

OREST PROJECT: LATE ROMAN POTTERY PRODUCTIONS FROM THE LOWER TEJO

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This paper presents the 5th century ceramic productions of the pottery centres of Porto dos Cacos (Alcochete) and Quinta do Rouxinol (Seixal), recovered in some of the kilns, during archaeological excavations (1985-1991). The set includes amphorae (class 22, class 23 and Lusitana 9) and coarse wares (with great diversity of functional forms). The information resulting from the excavation of the fish sauces production units of the Rua dos Correeiros (Lisbon, 1991-1995) is also considered, as an example of a consuming centre of these potteries' products. The archaeometric analysis has also allowed characterising the productions by instrumental neutron activation analysis (NAA).

KEYWORDS: PORTUGAL, TEJO, ROMAN CERAMICS, AMPHORAE, CHEMICAL ANALYSIS, NEUTRON ACTIVATION ANALYSIS.

INTRODUCTION

Any approach to the production of roman amphorae in *Lusitania* must bear in mind that the currently available record is the result of a "geography of the investigation". Not unlike other phenomena of Antiquity, what this means is that the indicators of geographic dispersion are a mirror of a specific moment in the progress of knowledge rather than an image of a past reality. For instance, one might refer that the first evidence of roman pottery production on the Lower Tejo was only found during the 1980s. The Lower Tejo was later acknowledged as one of the main production areas on the Portuguese territory.

Along with an ever-denser geographic dispersion, recent research also allows the detection of very broad chronological continuities, featuring productions of amphorae and domestic pottery between the 1st and the 5th centuries. A very long period, during which several forms and typological variants coexisted and succeeded each other, according to time's needs and fashions.

The close connection between ceramics production centres and areas related to the production and handling of fish-based products also becomes obvious. It seems acceptable to assume that similar procedures for the exploitation of marine resources must have been

implemented in the estuaries of the Tejo and Sado Rivers – intense occupation, with fish-salting facilities close to the river mouth and small peripheral units further away, and with pottery centres located upstream, upon the banks of the main river and its tributaries.

THE LOWER TEJO PRODUCTIONS

Only after archaeological excavations took place between 1985 and 1995 was it possible to understand the crucial importance of the lower course of the Tejo River within the framework of the analysis of the estuary economy at the time, comparing it with analogous geographical and historical contexts and establishing the similarities and differences between them (Raposo *et al.* 1992, 1995).

These works allowed to clarify the relation between the main production centres in the region and the consuming centres – the potteries at Porto dos Cacos (Alcochete) and Quinta do Rouxinol (Seixal) and the fish-salting tanks at Rua dos Correeiros (Lisbon) – thus contributing to a better understanding of regional economy in Antiquity (Fig. 1).

The significant amount of pottery sherds found over a large area during survey actions suggest that Porto dos Cacos might have been a true "industrial complex" (Fig. 2) specialized in the manufacture of domestic pottery and amphorae used as containers for fish-based products

(Class 20/21=Dressel 14, Class 22=Almagro 50 and Class 23=Almagro 51c) and probably for wine (Forms Lusitana 3 and Lusitana 9). Apart from this formal diversity, production carried on for a very long period of time, beginning in the middle of the 1st century and continuing up until the 5th century, judging from the types identified in the kilns and/or the dumping areas (Raposo 1990).

Despite the fact that only a limited area was subject to archaeological excavations, two separate sets of kilns have been identified. The first set featured a small kiln (kiln 1), which only kept the lower part of its combustion chamber and the *praefurnium* (Fig. 3). The stratigraphy identified here was very limited, and the only elements for a chronological characterisation were the few sherds of Class 22=Almagro 50 and Class 23=Almagro 51c.

The second set included two other kilns in close connection, confirmed by the excavation, a possible third being indicated by the geophysical survey. The structure of one of the former (kiln 3) was only partially uncovered, but the whole kiln was not yet excavated. The second kiln (kiln 2) was totally excavated, showing a larger circular plant structure (Fig. 4) (Raposo and Duarte 1996). The whole furnace was uncovered, showing a floor paved with small sandstone bricks and fragments of tiles, as well as parts of the *suspensurae* and the grill they supported. Parts of the vaulted baking chamber could also be seen.

The upper layer contained abundant fragments of sandstone bricks and tiles, coarse ware and amphorae of Class 23=Almagro 51c (clearly predominant) and Class 22=Almagro 50, associated with African red-slip ware – Forms Hayes 61a (325-400/420), 67 (400-500) and 73b (420-475).

The second and final layer, corresponding to the abandonment of the kiln, included a set of coarse ware types, some amphorae and an African red-slip plate were found scattered on the floor (Fig. 5).

The Class 23=Almagro 51c *amphorae* present a spindle-shaped body and small conical spike, solid or hollow (Fig. 6).

Some Class 22=Almagro 50 *amphorae* may also be seen, with several formal variants, the one with a cylindrical body (Keay XXII type) is predominant (Fig. 7).

And also the Lusitana 9 form, an *amphora* featuring a flat bottom with a footring, and two varieties – one with a piriform body, another with a barrel-shaped body. One of the amphorae features what seems to be a graffito of two stylised fish, on the body, under the handles (Fig. 8).

Some pieces of coarse ware that were recovered complete or almost complete may also be seen (Fig. 9).

Finally, a Hayes 61a plate is presented dated from 325 to 400/420, featuring a decoration of palm branches and concentric circles on the inside at the bottom.

The whole set enables us to establish the moment when

the kiln was abandoned, either at the end of the 4th century or during the first decades of the 5th century.

It also indicates that Class 23=Almagro 51c and Class 22=Almagro 50 *amphorae* were produced in kilns 1 and 2, the latter also producing the Lusitana 9 form. We were not yet able to identify any kilns related with the early production stages of this pottery, represented by Class 20/21=Dressel 14 and Lusitana 3 form, only found in the dumping areas so far. Among the sherds belonging to the latter form, we were able to assemble the largest and most significant series of potter markings known so far in Portugal. The *cognomen Germanus* is the most abundantly documented (Guerra 1996).

Among the infrastructures that supported the use of the kilns stand out a row of 46 amphorae of Classes 20/21=Dressel 14 which are carefully placed vertically so as to define an area whose function will only be clear after further archaeological work (Fig. 10).

A necropolis where 37 burials have already been identified complements the elements relating to the pottery activity (Sabrosa 1996). The graves are mostly structured by rectangular boxes, made with bricks or *tegulae*, though some of the burials were covered by Class 22=Almagro 50 and Class 23=Almagro 51c *amphorae*, placed horizontally and alternating bottoms and mouths (Fig. 11). The chronology of the recovered assemblage indicates that the necropolis was in use between the 3rd and the early 5th centuries.

The presence of this necropolis is a sure sign that the pottery centre was related to a settlement, of which no structural evidence has yet been found. The human occupation of this area could have lasted until the early 8th century, as is suggested by some of the evidence found so far, such as a fragment of a roman *ara* redecorated with characteristic motives of Visigoth age and a coin from *Emerita*, dating from the reign of Egica (698 to 700).

The site still encloses an enormous potential of archaeological information in the areas not yet excavated.

At the Quinta do Rouxinol pottery centre, archaeological work has revealed two kilns and possible remains of a third one (Fig. 12) (Duarte 1990; Duarte and Raposo 1996). Supported by the sand base and built mainly of small parallelepiped bricks, the only remains of the pear-shaped kilns are the lower part of the combustion chambers, the *praefurnium* and the bases of the *suspensurae* that used to support the grills (Fig. 13).

Slightly to the South, two pits dug into the sand were used to dump the rejected materials during the manufacturing process. One of these pits was filled with ceramics and some trunks and branches that were not used as a source of heating (Fig. 14). In contrast with the poor stratigraphy identified in the kilns, this pit provided a large stratigraphic sequence (almost 4 meters) and abundant remains, which allowed us to establish that, between the

middle of the 2nd century and at least the end of the 4th century this pottery centre produced amphorae of Class 22=Almagro 50 and Class 23=Almagro 51c and Lusitana 9 form, as well as a great deal of diverse domestic pottery.

