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# POTTERY PRODUCTION AT THE SERVICE OF THE NECROPOLIS
## On a suburban kiln in republican *Gades* (Cadiz, Spain)

### Introduction

In recent years, one of the most important archaeological novelties in Cadiz has been the documentation of a dense cluster of pottery workshops on the third island of the palaeoarchipelago known in sources as *Antipolis* (today's San Fernando)[2], which, in the light of these discoveries, forms the "pottery district" of ancient *Gadir*. In contrast to documentation from San Fernando's industrial quarter, the vestiges found in the city of Cadiz (**fig. 1**) on the northern end of the island of *Kotinussa* are few and partial, yet not wholly unknown[3].

This paper presents a small pottery kiln found during the course of a preventive archaeological intervention on c/ Troilo Nº 5 in the Santa Maria district (the historic centre of Cadiz, Spain). The structure appeared in isolation, filled to the brim with ceramic materials. This latter circumstance allows us to situate pottery production in the immediate vicinity of the city of Cadiz at a time of transition between the Punic and Roman worlds.

This late Punic kiln collapsed with the last firing inside. The materials are virtually limited to two types of Roman ceramics: the bowl-like lids used to cover cinerary urns in the necropoleis of Cadiz and a kind of massive "tumbler" whose exact functionality is not known. Another smaller group of ceramics was found in a pit located at the mouth of the *praefurnium*, which has been interpreted as a small dump where ruined or rejected pieces and the ashes and remains from kiln cleaning were deposited. This group featured several terracotta specimens pertaining to *thymiateria* shaped like women's heads and zoomorphic *askoi*, in addition to different types of common Roman ceramic platters, urns and pots.

Both the last materials produced in the kiln as well as those from earlier firings reveal a coroplastic and vase production that we suggest is related to and specialized in supplying the neighbouring necropolis with the items required for conducting funeral rites and worship[4].

### The kiln structure (fig. 2)

The small kiln was abandoned when the upper structures collapsed with the last firing, which consisted of small ceramic vases, inside.

The kiln appeared in the cross-section that separated the site from the adjacent property. Despite all efforts, only half the structure could be excavated, since the rest lay beneath a Roman wall from a later period that in turn traversed it, while the opposite side had been affected by a Roman trench that also dates from a subsequent period[5]. The walls and base of the kiln's foundation were made of the natural greenish limestone clay soil itself. Both the upper part of the combustion chamber as well as the firing chamber have been lost, although in the rear of the combustion chamber, part of the arches of the vault, which would have supported the floor, has been preserved. The classic plano-convex adobe construction materials documented in other similar structures were used[6].

Excavations revealed a kind of triangular pit connected to one end of the *praefurnium*, which was used as a dump for accumulating flawed or poorly fired ceramics that were discarded between layers of ash.

The plan of the kiln is sub-quadrangular, with rounded ends. The front of the combustion chamber is, in fact, a prolongation of the narrow passage or *praefurnium*, which measures slightly over one metre long by 23 cm wide and descends like a ramp to the centre of the chamber. Here stands the partially destroyed central pillar, made up of six round clay bricks or drums, somewhat warped by high temperatures. The floor rises abruptly at the central pillar, forming a step roughly 21 cm high. This particular construction feature has made it possible to identify and describe a new typological category, kilns "with a *praefurnium* with a step", which would be typical of this geographical zone[7]. This innovation has been explained as a functional improvement

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2 Bernal et al. 2003 passim. – D. Bernal et al., Carta Arqueológica Municipal. San Fernando (Sevilla, 2005) passim. – J. Ramón et al., El taller alfarero tardoarcaico de Camposoto (San Fernando, Cádiz) (Sevilla, 2007) passim. – Sáez 2008 passim.

3 Sáez 2008, 480–500.

4 Niveau de Villedary/Blanco 2007 passim.

5 Blanco 1999, 8.

6 Bernal et al. 2003 figs. 31,1; 34; 35. – Sáez et al. 2004, 102.

7 Bernal et al. 2003, 194–195. – D. Bernal et al., Los hornos púnicos de praefurnium escalonado (ss. III y II a.C.). Reflexiones a raíz del alfar de La Milagrosa (San Fernando, Cádiz). In: Bernal/Lagóstena 2004, II.607–620.

