Ceramics, style and exchange in the Early Neolithic Upper Mondego Basin: a technological approach

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ABSTRACT It has become clear that one way in which key aspects of the creation and use of material culture can be studied is by the integration of typological and physico-chemical analysis of ceramics. Such an integration holds the promise of revealing a wealth of information on the 'ways of making' pottery, as well as glimpses into their life as material objects beyond the phase of manufacture. In this paper, the preliminary results of a combined mineralogical, textural and elemental study of 59 pottery samples from the Early Neolithic levels of Buraco da Moura and Penedo da Penha (Central Northern Portugal), conducted by thin-section petrography and chemical analysis by neutron activation analysis, will be presented. The differences in the composition of the paste suggest that the ceramics were fired at low maximum temperatures (750°C), with a high heating rate and short soaking time.

1. Neolithisation of the Upper Mondego Basin: the contribution of ceramic analysis

One of the key issues in the consideration of the Iberian Neolithic is the study of the processes underlying the Neolithisation of the hinterland. Regarding these areas, it has been suggested that changes evident in the Early Neolithic rely heavily on a network of connections established between the coastal and inland regions. These studies have often drawn upon ceramic typology and stylistic comparison with other regional 'cultures'; but issues of pottery technology have been addressed only rarely and ceramic production has not been discussed.

In the case of the Upper Mondego Basin, in central/northern Portugal, ceramic stylistic correlations with extra-regional cultural traditions suggested the potential of a archaeometric approach to ceramic technology in this area, in order to explore some of the mechanisms through which the so called 'cultural influences' — which took their material form in pottery styles — would play a part in the Neolithisation of the Hinterland.

It has become clear that one way in which key aspects of the creation and use of material culture can be studied is by the integration of typological and physico-chemical analysis of ceramics. Such an integration holds the promise of revealing a wealth of information on the 'ways of making' pottery, as well as glimpses into their life as material objects beyond the phase of manufacture. In other areas of Europe, particularly the eastern Mediterranean, there have been ground breaking results from such approaches in terms of small-scale production and distribution, technological styles, long-term traditions and group identity.

2. Methods

In this paper, the preliminary results of a combined mineralogical, textural and elemental study of 59 pottery samples from the Early Neolithic levels of Buraco da Moura and Penedo da Penha, conducted by thin-section petrography and chemical analysis by neutron activation analysis, will be presented.

Petrographic examination was used for providing insight into technological choices through the reconstruction of clay 'recipes' and forming techniques. A combination of petrography with NAA was regarded as the most suitable for discriminating provenance, as the hard rock geology of the area hosts a variety of closely related formations. Chemical data was obtained by instrumental neutron activation analysis, irradiated in the core grid of the Portuguese Research Reactor (Sacavém), obtaining the concentration of major and trace elements: Na_2O, K_2O, Fe_2O_3, Cr, Co, Zn, Rb, Zr, Cs, La, Ce, Nd, Sm, Eu, Tb, Yb, Lu, Hf, Ta, Th and U.

Analytical data was integrated fully with typological information, the aim being to contextualise with analytical data the stylistic observations that underlie some of the archaeological questions. This is a first attempt in an ongoing project in order to assess the potentials and limitations of such a technological approach to ceramic style, and exchange.

3. Archaeological context

3.1. The sites

In the Upper Mondego Basin, several Early Neolithic settlements have been identified so far (Fig. 1) (Valera, 1998, 2002-2003). Penedo da Penha (PP1) and Buraco da Moura (BM) share several characteristics, both in terms of site morphology, the nature of occupation, and material culture (Valera, 2000b). They are agglomerations of large granitic blocks, chaotically disposed in such a way that complex sets of galleries were formed, and were occupied as rock shelters throughout prehistory.

PP1 is located on the edge of the deep Mondego Valley, in an extensive area of fairly homogeneous granitic country rocks, crossed by quartz dykes and aplite-pegmatite veins (Teixeira et al., 1961). Located in the outskirts of Serra da Estrela, BM is set on a less homogeneous geological context. Besides alkali and calc-alkali granite, the Schist-Greywacke Complex and derived metamorphic series represent an important formation in the local geology (Teixeira et al., 1967, 1974).

