TECHNOLOGICAL CHOICES AT THE ONSET OF THE IBERIAN BRONZE AGE: POTTERY FROM THE MONDEGO PLATEAU, PORTUGAL

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Abstract: *Ceramic analysis traditionally has focused on provenance as a tool to address exchange and large-scale interaction; most have tended not to explore variability beyond local/non-local concerns. This paper explores evidence for technological choices during the onset of the Early Bronze Age within a restricted area of North-Central Portugal (the Mondego Plateau), drawing on preliminary petrographic analysis of pottery from three sites. The analysis has revealed a much higher diversity of raw materials and paste preparation techniques than anticipated. Technological patterns do not correlate simply with typological categories but are often site specific, which is seen as reflecting differences in activities between sites.*

Keywords: *ceramics, thin-section petrography, Early Bronze Age, Chalcolithic, Portugal*

INTRODUCTION

Ceramic analysis traditionally has focused on provenance as a tool to address exchange and large-scale interaction. While studies orientated towards technology have tended to create a background against which foreign items could be singled out, most have tended not to explore variability beyond local/non-local concerns. However, over the last 20 years, anthropologists have shown that technology is a social practice and that decisions about the manufacture and use of pottery are informed by social norms. Therefore, ceramic technology has the potential to help understand social boundaries and interaction (e.g. *Dietler & Herbich 1998*).

Drawing on preliminary petrographic analysis of pottery from three sites in the Mondego Plateau (North-Central Portugal), this paper explores evidence for technological choices during the onset of the Early Bronze Age (EBA), a relatively broad period, covering the later third to the beginning of the second millennia BC. The Mondego Plateau is a suitable case-study to address these issues, due to the character of its geology and archaeology. Dominated by an extensive granitic batholith, the regional geology could be considered to offer a fairly restricted range of raw materials for pottery manufacture. This is reinforced by the fact that archaeological sites are located at very short distances from each other (circa 2 km), sharing, for the most part, the same potential resource areas. However, this close proximity might not be reflected in homogeneous pottery production, as pottery would not have been made everywhere, at all times, and for the same purposes. The diversity of broadly contemporary prehistoric sites on the Plateau allows for comparisons between places where people would have engaged with different kinds of activities, such as burial (at Carapito III), social gatherings (at Fraga da Pena), and daily living (at Malhada).

BACKGROUND, MATERIALS AND METHODS

Pottery variability and archaeological context

In the second half of the 3rd millenium BC, regional pottery is characterised by some long-lived shapes (spherical and hemispherical), considered to constitute the 'chalcolithic local tradition', by the appearance of new shapes (conical vessels, large cylindrical pots, and flat bases) and by the diversification of decoration (e.g. introduction of plastic applications) (*Valera 2006*). Some of these new ceramic categories have been given emphasis in archaeological accounts of this period because they are thought to suggest extra-regional connections. The best known of these are bell-beakers and, in Northern Portugal, comb-incised decorated pottery (**Fig. 1**). Rather than replacing existing shapes, the new shapes add to morphological (and possibly functional) diversity, since old and new types coexist and probably complement one another. Comparing two typological categories (Late Neolithic tradition and EBA transition), rather than focusing on beakers, may help assess changes in the ceramic technological tradition of the region.

Differences observed between ceramic assemblages are related, to a great extent, to the activities taking place in these sites, even though differences in chronology should also be considered: Carapito III is a megalithic burial (dolmen), situated in the left bank of the Carapito River (*Leisner & Ribeiro 1968*); Malhada is an open-air settlement on the slope of the Muxagata River valley; while Fraga is a small stone-walled enclosure overlooking this subsidiary of the Mondego (*Valera 2006*) (**Fig. 2**).