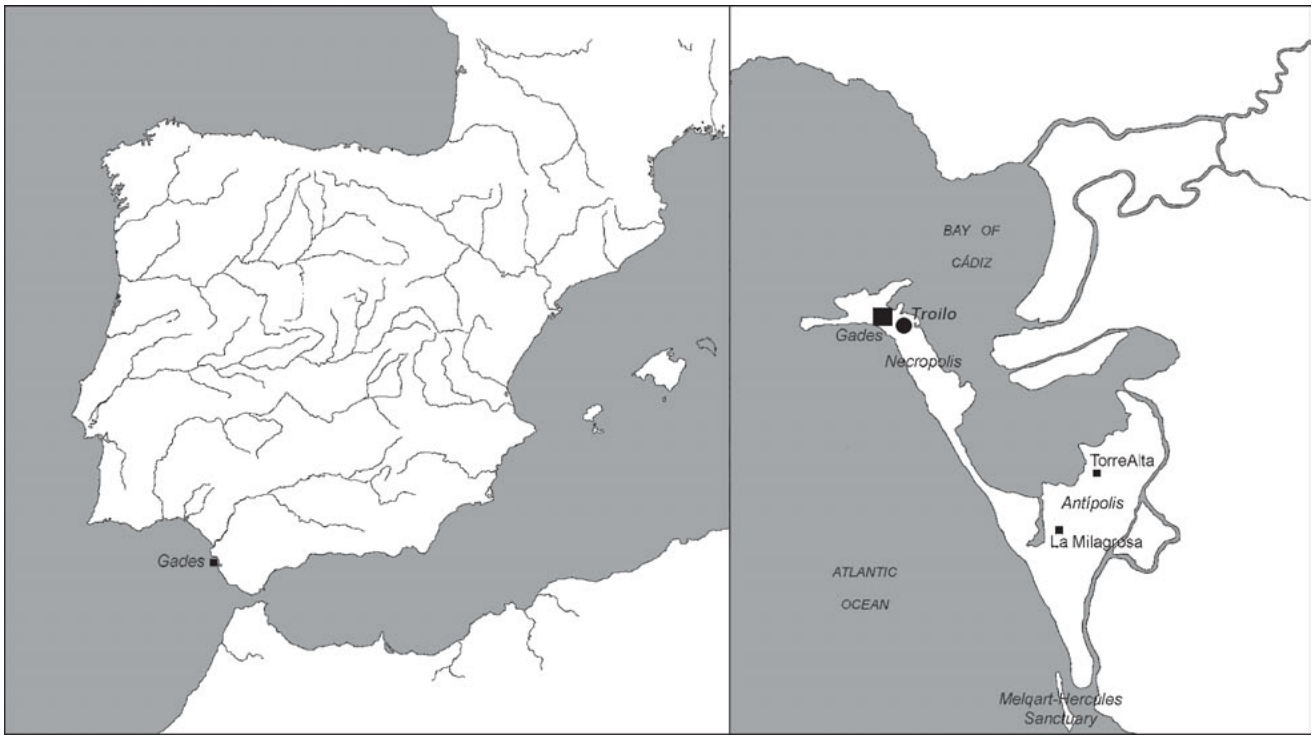


**Fig. 1.** Geographic contextualization and site location. After Bernal/Sáez 2008, fig. 2.

that enabled the heat to collect in the rear of the kiln. Along with other modifications, such as the reduced size of the structure, this feature allowed the heat to circulate throughout all the zones better, thus improving its general yield[8]. A chronology for this type of kiln has been proposed for roughly the late third to early second centuries BC[9], related to the Phoenician-Punic pottery tradition, in accordance with the documented materials in island kilns which define the type.

In short, the structure derives from a typology that was well-known in the Bay of Cadiz in late Punic times, possibly with several Roman innovations (including, perhaps, the quadrangular shape). In any case, we feel the conservative nature of the structure needs to be emphasized.

## Vase production

Most of the ceramic artefacts were discovered in two well-defined zones among copious amounts of ash and the plano-convex adobe remains pertaining to the collapsed upper structures.

In the first place, most of the objects (1,678), which corresponded to the last types the kiln produced (**fig. 3**), were found in the rear of the combustion chamber and the junction with the *praefurnium*. Almost all of them (92%) correspond to the manufacture of two concrete types of ceramics: bowl-like lids (1,313 pieces, 78%) and the truncated cone containers we have denominated tumblers (242 specimens, 14%). Other shapes appear in smaller quantities: several sizes of bifid-rimmed pots with different profiles (27.2%), small lids (56.3%) and several isolated terracotta sherds and figurative *askoi* (1%). Also figuring prominently are two elongated, cylindrical ceramic items (**fig. 4**), which we have interpreted as separators that would have been placed between the vases to prevent them from coming into contact with each other during firing, and some shapeless clay pellets.

In the second place, we also excavated a group of ceramics, although slightly fewer in number (87 items), from the dump at the mouth of the *praefurnium*. The formal variety of these objects (**fig. 5**) is greater than those in the kiln chamber, which supports our functional interpretation of the structure. We assume that the materials in this pit came from the kiln, a possibility supported by the significant documented level of ash that would have corresponded to the chamber's cyclical cleaning, the location itself of the dump connected to the *praefurnium* and the presence of several clay pellets among the materials recovered. The most numerous objects in this case were terracotta sherds belonging to *thymiateria* shaped like women's heads (**figs. 6–7**), zoomorphic *askoi* (**fig. 8**) (28 fragments, 32% of the entire production) and small lid shapes (29 units, 33%). These types were present among the combustion chamber material, although there were slightly fewer of them with respect to most productions, which is why we can assume that they had been manufactured before this last or last few firings. However, from the chronological point of view, we did not find a noticeable disparity and thus, they must have been

[8] Bernal et al. 2003, 200.
[9] Ibid. 200. – A.M. Sáez, El alfar tardopúnico de Torre Alta. Resultados de las excavaciones de 2002-03. In: Bernal/Lagóstena 2004, II.705.

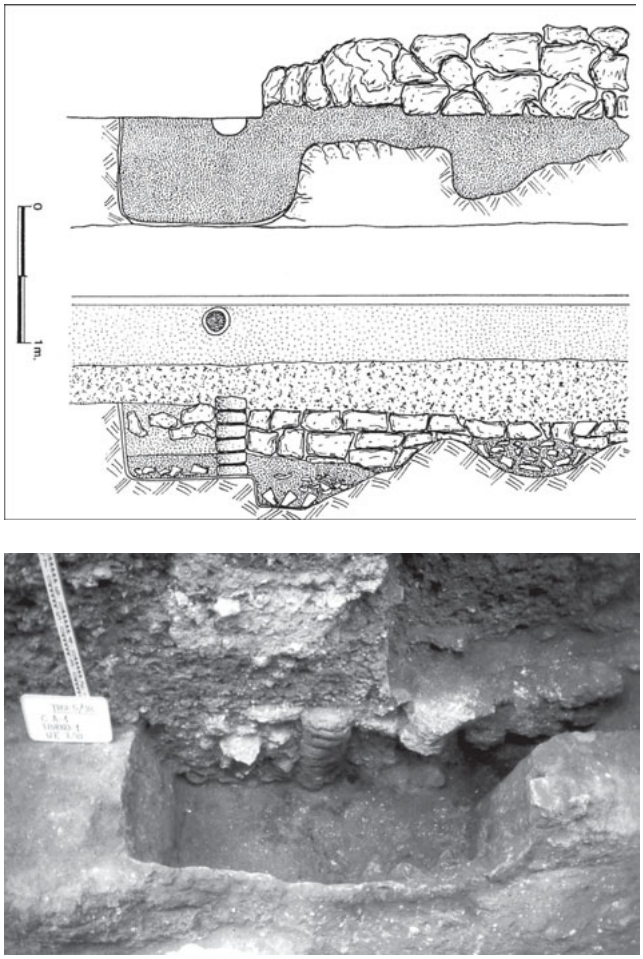

**Fig. 2. (a)** Ground plan and elevation of the kiln from C/ Troilo. – **(b)** Detail of the structure after excavation. (Drawings and photographs: Francisco J. Blanco Jiménez).

