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Jeroen Poblome, Daniele Malfitana and John Lund

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HEROM SHOWS ITS TRUE COLOURS!

EDITORIAL PREFACE

Jeroen Poblome, John Lund and Daniele Malfitana

UNIVERSITY OF LEUVEN, THE NATIONAL MUSEUM OF DENMARK, AND IBAM-CNR-ITALY

One of the privileges of editing HEROM is that our publisher, Leuven University Press, kindly allows us to help choose the colour of the cover. This year's colour we find pretty. Not that the others were bad, also considered as a set, but the 2015 hue, value and chroma – to put it in Albert H. Munsell's terms – are particularly lively. Fittingly so.

Indeed, HEROM is alive and kicking: as of 2015 two issues will be published annually, in the months of May and November of each year. In part this is a managerial decision, to continue to create a place for HEROM as a journal, but this new step also reflects the growing amount of contributions which are being proposed for consideration on Hellenistic, Roman and late antique material culture. This is nothing less than excellent news, as scholars of the past are increasingly becoming aware of how studies of material culture, broken though it may be, are oftentimes instrumental in grounding theory and concepts, archaeological or other-disciplinary, in the reality of the past. It also works the other way round, by allowing the study of the *minutiae* of past material culture, still the bread and butter of much classical archaeology, to meaningfully reach a wider audience, and in doing so surpass the *ad hoc* and often coincidental nature of the collections and assemblages we study.

As editors – as well as practitioners in this field – we cannot be alone in considering that every archaeological project, be it survey, excavation or even non-fieldwork-based, no matter how big or small in enterprise, dealing with aspects of the Hellenistic to late antique worlds, holds a variety of material culture, which represents considerable potential still to be unlocked. As ever

more archaeologists wish to be encompassing, inspirational and inclusive in explaining the human experiences of past communities, studies of material culture increasingly take centre-stage. And rightfully so. HEROM wishes to continue to function as a medium to voice concerns and issues in the study of ancient material culture, but much more so to demonstrate the potential of our evidence to contribute to a historically meaningful understanding of the past.

António José Marques da Silva's contribution is an excellent example of this ambition. The collection of material culture he presents is very much early Roman Imperial in nature. At face value. But to truly understand material culture one needs only to scratch the surface in order to discover how disconcertingly stubborn such evidence can be, pulling interpretations in many ways, without much sense of direction. That is where theoretical concepts come in, in this case mainly the originally linguistic notion of creolisation, in order to help create meaning to basically mixed messages, experiences and practices.

Sophia Germanidou offers an overview of dovecotes from the late Roman and Byzantine periods. Pigeon breeding structures represent the study of material culture in its widest sense. These features, documented in a range of historical, art historical and archaeological sources, do not necessarily conform to typically mobile material culture, such as pottery, glass vessels or objects cut from bone, but are mostly lost in the gap between architectural and material culture studies. Yet, transport amphorae were at times secondarily used as dovecotes. To be sure, this gap is a scholarly artefact, corresponding to no reality in the past, which is one of the reasons why HEROM wishes to bring this contribution.

The next two contributions deal with specific aspects of material culture remains, and as it happens both concern amphorae. Matthew Loughton and Laurence Alberghi consider the practices of piercing and holing amphorae, based on the study of an assemblage excavated recently at Toulouse. Basically from holes, useful observations can be derived on the nature and function of the studied site, as well as on the origins of some of the people who lived and worked there. It is illustrative of the potential of material culture studies that not only the objects *an sich* need to be considered, but also each and every detail of these. When properly documented, it is easy to grasp how seemingly odd features reveal past practices of daily life, possibly involving multiple uses of the same object.

Philip Bes and Leo Vanhecke, finally, do not deal with prototypical and well-known categories of amphorae. Their study concerns amphorae made

in the immediate vicinity of the Pisidian town of Sagalassos. The degree to which the scholarly world does not know these types of products seems to be related to their unknown and possibly very restricted range of distribution. Who produces amphorae in a mountainous region at quite a distance from the sea or other transport options anyway? The paper does not so much wish to attract attention to the existence of the Sagalassos amphorae *per se*, but demonstrates how detailed observation of basically oddities on these vessels reveals ancient practices. Even if the latter can only be interpreted in hypothetical terms, the various options indicate the intricacies of past reality of the associated *chaîne(s) opératoire(s)*.

HEROM 4.2 will present another series of individual studies. On the other hand, both issues planned for 2016 will feature thematic approaches. One will be dedicated to the memory and intellectual legacy of Professor David Peacock, who sadly passed away in March this year. He is and will be much missed, also on HEROM's scientific committee. The other 2016 issue will present a collection of contributions documenting the 'material turn' in the discipline of Geography, and the ways in which this represents an analytical as well as conceptual potential for the disciplines of the past.

CERAMICS, FOODWAYS AND LOCAL ‘SUB-CULTURES’ IN NORTH-WESTERN IBERIA AT THE HEIGHT OF THE ROMAN EMPIRE

THE CASTRO DO VIEITO CASE STUDY

António José Marques da Silva

FUNDAÇÃO PARA A CIÊNCIA E A TECNOLOGIA

CENTRO DE ESTUDOS ARQUEOLÓGICOS DAS UNIVERSIDADES DE COIMBRA
E DO PORTO

Introduction

A large-scale archaeological intervention (2004–2005) has resulted in the excavation of an immense assemblage of ceramics, coming from the indigenous population of Castro do Vieito in northwestern Iberia at the height of the Roman empire. The study of this assemblage forms the basis for a reflection on the way a community belonging to a non-elite local “sub-culture” maintained direct contact over a period of time with the soldiers of the empire’s army, and how they received Roman foodways. The acquisition of ceramic kitchenware originating from other regions of the empire, particularly the Baetican Haltern 70 amphorae, has been well documented in this settlement. Nothing indicates that there was a significant change in culinary practices amongst its inhabitants, who maintained their allegiance to their native culinary traditions. It can be said with certainty that, sometimes, these imported ceramics were used for purposes other than those for which they were originally intended. In reality, several generations elapsed between the first moment of contact with foreign culinary skills and the eventual general abandonment of local culinary traditions in this region. The definite adoption of the Roman culinary approach was to occur only at the end of the 1st

century AD. This time lag is symptomatic of the asynchronous, non-linear nature of this process. The linguistic concept of “creolization” is called upon at the end of the text; this concept can help to improve our understanding of the cultural dynamics of the process, i.e. those that do not fit into the standard parameters of what is usually understood by “Romanization”.

Historical context

Castro do Vieito is situated on the banks of the estuary of the River Lima, on Portugal’s northern coast (FIG. 1). This settlement had a very short period of occupation, corresponding to the very earliest stages of the integration of north-western Iberia into the *orbis romanum* (from the reign of Augustus until the middle or third quarter of the 1st century AD).¹ After the conquest, the inhabitants of this region experienced what R. Hingley has called ‘highly discrepant experiences.’² They were on the periphery of the standard course of integration within the empire, of what we might call in a generic way “Romanization”. Their social organisation and the built landscape, made up of fortified hill-top settlements (*castros*), both appear to have remained largely unaltered at the beginning of this process, as does the native material culture.



FIG 1. Localisation of the Castro do Vieito archaeological site in the context of the Hispania. Drawing J. L. Madeira.

The Romans drafted a permanent military contingent to this peripheral region of the empire in order to control the exploration of its abundant min-

1. Alarcão 1988.
2. Hingley 2005, p. 105.

eral resources and to recruit soldiers for the auxiliary corps of the imperial army.³ The final conquest of north-western Iberia mobilised a vast military contingent made up of seven or eight legions and various auxiliary units.⁴ The military forces involved in the conflict were gradually removed after the conquest. The *I (Augusta?)*, *II Augusta* and *V Alaudae* legions left the region during the reign of Augustus, followed by the *III Macedonica* during the reign of Tiberius. Only two legions (*VI Victrix* and *X Gemina*) and some auxiliary corps remained under Caligula, joined by the *legio I Aduitrix* at the time of the civil war (AD 68-69).⁵ In the Flavian period, the *exercitus hispanicus* was made up of only the *legio VII Gemina* and four auxiliary regiments.⁶ Thus the permanent military complement in the region went from 50,000 men at the end of the conquest to 27,000 men at the time of Tiberius, 18,000 men by AD 63 and only 9,000 men between AD 63 and AD 68.⁷

In the initial phase of the military occupation, in the majority of cases, both goods and people were transported mostly by river or sea.⁸ Castro do Vieito's setting in a strategic location on the river estuary, close to one of the region's largest mineral seams, made this settlement an important node in the military supply network. Regular supplies were needed for the drafted military personnel who controlled prospecting for gold upstream on the River Lima.⁹ Thus, this community was granted a privileged knowledge of the Romans' culinary traditions via this network which was mostly used to bring food for the Roman soldiers. Even if a significant quantity of food was acquired locally, "comfort food" was imported from other areas, place that might be very distant but that had been part of the empire from early on.¹⁰ This familiar foodstuffs ensured that the soldiers kept their *humanitas*¹¹ within an environment of "barbarians", because the food regime was one of the factors that distinguished civilised men from barbarians.¹²

It is even probable that military personnel or veterans of the auxiliary corps of the Roman army took up residence within this community at some times.¹³ The members of this community could be considered a local non-

3. Le Roux 1982; Millett 2001, p. 167.
4. Morillo Cerdán 2005, p. 21.
5. García-Bellido 2006, p. 630.
6. Santos Yanguas 1988.
7. Tranoy 1981, p. 170.
8. Naveiro López 1991, p. 139.
9. Silva 2012, p. 114.
10. Stallibrass and Thomas 2008, p. 155.
11. Silva 2013, p. 34.
12. Montanari 1997, p. 108.
13. Silva 2012, p. 157.

elite “sub-culture”, with levels and forms of interaction with the occupier’s culture that were distinct from those of the rest of the indigenous society, elite and non-elite alike. The level of stratification of the indigenous society in the period prior to the conquest is a very controversial issue. Many authors even question the existence of local elites before the arrival of the Romans.¹⁴ The archaeological profile of this period reveals great uniformity in culinary and food customs, so one can say at least that it is highly unlikely that differences in the consumption and preparation of food were factors in the construction of social distinction at this time.

The ceramic assemblage

Roman kitchenware, initially only introduced in the military camps and in the region’s administrative capitals, was not used by the majority of the local population. Within the indigenous context of this era, the archaeological profile only documents the existence of amphorae of the Baetican Haltern 70 type and, more rarely, fine ceramics, Campanian ware or *terra sigillata* from Italy, with an almost total absence of ordinary Roman kitchenware.¹⁵

Traditional indigenous earthenware was handmade at this time and fired at low temperatures in a reducing atmosphere. For this reason, black or grey clay with a metallic sheen, resulting from the addition of mica to the clay, was predominant. The kitchen equipment consisted of a static repertoire of easy-to-reproduce objects. The food preparation techniques in which these vessels were used were rudimentary, though adequate for the simple family life in the traditional circular dwellings, centred around the fireplace. Pots with a flat base and an ‘S’-shaped profile were placed directly on the hearth and surrounded by burning coals, whilst other vessels, such as pans with two side handles and pans with inner upright handles, were hung on a rack rail over the fire, allowing food to be prepared and cooked slowly (FIG. 2).¹⁶

From the end of the 1st century AD, this repertoire of traditional, local earthenware was replaced by another, clearly inspired by the Roman repertoire and techniques: earthenware made on the wheel, fired in an oxidising environment using light coloured clay, frequently highlighted with an application of a slip of the same tone. Now, the *batterie de cuisine* included typical forms of ordinary Roman ceramics, such as plates, cooking dishes and mortars

14. González-Ruibal 2007, pp. 401-450.

15. Martins 1990, p. 169.

16. Queiroga 2003, p. 64.

whose inner surface was furrowed. This suggests that at this time the local population adopted more sophisticated cooking techniques that profoundly altered the way of preparing food.¹⁷

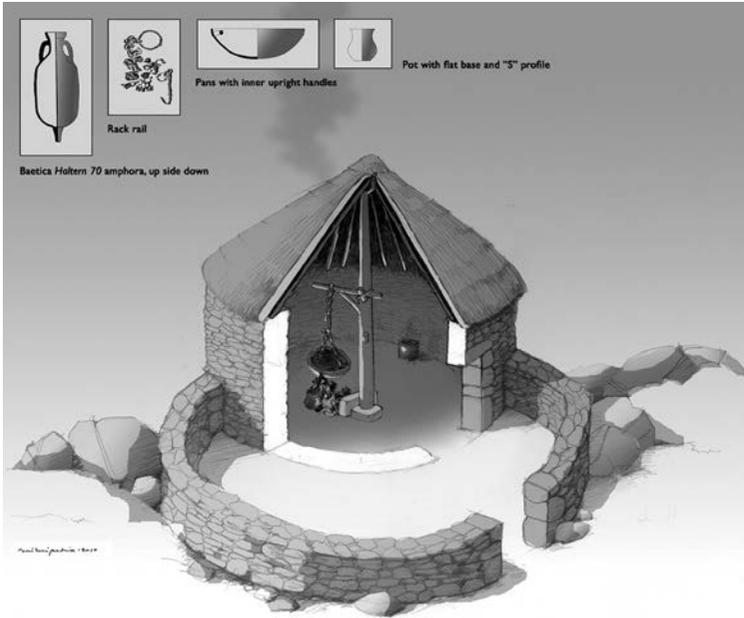


FIG. 2. Restitution of a traditional house of the Castro Culture, based on the results of the excavation of the house correlated with the archaeological structure Po186 of the Castro do Vieito archaeological site. Drawing J. L. Madeira.

These two realities are well-known, having been the object of various PhD theses published over the last 30 years.¹⁸ However, the way in which one reality shifted into the other was barely understood until the present time. The ceramic assemblage presented here dates from the initial phase of the military occupation of the region, at the precise moment of “culture clash” when traditional local way of life met that of the Romans, introduced by the soldiers of the Imperial army. Thus, we can understand more precisely how this meeting between the two cultures took place, by looking at culinary practices within the context of this particular non-elite local “sub-culture”.

17. Silva 2012, p. 76.

18. Silva 1986; Martins 1990; Almeida 2003; Queiroga 2003; Morais 2005.

The archaeological intervention

About two-thirds of the total area of the archaeological site of Castro do Vieito was affected by the construction of the A28 motorway in 2005 (FIG. 3). This critical perimeter of around 15,000 m² was the object of a large scale archaeological intervention carried out between June 2004 and July 2005 and directed by the author of this article with a team of 150 people. The strategy adopted was to excavate and record all the archaeological deposits (corresponding to a volume of around 12,000 m³) by stratigraphic units and to dismantle all the identified structures as far as the rocky substrata, a common practice in archaeological interventions within the context of rescue archaeology.

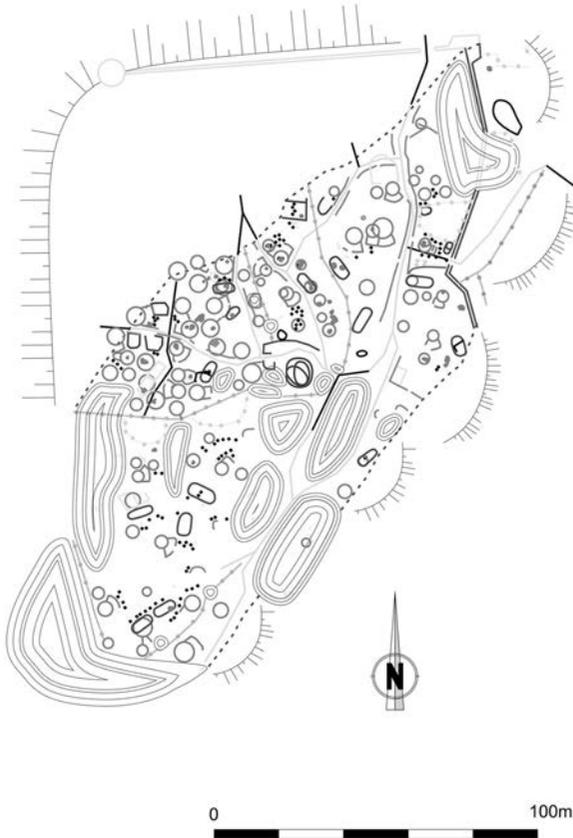


FIG. 3. Schematic plan of the Castro do Vieito. Drawing A. J. M. Silva.

A non-selective and systematic strategy of collecting the archaeological finds was intentionally adopted. The sample of ceramics studied corresponds to a total mass of around 14 tonnes.

Results

There being no evidence of ceramic production in the extensive area under study, it can be assumed that the earthenware used by the inhabitants of this settlement was obtained from the professional potters in the region,¹⁹



FIG. 4. Indigenous potter's marks from Castro do Vieito. Drawing A. J. M. Silva.

19. Silva 1986, p. 126.

who would frequently identify their wares with their own personal mark (FIG 4). The marks are generally simple, geometric motifs, being cut, finger-imprinted or sometimes stamped (FIG. 4, CV-DS-16) on the objects before being fired. Some of these markings were already known in other indigenous settlements in the region such as Sanfins and Briteiros.²⁰ Only one object (FIG. 4, CV-F-238), a cooking dish of Pompeian red ware,²¹ collected from a stratigraphic unit dating from the claudian-flavian(?) period, showed the mark *OQVIN* stamped on the bottom. This stamp identifies the *QUINTUS* workshop.²² The dependence of Castro do Vieito's inhabitants on the external sources for such everyday goods is paradoxical, when seen within the context of the generalised self-sufficiency that is so unmistakable at other levels of the archaeological record of this settlement.²³

The predominance of a formal repertoire of local ceramics ($82.86\% \pm 0.54$)²⁴ is a clear indication of the continuity of traditional culinary practices which goes along with the perpetuation of the local model of the organisation of domestic space (FIG. 5). However, imported ceramics are not entirely absent from this set. Amphorae are the most common exogenous products and amount to the considerable number of 3320 MNI.²⁵ By comparison, the archaeological assemblage of the capital of the *conventus*, *Bracara Augusta*, where archaeological interventions on a large scale have been carried for more than 20 years, comprises only 1457 MNI to date,²⁶ that is to say less than half the total of amphorae collected at Castro do Vieito.

20. Silva 1986, p. 126; Est LXIII – nos 1-3, 15-17, 39-41, 48-49.

21. Hayes 1997, p. 78.

22. This workshop produced this type of ware in *Lucus Augusti* (Naveiro López 1991, p. 181) or perhaps somewhere between this city and *Asturica Augusta* as E. J. Alcorta Irastorza suggests (Alcorta Irastorza 2001, p. 321).

23. Silva 2012, p. 74.

24. The proportions mentioned in this paper are always expressed with the confidence limit calculated for a confidence level of 99%, applying the formula proposed by Fletcher and Lock 2005, p. 76.

25. about MNI (Minimum Number of Individuals), see Symonds and Haynes 2007, p. 69.

26. Morais 2005, p. 100.

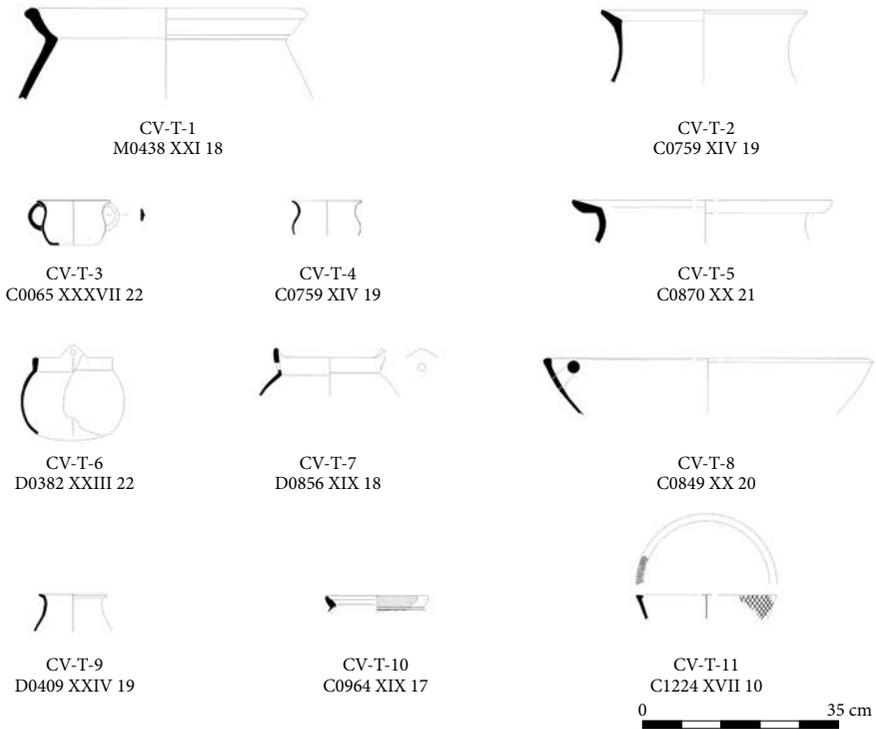


FIG. 5. Traditional indigenous types of pottery from Castro do Vieito. Drawing L. G. Pereira / A. J. M. Silva.

The majority of the imported ceramics finds at Castro do Vieito are *Baetican* amphorae of the Haltern 70 type ($8.59\% \pm 0.4$, FIG. 6). It is, in fact, the largest assemblage of amphorae of this type found to date in the whole of the Roman empire.²⁷ This particular type, which many scholars consider to be related to military supply in north-western Iberia,²⁸ would have been easily accessible

27. Some years ago, R. Morais and C. Carreras (2004) made a comparative study quantifying the presence of Haltern 70 amphorae in more than 188 archaeological sites of the Roman Empire. They concluded that the North Western area of the Iberian Peninsula had been the principal destination of this type of amphora, and *Bracara Augusta*, the most important distribution centre of the region, and consequently of the whole Empire. However, Haltern 70 specimens, quantified following the same methodology, are equivalent to 2775 NMI at Castro do Vieito, that is three times more than the Haltern 70 collection from the capital of *Conventus*.
28. Morais and Carreras 2004, p. 101.

to this community. It had an important function in the system of military supply, which largely depended on river access in order to reduce the cost of transporting goods between the coast and the inland area where the greater part of the permanent soldiers were billeted.

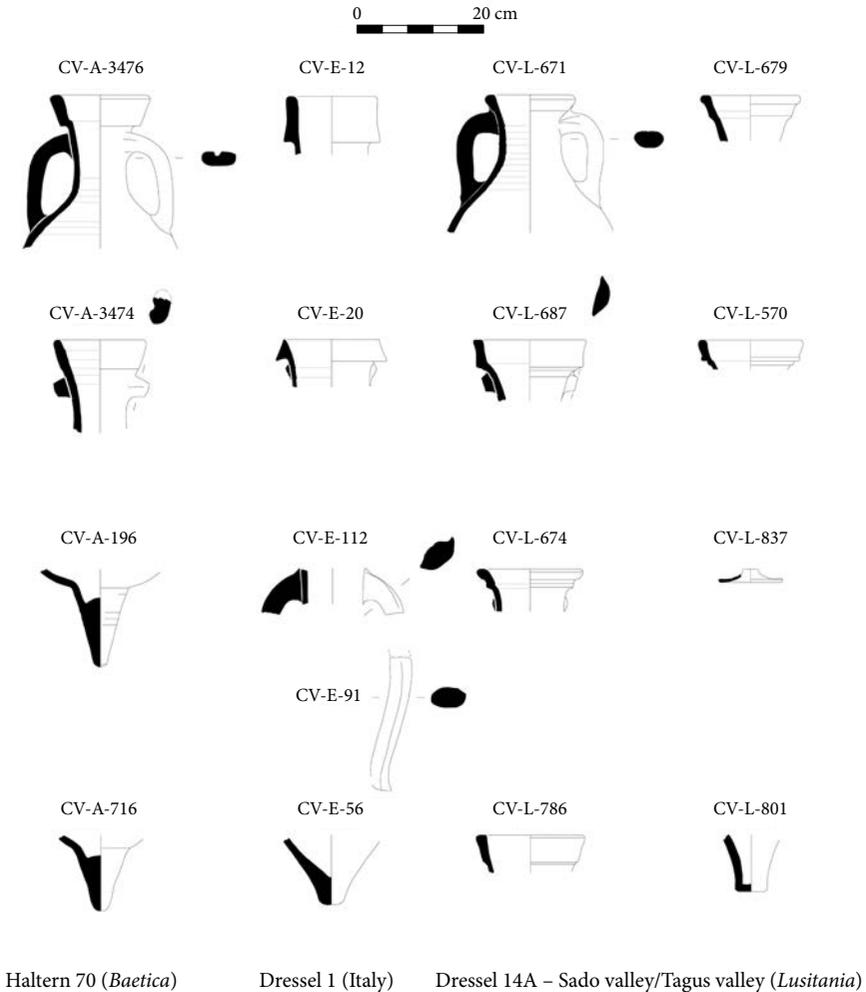


FIG. 6. Roman amphorae types from Castro do Vieito. Drawing L. G. Pereira / A. J. M. Silva.

This would explain the elevated number of vessels of this type when compared with the pottery assemblages of the neighbouring indigenous settlements. In a large settlement such as *Citânia Velha de Santa Luzia*, 5 km to the

west, the object of various large-scale archaeological interventions, Haltern 70 type amphorae total no more than 22 MNI. Amphorae of this type from the settlement at Terronha, 5 km to the east, where the area of intervention was 8000m², amount to no more than 8 MNI.²⁹ Whatever product was transported in these amphorae, its consumption by the local communities must have been of little significance. If we accept the idea that Haltern 70 amphorae were mainly used to transport wine,³⁰ little space remains to assert, as certain authors do³¹ that their presence in the region shows that the local population began at the time to consume wine imported from *Baetica*. This idea is also contradicted by Strabo's testimony (3.3.7) that the inhabitants of the region were sober and drank only water. According to him, the consumption of wine (which was produced locally in small quantities) was rare and kept for special occasions.

However, there are several indications that suggest re-use of these receptacles for various purposes other those for which they were originally made. In the majority of cases, the context in which they were deposited does not allow one to gauge how these amphorae were re-used. They would probably have been used for food but of a different type from that which was transported in them originally.³² This type of re-use is normally difficult to demonstrate. However, there are some signs that may indirectly confirm this practice.³³ The fragment of a handle CV-A-5098, coming from the post abandonment level (C0004 XIV 16) was decorated with a set of five dots cut into the clay, forming a half-circle around a sixth dot on the surface of the handle's base. The series of dots are in fact one of the most common motifs used to decorate the ceramics of the settlement's indigenous tradition. Another fragment, from a tiberio-claudian occupation level (D0230 XXIX-21) showed in turn a series of painted black dots on the inner rim of the lip. Painted black geometric decorations have also been observed on other artifacts of the indigenous tradition. Some authors believe that the decorated artifacts were used on special occasions, namely for banquets in some areas of northwestern Iberia,³⁴ a hypothesis that cannot be dismissed out the hand but which is difficult to prove in our present state of knowledge. However, the fact that these receptacles were decorated as though they

29. Morais and Carreras 2004.

30. In fact, most of the authors consensually accept that Haltern 70 amphorae were used to transport in them not only wine (Étienne and Mayet 2000, p. 82), but also olives, *defrutum* and other staples (Carreras 2004, p. 119).

31. Naveiro López 1991, p. 109; Morais 2004a.

32. Almeida 1986, p. 126.

33. Silva 2012, p. 72.

34. González-Ruibal, 2007, p. 498.

were part of the indigenous repertoire may indicate that they were used locally in the same way as the local artifacts.

The excavation of a hut (Mo259/Mo682/Mo692) allowed the observation that a Haltern 70 amphora had been partially buried on the coarse sand level (Po186) in the hut's interior, dating from the julio-claudian period. It is not strictly possible to say what would have been the new function of this object. However, as the top and the base had been removed before it was placed in this position, it would certainly not have continued to be used as a receptacle (FIG 2.).

Other types of amphorae,³⁵ such as the Lusitanian Dressel 14A amphora³⁶ ($1.03\% \pm 0.14$) and some imported fine ceramics such as *terra sigillata* from Italy ($0.1\% \pm 0.05$), Southern Gallia ($0.05\% \pm 0.03$) and Hispania ($0.16\% \pm 0.06$) are equally represented, although often residual (FIG 7). A substantial part of these artifacts had a second cycle of use after having been broken, frequently being transformed in spindle whorls (131 examples) or in circular plugs.³⁷

35. Dressel 1 amphora is documented by few specimens, in julio-claudian and tiberio-claudian levels of Castro do Vieito (FIG. 6: CV-E-56, CV-E-91, CV-E-112), representing only $0.12\% \pm 0.05$ of the total. The absence/presence of Dressel 1 amphorae is traditionally used by Roman specialists to distinguish republican levels from imperial levels. However, Dressel 1 amphorae continued to be produced until the begin of the augustan period. In fact, the presence of this type of containers is well documented in levels of the beginning of the imperial period in cities as *Burdigala* (Berthault 2005, p. 240) and *Lugdunum* (Desbat 1998, p. 152), in the whole NE of the *Galia* and in the roman camps of the Germanic Limes (Baudoux 1996, pp. 35-37). The variant A (FIG. 6: CV-E-20) and also the variant C (FIG. 6: CV-E-12) are both represented in the Castro do Vieito collection. The start of the production of the variant A is generally fixed between 145 and 130 BC and several authors, after N. Lamboglia (1955, p. 248), believed that the start of the production of the variant B, around 80 BC, marked the moment of the disappearance of the variant A (Olmer 2012, p. 325). Since the eighties, however a growing number of authors defends that the different variants had coexisted until the end of the production of Dressel 1 amphorae (Tchernia 1986, pp. 312-313, 320; Tchernia and Olmer 2004, p. 111; Empereur and Hesnard 1987, pp. 31-32. More recently: Olmer 2012).
36. The Dressel 14A amphora has some morphological affinities with the Baetican Haltern 70 type and, at the same time, with the tardo-republican ovoid type of the Cadix region (García Vargas 1998, pp. 74-76). Some authors argue that part of the rims found in some archaeological sites of *Lusitania* and *Gallaecia*, usually classified as Dressel 14A, belong to a local production of the ovoid type (Morais 2004b; Morais and Fabião 2007). However, this kind of amphora is documented in the earliest levels of Abul and Setúbal *officinae* (Sado valley), where the production of amphorae only starts in the tiberio-claudian period (Mayet *et al.* 1996, pp. 57, 84-86) and is already totally absent, a few kilometers distant of this two other sites, at Pinheiro *officina*, that begin to work in the half of the century (Mayet *et al.* 1998, p. 315; Mayet *et al.* 2002, p. 100). For more details, see Silva 2012, pp. 34-35.
37. FIG. 7, CV-S-132. This particular circular plug, found in a tiberio-claudian level (Co440 XXXII-27) is made with one of the two unique fragments of "B-Oide" campanian ware, discovered during the excavation of Castro do Vieito. The second fragment (CV-S-131) has been founded in a claudio-flavian(?) level (Co017 XXIX 20).

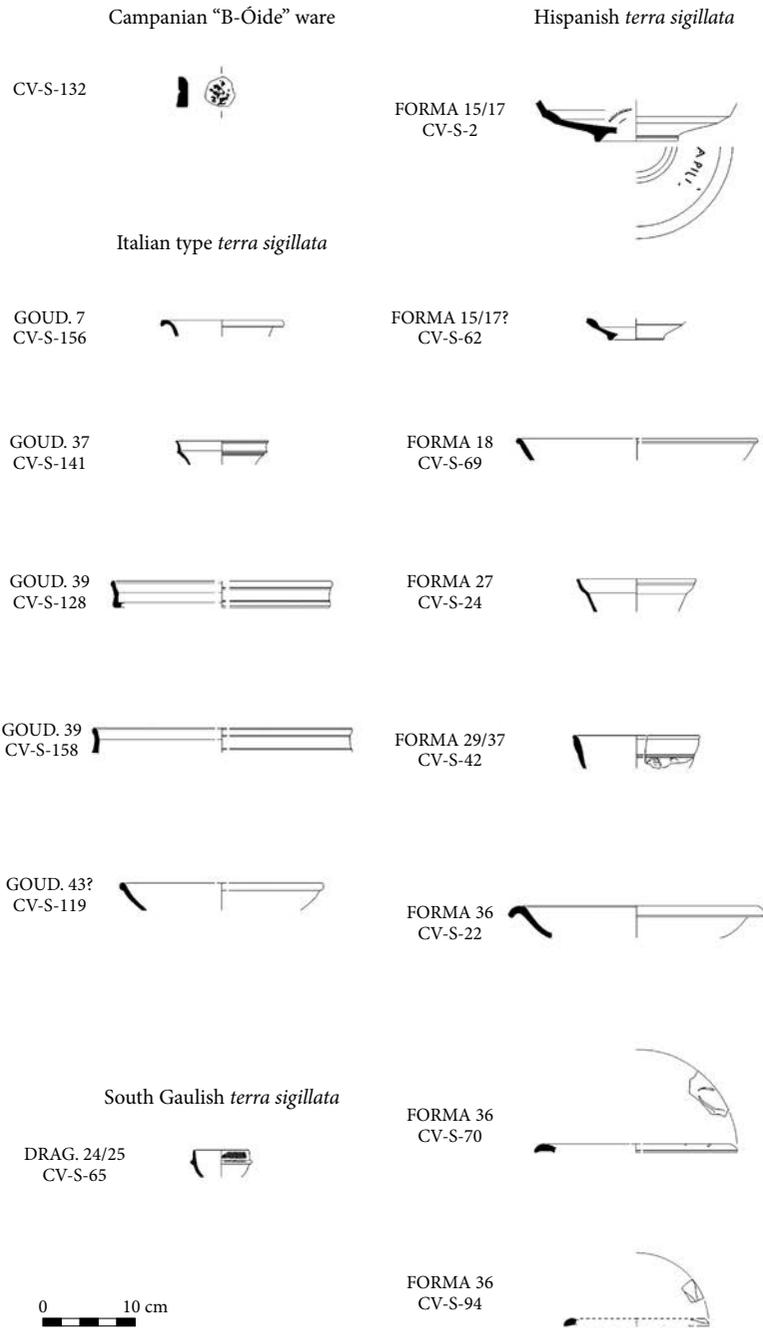


FIG. 7. Roman fine wares types from Castro do Vieito. Drawing Liliana G. Pereira / António J. M. Silva.