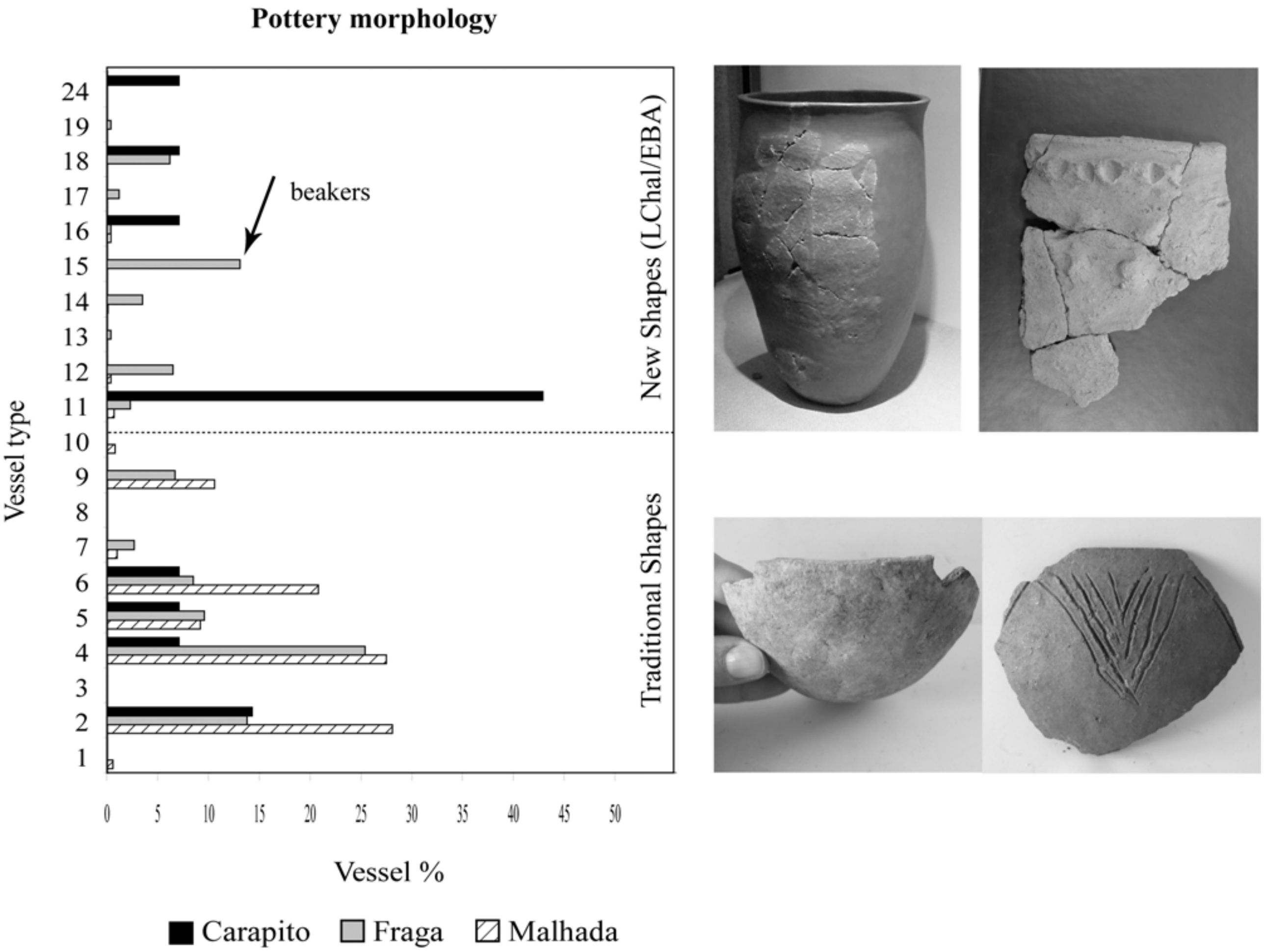


Fig.1 Pottery typology in the Upper Mondego at the onset of the EBA (following information from Leisner & Ribeiro 1968, Senna-Martinez 1989 and Valera 2006)

Geological background

The Mondego Plateau is located within the Central Iberian Zone, an area shaped by regional metamorphism associated with the main Hercynian deformation events (*Azevedo & Nolan 1998*) (**Fig. 3**). Its geology consists mainly of an extensive granitic batholith complex (the Beira batholith), crosscut by numerous dolerite, aplite-pegmatite and quartz intrusions. Small outcrops of country rocks, belonging to the Pre-Ordovician Beira Schist-Greywacke Complex (SGC), can be seen just west of the archaeological sites. The SGC includes micaschists (alternating with meta-quartzites, -siltstones, -sandstones, and -conglomerates), as well as sparse phyllite and metagreywacke (*Silva 2005: 6*). Armorican quartzite is locally present, and spotted schist and migmatite are frequent in the contact with the granitoids (*Teixeira et al. 1972*).