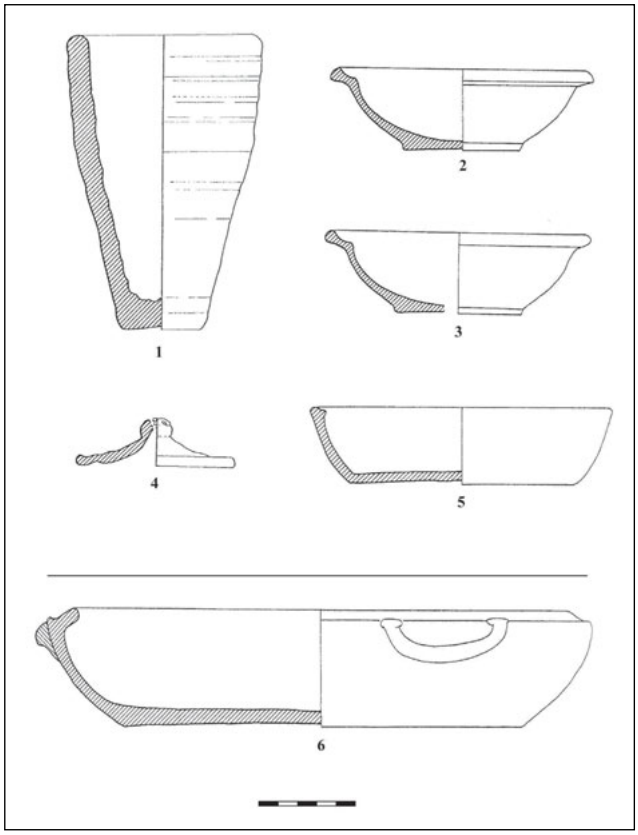


**Fig. 3.** Vases from the combustion chamber that correspond to the last firing produced in the kiln (US 8). **1** "Tumbler"; **2–3** bowl-like ledged lids; **4** small lid; **5** bifid-rimmed pot; **6** pot. – Scale 1:4 (Drawings by the author).

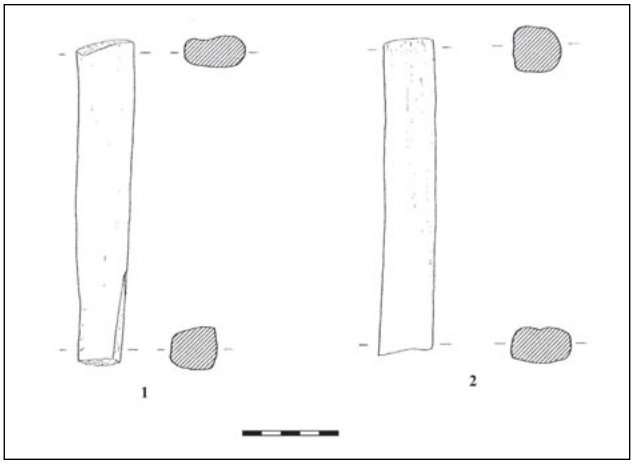


**Fig. 4.** Clay separators from the interior of the combustion chamber (US 8). – Scale 1:4 (Drawings by the author).

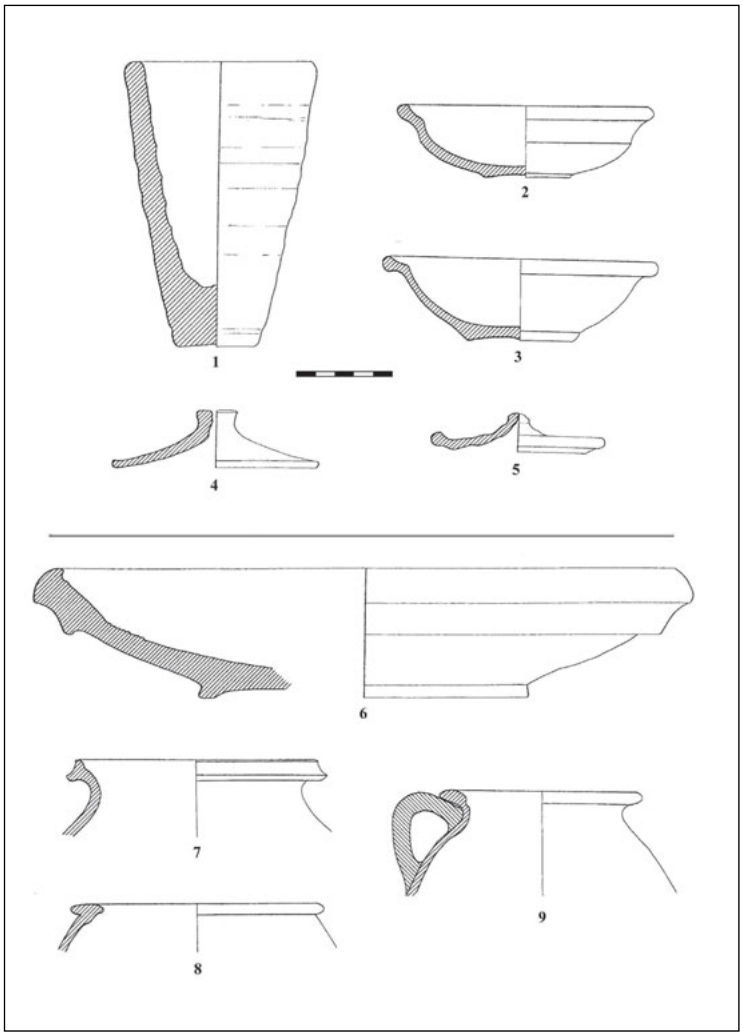


**Fig. 5.** Vase shapes found in the fill of the pit attached to the *praefurnium*, discarded materials and materials used by potters (US 11). **1** "Tumbler" ; **2–3** bowl-like ledged lids; **4** lid with a central knob; **5** small lid; **6** mortar; **7–8** urns; **9** jug. – Scale 1:4 (Drawings by the author).

