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SPEAKING VOLUMES

ON THE CAPACITIES OF TRANSPORT AMPHORAE FROM THE HELLENISTIC PERIOD THROUGH LATE ANTIQUITY*

Abstract
A good deal of scholarly attention has in recent years been given to the shapes and contents of transport amphorae, but the same cannot be said with regard to their volumes. The aim of the paper is to attempt to remedy this by presenting an overview of the holding capacity of a selection of Roman and Late Antique amphora types as a basis for a discussion of the following issues: 1) How standardized were Greek and Roman amphora capacities?; 2) Did the shape of an amphora reflect its contents?; 3) Was there a correlation between the primary contents of an amphora class and its capacity? It will be argued that ancient amphora capacities were not standardized to the degree that a modern consumer would expect and that it is doubtful that the contents – whether wine or oil – can be reliably deduced from the amphora shape, which rather seems to reflect certain regional patterns in the areas of production. However, the topic is admittedly so fraught with difficulties of a methodological and practical nature that these conclusions may only be regarded as preliminary.

INTRODUCTION

The purpose of this paper is to raise three questions related to the capacities of ancient transport amphorae: 1) How standardized were Greek and Roman amphora capacities?; 2) Did the shape of an amphora reflect its contents?; and 3) Was there a correlation between the primary contents of an amphora class and its capacity? My main focus will be on the Hellenistic, Roman and Late Antique periods, but some earlier evidence will also be touched upon[1].

Each question is fraught with difficulties of a methodological and practical nature, not least concerning the identification of the contents of the ancient amphora classes, even if Tania Panagou, Dario Bernal-Casasola, Michel Bonifay, and others have put our knowledge about this thorny issue on a firmer footing in recent years[2]. It is, moreover, still an open question whether transport amphorae were originally intended for one kind of primary contents or were multipurpose vessels, as suggested by some scholars[3]. The not uncommon reuse of amphorae, in particular at the local level[4], does not make things easier, since scientific residue analyses can rarely if ever distinguish between primary and secondary use. Still, Mark Lawall concluded in his discussion of the »Socio-Economic Conditions and the Contents of Amphorae« that »the primary contents model

* I wish to thank the editors for astute comments and bibliographical reference and Kathleen W. Slane for information about Late Roman 1 amphorae from Corinth. I am also grateful to Stephen Lumsden for having expertly corrected my English. After the manuscript was submitted, Jaime Molina Vidal and Daniel Mateo Corredor published a study on »The Roman Amphorae Average Capacity«, which comprises calculations of the supposed average capacity of no less than 265 amphora classes including subtypes (Molina – Mateo 2018, 303–308 tab. 1). The authors deal with some of the same issues as this paper, but from a different perspective. Hence, the two contributions complement each other.

1 Only the basic literature is cited for each amphora class. Comprehensive bibliographies may be found in several recent publications, e.g., Bezeczky 2013 and Dobreva 2017, or in the »Roman amphorae: a digital resource« database: <http://archaeologydataservice.ac.uk/archives/view/amphora_ahrb_2005/> (01. 04. 2023). The fractional versions of transport amphorae are not discussed in this paper.

2 Lund 2004; Bernal-Casasola 2015; Panagou 2016a. See now also Bernal-Casasola et al. 2021.

3 Lawall 2011 with references; Greene – Lawall 2015, 6 f.

4 Lawall 2011, 30–33; Abdelhamid 2013; Peña 2021.

does seem appropriate for the primary use of amphorae from the large scale producers whether in the Greek or in the Roman worlds«[5]. This paper will therefore concentrate on amphorae from some of these ›large-scale producers‹ for which there is scholarly consensus of sorts about their primary contents, in particular on those classes that probably contained wine and olive oil.

STANDARDIZATION OF LIQUID MEASUREMENTS IN CLASSICAL ANTIQUITY

In recent years, scholarly interest in standardization in antiquity has surged[6]. The term has many connotations, as demonstrated by Justin Leidwanger and Horacio González Cesteros in their introduction to this volume. This contribution deals with some of the volumetric aspects of amphora standardization.

The Greek word μετρετές designated »a liquid measure, 'αμφορεύς«[7], which according to Mabel Lang corresponded to 39.312 liters[8]. But other scholars have converted this measurement to 39.4[9] or 38.8356 liters[10]. We are not better off with the Roman ›quadrantal/amphora‹ measure[11], which Stephanie Martin-Kilcher correlates to 26.0928 liters[12], while others put it at 25.50[13], 26.26[14], or 26.196 liters[15]. Things are not made easier by the possibility that standards could vary from one place to the other and also over time[16], Malcolm Wallace thus observed that the mean capacity of Rhodian amphorae decreased from 27.3 liters between 230 and 200 B.C. to 26.2 liters about 200 B.C. and 25.4 liters about 187 B.C.[17]. The size of some Roman and Late Antique amphora classes also changed over time. Indeed, a new concerted study of the various kinds of evidence (archaeological, inscriptional, and philological) is called for if the discussion about standard liquid measures in antiquity is to be put on a firmer footing, but such an attempt is outside the scope of this contribution.

