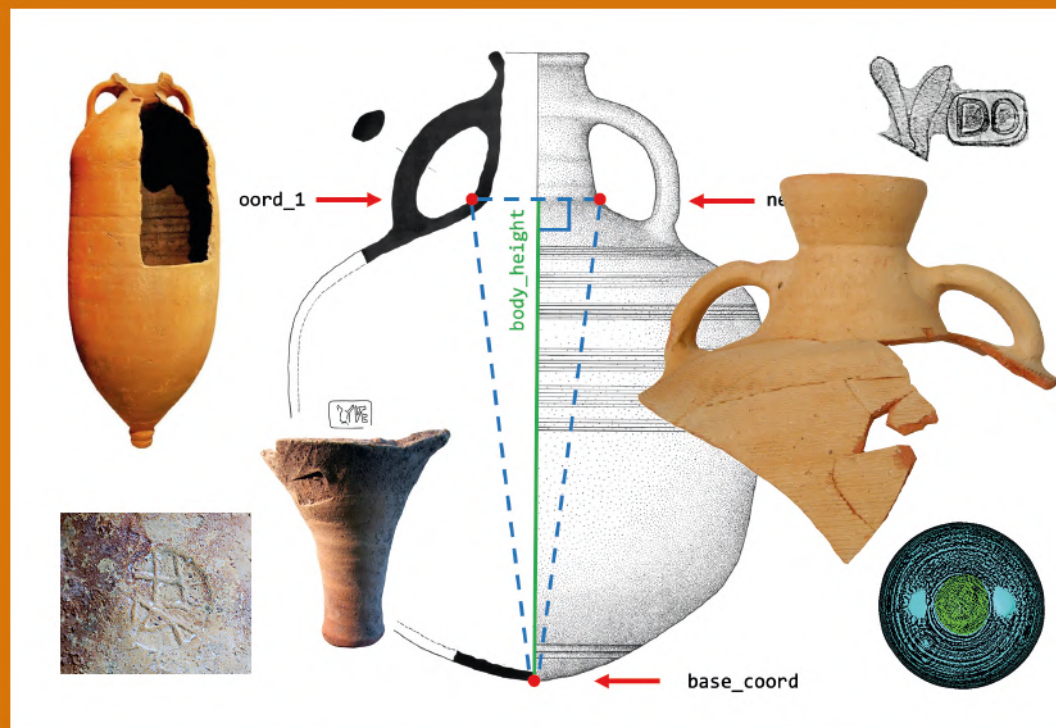


Horacio González Cesteros – Justin Leidwanger (eds.)

# Regional Economies in Action

Standardization of Transport Amphorae in  
the Roman and Byzantine Mediterranean



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CATARINA VIEGAS – CARLOS FABIÃO – RUI ROBERTO DE ALMEIDA

## STANDARDIZATION OF LUSITANIAN AMPHORAE BETWEEN CONVERGENCE AND DIVERSITY<sup>1</sup>

### Abstract

Amphora production as attested in Lusitania mostly accompanies the exploitation of marine resources. The main amphora workshop areas are located in Peniche, in the Sado and Tagus Valleys, and in the Algarve region. The earlier productions identified date from the Augustan period or slightly before (50–25 B.C.) and cover a set of quite diversified shapes that have been designated as ›ovoid types‹ and ›early Lusitanian‹, which are related to the late Republican ovoid types (mainly the Baetican ones), up to the early imperial Dressel 7/11 and Haltern 70 types. To date, manufacture can be linked to the Sado and Tagus Valleys, as well as to Peniche. From the middle of the 1<sup>st</sup> century onward, however, the main amphora type known in these regions is the Dressel 14 type. This is also the period when this amphora seems to have achieved an established position in the internal market of Lusitania, with a significant role in both urban and rural areas, as well as in western and central Mediterranean markets.

From the second half of the 2<sup>nd</sup> century onward, there was a clear modification in both the fish salt production structures and in the amphora shapes, which now diversified, with new ones being related to new products, such as wine. Some forms occur in different modules that correspond to different capacities, as seems to be the case of the Lusitana 3, Almagro 51C, and Algarve 1 type. This reveals how the workshops operated in direct connection with the fish-salting units as well as with the wine producers. The role of market pressure is also discussed in this context.

### INTRODUCTION

In accordance with the main themes of this volume concerning standardization, we will address the subject from the point of view of the amphora production in the westernmost province of the Roman Empire: Lusitania. From the Augustan period onward, the western part of Hispania Ulterior was integrated into the new province of Lusitania. Amphora production in the region of what is today Portuguese and Spanish territory was related mainly to the fish-salting industries, although minor production and commerce of wine in amphorae also existed. The core of this industry was on the Atlantic coastal areas of central and southern Portugal in the Sado and Tagus estuaries as well as in the Peniche area farther to the north. It also operated in the southernmost region, the Algarve. Production seems to have started slightly after the mid-1<sup>st</sup> century B.C. and lasted in some regions until at least the first half of the 6<sup>th</sup> century A.D. (fig. 1).

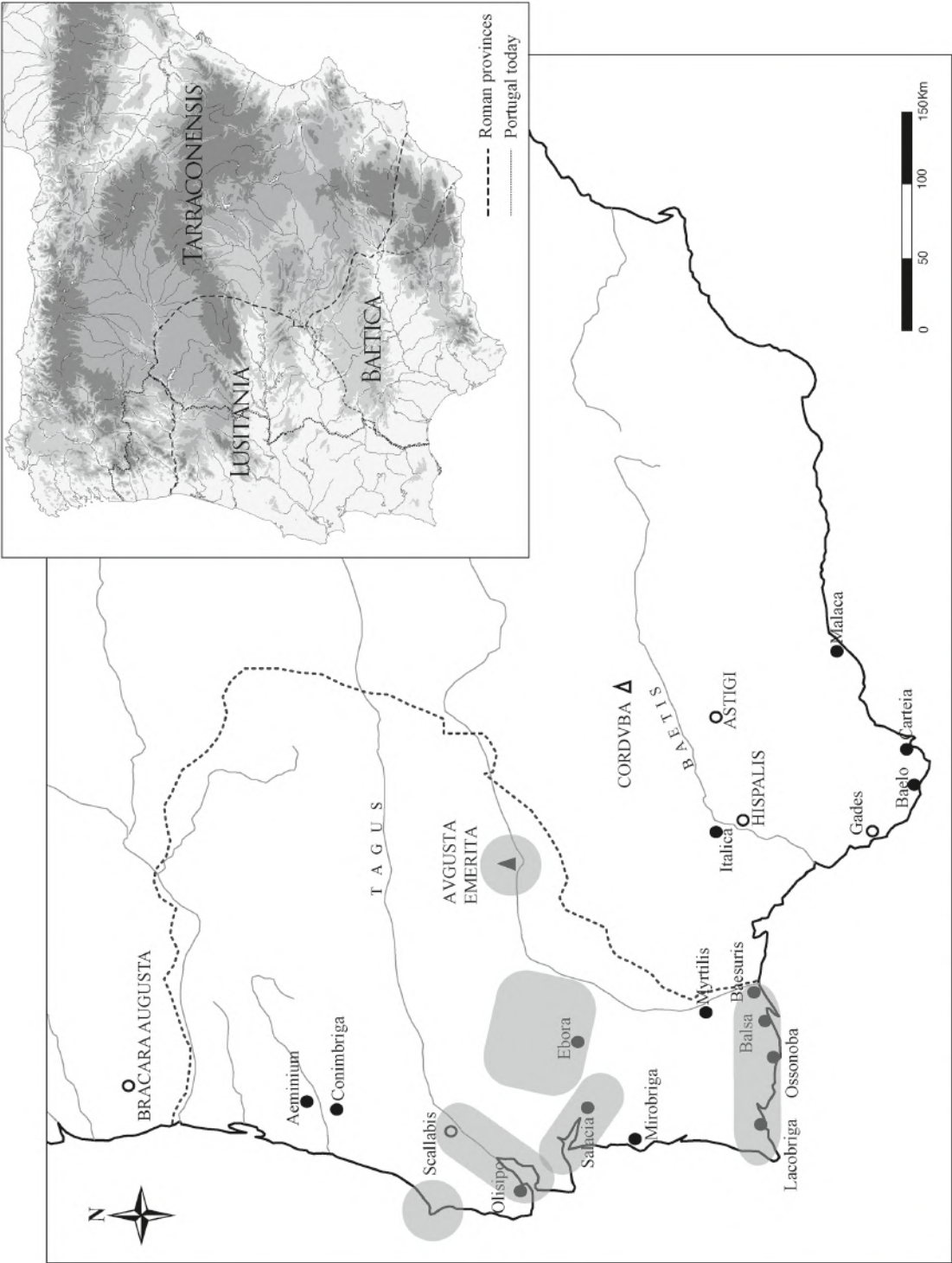
Our paper will focus on different aspects where standardization in production can be observed. Far from a homogeneous and linear process, we see different evolutionary dynamics converging toward standardized production in certain phases of the overall manufacturing process, while in other periods the opposite trend seems to take place in seeking diversification.

Concerning the characterization of different amphora types made in Lusitania, one should note that recent research into the periodization of the development of production has resulted in a more complex phasing than the previous one<sup>2</sup>, which comprised a phase in the early Empire (1<sup>st</sup>–3<sup>rd</sup> cent. A.D.) and a second one in Late Antiquity (3<sup>rd</sup>–5<sup>th</sup>/6<sup>th</sup> cent. A.D.). As will be seen in detail below, early production is now attested in Sado and Tagus Valleys from the Late Republican/early Augustan phase (50–25 B.C.), utilizing different shapes designated as ›ovoid types‹ and ›early Lusitanian‹. These forms share common features or are inspired by those from the Ulterior types,

<sup>1</sup> This work was financed by Portuguese funds through FCT – Fundação para a Ciência e a Tecnologia in the framework of the projects UIDB/00698/2020 and UIDP/00698/2020.

<sup>2</sup> Fabião 2004.





1 Map of Hispania, with emphasis on Lusitania, indicating the main geographical and/or pottery-making entities mentioned in the text: 1) Central Atlantic Coast (Peniche); 2) Tagus Valley; 3) Sado Valley; 4) Central Alentejo (?); 5) *Augusta Emerita* territory; 6) Algarve (© by the authors, based on the map in: Va. Aa. 1990)

such as the Late Republican ovoid types from the Guadalquivir Valley and the Cádiz region, and Early Baetican imperial forms such as Dressel 7/11 and Haltern 70 types<sup>3</sup>.

Production reached a high volume from the middle of the 1<sup>st</sup> century A.D. onward, both supplying the internal markets in Lusitania (major towns and *villae* in rural areas) and playing an important role in western and central Mediterranean markets<sup>4</sup>. Fish-based products were carried in Dressel 14 amphorae, the main type produced during that period; its production areas extend, though on a limited scale, also into the Algarve region in the south of Portugal. From the beginning of the 2<sup>nd</sup> century onwards, wine produced mainly in the rural settlements from the Tagus and Sado Valleys came to be marketed in the Lusitana 3 type amphora, not only within all Lusitanian markets<sup>5</sup> but even across its borders, particularly to neighboring Baetica<sup>6</sup>.

It is still difficult to understand what caused the major modifications of fish-salting production units (*cetariae*) from the second half of the 2<sup>nd</sup> or beginning of the 3<sup>rd</sup> century onward. What can be observed, however, are the consequences of these transformations, which included related changes in the typology of amphorae and also the production of more diversified forms. In addition to the containers of fish-based products (Almagro 51C, Almagro 51A–B, Algarve 1, Almagro 50, Sado 1 [= Keay 78], etc.) new shapes also appear related to wine. This would seem to be the case with Lusitana 9.

The end of amphora production should be closely related to the progressive abandonment of fish-salting units. The first serious disruption came in the second half of the 5<sup>th</sup> century, as exemplified by the cases of Tróia<sup>7</sup> (despite evidence for some continuity in the occupation of this settlement itself through the 6<sup>th</sup> cent.<sup>8</sup>), the site in Lisbon at Núcleo Arqueológico da Rua dos Correeiros (NARC)<sup>9</sup> and in Rua dos Fanqueiros<sup>10</sup>. There is, however, evidence for a few fish-salting units still active in the first half of the 6<sup>th</sup> century, as in Lagos (Algarve)<sup>11</sup>, and for the arrival of such late Lusitanian amphorae in provincial markets like Olisipo/Lisbon<sup>12</sup> as well as Hispalis/Seville<sup>13</sup> and Tarraco/Tarragona<sup>14</sup>, to mention just some examples<sup>15</sup>.

We will discuss different aspects that we recognize can be standardized, like the general shape of the amphora types, the specific shapes of their different parts (rim, neck, handles, body, spike), and their particular capacities. By doing so, we aim to establish a possible correlation with the units of measurement that could be used in antiquity. In this particular aspect, we will look at liquid and solid measurements – as we are not sure which system was used for foodstuffs like the several possible fish products – and attempt to correlate between modern and ancient measurement systems.

This endeavor aims to open case studies for further discussion rather than postulate a final model. The values used here remain approximate at the moment, and many questions remain unanswered. We therefore consider our work as just one new step on a long road still ahead, one contribution toward an understanding of Lusitania's role in the complex and interdependent provincial exchange systems within the Roman Empire.

<sup>3</sup> Morais 2004; Arruda et al. 2006; Morais – Fabião 2007; Fabião 2008; García et al. 2011; Almeida et al. 2014; Morais – Filipe 2016; Filipe 2016; Pinto et al. 2016a; Pimenta 2017; Almeida – Fabião 2019; García et al. 2019b.

<sup>4</sup> The main markets for these early imperial Lusitanian types, mainly represented by Dressel 14, were the towns and *villae* in Lusitania (see Raposo – Viegas 2016) as well as the Mediterranean markets as exemplified below: see n. 83.

<sup>5</sup> Fabião 2008; Quaresma – Raposo 2016a; Almeida 2016; Filipe 2018.

<sup>6</sup> Bernal-Casasola 2011; García 2015; García 2016; Filipe 2018.

<sup>7</sup> Étienne et al. 1994; Pinto et al. 2011.

<sup>8</sup> Pinto et al. 2016b.

<sup>9</sup> Bugalhão 2001; Grilo et al. 2013.

<sup>10</sup> Diogo – Trindade 2000.

<sup>11</sup> Ramos – Almeida 2005; Ramos et al. 2006; Ramos et al. 2007.

<sup>12</sup> Pimenta – Fabião (forthcoming).

<sup>13</sup> Amores et al. 2007.

<sup>14</sup> Remolà 2000; Remolà 2016.

<sup>15</sup> So far, there is no clear proof of these amphorae in markets outside the Iberian Peninsula.

## SOME HISTORIOGRAPHY AND CURRENT LINES OF RESEARCH

Research has recently taken place thanks to the teamwork of a relatively large and diverse set of scholars working in close cooperation. The projects undertaken include systematic investigation in the Tagus Valley under the Orest Project<sup>16</sup>, with specific research taking place at the Quinta do Rouxinol kilns<sup>17</sup> and at Porto dos Cacos<sup>18</sup> but also involving investigations into where fish-based products were manufactured and consumed<sup>19</sup>. The Sado Project<sup>20</sup> incorporates excavations at the Abul and Pinheiro amphora production centers as well as in Tróia, the largest production center for fish products. In Peniche, the excavation of the pottery workshops allows the identification of relevant amphora production but still not related to any *cetariae*<sup>21</sup>. In the Algarve region, a first attempt at investigating production was made in the 19<sup>th</sup> century, with the excavation of one kiln in S. Bartolomeu de Castro Marim<sup>22</sup>. During the 20<sup>th</sup> century, amphora production was identified during preventive archaeological excavations that took place at Quinta do Lago<sup>23</sup>. Manufacture was also identified at S. João da Venda<sup>24</sup>, Manta Rota<sup>25</sup>, and Salgados<sup>26</sup>. Martinhal, situated on the western coast and suffering from coastal erosion, remains the largest regional production center<sup>27</sup>. More recently, evidence of amphora production was also recovered in contract excavations in Lagos<sup>28</sup>.