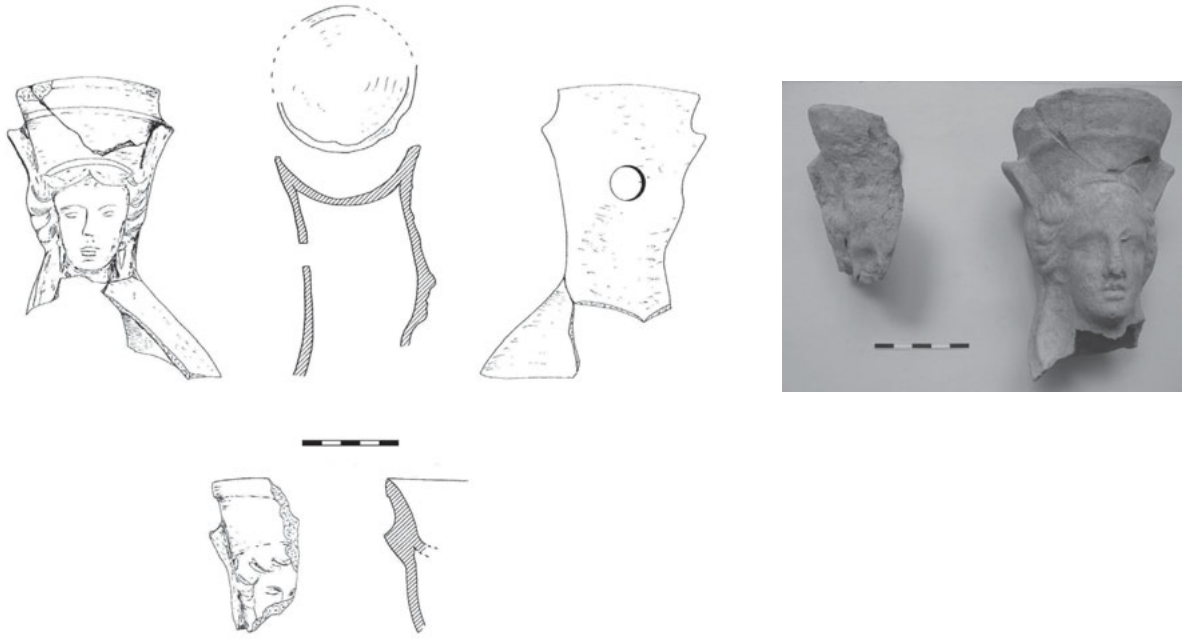

**Fig. 6.** *Thymiateria* shaped like women's head from Group 1. (Drawings and photographs by the author)

**Fig. 7.** *Thymiateria* from Group 2. (Drawings and photographs by the author)

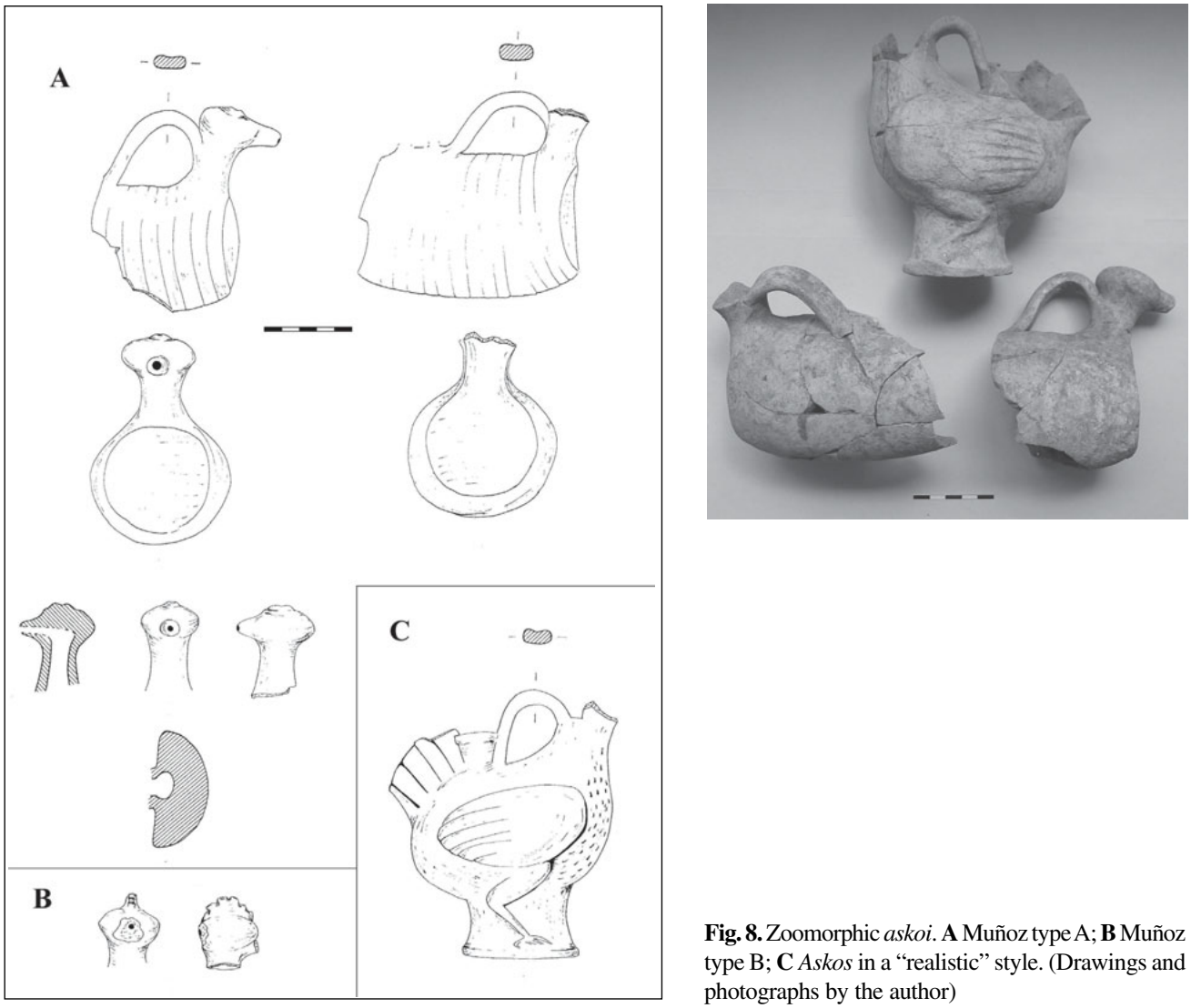


**Fig. 8.** Zoomorphic *askoi*. **A** Muñoz type A; **B** Muñoz type B; **C** *Askos* in a "realistic" style. (Drawings and photographs by the author)

manufactured close in time. In contrast, most of the shapes documented in the kiln are practically absent here, which would indicate that the kiln collapsed with its entire last production inside and that the objects in each firing were different from the previous ones, although all of them were small pieces related to the necropolis and worship. The other materials in the dump were divided among various types of common Roman ceramic platters, urns and pots, with the complete and noticeable absence of bifid-rimmed pots, which did, however, appear among the combustion chamber ruins.

In addition to several smaller fragments, four quite complete specimens of *thymiateria* shaped like women's heads were found[10]. Although they were few in number, we believe sufficient arguments exist to endorse their manufacture in the kiln, since most of them came from the pit located at the entrance to the *praefurnium*, which was conceived as a dump in which to deposit the remains from cleaning the combustion chamber (ash, remains of materials and clay) and failed firings[11]; a few fragments were also documented among the combustion chamber ruins, which would indicate their manufacture in earlier firings. Furthermore, the *thymiateria* were manufactured with the two pastes – reddish-orange and beige-yellow – that had characterized fine dishware production in Cadiz since Punic times, and were finished with the application of a slip made from the same clays. One specimen has a flaw in the upper cup, which indicates that it had been manufactured in the kiln and rejected as unfit for circulation. And finally, two of the four almost completely intact surviving specimens had been manufactured from a single matrix (**fig. 6**) and the other two from another matrix (**fig. 7**), as we have been able to verify[12].

Like the *thymiateria*, most of the *askoi* appeared in the pit next to the *praefurnium*, although several smaller fragments (mouths and hanging elements) were also found in the combustion chamber. Most of the pieces recovered (**fig. 8A.B**) belong to the three classic types (doves, roosters or hens and patterned) common in Hellenistic funeral contexts at Cadiz[13] and produced by many of the island's potteries in the second and first centuries BC.