

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

Patrícia Bruno

Architect, Mbc Architectonic and Landscape Heritage Restoration, PhD student in Pre-history/ University of Lisbon, 1600-214 Lisboa, Portugal, cbruno@fl.ul.pt

Paulina Faria

Civil Engineering, PhD in Architectural Heritage Rehabilitation, Assistant Professor/ Nova University of Lisbon, 2829-516 Caparica, Portugal, mpr@fct.unl.pt

SUMMARY: Earth mortars were constructively used since Ancient Neolithic in Southwest Iberia pre-historic habitat places.

According to archaeological information, these materials were applied on Neolithic Period to render ditches; 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 deeper the knowledge of pre-historic domestic structures and constructive techniques, making possible technological reproduction of habitat settlements.

KEY-WORDS: archaeological traces, characterisation, earth mortar, Neolithic habitat

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 seem to be applied in Atafonas, Defesa de Cima 2 (Torre de Coelheiros, Évora), Lajinha 8, Horta do Albardão 3 (São Manços, Évora), Xarez 12, Carraça 1 (Reguengos de Monsaraz, Évora) and Salema

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(Santiago do Cacém, Setúbal), where renderings with 2 to 5 cm thickness, were found *in situ*, covering ditches with several shapes and dimensions (Albergaria [1], Santos [2], Gaspar [3], Santos [4], Gonçalves [5, 6, 7], Silva [8]).

In Xarez 12 some of the earth structures, interpreted has culinary ovens, seem to have moulded walls, with thickness until 30 cm, prolonged above the ditches (Gonçalves [9]).

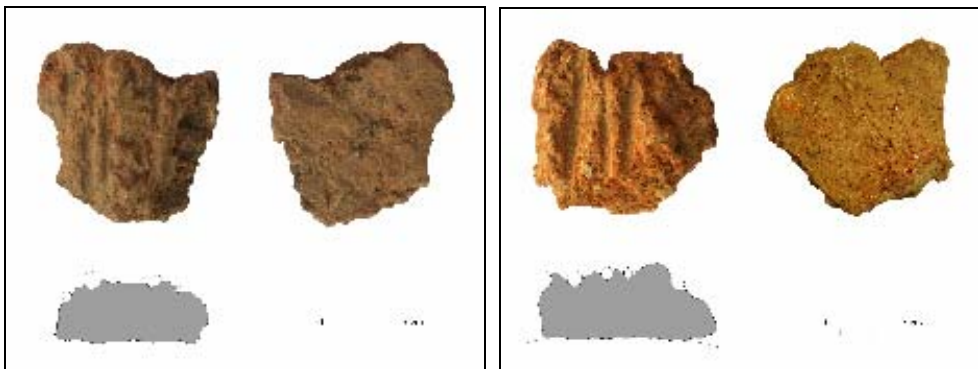
Later, on Cooper Age, the presence of earth vestiges showing negative prints of ramifications is dominant. These materials, probably coming from covering and filling hut's vegetable structures, were found in São Pedro (Redondo, Évora), Monte da Ponte (Nossa Senhora da Tourega, Évora), Monte Novo dos Albardeiros, Torre do Esporão 3 (Reguengos de Monsaraz, Évora), Porto das Carretas, Mercador, Moinho de Valadares 1 (Mourão, Évora), Porto Torrão (Ferreira do Alentejo, Beja), Cerro do Castelo de Santa Justa, Cerro do Corte João Marques (Alcoutim, Faro) and Alcalar (Portimão, Faro) (Mataloto [10], Hock [11], Gonçalves [12, 13], Silva [14], Valera [15, 16, 17], Gonçalves [18], Morán [19]). 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) and Alto do Outeiro (Baleizão, Beja) (Silva [20], Grilo [21]).