Apart from new data coming from fieldwork, particularly excavation in the framework of research programs but also preventive and contract archaeology projects such as at Lagos or Portimão (Algarve area), research has also involved the revision of old data retrieved in museum deposits, such as at the National Archaeology Museum in Lisbon. Despite all of these sources, the new information concerning production centers remains small. Some new data concerning kilns and fish-salting contexts is emerging from Lusitania, as in the case of Lagos<sup>29</sup> and Portimão<sup>30</sup> (Algarve region), Parvoíce (Alcácer do Sal)<sup>31</sup>, and Joaquim Granjo Street (Setúbal)<sup>32</sup>, but most of the recent information has been retrieved in consumption contexts, particularly for the first phases of the process, as at Pedrão (Setúbal)<sup>33</sup>, Monte dos Castelinhos (Vila Franca de Xira)<sup>34</sup>, and at the Alentejo hill forts and fortresses, like Rocha da Mina (Alandroal) and Caladinho (Redondo)<sup>35</sup>. We also have begun to achieve a general notion of how far some production disseminated, such as that from Peniche, thanks to a combined approach using morphological details, archaeometry, and amphora stamps<sup>36</sup>. In addition, the amphora production in Conimbriga has recently been characterized<sup>37</sup>.

<sup>16</sup> Amaro 1990; Duarte 1990; Raposo 1990; Raposo et al. 2005; Dias et al. 2001; Dias et al. 2010.

<sup>17</sup> Duarte 1990; Raposo et al. 2005; Raposo et al. 2016; Raposo 2017.

<sup>18</sup> Raposo 1990; Raposo et al. 2005.

<sup>19</sup> Dias et al. 2012.

<sup>20</sup> Mayet et al. 1996; Mayet – Silva 1998; Mayet – Silva 2002; Mayet – Silva 2016.

<sup>21</sup> Dias et al. 2003a and 2003b; Cardoso et al. 2016.

<sup>22</sup> Vasconcelos 1898.

<sup>23</sup> Arruda – Fabião 1990; Arruda 2017.

<sup>24</sup> Fabião – Arruda 1990.

<sup>25</sup> Viegas 2006.

<sup>26</sup> Bernardes et al. 2007.

<sup>27</sup> Silva et al. 1990; Fabião 2004; Bernardes 2008; Bernardes et al. 2013; Bernardes – Viegas 2016.

<sup>28</sup> Fabião et al. 2010; Fabião et al. 2017a.

<sup>29</sup> Fabião et al. 2017a.

<sup>30</sup> Major site intervention by Paulo Botelho and Sónia Ferreira, Botelho – Ferreira 2016.

<sup>31</sup> Pimenta et al. 2016.

<sup>32</sup> Silva 2018.

<sup>33</sup> Mayet – Silva 2016.

<sup>34</sup> Pimenta – Mendes 2014; Pimenta 2017.

<sup>35</sup> Mataloto et al. 2016.

<sup>36</sup> Fabião 2014.

<sup>37</sup> Correia et al. 2015.



Typological studies were almost the only concern of research on amphorae in the 1980s and 1990s and, to a certain extent, still today. Since then, major interest has also focused on fabric characterization using both petrography and chemical analysis based on NAA, the latter chiefly undertaken by the Instituto Tecnológico e Nuclear team in close collaboration with archaeologists<sup>38</sup>. This research has already enabled the identification of several amphora workshops from western and southern Lusitania through their chemical fingerprints using NAA. The petrographic study made possible the identification of the major amphora fabric groups from the Sado and Tagus Valleys and also from several southern Lusitanian amphora workshops in the Algarve region. Macroscopic analysis allows broader identifications but alone fails to distinguish the Sado and Tagus basin fabrics. Chemical analysis works if one wants to distinguish the Sado Valley productions from those from the Tejo basin, but the issue is not so relevant for imports to foreign regions since both originate from western coastal Lusitanian workshops.

As most of the amphorae are in direct association with fish-salting units and fish-based products, recent lines of research also take into account the faunal remains (mostly ichthyofaunal) recovered in these contexts that provide valuable information on the exploitation of marine resources<sup>39</sup>. More recently, research into organic residue analysis has also taken the first steps toward a better understanding of certain Lusitanian amphora types and their contents<sup>40</sup>. Other lines of research have focused on general information concerning amphora consumption in sites such as towns, *villae*, and other types of Roman settlements, and also on exploring the role of Lusitanian products versus imports from other provinces<sup>41</sup>. More recently, special attention was also paid to the contexts of transport of Lusitanian amphorae to better understand the rhythms by which these products were exported into the Mediterranean and Atlantic areas<sup>42</sup>.

We should mention here that most of the resulting research into Lusitanian amphorae has been presented through conferences and their subsequent publications<sup>43</sup>. Concerning the amphora workshops in the Sado Valley, several monographs have been published that offer a better understanding of some of the main features of amphorae produced in this area<sup>44</sup>. Besides the traditional monographs and relevant syntheses<sup>45</sup>, special mention should be made of online databases, as these play a significant role in current research by allowing free access and permanent updating of information. Southampton's database on »Roman Amphorae: a digital resource«<sup>46</sup> and more recently »Amphorae ex Hispania«<sup>47</sup>, the online lab based at the Institut Català d'Arqueologia Clàssica (ICAC) concerning the amphorae produced in the whole Iberian Peninsula, have made it possible to summarize the information concerning the main Lusitanian types. Through these digital platforms, one may find the state-of-the-art data and resources concerning Lusitanian amphora types and variants, their chronologies and distributions.

<sup>38</sup> Cabral 1977; Dias et al. 2003 and 2003b; Prudêncio et al. 2003; Prudêncio et al. 2009; Dias – Prudêncio 2016; Mayet et al. 1996.

<sup>39</sup> Assis – Amaro 2006; Gabriel et al. 2009; Gabriel – Silva 2016; Gabriel 2018.

<sup>40</sup> Morais et al. 2016.

<sup>41</sup> The list is long, but see, for example, Filipe 2018 (with extensive bibliography).

<sup>42</sup> Bombico 2017.

<sup>43</sup> »Lusitanian Amphora Congress« (Conimbriga), published as Alarcão – Mayet 1990; »Romanization of Sado and Tagus estuaries«, published as Filipe – Raposo 1996; International Symposium »Production and commerce of fish sauces during Proto-history and Roman period in the western Iberian Peninsula«, published as Silva – Soares 2006; International Conference »Lusitanian Amphora: Production and distribution«, published as Pinto et al. 2016a; and finally »International Seminar and Experimental Archaeological Workshop«, published as Fabião et al. 2017b.

<sup>44</sup> Mayet et al. 1996; Mayet – Silva 1998; Mayet – Silva 2002.

<sup>45</sup> Fabião 2004; Fabião 2008.

<sup>46</sup> <[http://archaeologydataservice.ac.uk/archives/view/amphora\\_ahrb\\_2005/index.cfm](http://archaeologydataservice.ac.uk/archives/view/amphora_ahrb_2005/index.cfm)> (10. 06. 2019).

<sup>47</sup> <<http://amphorae.icac.cat/amphorae/authors?page.2=>>> (18. 04. 2023).



## SOME CONCEPTS, METHODS AND PRACTICES OF STANDARDIZATION: THE LUSITANIAN CASE STUDY

When addressing the subject of Lusitanian amphora standardization, we believe that there are several linked issues here that deserve attention and reflect different aspects of the same reality. What are we referring to when we speak about standardization? We could address this matter from the point of view of standardization of types if we concentrate on morphologies with recurrent characteristics; another approach would be to focus on the standardization of capacity, where we could investigate the consistent volumes of one particular type of amphora even though it was produced in different regions. Also important may be expressions of regional or provincial standardization, which might entail convergence of these aspects within specific types in each of the main producing regions of Lusitania (fig. 2).

In analyzing the shapes of amphorae, their detailed observation and description, the calculation of metric values, and the averaging of values for specific features and morphological details were undertaken in a systematic way. Nonetheless, this was neither a new approach nor an innovative trend in Lusitanian amphora studies but rather one with long history of interest. At the very beginning, some attempts were made following the proposals of J. C. Gardin, as expressed at the Roman Amphora Conference held by the French School at Rome in 1974<sup>48</sup>. Those experiments were made with some amphorae from the Sado area<sup>49</sup>. D. Diogo also made some attempts using a unique method that was several times mentioned but never actually published. However, neither of these attempts achieved significant results; they are now part of the history of research, to be compared with new methodologies proposed in the last decades, particularly given all the changes that have taken place in the world of computing hardware and software (fig. 3).

In determining the capacities of different amphora types, we combined traditional measurement methods for several complete amphorae – i.e., the filling of the empty amphorae with polystyrene micro-balls – with systematic 3D modeling based both on already published material as well as contextual data from recent archaeological work. The latter were partly based on published specimens, many of which were revised and redrawn to confirm their reliability. The vector files were then converted (using Adobe Illustrator, CorelDraw or AutoCAD) into 3Ds MAX and Rapidform Xor to obtain 3D volumetric models and internal capacities<sup>50</sup>. We have established a dataset that we consider representative of the standardization processes in Lusitanian amphora production. Nevertheless, one should point out that the larger the sample, the better the results and the more solid conclusions that can be drawn. The empirical dataset should be increased to verify some of the results proposed here. We have also succeeded in estimating the weights of empty forms as another mechanism for assessing the quantity of amphorae in a given sample of fragmentary sherds (fig. 4).

Quantification of volumes of commodities traded in amphorae is not new; it has long been a concern on the scientific agenda and has been tackled by different approaches<sup>51</sup>. E. García Vargas recognized the importance of volumes for studying the goods imported to Seville during the Early Imperial and Late Antique periods<sup>52</sup>. This researcher worked with statistical approaches to estimate the percentages of different goods imported into the city according to origin, but by using information on the volumes of the amphorae and not their MNI as was conventional<sup>53</sup>. More recently, V. Martínez has made attempts to calculate (using AutoCAD software) the volumetric capacities of Lusitanian amphora types as compared with Baetican ones as part of the Palatine

<sup>48</sup> Vv. Aa. 1977.

<sup>49</sup> Coelho-Soares – Silva 1978; Fabião – Carvalho 1990.

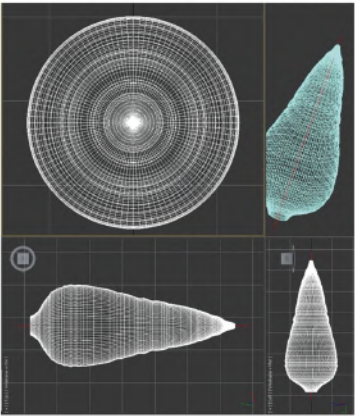
<sup>50</sup> This systematic procedure was developed with F. J. López Fraile.

<sup>51</sup> Orton et al. 1993; Wilson 2009.

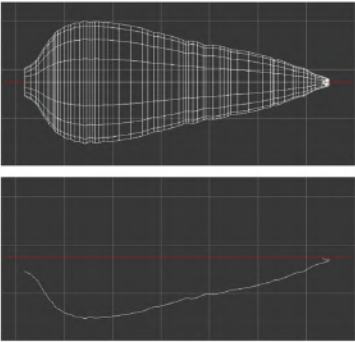
<sup>52</sup> García 2007.

<sup>53</sup> García 2007, 321. Information on the volumes of different amphora types was obtained from Ejstrud 2002; Tyers 1996; and for late Roman types, Bonifay 2004.

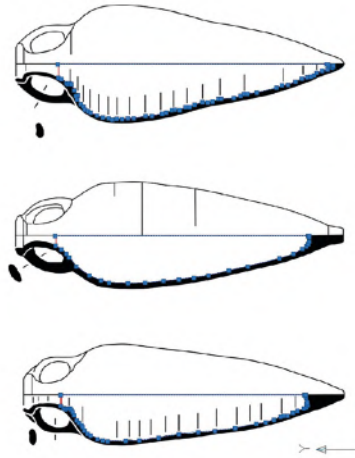




Model 16 sides to 100 sides



Line on rotation axis



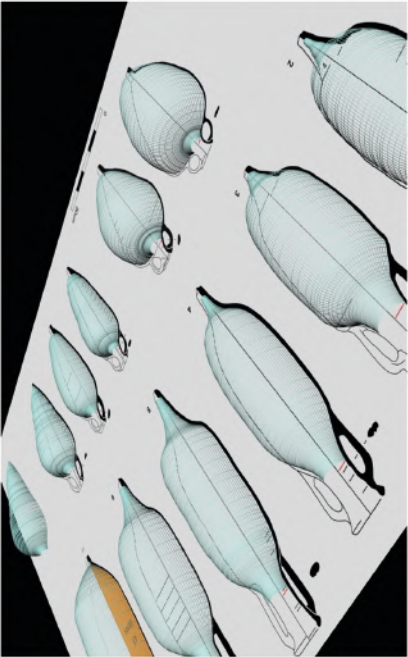
Vectorial lines CAD



Measure 3Ds Max (design 3D) & Rapidform Xor (redesign 3D)

Sextarius	1	~ 54 cl
Conglus	6	~ 3 1/4 l
Urna	24	~ 13 l
Amphora	48	~ 26 l
Culeus	960	~ 520 l

Roman units of measurement



Pottery volume wireframe

4 3D volume calculation procedure. Some aspects of the modeling and calculation process (© by the authors)



East Pottery Project (PEPP)<sup>54</sup>. Based on published drawings and online databases, 48 amphorae were processed. Volumetric models of complete amphorae were obtained mainly for the Lusitanian Dressel 14 and Almagro 51C types (with more than 20 examples of each) and to a lesser extent for the Lusitana 3, Keay 16, Almagro 50, Almagro 51A–B, and Sado 1 types<sup>55</sup>. Only two Baetican Dressel 14 amphorae were considered. The results produced a quite disparate range of values. Dressel 14 ranged in volume from 23.4 to 49.08 liters; overall the Baetican amphorae seemed to be slightly smaller than the Lusitanian ones<sup>56</sup>. Here we must stress that almost all the measurements were taken from drawings of amphorae published at 1 : 10 and other small scales. In our opinion, the problems of accuracy that derive from the reuse of small, published drawings and the lack of measurements based on first-hand drawings are partly responsible for this range of values.

If we accept these estimates as much more reliable than simple rim or MNV (minimum number of vessels) counts for calculating the quantity of commodities imported to one specific place, various technical aspects still remain to be discussed and further developed, such as the quality of line drawings and the point to which the vessel capacity is calculated (i.e., at the top of the neck or below)<sup>57</sup>. Central to this discussion about the quantification of amphorae and the volume of products transported, we must first produce reliable quantification protocols that allow the comparison of different samples across the Roman Empire. Several aspects must be raised as they paved the way for the seminar that took place at the University of Seville (in the framework of the ICAC Project »Amphorae Ex Hispania«), when a team of Portuguese and Spanish researchers proposed a quantification methodology known as the Seville Protocol 2014 (PCRS/14)<sup>58</sup>. Quantification and its related issues have been the subjects of several subsequent scientific meetings, including one held in Barcelona and published as »Quantifying ancient economies. Problems and methodologies«<sup>59</sup>. Discussed at this meeting were several methodological approaches to different aspects of the ancient economy through amphorae and related quantification issues. Also worth mentioning is the recent statistical tool proposed by J. Molina Vidal and D. Mateo Corredor: the average capacity (AC). This aims to obtain more reliable data on the volumes of goods transported in amphorae by providing a narrower confidence interval for each type<sup>60</sup>.