[14] Alongside the types described appeared an almost completely intact *askos* (**fig. 8C**) depicting a rooster in a realistic style[15]. This piece, which is exceptional inasmuch as there are no known parallels in the city's necropolis, must not have been unique if we consider the presence of several small fragments decorated with similar plumages. As in the case of the *thymiateria*, the introduction of this shape into the city's funerary practices from the second century BC onward has been explained by the arrival of Carthaginian elements after that city's definitive destruction in the mid-century[16], since this shape was unheard of in the necropolis of Cadiz until that time and, to the contrary, was widely known in Carthage and other central Mediterranean zones in the Punic world[17].

The presence of the types described – *thymiateria* shaped like women's heads, a late Punic iconography developed between the fourth and second centuries BC, and the zoomorphic *askoi* that characterized the facies in the second-century necropoleis of Cadiz – leads us to believe that this workshop had its chronological roots in Punic or late Punic times. However, the other vases it manufactured demonstrate that the kiln was already producing Roman fineware shapes, some of which were in the local style, while others, such as the bifid-rimmed pots, were in the image of Italic productions. Nonetheless, we do believe that the cultural atmosphere can still be considered essentially Punic[18].

The bowl-like ledged lids belong to the type that sealed cinerary urns in Cadiz until Julio-Claudian times[19]. Numerous variants existed, although they all shared a common profile: a hemispherical bowl shape with smooth, continuous lines and a rounded bottom, scarcely marked on the outside and slightly recessed beneath. The rim profiles varied widely, although they were always thick, which functionally allowed them to rest on the mouth of the urns they sealed. In turn, the ledge on the upper side of the rim would hypothetically allow them to support lids by means of analogous morphologies. The dimensions were quite constant (mouth dia.: 13–15 cm, base dia.: 4,5–6,5 cm, height: 4,0–4,5 cm), which comes as no surprise, since these vases pertain to the same series of ceramics. The few variations in size and certain morphological details would be explained by the artisan craftsmanship of this workshop's production.

The second shapes, the so-called tumblers, are truncated pyramid-shaped ceramic pieces that taper down to the base, with crudely fashioned thick walls and vertical rounded rims. Traces of turning remain on both their inner and outer faces, normally quite evidently, which leads us to believe that they were carelessly-fashioned recipients that cannot be regarded as fineware in any case. The dimensions are very constant; in fact, variation is minimum. The diameters of the mouths measure approximately 9,5 to 10 cm, the bases around 4 cm and the heights between 15 and 16 cm. The walls are approximately 1 cm thick, whereas the thickness of the base varies from 1 cm to 4 cm on occasion; nevertheless, there are no orifices in any of them.