3.2. Pottery typology

In contrast to other sites in the region, the Early Neolithic pottery assemblages from BM and PP1 are characterised by the predominance of closed shapes (such as spherical vessels, globular vessels and bowls), the high percentage of decorated vessels, and the frequency of appliqué features such as handles (Valera, 1998).

The assemblages of these sites are large and homogeneous in comparison to most other sites of the area both in terms of morphology and decoration. Their affinities suggest a strong cultural connection, which may be indicative of being occupied by the same group seasonally in a transhumant system.

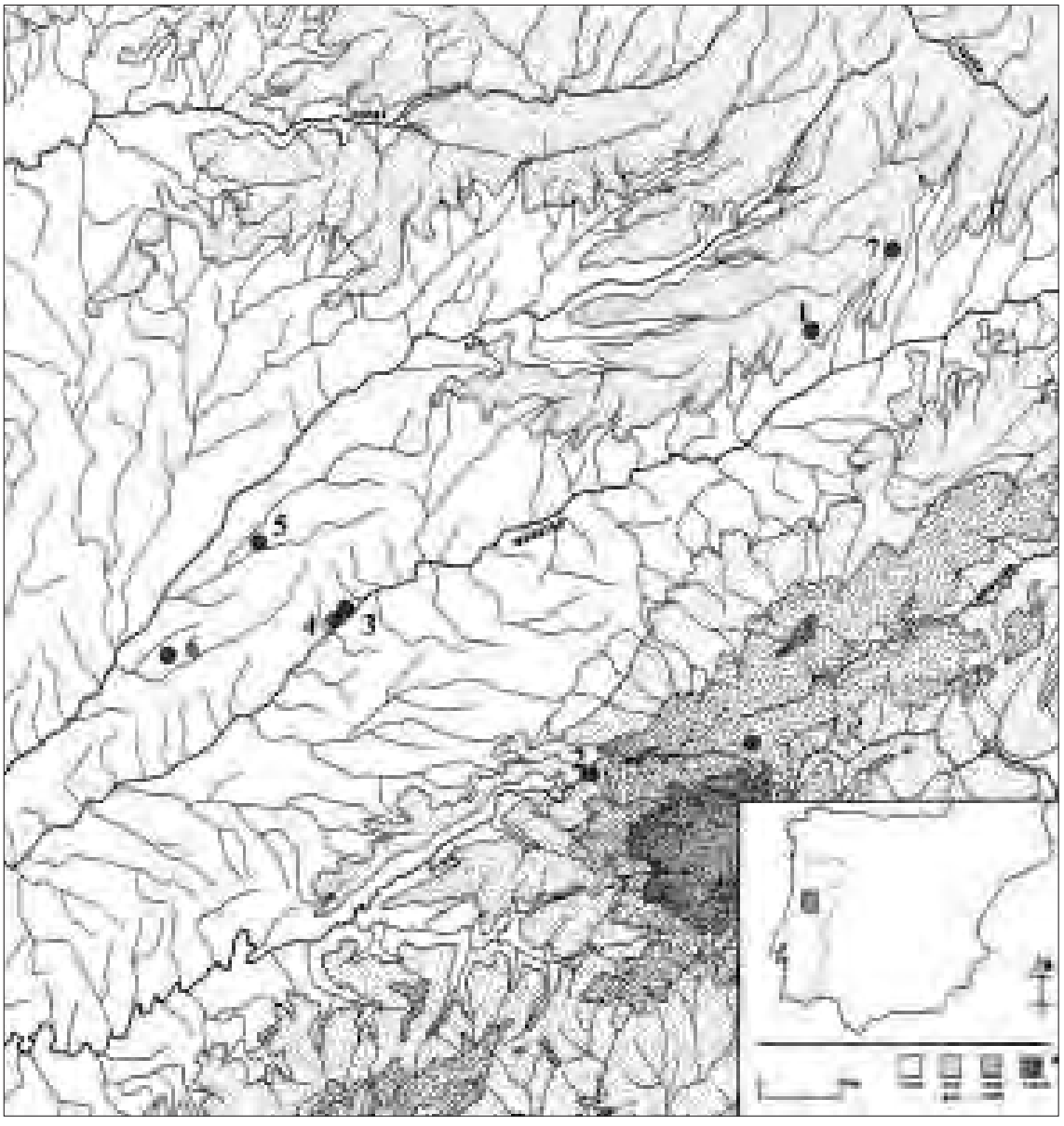

FIG. 1 – Early Neolithic sites in the Upper Mondego Basin: 1. Quinta da Assentada, 2. Buraco da Moura de São Romão, 3. Quinta do Soito and Folhadal, 4. Penedo da Penha, 5. Beijós, 6. Carriceiras, 7. Quinta da Rosa.

