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## African economy: the ceramic evidence

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### Introduction

Ceramic evidence is one of the main sources of study for the economy of Roman Africa. This is partly a consequence of the lack of direct archaeological evidence for foodstuff production in this region (although presses have been studied, only two farms have recently been excavated, in Tunisia, and only one in Libya: Ghalia 2006; De Vos and Maurina 2019; Mattingly and Zenati 1984), and more importantly on account of the wide distribution of African pottery (amphorae, tableware, cooking ware, lamps) throughout the Empire and sometimes beyond (Hobson 2015). There have, nonetheless, been a number of important studies over the last forty-five years which have attempted to integrate the limited archaeological information on African agriculture with the abundant, if equivocal, evidence of pottery (Carandini 1970; Fulford 1983; Fentress and Perkins 1988; Panella 1993; Reynolds 1995, 2010 and 2016; Fentress *et al.* 2004; Bonifay 2003).

In this chapter I will focus chiefly on the importance of pottery as an indicator of production and performance in the Roman economy, in particular its relationship with territories, foodstuffs and trade, as well as some of the recurring problems in the study of African wares.

### 1. Territories

Between the mid first century AD and seventh century AD, Roman Africa comprised the area from roughly Tripolitania to Morocco, though it remains open to question whether the latter, known as Mauretania Tingitana should be associated more with Roman Spain than Africa. This is pertinent for our purposes with respect to amphora production in Tingitana which imitated Spanish, not African types. Even if this part of the Roman Maghreb is set aside in a survey of the ceramic evidence, the territories of African ceramic production extended over some 2200 km from the Algerian-Moroccan border to the Syrtic Gulf in Libya.

### Amphora production

Considerable progress has been made in recent years in identifying archaeologically and archaeometrically the exact origin of African amphorae and tableware in the Mediterranean markets (Mackensen and Schneider 2002 and 2006; Capelli and Bonifay 2007, 2014 and 2016). The identification of African amphora production centers has benefited from the development and integration of three different tools: stamps with place names, surveys focused on the location of workshop surveys, and archaeometry. That said, our knowledge on the amphora production in Africa remains very heterogeneous. For example, information on production centers in Algeria is still very scarce with, only one production area reliably attested through stamps mentioning the cities of *Tubusuctu*/Tiklat and *Saldae*/Bejaia (Laporte 2010; Amraoui 2017) and devoted to the production of imitations of wine Gaulish amphorae (the so-called type Dressel 30). Another stamp, with a palm tree inserted between the letters M and C, previously interpreted as the possible mark of the capital of Mauretania Caesariensis, *Caesarea*/Cherchell, has now been disproven through recent petrographical analyses (Capelli and Bonifay 2014). Paradoxically, production in the region of Carthage-Utica was quite unknown until recently. It is now clear by virtue of new petrographical analyses and the discovery of probable kiln wasters in the western suburbs of Carthage and kilns in the port area of *Utica* (Ben Jerbania 2017), that the oldest amphora type of Greco-Roman tradition, now referred to as “Ancient African” dated to the second half of the 2nd century and 1st century BC, originated in this region, and not, as originally thought, in Tripolitania (and previously identified as “Ancient Tripolitanian”) (Capelli and Contino 2013). Northwest *Africa vetus* also seems to have been the production location of the earliest variants of classical Romano-African amphorae (types Ostia LIX), which appeared in the second half of the 1st century AD. This is significant as some of these containers found in Pompeii show a *titulus pictus* TAVR previously interpreted as indicating the city of *Tauromenitanum*/Taormina in Sicily, but now excluded by the petrography of these amphorae. The abbreviation *Taur* could perhaps refer to the African city of *Thabraca*, frequently spelled as *Tauraca*. The shipwreck Camarina A, found on the southern coastline of Sicily and dating late 2nd century AD,

transported a cargo of these amphorae, associated with a main cargo of Chemtou marble, generally said to have been exported from the ports of Tabarka or Bizerte. Thus the northwestern part of Zeugitana seems to have been the source of most of the earliest amphorae in Roman Africa (Bonifay *et al.* 2015).