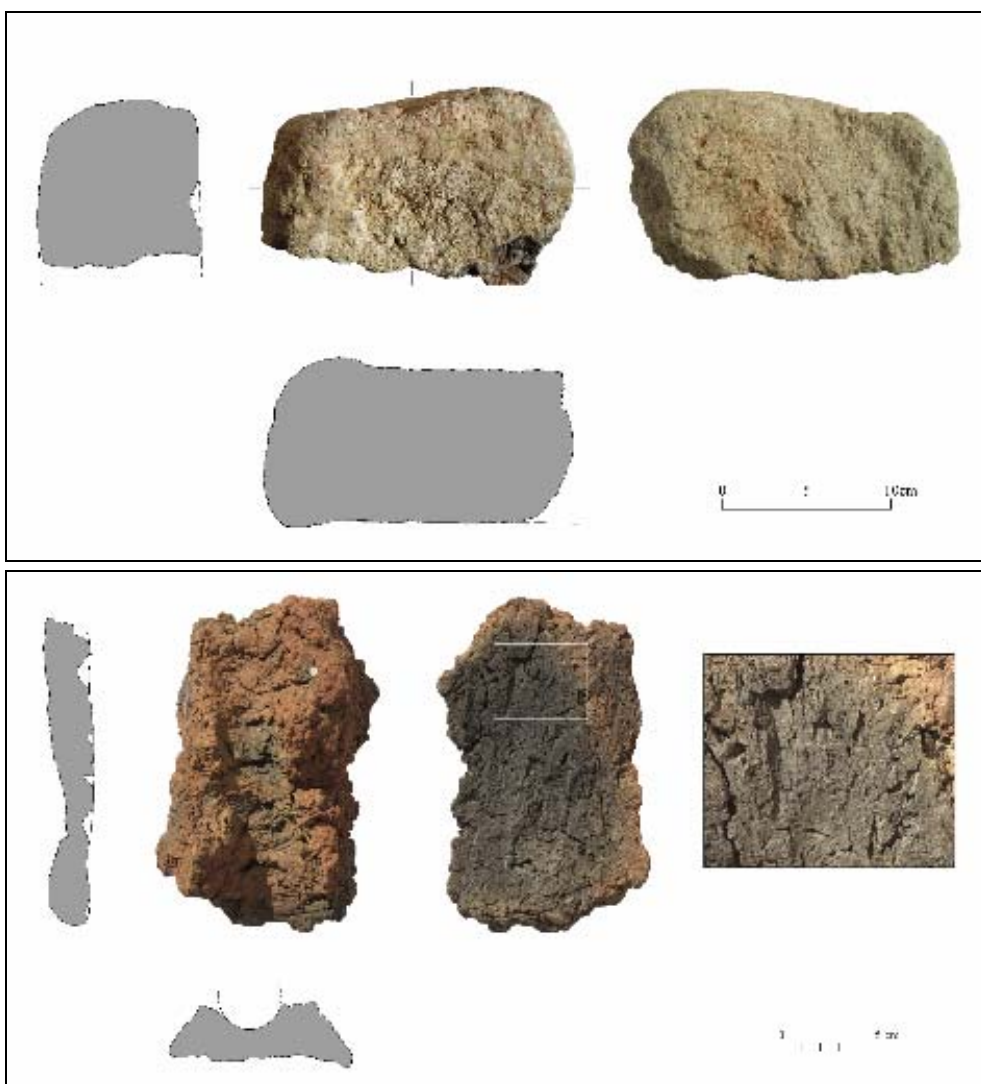
Earth was probably used on the construction of massive walls, as it seems in Alcalar's hut from "Corte 5", still in excavation.

Claysh renderings covering underground structures (bins and a water tank) were also found in calcolithic settlements, like Alto do Outeiro and Alcalar (Grilo [21], Morán [22]).

On Bronze Age, in spite the lack of domestic structures vestiges, earth mortars seem to be largely used, mostly covering and filling hut's vegetable structures; traces were found in Rocha do Végio 2 (Reguengos de Monsaraz, Évora) and Castro dos Ratinhos (Moura, Beja) (Bruno [23], Calado [24], Silva [25]). In Castro dos Ratinhos, archaeologists also found traces of earth renderings from a hut stone base.



Figures 1 and 2 - Fragments of earth mortars with ramification traces from Alcalar calcolithic settlement



Figures 3 and 4 - Mudbrick fragment from Alto do Outeiro calcolithic settlement; fragment of earth mortar, with ramification traces and straw addition, 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.

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On a first stage, samples were measured, designed and photographed; the second stage, still running, consists on laboratorial analyses (microstructural 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 ditches, probably used as storage bins, both excavated in the granitic substrate.

These renderings, with about 2 to 3 cm thickness, were exposed to combustion by fire, after application in the ditches 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 (Santos [26]).

Ditch 5 had circular plan, with 80 cm of diameter and maximum preserved depth of 83 cm; inside, close to the basis, contained imbricate stones with combustion vestiges. Clayish renderings were continuous, surfacing the lateral walls of the ditch.

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

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

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

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

Pastes presented little pores, with diameters until 1000 μ (1 mm); microfissures were also rare, with apertures until 200 μ (0.2 mm).

The following results were obtained in granulometry tests:

Fraction	Ø (mm)	% - ditch 5	% - ditch 16
Large pebbles	60-20	0	0
Medium pebbles	20-6	0	0.21
Small pebbles	6-2	7.25	1.55
Coarse sand	2-0.6	21.7	25.69
Medium sand	0.6-0.2	50.6	41.05
Fine Sand	0.2-0.06	12.25	19
Silte + clay	<0.06	8.2	12.5

Table 1. Granulometry of pastes from Defesa de Cima 2



Figures 5 and 6 - Defesa de Cima 2: left, Ditch 5 after excavation; right, detail of Ditch 5 interior renderings (photo: Filipe Santos/ Arqueohoje)



Figures 7 and 8 – Defesa de Cima 2: left: some samples from Ditch 5; right, photo of a sample from Ditch 5, with binocular glass, 20x amplified

Lajinha 8 (São Manços, Évora)

Samples from Lajinha 8 Ancient Neolithic settlement came from combustion structure L8.1, apparently a kind of oven (Gaspar [27]).

Structure L8.1 was made upon a ditch with 90 cm of diameter and 20 cm of depth. Claysh renderings surfaced the walls and the base of the ditch; inside archaeologists found combustion vestiges termoclasts.