On the other hand, the presence of discrete ceramic morphologies (such as 'bottle'-type vessels, parabolic vessels, conical bases and vertical handles with double horizontal hole), and particular decoration (such as the application of 'almagro' slip) suggests strong relations with other Iberian regions such as the Andalusia and the Spanish Meseta (Valera, 1998).

4. Archaeometric results

4.1. Main petrographic results

At both sites, a number of fabrics were identified. In each case there were two fabric groups which contained the majority of samples and which were preliminarily interpreted as 'local' on the basis of three observations: the relative homogeneity of their mineralogi-

cal composition, their general compatibility with the local geology, and their numerical representation within the assemblages. Beyond these main types there were a number of fabrics at each site defined in the main by textural criteria. Such petrographic characterisation followed the methodology proposed by Whitbread (Whitbread, 1986, 1989, 1991, 1995, 1996). Due to the relative mineralogical homogeneity of the ceramic assemblages under study, the variation in shape, size range, and both overall and differential frequency of inclusions proved important.

At an inter-site level, 'local' fabrics can be distinguished according to mineralogical composition: pottery from PP1 is characterised by relative abundance of tourmaline, absence of amphibole, and relatively weak mineral alteration, whereas pottery from BM is characterised by the presence of accessory amphibole, the lower frequency of small-grained tourmaline, and strongly metamorphosed rock fragments, consistent with proximity to the contact aureole.