## STANDARDIZATION OF LUSITANIAN AMPHORAE: PRODUCTION AREAS, TYPES AND CHRONOLOGIES

### »Early Lusitanian« Production

Given the contextual data from consumption sites, we know that the beginning of amphora production in Lusitania took place in the Late Republican period. However, there is not yet data from such early production contexts. The production centers that were identified in the Tagus and Sado estuaries and in the Peniche kilns only provide direct evidence from the last quarter of the last century B.C., that is, from the principate of Augustus. Archaeometric analysis from some of the amphorae from Olisipo allowed the identification of one peculiar fabric apparently coming from a pottery workshop still unknown in the archaeological record<sup>61</sup>.

<sup>54</sup> Martínez 2016, 129 f. fig. 1.

<sup>55</sup> For detailed information on the features of this Lusitanian types, see below.

<sup>56</sup> Martínez 2016, 130.

<sup>57</sup> Martínez 2016.

<sup>58</sup> Quantification issues have been addressed by the »Protocole de Beauvray«: see Arcelin – Tuffreau-Libre 1998. In the publication of the PCRS/14 in Adroher et al. 2016, there is an extensive bibliography on quantification methods.

<sup>59</sup> Remesal et al. 2018.

<sup>60</sup> Molina – Mateo 2018.

<sup>61</sup> Dias et al. 2012.

Concerning major typological trends, we observe that there is no reproduction of Italian models as occurred in other provinces in earlier periods such as in Ulterior/Baetica. Rather, morphologies have a clear affiliation with the Baetican Romanized amphorae from the Late Republican and Early Imperial periods, mostly related to the shapes from the Guadalquivir Valley and from the coastal area of Cádiz. As mentioned before, these ›early Lusitanian‹ types, once called Lusitanian ›ovoid types‹<sup>62</sup>, characterize the first stage of Lusitanian production. Research from the last decade has shown that the types produced from the second half of the 1<sup>st</sup> century B.C. to the middle of the 1<sup>st</sup> century A.D., or at least to the end of the reign of Tiberius, were not all ovoid types. Though some do have an ovoid body shape and appear to copy, reproduce, or simply be inspired by Ulterior types such as the Ovoid 1 and 4 from the Guadalquivir Valley, others do not seem to have an ovoid shape but rather resemble the Baetican Early Imperial types such as Dressel 7–11 or Haltern 70. Nevertheless, based on the available data from very fragmentary specimens and mainly rim fragments, we have come to realize that some of these Lusitanian Late Republican/Early Imperial types are easily identified (as the one similar to Ovoid 1 from Guadalquivir), while others are much more difficult. The problem lies in the fact that several share the same morphological details, such as short handles with a longitudinal groove or molded rims. Therefore, it is quite risky to classify as ›ovoid‹ all these types preceding Dressel 14, as in many cases we currently have only rim fragments<sup>63</sup>.

From what we are able to deduce, we can observe that within early Lusitanian production, over a period of almost a century, there emerged a rich and complex universe of shapes, such as (i) various ovoid types copying and reproducing other Ulterior/Baetican types, (ii) likely (but poorly preserved) non-ovoid types, (iii) amphorae copying and reproducing other Baetican types (Haltern 70, Dressel 7–11), and (iv) new provincial amphora forms with Baetican influences or inspiration. Most of the amphorae from the production center in Peniche, which started in Augustan times, belong to this last group<sup>64</sup>. As they form a different corpus both in terms of production context and in variety of shapes that show local originality – with specific types not copied from other amphorae – they should be considered as a separate entity. Their distribution was also mainly in western Lusitania to major towns including the province capital of Augusta Emerita<sup>65</sup>.

Concerning the analysis of standardization in capacity, we do not possess a single complete specimen for the oldest Lusitanian type, which resembles a copy or reproduction of the Ovoid 1 type. Accordingly, the first example studied was another early Lusitanian type, also ovoid-shaped, known as Lusitana 12<sup>66</sup>. Its fabric characteristics allowed production to be proposed in the Tagus and/or Sado Valleys, a suggestion that was recently confirmed by the kilns of Parvoíce (Alcácer do Sal)<sup>67</sup> and Setúbal<sup>68</sup>. Two complete examples<sup>69</sup> were used for the volume measurements based on drawings and the digital method described above. Another example from an Olisipo's artisan/industrial context (NARC) shows a *post cocturam* graffito with the numeral XLIX on the lower part of the neck and upper part of the body. It is tempting to consider this to be ›confirmation‹ of its capacity as 49 (*sextarii* [?]), which could be related to one liquid *amphora* or 48 *sextarii* (fig. 5).

The next type for which we were able to perform this assessment was the Lusitanian Haltern 70<sup>70</sup>. The Lusitanian production of this type follows very closely the Guadalquivir model in its general shape, including rim, body, and handles. The petrographic characteristics of the complete

<sup>62</sup> Morais 2004; Morais – Filipe 2016.

<sup>63</sup> Almeida – Fabião 2019, 184–186.

<sup>64</sup> Cardoso et al. 2016.

<sup>65</sup> Fabião 2014.

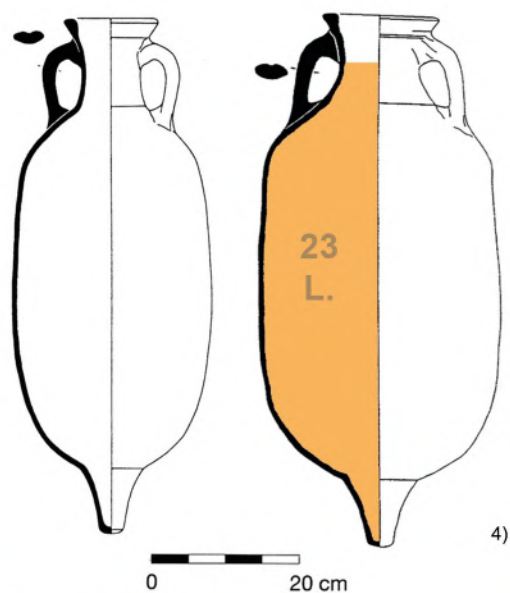
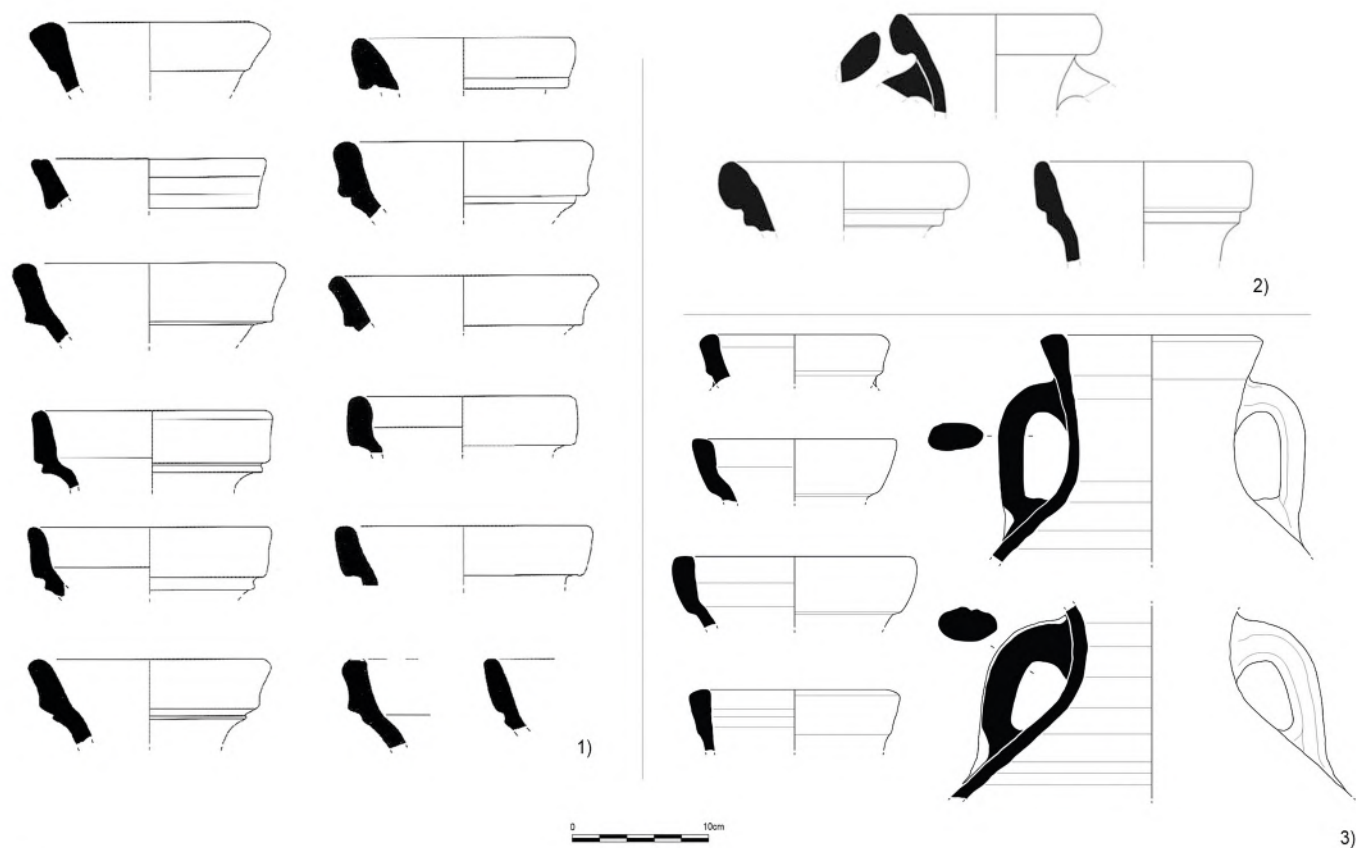
<sup>66</sup> Diogo 1987.

<sup>67</sup> Pimenta et al. 2016.

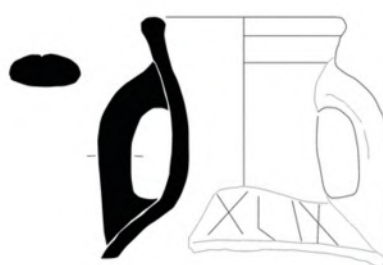
<sup>68</sup> Silva 2018.

<sup>69</sup> Diogo 1987; Diogo – Trindade 1998.

<sup>70</sup> Filipe 2016.



Capacity: *c. 1 amphora? or 48 sextarii*



Lisboa, Rua dos Correiros



5)

*49 sextarii ?*

- 5 Fragments of ›Early Lusitanian types‹, including Lusitana 12. 1) Santarém/Scallabis (Arruda et al. 2006); 2) Monte dos Castelinhos (Pimenta – Mendes 2014); 3) Lisbon, Rua dos Bacalhoeiros (Filipe 2008b ); 4) Lusitana 12 (Diogo 1987; Diogo – Trindade 1998); 5) Lusitana 12 upper part from Núcleo Arqueológico da Rua dos Correiros, Lisbon (© by the authors)



specimens are related to both the Tagus and Sado Valley pottery workshops. Of course, wine-related products should be the first contents considered, as with the Baetican prototype. Nevertheless, there is no direct evidence for its content, and the coastal location of its hypothesized workshops suggests it may have been mainly used to transport fish-based products<sup>71</sup>.

Comparative analysis of complete Lusitanian Haltern 70 examples from the Berlengas archipelago<sup>72</sup> and from chance finds in the Tagus River allowed further observations concerning morphological standardization<sup>73</sup>. This shows a quite homogeneous pattern for the region, with slightly different features from those of the original model, including a smaller rim and handles. In terms of capacity, calculated again based on the modeled drawings, they replicate the Baetican model in transporting 30 liters<sup>74</sup>.

Concerning Haltern 70 production in Mérida, the capital of the province reflects a bizarre location for production of an amphora with a non-flat base, as it is very far from the sea or any navigable river<sup>75</sup>. These amphorae can be considered a copy or local interpretation of the original model<sup>76</sup>. A wine or wine-related content is likely, and the production extends from the late Augustan until the Flavian period. Bearing in mind Pliny the Elder's reference to some famous olives from the Augusta Emerita region (nat. 15, 17)<sup>77</sup>, one should not rule out this possibility for the so-called Haltern 70 *emeritensis*<sup>78</sup>; olives were, after all, a common content in Haltern 70 amphorae according to the known *tituli picti* (fig. 6).

The production of these Lusitanian ›early types‹ seems to have begun between 40 and 30 B.C. and run until the Tiberian/early Claudian period; their distribution is attested in several different areas and contexts. On the one hand, they are found in Late Republican military settlements directly related to the process of conquest, with a particular distribution in the Tagus Valley, such as at Monte dos Castelinhos (Vila Franca de Xira)<sup>79</sup> and Santarém<sup>80</sup>, but also in other contexts in northern Portugal and modern Galicia<sup>81</sup> during the Augustan period. Then again, there is a significant presence in sites like the so-called fortins (small forts), ›castella‹, and hill forts, as is the cases of Castelo da Lousa (Mourão)<sup>82</sup>, Rocha da Mina (Alandroal), and Caladinho (Redondo) in the Alto Alentejo region<sup>83</sup>. This second group of sites in the inland of the future province of Lusitania seems to be related to the control of those territories connected to the emergent provincial capital of Augusta Emerita. In some instances, the amphorae have fabrics that point to a regional production, but the specific area of the workshop(s) has not yet been identified.

By contrast, these types are rare in the Algarve region at present, suggesting that production in this region only began in the Early Imperial period. Only in Monte Molião (Lagos) were a few examples possibly belonging to Lusitanian Haltern 70 rims identified, but the precise area of their production is still unknown<sup>84</sup>. It should also be highlighted that these early types are rare outside Lusitania, surely confirming a primarily local and regional distribution within Ulterior/Lusitania.

<sup>71</sup> Morais – Fabião 2007; Fabião 2008; Filipe 2016.

<sup>72</sup> Diogo 2005; Fabião 2014, 163 fig. 5–7; Filipe 2016.

<sup>73</sup> Quaresma 2005.

<sup>74</sup> For information on the volume of Haltern 70, see Carreras – Berni 2016.

<sup>75</sup> One should note that the Gaudiana is only a partially navigable river.

<sup>76</sup> Bustamante – Heras 2013; Bustamante – Heras 2016.

<sup>77</sup> Guerra 1995, 38.

<sup>78</sup> Fabião 2015.

<sup>79</sup> Pimenta – Mendes 2014; Pimenta 2017.

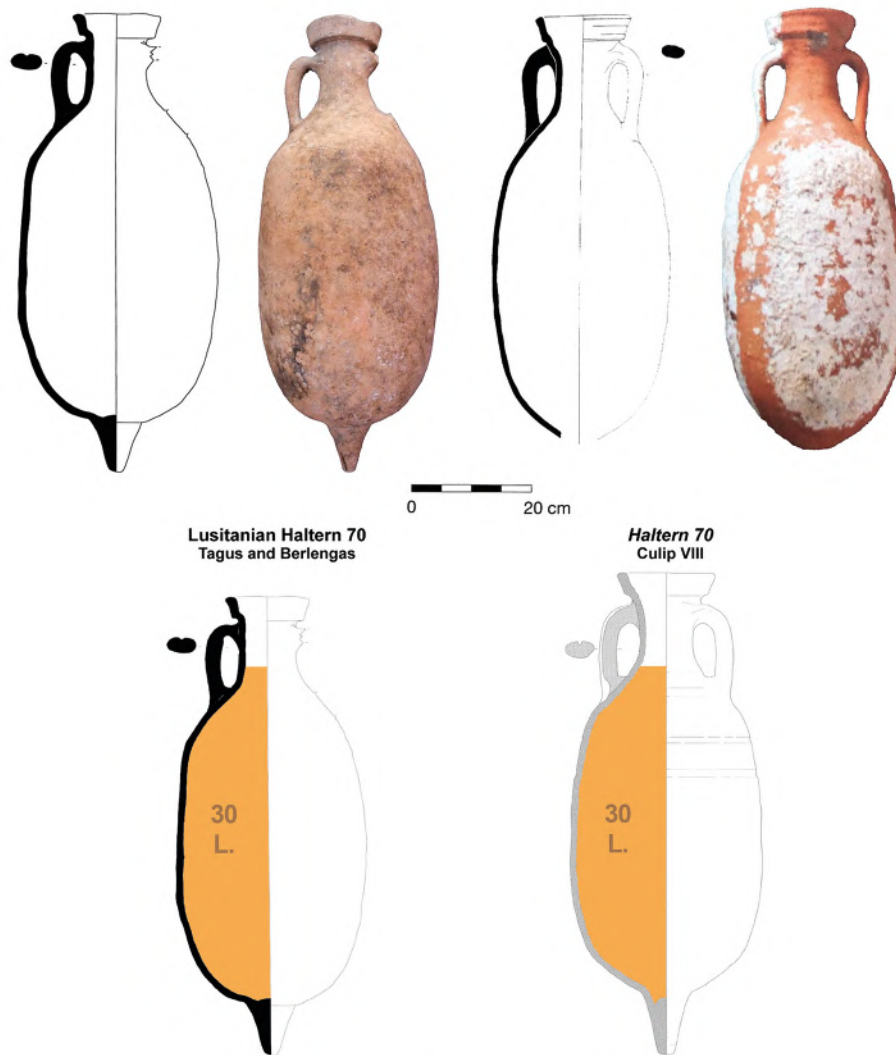
<sup>80</sup> Arruda et al. 2006.