STANDARD AMPHORA CAPACITIES?

Danish archaeologist Peter Oluf Brøndsted was one of the first scholars to address the issue of how to measure amphora capacities in his pamphlet on Panathenaic amphorae from 1832[18]. His solution was to fill two completely preserved amphorae with grain, which is now usually substituted by sand, rice, lentils, water, or polystyrene beads, the latter of which seems to be most common now. Since we do not know if ancient amphorae were filled all the way to the rim or not, it is important to measure both their ›body capacity‹ and their ›full capacity‹. When both measurements are not included in publications, as is often the case, an element of uncertainty is added. It is, however, not always possible, for practical reasons, to measure the capacity of transport amphorae in this manner, which is why other approaches have been developed[19], based, for instance, on 3D models. The latter have been discussed by Victor Martínez in a paper

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5 Lawall 2011, 32.

6 See, for instance, Wilson 2008; Kotsonas 2014; Greene – Lawall 2015; Lund 2015, 214; van Oyen – Pitts 2017.

7 Liddell – Scott – Jones 1122 s. v. μετρετές. See also Liddell – Scott – Jones 95 s. v. 'αμφορεύς. See further Mlasowsky 1996; Bentz 1998, 34 f.; Lawall 2000, 10–12; Schulzki 2000; Tiverios 2007, 15 f.

8 Lang 1964, 58; Desantis 2001, 106 fig. 63; Tiverios 2007, 15 n. 92.

9 Schulzki 2000; Ault 2007, 264; Wikander 2008, 762 f. tab. 30. 2.

10 Darton – Clark 1994, 11 s. v. amphora.

11 Lewis – Short 1966, 109 f. s. v. amphora.

12 Martin-Kilcher 1987, 152.

13 Wikander 2008, 763 tab. 30. 2.

14 <http://intarch.ac.uk/journal/issue1/tyers/intro.html> (01. 04. 2023).

15 Darton – Clark 1994, 9 s. v. amphora.

16 As was also the case with weight standards, cf. Tekin 2016, 19–24.

17 Wallace 2004, 430.

18 Brøndsted 1832.

19 For a recent overview of such methods, see Greene – Lawall 2015, 8; Cateloy 2016, 45–47.

on »Volumetric Calculations of Lusitanian Amphora Types« and by Stella Demesticha in her discussion of »Volumetric Analysis and Capacity Measurements of Selected Maritime Transport Containers«[20]. She demonstrates that this method has an element of error of about 5 %[21].

Martin Bentz has observed that the Panathenaic amphorae had a mean capacity of 26.33 liters with a variation of about 8–9 % on either side of this figure[22], and Malcolm Wallace's study of »Standardisation of Greek Amphora Capacities« from 2004 yielded a similar result[23]. He measured a number of Rhodian amphorae and found that the capacities of »twenty-six of these, made by five fabricants in the term of the eponym Pausanias« – i.e., between c. 230 and 200 B.C. – »measured with polystyrene beads, ranged from 25.4 to 29.1 liters (or less than ±8 %)«[24]. He found similar variations in other Hellenistic amphora classes and concluded that »Buying a single jar would take the risk of its being more than 3.5 per cent under standard size about one time in three and being more than 7.0 per cent under about one time in twenty (though as many jars would be over standard)«[25]. Víctor Martínez similarly found great variation in the capacities of 28 Lusitanian Dressel 14 amphorae; their capacities ranged from 23.4 to 49.8 liters with a mean of 34.1 liters. He arrived at a similar range of variation for the Almagro 51C/Keay 23 amphorae[26].