CV-H-1
C1168 XIV 2



CV-H-2
D0473 XVII 15



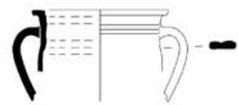
CV-H-3
C1197 XV 4



CV-H-4
D0009 XXVIII 25



CV-H-5
D0012 XXV 21



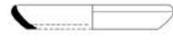
CV-H-6
D0646 XIX 7



CV-H-7
C1178 XIV 6



CV-H-8
C0563 XXVII 22



CV-H-9
D0204 XXIX 20
D0044 XXIX 21



CV-H-10
D0409 XXIV 19



CV-H-11
C0004 XXVIII 15



CV-H-12
C0971 XVIII 16



CV-H-13
D0379 XVIII 15



CV-H-14
D0379 XXV 17



FIG. 8. Hybrid types of pottery from Castro do Vieito. Drawing Liliana G. Pereira / António J. M. Silva.

Despite the fact that foreign ceramics were in the minority, the techniques used by the Romans seem to have influenced the potters of the region. They reproduced certain aspects of Roman production in a limited number of objects from this assemblage ($5.5\% \pm 0.33$): the light colour of the clay due to firing in an oxidising environment, sometimes highlighted by the application of a water slip on the surface; the introduction of certain morphological characteristics of Roman ceramics such as the ring base and even the reproduction of some forms of ordinary Roman earthenware such as cooking dishes and jugs (FIG. 8). As a rule, the artifacts that form this set simultaneously show morphological and/or technological characteristics of a local tradition and others of an exogenous one:³⁸ indigenous vessels forms fired in oxidising environment, Drag. 37 *terra sigillata* form in the traditional black micaceous clay, etc. In this way, they can be said to form a ceramic set of hybrid production, in the literal sense of the term.³⁹ However, small number of such shows that these “hybrid” pots were not preferred by the inhabitants of the settlement, even by a particular segment of the community, “hybrid” vessels, traditional vessels and imported vessels being randomly dispersed in all the excavation area.⁴⁰

Conclusions

There is a certain tendency in scholarship to define native culture by opposition to Roman culture, both being conceived as two necessarily antagonistic, monolithic and unchangeable realities.⁴¹ The native culture had been often defined in the past as a function of a dialectical relationship between the local elite, desiring to embrace the cultural model of the Roman elite, and the rest of the population, whose attitude to the invaders' culture had been considered in significantly different ways depending on the author: rejection pure and simple,⁴² immediate partial adoption,⁴³ or even indirect adoption via its emulation by the local elite.⁴⁴

Generally speaking, cultural elements introduced by an occupying army are rarely assimilated by the indigenous population, and if so, only in a superficial way. In fact, only limited segments of the indigenous society maintained a direct, repeated contact with an equally limited segment of the invading

38. Silva 2012, p. 77.

39. E. J. Alcorta Irastorza (2001, p. 448) observes the same hybridisation phenomenon in action on his study of the ceramic collection from the earliest levels of *Lucus Augusti*.

40. Silva 2012: Fig. 3.19, 3.25, 3.28, 3.29, 3.31, 3.32.

41. Webster 2001, p. 216.

42. Haverfield 1915, p. 79.

43. Collingwood and Myres 1936, p. 222.

44. Millett 1992.

society (i.e. their army), and were thus susceptible to influences that altered their way of conceiving the world and of living in it.⁴⁵ Those segments in contact with each other do not necessarily correspond, or at least not exclusively so, to the elites of the two societies in question. The Roman soldiers, for example, make up what Simon James designates as a non-elite ‘sub-culture’,⁴⁶ in which the indigenous population participated, being recruited for the auxiliary corps from this period onward. When these soldiers returned to their homeland and to civilian life, they must have spread some of the values and knowledge assimilated during their military career to their native society. At the end of their military service, these soldiers became Roman citizens, entirely independent on whether they become part of the local elite or not.

Thus, it is not possible to think of the local culture as a homogeneous whole, having only a single attitude towards the invading culture. Auxiliary corps veterans returning to civilian life, potters involved in the provincial economy, the local elite, members of the estuary community involved in the army’s supply network ... all, in their own ways and with their own particular ways of life, participated in the construction of the provincial culture. For this reason, this case study alone cannot explain the changes in the ways of preparing and consuming food in north-western Iberia during the Roman period as a whole but can merely chart the way these changes occurred in a very particular non elite local “sub-culture”.

On the other hand, when an indigenous population adopted definite elements from the invaders’ culture, this does not signify that they necessarily accorded them the same value, the same significance and the same function that these elements had held in the culture of origin. In reality, many exogenous artifacts had a “second life” in the hands of the indigenous population, being used for other ends than the ones for which they had been created. These artifacts, as we have previously seen, were frequently even reworked for this purpose. The great homogeneity of the elements of material culture relating to these practices, with regard to the set of dwellings within the settlement, equally suggests that the consumption of food continued not to be considered as a clear sign of social distinction in this “sub-culture”.

In practice, the local people tended to relate to these new elements in such a way as to integrate them into their daily practices, but in own particular way of viewing the world. This process consisted of re-understanding the elements coming from outside and of integrating them into systems that

45. Bastide 1971, p. 49; Woolf 1998, p. 15.

46. James 2001, p. 200.

had significance for the indigenous population. What we can observe is thus not the replacement of an indigenous cuisine by one coming from outside, as implied in the anthropological concept of acculturation,⁴⁷ that has often been used to explain cultural change in archaeology,⁴⁸ but rather a process of 'creolization'.⁴⁹ The linguistic concept of 'creolization' seems to be the more appropriate framework provided analysing cultural change not exclusively as a form of negotiation within the context of asymmetric relationships of power.⁵⁰ In this way, cultural dynamic may be considered without assuming from the outset that there is a constant, linear relationship between the different dimensions of this process, in this specific case - ceramic consumption, customs associated with food and their social significance.

Thus, in this case study, the inhabitants of the community under analysis, despite having probably observed the culinary practices of the Roman occupiers first hand, opted to maintain both traditional cooking techniques and traditional cooking utensils, even after having got to know and, from time to time, acquired earthenware associated with the foreign culinary practices. The availability of new culinary technologies and new food products have a general tendency to broaden the "*espace de liberté alimentaire*" for the "eaters".⁵¹ This may or may not, as appears to be true in this case, bring about immediate change with regard to food habits. In the majority of cases, this earthenware was used for purposes different from those with which the vessels were associated in their original cultural context. Thus, acquiring Roman ceramics does not necessarily affirm a allegiance to a specific social group or engender the reproduction of culinary habits associated with these objects within their cultural context of origin.⁵² New artifacts may even be integrated within a cultural set, a long time before the integration of new ideas or new habits associated with them from their original context.⁵³

The profound change in the indigenous population's way of life that is observed from the end of 1st the century AD onwards, can thus only be understood as a gradual process of cultural selection involving several generations, which progressively led to the disappearance of some of the more significant elements of the local culture seen before the Roman military occupation. "Becoming Roman", after all, can sometimes be a slow process.⁵⁴

47. Barnard and Spencer 1996, p. 594.

48. Woolf 1998, p. 14.

49. Webster 2001.

50. Mattingly 2011, p. 203.

51. Poulain 2006, p. 19.

52. Hingley 2005, p. 111.

53. Woolf 1998, p. 14.

54. Woolf 1998, p. 7.

Appendix

TABLE 1: Catalogue of potteries from Castro do Veito mentioned in this paper.

Specimen	Stratigraphic Unit	Square reference	Description	Provenience	Context's chronology
CV-DS-1	C0004	XXXI - 28	indigenous "dolium" with potter's mark	regional production	post-abandonment
CV-DS-2	C0883	XX - 20	indigenous "dolium" with potter's mark	regional production	julio-claudian
CV-DS-3	D0286	XIX - 21	indigenous "dolium" with potter's mark	regional production	tiberian-claudian
CV-DS-4	C0499	XXX - 23	indigenous "dolium" with potter's mark	regional production	tiberian-claudian
CV-DS-5	D0243	XVII - 19	indigenous "dolium" with potter's mark	regional production	claudian, flavian (?)
CV-DS-6	D0164	XIX - 0	indigenous "dolium" with potter's mark	regional production	claudian, flavian (?)
CV-DS-7	C1217	XVII - 13	indigenous "dolium" with potter's mark	regional production	tiberian-claudian
CV-DS-8	unknown context	-	indigenous "dolium" with potter's mark	regional production	-
CV-DS-9	C1190	XVII - 4	indigenous "dolium" with potter's mark	regional production	julio-claudian
CV-DS-10	C0065	XXXVII - 22	indigenous "dolium" with potter's mark	regional production	julio-claudian
CV-DS-11	C1226	VII - 9	indigenous "dolium" with potter's mark	regional production	tiberian-claudian
CV-DS-12	C1122	XIX - 10	indigenous "dolium" with potter's mark	regional production	tiberian-claudian
CV-DS-13	D0485	XX - 8	indigenous "dolium" with potter's mark	regional production	julio-claudian
CV-DS-14	C0603	XXIX - 26	indigenous "dolium" with potter's mark	regional production	tiberian-claudian
CV-DS-15	D0356	XXIX - 28	indigenous "dolium" with potter's mark	regional production	tiberian-claudian
CV-DS-16	unknown context	-	indigenous "dolium" with potter's mark	regional production	-
CV-F-238	C0017	XXIX - 20	cooking dish with potter's stamp	regional production - <i>Lucus Augusti</i>	claudian, flavian (?)
CV-F-247	D0243	XXIII - 21	small pot with potter's mark	regional production	claudian, flavian (?)
CV-F-255	D0164	XX - 2	small pot with potter's mark	regional production	claudian, flavian (?)
CV-F-x001	C0092	XXVIII - 9	small pot with potter's mark	regional production	tiberian-claudian
CV-F-x002	C0499	XXIX - 22	small pot with potter's mark	regional production	tiberian-claudian
CV-T-1	M0438	XXI - 18	indigenous "dolium"	regional production	tiberian-claudian
CV-T-2	C0759	XIV - 19	big pot with "aristado" type rim	regional production	julio-claudian
CV-T-3	C0065	XXXVII - 22	small "S" shaped pot	regional production	julio-claudian
CV-T-4	C0759	XIV - 19	small "S" shaped pot	regional production	julio-claudian
CV-T-5	C0870	XX - 21	big pot with "aristado" type rim	regional production	tiberian-claudian
CV-T-6	D0382	XXIII - 22	pot with "ear-type" handle	regional production	tiberian-claudian
CV-T-7	D0586	XIX - 18	pot with "ear-type" handle	regional production	tiberian-claudian
CV-T-8	C0849	XX - 20	pot with interior handles	regional production	tiberian-claudian
CV-T-9	D0409	XXIV - 19	small pot with "aristado" type rim	regional production	tiberian-claudian
CV-T-10	C0964	XIX - 17	pot with "Vigo" type rim	regional production	julio-claudian

Specimen	Stratigraphic Unit	Square reference	Description	Provenience	Context's chronology
CV-T-11	C1224	XVII - 10	shadow bowl - "Viladonga" type	regional production	tiberian-claudian
CV-A-196	C0443	XXXII - 23	amphora - Haltern 70	Spain - Andalusia	tiberian-claudian
CV-A-716	D0216	XXIX - 21	amphora - Haltern 70	Spain - Andalusia	tiberian-claudian
CV-A-2808	D0230	XXIX - 21	amphora - Haltern 70	Spain - Andalusia	tiberian-claudian
CV-A-3474	C0665	XXIV - 23	amphora - Haltern 70	Spain - Andalusia	tiberian-claudian
CV-A-3476	D0557	XX - 20	amphora - Haltern 70	Spain - Andalusia	tiberian-claudian
CV-A-5098	C0004	XIV - 16	amphora - Haltern 70	Spain-Andalusia	post-abandonment
CV-E-12	unknown context	-	amphora - Dressel 1C	Italy - Latium or Campania	-
CV-E-20	C1071	XVII - 16	amphora - Dressel 1A	Italy - Latium or Campania	tiberian
CV-E-56	C0004	XXXII - 27	amphora - Dressel 1	Italy - Latium or Campania	post-abandonment
CV-E-91	C0721	XXIV - 21	amphora - Dressel 1	Italy - Latium or Campania	tiberian-claudian
CV-E-112	C0112	XXVII - 8	amphora - Dressel 1	Italy - Latium or Campania	julio-claudian
CV-L-570	C0443	XXXII - 23	amphora - Dressel 14A	Portugal - Tage/Sado valley	tiberian-claudian
CV-L-671	D0382	XXIII - 22/23	amphora - Dressel 14A	Portugal - Tage/Sado valley	tiberian-claudian
CV-L-674	D0382	XXIII - 23	amphora - Dressel 14A	Portugal - Tage/Sado valley	tiberian-claudian
CV-L-679	D0535	XIX - 18	amphora - Dressel 14A	Portugal - Tage/Sado valley	tiberian-claudian
CV-L-687	C1071	XVII - 16	amphora - Dressel 14A	Portugal - Tage/Sado valley	tiberian
CV-L-786	unknown context	-	amphora - Dressel 14A	Portugal - Tage/Sado valley	-
CV-L-801	C1035	XVI - 16	amphora - Dressel 14A	Portugal - Tage/Sado valley	tiberian-claudian
CV-L-837	C0443	XXXI - 22	amphora - Dressel 14A	Portugal - Tage/Sado valley	tiberian-claudian
CV-S-2	D0024	XXX - 15	TSH - forma 15/17	Spain - <i>Tritium Magallum</i>	tiberian-claudian, flavian (?)
CV-S-22	C0017	XXIX - 20	TSH - forma 36	Spain - <i>Tritium Magallum</i>	claudian, flavian (?)
CV-S-24	C0011	XXVIII - 22	TSH - forma 27	Spain - <i>Tritium Magallum</i>	tiberian-claudian, flavian (?)
CV-S-42	C0196	XXIX - 21	TSH - forma 29/37	France - La Graufesenque	claudian, flavian (?)
CV-S-62	D0017	XXIX - 10	TSH - forma 15/17?	Spain	claudian, flavian (?)
CV-S-65	D0153	XX - 0	TSSG - Draggendorf 24/25	France - La Graufesenque	julio-claudian, flavian (?)
CV-S-69	UE012	S1 - J	TSH - forma 18	Spain - <i>Tritium Magallum</i>	claudian, flavian (?)
CV-S-70	UE012	S1 - J	TSH - forma 36	Spain - <i>Tritium Magallum</i>	claudian, flavian (?)
CV-S-94	UE012	S1 - J	TSH - forma 36	Spain - <i>Tritium Magallum</i>	claudian, flavian (?)
CV-S-119	C0004	XXII - 20	TSI - Goudinau 43?	Italy	post-abandonment
CV-S-128	C0499	XXIX - 23	TSI - Goudinau 39	Italy	tiberian-claudian
CV-S-131	C0017	XXIX - 20	campanian ware - "B-oidé"	Italy - Campania	claudian, flavian (?)
CV-S-132	C0440	XXXII - 27	campanian ware - "B-oidé"	Italy - Campania	tiberian-claudian
CV-S-141	C0120	XVIII - 4	TSI - Goudinau 37	Italy	tiberian-claudian
CV-S-156	C0092	XXVIII - 8	TSI - Goudinau 7	Italy - Padania or South of Etruria	tiberian-claudian
CV-S-158	D0017	XXIX - 19	TSI - Goudinau 39	Italy	claudian, flavian (?)
CV-H-1	C1168	XIV - 2	pot	regional production	julio-claudian
CV-H-2	D0473	XVII - 15	ovoid pot	regional production	julio-claudian
CV-H-3	C1197	XV - 4	pot with external handles	regional production	tiberian-claudian
CV-H-4	D0009	XXVIII - 25	small amphora - type I	regional production	claudian, flavian (?)
CV-H-5	D0012	XXV - 21	small amphora - type II	regional production	tiberian-claudian
CV-H-6	D0646	XIX - 7	small amphora - type III	regional production	julio-claudian, flavian (?)
CV-H-7	C1178	XIV - 6	small	regional production	julio-claudian
CV-H-8	C0563	XXVII - 22	plate	regional production	julio-claudian, flavian (?)
CV-H-9	D0204/D0044	XXIX - 20/21	cooking dish	regional production - <i>Lucius Augusti</i>	claudian, flavian (?)
CV-H-10	D0409	XXIV - 19	cup	regional production	tiberian-claudian
CV-H-11	C0004	XVIII - 15	"Draggendorf 36" profile dish	regional production	post-abandonment
CV-H-12	C0971	XVIII - 16	"Bracarense" thin walled cup - Mayet 1.3	regional production - <i>Bracara Augusta</i>	julio-claudian
CV-H-13	D0379	XVIII - 15	"botijo"	regional production	julio-claudian, flavian (?)

TSI = *terra sigillata* - italian type, TSSG = *terra sigillata* - south gaulish type, TSH = *terra sigillata* - hispanish type

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DOVECOTES FROM THE ROMAN AND BYZANTINE PERIODS

AN OVERVIEW

Sophia Germanidou

HELLENIC MINISTRY OF CULTURE

Late Roman and Byzantine vernacular architecture, created as a result of productive labor, still represents a field of study which has been overlooked by the majority of scholarly research. Many regard it as unrefined and designed to cater for and meet utilitarian requirements rather than evolving aesthetic values. Nevertheless, the pictorial, textual and physical evidence of structures used to manufacture and process goods may offer an unconventional insight into the material culture and subsistence of medieval peasantry, the populace commonly known as the “silent majority”.¹ However, the relevant material available is of a preliminary and rather tenuous character and therefore, solid conclusions or research focusing on particular aspects of the above, could prove to be an invaluable asset to the future state of scholarship.

Agro-pastoral pursuits formed the basis of people’s livelihoods in rural settlements. Their survival depended on their yields of horticulture and animal husbandry. Aviculture was, in all likelihood, regarded as a vital field of domestic husbandry in late Roman and Byzantine provincial economy. An essential component of that industry was the rearing and breeding of the wild rock pigeon (*Columba livia*), by far the most common species of the *Columbidae* family, inhabiting mainly rocky landscapes and rugged plateaus. Given that pigeons and doves were both domesticated², their names were used without suggesting any considerable physical differences; the term “dove” was merely used to describe a variety of smaller and white birds. Documentary sources from the late Roman and Byzantine period fre-

1. The term was first used to determine the conditions of medieval peasantry by White Jr. 1986(1978), p. 133.
2. Gandert 1973, pp. 119-123. Kakish 2012, n.p.

quently refer to the classification of birds, which were either tamed or wild in nature (*ὄρνιθων ἀγρίων ἢ χειροήθων*). This indicates that the domestication of birds, including pigeons, was common³. One of the most distinct and early accounts alluding to the practice can be quoted from saint Basil of Caesarea's emblematic *Hexaemeron* (377/8), where he argues for the domestication of birds (*χειροήθη δὲ καὶ τιθασσὰ τὰ πολλὰ τῶν ὀρνέων ἐκτρεφόμενα γίνονται...οἰκήσεις καταδεχόμενοι...⁴*).

Among the multiple uses of bird products evidenced in the past, the application of pigeon manure can be regarded as the most beneficial. As the cornerstone of people's diet, the cultivation of cereals and grains was a pre-requisite to ensure the sustenance, prosperity and further evolution of communities. Due to its high nitrogen and phosphorus, mixed pigeon waste served as an excellent fertiliser for deficient soils. Thus pigeon droppings were successfully and efficiently utilised as a rapid and advantageous compost in territories which lacked profitable agricultural yields. Consequently, the practice of pigeon domestication spread particularly throughout many parts of central and east Anatolia and north Africa (Egypt, Syria and the Middle East). A sole reference from Byzantine hagiography asserts the significance of this specific feature of pigeon breeding to the development of local primitive farming, even for small-scale gardening. A passage from version (A) of saint Athanasios (925-1000) *Life* (1000-1025) demonstrates the use of various animal waste as garden fertilisers⁵, collected annually or biennially and mixed with other domestic mammals guano.

The consumption of pigeon meat was not a tradition common to the Christian faith, mainly due to its attributed sanctity, and it therefore remains unclear whether common people partook in its consumption. This should, however, not be ruled out as evidence of archeo-zoological pigeon remains support the theory that they were used as items of nourishment. The findings reference the eating habits of a limited group of people, representing a rather incidental geographical range from Nikopolis and the Balkans to north Africa (Palestine, Carthage)⁶. In any case, the succulent meat of squabs, lean, mild and easily digested, and one of the fastest-reproducing forms of protein available, could not have escaped the interest of the upper class at that time. Textual

3. Lemerle *et al.* 1970, doc. 48, line 33, chrysobull dated 1080. For a commentary, see Papangelos 2011, p. 458. Sinakos 2011, pp. 81-82. Oikonomidès 1992, pp. 99-102, chrysobull dated 1088.
4. Giet ²1968, pp. 444-445, 172B.
5. Noret 1982, A, p. 81, chapter 173.4-7. Commented upon in: Talbot 2002, p. 53.
6. Harvey 1997(1989), pp. 169-170. Kroll 2010, pp. 106, 189-190.

sources furnish little evidence of pigeons being used as a food item, focusing more on the “variety and wealth” of dishes eaten by the landowners, rather than illustrating the daily food of the peasants. It is in such a culinary context that we must interpret a passage in the *Life* (821-822) of saint Philaretos the Merciful (702-792), which refers to pigeon meat combined with other species of domesticated fauna⁷. In the urban environment of Constantinople, pigeon meat seemed to have been considered as a vital form of nourishment, as attested in the *Life* (760-818) of Theophanes the Confessor (823-832)⁸.

Alternative uses of pigeon-related products are scarcely mentioned. The exploitation of animals in medical and pharmaceutical recipes was a customary and conventional practice, although pigeons were not as widely appreciated as other species⁹. Theophanes Chrysobalantes-Nonnos, the 10th century Byzantine physician, refers to a moist mixture that relieved larynx pains, created from elaborated raw materials derived from animals and birds, among them pigeon dung¹⁰.

In contrast to the dearth of information documenting the practical uses of pigeon products, the symbolic role of the dove is stressed in particular in the Scriptures and in the church literature, patristics and hagiography, leading to its exemplification as the archetypal, characteristic Christian symbol. The Old Testament contains a wealth of quotations demonstrating the chaste ethos of the dove. In the book of *Genesis* (8, 6-12) Noah sent out a dove after the great flood in order to determine how far the floodwaters had receded. It came back carrying an olive leaf in its beak, telling Noah that somewhere there was land, thus becoming a sign of hope. A *Psalms* passage links the dove with virtuous moral (74: 19) while it was praised as an allegory of tenderness and endearment in the *Song of Songs* (2:14, 4:1, 5:2, 6:9)¹¹. Evangelic tradition further epitomises its purifying character; Jesus’ s parents sacrificed doves on his behalf after his circumcision (*Luke* 2:24 prior referenced in *Leviticus* 1:14, 5:7, 12:8 and, also in *John* 2:13-22, and *Mark* 11:15-19, as a selling item destined for sacrifice) while it gained its most celebrated symbolism as the sign of the Holy Spirit descending upon Jesus at his baptism (*Matthew* 3:16, *Luke* 3:22).

7. Rydén 2002, p. 84, lines 411-415. Commented upon in: Leontsini 2011, p. 313.

8. *BHG* 17871, p. 9, lines 16-18.

9. Chroni 2010, pp. 154, 161.

10. Sonderkamp 1987, pp. 278 (258, 3), 347 (258, 2).

11. σὺ περιστερὰ μου, ἐν σκέπη τῆς πέτρας, ἐχόμενα τοῦ προτειχίσματος· δεῖξόν μοι τὴν ὄψιν σου, καὶ ἀκούτισόν με τὴν φωνήν σου, ὅτι ἡ φωνή σου ἠδεῖα, καὶ ἡ ὄψις σου ὠραία.... Ο my dove, in the clefts of the rock, in the crannies of the cliff, let me see your face, let me hear your voice, for your voice is sweet, and your face is lovely... (*Songs of Songs* 2:14).

Church Fathers accentuated the doctrinal symbolism of the dove¹², which became a familiar metaphor in the ecstatic visions of holy figures, recorded in their *Lives*' narrations, or integrated as a leading feature of transcendental nature in miraculous episodes¹³. Of particular interest is the quotation from the *Hexaemeron* (*Six days of Creation*), which comments on the physical characteristics of birds species, alluding to their lustful substance (...λάγνιοι, ἐπὶ παντὸς καιροῦ τὸ συνουσιαστικὸν ἔχουσαι...) ¹⁴. In secular literature the perception of the libidinous dove is equally represented in *Oneirocritica* (*Dreambooks*), signifying that it this was the prevailing value of their physical essence in collective psychology¹⁵.

Pigeons' nesting and breeding in controlled conditions of captivity¹⁶ did not require special treatments or capital investment. Flocks could be accommodated in modest structures. The location of their dwellings was chosen far from large trees that could house birds of prey and shielded from prevailing winds. Their construction obeyed a few common safety features: limited access doors and smooth walls with a protruding horizontal band of stone to prohibit the entry of climbing predators. Dovecotes were diverse in their materials and structure, shape and dimensions, depending on the availability of local materials. They were often situated within the confines of the village, at an outlying farmstead, where they either occupied part of some outbuilding, or stood alone, frequently adjacent to a vineyard or a garden –convenient locations for the direct use of fertilizer created by the birds.

Romans provided detailed accounts of the methods and practices of pigeon breeding employed in Italy during the first Christian centuries¹⁷, whereas Byzantine literature on agro-pastoral activities abided by the traditions inherited from the fruitful Late Roman treatises. Varro, who composed his *Res rusticae* in approximately 30 B.C., furnished important information describing the *columbarium* employing the Greek term *περιστερῶν* or *περιστεροτροφεῖον* as a large building with a vaulted roof, a single door, small and narrow windows, and smoothly plastered walls. Round nests, set side by side

12. See the numerous references of the dove in Gregory of Nyssa, In Canticum canticorum (homiliae 15). Langerbeck 1960.
13. i.e. The miracle of saint Thecla, who healed a child injured by a crane while feeding birds and pigeons. Dagron 1978, pp. 350-352, par. 20-25. Commented upon in: Leontsini 2011, p. 312.
14. Giet ²1968, pp. 446-447, 172C.
15. Oberhelman 2008, pp. 127, 161, 199.
16. On the necessity of capturing the birds (*ἀποκλείειν τὰ ὄρνεα*) see Leontsini 2011, p. 316, subnote 124. Theophanes Nonnos speaks of the pigeons that live in the fields (*περιστεραὶ αἱ κατ' ἀγρὸν διαιτώμεναι*). Sonderkamp 1987, p. 347 (258, 2).
17. Kron 2008, pp. 176-178, 192, 194, 204.

in rows running up to the vaulted roof, were carved for each pair of pigeons. Each nest had an opening just large enough to allow the entrance and the exit of a single pigeon. A board was affixed before each row, serving as an entrance to the nests, providing a place for the pigeons to walk around on (3.7). Columella, in his *De re rustica*, dating back on the 1st century A.D (8.11-1-7) and Palladius, who compiled his *De Re Rustica* in the 4th century (1.24), add little to Varro's narrative, with the exception of Columella's references to pottery nests, the so-called *fictilia columbaria*, and a recommendation to construct the pigeon house as a tower-like building.

Geoponika is the sole treatise which encompasses and incorporates excerpts from Roman literature, adapted, to a certain extent, to the culture of mid-Byzantine times. A whole chapter is devoted to pigeons and five authors contribute to the diffusion of expertise concerning this rapidly expanding domestic enterprise which was, as stated above, both profitable and capable of bringing in immediate income. Certain key-points evaluate specific issues, such as the necessity of their manure, or provide guidelines for the flocks' longevity and security, i.e. protection from birds of prey by plastering and smearing walls and facades with plant mixtures. The dovecote is repeatedly described as an elevated building, "fortified", probably two-storeyed (*οἶκος ἄχυρωμένος, εἰς τον πύργον*), which ought to be located a good distance so as not to be frequently disturbed by humans¹⁸.

Pictorial evidence illustrating dovecotes remain, as expected, limited, not only in number but also when it comes to the meticulous rendering of structural details. Nevertheless it was Roman art which provided the most renowned depiction of a pigeon house as a specimen of vernacular architecture, stressing its avicultural purpose. Located at the lowest right corner of the magnificent Palestrina floor mosaic, this depiction of a dovecote is usually overlooked or disregarded – owing to the remarkable complexity of a colorful and lively ensemble, diverse in landscape and activity details, rich in contextual and allegorical implications. The mosaic shows the Nile snaking from Ethiopia to the Mediterranean, echoing the Roman fascination with Egyptian exoticism and the spread of Egyptian cults in Italy. Dating from circa 100 B.C., it originally covered the apse in the Sanctuary of Fortuna Primigenia, the most celebrated and magnificent example of "Nilotic landscapes" genre¹⁹.

18. Beckh 1994(1895), p. 404-410, chapter 14. For an English translation: Dalby 2010.

19. La Malfa 2003, pp. 267-272, where past bibliography.



FIG. 1. Dovecote, Palestrina mosaic, circa 100 B.C.

The dovecote (FIG. 1) is depicted as a circular structure, without columnal support, surmounted by a conical dome in which nests were placed in rows leading to the exterior. Branches have been inserted around the top of the tower and beneath the dome to provide a place for the pigeons to perch before entering the nests. The artist emphasizes the practical purpose of the building-in-question by portraying pigeons around it. Direct proximity to water was considered uncommon or, rather, infrequent for pigeon breeding installations but is probably due to the artist's vivid imagination and the desire to highlight the role of the Nile as the central feature of the mosaic.

The sole representation of a dovecote in Byzantine art is portrayed in the Pseudo-Oppian's *Cynegetics* (*On Hunting*) manuscript (cod. Marc. Gr. Z 139, folio 13r.), a sumptuous example of Constantinopolitan workshop production, dating from the mid 11th century²⁰. Pseudo-Oppian refers to doves in a few instances dur-

20. Spatharakis 1980, pp. 22-35. Spatharakis 2004. The illustrated zoological treatise of *Ornithiaca* (*Ixeutica*) compiled by Dionysios "the poet", a contemporary of Dioscorides, another manuscript of antique origin that abounds in mythological references, is also worth mentioning. The work contains pictures of popular birds, among others, the *Columbriformes*, which are represented by four images corresponding to the known wild

ing his poetic inspiration, evoking, more or less, mythological implications. The miniature illustrating the dove-cote is not related to the accompanying text, rather it attributes verse 73 from Book A where doves are appointed with the Homeric term *τρήρωνας*, an epithet that defined the timid ones.



FIG. 2. Dovecote, Cynegetics manuscript (cod. Marc. Gr. Z 139, folio 13r.), mid-11th century.

The *columbarium* miniature dominates the lower band of the picture (FIG. 2). The tower-like construction consists of a high column supporting a two-storey dove-cote and a conical roof. The building is designed with careful and meticulous attention in the details, such as the elaborately decorated grid. The colours used are unconventional, a fact which deprives us of an understanding of the actual materials used for its construction – presumably wood would have been used for the main dwelling and rubble masonry for the column. The small, black circular apertures open behind the dark blue-grey facade, providing the entrance to the interior of the structure²¹.

and domesticated species. There are numerous examples of the images of the doves in Late Roman and Byzantine art; this, however, is not the subject-matter of the present study. Kádár 1978, pp. 77-90, especially pp. 86, 115-116. Ševčenko 2002, p. 84.

21. Spatharakis 2004, pp. 29, 56, Fig. 22. Kroll 2010, pl. 11. We should add the example of a “bird-house” in the *Sacra Parallela* manuscript. Weitzmann 1979, pp. 209-220, fig. 558, pl. CXXIII, fol. 200r., swallows building a nest inspired by a passage of saint Basil’s *Hexaemeron* (FIG. 3).



FIG. 3. Bird nest, Sacra Parallela manuscript, 9th century.

Two significant features in the depiction of the landscape and of the structure itself provide allusions to the Roman literal imagery: the threatening approach of a fox at the base of the dovecote as well as the tower-like building. On the other hand, the outline of the dovecote is very remote than its typical Roman counterpart as depicted in the Palestrina mosaic. The differentiation in form and materials can easily be understood by taking into account the climatic and geophysical factors of the indigenous landscape, which, to a great extent, play an influential role in the shape of vernacular edifices. However, we should keep in mind that this high quality manuscript is not an original production of the 11th century but rather a copy of an ancient, Greco-Roman prototype.

Evidence of excavated physical remains of dovecotes is scarce. Excavations in Israel have unearthed interesting types of dovecotes, dating from Roman times. These tower-like structures had a circular ground plan. Their exterior was built of unhewn stones with mud and layers of plasters and their interior was divided by traversing walls holding niches and helping support the roof²² (FIG. 4, 5). A fine example of correlating documentary sources, i.e. Greco-Roman papyri, which provide valuable information on the taxation of pigeon houses and pigeon dung²³, with archaeological finds can be seen in the

22. Oren 1968, pp. 56-61. Tepper 1986, pp. 170-196. Safrai 1994, pp. 99-100. Zissu 1995, pp. 56-68. Kloner and Zissu 2013, pp. 52-53. Negev and Gibson 2005, pp. 124-125. An early Roman specimen of a tower-like dovecote with a circular ground plan was excavated at Apollonia, in Cyrenaica (present-day Libya). Chamoux 1992, pp. 623-642.
23. HGV P. Flor 3 361 (85/86 AD), HGV P Oxy 55 3804 (AD 566). www.papyri.info/docs/apis.



FIG. 4. Columbarium, Masada, Roman period.



FIG. 5. Columbarium, Horvat Eleq, Roman period.

Egyptian village of Karanis. Several *columbaria* embedded within the sun-dried brick walls of massive square towers were estimated to have been in operation from the 1st century BC up to the 5th century at the latest²⁴. The particularity of this structure lays in the form selected for the nesting places: lined pots facing the inside of the tower, set horizontally in the masonry with the mouth serving as the entrance and the body of the pot as the pigeon housing, reminiscent of Varro precepts, the *fictilia columbaria* (FIG. 6). Beneath the rows of pots were either two or three rows of small rectangular niches, a regular feature of all large dovecotes, the purpose of which remains unclear. The most reasonable assumption seems to be that they were used for the squabs to nest in, before they reach breeding age. Based on their size and number (at least 1500), it is assumed that they were commercial establishments or adjuncts to a large estate or farm holding.



FIG. 6. Columbarium, Karanis, Roman period.

24. Husselman 1953, pp. 81-91. Wilfong 2012, pp. 234-236. On the dovecotes in peasant villages in late antique Egypt, see Bagnall 1993, p. 113.