The eastern coastline of Tunisia is one of the best known of all the African regions from the point of view of Roman amphora production. Four main areas can be distinguished from North to South. The first one is the city of *Neapolis/Nabeul*, where no fewer than some fifteen workshops, some of them very spectacular, have been identified through field survey (Bonifay *et al.* 2010). The production is attested from at least the mid-1st century AD (Punic types of the 3rd century BC are also known), and continues until the Arab conquest (and probably beyond). The high point of this production was between the second half of the 3rd century and mid 6th century AD, the Vandal period being particularly prolific. These amphorae are easy to recognize due to their recent accurate typological and petrographical characterization. A second zone is located in the modern Sahel region of Tunisia, the ancient Byzacena coastline. Within this area, the amphora production of the city of *Sullecthum/Salakta* is probably the best known (Nacef 2015), with a very distinctive fabric and a typology indicating a production from the second half of the 1st century AD until the 7th century, albeit with a hiatus during the 5th century at the very time when the Nabeul production is booming. Other important production centers are also known by stamps at *Hadrumentum/Sousse* and through surveys and excavations at *Leptiminus/Lamta* (Stone, Mattingly and Ben Lazreg 2011), the more southern one, *Thaenae*, being currently under study (Rêve *et al.* 2018). A third group is located inland in southern Byzacena which produced late Antique amphorae (e.g. the Majoura workshop) (Nasr 2015), and a fourth in eastern Tripolitania, currently within Tunisian territory, a region which is often overlooked when discussing the production of Tripolitanian amphorae. In this region workshops have been identified on the island of Jerba (Fontana, Ben Tahar and Capelli 2009), and in the vicinity of the Roman city of *Zitha* (Jerray 2016).

Lastly, in the Libyan part of Tripolitania, much progress has been made in the location of amphora workshops. Three production areas are identified, both from the point of view of the typology and the petrography: *Oea/Tripoli*, *Lepcis Magna*, and the Tahrana plateau. The latter region, recently surveyed by a Libyan-British team provided 35 new kiln sites where almost all Tripolitanian amphora types were produced (Ahmed 2019). During the Roman period this region was located in the hinterland of both the cities of *Oea* and *Lepcis Magna*.

This overview of our current knowledge on the location of amphora workshops raises a number of questions regarding the organization of production across territories and time. Two opposing models of production are evidenced through archaeology. The prevailing one, shows the location of the workshops in the suburbs of major coastal towns in Africa Proconsularis extending from Zeugitana (e.g. Carthage: Peña 1998) to Byzacena (e.g. *Thaenae*: Rêve *et al.* 2018), which were active at least from the 2nd century to the beginning of the 5th century AD. This model supposes that the foodstuffs produced, even far from the coastline, were transported to the port cities, collected in storerooms, and then transferred into locally produced amphorae, before being shipped. Stamps with the name of the city may have been intended to certify the guarantee of origin ('bottled at'). The second model, shows the production of amphorae on estates where oil and/or wine were primarily produced. In this case stamps indicate the name of the private, generally senatorial or sometimes imperial owner. This model is well attested in Tripolitania, contemporaneously with the first model (i.e. workshops in the suburbs of port cities in Byzacena). But it could also have something to do with the heterogeneity of the first production of Roman amphorae in northwestern Zeugitana, and with the transfer of kiln sites following the end of the urban workshops at the beginning of the 5th century (for example in *Sullecthum* or Nabeul).

#### Tableware production

Most every province of the Empire produced its own table ware, but none of these productions had the economic importance of the so-called African Red Slip Ware (hereafter ARS), distinguished by its

bright orange slip, and its standardized, and sometimes decorated forms. It was “the most widely distributed pottery of the Mediterranean in the whole of classical antiquity” (Carandini 1983).