The Class 23=Almagro 51c *amphorae* present a spindle-shaped body and a short spike, conical or cylindrical (Fig. 15).

The Class 22=Almagro 50 *amphorae* present a variant with a very narrow neck and bag-shaped body, the typical Keay XVI formal variant, and another where the neck is less narrow and the body is cylindrical, the Keay XXII type (Keay 1984) (Fig. 16).

The last characteristic form from this pottery is the Lusitana 9, with a piriform body, just like one of the variants from Porto dos Cacos (Fig. 17).

The clay moulds that were collected also suggest the local production of oil lamps.

The framing of these productions in the 3rd and 4th centuries is well supported by the recovery of a *denarius* from Maximus (datable 235 to 238) and of three other coins from the first half of the 4th century: one from Constantine I (datable 307 to 337), another from the same emperor or his successor, Constantine II (from 337 to 340), and a third one of less accurate reading but which also seems datable from the early decades of the 4th century.

The manufacturing chronology and its continuity until at least the early 5th century is confirmed by the recovery of several forms of African red-slip ware, datable from the 2nd half of the 2nd century to the 2nd half of the 5th century – Hayes forms 14, 16, 27, 44, 45a, 49, 50 and 67. Two small bowls of Hayes 52b form (dated between 280-300 and the end of the 4th century or the beginning of the 5th), whose rims have relief decoration motifs representing individual fish or fish eating other smaller animals, stand out from this set (Fig. 18) (Raposo and Duarte 1999).

Finally, the Centre at Rua dos Correeiros, in Lisbon, contains remains of human settlements dating back to the Iron Age (5th century BC), which have lasted until now. They reveal an urban riverside suburb with strong industrial, handicraft and trading characteristics (Amaro 1995; Bugalhão and Sabrosa 1995; Bugalhão 2001).

At the time of the Roman Empire, most of the area under study was occupied by several fish-salting industries and their respective supporting facilities, which must have been in operation between the 1st and the 5th centuries (Figs. 19 and 20). Here several examples of amphorae were collected, chiefly Class 22=Almagro 50 (the Keay XXII variety is predominant - Fig. 21), Class 23=Almagro 51c (featuring a broad range of formal variations of the rim and dimensions - Fig. 22). This seems an important issue as it's usually argued that the smaller variant is that one dated from a latter period. Here we have a solid evidence of a contemporary fabric and

use of both formal variants. Lusitana 9 form is also present (Fig. 23), as well. Within the Tejo River productions we have found Class 20/21=Dressel 14 and Lusitana 3 form in the earlier period.

Some of the coarse ware recovered at the site is also presented here (Fig. 24). The broad study of these productions may allow us to understand some of the relationships between fish-salting units and pottery centres. What we know today about this kind of models of regional development in Roman times indicates the close connection and interdependence of these economical activities.

In the case of the Lower Tejo, evidence gathered from the stratigraphic sequences, and the formal similarity of the *amphorae* and coarse ware allow us to establish a strong link between the Quinta do Rouxinol pottery and the bottling needs of the Rua dos Correeiros fish-salting units. That formal similarity has been further reinforced by the results of the archaeometric research.

Some of the fish-salting tanks keep their abandonment stratigraphy intact, with some preserved pieces of African red-slip ware, featuring a very homogenous chronology, which allows us to date from the 5th century, maybe it's first half, that moment of abandonment. The later pieces correspond to the Hayes 73 form, produced between 420 and 475. Four pieces have been recovered.

Besides the industrial complex, at Rua dos Correeiros a section of a road, several different habitation structures and a baths building were also identified (Fig. 19). The latter features a room paved with a polychrome mosaic dated from the 2nd half of the 3rd century, decorated with geometrical patterns.

RESEARCH LINES

The field work carried out at the estuary of the Tejo has thus driven to results that justified the development of the OREsT project – Roman Pottery in the River Tejo Estuary: Porto dos Cacos, Quinta do Rouxinol and Archaeological Centre of the Rua dos Correeiros, on which we presented more information in the Conference's poster section. This is a research project in full development, at a stage where working hypotheses are being formulated and explored, and thus far still from conclusive results.

Anyway, the information now available for the Lower Tejo allows the consideration of working rhythms and productive patterns that are clearly out of the traditional typology, though their shape is still very roughly drawn.

The methodology used is focused the encounter and complementarity between formal and technical analysis and the chemical characterisation of clays through the application of multi-varied data analysis models that aim at optimising the results of archaeological and archaeometric research.

From a formal point of view, a multiple analysis of a set of quantitative features was attempted, trying to define

objective criteria for the classification of the forms and variants of *amphorae*. We also aim to clarify the possibility of the “module” variations suggested by the handling and observation of the materials – for instance, Class 22=Almagro 50 seems to include the two formal groups as Simon Keay had already stresses (Keay 1984, 149-155 and 169-172) (Fig. 25), each seemingly including the distinction between a canonical and a *parva* form, the latter being smaller.

Yet, the difficulty of distinguishing the Tejo and Sado productions by means of petrographic analyses being confirmed (Mayet *et al.* 1996), only the chemical analysis will allow for the creation of a coherent and effective tool for the distinction of those major productive centres and their productions.

An archaeometric project has been approved within the *Instituto Tecnológico e Nuclear* (ITN) and *Instituto Português de Arqueologia* (IPA) protocol in the years 1998/1999/2000 and is still running, even some previous work has been done also by the ITN research team (Cabral *et al.* 1993-1994, 1996). The project aims at contributing to the establishment of the fingerprints of each centre, to be used in further works of *amphorae* provenance studies, and in studies of production and raw materials selection strategies, that may provide us with a better understanding of production and trade within *Lusitania* and also with other roman provinces.

At ITN, the *Cultural Heritage and Science* (CHS) group has available and in course a considerable amount of chemical analysis of archaeological sites all over Portugal, particularly of the roman period. So, the archaeometric research in the low Tagus is not only seen as a separate but as whole, thus justifying comparison done with other production centres, especially when one of the main goals, besides differentiates each production centre, is to establish provenance of ceramics of a Lisbon consumption centre.

This research project of ITN-IPA in the lower Tagus production centres contribute to the establishment of geochemical fingerprints of each centre, to be used in further works of provenance and sourcing studies.

Considering the capabilities of CHS at ITN, chemical analysis was done by means of instrumental neutron activation analysis (INAA), using the Portuguese Research Reactor, at Sacavém, Portugal. Details concerning the measurement and processing of the gamma spectra can be found in Prudêncio *et al.* (1986) and Dai Kin *et al.* (1999). This analysis permit to obtain the concentration of the following 30 elements: Na, K, Fe, Sc, Cr, Mn, Co, Zn, Ga, As, Br, Rb, Zr, Sb, Cs, Ba, La, Ce, Nd, Sm, Eu, Tb, Dy, Yb, Lu, Hf, Ta, W, Th, U. Most of these elements are used as variables in a multivariate statistical approach (Cluster analysis, R-mode Factor analysis, Discriminant analysis, Canonical analysis, etc.) in order to obtain chemical signatures for each production centre.

Taking into consideration that the ceramics in study came from production centres, which have used clay materials of similar geological environments (with the add of more or less temper), a clear distinction it's not easy, especially if using only petrographic and macroscopic paste characterisation (Mayet *et al.* 1996). Chemical analysis became then a very good help especially INAA, which permit to analyse not only major elements (Na, K, Fe), but also trace elements, namely Rare Earth Elements (REE) that can be good fingerprints.

The work developed so far within the running project enhanced the importance of setting geochemical fingerprints as the more useful tool to distinguish within production centres and the various *amphorae* typologies (Dias *et al.* 2001; Prudêncio *et al.* 2003).

In the case of Tagus and Sado basins, the concentration of Rare Earth Elements - Europium Anomaly, U, Th, Sc, and Fe, among the studied elements, were found to be the best fingerprints to differentiate the production sites (Fig. 26). These same elements also allowed pointing to a possible provenance for Correeiros *amphorae*, from Qta. Rouxinol production centre (from the left side of the Tagus river) - Fig. 27 (Dias *et al.* 2001; Prudêncio *et al.* 2003). Even so, further chemical analysis by INAA are running with ceramics of Correeiros, so a better correlation can be established.