The most emblematic dovecotes, which were also the most suitable to their surrounding landscape, were those hewn on sides of caves in steep and rocky cliffs. The softness of the limestone in the foothills of the Near East and Anatolia created ideal conditions that facilitated and popularised the nesting of pigeons in environments otherwise deprived of agricultural opportunities. Due to their limited cost, carved dovecotes developed as a common feature and constituted part of the early and middle-Byzantine settlements in the Cappadocian topography²⁵. Despite their great number of preserved examples, unparalleled in any other domain of vernacular architecture, they have not – yet – been credited as a distinct field of study but are regarded as exceptions²⁶. That may come as a consequence of the fundamental problem presented by the archaeological context of Cappadocian dovecotes; the actual date of the primary Byzantine use of the dovecotes, since the great majority of them were transformed and re-used after the Ottoman conquest. Owing to the vivid traditional association of pigeons with the Prophet Muhammad, pigeons perched and fed on the Prophet's shoulder as he preached, Islam respected and favored them. The impression of their religious and cultural significance is further strengthened by the diverse and abundant motives that decorated or were engraved or painted on the facades of Islamic pigeon-houses, including plant and animal figures, geometrical patterns and large ornamented inscriptions (FIG. 7).

Furthermore, pigeon-breeding practices and structures did not undergo alternative technical improvements nor did they become subjects to technological changes throughout the centuries; it was merely the discovery of chemical components that replaced and gradually phased out their operation around the mid-20th century. As a direct consequence it is extremely difficult to date hewn dovecotes to the Byzantine period unless based on external characteristics, such as the preservation of painted or engraved Christian symbols (FIG. 8).

25. The nesting of pigeons in cavities evoke Old Testament allusions, i.e. *Abandon your towns and dwell among the rocks, you who live in Moab. Be like a dove that makes its nest at the mouth of a cave* (Jeremiah 48:28). On the economy, society, agriculture and topography of Cappadocia during this period with few references or images related to dovecotes: Budde 1958, figs. 24, 25. Rodley 1958, pp. 6-9, 100, Fig. 148. Bertucci *et al.* 1995. Bixio *et al.* 2005. Kalas 2007, p. 40. Cooper and Decker 2012, pp. 64-66, Fig. 65.
26. Demenge 1995, pp. 42-51. Ousterhout 1997, pp. 301-306. Ousterhout 2005, pp. 153-155. Decker 2007, pp. 258-261.



FIG. 7. Ottoman dovecote, Göreme.



FIG. 8. Christian dovecote with painted crosses, probably of initial Byzantine use, Cappadocia.

Cappadocian dovecotes display the common features with their Roman ancestors. They were carved into limestone rocks, on highly remote and steep locations, effectively supporting the concept of the inaccessible shelter. The facades were flat, customarily facing the eastern or southern parts of valleys so as to shelter the birds from the cold and to enable the interior to receive sunlight. Nesting spaces were formed in small, closely and densely arranged groups, following a checkerboard pattern (FIG. 9). The entrance openings were roughly square, rectangular or circular in shape and carved into the external walls, protected occasionally by a rocky canopy.



FIG. 9. Dovecote, probably of initial Byzantine use, Göreme.

For the convenience of the pigeons and to encourage them to lay their eggs, alcoves were burrowed into the inner walls of the shelters and wooden perches were placed inside the dovecotes (FIG. 10). The inside of the niches was slightly slanted towards the top, allowing dung to fall directly into a central collection pit at the foot of the tower, where it dried. The inner checkerboard arrangement of pigeonholes made efficient use of space, maximizing the number of holes and keeping the weight and the amount of building material used in the tower to a minimum. The interior walls were further strengthened by the multiple uses of interior arches, barrel-vaulted ceilings, circular staircases and both interior and exterior buttresses.

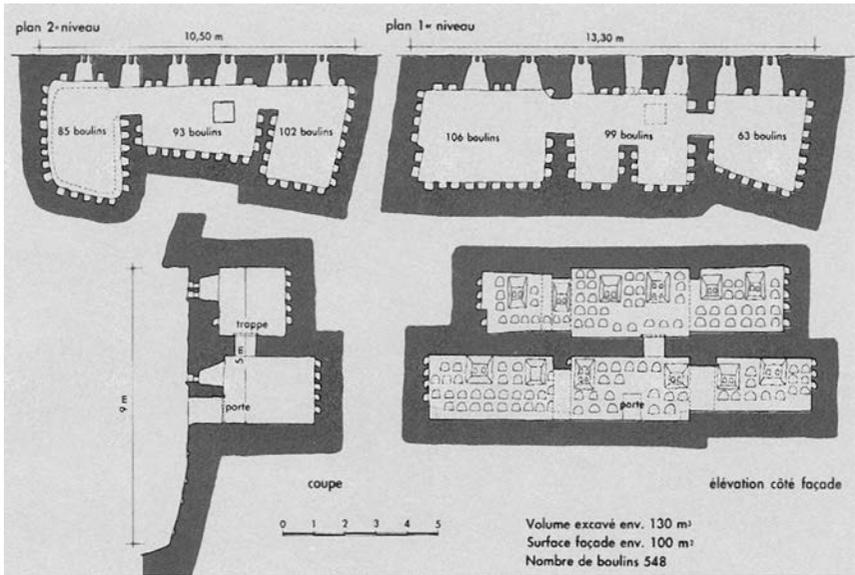


FIG. 10. Ground plan of the great Byzantine dovecote, Kizil çukur.



FIG. 11. Interior view of Byzantine dovecote, Kizil çukur.

Dovecotes of the variety described above constitute delicate examples of stone carving in the Cappadocian landscape, particularly concentrated in the valleys of Göreme and Ürgüp. One of the most magnificent Byzantine pigeon house complexes is situated at Kızıl çukur, in the Çavusin valley and a short distance from the church of Joachim and Anna, dating from the second half of the 11th century. The interior niches number more than 500 (FIG. 11) and are decorated with crosses and the tree of life²⁷. Dovecotes close to churches or even inside monasteries were a regular occurrence, attesting to the necessity of creating agricultural products. Of special note, due to its well-documented archaeological context, are the dovecotes at the rock-caved settlement of Çanlı Kilise, dating primarily from the 10th and 11th centuries. The pigeonholes were located irregularly on an upper level of the rock-cut residencies, hidden by the façade (which has now collapsed) and not directly accessed by the main level; meaning that at first sight, they were invisible and out of reach²⁸.



FIG. 12. A typical wine cultivated plateau in the rocky Cappadocian landscape.

Concluding this short overview of the archaeology, art and material culture of pigeon breeding and the dovecotes structures, a few preliminary remarks may be made. In principal, late Roman and Byzantine dovecotes shared similarities and characteristics inspired by the Roman tradition, mirrored in literature and in art. On structural grounds, however, dovecotes were differentiated

27. Demenge 1995, p. 51.

28. Ousterhout 1997, p. 303, Fig. 4. Ousterhout 2005, p. 154. Cooper and Decker 2012, p. 124.

depending on climatic and environmental conditions. They could, thus, be free-standing square or circular buildings, or hollowed into a rocky surface. In any event the traditional tower-like outline has survived throughout the centuries as the most pertinent solution effectively integrating function and form.

On economic grounds the valuable pigeon excrements formed a striking component of small-scale agrarian communities, since it provided sufficient fertiliser to transform desolated soils into arable land (FIG. 12). The large number of dovecotes attested in the Cappadocia region, which still remain unrecorded, confirm their intensive and systematic use, as elements of the livelihood and sustenance of thousands of people. From this viewpoint it is not unreasonable to assume that Cappadocia not only constituted a center of monasticism but was also a vivid region of communities, capable of managing and marketing high yielding territories²⁹. The capability of mass agricultural production is likely to have resulted in increased profits, adding a supplementary sphere of economic activity to the average farmstead. This can lead to a chain of other assumptions relating and enlightening the economic and social status of Byzantine Cappadocia, disengaging it from its prevailing and over-accentuated religious character³⁰.

Finally, the significance of perspectives that may be drawn from the humble material remains of structures, restricted to utilitarian purposes such as the dovecotes, leaves open the question of vernacular architecture and art. Still outcast by late Roman and Byzantine archaeology, it needs comprehensive surveys which could highlight and reveal important information about domestic topography, town-planning and settlement patterns. Forming integral components and standard hallmarks of peasant endeavor to overcome hardship, dovecotes still remain as an enduring tribute to the ingenuity of unknown artisans and to the persistence of aspiring farmers.

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29. Kalas 2004, pp. 101-119.

30. Rodley 1958, pp. 8-9.

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BODY PIERCING DURING THE LATE IRON AGE

THE CASE OF ROMAN AMPHORAE FROM TOULOUSE (FRANCE)

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INRAP

‘We believe the practice of deliberately holing vessels was probably widespread and we would welcome reports from colleagues of other examples’¹

Recent publications have demonstrated the considerable and varied evidence relating to the modification, recycling and reuse of amphorae and ceramics on Hellenistic and Roman sites from Mediterranean Europe and north Africa.² In this article, we will examine one specific form of modification involving the drilling of small holes (piercing) and the cutting of larger apertures (holing) on amphorae during the late Iron Age. This will be facilitated by examining an assemblage of more than 100 pierced and holed amphorae uncovered during a recent excavation on the industrial and trading site of *Tolosa* (modern Toulouse) in south-west France (TABLE 1).³ This article starts by summarizing the explanations suggested in the literature to explain

1. Fulford and Timby 2001, p. 296.
2. Peña 2007; Lawall and Lund 2011.
3. The authors would like to thank Peter Jud, Alexandre Lemaire, Lionel Orenge and Guillaume Verrier (all Archeodunum) for help and information during the course of the excavation and the study of the amphorae. The plan of the excavation was provided by Virginie Jolie (Archeodunum) while the computerization of the amphora drawings was done by Emmanuelle Meunier (Archeodunum). The photographs are by the authors unless otherwise stated. Finally, we are grateful for the comments of the two academic referees.

these two practices. The main body of the article outlines the evidence for the piercing and holing of amphorae, and examines the chronological, spatial and contextual evidence for these practices on the site. It will be shown that the piercing and holing of amphorae at Toulouse can contribute towards our understanding of the nature and function of this settlement, and shed light on the origins of some the people who lived and worked here. Finally, this article will also briefly collect examples of pierced and holed amphorae from late Iron Age sites in France and examples from the Roman period from throughout the Empire (TABLE 2).

Why pierce and hole amphorae?

Various explanations have been suggested for the piercing and holing of amphorae and ceramics in the literature.⁴ Concerning amphorae, most researchers have linked these practices with the opening and removal of the vessels original contents.⁵ For wine and olive oil amphorae small holes typically *c.*0.5-2 cm in diameter were drilled on the amphora body or through the tip of the base. Experiments have demonstrated that by drilling a second hole or by simply dislodging the amphora stopper the contents will be ejected in a steady stream.⁶ For fruit, salted fish, or garum amphorae larger circular or rectangular apertures (*c.*10-20 cm in diameter) were cut on the body. A second group of explanations links the piercing and holing of amphorae with various types of reuse (TABLE 2). Amphorae with large circular holes on their bodies could have served as urinals and for the collection of urine for fulling and dyeing, while they could also have been used to store foodstuffs.⁷ Amphorae that were used to draw water from wells and cisterns were sometimes holed on the neck or shoulder, to aid their immersion.⁸ Amphorae pierced with small holes around their lower body or base, could have served as strainers, funnels or as lamp covers.⁹ Amphora bases, handles and discs were sometimes pierced so that they could serve as loom or net weights.¹⁰

Complete and partially-complete amphorae reused in drainage structures were sometimes holed or pierced to aid this function.¹¹ A similar use

4. For amphorae cf. Peña 2007, pp. 66-69, 138-148, ff.; while Fulford and Timby 2001 have briefly discussed the piercing of Iron Age and Roman ceramics at Silchester, England.
5. Peña 2007, pp. 66-69; Bonifay 2004a, pp. 467-470, Bonifay 2004b, pp. 225-226.
6. Adan-Bayewitz 1986, pp. 92-95.
7. Peña 2007, pp. 138-140, Fig. 6.4; Callender 1965, p. 36.
8. Peña 2007, pp. 36-38, Fig. 6.3.
9. Peña 2007, pp. 144-145, 148; Tomber 2006b, pp. 299-300, Fig. 4.7; Tomber 2011.
10. Handberg 2011, p. 62; Peña 2007, p. 159.
11. Peña 2007, pp. 189-191, Fig. 6.23.

involved the holing of amphorae so that they could serve as pipeline connectors or settling basins.¹² In Italy and Egypt, amphorae were reused as plant pots (*ollae perforate*) to hold shrubs and trees, and the bases or lower bodies of these vessels were sometimes pierced to permit drainage and aeration.¹³ Some Roman wine amphorae, including vessels manufactured in Egypt, Beirut and Gaul, were pierced on the neck to allow the gases produced during fermentation to escape.¹⁴

Some of the explanations suggested for the piercing of ceramics could also be applicable to amphorae. It has been suggested that pierced ceramic vessels could have functioned as timing devices, to drain and filter water through a cloth, or used in the production of *garum* which was decanted, once ready, via piercing the vessel wall.¹⁵ At the late Iron Age farm of Villeneuve-Saint-Germain 'Les Étommelles' in northern France, several ceramics vessels were pierced through their bases and sides, and it has been suggested that they could have been used as funnels, water filters or as pierced lids.¹⁶ Other suggested uses include the filtering of milk products or the preparation of dyes and paints.¹⁷ One explanation that can be discounted is the repairing of amphorae using the hole-and-clamp technique, which was often used to repair ceramic vessels.¹⁸

Finally, amphorae could have been pierced or holed for various funerary, cult and ritual purposes. There is evidence for the deliberate mutilation, including the holing and piercing of ceramics from some late Iron Age and Roman sanctuaries and settlements.¹⁹ It has also been suggested that ceramics and amphora-parts were pierced so that they could be suspended or fixed to wooden structures and displayed in cult sites.²⁰ Some ceramics and amphorae recovered from funerary contexts were also pierced or holed so that they could serve as libation conduits for offerings of wine or

12. For example at Corinth, Greece; Slane 2011, pp. 101-102.
13. Kenawi *et al.* 2012; Macaulay-Lewis 2006.
14. Dixneuf 2011, p. 197; Reynolds 2005; Bertin 2010, p. 262, Fig. 12; SFECAG 2010, p. 264 discussion.
15. Fulford and Timby 2001.
16. Hénon *et al.* 2012, pp. 82-86, Fig. 57.
17. Bonaventure 2011, pp. 247-248.
18. Guldager-Bilde and Handberg 2012; Rotroff 2011; Slane 2011. Although Meyza and Bagińska (2013, p. 147, Fig. 9, p. 149) suggest that an Egyptian amphora from Nea Paphos, Cyprus, with two small holes on its upper neck was mended in antiquity the holes are more likely to have been cut to allow fermentation gasses to escape (cf. note 14). More convincing is a Corinthian B amphora from *Euesperides*, Libya, with five small holes including several still plugged with lead (Göransson 2007, pp. 113-114).
19. Nieloud-Muller 2011, p. 376; Trescarte 2007; Fulford and Timby 2001.
20. Trescarte 2007, p. 371; Poux 2004, pp. 287, 479-480.

other drinks.²¹ While many pierced north African amphorae were recovered from the Roman cemetery at Pupput, Tunisia, it is suggested that these were reused vessels and that the holes were created when the vessels were opened.²² It is possible that vessels which had been opened via piercing and holing were deliberately selected for reuse in the Pupput cemetery because they could be used (without further modification) as libation conduits or as sarcophagi. Finally, larger openings were often cut on amphorae which served as sarcophagi or held cremated remains.²³

Toulouse ‘caserne Niel’

The ‘Saint-Roch’ quarter south of the modern city centre provides evidence for a major late Iron Age agglomeration of about 40 ha that was heavily involved in industrial production and trade with the Mediterranean.²⁴ The site was located on a major trade route linking the Mediterranean with the Atlantic Ocean and with nearby iron and precious metal mining areas in the Pyrénées, and the southern Massif central. The redevelopment of the Niel military barracks (‘caserne Niel’) has permitted a large part of this site to be investigated using modern archaeological techniques. The excavation from 2009 until 2011 uncovered an area of c.2.6 ha and found dense occupation.²⁵ There were c.70 wells, evidence for the casting and working of bronze (zones 4), gold (zone 2), iron (zone 6) and lead (zone 4), animal butchery (zone 8) and domestic occupation in the western part of the excavation (zones 7, 11, 12 and 13) (FIG. 1).²⁶ The ceramics and small finds are consistent with a second century BC date and include La Tène II and Nauheim brooches, Italian Campanian A and rare Campanian B pottery. The excavation uncovered c.98 tons of amphorae and c.880,000 sherds of which the majority (c.99% by weight and number) are from the Italian Greco-Italic and Dressel 1A while there were occasional vessels from Tripolitania, Tunisia, Brindisi, Adriatic Italy, southern Spain, and Rhodes.²⁷ The earliest Greco-Italic amphorae were arriving during La Tène C2 (200–150 BC) while the absence of the Dressel 1B and the rarity of transitional Dressel 1A/Bs show that the site was abandoned by the end of the second century BC.

21. Peña 2007, pp. 145–148; Monsieur 2007; Simon *et al.* 2011.

22. Ben-Abed and Griesheimer 2004; Bonifay 2004a, 2004b, 2004c.

23. Peña 2007, pp. 165–170.

24. Arramond *et al.* 2007; Jud *et al.* 2012, 2013; Benquet *et al.* 2013.

25. The excavation was by Archeodunum and the director was Peter Jud.

26. Jud *et al.* 2012, 2013.

27. For a brief summary of the whole assemblage cf. Loughton and Alberghi 2012, while the Ancient Tripolitanian amphorae are discussed in detail by Loughton and Alberghi 2015.



FIG. 1. Plan of the 'caserne Niel' excavation.

Piercing and holing of amphorae at the ‘caserne Niel’

109 amphorae have been pierced or holed (TABLE 1). Unsurprisingly, the majority of pierced and holed amphorae were of Republican vessels (105 ex., 96%) while two Adriatic and two Ancient Tripolitanian amphorae complete the corpus. Most examples have been pierced with small holes with diameters ranging from 1 cm to 3 cm. Many of the holes are small and neat, with smooth margins, and appear to have been created with the use of a metal drill (FIG. 16). In contrast, some openings are irregular and slightly larger, and appear to have been cut-out with a chisel or gouge (FIG. 17-18). For three examples the holes have not completely pierced the wall and they probably represent failed or unfinished attempts at piercing these vessels.²⁸ Only five vessels have been holed by the cutting of larger circular or rectangular openings with diameters ranging from 5 cm to 18 cm.²⁹ Most of the holes are found on the lower body just above the top of the base (42 ex., 39%) while the next most common location is through the centre of the base (26 ex., 24%) (FIG. 2). Most of the remaining examples are found on the middle to upper body and this includes all the holed vessels. A small number of vessels are pierced on the shoulder/base of the neck, while two examples are pierced on the upper neck. Finally, for five examples the location of the holes could not be assigned to a specific location other than somewhere on the body.

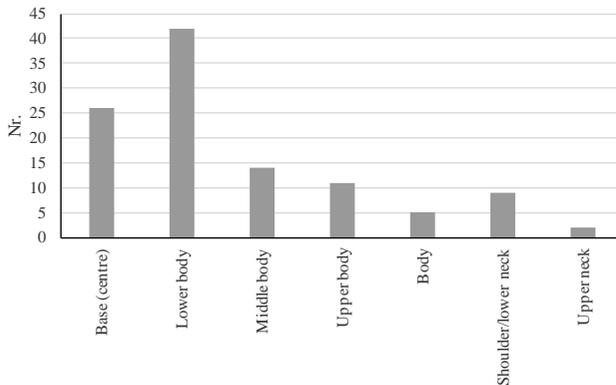


FIG. 2. Placement (nr.).

28. Pit FS3667 (Fig. 14 no. 4), US8093 (amphora layer/pavement), well PT12004.

29. The difference between piercing and holing is somewhat arbitrary. It could be argued that some of the holed examples with smaller openings, notably those from the wells PT4064 and PT6034 could be seen as pierced (TABLE 1). Perhaps holing should be reserved for amphorae with openings which allowed a hand, a small vessel or a scoop to remove a quantity of the vessels' contents.



FIG. 3. Distribution of pierced and holed amphorae at the 'caserne Niel'.

Spatial distribution

Pierced and holed amphorae were found throughout the excavation and were recovered from a variety of contexts and structures (FIG. 3). Most examples (79 ex., 72%) were recovered from closed contexts including 42 (39%) from wells and 26 (24%) from pits (FIG. 4). Many of the wells once they no longer served as sources of water were deliberately filled in with large dumps of Republican amphorae including many intact or partially-complete vessels. Only 11 examples (10%) were recovered from ditches although this reflects the small number of such structures from the excavation. Twenty-six examples (24%) came from open contexts notably the large dump of intact and partially-complete vessels in zone 4. This structure could represent a drainage type feature or vessels stored for reuse. Some pierced amphora-sherds were also recovered from the amphora layers and pavements which are found in many parts of the excavation.

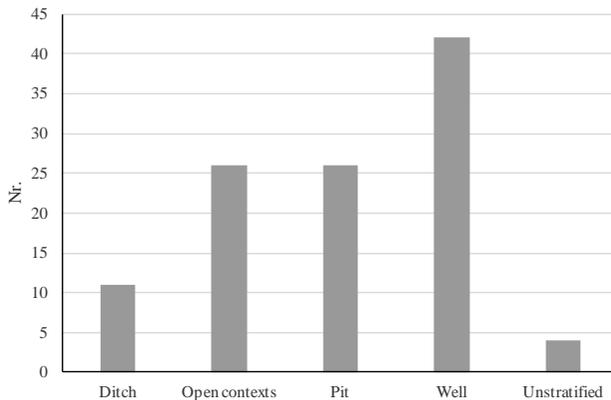


FIG. 4. Types of structures with pierced or holed amphorae.

The largest group of pierced and holed amphorae came from zone 4 with 42 examples (39%) (FIG. 3, FIG. 5). The next largest assemblage is from zone 6 (18 ex., 17%), followed by zones 2 and 12 both with 14 examples each (13%). These four zones account for the majority of examples (88 ex., 81%). There are no examples from zones 5 and 13, and only a couple from zone 8. While these zones all contain relatively large assemblages of amphorae there are relatively few pits and wells, which might partly explain their rarity.

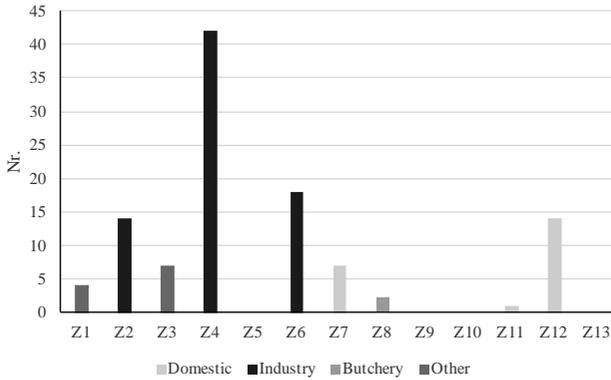


FIG. 5. Number of pierced and holed amphorae for the excavation zones.

The number of amphora sherds for one pierced or holed amphorae for the different excavation zones can provide a crude technique to compare the relative frequency of this practice across the excavation (FIG. 6). The lowest ratio is for zone 4 with one example for every 2,920 amphora sherds, followed by zone 2 (5,739) and zone 6 (6,467). In contrast, pierced and holed amphorae from zone 8 are rare with one example for every 56,584 sherds.

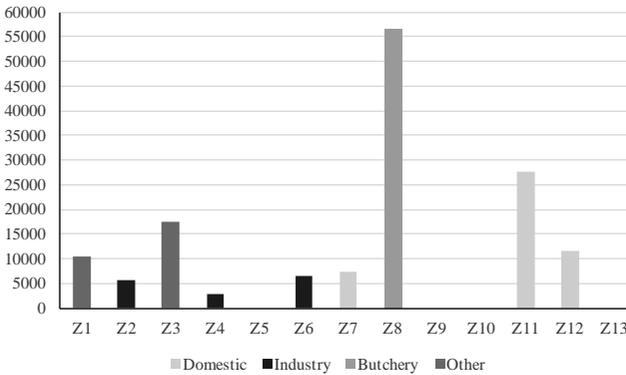


FIG. 6. Relative frequency of pierced and holed amphorae (expressed as the number of amphora sherds for one example) for the different excavation zones.

Nine structures and open contexts contain three or more pierced or holed amphorae (FIG. 7). The largest assemblage is the 13 examples from the dump of complete and partially-complete amphorae from zone 4. Several other

structures from zone 4 contain multiple examples. Nine pierced amphorae were recovered from the well PT2196 in zone 2.

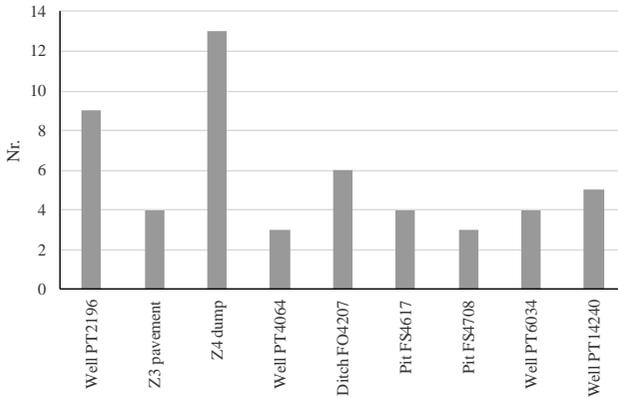


FIG. 7. Structures and open contexts with three or more pierced or holed amphorae.

Chronologically, although the majority of examples are from zone 4 which contains the latest occupation on the site dating to La Tène D1b (c.130-100 BC), examples are also found in structures from zones 2, 6 and 12 dating to La Tène C2 (c.200-150 BC) and La Tène D1a (c.150-130 BC). For example, pierced amphorae were recovered from several structures with assemblages of classic and late Greco-Italic amphorae, such as the pit F12015 and the well PT6034. The well PT2196 with nine pierced amphora sherds contained a large assemblage of late Greco-Italics and Dressel 1As dating to La Tène D1a (c.150-130 BC). Clearly, the piercing and holing of amphorae occurred throughout the occupation of the site although there is a clear increase in this activity dating to the end of the second century (c.130-100 BC).

The evidence shows that the majority pierced and holed amphorae were recovered from areas of the site which were used for various industrial activities (zones 2, 4 and 6). Indeed, pierced amphorae have been recovered from two artisanal pits in zone 4 (FS4678, FS4708: three ex.) and one in zone 2 (FS2304). In contrast, the zones with domestic occupation (zones 7, 11, 12, 13) tend to contain fewer examples. An exception is the domestic zone 12 with 14 examples, although it is worth noting that five of the pierced amphorae from this zone were recovered from the well PT14240 (FIG. 17-18). Additionally, zone 12 produced the largest assemblage of amphorae from the excavation and the ratio between the number of amphora sherds for one pierced/holed amphora (11,549) is significantly higher than the figures for zones 2, 4, 6 and 7

(FIG. 6). Only two pierced amphorae were recovered from zone 8, which provides important evidence for animal butchery. Presumably, the piercing of many of the amphorae recovered from the domestic areas of the site can be explained by the opening and decanting of these vessels. In contrast, the piercing of amphorae from the industrial zones may be connected to the reuse of modified amphorae in the industrial activities taking place in these areas. The following section will see if a closer examination of the pierced amphorae themselves can suggest if they resulted from decanting or from various types of reuse.

Piercing practices at the ‘caserne Niel’

The piercing and holing of amphorae at the ‘caserne Niel’ can be summarized by six distinct practices (FIG. 8):

1. The accidental holing and fracturing of amphorae.
2. The piercing of amphora-discs.
3. The piercing of amphorae with several slits (length *c.*2-4 cm) around the lower body/top of the base.
4. The piercing of amphora bases through the centre.
5. The piercing of amphorae with single holes (*c.*0.5-2 cm in diameter) typically on the lower body.
6. Holing and the cutting of larger oval or rectangular openings on the upper body.

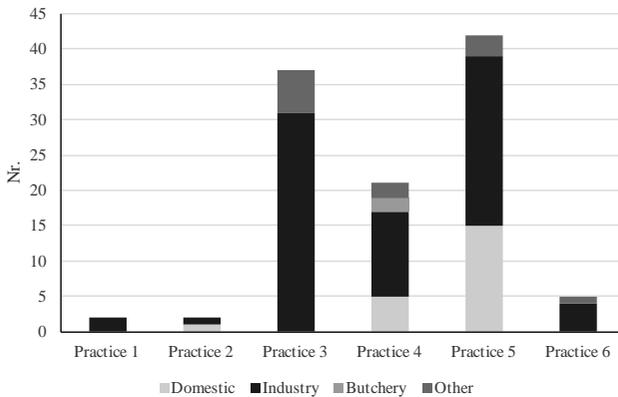


FIG. 8. Classification of the pierced and holed amphorae.

PRACTICE 1

A small number of examples represent the accidental holing and fracturing of amphorae in antiquity or during the excavation (FIG. 8). For example, a vessel from the well PT2196 with a large irregular hole on the upper neck could have been produced by the breaking and removal of the upper handle attachment. A second vessel recovered from the dump of amphorae in zone 4 (US4469) with an irregular hole on the upper body/base of the neck could also be accidental (TABLE 1).

PRACTICE 2

Although approximately 2,000 amphora-discs were recovered from the excavation only two, made out of Republican amphorae, were pierced in their centres. Presumably, these could have functioned as loom weights, spindle-whorls, or as labels (if threaded). Amphora discs from other late Iron Age sites in France were rarely pierced.³⁰

PRACTICE 3

A complete Dressel 1A body from the dump of amphorae in zone 4 provides the best example to illustrate this practice (FIG. 10 no. 1; FIG. 11). Firstly, the upper portion (from the shoulder above) has been detached and the break on the lower portion smoothed and polished. Secondly, around the top of the base three narrow slits have been cut through the vessel wall. Thirdly, grooves have also been cut on the outer surface below the openings. Approximately 37 Dressel 1As, mostly from zone 4 and the adjacent zones 1 and 3, have been modified in this way.³¹ The interiors of ten of these pierced amphorae are lined with a dull white/grey deposit (FIG. 13).³² Most have three slits although

30. This is the case for the Republican amphora-discs from late Iron Age sites in central France, cf. Loughton 2014.
31. Estimating the number of amphorae pierced and modified in this manner, rather than due to Practice 4, is hampered by the incomplete nature of many of the examples.
32. This incrustation was not produced by the precipitation of calcium carbonate by boiling water, as drinking water at Toulouse is soft. Furthermore, it does not resemble the deposits found lining some of the pierced late Iron Age ceramics from Villeneuve-Saint-Germain 'Les Étommelles' in northern France (a hard water area); Hénon *et al.* 2012, pp. 82-83, Fig. 58. This would seem to preclude the use of these amphorae to filter water and/or used for the boiling of water. The deposit does not appear to be a slag or *pozzolana*. It is hoped that chemical analysis to determine the origin of this deposit will form part of the programme of future work concerned with the publication of the excavation and the finds. It is also worth noting here that this deposit is not found on any of the non-pierced Dressel 1s, ceramic vessels or dolia from zone 4.

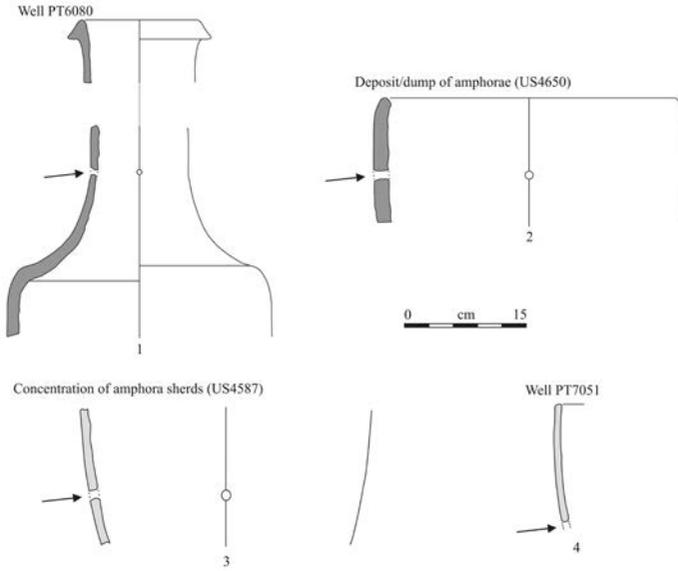


FIG. 9. Pierced Adriatic (nos. 1-2) and Ancient Tripolitanian amphorae (nos. 3-4). Note that vessels 2 and 4 have been modified to be reused as storage vessels.

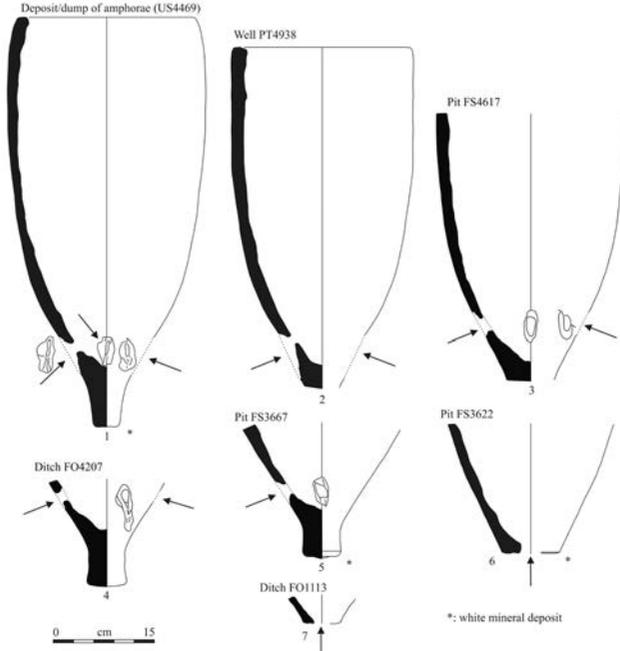


FIG. 10. Pierced Republican amphorae (Practice 3).

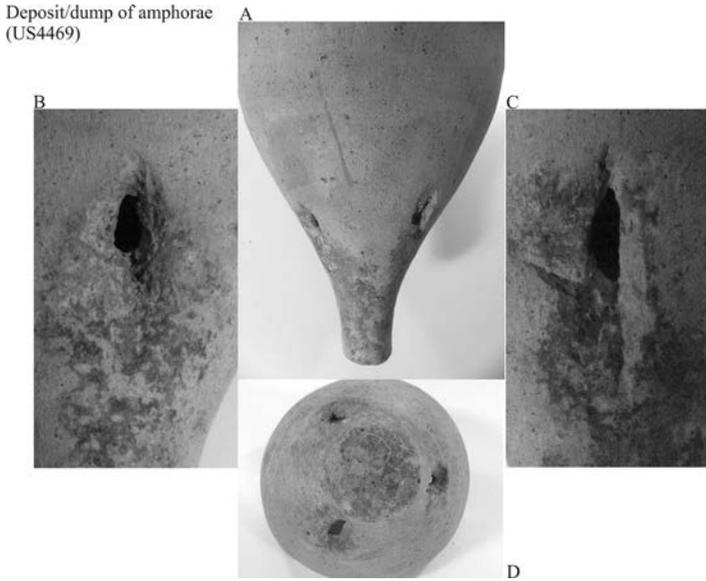


FIG. 11. Dressel 1A amphora pierced with three slits (Practice 3). Note the narrow grooves underneath the slits/holes and the discolouration (B-C).