Moving on to Late Antiquity, Peter van Alfen distributed the Late Roman 1 (LR1) amphorae from the 7th-century A.D. Yassıada shipwreck into 11 types[27], of which many had subtypes of their own. He divided the most popular type (I), which accounted for 39 of the 71 amphorae measured, into three subtypes (Ia, Ib, and Ic), each with a different capacity ranging from c. 6.1 (Ia) and c. 7.1 (Ib) to c. 8.2 (Ic) liters. The capacities of the other types clustered around c. 8.3 (Types II–VII) and c. 8.5 liters (Types IIIa–VI) with a »looser grouping of Type IIIb-c jars of c. 9.5 l«[28]. According to van Alfen, this variation does not exclude the possibility that a system of amphora standardization for specific commodities was in place, but he admits that »there is no guarantee that it was always adhered to in using the jars«[29]. He concludes that »the great variety of sizes and capacities in LRA1 amphoras is not easily explained by state regulation or need«, suggesting cautiously that they were due to »consumer-driven marketing practices«[30]. The Late Roman 1 amphorae from the Yassıada wreck are smaller and have a smaller holding capacity than many other Late Roman 1 amphorae. I am grateful to Kathleen Slane for having drawn my attention to five examples from Corinth with capacities between >18 and 36 liters[31]. At Nea Paphos in Cyprus, Late Roman 1 amphorae were produced in three sizes[32].

The evidence thus suggests that the capacities of ancient amphora classes were not standardized to the strict degree that modern consumers would expect[33], though this may have changed

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20 Martínez 2016; Demesticha 2017.

21 Demesticha 2017, 174 f. Of the 36 amphorae mainly from the Bronze and Iron Ages thus analyzed, 17 have a capacity below 15 liters, 6 between 15 and 30 liters, and 9 between 30 and 62 liters, cf. Demesticha 2017, 175–182 tab. A.

22 Bentz 1998, 32–34.

23 Wallace 2004.

24 Wallace 2004, 430.

25 Greene – Lawall 2015, 8–12 discuss an even greater range of variation in the capacities of 28 intact amphorae from a wreck at Pabuç Burnu dated to the second quarter of the 6th cent. B.C. For the Thasian amphorae, see now also Tzochev 2016a, 234 f.

26 Martínez 2016, 130–133 fig. 2. In both cases, however, the calculations contain outliers, and the result should be taken with a grain of salt.

27 For the Late Roman 1 type, see Peacock – Williams 1986, 185–187 Class 44; Pieri 2005, 69–84; Bezeczky 2013, 158–160 Type 52; Şenol 2018, 507–509.

28 van Alfen 1996, 192 f. 203. Cf. however, Pieri 2005, 70.

29 See now also van Alfen 2015, 18.

30 van Alfen 1996, 212 f.

31 Personal communication; Bonifay 1986, 300 quotes a figure of 26 liters.

32 Demesticha 2000, 549 f.

33 Thus also Laubenheimer – Gisbert 2001, 39 f; also Laubenheimer in this volume infra, chap. 7; Monachov – Kuznetsova 2017. The same seems to have been the case with the Levantine trade amphorae from the Bronze Age.

in the Late Roman period. In a study that focused on the globular (LR2-type) jars from the same wreck, van Alfen concluded that »it is possible that a conceptual turning point for standardization can be found shortly before the ship sank, which could account for both standardized and non-standardized jars being on the same ship«[34]. Still, approximate standards no doubt existed in the Hellenistic and Roman periods, and Wallace astutely observed that if you acquired a batch of amphorae, the different capacities would largely be evened out because the mean variation of a batch of 100 amphorae »should range on the order of ± one percent«[35]. As observed by Stefanie Martin-Kilcher, few ancient consumers would probably have acquired a whole amphora of wine[36], barring exceptional circumstances[37], and Dyfri Williams has demonstrated that this was also the case in Athens in the Late Archaic and Early Classical periods[38]. Indeed, σηκώματα, stone tables with standard measures of liquids, have been preserved from the ancient world. Such tables were presumably also used as standard measures for wine, although some of the quantities involved are so small that other liquids must have been involved[39]. This leads me to believe that the approximate capacity standards witnessed in, say, Rhodian amphorae may have originated from a desire on the part of the Rhodian state to impose a tax on its wine producers because a standardized measure would be necessary to ensure that they were all treated equally. Indeed, the stamping itself probably also had a fiscal character, according to Yvon Garlan[40].

DID THE SHAPE OF AN AMPHORA CLASS REFLECT ITS CONTENTS?

Andrei Opaiţ has proposed that there was a »link between the amphora shape and its contents,« suggesting that »a vessel with a shorter neck and ovoid or globular body was probably used for olive oil.« He also noted that »an amphora intended specifically for a fish product would either have no neck or a larger truncated conical neck that would not impede the filling and emptying of the vessel with fish sauce or salted fish. Wine amphorae on the contrary seem to have had a narrow and rather longer neck«[41]. Tania Panagou concluded that these assumptions »if used with caution and as a complementary tool, can offer reasonable indications«[42]. It may be observed in passing that some fish amphorae identified by Opaiţ have a wide mouth and hardly any neck[43], but the focus of this contribution is on oil and wine amphorae, and I shall therefore proceed to examine Opaiţ's suggestion that »a vessel with a shorter neck and ovoid or globular body was probably used for olive oil.«

An early example of a globular or ovoid jar is the Corinthian A amphora, which first appeared in the early 7th century B.C. and continued in production until about 300 B.C. Its body is more or less spherical; the neck is broad and flat, and the handles are heavy[44]. Most scholars agree that such amphorae contained olive oil, mainly because they have no resinous coating on the interior.