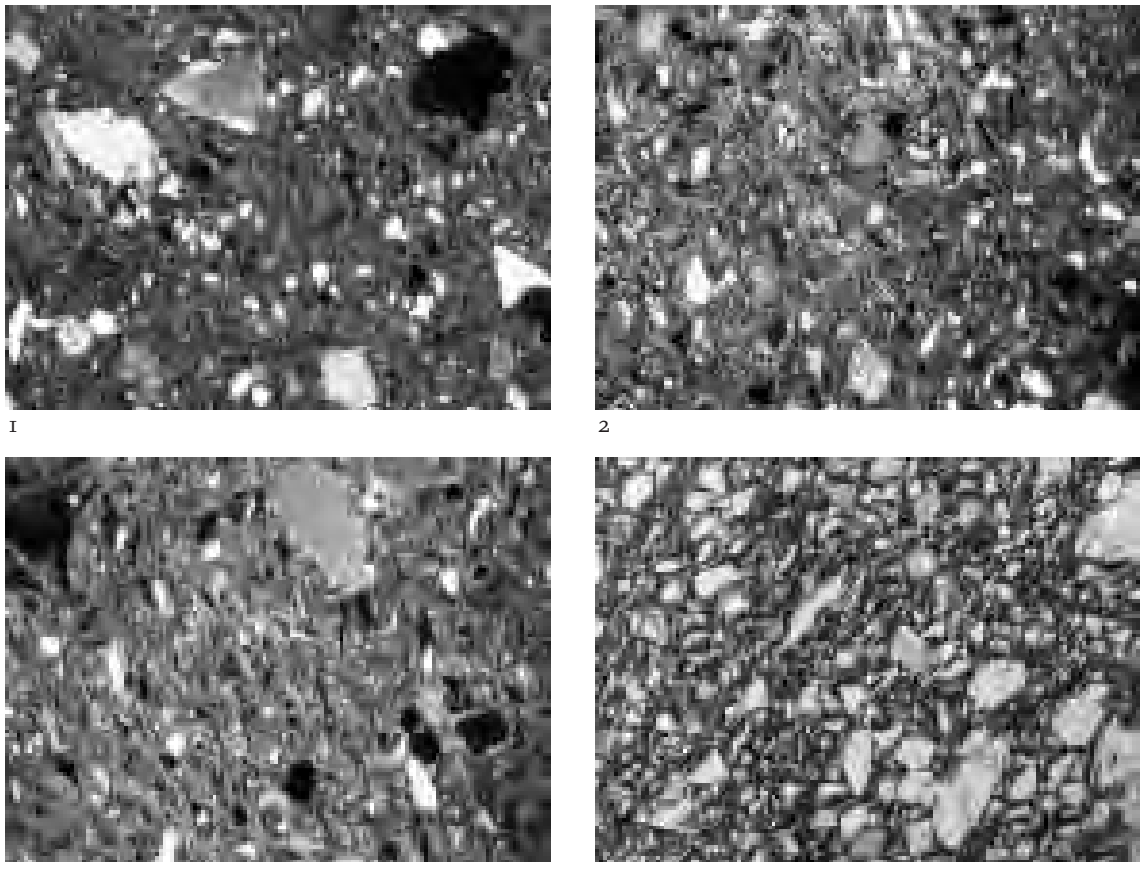

FIG. 2 – Microphotographs of BM and PP1 main Fabrics (Scale= x25): 1. BM Fabric 1 (sample= BM11); 2. BM Fabric 2 (sample= BM24); 3. PP1 Fabric 1 (sample= PP16); 4. PP1 Fabric 2 (sample= PP9).

Petrographic information regarding technology can be summarised into two main aspects. Firstly, different clay 'recipes' were detected in each site, and two manufacturing processes were identified: clay mixing and tempering (Fig. 3). Clay mixing was identified only in PP1 Fabric 5, which stands out from the overall manufacturing tradition. Temper materials include rock-derived material in both sites, and single examples of grog and possibly bone in BM. Secondly, both vessels and vertical handles appear to have been coil-built. Features clearly indicative of coiling (such as preferred orientation of elongated particles and voids, joint voids and relic coil domains) were detected in all fabrics and in most of the samples.

