Towards a Temporality Approach in Perdigões, Portugal: Chemical and Mineralogical Composition of Neolithic and Chalcolithic Pottery and Raw Materials

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INTRODUCTION

The Perdigões site is one of the largest known Portuguese Chalcolithic settlements, occupied during the late 4th-3rd millenium B.C in Reguengos de Monsaraz, in the South of Portugal. This circular shaped settlement spreads over an area of 16 ha, and is delimited by two concentric ditches (Fig.1).

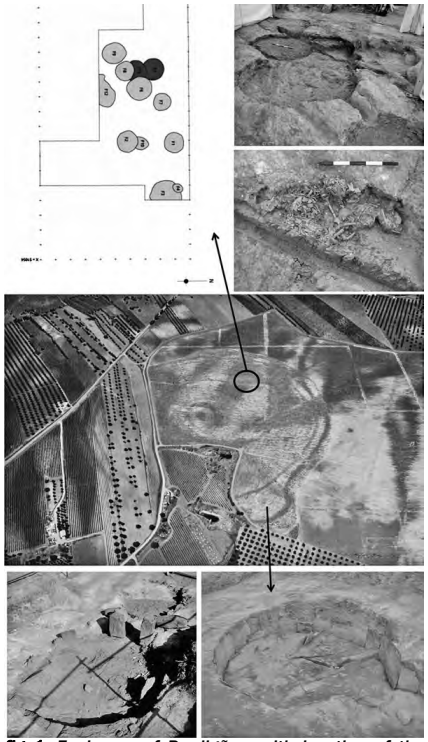

fig 1. *Enclosure of Perdigões, with location of the Necropolis (Tombs 2 and 1) below and burials in ditches above.*

The interpretive approaches that have been made are consciousness of its structural complexity; the topographic and landscape structure that has been excavated, allowed the development of interpretative discourses of the spatial organization of the site, also by means of astronomical and cosmological aspects (Valera, 2008). In addition, this site dovetail structures that are distributed differently over time, so that we may speak of "several" Perdigões lifelong the site occupation (Valera et. al., 2007; Valera, 2008), and also only part of the structural complexity is known (Valera, 2008). The on-going research is attentive to the fact that we are dealing with a reality that was dynamic, diverse, and complex, obtained from a register that provides fossilized palimpsest as a static, homogeneous, partial and still poorly known (Valera et. al., 2007).

The burial remains are diversified and mainly constituted by pottery, lithic artefacts, limestone and bone idols, *Pecten* shells, bone combs, etc. On a global perspective the pottery includes all the typical morphologies of the Late Neolithic and Chalcolithic of the South West of the Iberian Peninsula, and that differences occur between the Chalcolithic funerary and domestic recipients. According to the main goals of the archaeological project some of the answers can only be reached by an archaeometric approach, especially those concerning provenance and production technologies of the funerary ritual pottery, when compared with the domestic one (Dias et al, 2005; 2007), as well as, a diachronic approach (Neolithic to Chalcolithic), in relation to ceramic production strategy. So, it becomes important to realize if there are specific differences between the raw materials and the production technologies used on the making of pottery along time.

MATERIALS AND METHODS

According to the main objectives, an archaeometric study was performed comprising the chemical analysis of 70 Chalcolithic, and 30 Neolithic ceramic samples. The Calcolithic ones include ceramic recipients associated to funerary rituals (Tomb 1), to domestic typologies integrated in Tomb 1, to domestic typologies from the settlement area and to funerary recipient ceramics from Tomb 2. Neolithic pottery is mainly from sector Q, ditch 6.

The chemical analysis was done by means of instrumental neutron activation analysis (INAA). Ceramic samples and standards (sediment GSD 9 and soil GSS 1) were irradiated together in the core grid of the Portuguese Research Reactor (Sacavém) 7 hours (longer irradiation). This analysis permit to obtain the concentration of the following elements: Na, K, Fe, Sc, Cr, Co, Zn, Ga, As, Br, Rb, Zr, Sb, Cs, Ba, La, Ce, Nd, Sm, Eu, Tb, Yb, Lu, Hf, Ta, W, Th, U. Most of these elements were used as variables in a multivariate statistical approach, and also detailed analysis of element distribution was done in order to obtain chemical signatures, which able us to differentiate, or not, Neolithic from Chalcolithic pottery and/or typologies/uses.

The mineralogical composition of the ceramic body was obtained by X-ray diffraction. Non-oriented aggregate powders of the bulk paste sample were prepared and analyzed by using a XRD diffractometer, CuK_α radiation at 45 kV and 40 mA, a step size of 1º 2θ/min from 2º to 70º 2θ.