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cf. Cateloy 2016, in particular 47–52 figs. 4. 5.

34 van Alfen 2015, 30 f. For the 11th cent. A.D., see van Doorninck 2015.

35 Wallace 2004, 430 f.

36 One should not forget, though, that consumers could also acquire smaller quantities of wine in wineskins, Immerwahr 1992, and in the Hellenistic Period in coarse lagynoi, a shape favoured by individual drinkers, cf. Rotroff 1996, 22 and Rotroff 2006, 83–85.

37 Martin-Kilcher 1994, 539 f; Finkielsztejn 2010, 201; Badoud 2017, 10.

38 Williams 2018, 80–83.

39 See, e.g., Finkielsztejn 2010; Cioffi 2014. For the use of the term in papyri, see Mayerson 1998; Mayerson 2001.

40 Garlan 2000, 167–171. The rationale behind the stamping is debated, but the case for the fiscal character is well argued by Badoud, who concludes that it is »certain that the stamping reflected a tax on the production of amphoras«; Badoud 2017, 22. It seems more likely to me, however, that the taxation was directed at the agricultural produce contained in the amphorae, cf. Palaczyk 2017, 237; Börker 2019, 81 f.; Lund 2018.

41 Opaiţ 2007, 101 f.

42 Panagou 2016a, 315.

43 Opaiţ 2007, 102–117.

44 C. G. Koehler, A Brief Typology and Chronology of Corinthian Transport Amphoras <http://projects.chass.utoronto.ca/amphoras/corab92.htm> (30. 12. 2018).

and also because they are manufactured in a fabric similar to blisterware, which is associated with vessels used for oil in Corinth[45].

Corinthian B amphorae were first made about 525 B.C., and production continued into the 2nd century B.C. on Corfu and perhaps also at Corinth. Their shape changed over the centuries. At first it was nearly globular, but by the middle of the 5th century the body became ovoid[46], and it developed into a piriform shape by the 3rd century B.C. Corinthian B amphorae are thought to have primarily contained wine, mainly due to the fact that many are coated on the interior with a resinous substance[47].

The Massaliote amphorae are characterized by a spherical or ovoid body, a short neck, and heavy handles. The earliest examples, i.e., Types 1 to 3 in Guy Bertucchi's classification from 1992, were produced from the second half of the 6th into the 4th century B.C. Wine is thought to have been their primary contents. The resinous coating frequently found on their interior is used as an argument in favor of this theory, together with residue in an amphora found in the Bourse at Marseille. On the other hand, several examples were found to contain olives[48].

The shape of the Brindisi amphorae varied from nearly circular to ovoid. They were produced from the second half of the 2nd century B.C. through the early 1st century A.D. at several places on the south Adriatic coast, of which the best known are the Apani and Giancola workshops in the Brindisi area[49]. Some scholars think that olive oil was the primary contents, but others hold that they could also be used for the transportation of wine[50].

There is little doubt about the contents of the Dressel 20 amphorae that were made in workshops along the Guadalquivir Valley in Andalusia in southern Spain from before the middle of the 1st century A.D. into the middle of the 3rd century. It is generally agreed that this amphora class was exclusively used for olive oil. It has a large globular body with sharply bent or oval handles and a short neck[51].

The Gauloise 4 amphora was produced in Gallia Narbonensis between about A.D. 50 and the end of the 3rd century. It has a small ring base, an ovoid body, a bead rim, and grooved handles. Amphorae of this type are often coated internally, and they carry *dipinti*, which always refer to various kinds of wine (*Aminneum, Picatum, Passum*), and it is therefore generally agreed that they carried wine[52].

Moving on to Late Antiquity, the Late Roman 2 (LR2) amphora type has a broad-bellied, near-globular shape with a short neck and a cup-shaped mouth[53]. It was produced in the Argolid at Kanoupi, between Porto Cheli (ancient Halieis) and Hermioni between the 4th and 7th centu-

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45 Whitbread 1995, 256 f. and passim; Göransson 2007, 82 f.; Sacchetti 2012, 16–24; Pratt 2016, 98–208; Knapp – Demesticha 2017, 140–142; Şenol 2018, 367; <https://amphoras.artsci.utoronto.ca/corab92.htm> (01. 04. 2023).