The region is rocky, with overall undeveloped sandy soils, but alluvial deposits have formed along the main streams, while clay-rich materials have derived from *in situ* weathering of rocks. Fieldwork has confirmed the alteration of dolerite, aplite-pegmatites, schist and granites at locations close to the archaeological sites under study. These residual ‘clays’ were sampled and analysed chemically and mineralogically (by XRD) (*Dias et al. 2000*) in order to create a reference collection for ceramic analysis. Further mineralogical characterisation of these samples by optical microscopy has proven critical in the study of ceramic pastes, especially where clays of doleritic origin were used (**Fig. 4**).

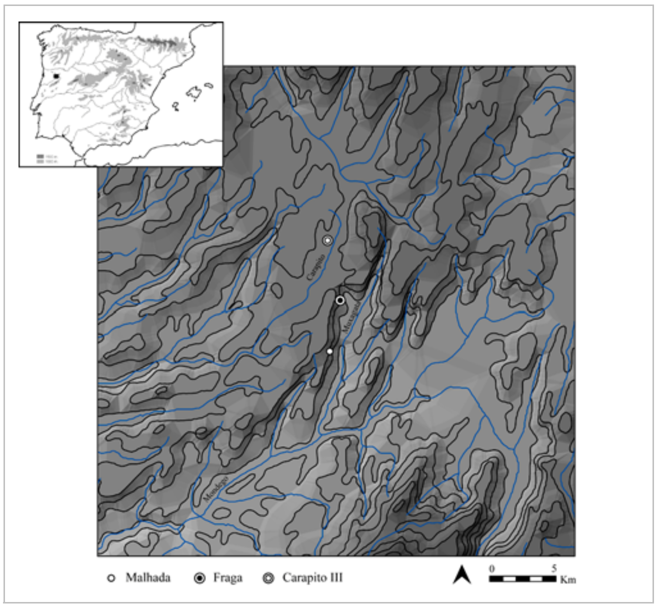


Fig. 2 Location of the archaeological sites in the Upper Mondego Plateau

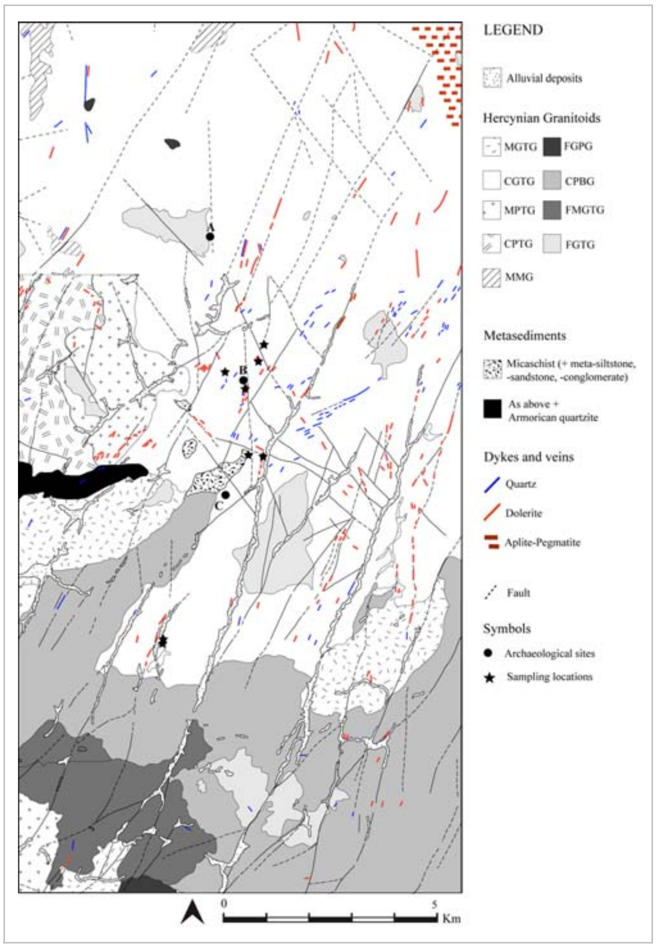


Fig. 3 Geological map with location of the archaeological sites under study (●), and clay sampling (★). Igneous lithologies include fine- (FGTG), fine- to medium- (FMGTG), medium- (MGTG) and coarse-grained two-mica granites (CGTG); fine- (FPTG), medium- (MPTG) and coarse-grained (CPTG) porphyritic two-mica granites; coarse-grained porphyritic biotite granite (CPBG); and medium-grained muscovite granite (MMG) (adapted from Azevelo & Nolan 1998 and Teixeira et al. 1972). Archaeological sites: (A) Carapito III, (B) Fraga da Pena & (C) Malhada.