The structure was probably arched covered by claysh materials, thrown down above the ditch's fill.

Samples were collected from the walls and the base renderings. Vestiges were composed by small plaques of various dimensions, with 1.5 to 3 cm maximum thickness. Concave interior faces of the plaques were smoothed. Pastes had brown-reddish colors and homogeneous compositions. Fine elements were dominant. Some sands (mostly quartzs) were found, with diameters until 1000 μ (1 mm).

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Negative traces of organic materials, animal or vegetable fibers were not detected. Pastes presented some pores, with diameters until 1000 μ (1 mm); microfissures were also rare, with apertures until 500 μ (0.5 mm)



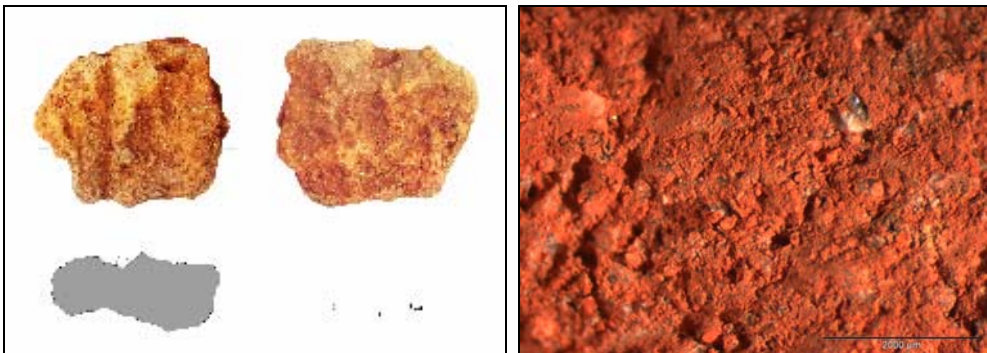
Figures 9 and 10 - Combustion structure L8.1 of Lajinha 8: left, before dismantling, with vestiges from the probable covering; right, final aspect of the structure, with renderings vestiges *in situ*

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 ditch, excavated in the granitic substrate. This artificial concavity had oval plan, measuring 0.76m x 0.89 m and 0.39 m to 0.44m 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 (Santos, [28]).

Vestiges were composed by plaques of burnt claysh pastes, with 5 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 be smoothed).



Figures 11 and 12 - Horta do Albardão 3: left, sample H.ALB.3.01.06 (3); right, photo with binocular glass, 20x amplified

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Pastes had brown-reddish colors and homogeneous compositions. Fine elements quantities were superior to larger aggregates; sands were mostly composed by quartz, with diameters until $500\ \mu$ (0.5 mm).

Negative traces of organic materials, animal or vegetable fibers were not detected. Pastes had some porosity, with circular and oval pore, no larger than $500\ \mu$ (0.5 mm) diameter; fissures had apertures until $200\ \mu$ (0.2 mm).

Valada do Mato (São Matias, Évora)

Materials from 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 (Diniz [29]).

Vestiges were composed by small plaques of burnt claysh pastes, with 1 to 2.5 cm thickness, smoothed in one of the faces and irregular on the other. Pastes had brown-reddish colors 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 $500\ \mu$ (0.5 mm).

Negative traces of organic materials, animal or vegetable fibers were not detected. Pastes had some porosity, with elongated pores (like pore-fissures), with diameters until $1000\ \mu$ (1 mm); rare fissures were detected, with apertures until $100\ \mu$ (0.1 mm).



Figures 13 and 14 - Valada do Mato: left, materials from unit 9/19; right, photo of a sample from the same unit, with binocular glass, 20x amplified

Toca da Raposa (Alter do Chão, Portalegre)

Sample from Ancient Neolithic settlement of Toca da Raposa was collected from a probable combustion base made of claysh paste, with elongated form (like a plaque), with about 2 cm thickness (Oliveira [30]). The paste had ochreous color 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, with diameters about $2000\ \mu$ (2 mm). There were not detected any negative traces of organic materials, animal or vegetable fibers.

Pastes had some porosity – with elongated pores (like pore-fissures), with diameters until $1000\ \mu$ (1 mm) – and also some fissures, with apertures until $500\ \mu$ (0.5 mm).

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Figures 15 and 16 - Toca da Raposa: left, possible combustion base (photo: Jorge Oliveira); right, photo of a sample of the same structure, with binocular glass, 20x amplified

DISCUSSION

All pastes presented homogeneous mixtures, by 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 1 mm.

Except materials from Horta do Albardão 3 (plaques with 5 to 6.5 cm of thickness), all samples seem to come from renderings, with 1 to 3 cm of thickness and smoothing in one of the faces. In two cases – Defesa de Cima 2 and Lajinha 8 – pastes were still above buttress (walls and bottoms of the ditches).

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

All materials were burnt by fire, and in the case of vestiges interpreted as combustion structures that enforces those interpretations. However, in Defesa de Cima 2, where ditches 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 ditches function was related with storage, has 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 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 possible technological reproduction of habitat settlements, outside the original site.

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