46 C. G. Koehler, A Brief Typology and Chronology of Corinthian Transport Amphoras; <http://projects.chass.utoronto.ca/amphoras/corab92.htm> (30. 12. 2018).

47 Whitbread 1995, 258–261 and passim; Göransson 2007, 88–114; Sacchetti 2012, 32–38; Knapp – Demesticha 2017, 140–142; Şenol 2018, 367; <https://amphoras.artsci.utoronto.ca/corab92.htm> (01. 04. 2023).

48 Bertucchi 1992, 37–67, 185–191 and passim; Sacchetti 2012, 43–48.

49 Manacorda – Pallecchi 2012; Palazzo 2013; González – Berni 2018, 71–73; Şenol 2018, 260.

50 Peacock – Williams 1986, 82 f. Class 1; Bezeczky 2013, 110–114 Type 28; Carre et al. 2014, 422 n. 20; Carreras et al. 2016; <http://archaeologydataservice.ac.uk/archives/view/amphora_ahrb_2005/details.cfm?id=51&CFID=0cbafef0-5362-4d13-9247-6d590777103f&CFTOKEN=0> (01. 04. 2023).

51 Peacock – Williams 1986, 136–140 Class 25; Martin-Kilcher 1987; Peña 1999, 86–88; Berni 2008; Bezeczky 2013, 139–142 Type 39; Kingsley et al. 2014; González – Almeida 2017, 55–58; González – Berni 2018, 21–29; <http://archaeologydataservice.ac.uk/archives/view/amphora_ahrb_2005/details.cfm?id=83&CFID=0cbafef0-5362-4d13-9247-6d590777103f&CFTOKEN=0 (01. 04. 2023).

52 Laubenheimer 1985; Peacock – Williams 1986, 142 f. Class 27; Martin-Kilcher 1994, 358–376 (in part); Bezeczky 2013, 134 f. Type 34; Delbey et al. 2015; <http://archaeologydataservice.ac.uk/archives/view/amphora_ahrb_2005/details.cfm?id=136> (01. 04. 2023).

53 Munn 1985; Pieri 2005, 90 f.; Diamanti 2010, 75–80; Bădescu 2012, 316–322; Gerousi 2014, 195; Heath et al. 2015; Şenol 2018, 425.

ries A.D.[54]. Dressel 24 *similis* amphorae, which were probably a typological predecessor to the LR2 amphora, were manufactured in kilns at Chios and Erythrai[55], but the latter type was not apparently made here, and other reported kiln sites do not stand up to closer scrutiny[56]. *Tituli picti* show that the Dressel 24 *similis* amphorae were oil containers[57], and Olga Karagiorgou concluded that the available evidence »strongly favours olive oil or olives as the primary content of LR2 [amphorae]« pointing among other things to the fact that LR2 kilns identified in the Peloponnese are situated in an area ideal for the cultivation of olives[58].

Wine amphorae, on the other hand, seem according to Andrei Opaiţ »to have had a narrow and rather longer neck,« longer than that of oil and fish amphorae. This holds true for many Classical and Hellenistic wine amphorae of the Aegean, such as those from Thasos, Chios, Cos, Knidos, and Rhodes[59], as well as for some other classes (Schöne-Mau XXXV, Pseudo-Dressel 2/4, Dressel 30) but not all[60]. Among exceptions to this ›rule‹ are the Gauloise 4, the Late Roman 4 (LR4, ›Gaza‹) amphorae, manufactured on the Palestinian coast[61], and the North African ›amphore globulaire.‹[62]. Dominique Piéri has argued that wine was probably also the principal contents of the bag-shaped Late Roman 5 (LR5) amphorae[63].

This review suggests that some oil amphorae (Corinthian A, Brindisi, Dressel 20, LR2) were indeed globular or ovoid but so were some wine amphorae (Corinthian B, Massaliote, Gauloise 4, and the amphore globulaire). Moreover, other oil amphorae did not have this shape, for example the Tripolitana I and III and the Africana I amphorae, which, according to Michel Bonifay, most likely contained olive oil[64]. Mark Lawall rightly observed that »what is striking about his results is the fact that the Africana types, despite different contents, all share the same general shape and the same basic forms of toe, mouth and rim«[65]. The tentative conclusion to be drawn from this evidence is that making assumptions about the contents of a given amphora class merely based on its shape is hazardous[66].

IS IT POSSIBLE TO ESTABLISH A CORRELATION BETWEEN THE CAPACITY OF AN AMPHORA CLASS AND ITS PRIMARY CONTENTS?