The chemical composition, which better contributes for differentiations within the Tagus basin (Porto dos Cacos and Quinta do Rouxinol) are (Prudêncio *et al.* 2003):

- *Amphorae* of the Porto dos Cacos have the higher contents of Na, Co, As and especially U.

- *Amphorae* from Quinta do Rouxinol have the lower amounts of U, and the higher of Fe.

So, we are in presence of important chemical differences in a few elements, being U the best one to differentiate within Tagus basin archaeological sites.

The ITN-IPA running project besides the chemical composition study also intends to perform a mineralogical characterisation of ceramics and clay materials of the respective surrounding areas. Field-work and sampling was already carried out in order to contribute to a more complete characterisation of each site and respective raw materials.

FINAL REMARKS

The ongoing archaeological and archaeometric studies in the scope of the OREsT Project aim at clarifying typological and formal variations in the ceramic productions of the Lower Tejo and their respective chronologies and at discussing the hypotheses of functional attribution.

Once a framework for reference has been established, significant aspects of pottery production and of the regional and empire economy (as regards production,

distribution and consumption) will become clear, thus confirming the potential of this type of study for knowing the social and economic history of Antiquity.

Ultimately, we may approach the perception of the model of the ancient city, clarifying its function not as a simple consuming centre but as a true pole of regional economic development. It shall also be possible to clarify the relation and the levels of interdependence between the pottery centres and the fish salting and transforming units.

These are questions that we shall continue to consider and work on.

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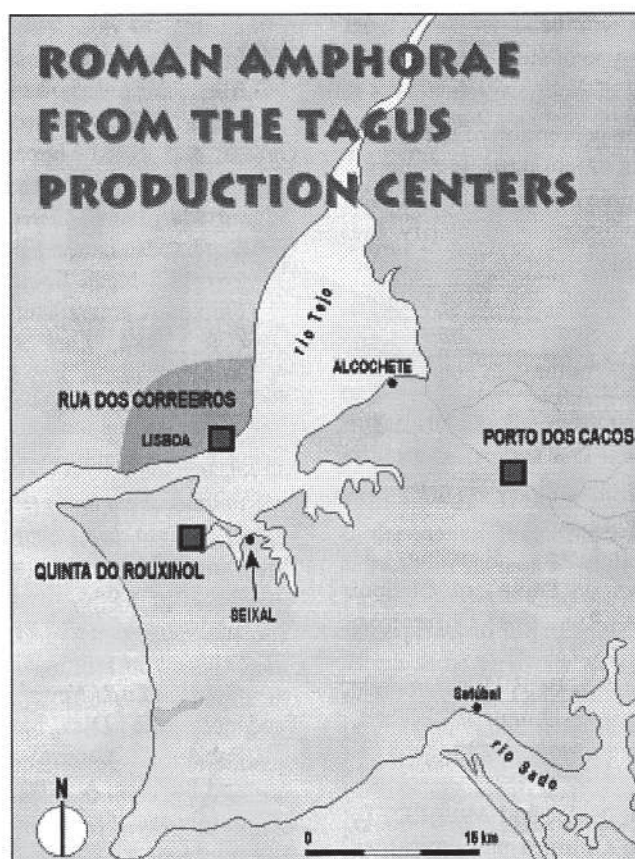


Fig. 1. Roman amphorae from the Tagus production centers (location map).

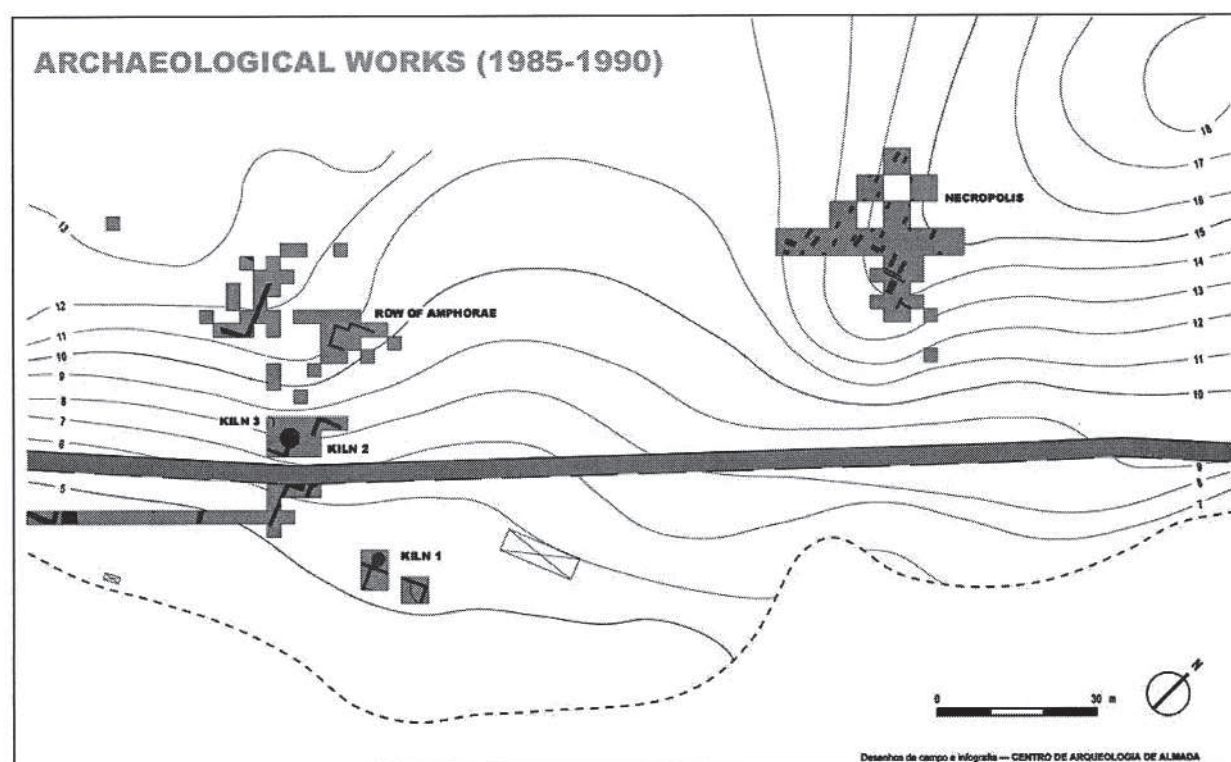


Fig. 2. Porto dos Cacos (Alcochete, Portugal).



Fig. 3. Porto dos Cacos (Alcochete, Portugal). Kiln 1.



Fig. 4. Porto dos Cacos (Alcochete, Portugal). Kilns 2 e 3.



Fig. 5. Porto dos Cacos (Alcochete, Portugal). Kiln 2.