<sup>81</sup> Morais 2004; Morais – Filipe 2016.

<sup>82</sup> Morais 2010.

<sup>83</sup> Mataloto et al. 2016.

<sup>84</sup> Arruda – Viegas 2016, 458 fig. 10.



***c. 1 amphora + 1 congius or 55 sextarii***

6 Lusitanian Haltern 70 from the Tagus/Sado Valleys and its capacity (© by the authors)

### Early Imperial Production

From the middle of the 1<sup>st</sup> century A.D. onward, a sort of convergence took place between these traditional early Lusitanian forms and the typical Dressel 14 type. The exact timing and manner of this process is still mostly unknown, and it is possible that different local or regional trends were in place around ca. 40–50 A.D. and continued until the early 3<sup>rd</sup> century. Throughout this long period, Dressel 14 was the major Lusitanian amphora form produced. Besides the Tagus and Sado Valleys<sup>85</sup>, production gradually extended to the southern Algarve region<sup>86</sup> and to the western Atlantic coast (Peniche)<sup>87</sup>.

This amphora type established its position in the internal Lusitanian market, being traded in quantities in both urban and rural areas; it was also exported to several areas of the western and central Mediterranean. Even so, we still lack a clear picture of the scale of Lusitanian exports,

<sup>85</sup> Raposo – Viegas 2016.

<sup>86</sup> Viegas 2016.

<sup>87</sup> Cardoso et al. 2016.



as there is still some confusion between the Baetican and Lusitanian production. Furthermore, knowledge of the Lusitanian fabrics remains poor among scholars in the different countries of the former Roman Empire. At Ostia, however, C. Panella identified Lusitanian amphorae in the stratigraphic records of the Terme del Nuotatore<sup>88</sup>, and the recent monograph of G. Rizzo put in context the presence and relevance of Lusitanian imports<sup>89</sup>. Rizzo also recently evaluated Lusitanian amphorae in archaeological contexts from Rome<sup>90</sup>. The last conference concerning production and distribution of Lusitanian amphorae gives an up-to-date global view of both aspects<sup>91</sup>, but the distribution data makes it clear that this achievement was just the first step in a topic that needs and deserves much more research.

The Dressel 14 type's contents were fish-based products, which is supported by the location of the kilns again in coastal areas and in close connection to fish-salting units, and more importantly by the first confirmed direct archaeological evidence of fish contents<sup>92</sup>. Concerning standardization, the Lusitanian Dressel 14 amphorae share the same overall shape, although some specific regional features should be noted. For instance, the center at Zambujalinho (Palmela), from the Sado estuary area seems to have produced chiefly Dressel 14 with small necks<sup>93</sup>, while another center at Garrocheira (Benavente)<sup>94</sup> in the Tagus estuary produced Dressel 14 with longer necks and handles. Unfortunately, we do not have amphorae preserving the complete profile from these pottery workshops, so we cannot confirm if these specific features had some relation to different modules or sizes of amphorae. According to volumetric data obtained from five complete amphorae of this type, the capacities can range from 31 to 36 liters, with most containers transporting 35 liters. Following the ancient Roman measurement system, this could be converted into ca. 1 *amphora* + 3 *congi*, or 65 *sextarii*, or 11 *congi*.

In this period there is also evidence for the Dressel 14 *parva* type (= Beltrán 73)<sup>95</sup> in addition to the normal Dressel 14 size, showing that both are clearly contemporary and traveled together, as evidenced by the Grum de Sal shipwreck (Ibiza)<sup>96</sup>. It is clear that they have the same fabric from the Tagus or Sado Valleys. In the Sado area, a smaller Dressel 14 type was also identified distinct from this *parva* version and called ›Late Dressel 14‹<sup>97</sup>, but unfortunately the available data are not sufficient to estimate the overall shape of the amphora or its capacity. Our sample at present is too small to reveal both the chronological changes and the specific features of each area or production center.

It is possible that the products of the Tagus and Sado estuaries have some peculiar dynamics of their own that we do not yet understand. In the Algarve region, Dressel 14 production is attested at S. Bartolomeu de Castro Marim, where the type also shows specific features that differ from those in the Sado and Tagus Valleys<sup>98</sup> (fig. 7).

Besides the large-scale and standardized production during the 1<sup>st</sup> and 2<sup>nd</sup> centuries A.D. of the Dressel 14 type, another amphora type begins production in this period: the Lusitana 3 type. According to some authors, its origin and influence may be understood as a Lusitanian interpretation of the Gauloise 4 wine amphora type<sup>99</sup>. Production of the Lusitana 3 type, which is mostly attested at the Tagus workshops, must have started at the end of the 1<sup>st</sup> century and continued until the

<sup>88</sup> Panella 1972.

<sup>89</sup> Panella – Rizzo 2014.

<sup>90</sup> Rizzo 2016.

<sup>91</sup> Pinto et al. 2016a.

<sup>92</sup> Alarcão – Mayet 1990; Gabriel 2013; Gabriel – Silva 2016; Gabriel 2018.

<sup>93</sup> C. Fabião personal observation.

<sup>94</sup> Amaro – Gonçalves 2016.

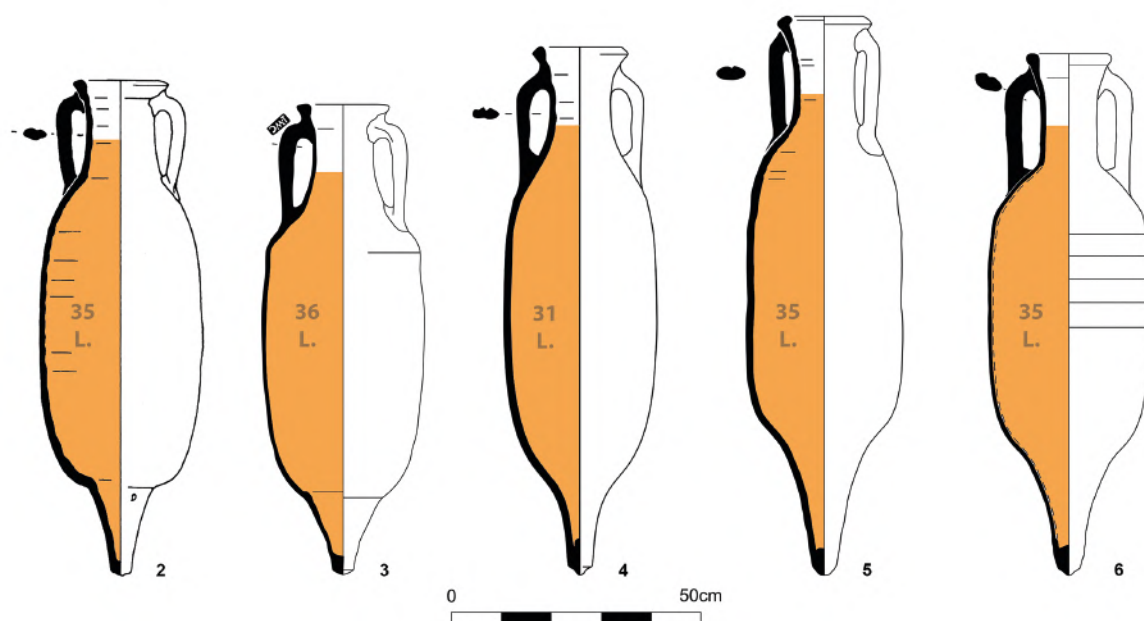
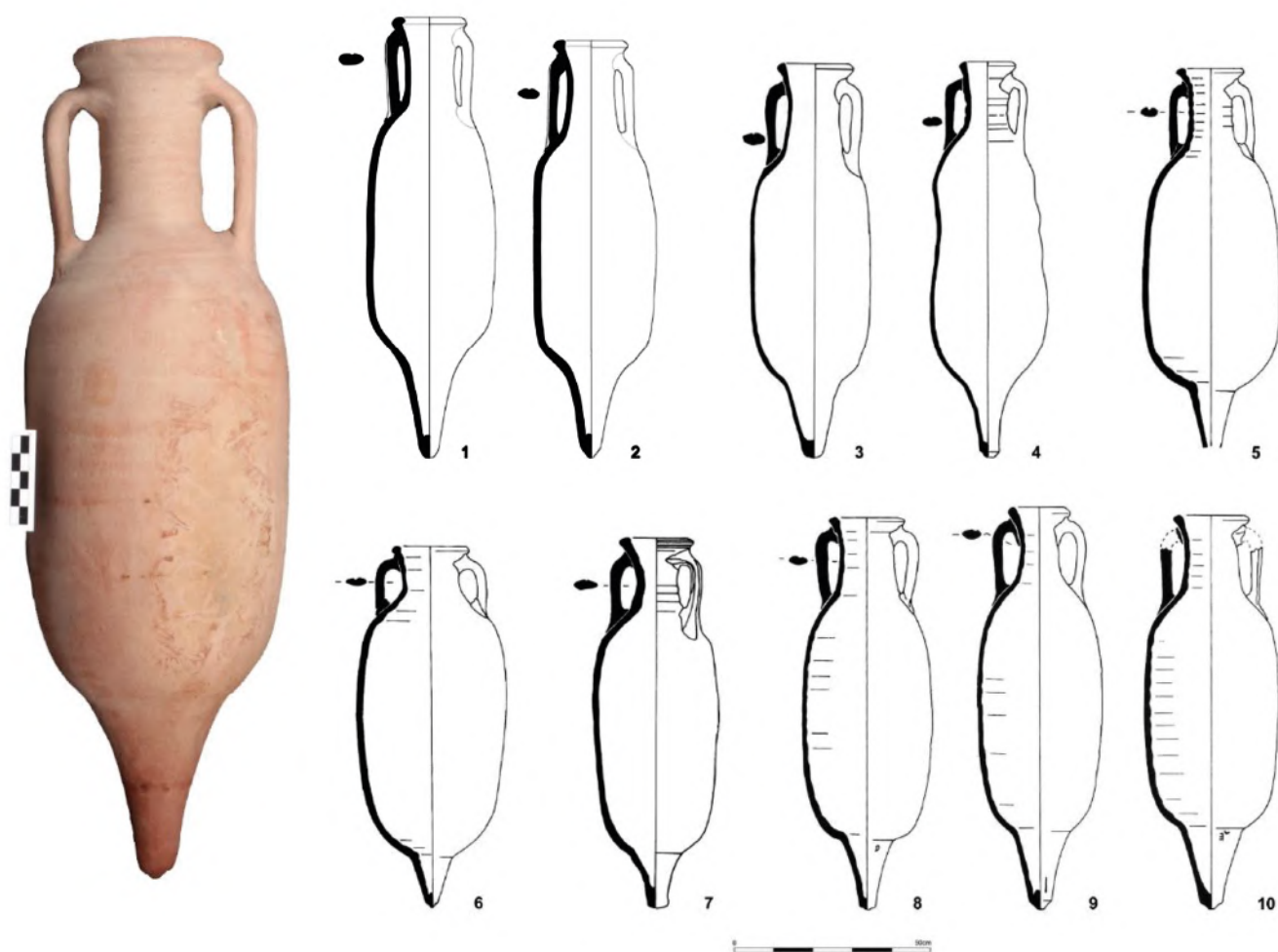
<sup>95</sup> Beltrán 1970; Almeida 2016.

<sup>96</sup> Hermanns et al. 2016.

<sup>97</sup> Mayet – Silva 1998.

<sup>98</sup> Despite a general trend toward standardization, there is also a certain degree of regional variation.

<sup>99</sup> Laubenheimer 1985. The link is mentioned by Quaresma – Raposo 2016a.



*c. 1 amphora + 3 congii or 65 sextarii*

- 7 Dressel 14 amphorae and their capacities. 1–2) Porto dos Cacos; 3–4) Setúbal; 5–6) Pinheiro workshop; 7) Tróia; 8–10) Abul workshop (from: Raposo – Viegas 2016 with bibliography)

early 3<sup>rd</sup> century A.D.<sup>100</sup>. From the late 2<sup>nd</sup> century on, it was also produced in the Sado estuary<sup>101</sup>. Most researchers accept that this amphora, with an inverted piriform body and flat bottom, could have been used as a wine container<sup>102</sup>. The hypothesis is reasonable considering the agricultural richness of the *ager olisiponenses*, where several *villae* are known, some of which are equipped with *cella vinaria* and installations for production. On the other hand, for researchers working in the Sado area, the huge importance of the salted-fish industries, the locations of pottery centers, and the minority production of the type (in contrast to the Tagus data) could suggest this particular amphora was not a wine container but again (as in case of Lusitanian Haltern 70 type) one devoted to transporting salted-fish products<sup>103</sup>.

The distribution of Lusitana 3 amphorae across Lusitania is well known, and the evidence is increasing, chiefly in the major towns<sup>104</sup>. We also know that it was exported elsewhere, namely to Baetica<sup>105</sup>. These recorded exports to other areas will increase with the concomitant improvement of researchers' knowledge about Lusitanian fabrics.

Generally, the capacity of this container must have been around 40 *sextarii* (7 *congi* or 1.6 *urna*), which corresponds to the 20–23 liters obtained in 3D modeling; a minority fall more broadly into the range of just below 18 to over 23 liters. While studying a set of Lusitana 3 amphorae from Tróia, stored in the National Archaeology Museum<sup>106</sup>, it was possible to observe, for the first time different modules corresponding to different capacities or volumes (fig. 8).

Table 1 Lusitana 3 specimen from Tróia and correspondence, table of their capacities

Module 1 (1/1)	Module 2 (3/4)	Module 3 (1/2)
ca. 22 liters	ca. 17 liters	ca. 11 liters
40 <i>sextarii</i>	30 <i>sextarii</i>	20 <i>sextarii</i>
7 <i>congi</i>	5 <i>congi</i>	3.5 <i>congi</i>
1.6 <i>urna</i>	1.25 <i>urna</i>	0.8 <i>urna</i>

Kiln sites in the Tagus and Sado estuaries produced both Dressel 14 and Lusitana 3 amphorae along with many other products, such as coarse wares. This raised questions regarding the nature of these production centers. Their greatest concentration is in estuarine areas, close to both fish-processing factories and relevant towns (sometimes these towns and production centers were the same places). This concentration and easy communication, on the one hand, and the diversity of products observed in each center, on the other, strongly suggest a production model based on the 'urban nucleated industry', to draw on the concept of D. Peacock<sup>107</sup>. The volume of amphorae and other ceramics also implies the existence of a high level of specialization, but this would also create some dependency on and vulnerability to market fluctuations, which we will see is an important issue.