FIG. 12. Republican amphorae pierced with two (A), three (B) and four (C) slits (Practice 3).

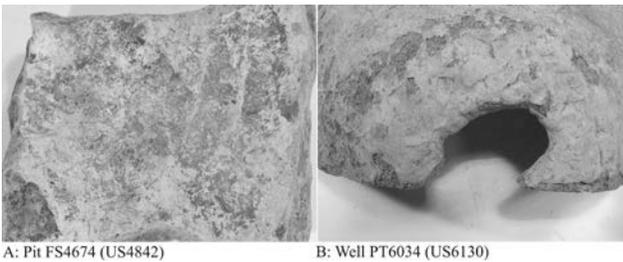


FIG. 13. Amphorae sherds with white mineral deposits. A: interior, B: exterior, note that the centre of the base is pierced.

there are occasional examples with two or four (FIG. 10-12).³³ In a small number of examples the centre of the base was also pierced (FIG. 10 no. 6-7; FIG. 13b) and this includes two examples from zone 6 (wells PT6034 and PT6056) which are also covered with the deposit found on some of the examples from zone 4. Some structures from zone 4 contain several amphorae modified in this manner: the dump of amphorae (eight ex.), ditch FO4207 (five ex.), pit FS4617 (four ex.) and the pit FS4708 (three ex.).

Function

None of the explanations outlined for the piercing of amphorae seem to account for this practice. These amphorae were not modified for reuse within the domestic sphere as they are absent from the domestic areas of the site. Although several examples were recovered from the potential drainage structure in zone 4, it is unlikely that they were modified for this purpose. Given that the majority of these pierced vessels came from zone 4 which was used for casting of lead and bronze, and the working of wood, a reuse connected to some form of artisanal activity seems a likely starting point.

Furnaces or crucibles

These amphorae could have functioned as furnaces or oven covers if the holes were threaded with a metal-chain, or as large crucibles perhaps for the smelting of bronze or lead, activities which are attested in zone 4. At Lyon during the Gallo-Roman period large ceramic amphora-shaped (H c.60 cm, Diam c.19-30 cm) crucibles sealed with a clay bouchon were used for the production of brass and other alloys by the process of cementation.³⁴ One example from a well at Lyon 'rue du Docteur Horand' was pierced two times (after firing) on the body, although this could possibly reflect a secondary reuse of the vessel, perhaps to draw water.³⁵ The slits on the amphorae could have served as vents to release, when required, the gasses produced during the cementation process and prevent the build up of pressure. However, the use of amphorae in this manner is unlikely as the interiors of the crucibles used in this process are turned blue because of the reducing atmosphere and this is not seen with any of the pierced amphorae.³⁶ Furthermore, the deposit found lining some of these amphorae does not seem consistent with the smelting of bronze or lead.

33. It is also difficult to ascertain the exact number of slits given that many of the bases are incomplete, although most intact examples tend to have three.
34. Picon *et al.* 1995; Nin and Picon 2003.
35. Picon *et al.* 1995, pp. 207, 209, Fig. 4.
36. Nin and Picon 2003, p. 473.

*Pitch production*³⁷

In the southern Massif central from the late Iron Age to the Roman period large ceramic urns were used for the production of pitch by the distillation of resinous wood by heat.³⁸ Two large urns were used: a lower one, set within the ground, acted as a reservoir to collect the pitch produced during distillation. The second vessel, packed with resinous wood (held in place by a wooden or metal grill), was inverted and placed on top of the lower vessel, around which a fire was built.³⁹ The base of the upper urn was often pierced to allow gases to escape. Clearly modified amphorae, like the vessel from US4469 (FIG. 10 no. 1), could have been utilized in a similar manner. In some examples the outside areas below the slits are discoloured from the venting of hot gases (FIG. 11). This practice could explain the finding of six Dressel 1 amphora bodies in zone 4 which had been set vertically in the ground (FIG. 14), although they were not pierced. Waste products from the production of pitch have been recovered from some of the wells in zone 4, confirming that its production occurred presumably in this part of the site.⁴⁰ Pitch or a liquid waste product was poured into several of the old wells in zones 6 and 12. This coated the amphora sherds (including the sherd breaks) in these structures with a dull black tar like deposit.



FIG. 14. Dressel 1 amphora bodies set vertically in the ground in zone 4 (Photo: Archeodunum).

37. The possibility that pierced amphorae were used on the site for the production of pitch was originally suggested by Alexandre Lemaire (Archeodunum).
38. Trintignac 2003; Mauné and Trintignac 2011; Orengo *et al.* 2013. The urns used in the Massif central had a height of about 1 m and a diameter of 0.9 m. In the eastern Pyrenees during the Roman period ceramic kilns about 1.8 m in diameter were used for the production of pitch; Orengo *et al.* 2013.
39. Mauné and Trintignac 2011, pp. 437-438, Fig. 4.
40. Alexandre Lemaire pers. comm.

Lime/Quicklime

A slightly similar use for the pierced amphorae is for the roasting of chalk or limestone for the production of quicklime/lime. The deposits found lining some of the pierced amphorae (FIG. 13) could be the lime putty produced by the slaking of roasted limestone.⁴¹ It is worth noting that none of the pierced amphorae with incrustations were reused in mortar type constructions.⁴²

Charcoal

The pierced amphora bodies could also have been used for the production of charcoal given that large quantities would have been needed for the smelting and working of metals on the site.

Plant pots

Some of the pierced amphorae could have functioned as plant pots (*ollae perforatae*). Purpose-made ceramic plant pots were often pierced around the side and sometimes through the base.⁴³ The pierced amphorae from the 'caserne Niel' could either represent the discarded containers of plants and shrubs imported from Italy, or amphorae modified and reused to grow plants on the site and/or for export to the surrounding region. However, an export trade in Mediterranean shrubs and trees to Gaul during the later second century BC seems unlikely. While purpose-made ceramic planters are known from many Roman villas in Gaul including from the nearby villa at Montmaurin⁴⁴, examples involving reused amphorae are rare. Findspots are limited to a small number of villa sites in Italy and commercial nurseries.⁴⁵ For example, a Roman period nursery at Abu Hummus, Egypt, reused a large number of modified (although not pierced) Egyptian amphorae, while amphorae were also used at some Pompeian nurseries.⁴⁶

To summarize the use of pierced amphorae for the production of pitch and quicklime seems the most probable explanation. The production of pitch on the site and the uses to which it was put will be discussed below.

41. At Murviel-lès-Montpellier 'Castellas' a modified Tarraconensis Oberaden 74 was reused to hold lime for construction work (Barberan *et al.* 2009) and similar examples are known from Pompeii; Peña 2007, pp. 132, 141, 143, 314.
42. For example, the large number of LR3 amphorae from Arap-Dere/Pis-Dere, Turkey, which were covered with quicklime were perhaps reused in some form of construction; Bezechky 2013, p. 23.
43. Macaulay-Lewis 2006, p. 207.
44. Barat and Morize 1999.
45. Macaulay-Lewis 2006, p. 216.
46. Kenawi *et al.* 2012, pp. 216-220.

PRACTICE 4

This involves the removal of the end of the base and the piercing of the lower body through the centre of the top of the base with a small circular hole (c.1-3 cm in diameter). 21 amphorae have been modified in this manner and are found throughout the excavation including the habitation areas.⁴⁷ Some could have functioned as loom weights or as funnels (FIG. 16 no. 2). Some of these examples could also be explained by the opening and decanting of amphorae through the base.⁴⁸ However, this seems a rather impractical and time consuming way to open Republican amphorae. Firstly, it would require the tricky removal of most of the base (without fracturing the lower body) and secondly, drilling through the remaining vessel wall which could be quite thick. Another potential drawback is that deposits of pitch often accumulated in the lower body and this could impede the outflow of wine.

PRACTICE 5

This common practice with 42 examples (FIG. 8) involves the piercing of amphorae with one circular hole (c.1-3 cm in diameter) on the lower neck, upper body, although most are found above the top of the base (FIG. 15-19). Amphorae pierced in this manner are relatively better represented in the habitation areas of the site (FIG. 8), notably zones 7 (four ex.) and 12 (10 ex.), and the adjacent zones 2 (eight ex.) and 6 (10 ex.), while only a small number were recovered from zone 4. However, many example are still recovered from the industrial areas of the site (FIG. 8) and these perhaps provide evidence for the consumption of wine by the artisans and their helpers who worked in these areas of the site.⁴⁹ It is worth noting that this practice includes all the pierced Ancient Tripolitanian and Adriatic amphorae (FIG. 9). Most of these are consistent with the decanting of wine and olive oil amphorae (in the case of the Ancient Tripolitanian amphorae). The most notable examples are the four Dressel 1As pierced with similar sized openings just above the top of the base (FIG. 17 no. 1, 3-5; FIG. 18) and a fifth vessel pierced with a small hole towards the middle of the body (FIG. 17 no. 2) from the well PT14240 in zone 12. A similar example was recovered from the well PT12022 (FIG. 15 no. 9). The decanting holes found on north African amphorae from the cemetery at Pupput, Tunisia,

47. It is possible that some of the fragmentary examples from zone 4 could be connected to practice 3.

48. This practice has been suggested for amphorae from some north African sites; Bonifay 2004b, pp. 200-201, Fig. 4.

49. Cf. Loughton 2009, pp. 91-92.

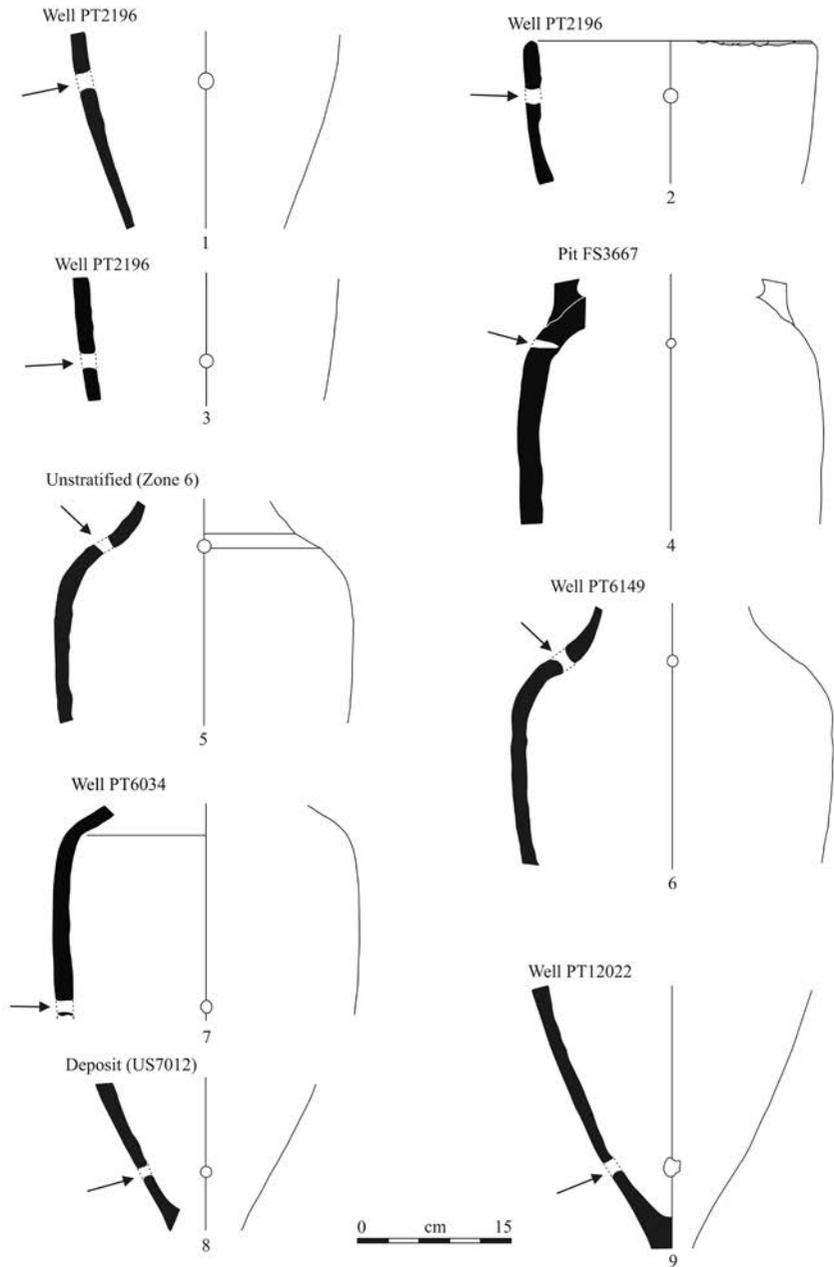


FIG. 15. Pierced Republican amphorae (Practice 5, except nr. 4: Practice 1). Note vessel no. 2 has also been modified to be reused as a storage vessel.

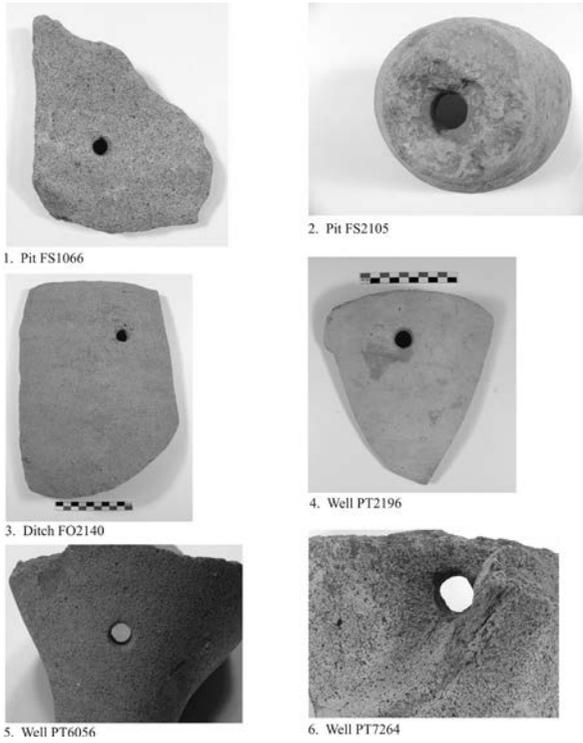


FIG. 16. Photos of various pierced amphora sherds from the 'caserne Niel' (Practice 4 and 5).

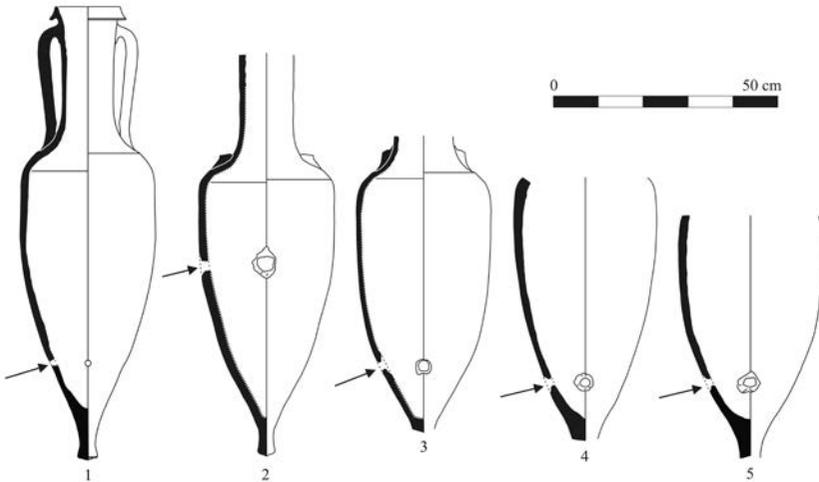


FIG. 17. Pierced amphorae from the well PT14240 (Practice 5).

are also similar in size, shape and placement (FIG. 25; TABLE 2).⁵⁰ Otherwise, it is hard to imagine what purpose these holes could have served. They are unlikely to have served as libation conduits given that none came from funerary structures. The vessels from the well PT14240 were rapidly discarded once they were emptied as they still preserve their resin linings. This suggests that the piercing of these vessels was not linked to some form of reuse.⁵¹

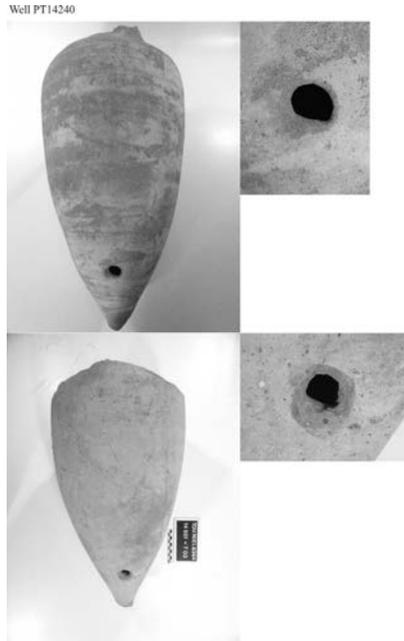


FIG. 18. Two pierced amphora from the well PT14240 (Practice 5).

Some of these examples could have served as water containers if they were set upright above the level of the ground, and the hole plugged with a wooden stopper so that water could be drawn-off when required. However, this set-up could have been used to decant the original contents. For example, amphorae from Silchester, England and from Caesarea Maritima, Israel, were pierced

50. Bonifay 2004b, 2004c.

51. It is worth noting that the complete and partially-complete Dressel 1s laid out in zone 4 did not preserve any resin linings suggesting that they would not survive in vessels exposed to the elements. However, these vessels may have been cleaned so that they could be reused. Some old amphorae deposited in recent contexts in the Aegean still preserve their resin linings (Mark Lawall pers. comm.).

with small holes that were then plugged with lead.⁵² Other types of reuse are possible, for instance the base fragment from the well PT6065 (FIG. 16 no. 5) with a small neat drill hole on the lower vessel wall could have been nailed up and used as a flowerpot.

A couple of more unusual pierced amphorae are worth discussing in detail. A complete Dressel 1A body from the well PT12008 has been pierced with two circular holes (*c.*2.0 cm in diameter) about *c.*20 cm apart on the middle/lower body (FIG. 19). It would have been difficult to thread a rope through the two holes so that the vessel could be lowered and raised from a water source, or carried. Again, the cutting of these holes to decant the amphora still seems the most likely explanation.



FIG. 19. Amphora pierced with two holes from the well PT12008 (Practice 5?).

Five amphorae pierced with small holes have also had their upper portions removed and the resulting breaks on the lower half polished and smoothed. This includes one Adriatic Lamboglia 2 (FIG. 9 no. 2), one Ancient Tripolitanian amphora (FIG. 9 no. 4) and three Republican amphorae (FIG. 15 no. 2; TABLE 1). The sawing-off of the upper portion was typically done to amphorae that were reused as storage vessels.⁵³ It is possible that these amphorae were all pierced (presumably to open and decant their contents) before they were modified and reused in this manner. Alternatively, the drilling of

52. Callender 1965, pp. 43-44; Adan-Bayewitz 1986, p. 100.

53. Approximately 100 Republican amphorae have been modified in this way at the 'caserne Niel' (Loughton and Alberghi 2012). Similarly 35, mostly Dressel 1s, were modified and reused as storage vessels at Gondole 'Les Chaumes' and none were pierced (Loughton in press 1).

the holes could have been linked with their subsequent use as storage containers. For example, if the holes were threaded with rope the vessels could have been suspended or the rope could have functioned as a handle.⁵⁴ It is also possible that the holes could have been used to tie down a cloth or leather cover.

Another unusual example is the Greco-Italic amphora from the well PT6173, which has been pierced with at least five or six narrow oval/elongate holes (c.2-4 cm in diameter) on the middle to lower body (FIG. 20). The nearest parallel is a complete Tripolitanian amphora from Ashkelon, Israel, with two rows of narrow holes on the body, which was possibly reused in a drainage structure.⁵⁵ This explanation seem unlikely to explain the amphora from the well PT6173 as the interior of this vessel is still lined with resin which presumably would not have survived if the vessel had been reused. The holes are unlikely to have resulted from the cutting of amphora-discs, as they tend to be larger and more oval. Again, the piercing of this vessel to remove its contents still seems the most convincing explanation.

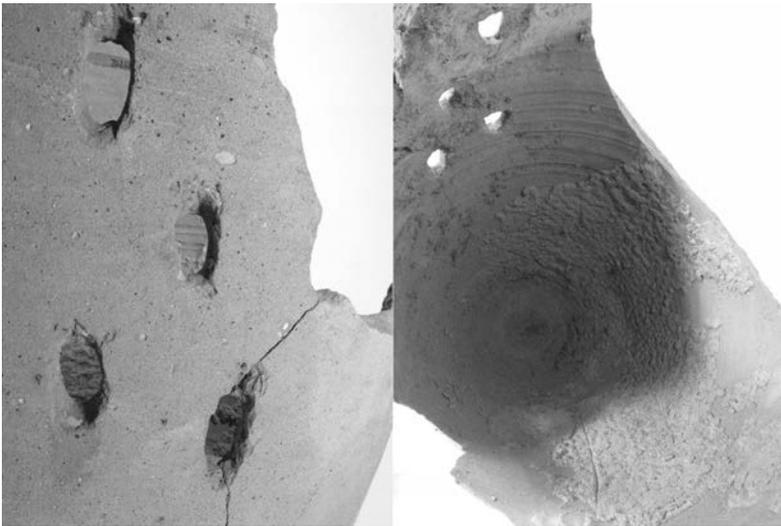


FIG. 20. Pierced amphora from the well PT6173 (Practice 5). Note that the interior of the vessel is still lined with resin (Practice 5?).

54. A similar explanation has been proposed for a Tarraconensis Oberaden 74 amphora from Bordeaux 'du Grand-Hôtel'; Chuniaud 2009, pp. 381-382, Fig. 6 no. 5. However, the small size of the holes on the examples from the 'caserne Niel' would seem to exclude the use of a suitably thick cord that would take the weight of the amphora and its contents.
55. Johnson 2008, pp. 145-146 no. 422.

PRACTICE 6

This rare practice involved the cutting of larger round (c.5-11 cm in diameter) or oval/rectangular openings (c.17-18 cm) on the amphora body. Examples are known from only four structures: well PT4064, well PT6034, well PT6270, and pit FS12658. There is also one unstratified example from zone 6. The well PT6270 contained a Greco-Italic body with a large circular hole (c.11 cm in diameter) on the middle body (FIG. 21). The Dressel 1 from the pit FS12658 has had two large oval/rectangular apertures cut (c.17-18 cm) on opposite sides of the middle body while the upper neck and rim appears to have been sawn-off (FIG. 21). Finally, from the well PT6034 there is a Dressel 1 with a circular hole (c.4-5 cm in diameter) on the upper body. It is worth noting that earlier excavations at the 'caserne Niel' also found several holed Dressel 1s (FIG. 22).⁵⁶

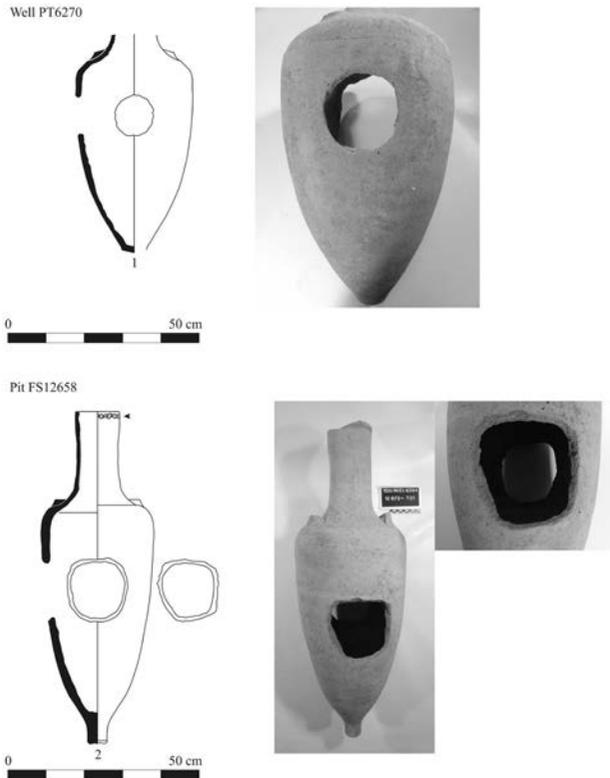


FIG. 21. Holed Greco-Italic amphora from the well PT6270 and holed Dressel 1A from the pit FS12658 (Practice 6).

56. Fouet 1969.

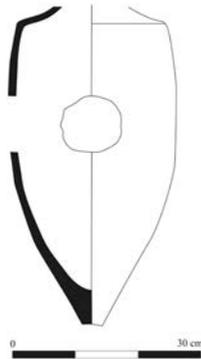


FIG. 22. Holed Republican amphora from Toulouse ‘caserne Niel’ well 2 (Fouet 1969, p. 75, Fig. 5 no. 50).

It is difficult to determine whether an amphora was holed to gain access to its contents or occurred later and involved the modification and reuse of the vessel. At first sight, the decanting of garum or salted-fish containers might seem an unlikely explanation for Republican *wine* amphorae. However, several Republican amphora kilns also provide evidence for fish salting and *garum* production while occasional Dressel 1s from Mediterranean wrecks and from terrestrial sites have been shown to have contained these commodities.⁵⁷ Spanish garum amphorae were often holed in a similar manner (TABLE 2). For example, several Dressel 7-11s from Fos-sur-Mer ‘l’Estagnon’ were opened by the cutting of large round or rectangular apertures on their bodies.⁵⁸ The cutting of openings on both sides of the amphora from pit FS12658 would seem to preclude its reuse as a storage vessel or to draw water from a well.⁵⁹ While the holed amphorae could have been reused in drainage structures, they were not recovered from the possible example in zone 4.

Amphora holing and amphora-discs

The holing of the amphora from the well PT6270 could instead be explained by the cutting of an amphora-disc. Yet, this seems rather impractical when discs could have been cut from smaller and more manageable sized sherds.⁶⁰ Indeed, it is possible to turn this argument on its head and suggest that per-

57. Loughton 2014; Marzano 2007. It is likely that a proportion of Republican amphorae were used to carry non-standard commodities, such as garum, salted-fish and olive oil.
58. Marty and Zaaraoui 2009, p. 412.
59. Amphorae reused to draw water from wells at Athens had oblate holes cut on their shoulders rather than on their bodies; Peña 2007, pp. 136-137, Fig. 6.3.
60. It has been suggested that ceramic and amphora discs were manufactured by using a chisel to cut down broken sherds; Guichon 2006; Papadopoulos 2002.

haps many, or some, amphora-discs were by-products of the decanting of Republican amphorae by holing. This might explain the recovery of some larger discs from the 'caserne Niel' (FIG. 23-24) with diameters ranging from 15 to 25 cm. It is hard to see what function these could have served: they are too large to have served as ceramic or amphora-stoppers, or as counters or tokens. They could have served as trays or plates, although wooden examples would have been more suitable. The existence of these larger 'amphora-discs' suggest that the holing of amphorae at the 'caserne Niel' was more common than indicated by the number of holed amphorae.

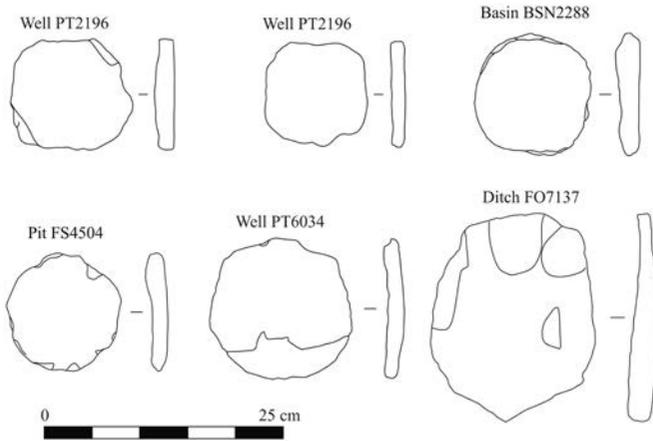


FIG. 23. A selection of large amphora-discs from the 'caserne Niel'.



FIG. 24. Large Republican amphora-disc (c.15 cm x 21 cm) from the well PT4064.

Discussion

Evidence for the piercing and holing of Republican amphorae from late Iron Age sites in France is uncommon (TABLE 2). Additional examples have been reported from the Toulouse region. A Dressel 1A with a large rectangular aperture cut on its body, and similar to the example from the pit FS12658, has been reported from Toulouse or Vieille-Toulouse.⁶¹ Two Dressel 1s pierced with small holes have been reported from Vieille-Toulouse.⁶² A recent excavation on Vieille-Toulouse uncovered three pierced and one holed amphorae from the early first century BC well 1048 (TABLE 2) (FIG. 26).⁶³ A Dressel 1A from the nearby second century BC farm at Blagnac ‘Ganellou’ was pierced two times on the body.⁶⁴

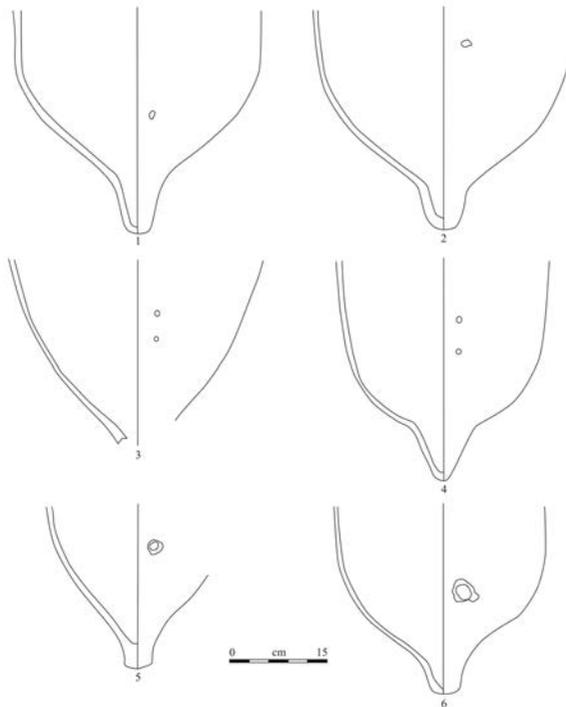


FIG. 25. Pierced north African amphorae from the Roman cemetery at Pupput, Tunisia (after Ben-Abed and Griesheimer, 2004).

61. Benquet 2002.

62. Fouet 1958, p. 126.

63. Loughton in press 2. The excavation was directed by J.Vial (Hadès).

64. Toledo-Mur *et al.* 2008, p. 252, Fig. 22.



FIG. 26. Pierced Dressel 1 from Vieille-Toulouse well PT1048.

Outside of the Toulouse region holed Republican amphorae have also been recovered from the settlements of Aix-en-Provence ‘Entremont’, ‘Terrain Coq’ and nearby Bouc-Bel-Air ‘Baou-Roux’.⁶⁵ Several holed amphorae (Dressel 1s?) have been reported from Ensérune near to Narbonne⁶⁶ while there is a holed Dressel 1 from Rodez ‘caserne Rauch’ in the southern Massif central.⁶⁷ A slightly unusual example is the Dressel 1A with two medium-sized (c.5 and c.7 cm in Diam) openings on the middle and lower body from Castres ‘Lameilhé’.⁶⁸ In central France holed Dressel 1As have been found on the late second century BC settlement of ‘Gandaillat’ (FIG. 27)⁶⁹ and the first century BC *oppidum* of Corent.⁷⁰ Most of these examples are consistent with the decanting of Republican amphorae and it is worth noting the rarity of examples outside of Mediterranean and south-western France. These finds-pots range in date from the second to the later first century BC.

65. Gateau 1990, p. 172, Figs. 7-8, 11; Poux 2004, p. 549, Fig. 286.

66. Fouet 1958, p. 126, note 51.

67. Gruat *et al.* 1991, p. 68, Fig. 6 no. 5.

68. Séguier and Izac-Imbert 2013.

69. Loughton 2014.

70. Poux 2011, p. 128.



FIG. 27. A holed (?) Dressel 1A amphora from Clermont-Ferrand ‘Gandailat’.

Pierced Republican amphorae have also been reported from a small number of late Iron Age sites from many parts of France although there is a bias, like the holed amphorae, to the south and south-west. This includes a Greco-Italic vessel from Saint-Mitre-les-Remparts ‘Saint-Blaise’⁷¹, a Dressel 1B sherd from Valence⁷², a complete Dressel 1A from Agen ‘l’Ermitage’⁷³, a complete Dressel 1B from Narbonne ‘Malar’⁷⁴, a Dressel 1A from Carcassonne ‘La Cavayère’⁷⁵ and three examples from western France (TABLE 2).⁷⁶ Pierced Dressel 1s have been also reported from Clermont-Ferrand ‘Le Brézet’ and Gondole ‘Les Chaumes’ (FIG. 28) in central France.⁷⁷ Some of these pierced amphorae, notably the vessels from Narbonne, and Agen ‘l’Ermitage’ which are remarkably similar to the pierced amphorae from the well PT14240, are consistent with the decanting of amphorae. Some of the other examples, such as the pierced base from Gondole ‘Les Chaumes’, are best explained as reuse. A pierced Dressel 1C from a tomb at Nîmes ‘Mas Vigier’ may have served as a libation conduit or the reuse of an old decanted amphora.⁷⁸ However, for many of these examples the lack of details means that it is not possible to ascertain why they were pierced.

71. Gateau 1990, p. 167.

72. Maza and Silvino 2011, p. 474.

73. Verdin *et al.* 2013, p. 130, Fig. 6.

74. Falguéra *et al.* 2012, pp. 47, 384.

75. Olmer 2012.

76. Mortantambe ‘Cabariot’, Échiré ‘chemin Chevaleret’; Toledo-Mur and Petitot 1998, p. 111, Fig. 73 nos. 43-44; Poux 2004, pp. 479-480, Fig. 249.

77. Loughton 2014, in press 1.

78. Barberan *et al.* 2013, pp. 546, 548, Fig. 15 no. 6.



FIG. 28. Pierced Dressel 1 base from Gondole 'Les Chaumes'.