The main question raised by these pieces is their function. This production was not sporadic, since it has been documented in workshops in the historic centre of Cadiz nearby[20] and in the

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10 A. M. Niveau de Villedary, Nuevos datos sobre la presencia de «pebeteros en forma de cabeza femenina» en la Bahía de Cádiz In: M.C. Marín/F. Horn (eds.), Imagen y culto en la Iberia prerromana: en torno a los llamados «pebeteros en forma de cabeza femenina». Spal Monogr. 9 (Sevilla 2007) 168–173.

11 Niveau de Villedary/Blanco 2007, 201–204.

12 Ibid. 205–208.

13 Muñoz 1992, 7-8.

14 Bernal et al. 2003 figs. 20,5–6; 25,6; 30,10–11. – Montero et al. 2004 fig. 2. – A. M. Sáez, Uso y producción de askoi en Gadir. Una posible evidencia del culto a Tanit. In: A. Akerraz/P. Ruggeri/A. Siraj/C. Vismara (eds.), L'Africa romana. Mobilità delle persone e dei popoli, dinamiche migratorie, emigrazioni ed immigrazioni nelle provincie occidentali dell'Impero romano. Atti del XVI Convegno di Studi Rabat, 15–19 diciembre 2004) (Roma 2006) 1971.

15 Niveau de Villedary/Blanco 2007, 208–210.

16 Montero et al. 2004, 422–423.

17 Muñoz 1992, 8.

18 J. L. López Castro, Las ciudades de fundación fenicia en el sur de Hispania: integración y pervivencias durante el Alto Imperio. In: C. González/A. Padilla (eds.), Estudios sobre las ciudades de la Bética (Granada, 2002) 241–262.

19 M. D. López de la Orden, Urnas cinerarias de la necrópolis romana de Cádiz. Anu. Arqu. Andalucía 2, 2000 (2003), 113 fig. 4,15.

20 Similar productions appeared in the unusual excavation of the site located on C/Santa María del Mare in Santa Cruz de Tenerife in the vicinity of the Phoenician-Punic necropolis (personal information from its excavator Maribel Molina Carrión).

Jerez countryside[21]. It has been suggested that they were flowerpots [22], yet in principle, their small size and the absence of orifices in the bases contradict this hypothesis. That they may have been used as amphorae lids has also been the object of speculation[23], but the existence of typologies conceived expressly for this purpose seems to negate this idea. Lastly, the most plausible option is that, despite their small size, they were building materials that may have been used in relation to the construction of the kiln chambers themselves.

The kiln's production must have varied in each firing (or series of firings). If the last firing consisted completely of the bowl-like lids and tumblers that blocked the combustion chamber, another series of elements in variable representation has been documented from earlier firings. The small lids, notable for their abundance, correspond to Shape 62 in Mercedes Vegas' classification[24] and Type 4 in Gloria Olcese's more recent systematisation[25]. Most of them have a central orifice that traverses the knob, which must have been used for introducing a small cord to facilitate extraction[26] . Functionally, they were used as lids for amphorae or other containers. The smaller ones must have been used to cover wine vessels, jugs and amphoriskoi in domestic environments. No documentation of this shape exists before 200 BC and its appearance is associated with innovations spread by the Romans, which must be related, on the one hand, to the small-scale production of new amphora shapes that were Italic imitations (first Greco-Italic and then Dressel 1) and on the other, to the mass manufacture of Rzmòn T-7.4.3.3 in the Punic-Carthaginian tradition.

The bifid-rimmed pots, which are included in Shape 14 of Vegas/*Novaesium* 18,[27] were manufactured exclusively in the last firings, because no traces of them were found in the dump. Recent excavations in the potteries at the Pery Junquera site have verified the local production of this shape, Italic in principle, in potteries in the south of the Iberian mainland[28].

The other materials found in the fill of the structure cannot have been vases manufactured in the kiln because of their scarce representation. In some cases, these objects were consciously or casually deposited in the dump; in others, they belong to different sedimentation layers. Featuring prominently among the materials found in the kiln's chamber was a large, intact pot that can be included among the "pots with handles" described in Antequerian productions[29]. The typological variety is greater in the pit-dump fill, which yielded a good many fragments from urns, jars and other closed shapes, some of which were in the Punic tradition, such as those with triangular rims, and others in totally Roman shapes, such as the pots with horizontal rims or the *caccabus* of Classical sources. Lastly, we point out the existence of a practically intact mortar that combines traditional morphologically Punic elements with other new features typical of republican specimens, such as the replacement of stones on the bottom by grooves. The surface of the piece was totally blackened when it was recovered and ashes were found inside it.

To sum up, the series represents a facies typical of common Roman-republican ceramics in the second and first centuries B.C., with the particular features of the zone of Cadiz, the sum of Punic survivals and the most dynamic production character in the coastal zones[30].

## The series' chronological bases and functionality

Two questions arise, now that the kiln and materials have been described: the chronology of the use and collapse of the combustion structure and adjacent pit and the final destination of the output from this small ceramics workshop on the city outskirts.

According to island parallels, the structure must have dated from between the third and second centuries BC, since it has been considered a Punic innovation that did not survive into Roman times, although a series of clarifications allows us to extend the chronology of the structure in Cadiz somewhat.

We start from the premise that at least three chronological phases need to be distinguished: the time of the kiln's construction, the period of its use and the time of its abandonment, differentiating between the abandonment itself and the site's final destruction. Owing to the lack of reliable diagnostic elements, we do not know exactly when the kiln was built although a series of indications leads us to assume that it was well into the second century BC, because of the chamber's quadrangular shape – a novelty introduced by the Romans that had not been used in the Punic world - the total absence of Punic ceramics and the presence and manufacture of characteristic republican types that allow us to assume a construction *ex novo* of the industrial complex.