Such a production model implies the existence and intervention of middlemen, namely ceramic traders, operating between the pottery workshops and the fish-processing factories. A degree of pressure would be exerted from the demand side concerning volume production or capacities. This situation can be seen, for instance, in the center at Pinheiro, which shifts its production to the Lusitana 3 and other minor forms when the demand for Dressel 14 amphorae declined due to a crisis in local fish-processing factories<sup>108</sup>. The presence of middlemen can be postulated

<sup>100</sup> Quaresma – Raposo 2016a.

<sup>101</sup> Mayet – Silva 2016.

<sup>102</sup> Quaresma – Raposo 2016a.

<sup>103</sup> For F. Mayet and her team working in the Sado area, this would be the first variant of the Almagro 51C, so linked to salted-fish contents, see Mayet et al. 1996; Mayet – Silva 1998; Mayet – Silva 2002.

<sup>104</sup> Fabião 1998; Almeida – Sánchez 2013; Filipe 2018.

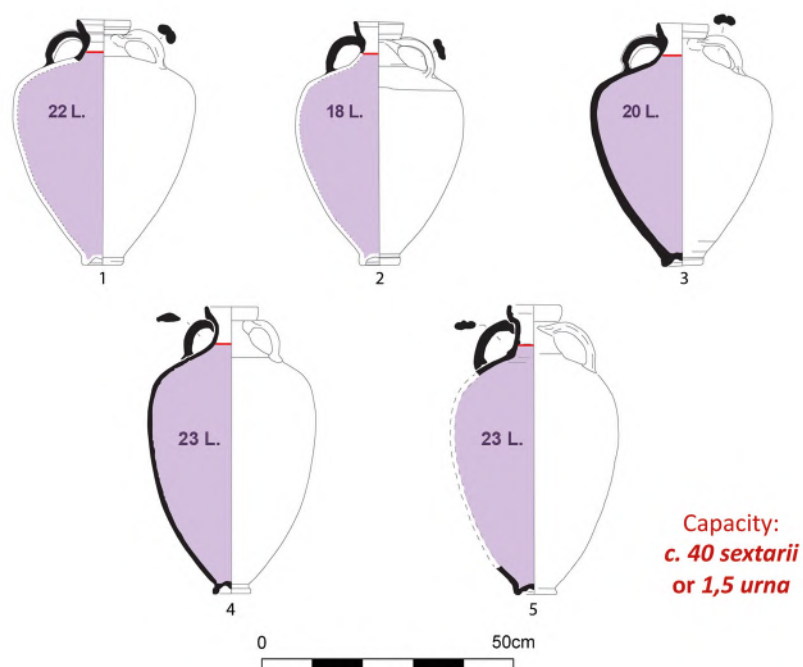
<sup>105</sup> García 2015; Bernal-Casasola 2016; García 2016; Quevedo – Bombico 2016.

<sup>106</sup> Work undertaken by C. Fabião.

<sup>107</sup> Peacock 1982, 38–43.

<sup>108</sup> Mayet – Silva 1998, 113–123.





8 Lusitana 3 examples and capacities (above); Lusitana 3 specimen from Tróia (below) (© by the authors)

from the significant variety of amphorae sources noted in some of the fish factories, such as Rua dos Correeiros or Casa do Governador da Torre de Belém, both in the Olisipo area<sup>109</sup>. The implications of this economic model for promoting amphora standardization can only be determined through further research.

<sup>109</sup> Dias et al. 2012. It was postulated that middlemen would acquire the products from the different workshops in the Tagus estuary, without specific preference for any of them, which could explain the diversity observed among the amphorae analyzed within individual sites.

### Late Antique Production

From the late 2<sup>nd</sup> and early 3<sup>rd</sup> centuries onward, there was a clear modification in structures dedicated to the processing of salted fish and fish-based products (*cetariae*), and some were abandoned<sup>110</sup>. This phenomenon still lacks a clear explanation. Various reasons have been proposed, from ecological changes to political turbulence to the Antonine plague, but no strong evidence has been found to support any of these explanations, and it may make little sense to imagine one single cause. From the 3<sup>rd</sup> century, a major change can be seen in Lusitanian amphora production. New varieties were made, and there was clearly a contribution by craftsmen coming from outside the Iberian Peninsula, perhaps including some from North Africa, as already suggested. These new amphorae were modeled on no previous local tradition<sup>111</sup>.

As a result, there is considerable diversification in Late Antique production, especially from the mid-3<sup>rd</sup> to the late 5<sup>th</sup> or even 6<sup>th</sup> century A.D. The most commonly produced and widely distributed types in Lusitania were the Almagro 51C, Almagro 50, Keay 16, Sado 1 (= Keay 78), Almagro 51A–B, Algarve 1, and Lusitana 9; there were also some minority types, like Sado 3, Lusitana 10, and others that still today need to be better characterized and studied<sup>112</sup> (fig. 9).

For this Late Antique production, the major areas are, once again, the Tagus and Sado estuaries. In both areas, some centers continued production as before, while others were abandoned, and new ones also appeared. One important change can be seen in the Algarve, an area that clearly increased its production and relevance in this period. The workshops on the Algarve coast were, from east to west, the major center at Martinhal (Vila do Bispo)<sup>113</sup> and other smaller but also important workshops, such as Lagos<sup>114</sup>, Quinta do Lago<sup>115</sup>, Salgados<sup>116</sup>, and São João da Venda (Loulé)<sup>117</sup>.

Concerning amphora morphologies, four main families of types were identified across these production areas: (i) Almagro 51C, (ii) Almagro 50 and Keay 16, (iii) Almagro 51A–B + Algarve 1, (iv) Lusitana 9 (unknown in the Algarve area). But the morphological picture is more complex still, with several other minor and specific regional types, such as those from the Sado region – Sado 1 (= Keay 78), Sado 3, and Lusitana 10 – and those from the Tagus region as well as those from both Tagus and Sado regions together. Taken together, these form components of a related or complementary group that includes both the late NARC small amphorae and those that have been called Beltrán 72 »related type« or *similis*<sup>118</sup>. As these regional variants are much rarer, with more limited circulation and probably also less standardization, we will discuss them but rather concentrate mostly on the major late Roman Lusitanian types.

Starting with the Almagro 51C type<sup>119</sup>, the first striking conclusion from the available data for volume was that it had the same capacity as the Dressel 14 and Lusitana 3 types. This form is typically characterized by an inverted piriform body in the 3<sup>rd</sup> to the 4<sup>th</sup> century, as seen at Porto dos Cacos<sup>120</sup> (Tagus estuary) as well as Pinheiro<sup>121</sup> and Abul<sup>122</sup> (Sado), while a spindle-shaped body is

<sup>110</sup> Fabião – Carvalho 1990.

<sup>111</sup> Fabião – Carvalho 1990.

<sup>112</sup> For an updated overview of Lusitanian amphora types, see Fabião 2008; »Ex Amphora Hispania«; Pinto et al. 2016a and b.

<sup>113</sup> Silva et al. 1990; Bernardes 2008; Bernardes et al. 2013; Bernardes – Viegas 2016.

<sup>114</sup> Ramos et al. 2006; Fabião et al. 2017a.

<sup>115</sup> Arruda – Fabião 1990; Fabião 2004.

<sup>116</sup> Bernardes et al. 2007; Bernardes – Viegas 2016.

<sup>117</sup> Fabião – Arruda 1990; Fabião 2004; Bernardes – Viegas 2016; Fabião 2017.

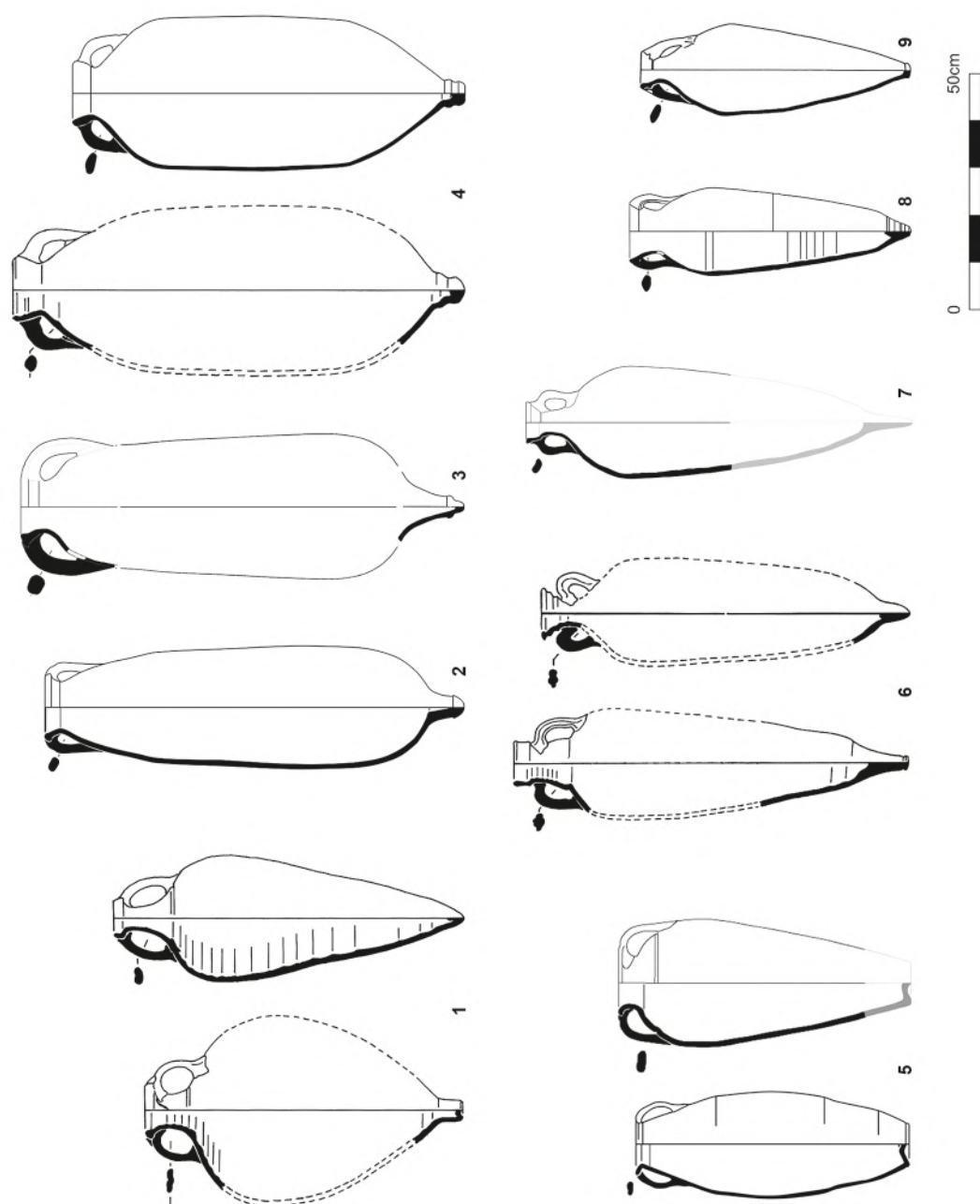
<sup>118</sup> This small amphora was distinguished for the first time in the excavations of NARC (see above).

<sup>119</sup> Viegas 2016; Viegas et al. 2014.

<sup>120</sup> Raposo 1990; Raposo – Duarte 1996.

<sup>121</sup> Mayet – Silva 1998.

<sup>122</sup> Mayet – Silva 2002.



9 Lusitanian amphorae types from the mid 3<sup>rd</sup> until the late 5<sup>th</sup>/early 6<sup>th</sup> century A.D. 1) Almagro 51C; 2) Almagro 50; 3) Lusitanian Key 16; 4) Sado 1 (= Keay 78); 5) Lusitana 9; 6) Almagro 51A-B; 7) Algarve 1; 8) Sado 3; 9) Lusitana 10 (© by the authors)



more representative of the 4<sup>th</sup> and 5<sup>th</sup> centuries at the Quinta do Rouxinol<sup>123</sup>, Porto dos Cacos<sup>124</sup>, and Pinheiro workshops<sup>125</sup>. Examples of the 3<sup>rd</sup> to the 4<sup>th</sup> century had the capacity to transport 36–38 liters, corresponding to 1 *amphora* + 1 *urna* (70 *sextarii* or 12 *congi*), which is quite similar to the average capacity of the Dressel 14 type; the typical 4<sup>th</sup> and 5<sup>th</sup> centuries shapes could contain from as much as 25 liters, which corresponds to 1 *amphora* (48 *sextarii* or 7.5 *congi*), down to 17 liters (32 *sextarii* or 1 *urna* + 1 *congius*), with some smaller modules that had only 10 liters of capacity or 1 *urna* (18–25 *sextarii* or 3–4 *congi*).

When these Almagro 51C amphorae are compared to both Dressel 14 and Lusitana 3 amphorae, they show the same average capacity of about 35–38 liters. Nevertheless, a closer examination allows some further observations. A case study provided by NARC in Lisbon – where debris covered a fish tank and is dated to the end of fish-sauce production in the mid-5<sup>th</sup> century<sup>126</sup> – shows that shapes corresponding to 35 and 17 liters (the module and the half-module) were produced and coexisted in the same consumption contexts in the same period. The same situation can be seen at the Tagus Valley production centers, such as Quinta do Rouxinol<sup>127</sup>. At least in the Tagus area, these two shapes or variants were not exclusive to one period or another as it seems to be the case for the Sado workshops; at the Tagus workshops, both variants were used together, but with a predominance of the spindle-shaped amphora, at least until mid-5<sup>th</sup> century A.D. Whether this is the result of market demand, as we postulated before, remains a question in need of further research.

Comparing the Tagus data with that obtained from the Sado Valley, the Pinheiro workshop demonstrates the existence of the same spindle shape but in a smaller version of the Almagro 51C that here only had the capacity to transport 11–14 liters (18–25 *sextarii*, 3–4 *congi*, or 1 *urna*). On the one hand, it seems there was some intention to implement standardization evident in the Tagus and Sado pottery workshops' products. On the other hand, this desire did not bring about a comparable homogeneity in shape in both regions: in the Sado area, we have just the spindle-shaped variant in the second half of the 4<sup>th</sup> and 5<sup>th</sup> century A.D. (fig. 10)<sup>128</sup>.

Another significant type in this period was the Almagro 50 amphora<sup>129</sup>, which was produced in the Tagus and Sado Valleys as well as in the Algarve workshops from the early 3<sup>rd</sup> to the end of the 5<sup>th</sup> century A.D. Despite usually being considered a singular amphora type, there are some morphological peculiarities that apply in each of these regions, and these different forms require further research. Some complete examples from the Tagus workshop at Porto dos Cacos (from the necropolis area) show the type with a transport capacity of 16 liters, 32 *sextarii* (5 *congi* or 1 *urna* + 1 *congius*). The Sado examples from the workshop at Abul II present the same capacity. The cylindrical elongated shape of the Almagro 50 amphora body was particularly suited to being a funerary container, as was the case in Tróia (Caldeira necropolis). In this example, the amphora has a capacity of 27 liters, equivalent to ca. 1 *amphora* (50 *sextarii* or 8 *congi*). Other measured specimens from well-known reference contexts of distribution, like Port-Vendres I (= Anse Gerbal)<sup>130</sup> and Randello<sup>131</sup>, fall within this same range (fig. 11).

The Lusitanian Keay 16 type<sup>132</sup> was produced in the same period but only in the Tagus and Sado estuaries and in smaller quantities than the typical Almagro 50 type<sup>133</sup>. When compared

<sup>123</sup> Raposo et al. 2016.

<sup>124</sup> Raposo – Duarte 1996; Raposo et al. 2016.

<sup>125</sup> Mayet – Silva 1998; Mayet – Silva 2016.

<sup>126</sup> Bugalhão et al. (in preparation).