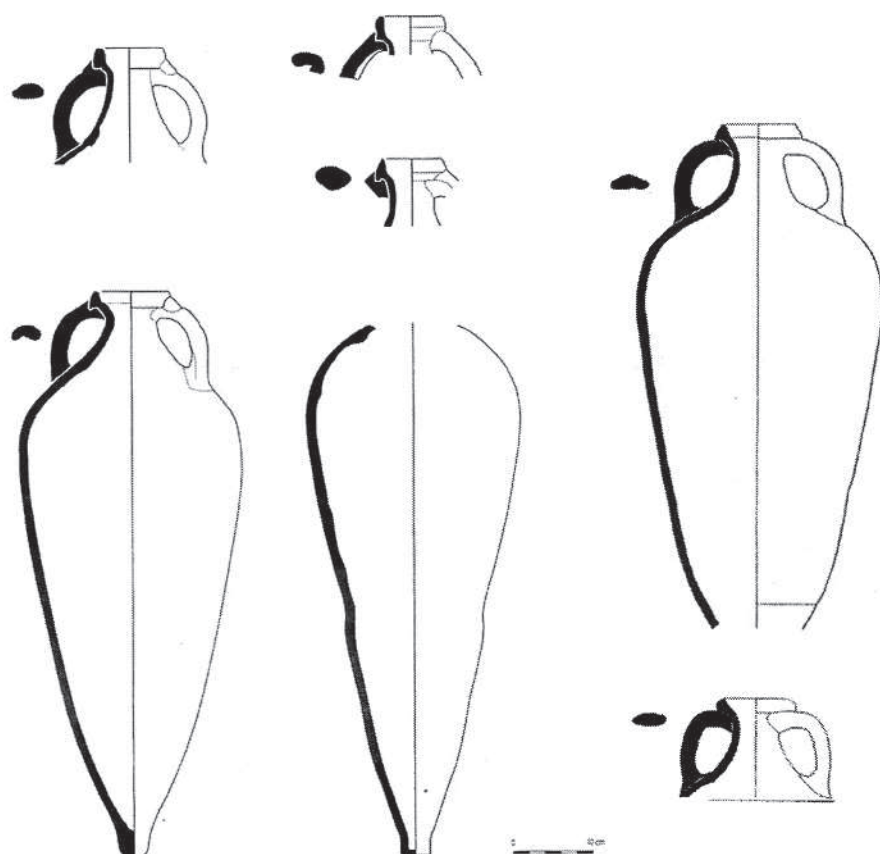


Fig. 6. Porto dos Cacos (Alcochete, Portugal). Class 23=Almagro 51c amphorae.

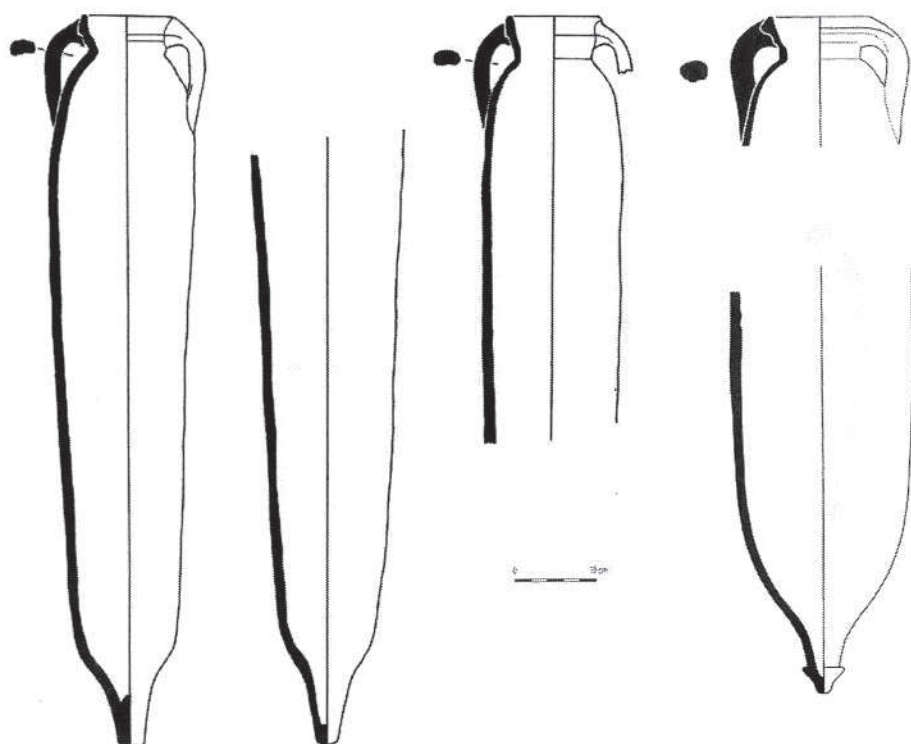


Fig. 7. Porto dos Cacos (Alcochete, Portugal). Class 22=Almagro 50 amphorae.

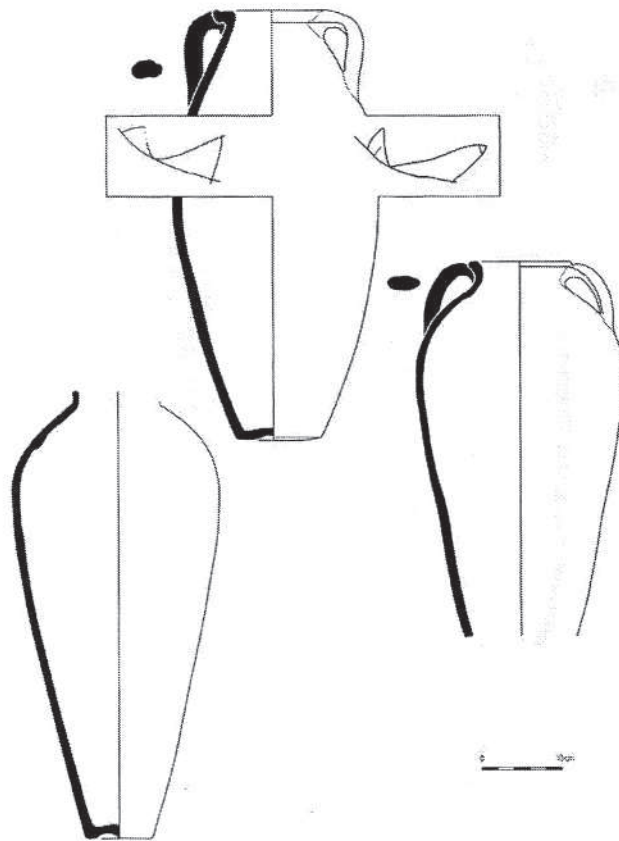


Fig. 8. Porto dos Cacos (Alcochete, Portugal). Lusitana 9 amphorae.

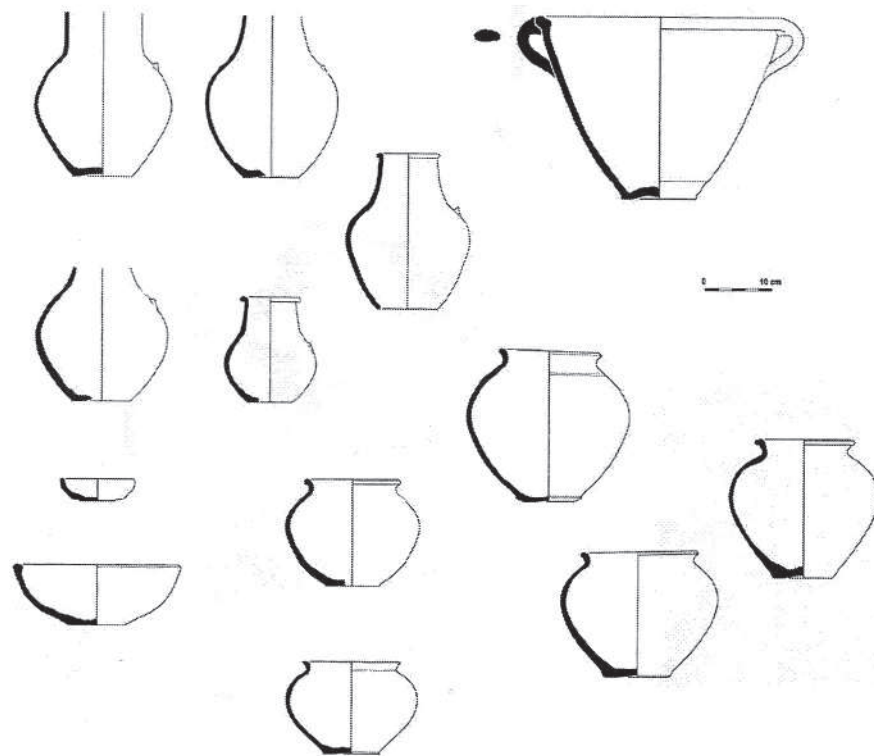


Fig. 9. Porto dos Cacos (Alcochete, Portugal). Coarse ware.



Fig. 10. Porto dos Cacos (Alcochete, Portugal). Partial view of a row of 46 amphorae of Classes 20/21=Dressel 14.



Fig. 11. Porto dos Cacos (Alcochete, Portugal). Burial covered by Class 22=Almagro 50 and Class 23=Almagro 51c amphorae.