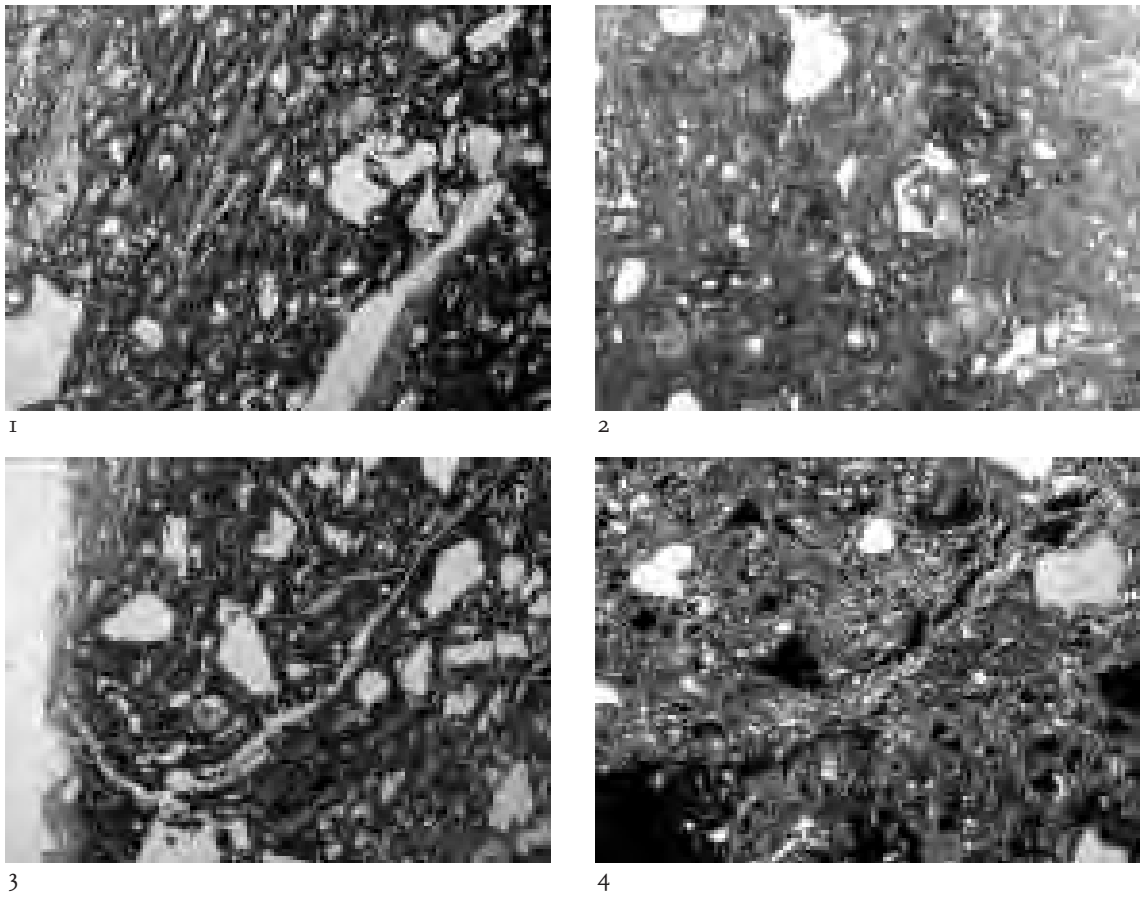

FIG. 3 – Manufacturing processes. Above: Body preparation - 1. clay mixing (sample= PP12), 2. grog tempering (sample= BM1); Bellow: Forming techniques - coiling: 3. vessel wall (sample= BM31), 4. handle (sample= PP18).

4.2. Chemistry results

Chemical data were log-transformed and treated with standard statistic procedures, using Mathsoft S-Plus software with scripts developed by the GeoPro Network. Chemical groups and outliers were defined by hierarchical agglomerative cluster analysis performed by average linkage, and then plotted against the first two components. As a result, four main groups and twelve outliers were established. From the 12 ungrouped samples, all but three are petrographic 'loners', a result that seems to suggest the compatibility of the NAA and petrographic results. It is important to stress that chemical analysis by NAA was intended only as a discriminatory tool in a preliminary approach to the ceramic composition, since no sampling of raw material resources was undertaken.

The main results can be summarised in five main aspects (Fig. 4). Firstly, despite the high standard deviation values, a clear site-specific chemical composition of pottery assemblages could be detected. The fact that the groups are separated on the basis of the values of rare earth elements reinforces the consistency of their geological differentiation. Secondly, the two main chemical groups (Group 1 and 2) overlap with the Fabrics preliminarily assumed to be 'local' for each site. Data from PP1 appear to be chemically more homogeneous than the ones from BM. Thirdly, despite the distinction between Group 1 and 2, which related to PP1 and BM respectively, they do slightly overlap. The fact that 3 out of 4 such samples were assigned to the same petrographic fabric (namely, BM Fabric 2) should