The location of ARS workshops has made considerable progress over the last few decades, even if there are still gray areas. The origin of the earliest category (‘A’), which began production in the late first century and continued until the late third century was probably located in the region of Carthage (a probable workshop has been recently discovered in the city of *Carpis*) (Ben Moussa 2017). On the other hand, the second most important class (‘C’), dated from the third to the mid- sixth century, has been linked to a series of kiln sites in central Byzacena, the most important of them being Sidi Marzouk Tounsi, probably a large estate (Mackensen 1993). Lastly, production ‘D’, dated to the Constantinian period is attested at rural estates (e.g. El Mahrine workshop) (Mackensen 1993) and, from the Vandal period onward, in urban suburbs both in the region of Carthage (*Uthina/Oudhna* workshop) (Barraud *et al.* 1998) and in the northern Gulf of Hammamet (*Pheradi Maius/Sidi Khalifa* workshop) (Ben Moussa 2007). Other productions with regional or sometimes large continental distribution are known in southwestern Byzacena (e.g. Sidi Aïch workshop) (Nasr 2005), Tripolitania, and Numidia, some of which are linked to rural estates (e.g. Wadi Taraghat kiln sites near *Lepcis Magna*) (Felici and Pentiricci 2002), as well as cities (e.g. *Diana Veteranorum/Zana* workshops in Algeria) (Fentress 2013).

The factors behind the shifting location of ARS workshops has been the subject of considerable debate. Some have suggested that the inland as opposed to coastal location of many workshops may have arisen from the need for fuel for the kilns, in particular olive waste which could be acquired from rural estates (Lewit 2011). The location of many kilns in the Atlas Dorsal region may also have been driven by the availability of iron-rich, poorly calcareous clay, much different from the clay used by the coastal amphora workshops. This could explain why ARS workshops are aligned with the mountainous relief, and close to the coastline only when the Dorsal reaches the sea (e.g. at Nabeul: ARS F).

Variations in the economic growth of the provinces could also have been a factor in the shift of production sites from Carthage to Byzacena in the third century (sometimes considered as a response to the third century crisis affecting northern Tunisian production: Dossey 2010: 89), followed by the revival of northern workshops in the 4th century, the shift to central Tunisian kiln sites under the Vandals, and finally the return to the Carthage region during the Byzantine period (Bonifay 2003). Even if we limit our survey to amphorae and tableware, it must also be acknowledged that African cookware (thereafter ACW) also benefited from mass production and wide distribution, probably due to its excellent resistance to thermal and mechanical shocks (Leitch 2013). It seems that the most widely distributed categories ACW ‘A’ and ‘C’ were produced in the same area that the first category of ARS, probably in the region of Carthage between the first and early fifth centuries.

## 2. Foodstuffs

### Amphora contents

In Africa as everywhere in the Roman Empire, ceramic containers were needed only when locally produced foodstuffs had to be commercialized overseas. Carandini (1970) argued that African amphorae in the 70s carried olive oil, based on the evidence of textual sources and the archaeological evidence of numerous presses, thought to be for olive oil production scattered throughout the African territories. However, it has since been demonstrated that many of these installations could also have served as wine presses (Brun 2003), and that in *Africa proconsularis* amphorae could also be used to transport salted fish (Slim *et al.* 2004). Some amphorae found in shipwrecks or humid terrestrial contexts showed traces of an internal pitch lining (for wine or *salsamenta?*), while others did not, thereby revealing different contents (Bonifay 2004 and 2007), suggesting the contents of African amphorae were more diversified than previously assumed (even if more or less all the Roman amphorae were pitched, oil made pitch migrate into the pottery-mass; as a consequence, the absence of visible traces of pitch is still an argument for an oil content, Garnier *et al.* 2011), and may have changed depending of the area of production and the chronology of their containers.