<sup>127</sup> Raposo et al. 2016.

<sup>128</sup> Mayet – Silva 1998; Mayet – Silva 2016.

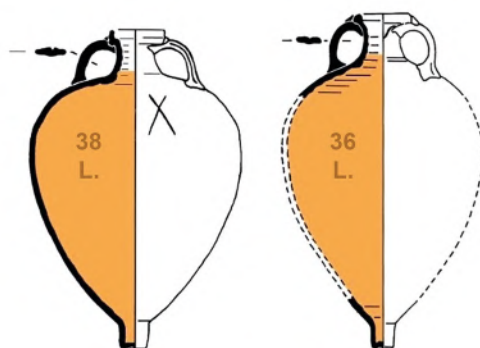
<sup>129</sup> Raposo – Almeida 2016.

<sup>130</sup> Chevalier – Santamaria 1971.

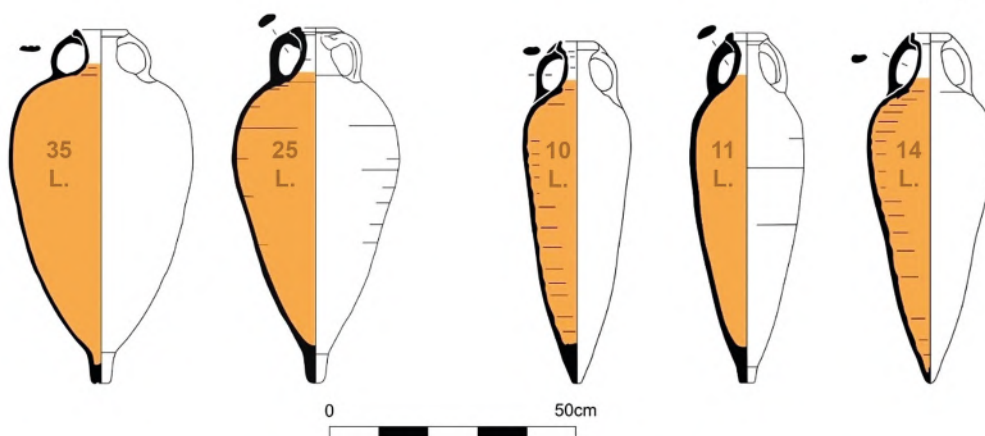
<sup>131</sup> Parker 1989.

<sup>132</sup> Almeida – Raposo 2016.

<sup>133</sup> These are often considered equivalents because the Lusitanian Almagro 50 and the Keay 16 share a great number of identical features. Nevertheless, they show different measures and proportions: see Almeida – Raposo 2016

3<sup>rd</sup> / 4<sup>th</sup> AD

*1 amphora + 1 urna  
or 70 sextarii*

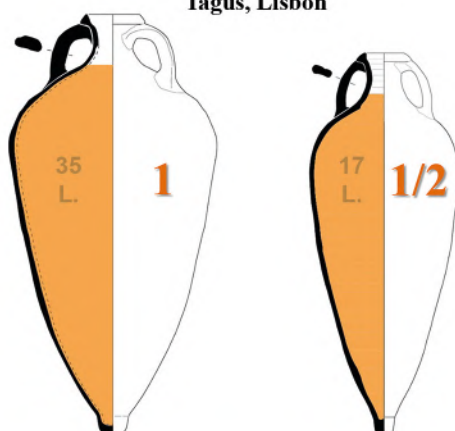
4<sup>th</sup> / 5<sup>th</sup> AD

*c. 1 amphora  
or 48 sextarii*

*c. 1 urna,  
or 18-25 sextarii*

Mid 5<sup>th</sup> AD: contextual data cases study

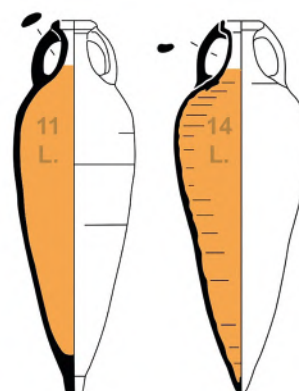
Tagus, Lisbon



*c. 1 amphora + 3 congii  
or 65 sextarii*

*32 sextarii  
or 1 urna + 1 congius*

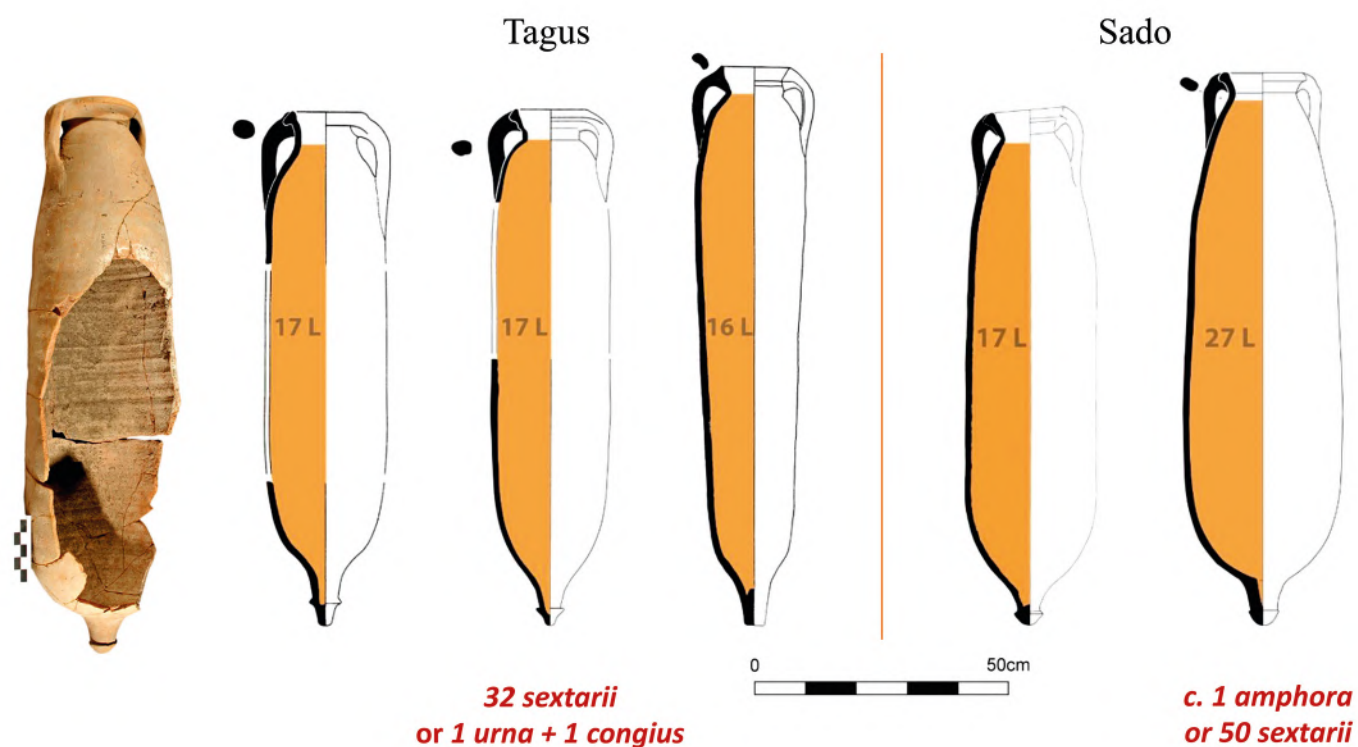
Sado, Pinheiro



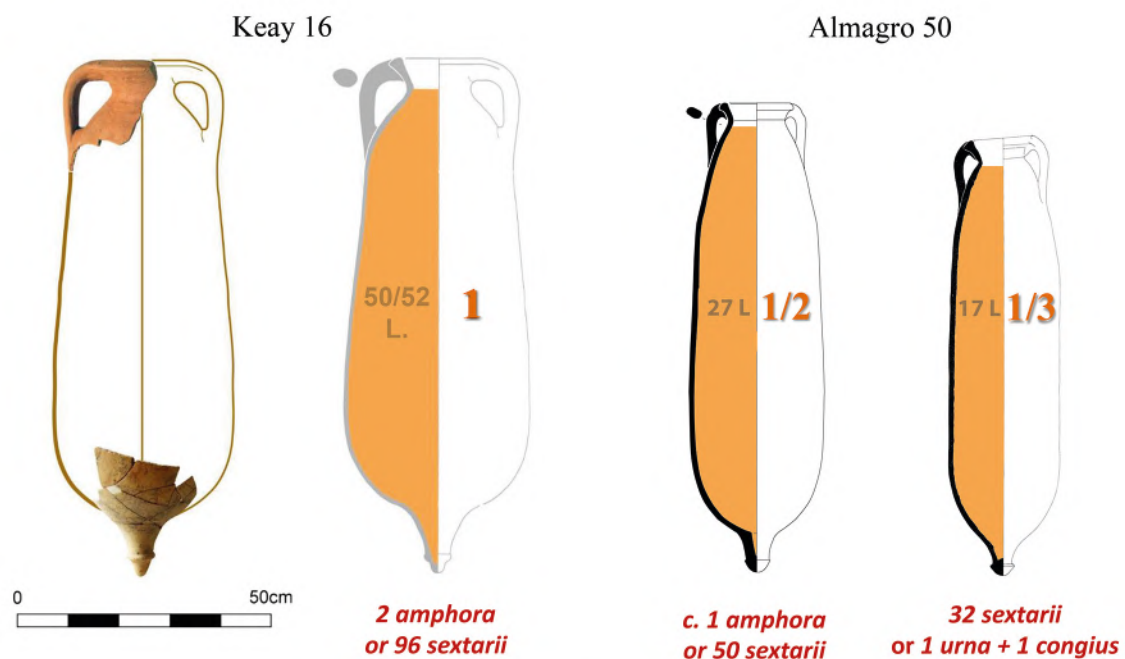
*18-25 sextarii  
or c. 1 urna*

10 Almagro 51C amphorae capacities and Tagus and Sado Valleys compared to contextualised cases (© by the authors, see Viegas et al. 2016 for bibliography)





11 Almagro 50 amphorae capacities (© by the authors, see Almeida – Raposo 2016 for bibliography)



12 Lusitanian Keay 16 capacity and comparative with Almagro 50 (© by the authors, see Almeida – Raposo 2016 for bibliography)

to the Almagro 50 shape, aside from some slight distinctions in the upper part (rim, neck and handles) the main difference seems to be the capacity, as Keay 16 contained almost double the volume of the previous type, for a capacity of 50–52 liters (equivalent to 2 *amphorae*, 96 *sextarii*, or 16 *congi*). It is certainly tempting to see here again two different modules of the same amphora type, but at present we do not have enough empirical data to support this assumption. If this proves to be accurate, then it is probably confined to the 3<sup>rd</sup> century, as there is no secure evidence for production of a Keay 16 type during the 4<sup>th</sup> and 5<sup>th</sup> centuries. Once again, it is possible to see market pressures behind this change (fig. 12).

The Sado 1 (= Keay 78), with its two variants (A and B), became the second most important container for fish products, after Almagro 51C, from the mid-3<sup>rd</sup> century onward, especially in its variant B between the mid-4<sup>th</sup> and the mid-5<sup>th</sup> century. This shape, first identified at Tarragona and assumed then to be an African amphora<sup>134</sup>, was later demonstrated to be a Lusitanian product<sup>135</sup>. The morphological characteristics of this type later called Sado 1<sup>136</sup> – the large cylindrical body with very short and narrow (or almost non-existent) neck and the thin body walls – mark a break in the amphora tradition of the Sado Valley. Although affinities with the Almagro 50 type have been recognized, mainly concerning the neck and handles, the Sado 1 morphology must be considered an original Lusitanian creation, most likely by producers from the Sado Valley<sup>137</sup>; however, in its creation and development, an African influence should also be recognized.

This type does not appear in the Tagus Valley, in either production or consumption contexts. It is notoriously absent in Lisbon and also in the capital of Lusitania, and indeed in the central and northern half of the whole province, in direct contrast to what we should expect considering the importance of these markets. It appears chiefly in the southern area, in urban centers, and at *villae* located in the immediate vicinity of, and in regions that can be directly supplied from, the Sado Valley itself and the terrestrial road network directly linked to the river: a significant distribution exists in the rural area of Beja/Pax Iulia, with the best examples coming from the *villae* of São Cucufate (Vidigueira)<sup>138</sup> and Monte da Cegonha (Selmes)<sup>139</sup>.

Despite the lack of examples in cities and rural settlements in the southern coastal area of Lusitania (today Algarve), this type's presence is well attested in port contexts of Portimão, along the Arade River and outside the province in shipwrecks indicating external trade routes: for example, Escolletes 1 on the nearby coast of Murcia, Fontanamare A on the southwest coast of Sardinia<sup>140</sup>, and at Turris Libisonis also in Sardinia<sup>141</sup>. This distribution indicates that foreign markets, probably those in the western part of the Roman Empire, were the main focus for its exports. Other examples may also not yet have been correctly identified.

The Sado 1 is the largest amphora among those produced in Lusitania. Concerning its capacity, it frequently reaches an average of 42–45 liters (1 *amphora* + 6 *congi*, or 80/81 *sextarii*). But there is also one specimen with a smaller capacity of 35 liters (1 *amphora* + 3 *congi*, or 65 *sextarii*) and one with an enormous capacity estimated at a minimum of 61 liters (2 *amphorae* + 3 *congi*, or 113 *sextarii*). Of interest is one fragment from Tróia showing a *post cocturam* graffito with the numeral LXII on the lower part of the neck and upper part of the body; once again it is tempting to consider this as confirmation of one of the capacities of this type at 62 (*sextarii* [?]), which could be related to a capacity of one *amphora* (65 *sextarii*) since the difference is minimal. The large capacity of this type suggests that it was more important, in terms of quantity of

(Keay 16); Raposo – Almeida 2016 (Almagro 50).

<sup>134</sup> Keay 1984, 149–155.

<sup>135</sup> Diogo 1987; Mayet et al. 1996; Mayet – Silva 1998; Pinto – Almeida 2016.

<sup>136</sup> Mayet – Silva 1998.

<sup>137</sup> Pinto – Almeida 2016.

<sup>138</sup> Mayet – Schmitt 1997; Pinto – Lopes 2006.

<sup>139</sup> Pinto – Lopes 2006.

<sup>140</sup> Bombico et al. 2014; Bombico 2017.

<sup>141</sup> Villedieu 1984.

transported goods, than the comparatively small number of individuals quantified in consumption contexts might suggest (fig. 13).

The Almagro 51A–B type was produced in the Tagus and Sado Valleys from the second half of the 4<sup>th</sup> to probably the late 5<sup>th</sup> century A.D. As far as we know, this type was much more frequent in the Sado pottery workshops than in those from the Tagus estuary. Although there are no complete examples, the reconstruction of one amphora from the Sado workshops points to a vessel of about 15–16 liters (30 *sextarii*, 5 *congi*, or 1 *urna* + 1 *congius*) or a little less at 13 liters (24 *sextarii*, 4 *congi*, or 1 *urna*). In the Algarve workshops at Martinhal (Vila do Bispo), Lagos and S. João da Venda (Loulé), and probably also at Salgados (Loulé), a regional and specific variant of this form with peculiar morphological features that are easy to identify and recognize in the archaeological record was produced from the middle of the 4<sup>th</sup> to the first half of the 6<sup>th</sup> century A.D. It was recently classified as Algarve 1<sup>142</sup>, as it was produced at several pottery workshops of the region rather than just in one specific center (fig. 14).