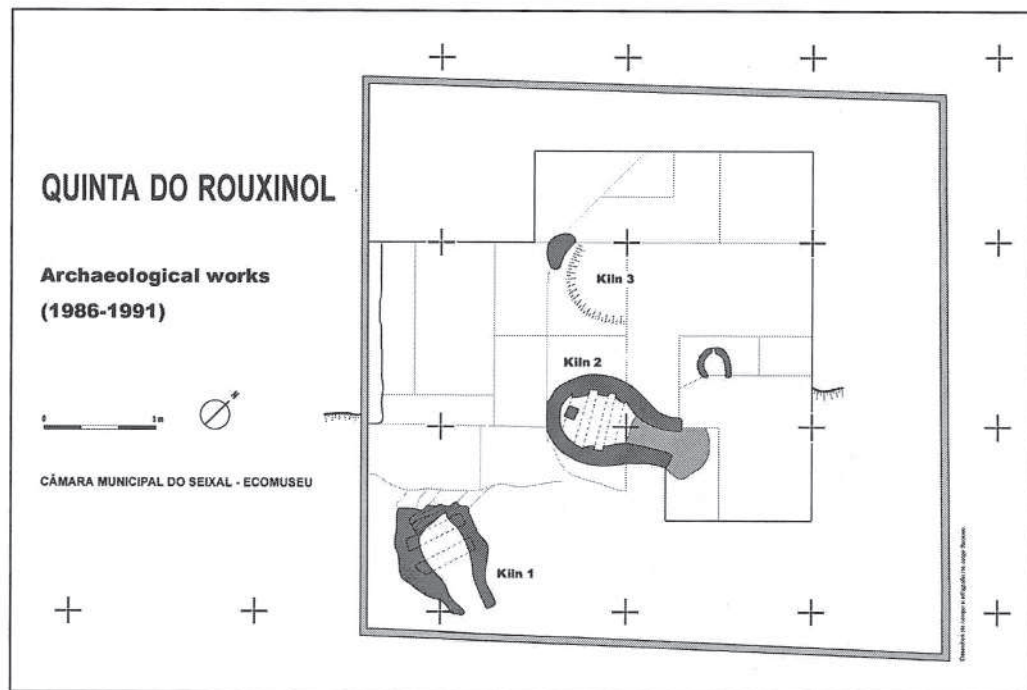


Fig. 12. Quinta do Rouxinol (Seixal, Portugal).



Fig. 13. Qtª do Rouxinol (Seixal, Portugal). Kiln 2.

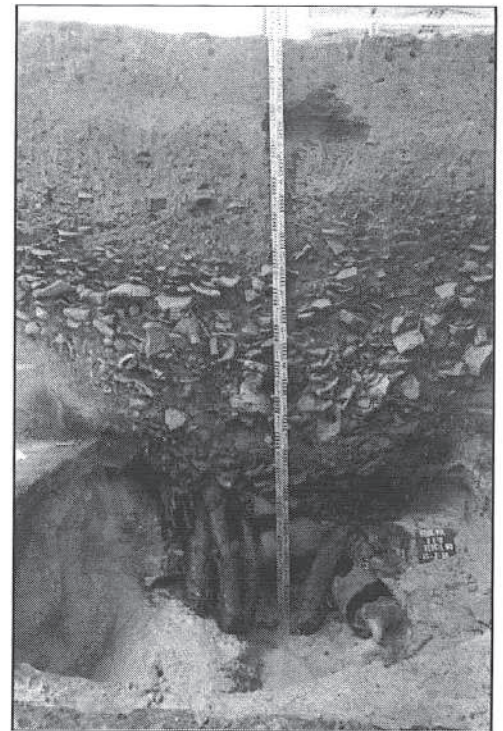


Fig. 14. Qtª do Rouxinol (Seixal, Portugal). Pit dug into the sand.

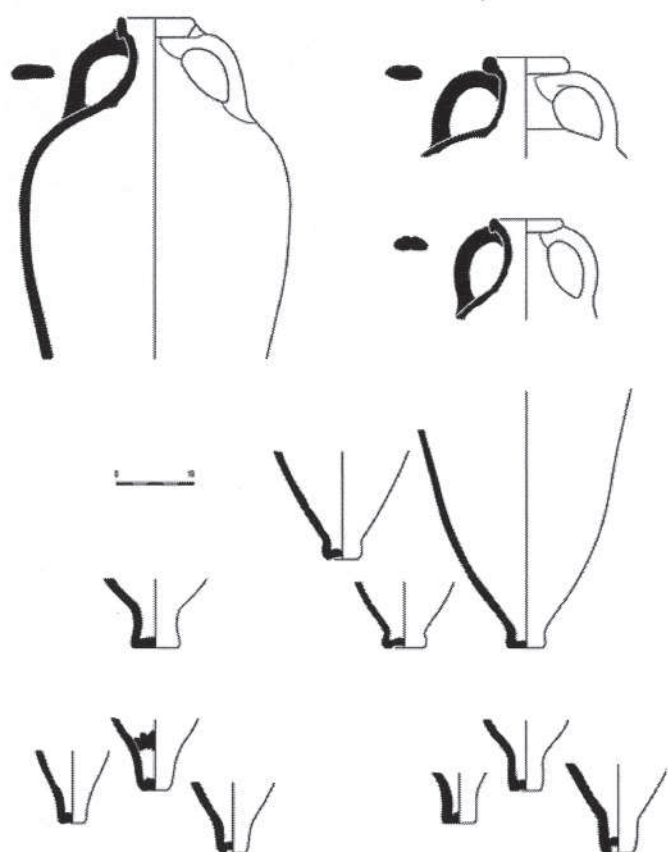


Fig. 15. Quinta do Rouxinol (Seixal, Portugal). Class 23=Almagro 51c amphorae.

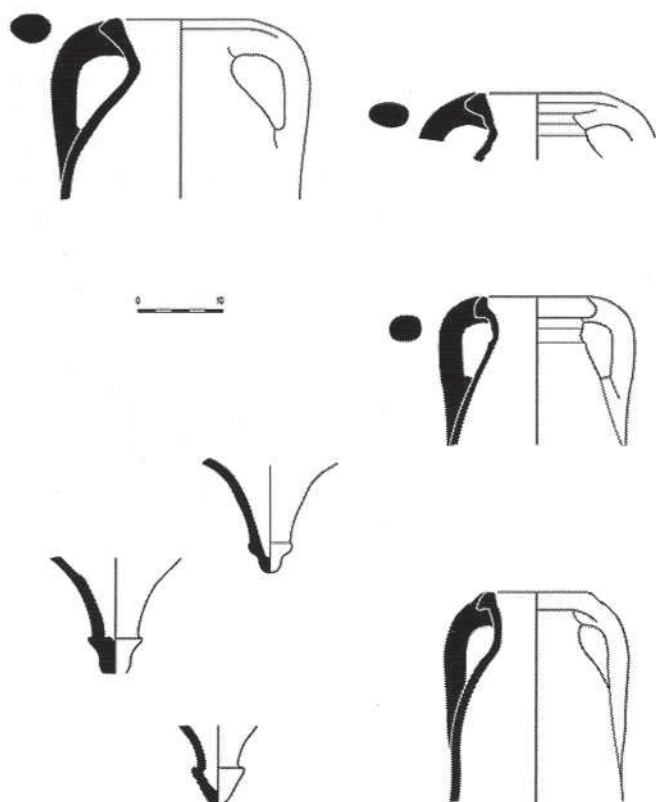


Fig. 16. Quinta do Rouxinol (Seixal, Portugal). Class 22=Almagro 50 amphorae.