The typology of the objects found inside it indicates that the kiln must have been functioning during a good part of the second half of the second century BC. Both the bird-shaped *askoi* as well as the *thymiateria* shaped like women's heads are funerary-worship typologies that were unknown until that time and introduced by the Carthaginians or Carthaginian influences around the mid-second century BC after the destruction of the Central African metropolis;

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21 I. GARCÍA/F. ZULETA/O. PRIETO, El yacimiento romano de El Torno-Cementerio de San Isidro del Guadalete. In: Bernal/Lagóstena 2004, II.666 fig. 11.

22 BLANCO 1999, 11.

23 NIVEAU DE VILLEDARY/BLANCO 2007, 212.

24 VEGAS 1973, 149 fig. 57.

25 G. OLCESE, Ceramiche comuni a Roma e in area romana: Produzione, circolazione e tecnologia (Tarda Età Repubblicana–Prima Età Imperiale. Doc. Arch. 28 (Mantova, 2003) 90–91 lám. 20.

26 BERNAL/SÁEZ 2008, 468–469 fig. 6.

27 VEGAS 1973, 43–45 fig. 15. – M. BELTRÁN, Guía de la cerámica romana (Zaragoza 1990) 201 fig. 99.

28 A. M. NIVEAU DE VILLEDARY, La producción de barniz púnico-gaditano en el s. II a.C. Nuevos datos aportados por el conjunto alfarero de Pery Junquera (San Fernando, Cádiz). In: Bernal/Lagóstena 2004, II.686.

29 E. SERRANO, La producción cerámica de los talleres romanos de la Depresión de Antequera. In: Figlinae Malacitanae. La producción romana en los territorios malacitanos (Málaga 1997) 221 fig. 16.

30 A. BALDOMERO/P. CORRALES/M.M. ESCALANTE/E. SERRANO/J. SUÁREZ, El alfar romano de la Huerta del Rincón: Síntesis tipológica y momentos de producción, In: Figlinae Malacitanae. La producción romana en los territorios malacitanos (Malaga 1997)155.

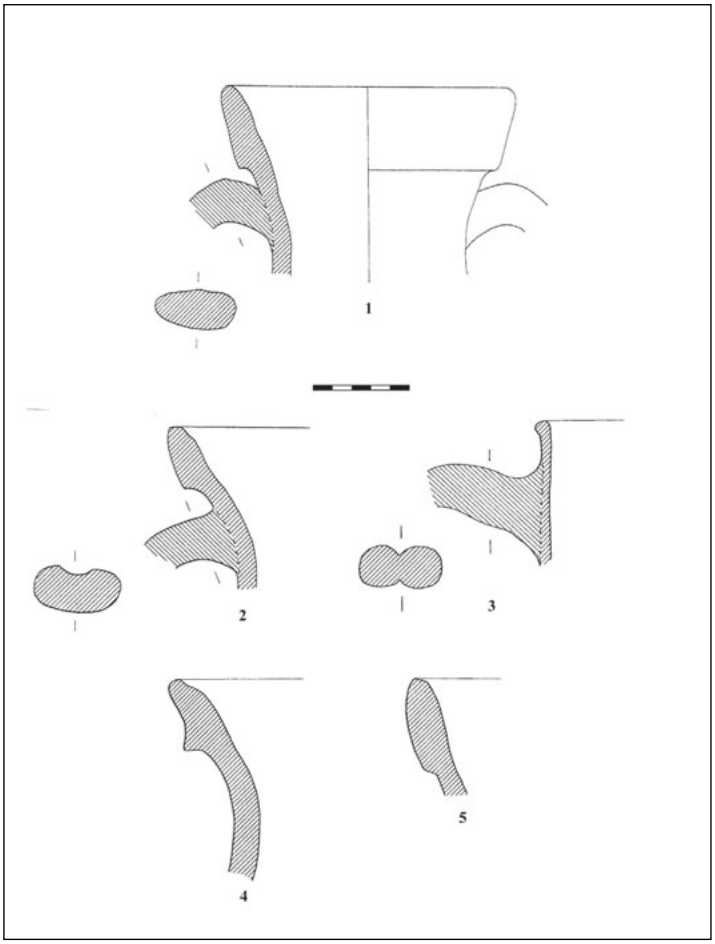


**Fig. 9**. Roman series of amphorae related to the destruction of the kiln (US 5) (mid-first century BC). **1–2** Ancient Haltern 70; **3** Dressel 2–4; **4** ancient Cadiz ovoid or Dressel 7; **5** possible ancient Dressel 20 or Haltern 70. – Scale 1:4 (Drawings by the author).

they may have lasted until an advanced date in the first century BC.[31] The rest of the common vases[32] can also be dated to the second century, which indicates the second half of the second century BC as the *terminus post quem* for the start of kiln operations. In turn, the materials that blocked it can be chronologically extended until a somewhat later date, between the late second century and early first century BC. *Terminus ante quem* applies because of the appearance in the first levels over the collapsed kiln of a coin from Alfaro's VI Series[33] minted in Cadiz, which gives us the second half of the first century BC as an approximate date[34].

Other reliable chronological pointers are the series of associated amphorae at the level of the wall construction that traverses the kiln. This wall must be related to the foundations of a house belonging to the construction of *Neapolis* by Lucius Cornelius Balbo in the mid-first century BC, which would have involved the reconversion of this suburban industrial zone into the new city's public centre. The series (**fig. 9**) consists almost exclusively of wine amphorae of Italic typology or influence (ancient Haltern 70, Dressel 2/4 and Cadiz ovoid) that date to around the middle of the first century BC, if not before.