ARCHAEOMETRIC APPROACH

Chalcolithic pottery from Perdigões was previously studied (Dias et al, 2005; 2007), together with clay materials representative of regional geological contexts. Tree chemical groups of Chalcolithic pottery were defined; the comparison between regional geology and those three groups, pointed to a general use of raw materials from the

palabras clave: Arqueometría, Neolítico, Calcolítico, Cerámica, Mineralogía, Geoquímica

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geological contexts immediate to Perdigões, i.e. clays derived from the diorite and gabbros alteration (particularly two groups including "funeral" and "common" pottery). By contrast, a third group consisting almost exclusively of "funeral" containers from tomb 1, points to the resource of more diverse raw materials. This group, being the smallest and more heterogeneous chemically, is the one that points to the use of altered schists far from Perdigões about 5 km to the N, S and W. It includes only funerary ceramics which is also consistent with the hypothesis of the necropolis of Perdigões can be used by distant communities. Regarding Neolithic samples, a certain chemical homogeneity exists; even two samples are detachable from the others due to higher amounts of chemical elements from the first transition row, more related with ferromagnesian minerals.

In a mineralogical point of view we have the same type of mineralogical association for both chronologies (Quartz ≥ Phyllosilicates > Ca Plagioclase > K Feldspar > Amphibole. This latter mineral is more consistently present in Neolithic samples (especially in the former mentioned loners). It is also important to enhance that in a few samples biotite can reach 25 %. No high temperature mineral phases were identified.

The methodological approach allowed the establishment of chemical patterns of Neolithic, Chalcolithic and related clays. The Fe, Sc, Ba, As, Zn, Ta, U and Light Rare Earth Elements (LREE) contents have a higher range in the Chalcolithic funerary pottery. A few of these funerary ceramics point to a complete different source, especially in the Rare Earth Elements (REE). One bigger group reflects the existence of more chemical homogeneity (majority of Neolithic and Chalcolithic domestic and funerary ceramics); another one is clearly explained by REE, especially LREE (majority of Chalcolithic domestic ceramics and some Neolithic ones). Quartzodiorite derived clays were probably the most used raw material for those groups, as well as diorites and associated gabbros, and in some cases also tertiary clays. On the other hand, a third group is explained specially by Fe, Sc, Cr and Co (mainly funerary ceramics of tomb 1 and one Neolithic sample). This group, which is the smallest, is also the only one which point to the use of weathered schists far from Perdigões about 5 km to the north, south and west (Fig. 2). Also outliers were defined for tomb 1 ceramics.

The diachronic approach of compositional features of ceramics from the Neolithic to the Chalcolithic reinforces the resource to local clay raw materials in a temporal point of view.

CONCLUDING REMARKS

Chemical and mineralogical composition was performed on both Neolithic and Chalcolithic ceramics from Perdigões, belonging to various archaeological contexts, as well as on local and regional clay raw materials. Trace elements become the most useful tool to establish a chronological ceramic production strategy. Compositional results of both ceramics and clay samples point toward a regional origin for most of the ceramics, with a spread of resources in the Chalcolithic funerary pottery. In fact, by combining a greater heterogeneity and a more distant geological origin then "common" ones, these ceramics used in funerary rituals may be originated from peripheral known contexts and which are located much close to that of geological origin of the used clays. If we add to this the fact that, in both excavated tombs, only secondary deposits have been identified, the possibility gets some relief of the distant communities use Perdigões in the management of their burial practices, which would reinforce the idea of the aggregator power of this site. We also may infer that, as predictable, most of the ceramics, independently of the studied chronology, points to the resource to local clays available close to the site, and have a certain chemical homogeneity, with the above mentioned exception of funerary pottery from tomb 1, which points to a spread in the clays resources. This fact is also consistent with the hypothesis of the necropolis of Perdigões can be used by distant communities, and of a consistent occupation of the site with the resource to the same type of raw materials from Neolithic to Chalcolithic.

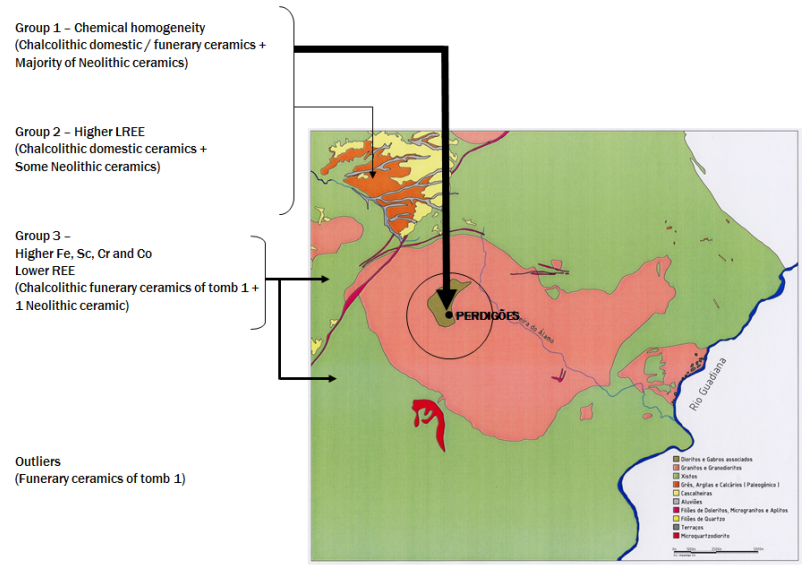

fig.2. *Geological map of Perdigões. Available and used raw materials for Neolithic and Chalcolithic ceramics.*

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