The number of amphorae from the 'caserne Niel' which were decanted via piercing is rather exceptional for a late Iron Age site in France even after taking into account the large size of the amphora assemblage (FIG. 29). Indeed, amphorae decanted by piercing are more likely to be recovered from sites in north Africa, Italy, Mediterranean France and the eastern Mediterranean (TABLE 2).⁷⁹ At the cemetery of Pupput in Tunisia 23 (?) vessels were pierced or holed and they account for 14% of the total number of amphorae.⁸⁰ At Fos-sur-Mer 'l'Estagnon' on the French Mediterranean coast 9% of the amphorae were pierced or holed.⁸¹ For Gaul Republican amphorae were typically opened by dislodging or breaking the mortar seal and wooden cork in the neck, or by 'ritual beheading' and severing the neck with the cork.⁸² On late Iron Age sites from south-western (Agen, Blagnac), central (Gandaillat, Le Brézet, Gondole) and eastern (Lyon) France pierced and holed amphorae are rare and typically account for less than 1% of the total number of amphorae (FIG. 29). It is possible that the decanting of amphorae by piercing indicates the presence of some foreign traders and/or artisans on the 'caserne Niel'. This hypothesis is also suggested by the greater representation of writing equipment, intaglios, toilet instruments, Campanian oil lamps, and coarseware ceramics from Marseille on the site.⁸³ The relatively

79. Bonifay 2004a, pp. 467-469; Peña 2007, pp. 66-69; Slane 2011, p. 98. However, we need to be cautious when accessing the frequency of pierced and holed amphorae as these practices may be underreported in the literature and even for assemblages where they are noted they may not be quantified.

80. Ben-Abed and Griesheimer 2004, p. 21.

81. Marty and Zaaraoui 2009.

82. Loughton 2014; Poux 2004.

83. Jud *et al.* 2012.

strong presence of Italian (Brindisi) and north African olive oil amphorae on the site might also be relevant.⁸⁴

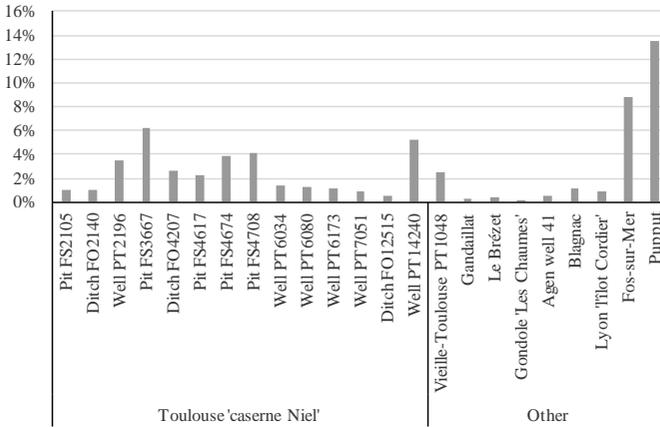


FIG. 29. Frequency of pierced and holed amphorae (% of the amphora NMI) for various structures on the ‘caserne Niel’ and for other late Iron Age and Roman sites in France and north Africa.

Evidence for the holing of amphorae is heavily dependent upon the recovery of intact and/or partially-complete vessels. This might explain why many holed amphorae are recovered from drainage structures constructed out of large numbers of complete and partially-complete vessels (TABLE 2).⁸⁵ At sites where amphorae were heavily broken up before deposition, as is the norm for many late Iron Age sites in Gaul, the evidence for the holing of amphorae will be destroyed. It is worth noting that large amphora-discs, which it has been suggested could provide indirect evidence for this practice, are found on the late Iron Age site of Gondole ‘Les Chaumes’, which has not produced any holed amphorae.⁸⁶

The reuse of amphorae on the ‘caserne Niel’ in industrial activities, notably for the production of pitch and quicklime, appears to be exceptional for a late Iron Age site. Other late Iron Age settlements from Gaul that were heavily

84. Loughton and Alberghi 2015.

85. Fos-sur-Mer ‘l’Estagnon’ (Marty and Zaaaroui 2009, p. 412), Narbonne ‘Malard’ (Falgüera *et al.* 2012, pp. 47, 384), Cádiz ‘Los Cargaderos-San Fernando’ (Bernal 2007, pp. 332-334, Fig. 7; Bernal *et al.* 2005, p. 207, Fig. 9), etc.

86. Loughton 2014, in press 1.

involved in various industrial activities provide no comparable evidence⁸⁷ nor are modified amphorae found on any of the late Iron Age pitch producing sites in the southern Massif central. The sturdy construction of Dressel 1 amphorae meant that they could be used repeatedly to produce pitch via distillation. While they are smaller than the ceramic urns used in the Massif central⁸⁸ they could still have been used to produce large quantities of pitch. Another advantage is that with a suitable supply of resinous wood pitch could have been produced all year round (and when required), unlike the production sites in the Massif central, which were seasonal operations and limited to the summer months.⁸⁹

The use of amphorae to produce large quantities of pitch on the 'caserne Niel' raises the question of the demand for this commodity and its uses on the site. Much of the pitch could have been used on the site for the waterproofing of barrels and ceramic jugs, used for the redistribution of wine. Pitch could also have been added to poor quality or sour wines to make them palatable for consumption on the site or for sale. Pitch could also have been used to reline old Republican amphorae so that they could be reused to export commodities. Some merchants could have been increasing their profit margins by bulking out wine into additional amphorae by the addition of poorer quality wines and pitch. Some of the reconditioned amphorae could have been refilled with wine that arrived on the site in dolia, barrels and skins, or even with wine produced in southern Gaul.⁹⁰ There are several other finds from the excavation that support the relining and refilling of amphorae. Cork-stoppers, used to seal amphorae, were being manufactured in zone 4⁹¹ while an amphora full of *pozzolana* was also recovered from this zone. Quicklime could also have been used to seal amphorae. Several amphora handles and bases engraved with double-letter stamps were recovered from the site.⁹² These could have been used to stamp the mortar seals placed over the cork in the amphora mouth. Finally, large numbers of intact Dressel 1s were recovered from zone 4, which once cleaned, could have been reused. The possibility that some amphorae were recycled, refilled and redistributed has been receiving increasing recog-

87. Clermont-Ferrand 'Aulnat-Gandaillat', Levroux 'Les Arènes', etc.

88. Cf. note 38.

89. Orengo 2013, p. 811.

90. The Dressel 1As fired at a kiln at Agde 'Saint-Michel' in Languedoc during the second half of the second century BC (Py *et al.* 2001, p. 98; Gomez 2013) were presumably filled with local vintages. Evidence for the production of wine in parts of Languedoc and Roussillon is attested from the third/second century BC onwards (Mauné 2013).

91. Alexandre Lemaire pers. comm.

92. Loughton and Alberghi 2012; Loughton 2015.

dition in the literature.⁹³ Some Mediterranean amphora cargoes containing reused vessels have also been recently identified.⁹⁴ Finally, pitch could have been exported in old reused amphorae to more distant markets, as it was a valuable commodity. Indeed, pitch has been found in the cargoes of several Mediterranean shipwrecks⁹⁵ and papyrological evidence suggests that resin produced in the eastern Mediterranean was exported to Egypt.⁹⁶

Conclusion

The majority of the pierced and holed amphorae from the 'caserne Niel' are consistent with two practices: decanting and the reuse of Dressel 1s in various industrial productive processes. It is unlikely that amphorae from the 'caserne Niel' were pierced or holed for ritual and funerary uses. It has been suggested that large amphora-discs can be used to indicate the holing of amphorae on sites. The presence of such discs on many late Iron Age sites might suggest that the opening of Republican amphorae via holing was more common than indicated by the small number of actual holed amphorae. This would also support the suggestion that a proportion of Republican amphorae carried garum, salted fish, or fruit. Finally, it is hoped that this article will stimulate greater awareness of the modification and reuse of Republican amphorae, and the detailed recording of such evidence.

93. Cf. Lawall, 2011a, pp. 30-32.

94. The Africana Is, Tripolitanian Is and Knossos 19s from the Grado wreck, Italy, were reused to hold Adriatic fish products; Auriemma 2000. Some heterogeneous Dressel 1 cargoes, notably the Miladou wreck (Dumontier and Joncheray 1991), might also provide evidence for this practice (Loughton 2014).

95. For example, Greco-Italic amphorae from the Héliopolis wreck contained pitch (Long 1998, p. 341) and so to did the Dressel 1As from the late second century BC Torre la Sal wreck, Spain (Parker 1992, p. 428). Nine Mendean wine amphorae contained pitch in the Tektaş Burnu wreck, Turkey (Carlson 2003, pp. 588-589). Finally, the Lamboglia 2s in the Sud-Caveaux 1 wreck also contained pitch (Long 1998, p. 341).

96. Mayerson 2004; Gallimore 2010, pp. 179-181.

Appendix

TABLE 1. Pierced and holed amphorae from the 'caserne Niel'.

Structure	Z. Date (approx.)	Amphora type	Location		Deposit	Reused vessel	Accidental or modern?	Figure
Not stratified	1 ?	Republican	Lower body (just above base)	Hole (c.2 cm in diam)				
Pit FS1066	1 170/160-150 BC	Republican	Shoulder/lower neck	Hole (c.0.5 cm in diam)				FIG. 16 no. 1
Ditch FO1246	1 130-100 BC?	Republican	Base (centre)	Hole (c.2 cm in diam)				
			Lower body (just above base)	Two holes (broken)				
Amphora layer/pavement	2 170/160-150 BC	Republican	Base (centre)	Hole (c.1.5 cm in diam)				
Deposit/dump	2 170/160-150 BC	Republican	Amphora disc	Hole (c.1 cm in diam)				
Pit FS2105	2 170/160-150 BC	Republican	Base (centre)	Hole (c.1.2 cm in diam)				FIG. 16 no. 2
Ditch FO2140	2 150-130 BC	Republican	Middle body	Hole (c.1.2 cm in diam)				FIG. 16 no. 3
Well PT2196	2 150-130 BC	Republican	Base (centre)	Hole (c.1.1 cm in diam)				
			Upper body (below shoulder)	Hole (c.2.6 cm in diam)				
			Middle body	Hole (c.1.2 cm in diam)			X	
			Upper neck	Irregular hole (c.5 cm in diam)				
			Middle body	Hole (c.1.2 cm in diam)		X		FIG. 15 no. 2
			Middle body	Hole (c.1.2 cm in diam)				FIG. 15 no. 3
			Middle body	Hole (c.1.5 cm in diam)				
			Lower body (just above base)	Hole (c.1.5 cm in diam)				FIG. 15 no. 1, FIG. 16 no. 4
			Upper body (below shoulder)	Hole (c.1 cm in diam)		X		
Pit FS2304	2 150-130 BC	Republican	Base (centre)	Hole (c.1 cm in diam)				
Amphora layer/pavement	3 130-100 BC?	Republican	Upper body (below shoulder)	Hole (c.3.2 cm in diam)		X		
			Base (centre)	Hole (c.1.4 cm in diam)				
			Lower body (just above base)	Three holes (broken)				
			Lower body (just above base)	Hole (c.2.7 cm in diam)				
Pit FS3622	3 130-100 BC	Republican	Base (centre)	Hole (c.3 cm in diam)	X			FIG. 10 no. 6
Pit FS3667	3 150-130 BC	Republican	Lower body (just above base)	Hole (c.3.5 cm in diam)	X			FIG. 10 no. 5
			Shoulder/lower neck	Drill hole (c.1 cm in diam) not pierced wall				FIG. 15 no. 4
Ditch FO1113	4 130-100 BC	Republican	Base (centre)	Hole (c.2.4 cm in diam)				FIG. 10 no. 7

Structure	Z. Date (approx.)	Amphora type	Location		Deposit	Reused vessel	Accidental or modern?	Figure
Amphora layer/pavement	4 130-100 BC	Republican	Base (centre)	Hole (c.2.8 cm in diam)				FIG. 9 no. 3
Concentration of amphora sherds (US4587)	4 130-100 BC?	Ancient Tripolitanian Amphora	Middle body	Hole (c.0.8 cm in diam)				
Pit FS4060	4 130-100 BC	Republican	Lower body (just above base)	Four holes (c.2.5-3.0 cm in diam)				
Well PT4064	4 130-100 BC	Republican	Base (centre)	Hole (c.5 cm in diam)				FIG. 10 no. 4
			Base (centre)	Hole (c.4 cm in diam)				
			Upper body (below shoulder)	Holed (c.5 cm in diam)?				
Ditch FO4207	4 130-100 BC	Republican	Lower body (just above base)	Two holes (c.2.5 cm in diam)				
			Lower body (just above base)	Two holes (broken)				FIG. 10 no. 1, FIG. 11
			Lower body (just above base)	Two holes (broken)				
			Base (centre)	Hole (c.1 cm in diam)				
			Lower body (just above base)	Hole (c.1.7 cm in diam)				
			Lower body (just above base)	Hole (broken)				
Deposit/dump of amphorae	4 130-100 BC	Republican	Lower body (just above base)	Two holes (c.1.5 cm in diam)				
			Lower body (just above base)	Two holes (c.1.2 cm in diam)				
			Shoulder/lower neck	Hole (c.4 cm in diam)				
			Lower body (just above base)	Three holes (broken)	X			
			Lower body (just above base)	Three holes (c.2 cm in diam)	X	X		
			Lower body (just above base)	Three holes (broken)				
			Lower body (just above base)	Hole (c.4 cm in diam)				
			Upper body (below shoulder)	Irregular hole (c.5 cm in diam)			X	
			Lower body (just above base) and centre of base	Three holes (c.1.5-2 cm in diam)				
			Base (centre)	Hole (c.3.2 cm in diam)				
			Lower body (just above base)	Two holes (c.0.9 cm in diam)				
			Lower body (just above base)	Three holes (c.2 cm in diam)				
		Adriatic (Lamboglia 2)	Upper body (below shoulder)	Hole (c.1 cm in diam)		X		
Well PT4395	4 130-100 BC	Republican	Lower body (just above base)	Hole (c.2-3 cm in diam)	X			
			Base (centre)	Hole (c.3 cm in diam)				
			Upper neck	Hole (c.4.2 cm in diam)				

Structure	Z. Date (approx.)	Amphora type	Location	Deposit	Reused vessel	Accidental or modern?	Figure
Pit FS4552	4 130-100 BC	Republican	Base (centre) Lower body (just above base)	Hole (c.2 cm in diam) Hole (c.1 cm in diam)	X		
Pit FS4617	4 130-100 BC	Republican	Lower body (just above base) Lower body (just above base) Lower body (just above base) Lower body (just above base)	Two holes (c.2.5 cm in diam) Hole (c.2.5 cm in diam) Two holes (c.2.5 cm in diam) Hole (c.2 cm in diam)			FIG. 10 no. 3
Pit FS4674	4 130-100 BC	Republican	Base (centre) Lower body (just above base)	Hole (broken) Two holes (c.1.5 cm in diam)	X X		
Pit FS4708	4 130-100 BC	Republican	Lower body (just above base) Lower body (just above base) Lower body (just above base)	Two holes (c.2.5 cm in diam) Three holes (c.2, 2.5 cm in diam) Four holes (c.2-3 cm in diam)			FIG. 12A FIG. 12C
Well PT4938	4 130-100 BC	Republican	Lower body (just above base) Lower body (just above base)	Two holes (broken) Three holes (c.2-2.5 cm in diam)		X	FIG. 10 no. 2 FIG. 12B
Not stratified	6 ?	Republican	Shoulder/ lower neck Upper body (below shoulder)	Hole (c.2.4 cm in diam) Holed (broken c.6 cm in diam)?			FIG. 15 no. 5
Well PT6012	6 170/160-150 BC	Republican	Upper body (below shoulder)	Hole (c.1 cm in diam)			
Pit FS6018	6 170/160-150 BC	Republican	Body	Hole (c.1.5 cm in diam)			
Well PT6034	6 170/160-150 BC	Republican	Base (centre) Middle body Middle body	Hole (c.2.6 cm in diam) Hole (c.1.2 cm in diam) Hole (c.1.1 cm in diam)	X		FIG. 13B FIG. 15 no. 7
Well PT6056	6 130-100 BC	Republican	Upper body (below shoulder) Lower body (just above base) Base (centre)	Holed (c.4.4 x 3 cm in diam)? Hole (c.1.1 cm in diam) Hole (c.1.4 cm in diam)		X	FIG. 16 no. 5
Well PT6080	6 170/160-150 BC	Adriatic (Greco-Italic/Lamboglia 2) Republican	Shoulder/ lower neck Upper body (below shoulder)	Hole (c.0.7 cm in diam) Hole (c.3 x 2 cm in diam)			FIG. 9 no. 1
Well PT6149	6 170/160-150 BC	Republican	Shoulder/ base of neck Lower body (just above base)	Hole (c.0.8 cm in diam) Hole (c.2.5 cm in diam)			FIG. 15 no. 6
Well PT6173	6 170/160-150 BC	Republican	Upper body (below shoulder) Middle body	Hole (c.1.8 cm in diam) c.4-6 holes (c.2-4 cm in diam)		X	FIG. 20

Structure	Z. Date (approx.)	Amphora type	Location		Deposit	Reused vessel	Accidental or modern?	Figure
Well PT6270	6 170/160-150 BC	Republican	Middle body	Holed (c.11 cm in diam)				FIG. 21 no. 1
Well PT6327	6 130-100 BC	Republican	Base (centre)	Hole (c.1 cm in diam)				
Deposit/dump (US7012)	7 170/160-150 BC	Republican	Lower body (just above base)	Hole (c.0.8 cm in diam)				FIG. 15 no. 8
Layer SL7020	7 170/160-150 BC?	Republican	Base (centre)	Hole (c.1 cm in diam)				
Well PT7051	7 130-100 BC	Ancient Tripolitanian Amphora	Middle body	Hole (c.1 cm in diam)		X		FIG. 9 no. 4
Well PT7264	7 130-100 BC	Republican	Shoulder/lower neck	Hole (c.1 cm in diam)				FIG. 16 no. 6
Pit FS7495	7 170/160-150 BC	Republican	Shoulder/lower neck Amphora disc	Hole (c.1.5 cm in diam) Hole (c.1 cm in diam)				
Pit FS7591	7 170/160-150 BC?	Republican	Base (centre)	Hole (c.2.9 cm in diam)				
Amphora layer/pavement (US8093)	8 150-130 BC?	Republican	Base (centre)	Drill hole (c.1.1 cm in diam) not pierced wall				
Pit FS8139	8 170/160-150 BC?	Republican	Base (centre)	Hole (c.1 cm in diam)				
Pit FS11058	11 130-100 BC?	Republican	Body	Hole (c.1 cm in diam)				
Amphora layer/pavement (US14088)	12 150-130 BC?	Republican	Shoulder/lower neck	Hole (c.1.2 cm in diam)				
Cleaning (US12260)	12 ?	Republican	Base (centre)	Hole (c.1.5 cm in diam)				
Layer (US12575)	12 ?	Republican	Lower body (just above base)	Hole (c.1.1 cm in diam)				
Well PT12004	12 170/160-150 BC	Republican	Base (centre)	Drill hole (c.2 cm in diam) not pierced wall				
Well PT12008	12 130-100 BC	Republican	Middle body	Two holes (c.2 cm in diam)				FIG. 19
Pit FS12015	12 200/180-150 BC	Republican	Base (centre)	Hole (c.2.2 cm in diam)				
Well PT12022	12 170/160-150 BC?	Republican	Lower body (just above base)	Hole (c.1.5 cm in diam)				FIG. 15 no. 9
Ditch FO12515	12 170/160-150 BC	Republican	Body	Hole (c.1.5 cm in diam)				
Pit FS12658	12 130-100 BC	Republican	Middle body	Holed (c.17.5, 18 cm)				FIG. 21 no. 2
Well PT14240	12 150-130 BC	Republican	Lower body (just above base)	Hole (c.2.5 cm in diam)				FIG. 17-18
			Lower body (just above base)	Hole (c.2.8 cm in diam)				FIG. 17
			Lower body (just above base)	Hole (c.2.3 cm in diam)				FIG. 17-18
			Middle body	Hole (c.3.7 cm in diam)				FIG. 17
			Lower body (just above base)	Hole (c.1 cm in diam)				FIG. 17

TABLE 2. Examples of pierced and holed amphorae from the literature.

Site	Type of amphora	Description	Placement	Interpretation	Recovered from drainage structure	Reference
Bulgaria						
Maritza 'Hebros'	Mendeian	Pierced with three holes (0.4 cm in diam)	Shoulder and middle body	Mending holes or decanting		Lozanov 2010, p. 93, Pl. 52 no. 4
Cyprus						
Kyrenia wreck	Several Rhodian amphorae	Pierced with holes	Body	From wear?		Lawall 2011b, p. 44
Nea Paphos 'Maloutena'	Egyptian	Pierced with two small holes	Upper neck	To allow fermentation gases to escape		Meyza and Bagińska 2013
Egypt						
Karnak	Rhodian	Pierced with small hole	Neck	To allow fermentation gases to escape?		Marouard 2007, p. 347, 356, Fig. 2
Mons Claudianus	Egyptian	Several amphorae pierced with small holes (c.0.5-1.0 cm in diam)	Upper neck	To allow fermentation gases to escape		Tomber 2006a
	Egyptian	Several circular holes (c.2-3 cm in diam)	Body	Lamp cover (?)		Tomber 2006b, pp. 299-300, Fig. 4.7
Thebes	LRA5	Pierced with small holes	Shoulder or body	Decanting		Adan-Bayewitz 1986, p. 92
Wadi Natrun	LRA 7s	Pierced with a small circular holes	Upper neck	To allow fermentation gases to escape		Konstantinidou 2010, pp. 958-959, Fig. 6 no. 22, Fig. 7 no. 26
Various sites	Egyptian	Often pierced with a small circular hole	Upper neck	To allow fermentation gases to escape		Dixneuf 2011, pp. 197, 200
France						
Agen 'Ermitage' well 41	Dressel 1A	Pierced with small circular hole (c.1-2 cm in diam)	Lower body	Decanting		Verdin et al. 2013, p. 130, Fig. 6
Aix-en-Provence 'Entremont'	Late Greco-Italic	Large circular hole	Upper body	Decanting		Gateau 1990, p. 172, Fig. 15
	Dressel 1A	Large circular hole	Middle of body	Decanting		
Aix-en-Provence 'Terrain Coq'	Dressel 1	Large circular hole (c.8-9 cm in diam)	Middle of body	Decanting		Poux 2004, p. 549, Fig. 286
	Several Dressel 1As	Pierced with small circular holes	Neck	Decanting?		Jacquet et al. 2009, p. 87
Amiens 'Palais des Sports'	Dressel 7-11	Pierced with three circular holes (c.2-2.5 cm)	Body	Decanting?		Marlière 2010, p. 346
Amiens 'ZAC Cathédrale'	Gauloise 4	Possibly pierced with two small holes (?)	Neck	To allow fermentation gases to escape		Laubenheimer and Marlière 2010 vol. 2, p. 406
Arles	LRA 3	Pierced with medium sized round hole	Shoulder/base of neck	Decanting		Pieri 1998, pp. 100-101
Avenches 'Musée Romain'	Gauloise 3	Medium sized round hole	Upper body	Decanting or water container		Laubenheimer 2005
Barzan 'Moulin-du-Fâ'	Aquitaine	Four small holes (c.1-2 cm in diam)	Shoulder	Water container		Berthault 2011, pp. 467, 469, Fig. 11
Blagnac 'Ganellou'	Dressel 1A	Pierced with two small holes	Upper body	?		Toledo Mur 2008, p. 252, Fig. 22

Site	Type of amphora	Description	Placement	Interpretation	Recovered from drain-age structure	Reference
Bordeaux 'du Grand-Hôtel'	Oberaden 74	Reused vessel (upper portion removed) pierced with small hole	Upper body below modified margin	Cord/rope hole so the vessel could be suspended		Chuniaud 2009, pp. 381-382, Fig. 6 no. 5
Bouc-Bel-Air 'Baou-Roux'	Dressel 1A	Large circular hole	Middle of body	Decanting		Gateau 1990, p. 172, Fig. 16
Carcaïssonne 'La Cavayère'	Dressel 1A	Pierced with small circular hole (c.1 cm in diam)	Middle of neck	?		Olmer 2012
Castres 'Lameilhé'	Dressel 1A	Two large circular holes (c.5 cm and c.7 cm in diam)	Middle and lower body	Decanting?		Séguier and Izac-Imbert 2013
Clermont-Ferrand 'Gandaillat'	Dressel 1A	Large circular hole (c.8 cm in diam)	Upper body	Decanting?		Loughton 2014
Clermont-Ferrand 'Le Brézet'	Dressel 1A	Pierced with small hole (c.0.5 cm in diam)	Lower body	Decanting?		Loughton 2014
Corent	Dressel 1A	Large circular hole	Upper body	Decanting?		Poux 2011, p. 128
Échiré 'chemin Chevaleret'	Dressel 1	Pierced with small hole (c.2 cm in diam)	Body sherd	For suspension/ fixed to wooden support?		Poux 2004, pp. 479-480, Fig. 249
Ensérune	Unspecified (Dressel 1?)	Holed	Middle of body	Decanting?		Fouet 1958, p. 126 note 51
Fos-sur-Mer 'l'Estagnon'	Dressel 12	Pierced with small hole	Upper neck	Decanting	X	Marty and Zaaoui 2009, p. 412
	Rhodian	Pierced with small hole (c.1-2 cm in diam)	Upper body below shoulder	Decanting	X	
	Dressel 20	Pierced with three small holes	Base	Decanting	X	
	Two Dressel 20s	Large rectangular/oval holes (c.15 x 23 cm)	Shoulder	Decanting	X	
	Dressel 5	Rectangular hole (c.7 x 8 cm)	Lower body	Decanting?	X	
	Dressel 7-11	Rectangular hole (c.9 x 10 cm)	Upper body below shoulder	Decanting	X	
	Dressel 7-11	Large oval hole (c.13 x 17 cm)	Shoulder	Decanting	X	
	Dressel 7-11	Rectangular hole (c.12 x 13 cm) and two small holes	Upper body and base of neck	Decanting?	X	
	Tripolitanian	Attempt to cut an opening	Shoulder	Decanting or reused as storage vessel?	X	
Fréjus 'Villa Romana'	Dressel 1B	Pierced with small elongate hole	Lower body	Planting pot or drainage function	?	Excoffon 2011, pp. 48-60
Gondole 'Les Chaumes'	Dressel 1	Pierced with small circular hole (c.2 cm)	Base (centre)	Funnel or weight?		Loughton in press 1
Lattes well PT471	Gauloise 4	Pierced with small circular hole (c.1.5 cm)	Base (centre)	?		Piqués et al. 2005, p. 101, Fig. 19 no. 12)
Lattes well PT348	Gauloise 1	Pierced with small circular hole (c.1 cm)	Base (centre)	?		Piqués et al. 2005, pp. 105-106, Fig. 21 no. 12-14)
	Gauloise 1	Pierced with three small circular hole (c.1 cm)	Base	Sieve?		Piqués et al. 2005, pp. 105-106, Fig. 21 no. 12-14)
	Gauloise 1	Pierced with four small circular hole (c.1 cm)	Base	Sieve?		Piqués et al. 2005, pp. 105-106, Fig. 21 no. 12-14)

Site	Type of amphora	Description	Placement	Interpretation	Recovered from drainage structure	Reference
Lyon 'L'ilot Cordier'	Dressel 1A	Pierced with small circular hole (c.2 cm)	Lower neck	Decanting?		Jacquet et al. 2009, p. 87, Fig. 3
	Dressel 1A	Pierced with small circular hole	Base (centre)	Funnel or weight?		Jacquet et al. 2009, p. 87, Fig. 3
Lyon 'Verbe Incarné'	Several Dressel 1As	Pierced with small circular holes	Neck	Decanting?		Jacquet et al. 2009, p. 87
Marseille 'La Bourse'	Greco-Italic	Pierced with small circular hole (c.1 cm in diam)	Body sherd	Weight		Bertucchi and Marangou 1989, p. 75, Fig. 22 no. 21a
Marseille 'fort Saint-Jean'	Key LXII	Pierced with small hole (c.2-3 cm)	Shoulder	Decanting		Guyon and Santa 2003
Messimy-sur-Saône	Gauloise 4	Pierced with small circular hole (1 cm in diam)	Base of neck	Decanting		Guyon and Santa 2003
Montpellier museum	Gauloise 1	Pierced with small hole	?	Decanting?		Guyon and Santa 2003
Mortantambe 'Cabariot'	Two Dressel 1Bs	Pierced with small circular holes (c.1.5 cm in diam)	Middle of neck	Decanting?		Toledo-Mur and Petitot 1998, p. 111, Fig. 73 nos. 43-44
Narbonne region	Gauloise 4s	Pierced with small holes	Upper neck	To allow fermentation gases to escape		SFEACAG 2010, p. 264 discussion
Narbonne 'La Nautique'	Dressel 2-4 Tarraconensis	Large circular hole (c.12-14 cm in diam)	Top of body	Decanting	X	Falguéra et al. 2012, p. 179
	Dressel 1B	Possibly pierced with small round hole (c.2-3 cm in diam)	Lower body	Decanting	X	Falguéra et al. 2012, pp. 47, 384
Narbonne 'Port-la Nautique'	Dressel 2-4 Tarraconensis	Pierced with small round hole (c.4 cm in diam)	Lower body	Decanting	X	Falguéra et al. 2012, p. 221
Nîmes 'Mas Vigier' tomb SP2483	Dressel 1C	Pierced with small round hole (c.3 cm in diam)	Lower body	Decanting or libation conduit?		Barberan et al. 2013, pp. 546, 548, Fig. 15 no. 6
Orléans 'îlot de la Charpenterie'	Beltran II	Pierced with small hole (c.3 cm in diam)	Top of base	Decanting		Couvin 2008, p. 417, Fig. 21 no. 20
Paris region	Local regional amphorae	Pierced with small hole (c.0.5-1 cm in diam)	Upper neck	To allow fermentation gases to escape		Bertin 2010, p. 262, Fig. 12
Puy de Dôme 'col de Ceyssat'	Local regional amphora (?)	Pierced with small round hole	Lower body	For suspension?		Trescarte 2007, p. 373, Fig. 6 no. 7
Rodez 'caserne Rauch'	Dressel 1	Slightly irregular hole (c.7 x 5 cm)	Lower body	Decanting?		Gruat et al. 1991, p. 68, Fig. 6 no. 5
	Dressel 1	Pierced with small hole (c.2 cm in diam)	Lower body	Decanting?		Gruat et al. 1991, p. 72, Fig. 10 no. 1
Saint-Georges-de-Reneins	Gauloise 4	Pierced with small circular hole (1 cm in diam)	Base of neck	Decanting		Guyon and Santa 2003
Saint-Mitreles-Remparts 'Saint-Blaise'	Greco-Italic	Pierced with small hole (?)	Base of neck	Decanting?		Gateau 1990, p. 167, Fig. 6
Toulouse 'caserne Niel' well 1	Dressel 1A	Circular hole (c.5-6 cm in diam)	Middle of body	Decanting		Fouet 1969, p. 75
Toulouse 'caserne Niel' well 2	Dressel 1A	Circular Hole (c.10 cm in diam)	Middle of body	Decanting		Fouet 1969, p. 75, Fig. 5 no. 50
Toulouse or Vieille-Toulouse	Dressel 1A	Large rectangular hole	Middle body	Decanting		Benquet 2002, Fig. II-11

Site	Type of amphora	Description	Placement	Interpretation	Recovered from drain-age structure	Reference
	Dressel 1	Two round holes (c.4-6 cm in diam)	Middle of neck and base of neck/shoulder	Decanting?		Benquet 2002, Fig. II-11
Vaires-sur-Marne 'L'île-Ronde'	Dressel 1	Pierced with hole	?	?		Bulard and Drouhot 1981
Valence	Dressel 1B	Pierced with a small hole	Body sherd	?		Maza and Silvino 2011, p. 474
Vieille-Toulouse	Two Dressel 1s	Pierced with small holes (c.3 cm in diam)	Middle body	Decanting?		Fouet 1958, p. 126
	Dressel 1	Pierced with two small holes (c.0.5 cm in diam)	On opposing side of the middle body	Decanting?		Fouet 1958, p. 126
Vieille-Toulouse well PT1048	Dressel 1	Pierced with linear hole (c.2.5 cm x 0.6 cm)	Top of base	Decanting		Loughton in press 2
	Dressel 1	Circular hole (c.11 cm in diam)	Middle body	Decanting		
	Dressel 1	Pierced with small hole (c.2.5 cm in diam)	Top of base	Decanting		
	Dressel 1	Pierced with hole (c.2.3 cm in diam)	Centre of base	Reuse as white mineral deposit		
Villeneuve-sur-Lot 'Eysses'	Dressel 20	Pierced with four small holes	Base	Decanting		Berthault 2010
Vismes-au-Val 'les Dix-Sept'	Gauloise 4 (Lyon)	Pierced with five holes	Three on the shoulder and two on the base	Recovered from a tomb, modification for ritual purposes (?)		Laubenheimer and Marlière 2010 vol. 2, pp. 454-455
Germany						
Dangstetten	Dressel 12	Pierced with small hole (c.1.5 cm in diam)	Upper body below shoulder	Decanting		Ehmig 2010, Fig. 22
Hofheim 'Erdlager'	Dressel 7-11	Possibly pierced with two small round holes (c.2-2.5 cm in diam)	Lower body	Decanting		Ehmig 2007, Fig. 59 no. 704
Greece						
Athens	Six LRA 3s	Pierced with oblate or round holes	Shoulder	Water containers		Lang 1955 p. 286, Pl. 79; Peña 2007, p. 136
	Forlimpopoli	Pierced with oblate hole (c.5-8 x 2-4 cm)	Shoulder	Water container		Peña 2007, pp. 136-137, Fig. 6.3
	Keay 52	Pierced with oblate hole (c.5-8 x 2-4 cm)	Shoulder	Water container		Peña 2007, pp. 136-137, Fig. 6.3
	Unspecified	Pierced with oblate hole (c.5-8 x 2-4 cm)	Shoulder	Water container		Peña 2007, p. 136
Corinth	Beltran II	Pierced with several pairs of small slots	Neck	?		Slane 2011, pp. 98-99, Fig. 5
	Corinthian A	Pierced with small hole and lead stopper	Middle body	Decanting		Slane 2011, p. 98
	Dressel 6	Pierced with two large circular holes	Body	Pipeline connector or settling basin		Slane 2011, p. 102, Fig. 11
	Gaza amphora	Pierced with small hole (0.5 cm in diam)	Lower body	Decanting		Slane 2011, pp. 98-99, Fig. 3a
	Kapitän II	Pierced with small hole	Neck	Reused as bellows		Slane 2011, pp. 101-102, Fig. 9a-b
	Palestinian amphora	Pierced with small hole	Shoulder	Aid decanting via mouth by air intake		Slane 2011, pp. 98-99, Fig. 3b