The capacities of the oil and wine amphora classes reviewed above are a natural first step towards investigating whether there was a correlation between the volume of an amphora class and its primary contents.

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54 Munn 1985.

55 Opaiţ – Tsaravopoulos 2011.

56 Reports of production of LR2 amphorae at Reşadıye in the Knidian Peninsula seem in fact to refer to the LR1 type, cf. Tuna et al. 1987, 49, and an alleged kiln site in Chios produced amphorae of the subtype Zeest 70 according to Opaiţ 2004, 11.

57 Opaiţ – Tsaravopoulos 2011.

58 Riley 1981, 117 f. 122; Peacock – Williams 1986, 182–184 Class 43; Karagiorgou 2001; Bezeczky 2013, 153; <http://archaeologydataservice.ac.uk/archives/view/amphora_ahrb_2005/details.cfm?id=239> (01. 04. 2023). However, Pieri 2005, 92 f. opts for wine as the principal contents.

59 Şenol 2018, 357. 359. 369 f. 395 f. 408.

60 For these, see Bonifay 2004, 87–155; Bonifay 2007.

61 Riley 1981, 117 f. 120; Peacock – Williams 1986, 198 f. Class 49; Majcherek 1995; Pieri 2005, 101–114; Freed 2009, 155; Bezeczky 2013, 170–172 Type 57; Şenol 2018, 445 f.; <http://archaeologydataservice.ac.uk/archives/view/amphora_ahrb_2005/character.cfm?id=16> (01. 04. 2023). Lawall 2011, 23 f. notes that papyrological finds show that LR4 amphorae »are frequently attested as containing not only imported wine, but also imported grapes, olive oil, nuts, olives, honey, cheese, pickles fish products, fruit and meat.«

62 Bonifay – Capelli 2018, 68.

63 Riley 1981, 117 f. 121; Peacock – Williams 1986, 191 Class 46; Lund 1993, 133–135; Pieri 2005, 114–127; Freed 2009, 155; Bezeczky 2013, 171.

64 Bonifay 2007, 87–155. The conclusion is based on the location of the amphora workshops and the absence of an internal resinous coating. See also Woodworth et al. 2015.

65 Lawall 2011, 25.

66 Lawall 2011, 33 is likewise critical of the notion of ›oil shapes‹ and ›wine shapes.‹

As far as oil amphorae are concerned, Carolyn Koehler stated that Corinthian A amphorae »are on the whole much larger than those of other Greek amphora series; in all periods they held various amounts, the smallest about 18 litres, the largest 70, and the majority above 40«[67]. This accords with the recently quoted average capacity of 46.2 liters[68]. A Brindisi amphora found at Ashkelon in Israel holds 54.25 liters, and one in Alexandria has a capacity of 64.36 liters[69]. The measured capacity of the Dressel 20 amphorae varies between 58.50 and 80.50 liters, with a mean of about 69.51 liters[70]. The capacity probably varied over time, and they could – according to *tituli* – contain between 59 and 191 liters »with a plurality receiving 215–16 pounds of oil (ca 78–79 l)«[71]. The capacity of the Tripolitana II–III amphorae is 80–85 liters[72], that of the Africana I class is 35–40 liters[73], and LR2 amphorae contained about 40–45 liters[74]. When the average capacities of these oil amphorae are combined, it emerges that they contained a mean of 56.3 liters, a figure that should of course be taken with a grain of salt due to the many uncertainties involved.

Wine amphorae present a somewhat different picture. The capacity of the Corinthian B amphorae fluctuated between 19.3 and 27.6 liters, but Carolyn Koehler notes that a »certain intended size« of about 25 liters was attained by the early 3rd century B.C.[75]. The capacity of the Massaliote 2b and 3 amphorae varied between c. 15.5 and 28.3 liters, with a mean of 22.4 liters[76]. The Thasian amphorae of types Ia and Ib each held an average of 6.3 and 11.1 liters[77], and the Rhodian ones contained between 25.4 and 27.3 liters[78]. For Knidian amphorae, capacities between 25.2 and 39.95 liters have been reported, with a mean at 34.4 liters[79]. The completely preserved Gauloise 4 amphorae from the kiln site at Sallèles d'Aude had a capacity between 29.9 and 37 liters, with a mean of 33.9 liters[80]. LR4 (Gaza) amphorae of the 5th and early 6th centuries (Pieri type 4B) contained between 24 and 26 liters[81], and the Late Roman 5 amphorae have a standard capacity

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67 <https://amphoras.artsci.utoronto.ca/corab92.htm> (01. 04. 2023).