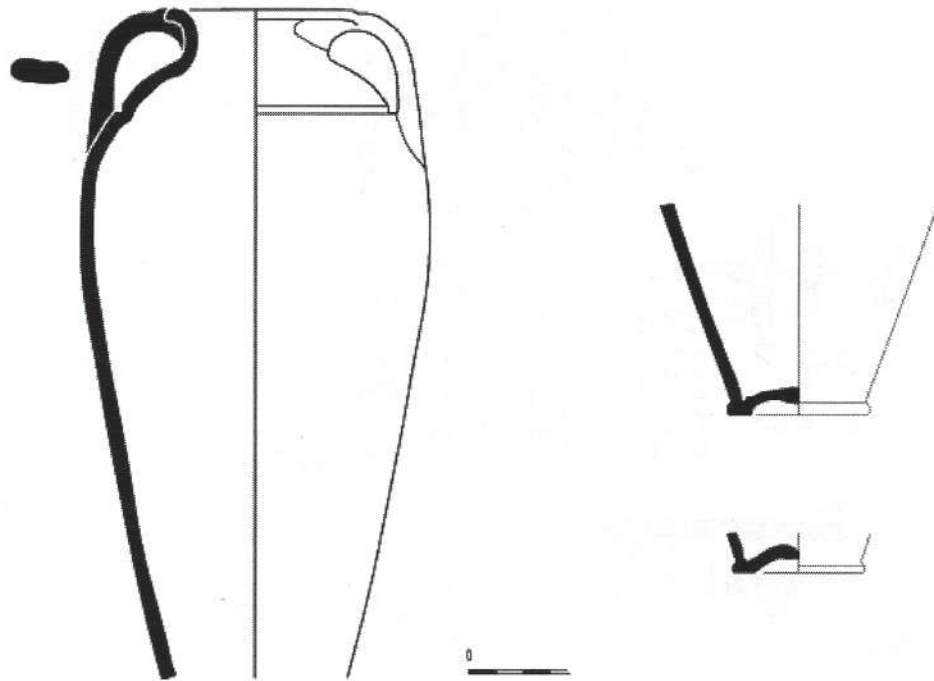


Fig. 17. Quinta do Rouxinol (Seixal, Portugal). Lusitana 9 amphorae.

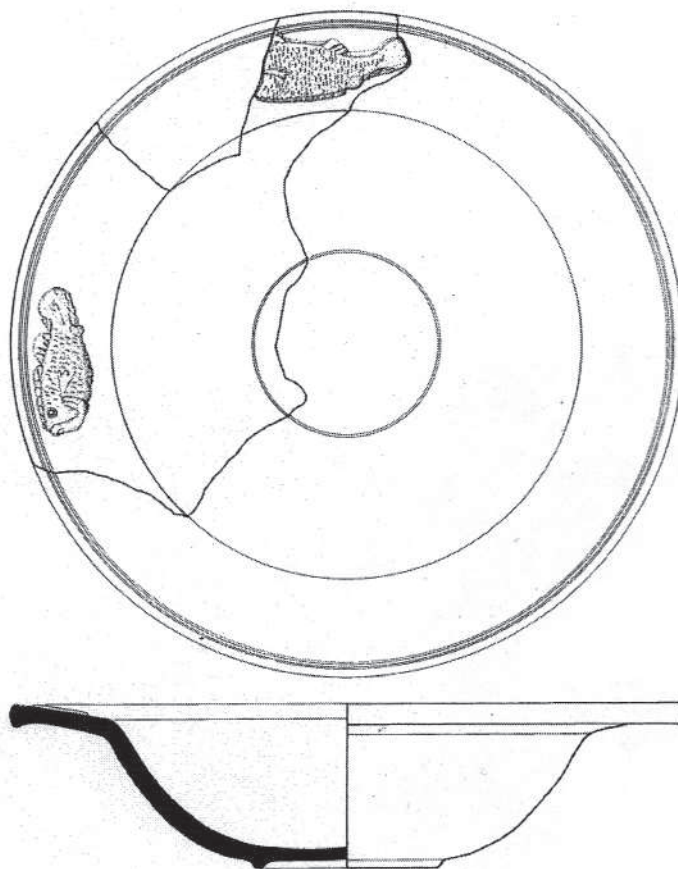


Fig. 18. Quinta do Rouxinol (Seixal, Portugal). Bowl of Hayes 52b form (280/300-end of the 4th century or beginning of the 5th).

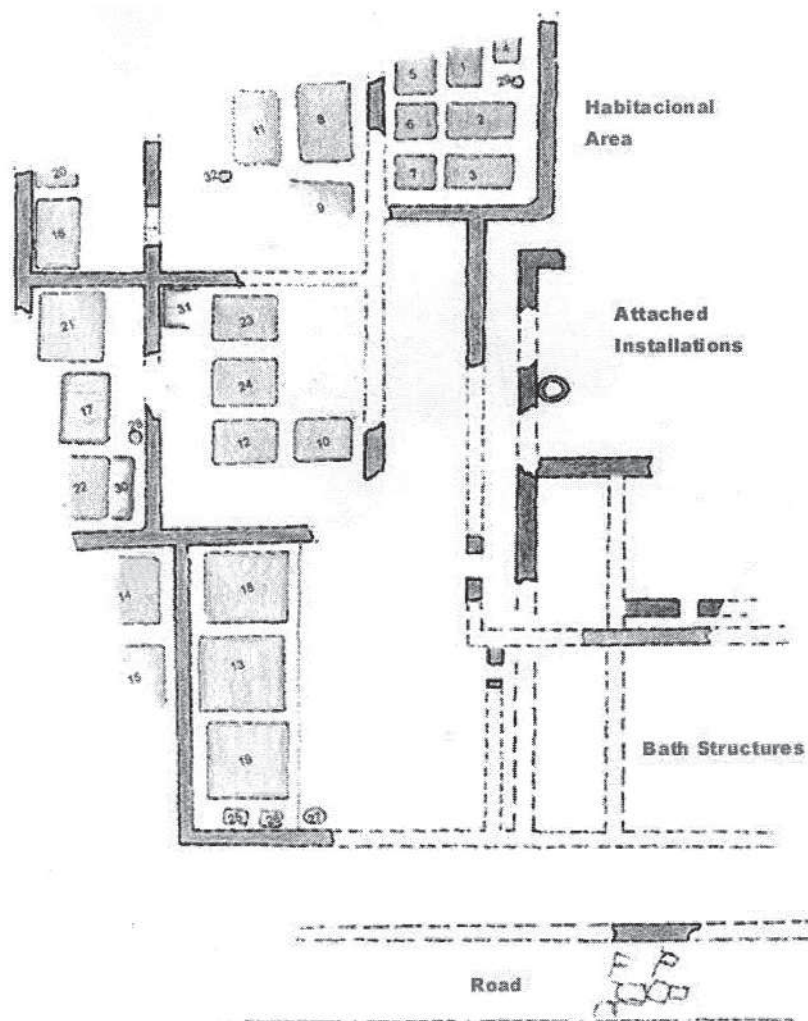


Fig. 19. *Rua dos Correiros* (Lisboa, Portugal).



Fig. 20. *Rua dos Correiros* (Lisboa, Portugal).

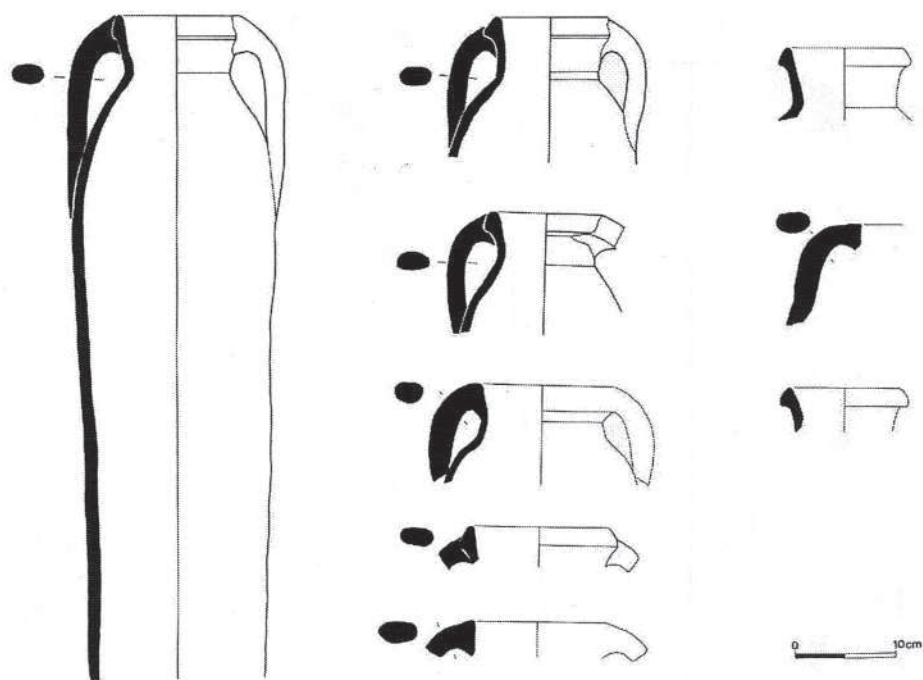


Fig. 21. Rua dos Correeiros (Lisboa, Portugal). Class 22=Almagro 50 amphorae.