Our understanding of the contents of the different families of African amphorae is thus still limited in the absence of an ambitious program of chemical analyses. Hence the content of Roman amphorae of Punic tradition (with handles attached on the shoulder), produced in Africa from the Republican period to the Arab conquest, remains highly uncertain. The traditional hypotheses were salted fish or fish sauces, but wine cannot be excluded. This could be the case for those produced in Tripolitania (type Tripolitana II), in workshops sometimes very distant from the coastline. On the other hand, some of these containers found in Africa with large capacities should be regarded as storage amphorae rather than transport amphorae.

The content of the first African amphorae of Greco-Roman morphology, with handles attached on the neck and produced in northwestern Zeugitana in Republican Age (type 'Ancient Africana') is completely unknown. Oil is the most frequently advanced hypothesis, but other contents (salted fish and wine) are also possible, as well as interchangeable contents. The progressive standardization of the typology of amphorae from this region at the beginning of the Empire (types Ostia LIX and XXXIII) appears to be linked to the development of olive growing for preserved olives and/or olive oil.

Large scale amphora production migrated during the mid-second century to the eastern coastline of Byzacena, in prominent port cities like *Hadrumetum*, *Leptiminus*, *Sullecthum*, etc. Until the end of the third century, these huge workshops produced two amphora types, Africana I and Africana II, with two different contents. Africana I, with a capacity of about 40 liters, is the African oil-container *par excellence*, alongside the Tripolitanian types I and III. Even if these containers were probably pitched, like all amphorae in the Roman period, traces of this lining are no longer perceptible, which is characteristic of all oil-containers (Garnier *et al.* 2011).

Africana I and Tripolitana I/III are the most frequent African containers in the Monte Testaccio dump, alongside with the Spanish oil amphorae of type Dressel 20. In contrast, type Africana II which show traces of pitch are rare at Monte Testaccio. Even if wine has sometimes been proposed (in particular for variant II A), salted fish or fish sauces were the most probable content of these amphorae. This could be the case from variant II C, produced from the mid 3rd century onwards in the city of *Neapolis/Nabeul*, in southwestern Zeugitana, a place where numerous salted fish factories have been identified and excavated (Slim *et al.* 2007). Its Byzacena counterpart, variant II D, could have the same content, even if wine is another possibility (Stone *et al.* 2011).

The fourth century family of medium sized amphorae (type Keay 25 or Africana III), were perhaps derivatives of this latter type, and were produced widely in Africa (evidence from Carthage, Nabeul, and Byzacena, possible imitations in Tripolitania and Mauretania Caesariensis). But their contents are also problematic. Recent chemical analyses have proven that at least some of these containers (variant III A) were transporting wine (Woodworth *et al.* 2015). This could explain the ubiquitous presence of this container throughout the Mediterranean, included the East. On the other hand, it seems that variant III B, mainly originating from Nabeul, was chiefly devoted to the transport of fish products. Lastly, some variants may have contained olive oil.

From the late fourth or beginning of the fifth century, things become more complicated from the point of view of both typology and contents. The fifth century is characterized by a small and slim version of the emblematic type of the preceding century, popularly called *spatheion* by specialists. This container did not seem to have a specific content, but could act as a space filler in order to optimize the shipments of whatever foodstuffs it might have carried. On the other hand, it is impossible for now to determine the content of each type of large amphorae of the Vandal and Byzantine period as they were widely produced across Africa for what appear to be diverse purposes owing to the including oil, fish products and wine, which continued to be transported in these amphorae until at least the end of the seventh century.

The overseas distribution of African wine has sometimes been difficult for scholars to accept because of the emphasis on olive oil as the single explanation for the distribution of African amphorae. However, even if some aforementioned hypotheses regarding wine amphorae are still uncertain, it must be noted that the African workshops also imitated from the first century to the seventh century

AD non African types clearly devoted to the transport of wine (types Schöne-Mau XXXV, Dressel 30, LRA 1).