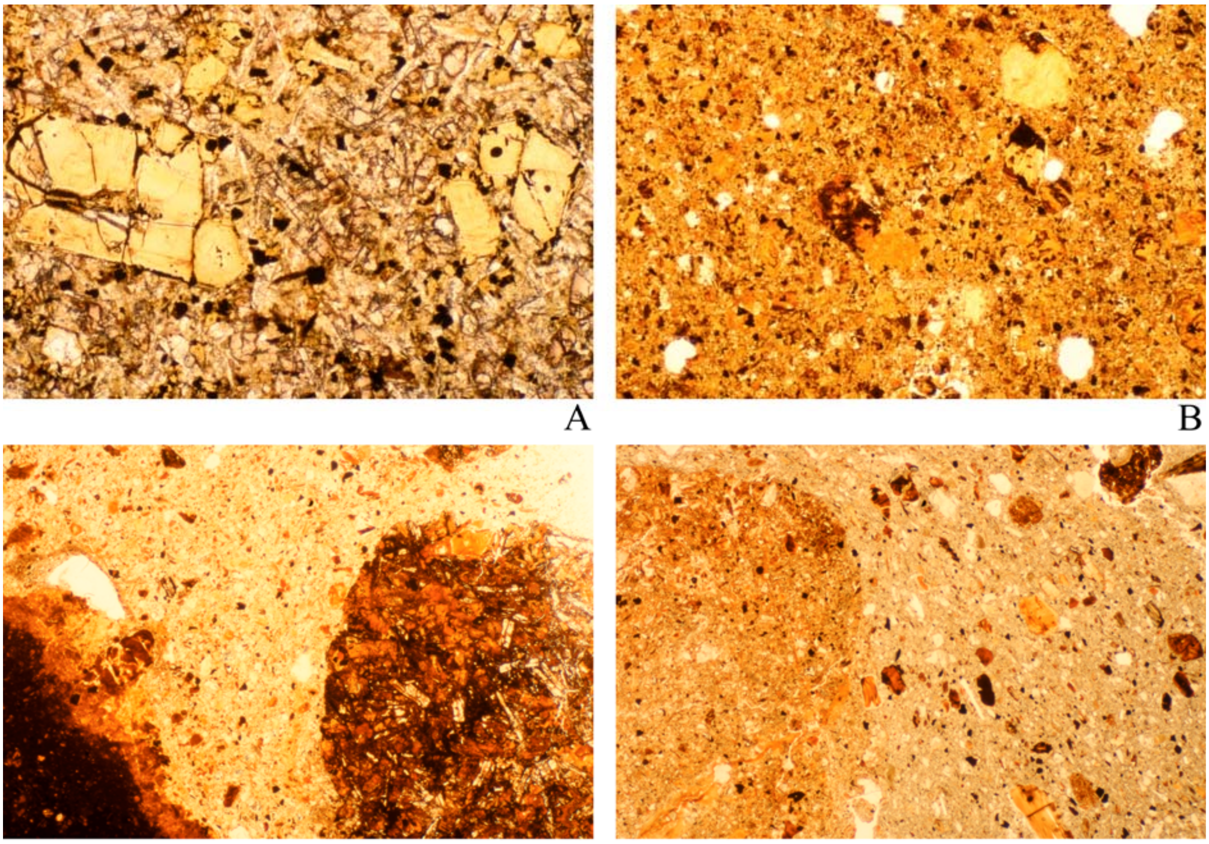
METHOD AND APPROACH

A total of 168 ceramic samples was selected and analysed by optical microscopy, taking into account the range of shapes and decorations at each site. Petrographic analysis aimed to define fabric groups, following methodologies proposed by Whitbread *(Whitbread 1995)*. Ceramic fabrics are intimately related to geology and mineralogy, but are also the product of anthropogenic manipulation. Therefore fabrics are seen as products of technology, since they relate to the ways in which natural materials are selected and combined in culturally specific manners.