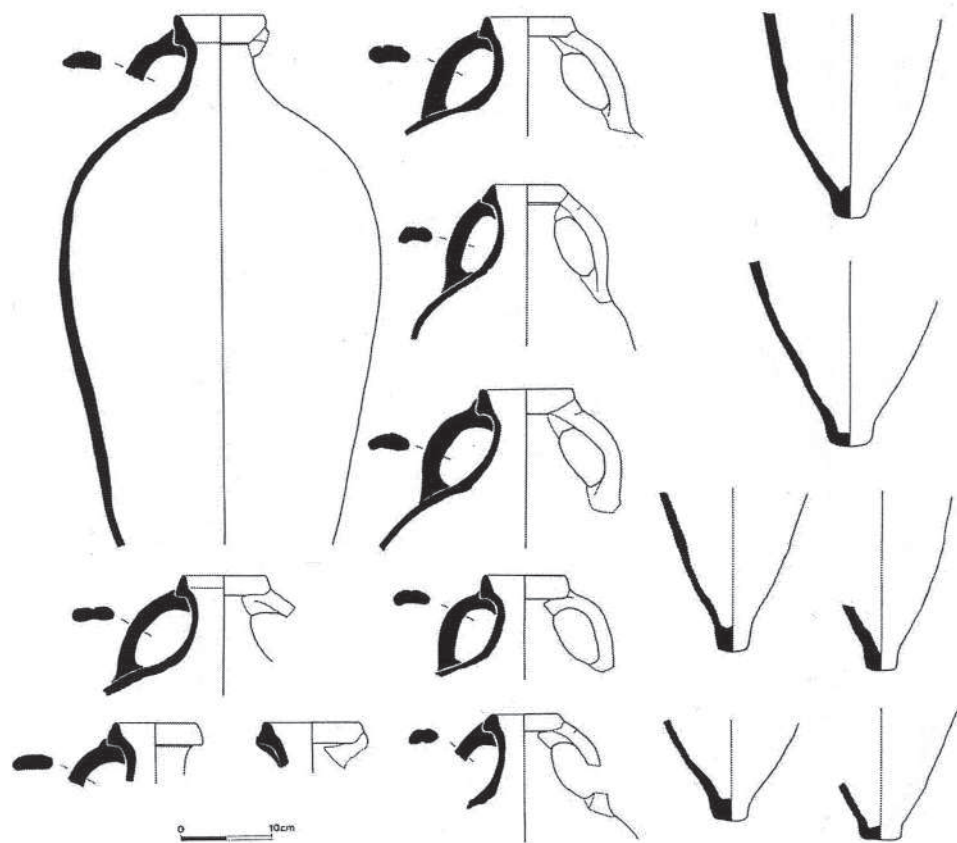


Fig. 22. Rua dos Correeiros (Lisboa, Portugal). Class 23=Almagro 51c amphorae.

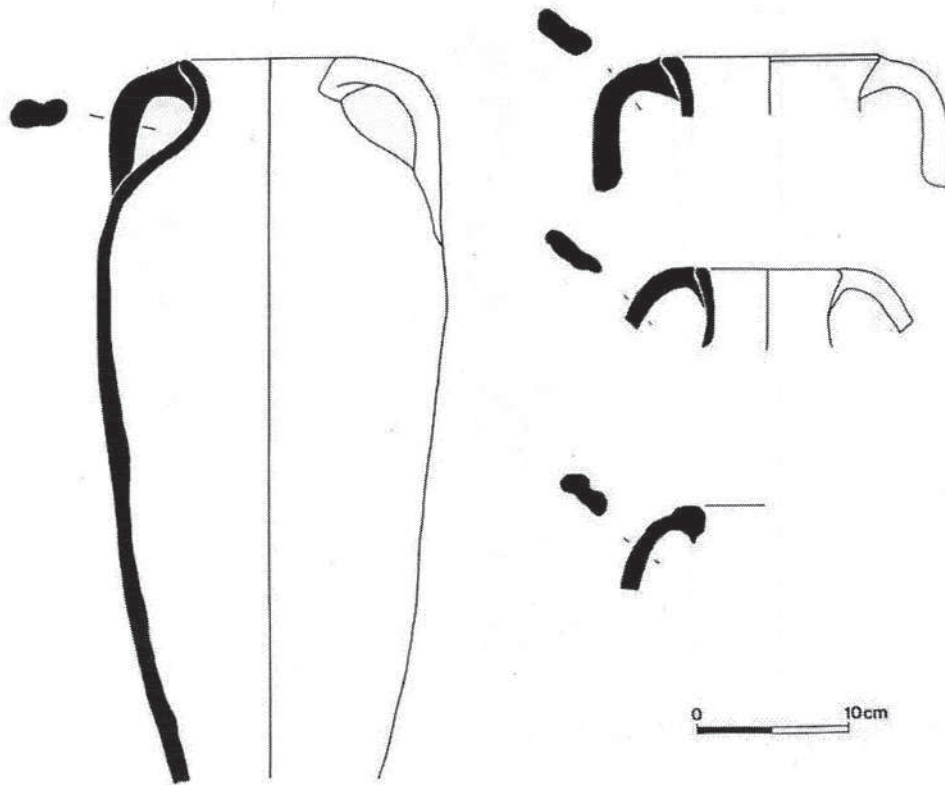


Fig. 23. *Rua dos Correiros* (Lisboa, Portugal). Form Lusitana 9 amphorae.

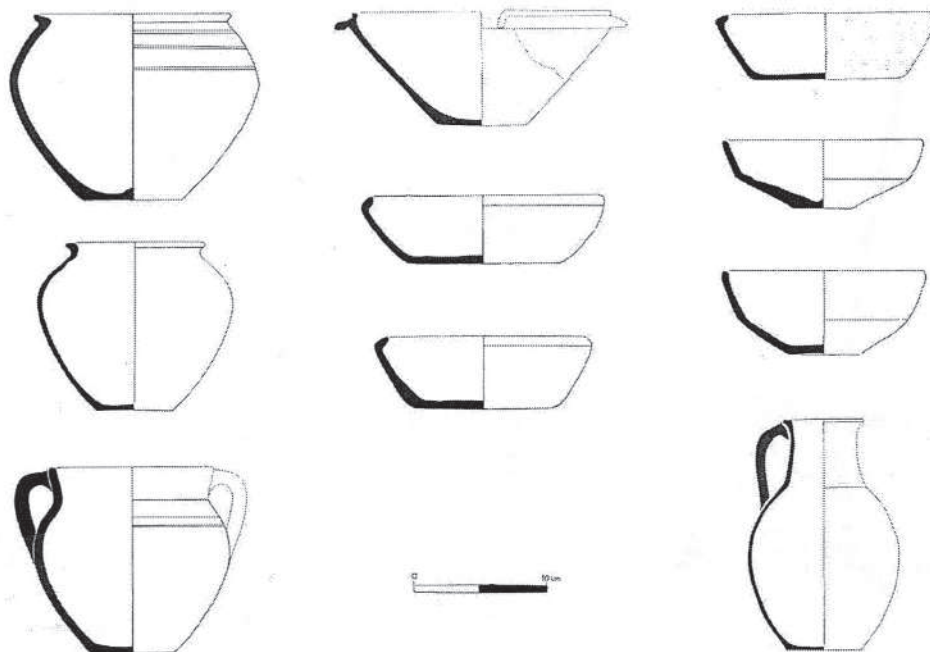


Fig. 24. *Rua dos Correiros* (Lisboa, Portugal). Coarse ware.