It seems plausible to consider the existence of a modular system here, with the same overall shape used for a larger module, although this is difficult to confirm since there is no complete example from a Lusitanian pottery workshop. An average of 15 liters (perhaps equivalent to 24 *sextarii*, 4 *congi*, or 1 *urna*) is proposed based on the reconstruction of an incomplete example from Lagos. A smaller module of only 8 liters (arguably equivalent to 14 *sextarii*, 2.5 *congi*, or  $\frac{1}{3}$  *amphora*) is documented in a complete example from Martinhal (Vila do Bispo)<sup>143</sup>. It must also be stressed that these two types, Almagro 51A–B and Algarve 1, share the same general shapes, although they show differences in the rim, the handles (profile and position), as well as the neck. Concerning the Algarve 1 type and its different modules, the Sud-Lavezzi 2 shipwreck provides a relevant case study<sup>144</sup>. It seems possible that the amphorae from that wreck belong to the Algarve 1 type<sup>145</sup>, with the larger module corresponding to one unit, while the medium represents half of the unit, and the smaller size three quarters of the unit. It is possible that this standardization based on capacity was also related to the commercialization and circulation of the products traded since they enabled easy loading and storage within ships (fig. 15)<sup>146</sup>.

The flat-bottomed Lusitana 9 type is assumed to have transported wine products and was produced in both the Tagus and Sado estuaries from the middle of the 3<sup>rd</sup> to the middle of the 5<sup>th</sup> century, but it seems likely to have had a more limited circulation than other types<sup>147</sup>. Nonetheless, we know that it was transported not only to *villae* located throughout inland provincial areas<sup>148</sup> but also to the capital of the province, Augusta Emerita<sup>149</sup>, as well as to Baetica<sup>150</sup>. Its capacity seems to vary from around 13–14 liters (about 1 *urna*, 24 *sextarii*, or 4 *congi*) to 16 liters (1 *urna* + 1 *congius*, 32 *sextarii*, or 5 *congi*) (fig. 16).

In the later phases of production, there seems to be a lower degree of standardization across all Lusitanian manufacturing regions compared with the situation in the 1<sup>st</sup> and 2<sup>nd</sup> centuries A.D.; each of these main areas now follows its own path, developing in their repertoires specific variants of certain shapes and also some unique forms. To the first group belong the Almagro 51A–B type for the Sado Valley (as its production is not yet known in the Tagus workshops) and the Algarve 1 for the region's coastal area. To the second belongs the complex universe of examples related to or inspired by the Baetican Beltrán 72 type, as well as some late smaller and miniature shapes which include Sado 3 and Lusitana 10, apparently only produced in the Sado workshops.

<sup>142</sup> Fabião et al. 2010; Fabião et al. 2017a.

<sup>143</sup> Cf. Fabião et al. 2017a.

<sup>144</sup> Liou – Domergue 1990.

<sup>145</sup> A Lusitanian provenance was confirmed by Bombico et al. 2014, 367.

<sup>146</sup> Pinto – Almeida 2016.

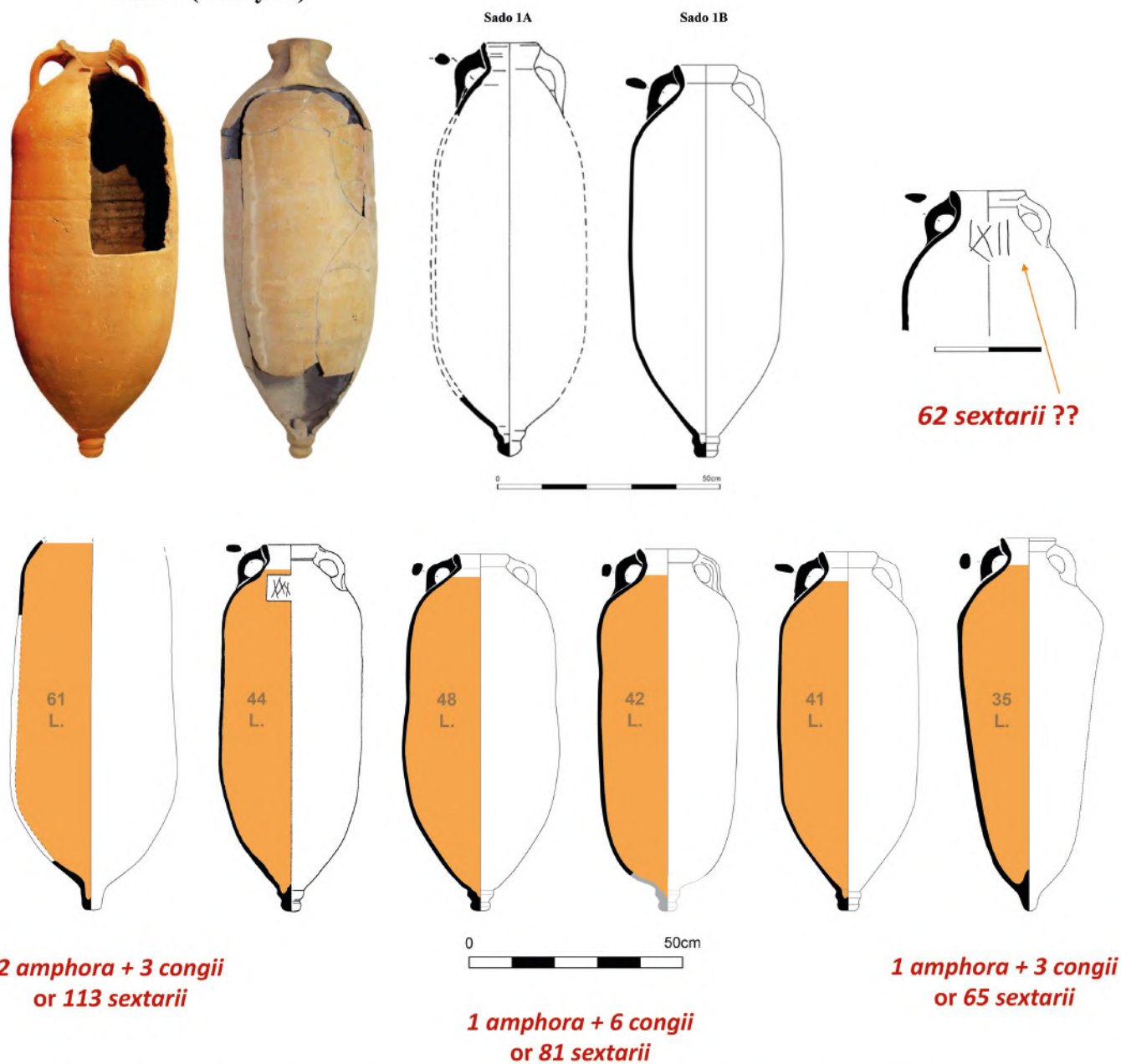
<sup>147</sup> Quaresma – Raposo 2016b.

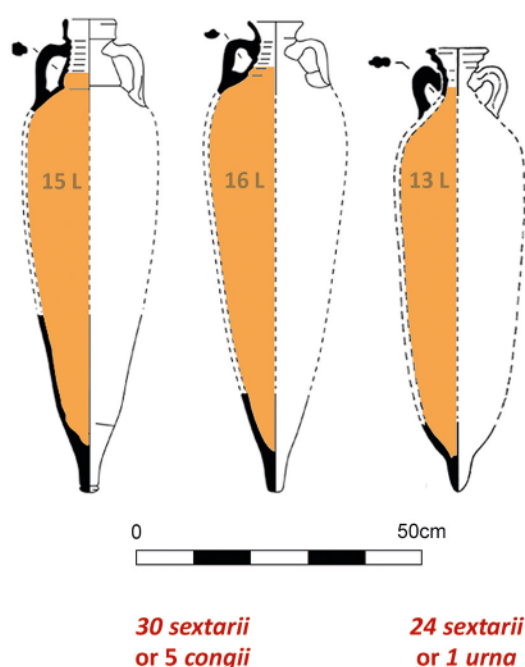
<sup>148</sup> Pinto – Lopes 2006.

<sup>149</sup> Almeida 2016.

<sup>150</sup> Fabião (forthcoming).



**Sado 1 (=Keay 78)**



14 Almagro 51A–B amphorae and their estimated capacities (© by the authors)

Lusitanian form inspired by the Baetican one<sup>159</sup>; this form needs to be properly characterized and studied as a type (fig. 17).

At the same time, there are some examples we could consider as ›miniatures‹ that have been identified over the last two decades but have yet to be properly studied. These are only recently being properly recognized and described. Most of the known examples represent rims, upper parts with handles, or bodies and bottoms. This is the case for some examples from consumption contexts in the Tagus and Sado areas, such as at the NARC in Lisbon<sup>160</sup> and Tróia<sup>161</sup>, but also at Mérida, the capital of the province<sup>162</sup>, showing their role in larger trade routes and outside markets (fig. 18).

Also unusual in consumption contexts are other late types such as Lusitana 10 and Sado 3. Both seem to have started to be produced in the first half of the 5<sup>th</sup> century, particularly in its second quarter, but only in the Sado estuary as far as we can assess from the Pinheiro workshop's stratigraphy and contexts<sup>163</sup>. The end of their production can be dated to the beginning of the 6<sup>th</sup> century. Both types appear to be related to the Almagro 51C and are difficult to distinguish if only as fragments. For both types, the proposed contents are fish-based products. The late Lusita-

It is commonly assumed in the latest overviews on Lusitanian amphorae that the production of Beltrán 72 did not take place around the central part of Portugal, nor in the Algarve, together with Keay 16<sup>151</sup>. Nevertheless, there are some incomplete amphorae with petrological characteristics typical of the Tagus and Sado regions that resemble this Baetican type: at Quinta do Rouxinol<sup>152</sup> in the Tagus estuary, and in the Sado estuary at Quinta da Alegria<sup>153</sup>, Abul (in layers dated to the second quarter or mid-3<sup>rd</sup> cent. A.D.)<sup>154</sup>, and Pinheiro (in contexts of both the early 4<sup>th</sup> cent.<sup>155</sup> and end of the 4<sup>th</sup> or beginning of the 5<sup>th</sup> cent. A.D.<sup>156</sup>). Within this group, the best-preserved examples come from the fill layers of a vat in a presumed fish factory at Rua dos Fanqueiros, in the center of Lisbon, dated to the second half of the 5<sup>th</sup> century A.D.<sup>157</sup>, and from the riverbed of the Rio Arade in the Algarve<sup>158</sup>. We suggest that these are not Lusitanian copies of Beltrán 72, as with the Lusitanian Keay 16 type, but rather represent a related

<sup>151</sup> Fabião 2004, 397; Fabião 2008; González et al. 2016.

<sup>152</sup> Raposo – Duarte 1996, fig. 6 nos. 8. 9.

<sup>153</sup> Mayet et al. 1996, fig. 55 nos. 193.

<sup>154</sup> Mayet – Silva 2002, 196 fig. 101 nos. 33. 37. 39. 40.

<sup>155</sup> Classified as ›unusual forms‹ by Mayet – Silva 1998, fig. 91 no. 113.

<sup>156</sup> Classified as ›indeterminate‹ by Mayet – Silva 1998, fig. 120 no. 47.

<sup>157</sup> Diogo – Trindade 2000.

<sup>158</sup> Cardoso 2013, 113 no. 5817.01.06.

<sup>159</sup> Almeida et al. 2014, 418; González et al. 2016, 214–216; Pinto et al. 2016a, 190.

<sup>160</sup> Bugalhão 2001, 89 fig. 63; 138 fig. 92.

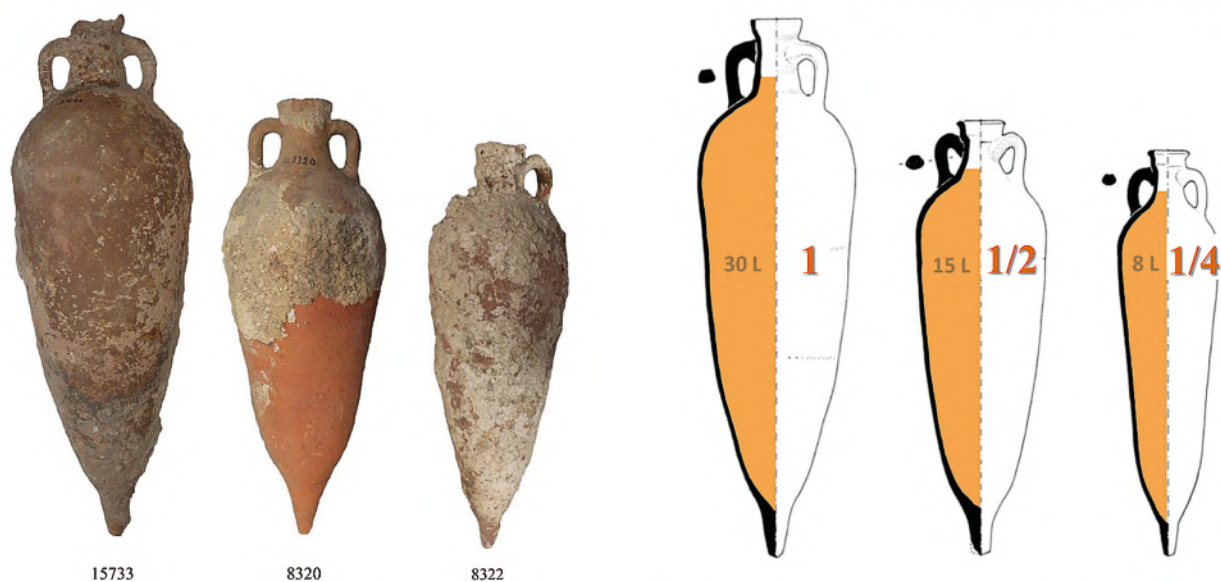
<sup>161</sup> Almeida et al. 2014, 418; Pinto et al. 2016a, 190 fig. 15.

<sup>162</sup> Almeida 2016, 204–206 fig. 11.

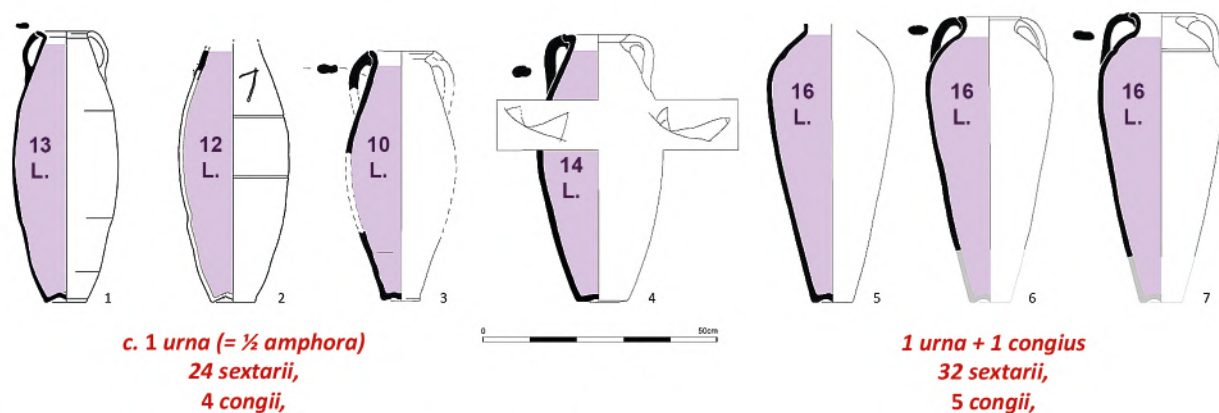
<sup>163</sup> Mayet – Silva 1998, 286–291.