PETROGRAPHIC RESULTS

Petrographic analysis has revealed a much higher diversity of raw materials and paste preparation techniques than had been anticipated. Approximately 50% of the samples are of materials derived from the weathering of granites and related metamorphosed rocks. The combination of materials with similar mineralogy makes clear petrographic distinctions difficult to establish. Not only are regional igneous lithologies fairly homogeneous in mineralogical terms, but also granitic rocks can display gneissic textures (*Carvalho 1992*); some granites have undergone deformation or have been affected by regional schistosity (*Azevedo & Nolan 1998: 3-4, fig.3*), and migmatite occurs in the contact with country rocks (*Silva 2005: 6*). As a result, differentiating between igneous and metamorphic derived 'clays' is not always straightforward, and detailed examination of these samples is ongoing.

A variety of clays of different lithological origin was also identified, including granites (two-mica, muscovite- and biotite-rich), dolerites, micaschists, quartzite and finer-grained metamorphic rocks (fine phyllite or slate), associated or not with metasediments (possibly metagreywacke). A small group of samples from Malhada demonstrate the selection of a different kind of material, an amphibole-bearing, biotite-rich intermediate igneous rock, showing myrmekitic and micrographic textures. For the most part, the clays used for pottery manufacture appear to have undergone little or no transport, while sedimentary deposits seem to have been exploited only occasionally.



A B C D

Fig. 4 Microphotographs of dolerite at different stages of weathering (A, B and C), and pottery (D) made with clays derived from weathering dolerites. Briquettes were prepared for clays (B) and (C), and fired at 650ºC in oxidizing conditions: (A) sample PSP-1, (B) sample PSP-2, (C) sample QG-2 and (D) ceramic sample MAL-257 (Fabric 4). PPL, width = 290 μm.

The clays identified were not always used in the same way. Indeed, different ceramic pastes were sometimes produced by using the same base clay, prepared differently. Doleritic clays, for example, were either tempered with grog or granitic rock fragments, or were used without any mixing (**Fig. 5**). Similarly, the phyllite / metasedimentary clays were selected for the production of two different ceramic pastes, one involving the addition of grog and the other of large fragments of granitic rocks. Tempering (with grog, rock fragments or, in one case, sand) and varied kinds of clay mixing (e.g. silty clay and a very coarse granitic material in Fabric 15) have been identified in a number of vessels, but around 70% of the samples analysed do not seem to have been tempered or mixed.

In summary, the petrographic results are three-fold: (i) a range of raw materials was used in pottery manufacture; (ii) these materials seem to be mineralogically compatible with the regional geology; (iii) and, most importantly, different methods were employed in the preparation of discrete pastes. Although detailed petrographic classification is still in progress, 18 fabric groups have been defined along with several 'outliers'.

DISCUSSION

The study demonstrates that technological choices are being exercised in the production of pottery during this period, notably in decisions over raw material selection and combination.

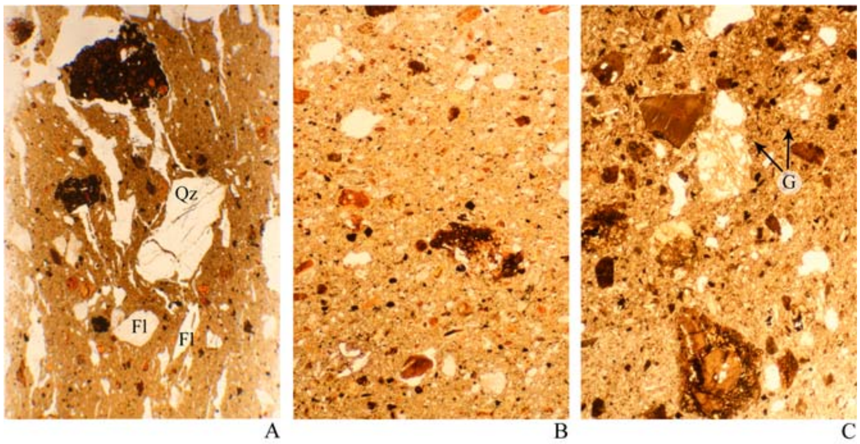


Fig. 5 Technological diversity in doleritic fabrics:

(A) granitic temper (sample FP-41, Fabric 6), PPL, height = 900 µm;
(B) no transformation (sample MAL-59, Fabric 3), PPL, height = 290 µm;
(C) grog temper (sample FP-21, Fabric 5), PPL, hight = 290 µm.