Site	Type of amphora	Description	Placement	Interpretation	Recovered from drainage structure	Reference
	Unspecified	Several amphorae pierced with large circular holes	Middle body	Pipeline connector or settling basin		Slane 2011, pp. 101-102, Fig. 10a-b
Israel						
Ashkelon	Ancient Tripolitanian amphora (?)	Pierced with two rows of three holes or narrow slits	Body	Drainage function or decanting?	?	Johnson 2008, pp. 145-146 no. 422
Caesarea Maritima	10 LRAs	Pierced with one or more small holes (0.4-0.6 cm in diam)	Shoulder or upper body	Decanting		Adan-Bayewitz 1986, p. 92
	Four LRAs	Pierced with small hole (c.0.4 cm in diam)	Shoulder	Decanting		Adan-Bayewitz 1986, p. 98
	LRA	Two small holes plugged with lead (c.2.0 cm and c.1.0 cm in diam)	Shoulder	Decanting		Adan-Bayewitz 1986, p.100
Italy						
Adria	Corinthian B	Pierced with small hole	Middle body	Decanting or libation conduit?		Sacchetti 2012, p. 119, Fig. 72
	Greco-Italic	Pierced small hole	Middle body	Decanting?		Toniolo 2000, p. 13, Fig. 2
	Greco-Italic	Pierced small hole	Middle/lower body	Decanting?		Toniolo 2000, p. 111, Fig. 259
	Greco-Italic	Pierced small hole	Middle body	Decanting?		Toniolo 2000, p. 113, Fig. 267
	Greco-Italic or Lamboglia 2	Pierced with small hole	Middle body	Accidental or modern?		Toniolo 2000, p. 170, Fig. 406
Altino	Dressel 43	Pierced with round hole	Middle body	Decanting?		Toniolo 1991, p. 82, Fig. 153
Ancona 'Porto Recanati'	Forlimpopoli	Pierced with small hole	Base	Libation conduit		Peña 2007, pp. 146-147
Bacoli wreck	Unspecified	Holed	Body?	From wear or reused as water container?		Lawall 2011b, pp. 44-45
Forcello	Samos-Milet/1 Lawall	Pierced with small hole (c.0.5 in diam)?	Middle of neck	Decanting or libation conduit?		Sacchetti 2012, p. 189, Pl. 23
Lipari 'contrada Diana' tomb 2082	Etruscan	Medium sized round hole	Shoulder	Libation conduit?		Cavalier 1985, pp. 54-55, Pl. 15
Milan 'Università Cattolica'	At least six Dressel 6s	Medium to large circular or oval holes	Lower body/underside of base	Decanting or drainage function?	X	Bruno 1998
Naples	Calabrian amphora?	Pierced with round hole (c.5 cm in diam)	Top of neck below the rim	Accidental or modern?		Arthur 1989, p. 137, Fig. 2 no. 11
Padova	Lamboglia 2	Large circular hole	Shoulder	Decanting	X	Pesavento-Mattioli 1992, Fig. 77
	Dressel 6A	Large circular hole	Upper body below shoulder	Decanting	X	Pesavento-Mattioli 1992, Fig. 90
Potentia tomb 18	Forlimpopoli	Small circular hole	On underside of base	Libation conduit		Monsieur 2007, p. 139, Fig. 5
Pompeii	Beltran IIs and/or Dressel 7-11s	Large squarish or rectangular holes	Neck or Body	Decanting		Peña 2007, pp. 68-69
	Dressel 2-4	Large circular hole (c.8-10 cm in diam)	Upper body	Urinal		Peña 2007, p. 139, Fig. 6.4
Pompeii 'Garden of Hercules'	Unspecified	Several holes	Base	Planting pot		Kenawi et al. 2012, p. 217
Rome 'Nuovo Mercato Testaccio'	African Ostia XXIII	Small circular hole (c.2-3 cm in diam)	Lower body	Decanting?		Contino 2013, p. 328, Fig. 8

Site	Type of amphora	Description	Placement	Interpretation	Recovered from drainage structure	Reference
Rome 'Palatine Hill'	Palatine East Amphora 3	Pierced with small circular hole	Lower body just above the base	Planting pot?		Peña 1999, pp. 80-81, Fig. 13 no. 26
Rome 'San Francesco a Ripa'	African IIIC	Pierced with small hole	Lower body	Decanting?	X	Filippi et al. 2014, pp. 1006, 1010, Fig. 8.2
Secca dei Mattoni wreck	Two Dressel 1s	Holed	Body?	From wear or reused as water containers?		Lawall 2011b, pp. 44-45
Tivoli 'Hadrian's villa'	Schöne-Mau XXXV/Ostia III and other types not specified	Pierced with three circular holes	On shoulder or body	Planting pots		Kenawi et al. 2012, p. 218
Vicenza	Lamboglia 2	Pierced with small hole	Lower body just above the base	Decanting	X	Mazzocchin 2013, p. 67, Fig. 78
	Dressel 6A	Pierced with small hole	Lower body just above the base	Decanting?	X	Mazzocchin 2013, p. 90, Fig. 113
	Dressel 6B	Pierced with small hole	Top of base	Decanting	X	Mazzocchin 2013, p. 81, Fig. 101
	Tripolitanian I	Pierced with two small holes	Upper neck and below rim	Decanting?	X	Mazzocchin 2013, p. 82, Fig. 102
Lebanon						
Beirut	Beirut amphorae	Often pierced with a small circular hole	Neck	To allow fermentation gases to escape		Reynolds 2005, pp. 569, 598, Fig. 81
Libya						
<i>Euesperides</i>	Corinthian B	Pierced with five small holes	Body	Repair holes		Göransson 2007, pp. 113-114 nos. 202-205
Portugal						
<i>Bracara Avgvstaa</i>	Beltran 72 similis	Pierced with small circular hole (c.0.8 cm in diam) and rectangular slit (c.2 x 0.8 cm)	Lower body	?		Morais 2000, pp. 697, 699, Fig. 1
Sicily						
Portopalo di Capo Passero wreck	Greco-Italic	Pierced with round hole	Upper body	From wear or reused as water container?		Olcese et al. 2013, p. 492, Fig. 8
Skerki Bank 'Isis' wreck	Keay 52	Round hole (c.3 cm in diam)	Shoulder	Water container		Peña 2007, pp. 137-138; Freed 1994
	Keay 52	Irregular hole (c.1 x 2 cm)	Shoulder	Water container		Peña 2007, pp. 137-138; Freed 1994
Spain						
Cádiz 'Los Cargaderos-San Fernando'	Dressel 2-4 Tarraconensis	Large sized round hole (c.9 cm in diam)	Middle of body	Decanting	X	Bernal 2008, pp. 332-334, Fig. 7
	Beltran IIA	Large rectangular aperture (c.8 x ? cm)	Lower body	Decanting	X	Bernal et al. 2005, p. 207, Fig. 9 no. 1
	Beltran IIB	Slightly irregular medium sized round hole (c.5-6 cm in diam)	Lower body	Decanting	X	Bernal et al. 2005, p. 207, Fig. 9 no. 3

Site	Type of amphora	Description	Placement	Interpretation	Recovered from drainage structure	Reference
El Sec wreck	Punic amphora	Holed	Body?	Wear hole or reused as water container?		Lawall 2011b, pp. 44-45
Emporion	Several Maña Ds	Medium sized circular holes	Lower body	Recovered from cistern		Pascual-Berlanga and Ribera-Lacomba 2013, p. 287, Fig. 68
Escombreras III wreck	Haltern 70	Pierced with small hole	Middle body	Wear or accidental?		Garrote and Marimon 2004, p. 87, Fig. 49
Garraf 'Sitges'	Dressel 20	Large round hole (c.13 x 11 cm)	Upper body	Decanting		Berni-Millet 1998, pp. 155, 177, Fig. 26
Switzerland						
Augst	?	Large squarish hole	Body	Decanting or reused as storage vessel		Callender 1965, p. 36
	Beltran II	Medium sized round hole (c.4 cm in diam)	Upper body/shoulder	Decanting		Martin-Kilcher 1994, Pl. 208 no. 4572
	Haltern 70	Large circular hole (c.9 x 11 cm)	Middle body	Decanting		Martin-Kilcher 1994, Pl. 177 no. 3781
		Pierced with small round hole (c.2-2.5 cm in diam)	Upper body/shoulder	Decanting		Martin-Kilcher 1994, Pl. 181 no. 3866
Augst or Basel	Beltran I	Large rectangular hole (c.8 x 5 cm)	Body	Decanting or reused as storage vessel		Callender 1965, Pl. IVb
Basel-Gasfabrik	Dressel 1	Pierced with small round hole (c.0.5 cm in diam)	Body sherd/disc	Spindle-whorl		Poux 1997, p. 167, Fig. 23c
Windisch	?	Large squarish hole	Body	Decanting or reused as storage vessel		Callender 1965, p. 36
Tunisia						
Carthage 'avenue du President Habib Bourguiba, Salamambo'	Several African amphorae	Pierced with small holes (c.0.5 cm in diam)	Body sherds/discs	Spindle-whorls		Fulford and Peacock 1984, appendix 2
<i>Pupput</i> PP2342.5	African I	Pierced with one medium sized hole (c.10 cm in diam)	Shoulder	Decanting		Bonifay 2004a, p. 469, Fig. 264
Tomb 203	Hammamet 2	Pierced with one small hole (c.1-2 cm in diam)	Lower body	Decanting		Bonifay 2004b, p. 207, Fig. 8
Tomb 402	African IIA	Pierced with one small hole (c.1-2 cm in diam)	Lower body	Decanting		Bonifay 2004a, p. 108, Fig. 57
Tomb 406	Hammamet 1A	Pierced with one small hole (c.1-2 cm in diam)	Tip of base	Decanting		Bonifay 2004b, p. 201, Fig. 4
	Hammamet 1C	Pierced with two small holes (c.1-2 cm in diam)	Lower body	Decanting		Bonifay 2004b, p. 202, Fig. 5
Tomb 425	African I	Pierced with one small hole (c.1-2 cm in diam)	Lower body	Decanting		Bonifay 2004a, p. 106, Fig. 56
	African I	Pierced with one medium sized hole (c.10 cm in diam)	Shoulder	Decanting		Bonifay 2004a, p. 469, Fig. 264
Tomb 615	African IIA	Pierced with one small hole (c.1-2 cm in diam)	Lower body	Decanting		Bonifay 2004a, p. 109, Fig. 58
	Hammamet 1C	Pierced with one small hole (c.1-2 cm in diam)	Lower body	Decanting		Bonifay 2004b, p. 203

Site	Type of amphora	Description	Placement	Interpretation	Recovered from drain-age structure	Reference
Tomb 642	African IIA	Pierced with two small holes (c.1-2 cm in diam)	Lower body	Decanting		Ben-Abed and Griesheimer 2004, p. 151, Fig. 103 Ben-Abed and Griesheimer 2004, p. 151, Fig. 103 Ben-Abed and Griesheimer 2004, p. 151, Fig. 103 Ben-Abed and Griesheimer 2004, p. 159, Fig. 112 Ben-Abed and Griesheimer 2004, p. 25, Fig. 9 Ben-Abed and Griesheimer 2004, p. 25, Fig. 9 Bonifay 2004b, p. 207, Fig. 9 Bonifay 2004a, p. 108, Fig. 57 Bonifay 2004a, p. 108, 568, Figs. 57, 264 Bonifay 2004a, p. 95, Fig. 50 Bonifay 2004a, p. 106, Fig. 56 Bonifay 2004b, p. 201, Fig. 4 Bonifay 2004a, p. 150, Fig. 82
	Bonifay type 30	Pierced with one small hole (c.1-2 cm in diam)	Lower body	Decanting		
	Hammamet 2	Pierced with two small holes (c.1-2 cm in diam)	Lower body	Decanting		
Tomb 653	African I	Pierced with one small hole (c.1-2 cm in diam)	Lower body	Decanting		
Tomb 700	African I	Pierced with one medium sized hole (c.7-8 cm in diam)	Lower body	Decanting		
	African I	Pierced with one medium sized hole (c.5 cm in diam)	Upper body	Decanting		
Tomb 876	Hammamet 2	Pierced with one small hole (c.1-2 cm in diam)	Lower body	Decanting		
Tomb 1007	African IIA	Pierced with one small hole (c.1-2 cm in diam)	Lower body	Decanting		
Tomb 1043	African II	Pierced with large hole (c.15-20 cm in diam)	Upper body	Decanting		
Tomb 1058	Hammamet 2	Pierced with one small hole (c.1-2 cm in diam)	Upper body	Decanting		
Tomb 1213	African I	Pierced with two small holes (c.1-2 cm in diam)	Upper body	Decanting		
Tomb 1308	Hammamet 1B	Pierced with two small holes (c.1-2 cm in diam)	Lower body and tip of base	Decanting		
Tomb 2376	Two Dressel 30s	Pierced with large hole (c.10 cm in diam)	Shoulder	Decanting or water container?		
Turkey						
Elaiussa Sebaste	LRA 1	Medium sized hole	Shoulder	Water container		Ferrazzoli and Ricci 2010, p. 823, Fig. 4 no. 15
Ephesus "Terrace House 2"	LRA 3	Linear hole	Middle body	?		Bezczeky 2013, Pl. 56 no. 4
	Ephesus 56	Small round hole	Middle body	?		Bezczeky 2013, Pl. 56 no. 6
UK						
Silchester	Not specified	Pierced and plugged with lead	?	?		Callender 1965, pp. 43-44
Ukraine						
Cherson	Lesbos amphora	Pierced with medium sized circular hole	Upper body/shoulder	From wear?		Lawall 2011b, p. 44
Kerch	Unidentified African amphora	Pierced with one small hole (c.0.5 cm in diam)	Lower body	Decanting		Smokotina 2014, p. 76, Fig. 6 no. 41
Olbia	Various Greek vessels	Pierced with small holes (c.1 cm in diam)	Body sherds	Net or loom weights		Rusjaeva 2010, p. 515
Panskoye	Various Greek vessels	Pierced with small holes	Body sherds and handle fragments	Net or loom weights		Handberg 2011, p. 62

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TURNING OVER A NEW LEAF

LEAF IMPRESSIONS OF *STYRAX OFFICINALIS* L. AND *VITIS VINIFERA* L. ON LATE ROMAN SAGALASSOS AMPHORAE

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Introduction

During the 2005 campaign at Sagalassos¹, a ceramic object of considerable interest was encountered: a rim fragment of a Sagalassos Amphora, found in a deposit datable to phase 8 (ca. 450/475-550/575) of the relative chronology of Sagalassos Red Slip Ware (hereafter SRSW), and bearing the partial impression of a leaf ‘folded’ over its rim. Initially it was deemed the result of an accidental event: at some point during the drying process, while the clay was still rather wet, a leaf must have fallen from a tree and attached itself to the amphora, before it was eventually removed by the potter, or burnt in the kiln. Further specimens, however, were found between 2008 and 2011, and the earlier assumption of a curious oddity was quickly dismissed; a more systematic review of previously collected material was initiated in an attempt to find other examples. Whilst Appendices 1 to 4 capture the backgrounds of species identification of the leaf impressions, technical addenda and the catalogues of the samples, following a preliminary report², this paper first discusses the Sagalassos Amphorae, then presents the characteristics of the leaf

1. Waelkens 2002, 2004; Waelkens and Loots 2000; Vionis *et al.* 2009.
2. Bes and Vanhecke 2014.

impressions, and concludes by offering thoughts on their possible purpose(s) and wider significance. All dates are AD unless otherwise indicated.

The Sagalassos Amphorae

BACKGROUND

More than 20 years of multidisciplinary scientific activity at Sagalassos (Ağlasun, Burdur Province, Turkey) has recorded many facets of the manufacturing process of SRSW (Sagalassos Fabric 1), from the quarrying of the clay raw material to a notion of its production organisation and distribution³. Vessels of Sagalassos Fabric 4 constitute the second largest proportion in deposits excavated in the urban area. It is a heterogeneous fabric group mostly used for the manufacture of cooking wares and amphorae, and to a lesser extent also for the production of jugs, bowls and so forth⁴. Differences can be noticed, for instance, in the mica or lime content, yet it is impossible to differentiate *sub*fabrics macroscopically⁵. Fabric 4 is especially prominent in late 4th- to 7th-century deposits, although the clays were already being extracted (at least) from the Classical-Hellenistic period onwards, and Early and Mid-Roman cooking wares have now also been archaeometrically coupled to these clay sources⁶. The original idea that Fabric 4 vessels might have been manufactured at a number of settlements (farms, etc.) elsewhere within the territory stemmed from the complete absence of evidence for production of Fabric 4 vessels at Sagalassos as well as the macroscopically visible differences in clay composition. In Antiquity, it was not uncommon for pottery production to go hand in hand with agricultural settlements⁷. Sherd and clay analyses have now shown that the Fabric 4 clay (group) occurs naturally in the wider Ağlasun Valley, to the south and southwest of Sagalassos, particularly its central part⁸. We may assume that the workshop(s) is/are to be sought in the (close) proximity of these clay sources, probably at a (walking) distance no more than about 5 km, which generally falls well within reach of the (agricultural) sites that would have been located in this valley⁹. This/-ese workshop(s), however, has/have not yet been identified archaeologically. The surface assemblage of several sites contains a clear Late Roman component

3. Poblome 1999, in press; Murphy and Poblome 2011, 2012.
4. Degeest 2000, pp. 84-85, 149-165, Fig. 157-200; Corremans *et al.* 2010.
5. Neyt *et al.* 2012; pers. obs.
6. Neyt *et al.* 2012, esp. 1304.
7. Mackensen 1993; Lewit 2011, pp. 318-322; Jackson *et al.* 2012.
8. Neyt *et al.* 2012; Poblome in press; Kaptijn *et al.* 2013.
9. Neyt *et al.* 2012, p. 1302; Arnold 1989, pp. 32-57, esp. 38-51, Fig. 2.5.

and the combined results of archaeological survey, geophysical prospection and surface pollution study of one such site, Çatal Oluk, located in the foothills below Sagalassos, strongly argue for the manufacture of pottery, yet here the manufacture of brick and tile is postulated¹⁰. In general, however, only a fairly small part of the Ağlasun Valley has been surveyed, and consequently no conclusive answers can be formulated on diachronic settlement patterns and land use, though the current (Late Roman) view is one of a landscape wherein isolated farmsteads, or several farmsteads grouped together, existed.

Sagalassos Amphorae emerged in the second half of the 4th century against a background of geopolitical changes that came about following the foundation of Constantinople in 330 as capital of the Eastern Roman Empire¹¹. This not only caused a partial reorientation of existing exchange patterns¹², but also created new incentives for agro-economic exploitation (in the east). Wealthy members of Sagalassian society embraced these opportunities and invested in the production of agricultural surpluses¹³ albeit on an apparently modest scale: no Sagalassos Amphorae are attested (or recognised) outside its territory¹⁴. Handles that are morphologically similar, and presumably contemporaneous yet made in (a) different fabric(s), have been found recently in the Bereket Valley, located on the southwestern fringes of the territory of Sagalassos¹⁵.

The contents of Sagalassos Amphorae are still largely unknown. Residue analyses have yielded markers for wine, olive oil and walnut oil, yet the sample size does not allow to generalise these results, nor to ponder about their socio-economic significance. Remarkably, most of the fragments for which markers for vegetal oils were found contained traces of pitch, giving reason to argue that the 'classical' dogma of pitch=wine no longer always holds true¹⁶. More generally, of course, vessel reuse needs to be reckoned with. Furthermore, the discovery of leaf impressions on Sagalassos Amphorae offers intriguing yet tentative indications for the possible exploitation of certain agricultural resources, and possibly even their combined use.

10. Dirix *et al.* 2013.

11. Poblome *et al.* 2008, pp. 1002-1003; see the entry 'Sagalassos' in the University of Southampton's 'Roman Amphorae: a Digital Resource' (http://archaeologydataservice.ac.uk/archives/view/amphora_ahrb_2005/, accessed 17 March 2015).

12. Bes and Poblome 2009; Bes in press.

13. Poblome *et al.* 2008.

14. Pers. comm. N. Firat and S. Özdem for Perge.

15. Kaptijn *et al.* 2013, pp. 86-88, Fig. 11-12.

16. Romanus *et al.* 2009.

MORPHOLOGY & DECORATION

Degeest's¹⁷ H-types (H110-140, 160) have now been reclassified as P-types, and whilst the typology of Sagalassos Amphorae is discussed elsewhere¹⁸, highlighting their typological characteristics serves the general purpose. First, all types have a more or less globular body, originally thought to be inspired by early versions of the well-known Late Roman Amphora 1 (LRA 1)¹⁹. However, that Sagalassos Amphorae are basically flat-based is but one morphological feature that implies a more nuanced view²⁰, and possibly the inspiration of the Sagalassos Amphorae needs to be (partly) sought elsewhere. The neck in general is cylindrical and mostly 5-7 cm high, and the rim diameter ranges from ca. 6 to 13 cm: plain, triangular and grooved rim profiles can be identified. As complete examples are rare, we remain largely uninformed about precise measurements concerning their volume and height. The capacity of two complete specimens comprises 12.5 and 15.6 litres respectively. As for height and greatest width, one example of type 4P100 has a height of ca. 42 cm and a width around the lower shoulder of some 30 cm; the height of an example of type 4P120 is ca. 38 cm, with a width of ca. 29 cm measured half-way down the vessel and below the shoulder. The general impression is that the variety in height and width is fairly restricted.

The handles are in fact used as the main differentiating feature in building the typology. They are, without much exception, curved and run from the rim or halfway down the neck to the lower shoulder. Circular, ovoid, and multiple- and single-ridged handle sections are the most commonly encountered: most distinct are the torted (type 4P100) (FIG. 1) and the grooved (type 4P120) handles, both circular in section. No clear-cut association between a particular handle section and a particular rim profile can be demonstrated thus far, nor for that matter between the morphological characteristics of the different variants and the leaf impressions proper.

Sagalassos Amphorae are generally devoid of any 'real' decoration or surface finish (the lack of ribbing/ridging also rather sets them apart from LRA 1), though many fragments present a smoothed exterior surface. Some examples are covered by a thinly applied wash – a (thin) layer of rather watery clay²¹ – that partially and irregularly covers the upper half of a vessel. Graffiti and

17. Degeest 2000, pp. 160-163.

18. Poblome *et al.* 2008; Corremans *et al.* 2010.

19. Poblome *et al.* 2008, pp. 1003-1006.

20. Pers. comm. P. Reynolds.

21. Rye 1981, p. 41.

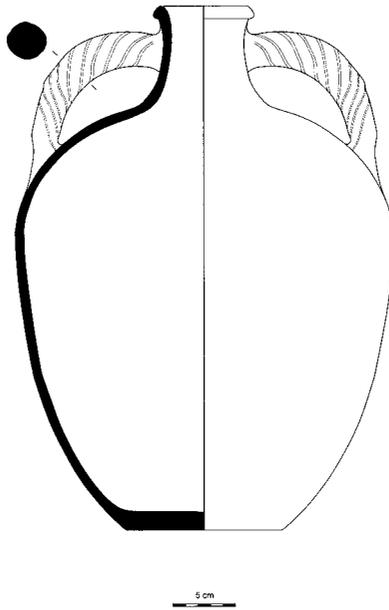


FIG. 1. A complete specimen of a Sagalassos Amphora type 4P100 (© Sagalassos Archaeological Research Project).



FIG. 2. Stamp on the handle of a Sagalassos Amphora, possibly reading E[A or Δ]N[1 or 2 letters?]/OY. The second letter could, though unlikely, also be an 'Λ'; the fourth and/or fifth letter(s) might include an 'T' (perhaps preceding 'OY', then readable as 'IOY'); also, two letters may be ligatured, though this cannot be made out with any confidence (© Sagalassos Archaeological Research Project).

especially stamps are rare, and since only one out of the seven documented (partially preserved) graffiti was made *ante cocturam* we cannot unequivocally associate these with, for instance, content. The handful of stamps that is known thus far are placed at the lower end of the handle or, otherwise, on the handle proper; their reading is not always clear however (FIG. 2). Possibly these represent different workshops, or potters, yet the very small quantity does not allow to investigate, for example, a relation with certain morphological features.

The Leaf Impressions

CHARACTERISTICS

Fragments of 29 different Sagalassos Amphorae with leaf impressions have hitherto been recognised, 18 (TABLE 1) of which were studied in detail, and are presented in Appendices 2 to 4. Basically, the impressions do nothing more than demonstrate that (some) people folded leaves over the rims of (some) Sagalassos Amphorae. However, exactly because the impressions share a number of particular features it is our conviction that they were made intentionally, even if their purpose(s) presently elude(s) us; Appendix 1 more generally explores the methodology of species identification based on vegetative features.

1. The mostly fragmented nature of the amphorae means that generally only one impression is attested, usually incomplete; a complete rim probably bore more than one. As a matter of fact, one rim bears two leaf impressions (Cat. 2, FIG. 3; FIG. A.3 in Appendix 2), and the impressions of possibly three leaves cover the entire rim of the only completely preserved specimen (Cat. 11, FIG. 4; FIG. A.12a-d in Appendix 3), where two leaves appear to be positioned against one another with their petioles;
2. The surfaces where the leaves were impressed often show signs of flaking, like paint can tend to peel off (FIG. 5). The entire top of the amphora was perhaps dipped into a liquid clay mixture into which the leaves were subsequently impressed. This was a finer clay than that of the amphora body, and due to its finer quality veins up to the 3rd order can be discerned on some fragments. This can be seen very well on Cat. 2 (FIG. 3; FIG. A.3 in Appendix 2); here, this additional layer of clay also covers the outer groove of the rim's profile. On all the studied fragments this additional layer is damaged, thus revealing its presence. The damaged parts are irregular in form and locally often show involuted margins of the intact parts of the 'slip' layer around the damaged spot. The flaking can possibly

TABLE 1: Contextual-chronological and typological/morphological information on the 18 *Sagalassos Amphorae* with leaf impressions discussed in this article; numbers in the first column correspond with the individually numbered impressions throughout the text and in the Appendices 2-4 (© Philip Bes and Leo Vanhecke; *Sagalassos Archaeological Research Project*).

Cat.	Genus	Context	Context Date	Type	Rim Profile	Rim Diam (in mm)	Handle Section	Handle Attachment
1	<i>Syrax officinalis</i> L.?	2000-B3-197	550-575/600	4P	Thickens toward the top; the upper surface steps up toward the interior	110	-	-
2	<i>Syrax officinalis</i> L.	2004-NEG-83 (a)	550-575/600	4P130?	Plain; flat on top?, thickened upper part	103 (interior)	Multiple-ridged; ovoid; folded on underside	To upper rim
3	cf. <i>Syrax officinalis</i> L.	2004-NEG-83 (b)	550-575/600	4P	Triangular rim (similis to number 4)	ca. 65	-	To neck
4	<i>Syrax officinalis</i> L.?	2004-NEG-83 (c)	550-575/600	4P	Triangular rim (similis to number 3)	ca. 70	-	To neck
5	<i>Syrax officinalis</i> L.	2006-MAC-156-338	Perhaps 550-600, up to 625	4P	Plain; bevelled towards interior	-	-	-
6	cf. <i>Syrax officinalis</i> L.	2000-LA-175	575-into 7th century	4P	Turns slightly outward; upper is slightly thickened; grooved	90	Circular probably	To neck
7	<i>Vitis vinifera</i> L.?	2005-MAC-23	450/475-550/575, 1x post-550/575; some residual	4P	Plain; two grooves just below exterior rim	-	-	-
8	<i>Vitis vinifera</i> L.	2003-NEG-68	500-600, perhaps into 7th century	4P	Plain; rounded top, thickened upper part	100	-	-
9	<i>Vitis vinifera</i> L.??	2004-NEG-57	575/600-625/640	4P	Plain; flat on top, thickened upper part	100	-	-
10	<i>Vitis vinifera</i> L.?	2008-FG1-86-127	575-700 (deposition ca. 1 century later)	4P	Bevelled towards interior	130	Slightly multiple-ridged; ovoid	To upper rim

Cat.	Genus	Context	Context Date	Type	Rim Profile	Rim Diam (in mm)	Handle Section	Handle Attachment
11	<i>cf. Vitis vinifera</i> L.	2001-DA2-80 (a)	400-700	4P100	Turns outward, with outer flange just below the lip: 'triangular'	80-85	Torsed, circular	To neck
12	<i>cf. Vitis vinifera</i> L.	2001-DA2-80 (b)	400-700	4P100	Turns outward, with outer flange just below the lip: 'triangular'	ca. 90	Torsed, circular	To neck
13	-	1991-DT-381	400-700	4P100	With interior ledge	90	Torsed, circular	To neck
14	-	2000-B1-122	525/550-600?	4P	Thickens to the top, rounded and bevelled toward the interior	70	-	-
15	-	2000-LA-125 (a)	575-into 7th century	4P	Thins to the top and flaring out, with a triangular section	ca. 110	-	To neck
16	-	2000-LA-125 (b)	575-into 7th century	4P	Neck flares out slightly, triangular rim, upper surface steps up towards the interior	90	-	To neck
17	-	2004-LA-1	450/475-550/575, but little Late Roman SRSW; residual Early Roman	4P	Neck flares out slightly, with a flange just below the rim	ca. 90	-	To neck
18	-	2009-UAN-5-5	575-625; residual Late Hellenistic-1st century	4P	Flanged rim	-	-	-



FIG. 3. Cat. 2: Impressions of the underside of a leaf of *Styrax officinalis* L. (also see FIG. A.3 in Appendix 2) (© Sagalassos Archaeological Research Project).



FIG. 4. Cat. 11: the single completely preserved top of a Sagalassos Amphora which bears leaf impressions (also see FIG. A.12a-d in Appendix 3) (© Sagalassos Archaeological Research Project).

be explained by “differential shrinkage”: the vessel body had already dried to a considerable degree prior to the application of the additional layer, which resulted in less than ideal circumstances for the second layer to attach itself fully and for both to dry and shrink evenly²². This damaged outer clay layer is (one of) the reason(s) that the leaf impressions are often very incomplete, thus probably also explaining why in general so few impressions are recognised, which in turn implies that (many?) more amphorae may have borne leaf impressions. Indeed, only tiny patches of some impressions are preserved. We can discount that this was done post-firing and thus that the impressions were air-/sun-dried, simply because of the fact that the impressions would have dissolved in water while being washed, and probably have crumbled in the process. All in all this points to an additional, specific step in the manufacturing process;



FIG. 5. Cat. 12: a fragmentary impression of a leaf of *Vitis vinifera* L. (© Sagalassos Archaeological Research Project).

3. In general, the (additional layer of) clay was in a condition favourable for leaves to be impressed into;
4. None of the examined fragments with leaf impressions could unequivocally clarify the order of actions concerning the application of the wash and the impressing of leaves. However, fragments that preserve the handle indicate that the leaves were impressed after the handles were attached to

22. Rye 1981, p. 41.

the rim or neck. It thus seems legitimate to suppose that the leaf impressions were fabricated during the final stage of the whole procedure.

5. It was the underside of the leaf, where veins are most pronounced, that was folded over the rim. Also, given the generally sharp impression of the major and minor veins, it appears as if the impressing was done firmly, on both sides of the rim, thus we can do away with the idea of these impressions being (co)incidental (Cat. 12, FIG. 5);
6. The central vein follows the lip, though because of the latter's curvature this vein can never truly follow the rim (Cat. 2, FIG. 3). Nevertheless, this suggests that the potter thus made the most of the surface of each leaf. The leaf was subsequently 'folded'. This is another reason for accepting the non-incidental character of these impressions;
7. Where the impressed surface is well preserved, veins up to the 3rd order can be recognised (FIG. 3);
8. The impressions were probably made with fresh leaves, which must have been used anywhere between immediately after picking and up to several days after being picked, since leaves can remain fresh when kept between wet tissue, for example, or simply in water. Dried leaves are vulnerable to crumbling and are thus unsuitable. This also reveals in which part of the year these amphorae were made, i.e. roughly (May-)June to September(-October), when also dry fuel was available, rather than during the wet, harsh autumn and winter months;
9. The leaves were probably removed before firing: the atmosphere and gradually increasing temperature in the stoking chamber would otherwise have created a reducing atmosphere between the leaves and the vessel for a sufficient length of time for discolourations to come into being. In fact, the additional, finer clay mixture used into which the leaves were impressed, is the same colour as the body clay, which suggests both were exposed to the same firing conditions;
10. A screening of cooking wares and other (closed) Fabric 4 vessels (mostly jugs) from some major deposits did not result in the discovery of leaf impressions on vessels other than the Sagalassos Amphorae, which strengthens the particular connection.

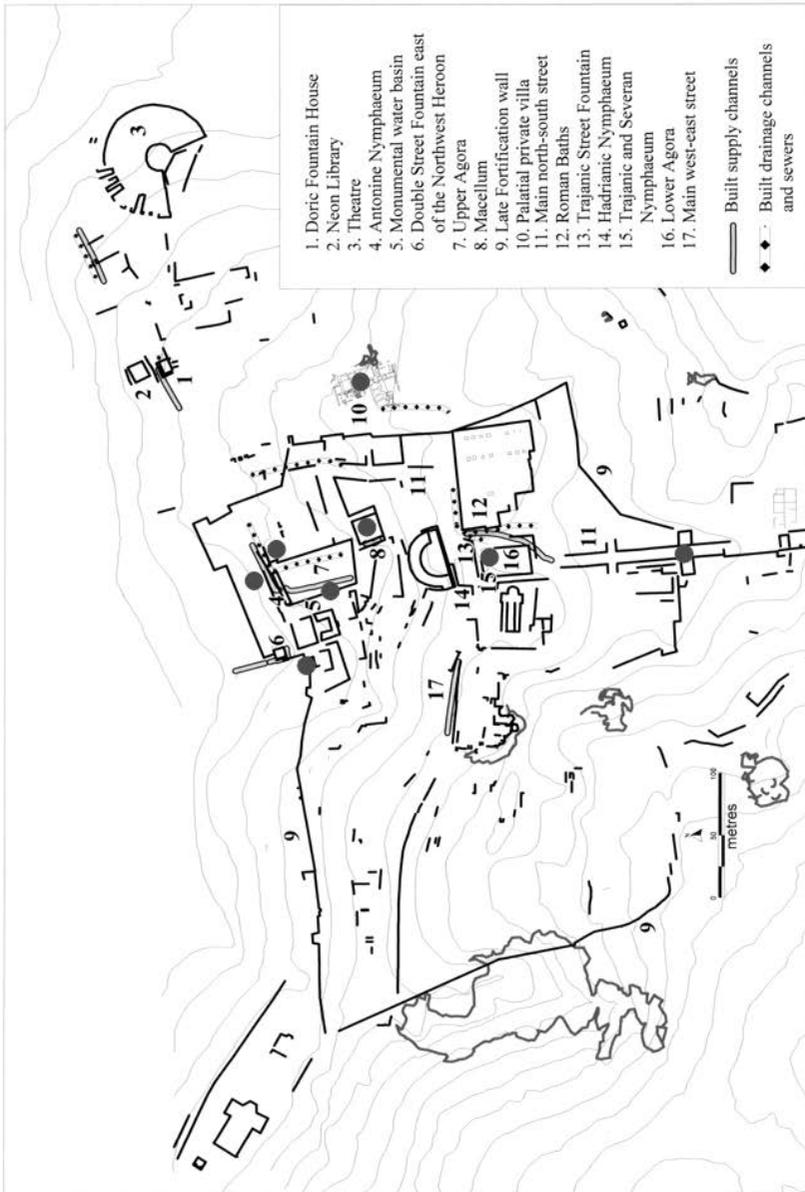


FIG. 6. Plan of the urban centre of Sagalassos, with findspots of Sagalassos Amphorae with leaf impressions indicated (© Joeri Theelen; Sagalassos Archaeological Research Project).