## Sud-Lavezzi: a case study

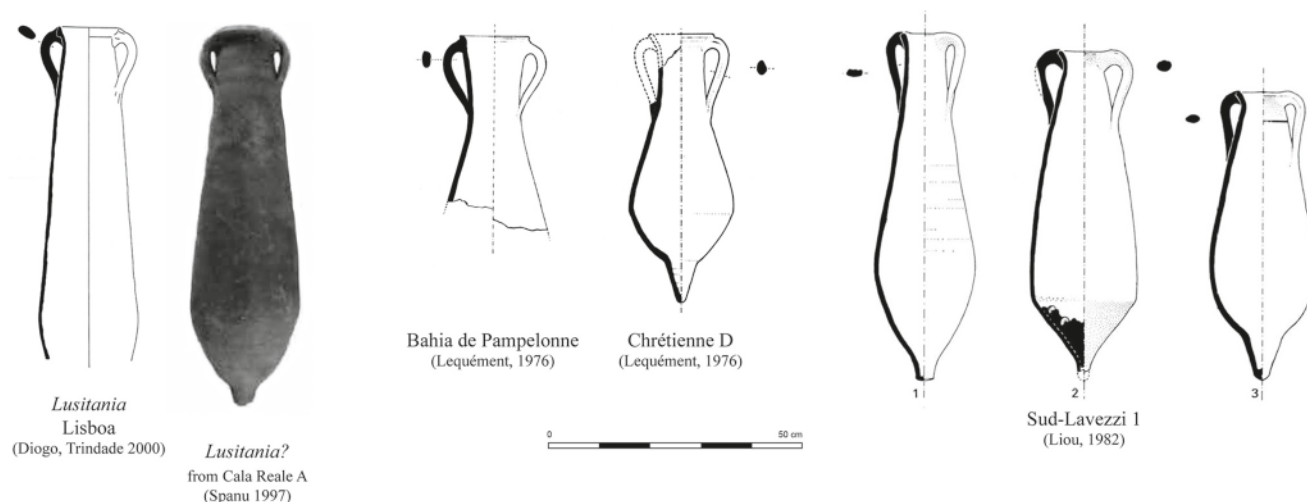


15 Algarve 1 amphorae examples, estimated capacities and a case study based on the Sud-Lavezzi shipwreck (© by the authors)

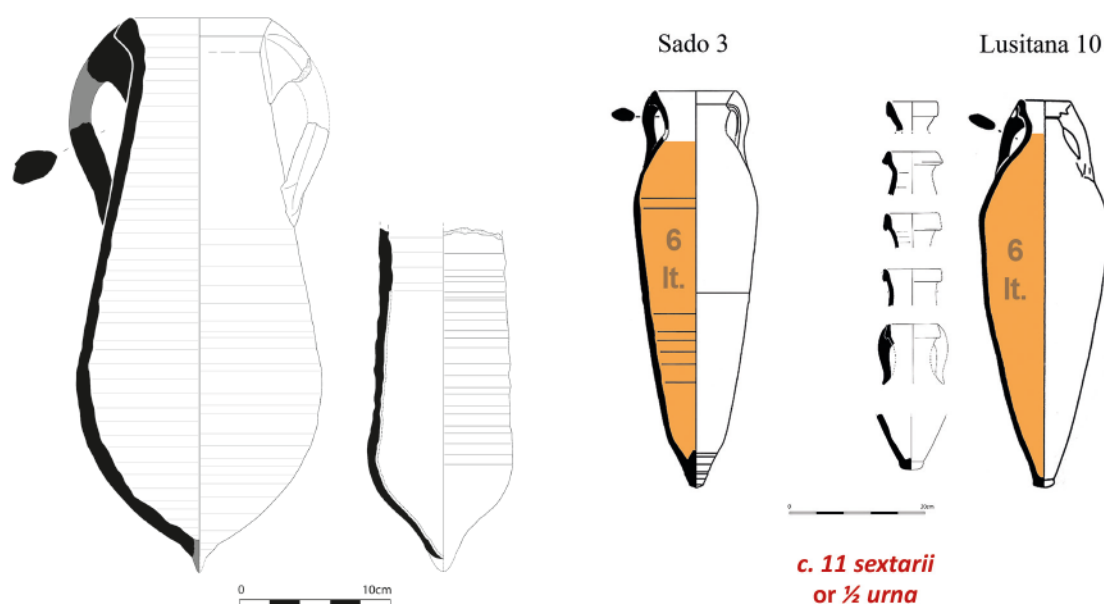


16 Lusitana 9 and their capacities (© by the authors, see Quaresma – Raposo 2016 for bibliography)





17 Late Lusitanian types: ›Beltrán 72‹ related (?) (© by the authors)



18 Late Lusitanian ›miniaturized‹ forms appeared in Mérida (according to Almeida 2016, fig. 11)

19 Sado 3 and Lusitana 10 amphorae and capacities (© by the authors)

na 10<sup>164</sup> is a small amphora, distinguished from the Almagro 51C by its shorter size, narrow neck, and rim now without an internal groove. It appears always in very limited numbers and certainly did not play an important role in Lusitanian production<sup>165</sup>. The Sado 3 amphora, first identified at the workshop of Pinheiro<sup>166</sup>, is another small and late type of minor circulation: it differs from Lusitana 10 and Almagro 51C by its wider neck (7–9 cm) and mouth (11–14 cm width), almost the same diameter of body, short handles in an S-shape profile and very close to the neck<sup>167</sup>. An almost complete example was collected at Scallabis/Santarém, a Roman town in the Tagus Valley<sup>168</sup>. Both types have an average capacity of 6 liters (11 *sextarii* or a half *urna*) (fig. 19).

<sup>164</sup> Diogo 1987.

<sup>165</sup> Almeida et al. 2014, 419; Pinto et al. 2016a, 183.

<sup>166</sup> Mayet – Silva 1998; Fabião 2008, 742 f.

<sup>167</sup> Mayet – Silva 1998, 289.

<sup>168</sup> Arruda et al. 2006, 249 fig. 6.

What is quite remarkable and worth stressing here is that these supposedly ›minority‹ forms were exported not only to nearby provinces but also outside the Iberian Peninsula, and they even arrived at some markets of the western Empire, including Rome. At least this may be inferred from the type's presence in several shipwrecks. The first, *Cale Reale A*<sup>169</sup>, dated at the second half of the 4<sup>th</sup> or beginning of the 5<sup>th</sup> century A.D., contained a Lusitanian cargo of Sado 3 and Beltrán 72 related forms traveling together with spindle-shaped Almagro 51C and Almagro 51A–B. The second wreck, *Sud-Lavezzi 1*, also dated to the late 4<sup>th</sup> or early 5<sup>th</sup> century<sup>170</sup>, contained a mixed cargo of Lusitanian Algarve 1, Almagro 51C, and Beltrán 72 related types<sup>171</sup> along with other Baetican types. Information concerning imports to other markets must also be evaluated since some of the major Lusitanian types were also produced in other regions, and we must look at fabrics rather than rely on only typological classification. Given its location off Sicily, the *Randello* ship was probably heading to some eastern destination<sup>172</sup>.

The same trend away from standardization can be detected in the Algarve region at both consumption centers and kiln sites. At the *villa* of Vale da Arrancada (Portimão), the Late Antique amphora assemblage shows several examples of Lusitanian forms that may have their provenience in Martinhal (Vila do Bispo) – or in other kiln centers not yet identified – along with different forms that could not be linked to a specific type and were accordingly labeled as ›undetermined‹<sup>173</sup>. These signs of experimentation and the African influence in amphora morphologies are features observed at Martinhal, where the Keay 25 type was being locally produced<sup>174</sup>.

## STANDARDIZATION: ONE OR MANY? WHY SO AND WHEN?

The first questions one may pose relate to whether there was standardization and, if so, who was demanding it: the producers, the transporters, or the consumers (i.e., the market)? The answer seems both simple and complex, depending on what sort of answer we are looking for. Some form of standardization, if it existed, could have been in a way ›imposed‹ by one or many link(s) in the chain of production and distribution. Did the potters need to respond to some sort of demand, perhaps from those transporting the jars, that the amphorae should fit the particular configuration of space available within a ship? That is, it may have served not only commercial accuracy but also to make shipment easier. Perhaps the producers of the salted-fish products benefited also from some form of standardization, as it made the management of prices and evaluation of quantities in commercial agreements easier. We must not see this standardization process as a matter of mm-level precision but as a more general trend, where different regional traditions could come into play.

One must be aware of chronological issues too. Standardization may have different meanings or constraints depending on the chronological context in which the producers or exporters operated. Those times when the Roman Empire was stronger and more interconnected could have seen different trends from other times when there was no strong political unity and the different regions or communities operated more independently. The available data show that from the late 5<sup>th</sup> century onward, Lusitanian amphorae almost disappear from archaeological contexts. That means reduced production and less connectivity among regions from the Lusitanian point of view. But these are just common-sense observations that merit further investigation.

Based on the relevant set of data from both workshops and consumption centers, we have tried to address the subject from the point of view of typological standardization, which has led us to identify capacities and volumes for different types of vessels. Regional variation in this phe-

<sup>169</sup> Spanu 1997, 113 f.; Bombico et al. 2014, 366–369; Bombico 2017, 159, 225.

<sup>170</sup> Liou 1982; Massy 2013.

<sup>171</sup> A Lusitanian provenance was confirmed by Bombico et al. 2014, 367.

<sup>172</sup> Parker 1989.

<sup>173</sup> Fabião et al. 2016, figs. 3, 10.

<sup>174</sup> Bernardes et al. 2013.



nomenon was also taken into account, alongside chronological variation. Even if trends revealed through the systematic analysis of several complete examples are real and valid, one should be careful not to rush to definitive conclusions, as the empirical base must first be enlarged. Once this happens satisfactorily, it will allow us to confirm or reject some of the trends identified in this paper.

As capacities and modules are recognized for certain types, they allow us to suggest that they represent different parts of one unitary system. We were also able to confirm that smaller and larger modules coexisted in the same (mainly commercial and consumption) contexts and during the same period rather than representing a chronological change; that is, the smaller versions are not later than the larger. Another important matter should also be stressed here, though: different modules are quite difficult to identify from rims alone since their diameters do not show the same pattern of variation as the bodies. For example, if only the rim was preserved from the spindle-shaped Almagro 51C amphora, which has the capacity of an *urna* (12 liters), it could easily be confused with that of common ware.

As part of an artisan system, pottery production is subject to everyday variations. Even so, the degree of standardization that some types have shown is surprising. On this topic, we must look also to other categories of pottery that were often produced in the same workshops in an effort to understand the degree of standardization they may have achieved. Experimental archaeology related to the manufacture and firing conditions of amphorae at Quinta do Rouxinol has allowed better understanding of traditional techniques, demonstrating that standardization and repetition of the same models were not difficult tasks<sup>175</sup>. When asked to reproduce Roman amphorae, the potter made a simple template with small clay balls and pieces of cane. With that very simple system, the potter was able to produce several amphorae of the same shape and volume. Such a template is impossible to track in the archaeological record. It is not hard to imagine that a craftsman growing up in a workshop with its specialized labor force, from apprentice to master potter, would be able to replicate many amphorae of almost the same shape and volume. Moreover, his perceptions regarding the shape and volume of an amphora are not necessarily what we might have in mind when looking for standard models.

For Late Antique production, the increase in diversity among amphora shapes is obvious. If one conceptualizes each shape as representing a single product, then one might think that all these different amphorae were designed for different products. All of them, or almost all of them, though, were for fish-based products but not necessarily the *exact* same product<sup>176</sup>. In most of the Almagro 51C amphorae, it is impossible to store a more solid product, as its mouth and neck are both too narrow to permit easy access. For the Keay 16, Almagro 50, or Sado 1 types, by contrast, this is quite possible. Can we therefore suggest fish sauce, for example *liquamen* and *hallec* for the Almagro 51C type and salted fish for the other types? This is just one possibility. All archaeozoological studies of residues from the fish products contained in amphorae from the periods considered here and in the deposits at the inner base of the processing vats (*cetariae*) gave the same result: sardines, not sliced and diced but whole sardines<sup>177</sup>. This is perhaps not a surprising result. When one thinks of salted sardines, one assumes whole fish. But if one thinks of a compound of sardines and salt, macerated to obtain a sauce as mentioned in ancient literary sources, the whole sardine would still be used, while the final product would be a sauce rather than salted sardines.

If we assume that standardization resulted from market pressure – the most logical hypothesis as there is no evidence of an *annona* context for Lusitanian products – one can identify some general trends. There is one trend that extends from the 1<sup>st</sup> to the 3<sup>rd</sup> or 4<sup>th</sup> century, in which we can-

<sup>175</sup> Fabião et al. 2017b. These simple ›tools‹ can be seen in Raposo et al. 2013, fig. 3 and in the video »Arqueologia Experimental\_Quinta do Rouxinol« (4'18" onward) at <<https://www.youtube.com/watch?v=vFSvOgRvsuY&t=561s>> (19. 05. 2019).

<sup>176</sup> For the different types of fish products, see Curtis 1991; García et al. 2019a.

<sup>177</sup> Gabriel et al. 2009; Gabriel – Silva 2016.

not see any change in the general shape or volume of the amphorae for fish products, despite the presence of some smaller modules possibly related to different fish products or simply different contexts of distribution. Some difference, though, can be noticed in the capacity of the Lusitana 3 amphora that is assumed to have transported wine. But within the different modules recorded in some of the rarer amphorae, it is possible to see a sort of standardization within the three different capacities following the proportional relationship of one, one half, and three quarters. Again, this is an intriguing result, but we must bear in mind the currently limited sample that needs future confirmation.

Addressing the subject of standardization in Lusitanian amphora production also calls for special attention to the observation of regional trends. In the Sado and Tagus Valleys, the production of amphorae seems to be clearly separated from the fish-product workshop units. This could explain a certain degree of fabric standardization evident in these regions, with a quite stable use of what seems to have been the same sources of clay throughout a long period of production from the 1<sup>st</sup> to the late 5<sup>th</sup> century. In the Algarve area, the situation is quite diverse, with a few examples of amphora workshops occurring in the same settlements as the fish-salting units, sometimes in the context of the Roman *villa*. It is possible that these different modes of production could help to explain the local diversity in some amphora types.

In Late Antiquity, it is also possible to see some standardization around different modules, within a context of miniaturization that meant less volume per amphora. Whether that translates to a higher unit cost for the transported product or, on the contrary, a greater distribution of these fish-based products is also a question that requires further research. One thing seems clear, though: the different modules were exported together both in the earlier times, as we can see in the Grum del Sal wreck, and also in Late Antiquity, as in the Sud-Lavezzi 3 wreck. This is certainly not a peculiarity of Lusitanian products but rather the general pattern observed for amphorae on Mediterranean wrecks.

Despite all the questions that remain to be answered concerning standardization, the general framework of amphora production can be summarized as follows: the early Lusitanian types produced from the Augustan period onward seem to derive from the Baetican ones. From the middle of the 1<sup>st</sup> to the mid-3<sup>rd</sup> century, the Dressel 14 type was the most common amphora transporting fish products not only from the coastal areas to the inland towns and *villae* of Lusitania but also to the wider markets of the Mediterranean. Most of the Lusitanian amphorae were destined for fish products, but the distribution of Lusitana 3 shows that other commodities, such as wine, were also being exported from the middle of the 2<sup>nd</sup> or early 3<sup>rd</sup> century onward. This is also the period when major changes occurred in the manufacture of salted-fish products, with modifications being made in the *cetariae* and consequently also in the amphora shapes. From this period onward, there is diversity in forms: Almagro 51C was the most successful container for fish-based products for both internal and external markets, but other forms are also present, such as Almagro 50, Almagro 51A–B, and Lusitana 9, to mention just the most common. In later phases, minority types occur, as well as forms that are difficult to ascribe to any particular type, showing a lower degree of standardization in this late phase.

With the ultimate goal of examining the social and economic framework behind amphora production in the different regions of Lusitania from the Augustan period until the late 5<sup>th</sup> or early 6<sup>th</sup> century A.D., a major effort is underway to fully characterize both their forms and fabrics. With better identification of Lusitanian amphorae by scholars working across the ancient world, the distribution map of Lusitanian products will become more complete. This, in turn, will contribute to a clearer and more nuanced understanding of the economic role of Lusitania in the larger framework of the Roman Empire and the Late Antique world that followed.



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