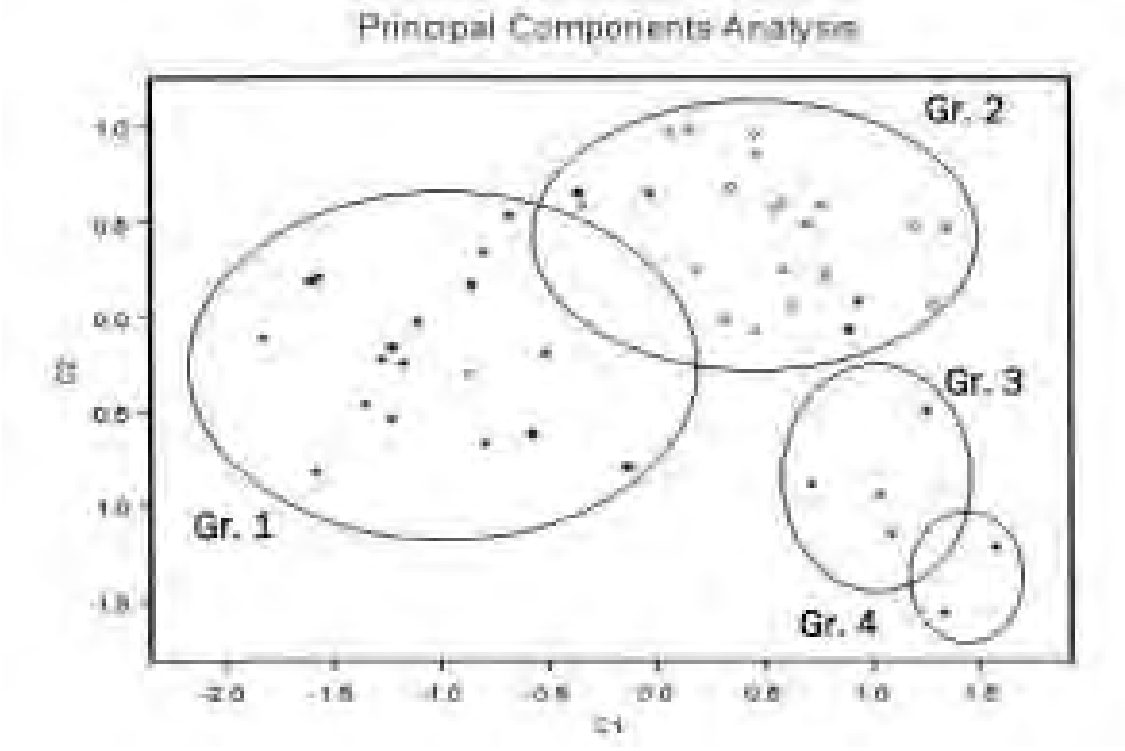

FIG. 4 – PCA plot of the first two components on log transformed data, standardised to Sm: total number of samples=47 after removing the outliers (dark dots=BM; white dots=PP1). The circles are just indicative of clusters and do not signify 95% certainty.

be noted. Fourthly, a few vessels from BM cluster within the PP chemical group, and PPE22 clusters within the BM group. Finally, Groups 3 and 4 generally overlap with BM Fabrics 3 and 7, on the one hand, and Fabric 4, on the other hand. They could have been regarded as a unique chemical group if petrographic information had not been considered.

These details of the interplay between petrographic and chemical data are at this stage enticing, but judgement on their implications in terms of pottery exchange should be reserved until further comparative geological and archaeological samples are obtained.

5. Archaeological implications: ceramic style and exchange in the Upper Mondego Basin

On the basis of these preliminary results, some observations regarding ceramic style and exchange can be introduced.

Despite the fact that pottery from both PP1 and BM is otherwise very similar in shape and decoration, in each site a clear main group of samples was discriminated in both chemical and petrographic terms. Nor were technological differences evident between sites, regarding the main steps of the manufacturing sequence

The clay pastes do not vary according to morphological types and/or decorative techniques. Ceramic types appear randomly scattered within both petrographic and chemical groups, and no Fabric is linked to the production of a particular pottery type or set of types.

The results obtained so far reinforce the image of cultural homogeneity drawn from previous morphological studies (Valera, 1998, 2000a), at both intra- and inter-site level, but petrographic and chemical 'outliers' agree in suggesting a possible non-local origin for a small number of pots. However, only BM1 (a spherical vessel tempered with grog) and

PPE12 (a bottle-shaped vessel manufactured by clay mixing) represent discrete technological traditions within the assemblages. It is notable that these vessels display the highest quality almagro slips.

These preliminary data have implications for our understanding of issues of ceramic exchange over a distance at this early stage in the region. If pottery types and stylistic features connected to the Middle Neolithic of Alta Andalusia such as the vertical handles with double horizontal holes and bottle-type vessels are considered some observations can be made.

Regarding the vertical handles (Fig. 5), the analytical and petrographic characterisation of three sherds from BM and PP agree in suggesting the local production of these items. On the basis of these results, the presence of vertical handles in the Upper Mondego Basin, outside the Iberian southeastern regions and the Spanish Meseta, cannot be explained in terms of movements of pots over long-distance; rather transmission of ideas or movement of people may be in process.