Leaf impressions of some sort appear to be near-absent from the scientific literature on (Graeco-)Roman and post-Roman amphorae studies (cf. *infra*) – the impressions on the Sagalassos Amphorae presented here appear to be a unique case – which on the whole does not make it easier to interpret these impressions. Leaf-impressed amphorae rims have thus far been found in most major excavation areas within the urban centre of Sagalassos (FIG. 6), even if only a selection is presented here. However, only a small portion of the pottery collected during 25 years of excavation has been investigated with this phenomenon in mind. Fully quantified evidence from three well-preserved secondary contexts indicates that the proportion of Sagalassos Amphorae of the total sherd count and weight ranges from ca. 11.9%/11.7%, 22.8%/22.6% to 38.8%/29.1% (the lower weight % for context SA-2004-NEG-83 is (largely) caused by 14 larger/heavier pithos fragments). Leaf impressions of (only) 18 different Sagalassos Amphorae could be examined, which suggests that the phenomenon was rather rare. However, even if it cannot be precisely determined how many individual amphorae the sherd count for each of the contexts represents, each of these contains one or more leaf impressions, which places the studied total of 18 in a somewhat different light, and the presence of leaf-impressed Sagalassos Amphorae possibly varies considerably from one context to another (TABLE 2).

TABLE 2: Some numerical background to three deposits in which Sagalassos Amphorae with leaf impressions were found (© Philip Bes; Sagalassos Archaeological Research Project).

Context	N Count/ Weight	n Sagalassos Amphorae Count/ Weight	% Count/ Weight	With Leaf Impressions
SA-2000-LA-117 & 125 (Lower Agora, northern room western portico, semi-commercial?)	5,986/166,345	1,367/37,512	22.84%/22.56%	3 (2 unidentified; 1 not yet studied) (maximum amphorae individuals=35)
SA-2003-NEG-68 (Upper Agora, North-East Building (occupational/domestic waste?))	982/23,540	117/2,752	11.91%/11.69%	1 (<i>Vitis vinifera</i> L.) (maximum amphorae individuals=8)
SA-2004-NEG-83 (Upper Agora, North-East Building (occupational/abandonment debris))	907/40,484	352/11,790	38.81%/29.12%	3 (<i>Styrax officinalis</i> L.) (maximum amphorae individuals=9)

The chronological background for most of these finds is rather well-documented. Whilst a few archaeological deposits in which such rims occur are dated to SRSW phase 8 (ca. 450/475-550/575), most were found in deposits dated between ca. 550 and 650. Some deposits fall earlier in this period, some later: a deposit cannot always be *very* precisely dated. On the other hand, as nearly no primary deposits have been found in urban Sagalassos, drawing on pottery as a proxy to reconstruct and interpret the functional or social use of spaces has to be done with caution; furthermore, pottery is only part of the archaeological and chronological story²³.

IDENTIFICATION OF THE PARENTAL PLANTS OF THE IMPRESSED LEAVES

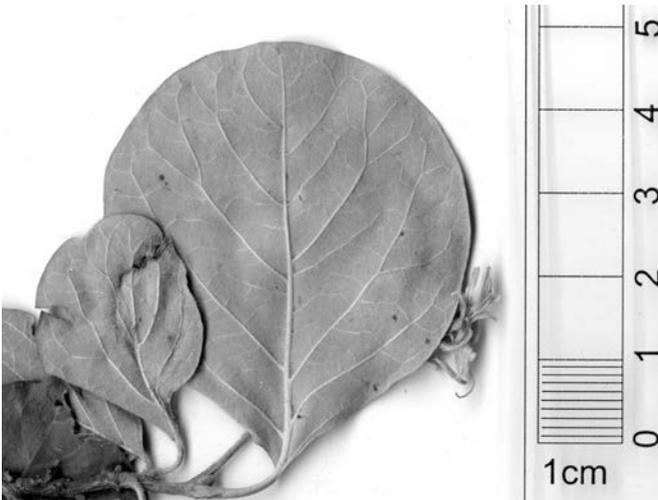


FIG. 7. Outline and venation of air-dried present-day leaves of *Styrax officinalis* L. (© Botanic Garden Meise).

For the entire set it was possible to identify two different species: *Styrax officinalis* L. and *Vitis vinifera* L. It was not possible to determine all samples with equal reliability and some of the leaf impressions were so incomplete that it was impossible to propose any reliable identification (Cat. 13-18, Appendix 4). TABLE 1 summarises the botanical identification, as well as some basic archaeological and typological information for the examined samples. In Appendices 2-3 we list and describe the certain identifications, followed by mentioning other material that nevertheless shows affinity to

23. Poblome *et al.* 2010.

each taxon (Appendix 4). Attention is also paid to the zones on the pottery where the leaf impressions are situated, as well as the additional clay layer (cf. supra). Detailed, original descriptions of the fine foliar architecture of these two species, based on the examination of herbarium material and according to published rules²⁴, can be used for comparison (cf. Appendices 2-3).

Styrax officinalis L. (Appendix 2) is an eastern Mediterranean shrub or small tree. It is well known, from Antiquity on, for the manufacture of perfumes and incenses and for its pharmaceutical properties. The main area of distribution of *Styrax officinalis* L. corresponds with the eastern Mediterranean coasts and the islands between eastern Greece and Israel, particularly Crete and Cyprus. In Turkey it is concentrated along the west and south coasts, yet the species does penetrate deeper into central Turkey²⁵. Nowadays, in the general area of Sagalassos *Styrax officinalis* L. is found at a number of spots in the Ağlasun Valley; FIG. 7 shows a present-day dried leaf in detail. More to the south, in the coastal zone of ancient Pamphylia²⁶, the shrub can be found abundantly, for instance, at ancient Sillyon and in the mountains north of Kaş²⁷ and Termessos²⁸. It grows in a wide variety of habitats, including macchie and deciduous shrub, and is occasional to dominant in oak and pine woods, especially on stony, basic, calcareous soils. In Turkey it occurs from sea level up to 1,500 m above sea level, and most frequently between 100 m and 600 m²⁹. Herodotos, Hippokrates and Theophrastos are among the earliest classical sources that describe the use of *styrax* resins. Benzene resins are also produced by *Liquidambar orientalis* Miller, which is native to southwest Anatolia³⁰. The production of benzene resins by *Styrax officinalis* L. was questioned and examined³¹, and it was stated that this species has no significance at all for the extraction and production of these resins. However, the same source also stated that at least some local varieties might produce such resins. More recently, several chemical substances that are produced by *Styrax officinalis* L. have been mentioned, including benzofuran³². A clear determination of this species is possible with the material from SA-2004-NEG-83 (Cat. 2-4) (FIG. 3; FIG. A.3-5 in Appendix 2); Cat. 2 (FIG. 3; FIG. A.3 in Appendix 2) provides the clearest impression.

24. Ellis *et al.* 2009.

25. Amigues 2007a, esp. p. 265.

26. Amigues 2007a.

27. Pers. obs.

28. Dinç Düsen and Sümbül 2007, p. 381.

29. Davis 1977; Browicz 1983, volume 2, pp. 24-25, Fig. 37; Donner 1990.

30. Amigues 2007a, pp. 271-282, Fig. 9.

31. Zeybek 1970.

32. Güner *et al.* 2000.

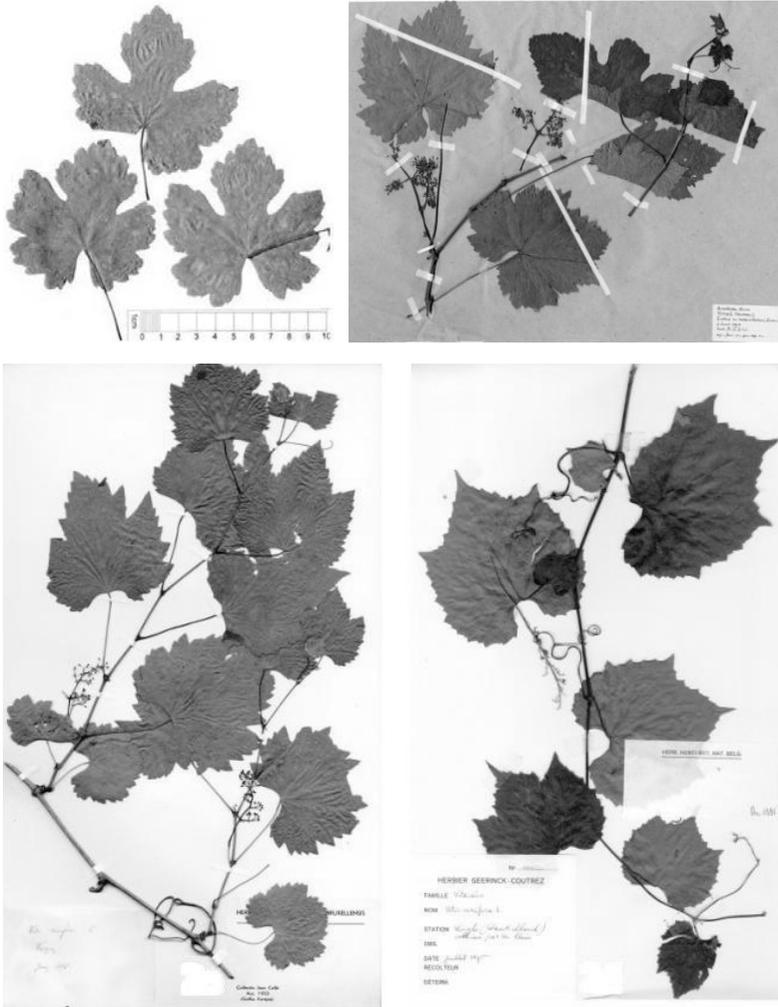


FIG. 8a-d. *Vitis vinifera* L.; a and b: almost palmatisect leaves; c: shallowly palmately incised leaves, circumference almost rounded, d: three-toothed, not deeply incised leaves (© Botanic Garden Meise).

Only one photo permitted the identification of *Vitis vinifera* L. (Cat. 8; FIG. A.9 in Appendix 3); because of its very good quality, it was possible to enlarge the original, allowing some of the details of the leaf venation pattern to be studied under greater magnification. Relevant for the identification of this leaf impression as *Vitis vinifera* L. is (1) the combination of the primary leaf venation pattern (palmate instead of pinnate) in relation to the leaf size cat-

egory, (2) the width of the mean distance between the secondary veins of the intercostal areas in relation to the angle between the primary and secondary veins and the diameter and course of the secondary veins, and (3) the course and gauge of the tertiary veins. Summarised, the morphological characteristics of the venation pattern in general and of the major (1st and 2nd order) and the 3rd order veins in particular made identification possible. Generally speaking, leaves of the vine plant are very plastic in their overall morphology. This is of course the result, or rather a side effect, of centuries (or rather millennia?) of cultivation, domestication and efforts to 'improve' the original wild vine. The outline of the vine plant leaves varies from more or less deeply palmately incised (FIG. 8a-b) to almost rounded without or with three short super teeth (FIG. 8c-d). The vine is nowadays still cultivated within the territory of Sagalassos (in the small town of Ağlasun and in the vicinity of the excavation sites), but always on a very small scale.

Interpretation

The systematic nature of the impressions implies a conscious step in the manufacturing process (cf. *infra*), and all indications suggest that these were made after the "primary forming" phase of the vessel, which includes attaching the handles³³. Their identification as *Styrax officinalis* L. and *Vitis vinifera* L. also lends these impressions a fascinating dimension, even if their combination might be coincidental. Nevertheless, so far it is not clear to us why some Sagalassos Amphorae bear leaf impressions in particular zones: do they serve some utility purpose, are they purely ornamental, or should we consider both aspects whereby one evolved out of the other? Because of the apparent lack of known parallels, each of the following suggestions remains hypothetical:

1. The leaves were impressed/applied to prevent soil or dirt sticking to the rim while the amphora was drying, upside down, yet closed vessels were not necessarily always dried upside down. Since a potter wishes to finish his products without any such faults, this is a plausible possibility. Yet, this would not require the leaves to be folded over, although by aligning the central vein with the rim the potter thus made the most of the surface area of each leaf. However, there must have been easier methods: mats, for one. Also, leaf impressions have not (yet) been encountered on closed Fabric 4 vessels other than amphorae. Moreover, *Styrax* leaves are fairly small (9.5 by 6.5 cm maximum), and whilst *Vitis* leaves can be larger, single

33. Rye 1981, p. 62.

leaves of very common alternative species with much larger leaves (such as *Verbascum* species) could have covered the entire mouth of an amphora;

2. The leaves were impressed/applied to prevent vessels from fusing during firing. This, first of all suggests that the leaves were *not* removed. Moreover, only if the rim (with the impressed leaves) of an amphora had been in direct contact with another vessel would the leaves have met this purpose. This hypothesis, then, implies that the amphorae in the kiln were likely stacked one on top of the other, that is, base resting upon rim. However, other stacking methods could have been used (for example placed on their side, with or without (ceramic) spacer objects). As a matter of fact, the interior and exterior surfaces also suggest similar firing conditions, with the interior of an amphora not being closed off by the vessel above;
3. The leaves were impressed/applied in preparation for lining an amphora's interior surface with pitch; the leaves would prevent pitch from sticking to the rim, and thus keep it clean. Sagalassos Amphorae were pitched, though not always³⁴. It was then required to heat the resin and/or to reheat an amphora for the resin to flow more easily. However, this implies that the additional clay layer that carries the impressions would then not have been kiln-fired. Furthermore, since resin liquidifies at 70-80 °C³⁵, heating the resin in a separate vessel and subsequently pouring this into the amphora whilst moving the vessel seems less cumbersome. Funnels could have been used to this end;
4. Because of shrinkage in the course of the drying process the leaves would have come off, indicating that the amphora had dried sufficiently. They thus acted as a control mechanism (as well as preventing dirt from sticking to the rim) for the potter or an affiliate. If closed vessels were dried upside down, the bottom (after the handles the thickest part of Sagalassos Amphorae) would lose water both through evaporation and trickling within the vessel's body. The rim could then have been the last part to have dried sufficiently for an amphora to enter the next stage. The leaves were then probably removed before entering the kiln (cf. supra). Somehow, then, one would expect to find leaf impressions on other (semi-)closed vessels too – for instance cooking vessels, jugs. However, it is hard to believe that a double-folded leaf covering the rim would remain in position without some sort of tool. Also, by 'observing' and 'feeling,' an experienced potter was well able to recognise whether or not a vessel had dried

34. Romanus *et al.* 2009, p. 901, Table 1.

35. Zemer 1978, p. 96.

sufficiently. Related to this seems to have been the use of fig leaves in the manufacture of *pithoi* on 20th-century Cyprus, which were being applied over each coil to prevent them from drying out too quickly and too much, so as to assure a good adhesion with the next coil³⁶;

5. These impressions had a decorative purpose. Greek and Roman amphorae present a wide, morphological variety (including surface treatment). Since amphorae were intended primarily to transport and/or store agricultural produce this probably had more to do with their provenance and content rather than with any purely stylistic or decorative objective. The wide variety in amphorae shapes – including the act of ‘copying’, for example in the case of LRA 1 – could then also be seen as product differentiation *avant la lettre*. This reasoning is problematic if one holds on to the traditional Greek and Roman amphorae-inspired production. It is less cumbersome to accept more individualistic ideas of local craftsmen;

6. In line with this comes product recognition, or labelling. This, though fascinating, implies that those involved in the manufacture as well as those in the chain of distribution and people on the receiving end actually knew and recognised the leaves i.e. impressions (and subsequently also content). However, numerous Greek and Roman amphorae bear witness to two very common methods: stamps and *dipinti/tituli picti*³⁷. Although not (always) readable and interpretable unequivocally because of their ‘coded’ character, these were efficient ways of capturing information on content, volume, provenance, etc. On the other hand, the seemingly unique character of these impressions may represent a local form of communication. Also, no normally conditioned people have difficulties in identifying the daily goods – say plants – they deal with. Both the vine and the *Styrax*-shrub are very typical and cannot have posed any problem in being identified as such. That this kind of use of leaf impressions seems to be (so far) very local is not really problematic, it only suggests that it may in fact have been a rather superfluous practice, not essential to the primary use of the vessels. In this respect, that the leaf impressions might somehow be tied in with religious or cultic practices definitely is an intriguing question, yet one for which at present neither archaeological nor historical evidence can be brought forward;

36. London 1989; Giannopoulou 2010, pp. 68-69, 134.

37. Peacock and Williams 1986, pp. 9-16; Fournet and Pieri 2008.

7. Finally, the leaves were impressed/applied in the process of sealing the amphorae³⁸. How exactly Sagalassos Amphorae were sealed remains unclear – lids (in Fabric 4) do occur in Late Roman deposits but are uncommon; too few diameters are known to evaluate how their range is associated with the amphorae – but perhaps the leaves provided a necessary layer between the rim-neck and the sealing material or object. Yet again though, larger leaves would have suited this purpose much better. The firing sequence it implies obviously nullifies this hypothesis. The lid, stopper or whatever sealing material was inserted (immediately) after the leaves were impressed/applied (and could have shifted), and of course after the vessel was filled with the destined content. However, since the additional layer of clay was fired – presumably without the leaves – this implies that the amphorae were fired *including* the stopper or lid.

Not only do(es) the reason(s) for making the impressions elude(s) us, obviously the impressions proper also do not prove that the amphorae originally contained wine or *styrax* gum/resin. Some Sagalassos Amphorae at one point in their life-cycle contained wine, yet *styrax* gum/resin has not (yet) been identified³⁹. Benzoe resin from *Styrax officinalis* L. was recently identified in a Late Roman incense burner from Egypt⁴⁰. *Vitis* and *Styrax* are attested in pollen corings from the territory, yet chronologically only *Vitis* possibly matches the period relevant to these impressions (ca. mid-5th to mid-7th century). However, since both species produce very few pollen, their (near-) absence is therefore hardly indicative. Whereas we may imagine that *Vitis* was cultivated, *Styrax* was perhaps not, and its leaves were picked (and its gum/resin extracted?) from the wild population⁴¹.

It is archaeologically attested that the Ağlasun Valley was occupied in (Late) Roman-Early Byzantine times; given the distance to Sagalassos proper people possibly farmed the land from the city, and/or lived in (isolated) farms or (small) hamlets. Future archaeological research will hopefully also resolve the question of how the workshop(s) producing Sagalassos Amphorae was/were organised. They were undoubtedly involved in agro-economic (and artisanal) activities, probably to supply both themselves as well as Sagalassos⁴². Non-agricultural work had to be done during or outside the sowing and harvest-

38. Zemer 1978, pp. 89-90, 115-116, 120; Thomas 2011.

39. Pers. comm. J. Baeten.

40. Modugno *et al.* 2006.

41. Vermoere 2004.

42. Vanhaverbeke and Waelkens 2003, pp. 251-265, 285-299.

ing season, and was also (partly) determined by climatic conditions⁴³. Pottery production is one such activity, and the union between agriculture and pottery production was not uncommon in Antiquity⁴⁴. One or more members of the household, or (itinerant) professional potters, took up this (seasonal?) task⁴⁵, which (also) required considerable skill. Possibly both shrubs grew/were cultivated in the (immediate) vicinity of the workshop(s)/farm(s). As it was observed that the leaves were fresh at the very moment of folding, the impressing of these leaves, and possibly also the manufacture of the amphorae, possibly took place when the leaves came in as a result of pruning activities (perhaps used as fuel for kilns and/or ovens), or were picked directly.

Styrax/storax, and above all wine figure prominently in written sources datable between the 5th century BC and the 7th century⁴⁶. Although these sources have little (in)direct significance for the mostly archaeological and ceramological story set out above, it is felt, however, that (some of) these sources potentially clarify interesting aspects about the perception and use of *styrax/storax* in particular, as well as wine.

For one, Storax actually also occurs as a *cognomen*: C. Lusius Storax⁴⁷, and M. Scribonius Storax⁴⁸ for example are attested. Interestingly, Pisidia is mentioned twice for its relatively good *styrax*⁴⁹. According to Strabo⁵⁰, *Styrax* (?) grew plentifully at ancient Selge in Pisidia, where it was used for cultic purposes. The objects depicted on Selgian coins – traditionally seen as *Styrax* branches – are interpreted as “*Baumstämme*” or “*Kultbäume*”⁵¹, whereas Weiß considers these to be “*Nadelbäume*”⁵². According to Amigues⁵³, the “*Selgéens n’avaient qu’à descendre les pentes du Bozburun pour trouver le liquidambar le long d’un affluent du Kestros en amont de l’actuelle Gebiz*”, thus apparently favouring *Liquidambar* rather than *Styrax* as the source of Selgian *styrax*⁵⁴.

43. Rye 1981, p. 25.

44. Lewit 2011, pp. 318-322; Mackensen 1993.

45. For example London 1989.

46. Amigues 2007a; her otherwise excellent article lacks the fairly extensive papyrological references.

47. Clarke 2003, pp. 145-151; Buonocore 1995, pp. 125, 137.

48. Pettinger 2012, p. 41.

49. Dioscorides, *De Materia Medica*, Book I.66.1; Plinius Maior, *Naturalis Historiae*, Book XII.124-125; Broughton 1975, p. 615.

50. *Geographika*, Book XII.7.3.

51. Nollé 2000.

52. Weiß 1992.

53. Amigues 2007b, p. 288, also 2007a, pp. 288-294.

54. Amigues 2007a, pp. 278-282, Fig. 10-14, for work by L. Robert on the exploitation of *Liquidambar orientalis* Miller.

Styrax is thought to figure in another way on Selgian coins, as a wreath adorning Herakles' head⁵⁵. Yet, the *Styrax* branches that are thought to be depicted on coins minted at Selge have recently received a different, if related, interpretation⁵⁶. Amigues rightfully questions the interpretation of the objects as (*Styrax*) branches – an interpretation that was based on Strabo's account – thereby raising some interesting points. Amigues instead proposes that these represent small-size presses that were used in the fabrication process of the actual *styrax* or *storax* gum/resin, thus symbolising Selge's prosperity that it (partly) owed to the (commercial?) exploitation of *Liquidambar* (and perhaps also *Styrax*?)⁵⁷. Though intriguing, can these objects be taken at face value? There is in fact some variety in the style and level of detail of this motif on the coins published: some more or less could resemble a press, others could be branches, whilst still others appear to be stylised objects more than anything else⁵⁸. Also, her explanation of the presumed morphological development of the motif is not completely satisfactory. Moreover, some of the blocks (?) on which the screws 'stand' (if not representing the lower part of a press)⁵⁹, are actually not unlike the cuirass motifs found (amongst others) in Sagalassos, as part of the repertoire of Pisidian military iconography⁶⁰. Be that as it may, most references to *styrax* nevertheless pertain to the perfume, incense and medicine 'industry'. Some Egyptian papyri list medicinal recipes that include *styrax*, seemingly a commodity of considerable value; two kinds of *styrax*, for instance, are listed in Diocletian's Price Edict⁶¹. Another Egyptian papyrus mentions wine that was supposedly flavoured with *styrax* (gum/resin)⁶²; it is plausible to imagine that the people who occupied themselves with the agricultural and artisanal ins and outs in the valley of Sagalassos, where both species grew (together), were not ignorant of the fact that *styrax/storax* could be used (also) as a flavourer (in the locally-produced wine).

55. For instance Sammlung Von Aulock 3, 1964, Numbers 5282-5284, Tafel 175 (though the "Keule" [clubs] of Numbers 5282 and 5284 bear close resemblance to the so-called *Styrax* branches); Scheers 2000, pp. 511, 544, Number 25; SNG 32, Numbers 257-261, Plate 10.
56. Sammlung Von Aulock 3, 1964, Numbers 5284, 5300-5301, Tafel 175; SNG 32, Numbers 256, 272, Plate 10; Nollé 2000, p. 713, Numbers 2-8 (not referring to *styrax*!).
57. Amigues 2007a, pp. 294-308; Nollé 2009, contra: <http://edergi.akdeniz.edu.tr/index.php/Gephyra/article/view/72>, accessed 1 April 2013: the full text of this article came to our attention too late.
58. For the latter, Nollé 2000, p. 713, Number 6, "Kultbäume" with "Wimpeln".
59. Though see Nollé 2000, p. 713, Number 7.
60. Loots *et al.* 2000, pp. 604-605, Fig. 8: "depicting a piece of Hellenistic armour, similar to those [...] [at] some of the Hellenistic city gates at Selge".
61. Lauffer 1971; Crawford and Reynolds 1979; for instance also *P.Prag* I.88 (Pintaudi *et al.* 1988, pp. 175-178), *P.Vindob. Worp* 20 (Worp 1972, pp. 154-157).
62. Andorlini 2001, pp. 163-170.

Modern scholars' opinions differ strongly – not always well-argued – as to what species *styrax/storax* mentioned in the sources exactly refer to. Some favour *Styrax officinalis* L.⁶³, others *Liquidambar orientalis* Miller⁶⁴. Amigues prefers to distinguish between “*styrax solide*” (Cilician styrax?), which derives from *Styrax officinalis* L. (l'aliboufier), and “*styrax liquide*”, which was obtained from *Liquidambar orientalis* Miller⁶⁵. Perhaps *styrax/storax* denoted an overarching concept that included different gums with similar properties – a “*brand-name*”⁶⁶.

Conclusion

The discovery of leaf impressions (cf. Appendices 1-4) on the rims of Late Roman Sagalassos Amphorae, and their subsequent botanical identification, represent a thus far unique phenomenon within the Roman world, making it difficult to make any firm statements. Their socio-economic and -cultural context, however, is an even more problematic matter, and largely drives on assumptions, some of which are difficult to verify. Several aspects can nevertheless be inferred with (great) certainty. First, Sagalassos Amphorae were manufactured from the second half of the 4th into the 7th century, most likely in the valley below Sagalassos. Also, the impressions share a number of characteristics that imply these were made intentionally; how often remains unknown, yet the currently identified examples suggest the phenomenon to have been anecdotal. Even if a certain identification is possible in only a few cases, close scrutiny allowed us to identify *Styrax officinalis* L. and *Vitis vinifera* L., two species that evidently grew in the surroundings of Late Roman Sagalassos, and still do so today.

Archaeological, archaeobotanical and written evidence suggests that both species were exploited, and such may also have been the case in the area of Sagalassos. However, none of the possibilities discussed seems to explain fully and satisfactorily the purpose of the impressions. It is not unlikely to think that the impressions represent a very localised practice, perhaps not even practised by all potters involved in the manufacture of these amphorae. The question as to whether these impressions were utilitarian or (purely) ornamental, or whether the reason possibly encompassed both aspects, must be left open for the time being.

63. See Vermoere 2004, pp. 26, 31.

64. Langenheim 2003, pp. 354-355.

65. Amigues 2007a, pp. 262-265, 271-274, 312.

66. Wallace-Hadrill 2008, pp. 373-374; Braund 2005, p. 124.

Appendix 1. Plant Identification

IDENTIFICATION OF PLANTS BASED ON THEIR VEGETATIVE FEATURES: POSSIBILITIES AND LIMITATIONS

Leaves, like flowers, possess powerful characteristics to identify vascular plants. They contribute in determining the family and genus to which a plant belongs, and help to nominate the very species. As a rule it is the combination of both generative and vegetative characteristics (respectively the morphology of the flower and fruit (and their composing structures) and of leaves and stems) that makes a balanced identification possible. All traditional identification works (the so-called “floras”) and the more fundamental systematic taxonomic surveys of angiosperms make use of a mixture of these two sets of morphological variables⁶⁷. However, floral characteristics are usually far better represented and more finely elaborated in these works. The reason for this is that compared to leaves and other vegetative features, flowers and fruits exhibit both a more spectacular, easier to exploit differentiation among the various plant groups and a higher stability within the groups. Indeed, flowers can present almost any colour of the visible spectrum (while foliar leaves essentially are limited to a variation of green). Flowers form three-dimensional structures and are composed of four highly differentiated structural units (calix, corolla, stamens, gynaecium). Leaves are flat (“bi-dimensional”) and show few or no distinguishing structural elements. Moreover, many vegetative characteristics are very variable and more sensitive to (non-genetic) external, environmental factors⁶⁸. They therefore are traditionally considered of lesser importance in relation to taxonomic work⁶⁹.

For the ordinary identification of “complete” plants (i.e. with flowers (and/or fruits), stems and leaves) the necessary vegetative features used in combination with floral characteristics are limited to a small number of predetermined categorical status types that describe the leaf arrangement on the stems (*phyllotaxis*), the overall leaf shape, the shape of the leaf margin, the architecture of the major leaf venation and the nature and amount of hairiness and various other appendices. This very basic information on leaf characteristics, completed by specific illustration (such as line drawings of the leaves), can, even when used in isolation, be sufficient to identify vascular plants, if these characteristics are available in a systematic manner, for

67. Tutin *et al.* 1964; Geesink *et al.* 1981.

68. Good 1964; Hickey 1979; Gregory-Wodzicki 2000.

69. Ellis *et al.* 2009.

example when they are present for all plants under consideration⁷⁰. This latter condition is usually not fulfilled in the “normal” identification keys of floras since vegetative characteristics are only used in a rather opportunistic way (for instance when floral characteristics are not exclusive enough or are too complicated). So, most of the traditional floras, even the best ones, are not readily suited for identifying plants based solely on the characteristics of leaf morphology and other vegetal characteristics, even when, ideally, living, complete material is available for study.

IDENTIFICATION OF FOSSIL LEAF IMPRESSIONS AND LEAF IMPRESSIONS ON POTTERY

Fossilised impressions of leaves and leaf impressions on pottery are both subjected to the same kind of additional difficulties when it comes to the identification of the plant species that left the impressions. Very often these impressions have come down to us only in a fragmentary state; consequently, elementary information on the leaf morphology, such as the general leaf shape and the shape of the leaf base, leaf apex and/or leaf margin, can be incomplete or even lacking and therefore these important characteristics cannot be checked. Information on the relative position of the leaves on the stem is almost always lacking (and so on the *phyllotaxis* of the plant), which further reduces the possibilities for identification. Many of the finer details (such as the type and density of the hairiness) are difficult to interpret or cannot be observed at all. Finally, and of a different nature, the impressions on pottery and fossils can give a reversed, negative image of the original leaf material, which further complicates the interpretation of the observed patterns and structures. On the other hand, fossil leaf impressions and leaf impressions on pottery do differ with respect to a significant different aspect. While fossilised impressions reflect on the past flora, pottery impressions are related to the contemporaneous flora. Based on the incomplete elementary leaf characteristics mentioned above it has been very tricky in the past to relate fossil leaves to modern plant taxa and such efforts have resulted in many unreliable conclusions and lots of imaginary taxonomic entities for the fossilised plants⁷¹.

Since the last quarter of the past century great progress has been made by using more advanced analytical techniques focused on new foliar features, especially on the fine architecture of the leaves (the finest venation patterns) and, to a lesser degree, the characteristics of the *cuticula*, the outer, protec-

70. Götz 1975.

71. Dilcher 1974; Ellis *et al.* 2009.

tive, waxy and hydrophobic layer produced by and covering the epidermis⁷². Especially the description of the fine architecture of vein endings at the level of the finest ramifications (the “FEVs”, Freely Ending Veinlets) and the architecture of the *alveoles* gradually have grown in importance. Areoles/alveoles/vein islets are the smallest architectural units of the leaf lamina, completely surrounded by veinlets of the last but one order, forming a closed mesh. Veinlets of the last order can end freely within such an area⁷³. The shape and size of these ultimate meshes, as well as the gauge of the mesh walls are good diagnostic characteristics. The characteristics of the free ending last order veinlets within the meshes are even more important⁷⁴.

The successive improvements of the overall classification systems built for integrating the architectural characteristics of leaves⁷⁵, actuated by the need to identify an ever-growing number of fossil angiosperm leaves, led finally to a mature, practical manual of leaf architecture⁷⁶. No doubt this (provisional) latest system makes the study of the fine structure of leaves more accessible and it will stimulate the application of foliar characteristics in palaeobotany and palaeoecology as well as in modern taxonomy and plant identification. At all taxonomic levels from species to subclass, the leaves of dicotyledonous species have a consistent and recognisable, characteristic pattern of major and minor veins, allowing a distinction to be made even between closely related species⁷⁷. These vein patterns can therefore be considered as “fingerprints of the leaves” or “vein-prints”. On the other hand, no two leaves have exactly the same pattern and even on one and the same leaf different spots can be similar yet not identical⁷⁸. Also, plant groups based solely on leaf architectural characteristics differ from taxonomic groups based on floral characteristics⁷⁹.

The problem of the accurate identity of fossilised extinct plants is not directly relevant for the identification of leaf impressions on pottery, because leaf impressions of plants living one or a few thousand years ago can still be considered as representative for the modern, actual flora, but it did stimulate the development of the detailed study of the leaf architectural organisation. Also, one should keep in mind that we are now still only at the beginning of the

72. Dilcher 1974; Kimura *et al.* 2008; also Ellis *et al.* 2009.

73. After Napp-Zinn 1973; Hill 1980.

74. Roth 1996.

75. Von Ettinghausen 1861; Hickey 1973; Dilcher 1974; Melville 1976; Hickey 1979; Hill 1980; Spicer 1986; Klucking 1995; Roth 1996; Ash *et al.* 1999; Herbig 2001.

76. Ellis *et al.* 2009.

77. Kimura *et al.* 2008.

78. Corner 1968, in Klucking 1986; Hickey/Wolfe 1975; Roth 1996; Herbig 2001; Ellis *et al.* 2009.

79. Klucking 1995.

systematic exploration of fine leaf architecture⁸⁰ and that it is not possible at present to draw on general surveys of the occurrence of the various characteristics throughout the entirety of the angiosperm families. An example of a more or less systematic approach was realised by Klucking⁸¹, who studied six different, mostly tropical, families.