Containers in perishable materials (skins and barrels) were also used in Africa, as portrayed in ancient iconography, but their use is mainly attested for terrestrial transport. Oil and wine produced inland and intended for overseas export were probably first packaged in leather skins in order to be transported by donkeys or carts to port cities. However, we cannot rule out the possibility that low-quality wine and even fish products were sometimes exported in barrels (Marlière and Torres Costa 2007).

#### Tableware distribution

In the same way as all African amphorae were initially dedicated to the transport of olive oil, the production and the commercialization of African Red Slip Ware were first linked to the development of olive growing in Roman Africa: ARS was “no more than a simple accompanying product” of African oil (Carandini 1983). The problem is that we do not have, prior to the first half of the fifth century, any archaeological evidence of joint transport of ARS and African amphorae. ARS cargoes of the second to fourth centuries are completely lacking, except for some complementary loading on ships with a heterogeneous cargo of Spanish and African amphorae, which are difficult to interpret (Bonifay and Tchernia 2012). Obviously ARS was mainly travelling with another commodity that archaeology is unable to identify. On the other hand, it should be admitted that the primary ARS workshops (categories ‘C’ and ‘D’) are not located in olive cultivation zones.

Indeed, the region of Maktar (category ‘C’) and the lower Medjerda valley (category ‘D’) were especially devoted to the cultivation of grain. The hypothesis of grain as the engine of ARS production and distribution has sometimes been advanced but mainly as an exception which could explain the first ARS exports prior to the development of olive production in Africa, or to the specificity of its distribution in Eastern Mediterranean where African amphorae are rare. Rather than the exception, the distribution of ARS with grain cargoes (invisible in the submarine archaeological record) may have been the rule (Bonifay 2003).

In sum, African amphorae and tableware tell us about the four main Mediterranean foodstuffs of Antiquity (grain, olive oil, wine, and fish products), the production of which is barely documented in the field.

### 3. Trade

The mass of publication on African ceramics throughout the Mediterranean has yielded much new knowledge on trade in the Roman World. In this section I shall summarize some of the most important finds arising from this work.

#### Routes

The movement of African ceramics shows that several types of maritime or terrestrial connections could coexist.

First, direct routes are attested (Bonifay 2009). For example, a series of second to third century shipwrecks found along the eastern coast of Sicily and on the Tyrrhenian coast north of Rome carrying homogeneous cargoes of African amphorae originating from port cities of Byzacena: *Sullectum* (Plemmirio B and Ognina wrecks), *Leptiminus* (Giglio Porto), and *Hadrumentum* (Giannutri) point to a maritime route leading from the Tunisian Sahel to either Rome or more northern Italian cities (Luni?). Homogeneous cargoes have also been found along the southern Gaulish coastline dating from the early fourth century onward and originating from *Sullectum* (Héliopolis 1) and Nabeul (Pampelonne) may indicate another distinct transmarine trade towards Southern Gaul. There is also evidence of another commercial route along the eastern Adriatic coast, like the wreck of *Sobra* (4th century) with a homogeneous cargo from Nabeul. Lastly, a series of wrecks with Tripolitanian amphorae of the 1st to 2nd century AD found in the Euboean channel in Greece (Koutsouflakis and Argiris 2015) could be linked with the trade of marble of this region. It is much more difficult to find archaeological evidence of primary ARS transport to Rome. The uniform character of the presence of this tableware throughout

the Mediterranean is an argument favoring redistribution through the *Portus* storerooms, “given the pivotal role played by Rome in the economy of the Mediterranean” (Fentress *et al.* 2004: 17). However, no shipwrecks have been found to confirm this hypothesis to date. However, the recent study of the distribution of African ceramics in Sicily confirmed that the northern coastline of the island was not supplied directly from Africa, but more probably from Rome, perhaps through return cargoes (Fentress *et al.* 2004; Bonifay and Malfitana 2016).

