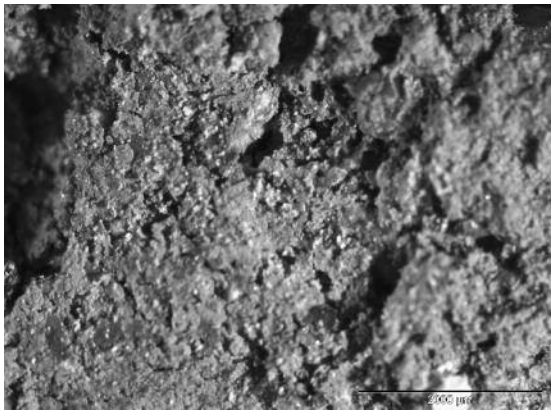

Fig. 16 Toca da Raposa: binocular glass photo of a sample from the probable combustion base, 20x amplified.

with diameters about 2.0 mm. There were not detected any negative traces of organic materials, animal or vegetable fibbers (figure 16).

Pastes had some porosity – with elongated pores (like pore-fissures), with diameters until 1.0 mm – and also some fissures, with apertures until 0.5 mm.

Discussion

All pastes presented homogeneous mixtures, under binocular glass observation, due to good kneading. Fine elements were dominant, with large quantities of sands. Pastes had some porosity and micro fissures with apertures only until 1mm.

Except for the materials from Horta do Albardão 3 (plaques with 5.0 cm to 6.5 cm of thickness), all samples seem to have come from renderings, with 1.0 cm to 3.0 cm thicknesses and smoothing in one of the faces. In two cases – Defesa de Cima 2 and Lajinha 8 (figures 6 and 10) – pastes were still above buttress (walls and bottoms of the pits).

After materials extraction (clay, sand), mixing and kneading, pastes would be hand laid above buttress, in only one layer. Subsequently, renderings would be manually smoothed.

All materials were burnt by fire, and the case of vestiges interpreted as combustion structures enforces those interpretations. However, in Defesa de Cima 2, where pits were interpreted as storage bins, two suppositions stand:

- Renderings combustion was made only to waterproof the bins' interior;

- Renderings combustion was made to toast cereals, to better conserve them and, in this case, structures would have two functions – storage and combustion.

Due to maximum conserved depths of many structures of Defesa de Cima 2 – until 83 cm – it seems highly probable that those pits function was related with storage, as archaeologists support.

Conclusions and future developments

From a data base which includes all the main excavated habitat places in South Portugal, it will be possible to identify some of the techniques and typologies used on the construction of domestic structures, since Ancient Neolithic to the Bronze Age.

The authors also believe that the development and analysis of case studies will help to understand the technologies of extraction, manufacture and application processes of earth building materials on Pre-history, making technological reproduction of habitat settlements possible, outside the original site.

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