THE FINE ARCHITECTURE OF PLANT LEAVES AS AN IDENTIFICATION TOOL

The general term “leaf architecture” denotes a number of morphological characteristics of leaves, involving form and position. They include venation patterns (primary and fine), marginal configuration, leaf shape, and gland position⁸². Modern complete systems, aiming at maximising the contextual significance of all possible variation, were developed by a number of authors⁸³. The venation patterns are most important. If those are lacking from the impressions, or if they are not distinct enough, then identification is simply not possible. In the following synopsis, based on the literature mentioned above, only the most important morphological elements used as distinguishing criteria are listed.

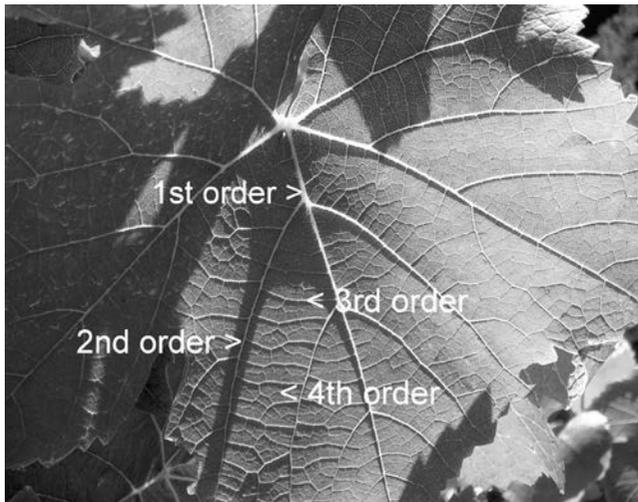


FIG. A.1. The hierarchical order of the foliar veins illustrated on the underside of a fresh leaf of *Vitis vinifera* L. (© Botanic Garden Meise).

80. Hickey 1979.

81. Klucking 1986-1995.

82. Hickey 1979.

83. Hickey 1973, 1979; Dilcher 1974; Melville 1976; Hill 1980; Spicer 1986; Klucking 1995; Ash *et al.* 1999; Herbig 2001; Ellis *et al.* 2009.

1. The definition of the hierarchy of the veins: 1st, 2nd, 3rd, 4th and higher order, see FIG. A.1 in relation to different zones of the lamina; the higher the order, the thinner the veins. Veins of the 4th and 5th order are frequently called veinlets. The low order veins (1st and 2nd order) are also called primary or major veins or gross venation; the higher order veins are also called the minor veins or fine venation;
2. The occurrence or absence of special types of veins;
3. The ramification patterns of veins, especially of the 1st and 2nd order (palmate, pinnate, dichotomous, parallel, transition forms, etc.);
4. The type of network the veins of different orders compose (cross-venulate, longitudinal, reticulate, scalariform, etc.);
5. The number of veins and the distance between them (defining the density of the veins, viz. number per area unit);
6. The thickness of the veins (gauge) in relation to their order;
7. The angle between two interconnected veins of different orders;
8. The way veins of different orders are connected (types and number of nodes);
9. The geometric course of the veins of different orders (straight, more or less arcuate, partly straight and partly arcuate, sinuous, chevron-like, etc.);
10. The way the vein extremities behave near the leaf margin (anastomosing or not);
11. The size and shape of the areoles and their relative number in relation to leaf area;
12. The diameter of the maximum inner circle of the areoles;
13. The number and structure of the ultimate veinlets ending in the areoles;
14. The spacing, relative number and shape of leaf margin teeth, etc.

The texture of the leaves, the type, density and localisation of their *indumentum* (leaf hairiness) and the number and position of glands can also be very helpful (inasmuch as they can be deduced from the impressions). It should be kept in mind that knowledge on the size of the leaves remains essential (for calibrating), as does information on the general leaf shape and margin.

IDENTIFICATION PROCEDURE AND METHODS

Since the taxonomical exploration of the characteristics of the fine leaf architecture of angiosperms (and ferns) is still in its infancy (cf. supra), systematic reviews of those characteristics are currently not yet available, certainly not at the level of species, but even not at the levels of genera and families. For the identification of the leaf impressions on pottery we therefore necessarily have to fall back on the second-best strategy to perform the same identifica-

tion job, namely the direct comparison of the impressions with the original material of dried herbarium specimens kept in herbarium collections.

National herbarium collections, such as those at the Botanic Garden Meise, house hundreds of thousands of species originating from all over the world. However, logically only a very small share of those can be considered as potential matches to the leaf impressions on ceramics found in a specific region. It is justified to suppose that the impressions reflect only plant species (native species as well as cultivated or otherwise imported species related to one economic activity or another at that time) that were present in the (wide) surroundings of the pottery (manu)factories. By considering the whole of the historic territory of Sagalassos as the hinterland for the potential species responsible for the impressions, the number of potential species is already strongly reduced. There is no reason to suppose that the present-day flora within the former historic Sagalassos territory differs much from the flora of the period when the Sagalassos Amphorae were made. This territory as a whole is composed of strongly Mediterranean as well as more or less continental (steppic) and subalpine parts and is therefore characterised by considerable climatological variation, reflected in its flora. Since this climatological spectrum is already very wide, potential minor climatological differences between the past thousand years and now cannot have been of great significance for changes in the composition of the local flora (relatively few presence/absence differences, but differences rather of degree).

The modern flora within the historic territory of Sagalassos is relatively well known as a result of eight campaigns of botanical fieldwork (between 1997 and 2004) during which material of some 3,500 (complete) plant specimens was collected, dried and prepared as herbarium specimens. The herbarium specimens of this reference collection were identified (mainly during the same period) with all available identification keys. The most important among those are the nine volumes and the two supplements of the “Flora of Turkey”⁸⁴; a range of other books and papers was consulted as well⁸⁵. The provisional base list of all vascular plant taxa known to occur (at the present time) within the ancient Roman territory of Sagalassos contains some 900 taxa (875 species and 25 infra-specific taxa). By no means is this a “definitive” list: some species present in the past could have disappeared now, or vice versa, present species were not necessarily present in the past. Also, plants could have been imported from elsewhere. Nevertheless, the inventory of the

84. Davis 1965-1988; Güner *et al.* 2000.

85. Donner 1990; Götz 1975; Kürschner *et al.* 1995; Pils 2006; Sorger 1998, 2000; Yalıtırık 1997a, b.

regional flora offers the best possible departure point from which to determine the set of potential species.

In a first step the fragments with impressions were examined in order to determine the overall leaf architecture of the impressed leaves. The size and general shape of the leaves were determined (inasmuch as possible), as well as the shape of the leaf margin and the basic ramification patterns of the veins of the 1st and 2nd order (pinnate or palmate). These characteristics were then used as guiding criteria for the selection of species that should be submitted to a finer analysis of their leaf morphology, especially of the pattern of their finer leaf venation. After this selection procedure, the initial list of some 900 taxa was reduced to a shortlist of some 20 species. The venation characteristics of the leaves of these selected species were then examined in more detail under a binocular stereomicroscope. Most attention went to the venation patterns of the veins of the 2nd and 3rd order: the relative distance between the successive veins of the 2nd order, the shape of the nodes, the relative thickness of the veins of the first three orders, the angle between the veins of the 2nd and 3rd order, the way veins of the 2nd order terminate, the degree and the nature of anastomose occurring near the leaf margin, the type and density of the hairiness, the presence or absence of special structures such as glands and leaf margin teeth. The shape and size of the *alveoles*, although not studied in detail, were also drawn into the comparison for some impressions.

For the identification of the leaf impressions on the pottery fragments we had to rely on photographs taken in the Sagalassos excavation house, which is where the fragments are kept. Although made for this very purpose, not all of the original photographs allow great enough magnification for the study of the details of the venation patterns.

Appendix 2. Fine Foliar Architecture of *Styrax officinalis* L. (Description and Terminology follow Ellis *et al.* 2009) & Catalogue

According to Davis⁸⁶ the leaves of *Styrax officinalis* L. are broadly elliptic to ovate, obtuse, entire, 4.5-9.5 by 3.7-6.5 cm, have 5-7 pairs of lateral veins and are bright green and sparingly stellate-pubescent above (later glabrous), while densely stellate-tomentose underneath. Simple petiolated leaf, more or less isodiametric (and slightly longer than broad) to elliptic.

Size-class microphyll (225-2.025 mm²) to notophyll (2.025-4.500 mm²). Petiole mostly less than 1 cm long, canaliculate, often gently, somewhat asymmetrically or sinuously curved to almost hooked, especially near the point of attachment (somewhat like the handle of a cane or umbrella). Leaf margin untoothed, at most very slightly sinuous; apex angle obtuse and apex rounded to almost acute (elliptic leaves); shape of the leaf base rounded to concavo-convex and almost decurrent. Surface texture: upper side sparingly covered with isolated stellate hairs, lower side densely tomentose with stellate hairs.

Principal venation pattern pinnate, primary vein monopodial, naked basal veins absent. Secondary veins gently curved to almost straight, the major secondary veins do not reach the leaf margin and form loops of secondary gauge (brochidodromous major secondaries). Compound agrophic veins especially in the basal half of the leaf. Course of the minor secondary veins simple brochidodromous (joining together in series of prominent arches or loops of secondary gauge), marginal secondary present. The spacing between the major secondary veins is irregular, abruptly decreasing proximally; the angle between the secondaries and the 1st-order midvein is rather uniform, their attachment to it is somewhat decurrent. Intersecondary veins rather rare (in general less than one per intercostal area), their course more or less parallel to the major secondaries to almost perpendicular to the midvein, mostly longer than half the length of the subjacent secondary, branching and reticulating in their distal course. Intercostal tertiary vein fabric sinuously difficult to interpret on the abaxial side of unbleached leaves (corresponding with the leaf side shown by the leaf impressions on pottery). Course of the tertiaries partly opposite percurrent (sometimes more or less sinuous to chevron-like) and partly irregular reticulate, their angle inconsistent. Epimedial tertiary veins reticulate, their course more or less perpendicular

86. Davis 1977, volume 6, p. 144.

to the midvein in their proximal course. The course of the external 3rd-order veins (exmedially of the outermost secondaries) looped. The quaternary and higher order vein fabrics irregularly reticulate. These have not been analysed in detail because they are not visible on the leaf impressions. The same goes for the type of areolation and the freely ending veinlets.

CATALOGUE FOR *STYRAX OFFICINALIS* L.

Cat. 1) SA-2000-B3-197

A clear leaf impression is visible on only one of the fragments (FIG. A.2a, right). It is positioned on the upper side of the rim (FIG. A.2b) and runs down the exterior (FIG. A.2c). The leaf impression is between 2 and 3 cm long. On the flattened, horizontal top of the rim it shows part of a fine, straight primary vein (slightly centrifugally orientated), and three finer, but still well delimited, gently curved secondary veins. The same leaf impression continues on the exterior (but less clearly) where four more secondary veins are visible. There is not enough detail as to the texture of the leaf, in particular on how the secondary veins terminate (anastomosing with each other or not?) and what the tertiary veins look like, for a solid identification. It has the appearance of a *Styrax officinalis* L. leaf, but the identification remains unsure for the additional layer of clay covering the body has eroded (in particular by the small dimensions of the impression: the rest of the impression is gone).



FIG. A.2a. Cat. 1: fragmentary impressions of leaves of *Styrax officinalis* L.; two fragments probably of the same amphora (© Sagalassos Archaeological Research Project).



FIG. A.2b. (FIG. A.2a, right). Cat. 1: a fragmentary impression of a leaf of *Styrax officinalis* L. (© Sagalassos Archaeological Research Project).



FIG. A.2c. (FIG. A.2a, right). Cat. 1: a fragmentary impression of a leaf of *Styrax officinalis* L. (© Sagalassos Archaeological Research Project).

Cat. 2) SA-2004-NEG-83 (a)

Two impressions of the same species are clearly visible where the handle was attached to the rim (FIG. A.3; also see FIG. 3 in the main text). Their primary veins run obliquely on the rim, under the same angle but in opposite directions, as if mirrored against the theoretical plane running lengthwise down the middle of the handle. The leaf venation patterns shown by both leaf

impressions clearly depict a pinnate architecture: secondary veins connect to the primary vein on both sides of that vein. Furthermore, the pattern of secondary and locally even of tertiary veins is clearly discernable. Of most importance is the junction of the secondary veins near the leaf margin that is obvious at several spots. Moreover the leaf margin itself is also visible for the major part of the impressions, permitting a fair view of the general shape of the leaf. The leaf impression indicates a rounded leaf with an entire, at most somewhat retuse margin. The venation pattern is closed by anastomosis of the lateral (secondary) veins near the leaf margin. The pattern of these veins is very characteristic, being curved gently first in the vicinity of the primary vein, then more or less straight, and finally crooked almost like a hook when joining the distal neighbouring vein. Clearly visible are the brochodromous major secondaries and at least on one of the impressions the agrophic veins in the basal part of the leaf. The network of tertiary veins between the veins of secondary order is well developed and partly visible. Together with the secondary veins they form a typical, closed patchwork of rather regular, isodiametric cells. In all these characteristics, as well as by the rather typical curved end of the petiole, this impression closely resembles the shape and the foliar architecture of *Styrax officinalis* L.



FIG. A.3. Cat. 2: impressions of two leaves of *Styrax officinalis* L.; see also FIG. 3 in the main text (© Sagalassos Archaeological Research Project).

Cat. 3) SA-2004-NEG-83 (b)

Rather unclear impressions of two leaves, possibly of the same species, are visible on the flattened part of the rim (FIG. A.4a-b). Both leaves cross the lip in an oblique manner. The main architecture type of one of the impressions is clearly pinnate, with a central primary vein and several secondary veins along both sides of the primary vein. The nature of these veins (both primary and secondary) point to leaves of *Styrax officinalis* L., especially the way the latter are curved, the distance between them, the varying angle between them and the primary vein, and the gauge of the latter. However, there is not enough clear evidence to be sure. The second impression is too incomplete for identification.



FIG. A.4a. Cat. 3: two fragmentary leaf impressions, probably of *Styrax officinalis* L. (© Sagalassos Archaeological Research Project).



FIG. A.4b. Cat. 3: detail of FIG. A.4a (© Sagalassos Archaeological Research Project).

Cat. 4) SA-2004-NEG-83 (c)

Visible only are small parts (ca. 2.5 cm) of two leaf impressions on the outer rim (FIG. A.5a-b). That on the right is positioned with a slight upward inclination (some 30 degrees compared to the horizontal line of the rim). The curved end of its petiole assumes a horizontal position. On both sides of the solid primary vein secondary veins are impressed, yet are unclear, not in the least due to the additional layer of clay having mostly peeled off. The impression on the left shows less detail, but some typically arched veins closely resemble the zone of the *Styrax officinalis* L. leaf margin where the ends of secondary veins anastomose. There is not enough hard evidence here to support a well-founded identification, yet based on the morphology of both the primary and secondary veins, we are inclined to attribute these impressions with some reservations to *Styrax officinalis* L.



FIG. A.5a. Cat. 4: two fragmentary impressions, probably *Styrax officinalis* L. (© Sagalassos Archaeological Research Project).



FIG. A.5b. Cat. 4: detail of FIG. A.5a (© Sagalassos Archaeological Research Project).

Cat. 5) SA-2006-MAC-156-338

As this fragment has been photographed from three sides it is possible to have an almost complete image of the entire leaf (FIG. A.6a-c). The impressed part of the leaf is approximately 3.5 cm long on the inner side of the fragment and approximately 3 cm on the outer side. The leaf's length and width can both be estimated as about 5 cm. The main venation pattern is of the pinnate type, the central, primary vein being located on top of the rounded rim. Secondary veins run down on either side of the rim (FIG. A.6a-b). Their venation pattern is very apparent and clear-cut. These veins depart from the primary vein (FIG. A.6c) at different angles, are gently, rather sinuously curved and join each other near the leaf margin. They do not therefore run parallel for most of their course. Tertiary veins connect the secondary veins. Except in the proximity of the leaf margin they run more or less perpendicular to the secondary veins and form somewhat irregular, rectangular leaf units (delimited by the secondary and tertiary veins). Near the leaf margin however, where the secondary veins anastomose, these units become more isodiametric and more irregular in size. The margin of the leaf is complete, and slightly irregular. The general shape of the leaf is circular to broad-elliptic. This leaf architecture, particularly the venation pattern of the secondary and tertiary veins, as well as the size and general shape of the leaf, all point to *Styrax officinalis* L.

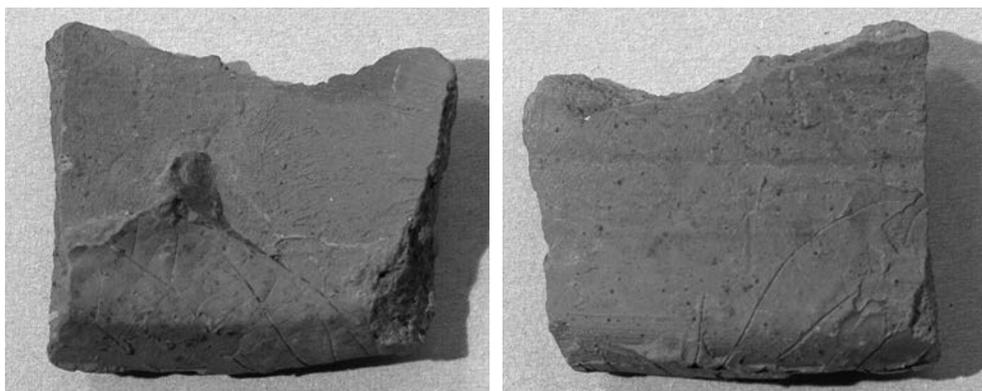


FIG. A.6a-b. Cat. 5, interior (left), exterior (right): fragmentary impression of a leaf of *Styrax officinalis* L. (© Sagalassos Archaeological Research Project).



FIG. A.6c. Cat. 5, top. Despite the somewhat blurry image, the central vein running along the lip of the vessel is still clearly discernable, as are the secondary veins (© Sagalassos Archaeological Research Project).

Cat. 6) SA-2000-LA-175

Traces of a leaf impression are visible on the ex- and interior (FIG. A.7a, centre, FIG. A.7b-c). On the exterior, three secondary veins run down obliquely from the rim. These veins resemble the *Styrax officinalis* L. secondary veins. On the interior two veins are discernable which are thicker and more strongly curved. Very close to the oblique (splayed) top of the rim some traces of tertiary veins can be distinguished between the two secondary veins, but without much detail. Impressions of two leaves of the same species are visible (FIG. A.7a, left, FIG. A.7d). The two impressions, one showing three, and the other

showing two secondary veins, are slightly differently orientated. The characteristics of the leaf venation pattern do not permit a certain identification. On this fragment the erosion of the additional layer of clay is very apparent. Only one secondary vein is clearly visible, running obliquely from the rim downward, some others are too fragmentary for interpretation (FIG. A.7a, right, FIG. A.7e). Also a few tertiary veins perpendicular to the first mentioned secondary vein are present. The combination resembles that of *Styrax officinalis* L. leaves.



FIG. A.7a. Cat. 6: two fragmentary impressions, probably of *Styrax officinalis* L. Fragments of the same amphora (© Sagalassos Archaeological Research Project).



FIG. A.7b-c. Cat. 6: exterior and interior of FIG. A.7a, centre. Visible are traces of masking tape (© Sagalassos Archaeological Research Project).



FIG. A.7d. Cat. 6: exterior of FIG. A.7a, left (© Sagalassos Archaeological Research Project).

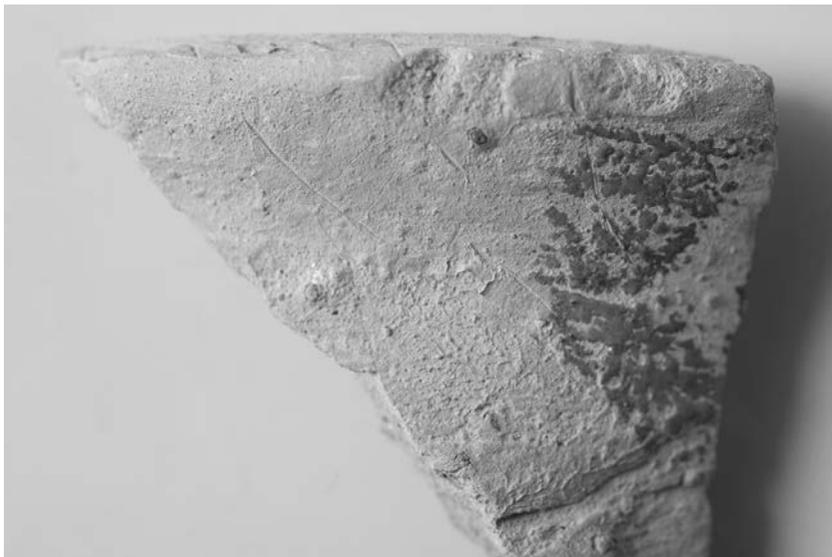


FIG. A.7e. Cat. 6: exterior of FIG. A.7a, right. Visible are traces of masking tape (© Sagalassos Archaeological Research Project).

Appendix 3. Fine Foliar Architecture of *Vitis vinifera* L. (Description and Terminology follow Ellis *et al.* 2009) & Catalogue

Simple, petiolated leaves, approximately as wide as they are long (both longer than wide leaves and wider than long leaves occur), petiole 0.5-1 the length of the lamina, grooved, lamina attachment lateral. Size class of the lamina mesophyll (4.500-18.225 mm²). In outline, the general form of the lamina is very variable, ranging from almost orbiculate or oblate and unlobed, through deeply palmately three- or five-lobed to palmatisect-pinnately lobed. Leaf margin dentate to serrate, teeth irregularly spaced, of three distinct sizes, length very variable among different forms, shape of the sinus between the teeth angular, both the distal and proximal sides of the teeth flexuous; principal vein present in the teeth, marginal terminating at the apex of the teeth, accessory veins running from the sinus; apex of the teeth spherulate. Apex of the unlobed lamina convex, rounded, apex shape of individual lobes (lobed lamina) more or less straight (lobed leaves) to acuminate. Base angle of the lamina reflex, base lamina cordate. Surface texture: upper side (adaxial side) almost without pubescence except on the major veins (short, rather stiff hairs follow the course of the principal veins; pubescence diminishes with increasing vein order); lower (abaxial) side of the leaves more or less densely pubescent to almost naked, except on the major veins.

Primary vein framework of the basal actinodromous palmate type with five basal veins. Compound agrophic veins present. Major secondary vein framework: major secondaries reach and terminate in the margin (craspedodromous); interior and minor secondaries absent or rare; gauge of the marginal secondaries of the same order of the finest secondaries; spacing between the major secondaries smoothly increasing proximally to irregular, the attachment of the major secondaries to the primary veins decurrent. Intersecondary veins absent. Intercostal tertiary vein fabric percurrent (crossing between adjacent secondaries), opposite and straight to sinuous or alternate. Intercostal tertiary vein angle variable, increasing exmedially. Epimedial tertiary fabric percurrent, mixed, admedical as well as exmedical their course parallel to the intercostals tertiaries. Quarternary vein fabric mixed percurrent, irregular reticulate. Quinternary vein fabric more or less regular, reticulate. Good development of areolation. Freely ending veinlets unbranched or with one branch, terminals simple.

The impressions of Cat. 7 and 9-12 are too small and/or not well enough preserved to permit scientific identification without reservations. For some the available characteristics (solely the characteristics of course and gauge of the secondary veins and the distance between them) look very much the same as for *Vitis vinifera* L., but strictly speaking this is not enough scientific proof of their identity. We do mention them here because they provide additional information on the frequency of leaf impressions in general and on the type of pottery on which they occur, as well as on the zones of the vessels where they can be found.

CATALOGUE FOR *VITIS VINIFERA* L.

Cat. 7) SA-2005-MAC-23

Two secondary veins run obliquely downward from the rim (FIG. A.8), so the corresponding primary vein is situated on the flattened top of the rim. Based on the characteristics of the secondary veins (their course and gauge) and the distance between them, this impression is possibly that of a *Vitis vinifera* L. leaf.



FIG. A.8. Cat. 7: a fragmentary impression of a leaf of *Vitis vinifera* L. (© Sagalassos Archaeological Research Project).

Cat. 8) SA-2003-NEG-68

Since the leaf impression is incomplete (FIG. A.9), the size class of this leaf⁸⁷ can only be estimated as “mesophyll” (4.500-18.225 mm²). The visible leaf venation pattern is characterised by a limited number (four) of veins running parallel to each other, separated by intercostal distances of 8-10 mm. These veins belong to the major venation pattern and are relatively straight and fine, but at the same time well-pronounced and clearly delimited. In several zones of this leaf impression, veins of a higher order to those (so smaller, thinner veins) running perpendicular to the latter ones can be discerned. These veins are less straight, more sinusoidal. The combination of both types of veins forms, at least locally, a more or less pronounced scalariform pattern. At greater magnification veins of a still higher order are discerned, but not much of the details nor of the full pattern can be clearly observed. Although the parallel course of the principal veins visible on the impression seems to suggest that the leaf is characterised by a pinnate main leaf venation pattern, we do believe that we are dealing with a palmate type of pattern here. Located on top of the rim of the fragment runs one of the “principal”, or 1st-order veins of a palmate construction. Only a small part of the leaf is visible on the leaf impression and the other primary veins of the palmate framework are not visible on the fragment. The major visible veins therefore have to be

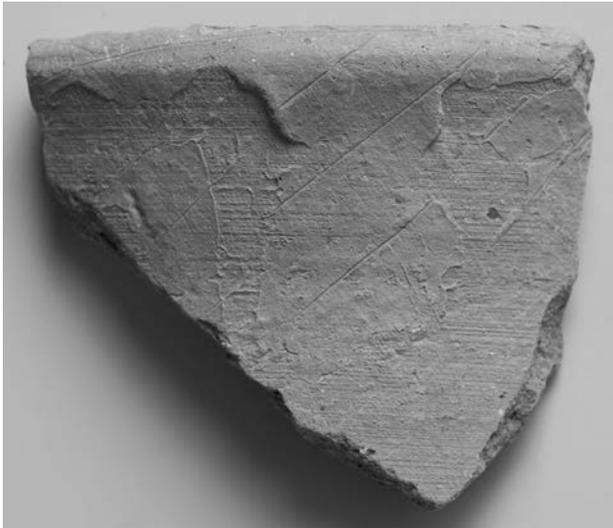


FIG. A.9. Cat. 8: a fragmentary impression of a leaf of *Vitis vinifera* L. (© Sagalassos Archaeological Research Project).

87. *Sensu* Webb 1959, in Ellis *et al.* 2009.

considered as secondary veins, while the visible veins of a higher order, linking the secondary veins perpendicularly, correspond to tertiary veins. The superficial (additional) layer of clay is damaged in several places.

Cat. 9) SA-2004-NEG-57

The leaf impression is situated near the upper edge, only tiny details of approximately 1.5 cm of two secondary veins are visible, running obliquely downward from the rim (FIG. A.10). Probably a primary vein is running on top of the rim (invisible). The morphological characteristics of these veins are reminiscent of *Vitis vinifera* L. The fine, additional layer of clay is mostly eroded.



FIG. A.10. Cat. 9: a fragmentary impression of a leaf of *Vitis vinifera* L. (© Sagalassos Archaeological Research Project).

Cat. 10) SA-2008-FG1-86-127

The impressed leaf veins are situated near the upper end of the collar, near the rim and near the handle (FIG. A.11). Six secondary veins can be distinguished, over a distance of about 5 cm, all running parallel, and obliquely downward from the rim. The distance between the veins is about 10-12 mm. The combined characteristics of the secondary veins resemble those of *Vitis vinifera* L. The additional layer of clay has largely eroded.



FIG. A.11. Cat. 10: a fragmentary leaf impression, probably of *Vitis vinifera* L. (© Sagalassos Archaeological Research Project).

Cat. 11) SA-2001-DA2-80 (a)

Two (possibly even three) leaf impressions are clearly visible (FIG. A.12b-d, also see FIG. A.12a). The clearest impression shows the principal vein over a length of about 7 cm (the middle part is lacking), as well as (very) short partitions of five secondary veins (FIG. A.12b). It is noteworthy that these five veins are all situated along the same side of the principal vein: no veins are impressed (or preserved) along the other (i.e. inner) side. The model of the veins and the space between them (ca. 1 cm) are once again similar to that of *Vitis vinifera* L. impressions, but taken on their own merit these characteristics do not form a solid enough scientific basis for a formal determination. Destruction of the additional layer of clay is evident in some zones.



FIG. A.12a. Cat. 11: fragmentary impressions cf. *Vitis vinifera* L. leaves. This is the only complete amphora top with leaf impressions presently known (see also FIG. 4 in the main text) (© Sagalassos Archaeological Research Project).



FIG. A.12b-c. Cat. 11: detail of FIG. A.12a (© Sagalassos Archaeological Research Project).



FIG. A.12d. Cat. 11: detail of FIG. A.12a (© Sagalassos Archaeological Research Project).

Cat. 12) SA-2001-DA2-80 (b)

This fragment shows the inner side of the rim, the neck and the torted handle (FIG. A.13, FIG. 5 in the main text). Parts of a primary vein on top of the upper rim and five secondary veins, running parallel downward at more or less regular distances from each other, can be observed. All veins are fine, at least partly straight and clearly delineated. The combination of the distances between the secondary veins and their morphological characteristics correspond with the leaves identified earlier as *Vitis vinifera* L. leaves (see Cat. 8). The additional layer of clay is severely damaged.



FIG. A.13. Cat. 12: fragmentary impressions of a *Vitis vinifera* L. leaf (see also FIG. 5 in the main text) (© Sagalassos Archaeological Research Project).

Appendix 4. Unidentified Leaf Impressions

The leaf impressions listed below (Cat. 13-18) are too fragmentary to obtain identification with any reliable degree of certainty. Moreover, in some cases (for example Cat. 16) only tiny patches are preserved, so that we also cannot be completely certain that we are dealing with leaves that were intentionally impressed in accordance with the characteristics listed in the article.

CATALOGUE

Cat. 13) SA-1991-DT-381

Leaf impressions, rather difficult to distinguish (FIG. A.14a) due to the photography and the poor outline of the venation pattern, are situated on the obliquely profiled inner side of the rim (FIG. A.14b). A short end of a fine straight vein and a few finer veins of a higher order, perpendicular to the former, can be discerned. The additional layer of clay is severely damaged.



FIG. A.14a. Cat. 13: rim with traces of a leaf impression; unidentified species (© Sagalassos Archaeological Research Project).

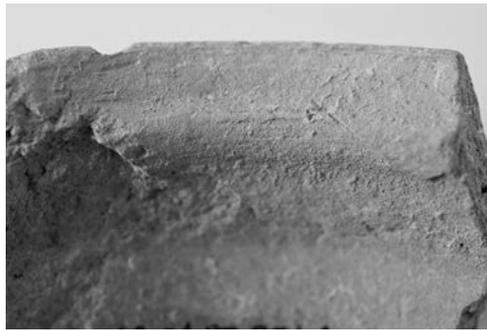


FIG. A.14b. Cat. 13: detail of FIG. A.14a (© Sagalassos Archaeological Research Project).

Cat. 14) SA-2000-B1-122

Possibly a 1-2 cm long impression of a vein on the upper side of the rounded rim of an amphora (FIG. A.15a-b).



FIG. A.15a. Cat. 14: a rim bearing faint traces of a leaf impression; unidentified species (© Sagalassos Archaeological Research Project).

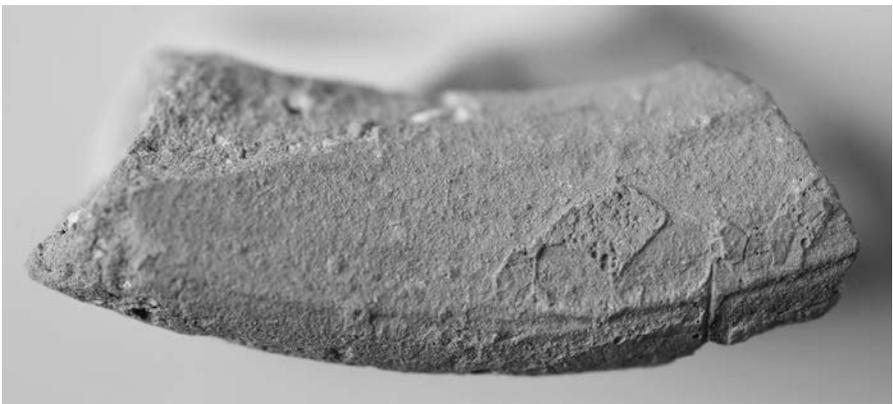


FIG. A.15b. Cat. 14: detail of FIG. A.15a (© Sagalassos Archaeological Research Project).

Cat. 15) SA-2000-LA-125 (a)

A trace of one vein, less than 1 cm long (FIG. A.16a-b).



FIG. A.16a. Cat. 15: a poorly preserved vein; unidentified species (© Sagalassos Archaeological Research Project).



FIG. A.16b. Cat. 15: detail of FIG. A.16a (© Sagalassos Archaeological Research Project).

Cat. 16) SA-2000-LA-125 (b)

An impression of one vein is approximately 0.5 cm long (FIG. A.17b, also see FIG. A.17a).



FIG. A.17a. Cat. 16: a rim bearing faint traces of a leaf impression; unidentified species (© Sagalassos Archaeological Research Project).



FIG. A.17b. Cat. 16: detail of FIG. A.17a, right (© Sagalassos Archaeological Research Project).

Cat. 17) SA-2004-LA-1

One vein, less than 1 cm in length, is impressed on the obliquely flattened part of the rim (FIG. A.18a), whilst poorly preserved impressions (of two leaves) can be discerned on the upper exterior (FIG. A.18b-c).



FIG. A.18a. Cat. 17: a rim bearing faint traces of (two?) leaf impressions; unidentified species (© Sagalassos Archaeological Research Project).



FIG. A.18b-c. Cat. 17: details of FIG. A.18a (© Sagalassos Archaeological Research Project).

Cat. 18) SA-2009-UAN-5-5

The impression upon the rim is reminiscent of that of a leaf's central vein, though it is somewhat coarser and more pronounced. As such, it bears more resemblance to a petiole or twig (FIG. A.19b, also see FIG. A.19a).



FIG. A.19a. Cat. 18: a rim bearing faint traces of a possible leaf impression; unidentified species (© Sagalassos Archaeological Research Project).



FIG. A.19b. Cat. 18: detail of FIG. A.19a (© Sagalassos Archaeological Research Project).

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If issues arise which are not covered by these guidelines – or in the case of doubt about their application – please contact the Editors for clarification.

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