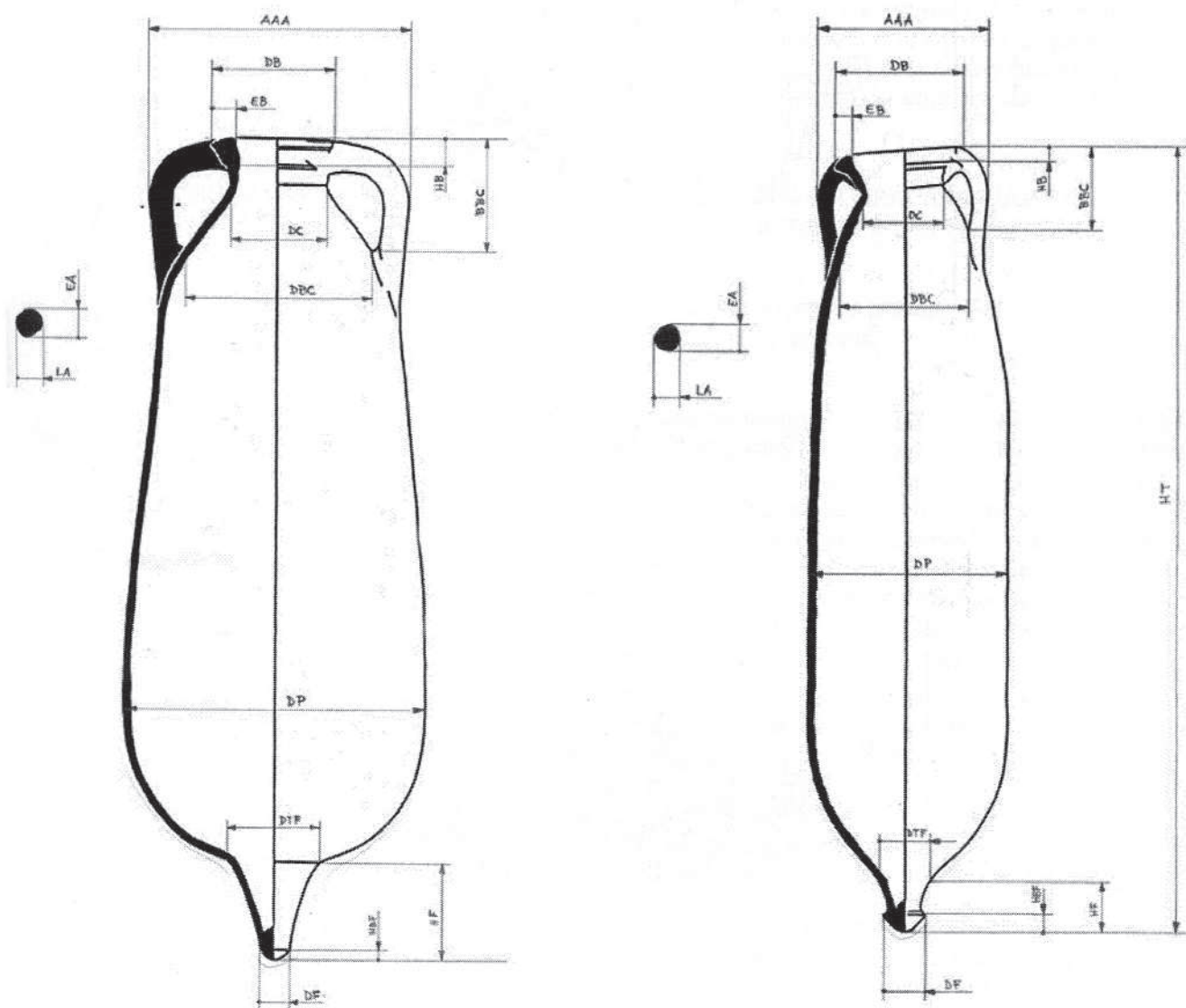


Fig. 25. Class 22=Almagro 50 amphorae formal sub-groups.

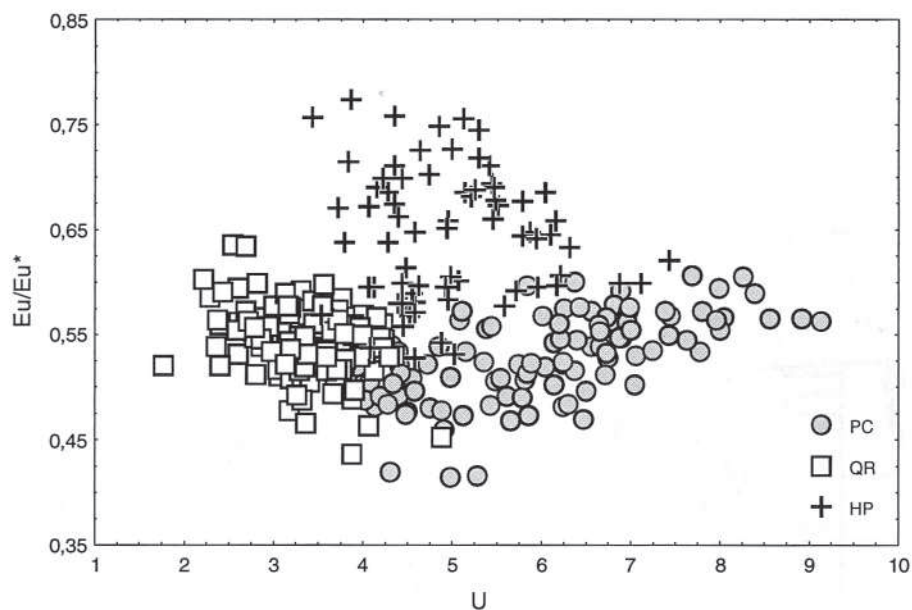


Fig. 26. Plot of Eu/Eu^* and U illustrating the distinction between the three production centres of Sado basin (HP) and Tagus basin (PC, QR).

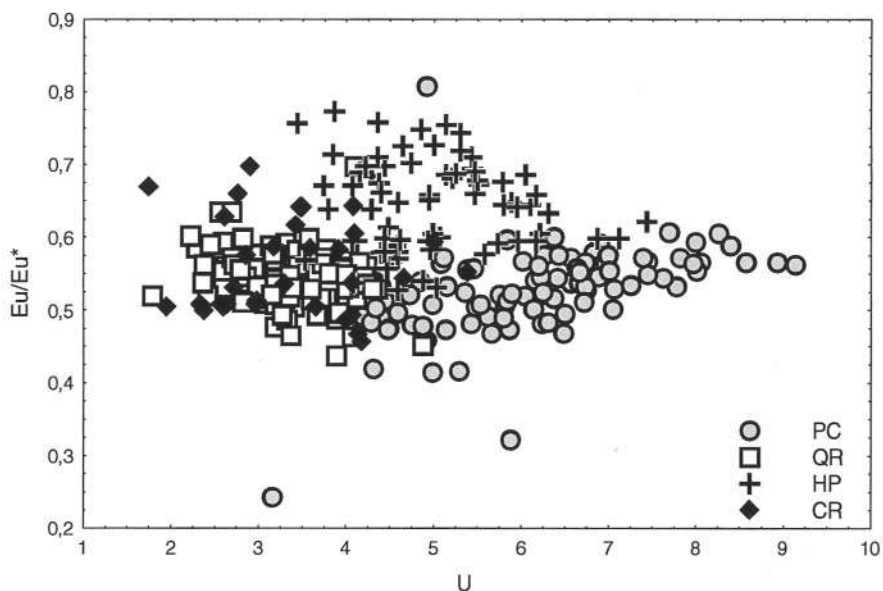


Fig. 27. Plot of Eu/Eu^* and U illustrating the chemical similarity between Correeiros consumption centre and Quinta da Rouxinol production centre.