The last chronological data are offered by a second series of amphorae (**fig. 10**) from the levels over the kiln fill, which dates the structure's definitive blockage, which must have been slow, to Augustan times (the first century AD). Sauce shapes (Dressel 7/11, Dressel 12, Beltrán IIB) are more common than wine shapes (Augustan Haltern 70) on this occasion.

In short, the chronological data lead us to suggest the period between the second half of the second century BC and the first years of the following century as the structure's date of operation, making it a residual survival of late Punic kiln structures characteristic of a somewhat earlier time.

In principle, we do not know whether this modestly-sized potter's kiln was part of a larger industrial complex, although there is no evidence of this in the environs (other kiln structures or vessels). The kiln was used to manufacture small, common ceramic pieces and votive-religious terracotta items. In contrast to island kilns, the structure in Cadiz corresponds to a specific activity that arose *ex novo* with a more concrete function, as opposed to the large-scale "industrial" character of pottery production in Antipolis in Phoenician-Punic times. Hence, this small workshop on the city outskirts was

[31] Montero et al. 2004, 422–423.
[32] Bernal/Sáez 2008, 457.
[33] C. Alfaro, Las monedas de Gadir/Gades (Madrid, 1988) 81–84.
[34] Blanco 1999, 11.

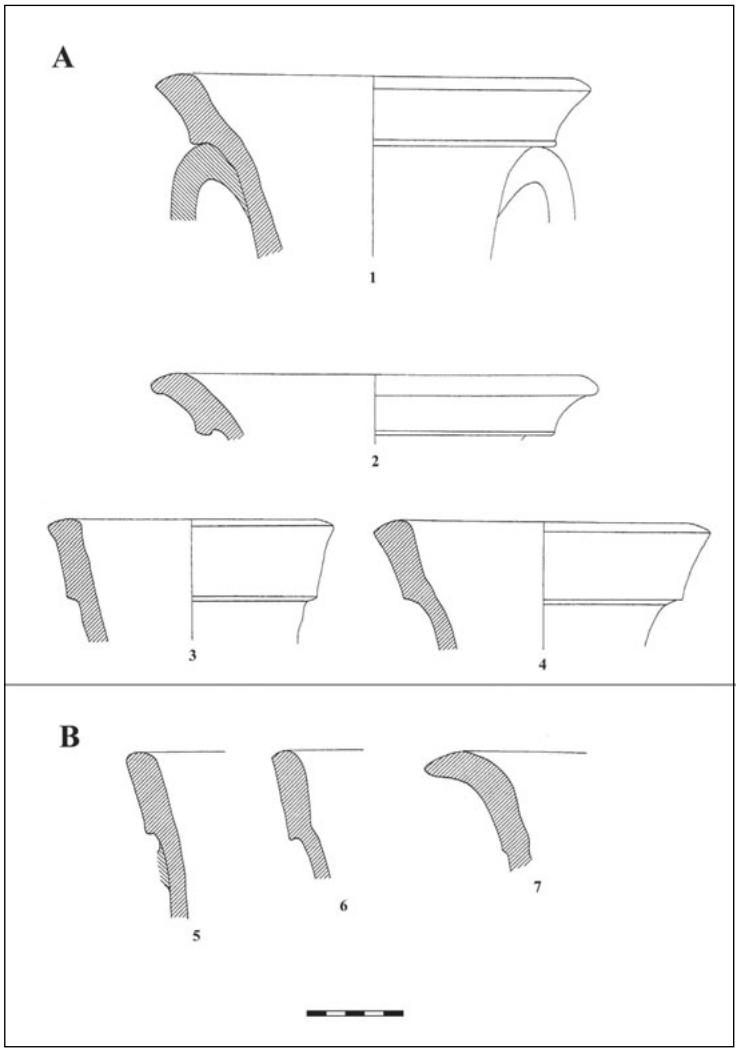


**Fig. 10.** Assemblage of Early Roman amphorae from the kiln blockage (levels above US 11 and US 8) (late first century BC to the early first century AD). **– A.** Pit fill (US 11): **1** Dressel 12; **2** Dressel 7/11; **3–4** Dressel 7/11? – **B.** Kiln chamber fill (US 8): **5–6** Haltern 70 from Augustan times; **7** Beltrán IIB. – Scale 1:4 (Drawings by the author).

Punic in type, but operated during the second and first centuries BC, as denoted by the repertoire of vases produced in it. The analysis of ceramic types leads us to suggest that the kiln was largely devoted to supplying the nearby necropolis with certain products. There are no doubts about the destination of certain vase categories, such as the zoomorphic *askoi*, *thymiateria* shaped like women's heads and bowl-like lids used to cover funerary urns, the shapes that make up the bulk of production. Nevertheless, other shapes such as the tumblers, bifid-rimmed pots or small lids, in principle, were not apparently used for funerary purposes. The rest of the shapes are in the minority and may have belonged to the potters.

On other occasions we have echoed the possibility of the existence of the "mass" manufacture of ceramics devoted exclusively to supplying the needs of the necropolis and funerary worship[35]. Semitic liturgical prescriptions entailing the abandonment (breakage and interment) of a series of dishes once they had been used in sacred rites implied a high demand for ceramic containers, which to a large extent had to be made in the vicinity of necropoleis and places of worship. The existence of several rituals in which many faithful took part also involved the need to supply quickly and easily the elements used in them; hence, the existence of potteries next to temples and cemeteries and the explanation behind the discoveries of extensive quantities of ceramics in ritual graves and wells[36]. The location of potteries next to necropoleis was frequent in the Phoenician-Punic world, insofar as both were generally located outside city perimeters.

At any rate, temples and necropoleis must not have been provisioned solely by the articles manufactured in attached workshops, as is proven by the output of several structures in the industrial district of Antipolis apparently devoted exclusively to the production of non-vase categories, such as terracottas, stamped discs and slipped ceramics[37].

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