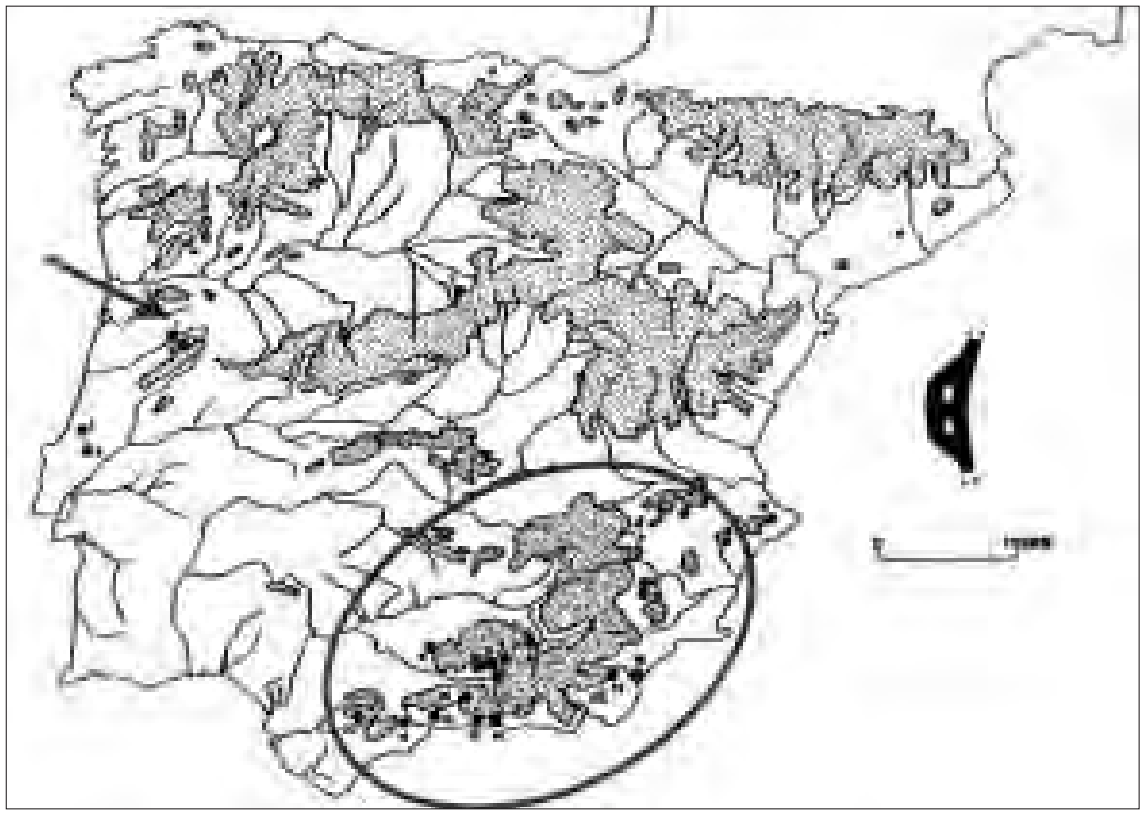

FIG. 5 – Spatial distribution of vertical handles with double vertical holes in Iberian Peninsula. The arrow points the location of BM and PP1 (adapted from Valera, 1998).

In the case of the bottle-type vessels, a more complex scenario can be envisaged. Although the number of samples studied is so far too small to allow further discussion, the possible 'imitation' — in the case of PPE6 — of 'foreign' stylistic templates (represented by PPE12) should be considered. These vessels in the same shapes appear in different clay recipes, indicating very different ways of making the clay body — with grog temper and rock temper respectively. The implications of such observations rely on the fact that, although produced locally, this pottery is linked in typological terms to other inland regions.

Understanding the Neolithisation of the area depends on information regarding compositional, morphological and decorative templates. Their interplay marks out the difference

between three interpretative alternatives: those of ideas moving, material culture moving and people moving. In case of the Upper Mondego Basin, and on the basis of the data obtained so far, pots are not moving apparently; but according to the set of ^{14}C dates recently available for the southern and northern Mesetas, as well as other Hinterland regions (Valera, 2000b), something is moving fast.

6. Final remarks

The presentation of this preliminary work intended to show the potential of a technological approach in shedding light on the multidimensional and multicultural processes underlying the neolithisation of Iberia at a regional scale.

Within an ongoing project, such approach to ceramic style will be pursuit by expanding the work to other sites, namely recently identified settlements, whose material culture contests the image of cultural homogeneity drawn from BM and PP1 ceramics, and by carrying out raw material prospection and sampling in the Upper Mondego Valley. These are expected to provide further relevant information for addressing issues of exchange and intra- and inter-regional social relations.

NOTES

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