68 Knapp – Demesticha 2017, 141.

69 Barako 2008, 455 Amphora 25; Şenol 2018, 261 no. 220; 262–264 nos. 221–223 have capacities between 35.52 and 43.66 liters.

70 Based on Peacock – Williams 1986, 51–53 tab. 1 with the omission of two small amphorae holding 39 and 45.95 liters each, and Kingsley et al. 2014, 3. According to »Roman Amphorae: a digital resource,« the average capacity is 70–75 liters; <http://archaeologydataservice.ac.uk/archives/view/amphora_ahrb_2005/index.cfm> (01. 04. 2023).

71 Martin-Kilcher 1987, 54–58. 152–157; Bezeczky 2013, 139–142; van den Berg 2015, 447 with references. The quotation is from Peña 1999, 86. For this issue, see Rodríguez 1984; Rodríguez 1990; Rodríguez 2000; Berni 2008; Aguilera 2012.

72 <http://archaeologydataservice.ac.uk/archives/view/amphora_ahrb_2005/character.cfm?id=306> (01. 04. 2023).

73 <http://archaeologydataservice.ac.uk/archives/view/amphora_ahrb_2005/character.cfm?id=1> (01. 04. 2023). Auriemma 2000, 27 n. 4 quotes a figure of 43–44 liters; Şenol 2018, 220 no. 185 has a capacity of 37.15 liters.

74 <http://archaeologydataservice.ac.uk/archives/view/amphora_ahrb_2005/character.cfm?id=239> (01. 04. 2023) quotes a figure of 40–45 liters. Karagiorgou 2001, 149 states that their capacity is »mainly about 40 litres,« but she also (142) refers to examples at 30 liters.

75 <https://amphoras.artsci.utoronto.ca/corab92.htm> (01. 04. 2023).

76 Bertucchi 1992, 39. 54. 58 f. 62. 64 f.

77 Cf. Bon – Bon 1957, 17–19; Brašinskij 1984, 180–182; Panagou 2016b, 210 and n. 3. See also Tzochev 2016a, 234 f.; Tzochev 2016b.

78 Wallace 2004, 430. The mean capacity for the 11 examples quoted by Brašinskij 1984, 199 f. is 27 liters (disregarding 7 fractional amphorae). See also Monachov 2005, 88–91 and passim.

79 Alpözen et al. 1995, 86. 88 f.; Şenol 2003, 33–38; Şenol 2009, 126–129; Panagou 2016b, 229 n. 3; Şenol 2018, 397 f. According to Dündar 2013, 167: »The capacity of Cnidian amphorae in the 3rd century B.C., of approximately 40 litres, decreases by the end of the 2nd century B.C. to 3 litres, and in the Roman Imperial period, during the 1st–2nd century A.D. was further reduced in capacity to 17 litres.« Cf. <https://amphoras.artsci.utoronto.ca/corab92.htm> (01. 04. 2023).

80 Laubenheimer – Gisbert 2001, 37.

81 Pieri 2005, 105. The earlier type A held between 13 and 16 liters. According to »The Roman Amphorae« website, their capacity was 20–25 liters: <http://archaeologydataservice.ac.uk/archives/view/amphora_ahrb_2005/character.cfm?id=16> (01. 04. 2023).

between 20 and 25 liters[82]. The average capacities of these wine amphorae thus varied between 8.3 and 34.4 liters. However, Coan amphorae make up an exception to this ›rule,‹ with a capacity varying between 40.6 and 51 liters and a mean of 44.5 liters[83]. Still, the average capacity for all of the wine amphorae under discussion – including the Coan ones – amounts to only 28.2 liters, about half of the corresponding figure for the oil amphorae. The very same difference is illustrated graphically by the oil and wine amphorae from North Africa, as identified by Michel Bonifay, who did not, I think, factor in the size of the amphorae when he determined their contents[84].

This is not to suggest that all wine amphorae were smaller than all oil amphorae throughout the ancient world and for all periods. The sample analyzed here is evidently too small to allow for such a sweeping conclusion. Other factors may have been involved. For instance, it has been suggested that the capacity of an amphora was determined by the value of its contents; that is, a more valuable commodity would be shipped in a smaller container than a less valuable one[85]. Still, if future research confirms that the capacity of ancient olive oil amphorae was, generally speaking, greater than that of those containing wine, then this may perhaps be explained with reference to olive oil's relatively long ›shelf life‹, a suggestion originally put forward by Olga Karagiorgou in her study of the LR2 amphorae. She observed that »the detrimental impact of oxygen on the flavour and body of the wine« meant that a wine amphora had to be emptied reasonably quickly once its seal had been broken, in contrast to those containing olive oil[86].