Qz = quartz, Fl = feldspar, G = grog.

Furthermore, specific technological practices cannot be explained exclusively by evoking technical constraints imposed by the physical properties of the raw materials, since sometimes the same clay is used in different ‘recipes’. These technological choices vary between sites, indeed we could characterise many as being site specific. Although this picture may blur once the petrographic analysis is finalised, it is nevertheless surprising that a separation between sites might be established at all, since they are situated at such short distances from each other.

Similarly, some raw materials are absent from specific sites. For example, doleritic and phyllite / metagreywacke clays do not occur at Carapito III. This suggests different production strategies for the pottery found at Carapito, when compared to Fraga and Malhada. Although differences in lithology in the vicinity of the sites occur, the diversity of activities taking place at those sites must be taken into account when considering these differences. Pottery manufacture does not occur everywhere or for the same purposes. Vessels found at burial grounds such as Carapito III, for instance, would not have been made on site; but instead transported from production places for ritual and funerary use. This might show the choice of different raw materials for ritual vessels, but might also reflect the use of Carapito III by groups other than those occupying Malhada or Fraga. While the sites may not be synchronic, this does not explain all variability, since the sites are different in character.

Some technologies are also site specific. Grog is a particularly interesting case, as it is almost absent regionally[1] and, in this time period, is found only at Fraga. This has previously been considered indicative of pottery importation (*Dias et al. 2002: 256*), but the grog was added to clays of different lithological origin, and seems exclusive to vessels used at the enclosure of Fraga. Fraga da Pena is an exceptional site in the region, with the largest bell-beaker assemblage, considerable stylistic diversity, and an archaeological assemblage suggestive of practices other than daily inhabitation (*Valera 2006*). When this is considered, technological patterns such as the grog tempering gain further importance.

Crucially, the three typological categories (the ‘Chalcolithic ceramic tradition’, new morphologies of the Late Chalcolithic/EBA transition, and beakers) do not correlate simply with technological patterns. In fact, not even in the case of beakers are technologies exclusive. Other more subtle patterns of variability (variation in decoration or between phases of occupation) must also be addressed at an intra-site level, and this is work is progress.

CONCLUSIONS

Previous characterisation of ceramics from Fraga and Malhada (by XRD and INAA) has suggested the use of clays derived from weathered dolerites, schist and granites (*Dias et al. 2002*). Thin-section petrography confirms the use of these raw materials but identifies still other clays. Moreover, it indicates diversity within the broad classifications of acid igneous, basic igneous and metamorphic materials. This diversity, and the fact that several clay processing techniques have been documented, provides new information that may explain the variation in chemical composition previously reported for some of the ceramics analysed (*Dias et al. 2005: 46*), an issue that is currently under investigation.

The analytical programme was able to define a large number of small petrographic groups, representative of different technological choices. These seem not to be made according to vessel shape and the presence/absence of decoration, which have been the main criteria used by archaeologists to discuss technological variability. Although appropriate for standardised and workshop-based production, these criteria might not be the most useful when dealing with unstandardised production and long-lived pottery shapes such as those highlighted by this study.

The diversity of fabrics suggests an unspecialised, 'domestic' mode of production, which may have taken place episodically, according to need, and batches of different shapes could be made together. These findings open up new possibilities of interpretation. At an intra-site scale, variability might be seen to reflect many episodes of production throughout the use of the site, adding temporal depth to an otherwise more abstract history. It might also relate to different groups of people (such as families or households) living together or using the same site (for gathering or burial) but making pottery in slightly different ways. At a more general level, considering technological variability in these terms has important archaeological potential. It can provide insight into the transmission of technological knowledge, its transformation, and decisions about the appropriateness of pottery technology vis-à-vis its consumption in different social contexts. These questions are at the core of this ongoing research.

[1] Grog has been identified in only three other ceramic samples, from a total of 442 examined for the Mondego Plateau during this and previous projects (*Jorge et al. 2005*).

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