CONCLUSION

Ancient amphora capacities were not standardized to the degree that a modern consumer would expect: the capacities within a single class varied between 8 and 10 % or more. However, this inconsistency could be evened out by acquiring a large batch of amphorae, as pointed out by Malcolm Wallace, and it would not be a problem for the everyday consumer who probably bought a carefully measured smaller amount of wine or oil from a retailer. The evidence suggests that oil amphorae did, on the whole, have a larger carrying capacity than wine amphorae[87], which may have had something to do with the longer shelf life of olive oil over wine, once the seal was broken. But it is hard to maintain the notion that the contents – whether wine or oil – of an amphora can be reliably deduced from its shape. It rather seems that this reflected certain regional patterns[88]. Many Archaic East Greek amphorae thus shared a somewhat similar shape[89], and the same holds true for the Hellenistic wine amphorae from the Aegean and also for most of the amphorae produced in Roman North Africa, regardless of their contents[90]. A buyer far from the production area of the amphora would probably not have been aware of such regional patterns, which incidentally supports the notion that the trade in amphorae (or rather their contents) was highly organized and carried out on a well-informed basis.

Due to the many uncertainties involved, these conclusions should all be regarded as preliminary. The only certainty to emerge from this study is that more – indeed many more – volumetric studies of transport amphorae are in order. This contribution has tried to cover most of the Mediterranean over an extended period of time, but the best way to arrive at clearer answers is presumably to abandon a global view in favor of studying the issues at a regional and even local level, which is to a large extent precisely what the present publication is all about.

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82 <http://archaeologydataservice.ac.uk/archives/view/amphora_ahrb_2005/character.cfm?id=267> (01. 04. 2023).
83 Brašinskij 1984, 201; Alpözen et al. 1995, 96 f.; Şenol 2003, 42 f.; Şenol 2009, 130–132; Panagou 2016b, 210 n. 3.
84 Bonifay 2007 fig. 1.
85 Steckner 1989, 69 f.
86 Karagiorgou 2001, 148 f.
87 Thus, also Molina – Mateo 2018, 308.
88 For examples, see Lawall 2017 and Philis 2019.
89 See Pierre Dupont in: Cook – Dupont 1998, 142–191.
90 See Bonifay 2007, fig. 1.

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Horacio González Cesteros – Justin Leidwanger (eds.)

REGIONAL ECONOMIES IN ACTION

Standardization of Transport Amphorae in the Roman and Byzantine Mediterranean

Proceedings of the International Conference at the Austrian Archaeological Institute and the Danish Institute at Athens, 16–18 October 2017

Österreichisches Archäologisches Institut
Sonderschriften Band 63

Herausgeber
Österreichisches Archäologisches Institut
Abteilung Historische Archäologie
Reihenherausgabe
Sabine Ladstätter, Oliver Hülden, Martin Steskal, Alice Waldner, Barbara Beck-Brandt
Franz Klein-Gasse 1
A-1190 Wien
<www.oeaw.ac.at/oeai>

Das Österreichische Archäologische Institut ist eine Forschungseinrichtung der
Österreichischen Akademie der Wissenschaften

ÖAW ÖSTERREICHISCHE AKADEMIE DER WISSENSCHAFTEN

Forschungsergebnisse von Austrian Science Fund (FWF): M 2035
Veröffentlicht mit Unterstützung des Austrian Science Fund (FWF): PUB 936

FWF Der Wissenschaftsfonds

Eigentümer & Verleger
Verlag Holzhausen GmbH
Traungasse 14–16
A-1030 Wien
<www.verlagholzhausen.at>
<https://shop.verlagholzhausen.at/collections/archaeologia>

HOLZHAUSEN
Der Verlag

Redaktion und Lektorat: Barbara Beck-Brandt
Englisches Lektorat: Sarah Parker, Sarah Cormack
Satz und Layout: Andrea Sulzgruber
Umschlaggestaltung: Büro Pani, Andrea Sulzgruber

1. Auflage 2023
Verlagsort: Wien – Herstellungsort: Wien – Printed in the EU

ISSN 1998-8931
ISBN 978-3-903207-73-8

Die verwendete Papiersorte ist aus chlorfrei gebleichtem Zellstoff hergestellt, frei von säurebildenden Bestandteilen und alterungsbeständig.

Bibliografische Information der Österreichischen Nationalbibliothek und der Deutschen Nationalbibliothek: Die ÖNB und die DNB verzeichnen diese Publikation in den Nationalbibliografien; detaillierte bibliografische Daten sind im Internet abrufbar. Für die Österreichische Bibliothek: <http://onb.ac.at>, für die Deutsche Bibliothek: <https://dnb.dnb.de>.

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