The role of these return cargoes in African trade was first highlighted by grain ships from Rome returning to Africa including building materials from Italy as ballast (Tomber 1987). In terms of the Egyptian grain shipments to and from Rome, this may also explain the presence of ARS of northwestern Sicily, and then in Alexandria and the Eastern Mediterranean (Bes 2015). This model could explain the entire distribution system for African ceramics. Indeed, *Portus* at the mouth of the Tiber may have acted as a ‘hub’ in the distribution of the African commodities throughout the Mediterranean.

A second type of indirect routing, much more surprising, is implied by segmented maritime transport of African amphorae towards Rome. This destination is assumed through a series of wrecks scattered from the Balearics to Corsica and the Tyrrhenian coastline) dated to between the mid third century and the beginning of the fourth centuries AD, and comprising a mix cargo of majority Spanish amphorae and complementary African ones. The most famous of these wrecks is Cabrera III in Majorca dating back to c. 265 AD. The composition of the cargo and the location of the wrecks suppose that the African amphorae were first transported to a port in southern Spain, then reloaded together with Spanish amphorae, before being sent to Rome (or elsewhere in the Mediterranean). This strange circuit could have something to do with a commodity (Spanish or British tin) that the African merchants were obliged to collect in southern Spain during the troubled second part of the 3rd century (Bonifay 2020). Cabotage also had a role to play, sometimes in primary distribution, as shown by the similarity of the ceramic assemblages found in the south-western part of the island and in the Cape Bon region in Tunisia. In this case, African amphorae and ARS were part of a small-scale circular trade in the strait of Sicily, perhaps backed by the more lucrative exploitation of the sulphur mines of Agrigento.

Lastly, transport was sometimes completely conducted by road. This is certainly the case of Africa where there was no alternative river route. Among the wares circulating inland were ‘continental’ ARS wares, which were locally produced from the end of the 2nd century onwards, and can be considered as ‘substitutes of importation’ (Bonifay 2017). Imports of main Tunisian workshops are also attested, as well as arrivals of wines in their original containers, serving a market capable of affording them, in particular the officers of the *Legio III* in *Lambaesis*. Elsewhere in inland Africa amphorae are rare, that is why the reference to AMPH(*ora*) on the Zarái inscription (Troussset 2002-2003) may refer to a unit of measure rather than to a real ceramic container. In the Fazzan region, numerous Mediterranean amphorae have been found, including large Tunisian types probably carried by camels, but mainly small variants of Tripolitanian types specially produced for the transport (of fish products?), and carried by donkeys (Leitch 2014). The third example concern the oases road towards Egypt, which seems to have been used at two different times: first, during the end of the 2nd century and the 1st half of the 3rd century AD when the bypass road of the limes was secured by the garrisons of the Roman forts (Bu Njem, Gheriat el-Gharbia), and then during the Vandal period when the maritime connections between Africa and Eastern Mediterranean slowed (Ballet, Bonifay and Marchand 2012).

The distinction between inland and overseas commerce in ceramics and foodstuffs is somewhat arbitrary, but the reconstruction of various itineraries allows us to observe important trends and developments, as David Stone has demonstrated in his ‘biography’ of the migration of amphora from *Leptiminus* to the villa of Montmaurin in Gaul (Stone 2009). As highlighted in Sicily, the distribution of African ceramics in the Western Mediterranean from the second century onwards is mainly linked to the direct connection between Africa and Rome (grain, and then oil supply). Return cargoes and cabotage generated a pattern whereby commodities reached inland centers such as Cordoba, Saragossa, Lyon, and Milan through waterway corridors. The success of this distribution depended completely on demand of course, which explains why African oil amphorae are rare in Spain, and ARS ‘A’ is slow to be adopted in the regions where Italian, Gaulish, and Spanish Terra Sigillata were

produced. Moreover, some very peripheral regions like the northern coastline of Spain, northern and western coastline of Gaul, and *Germania inferior* are barely touched by African ceramics, except during very specific periods.

The penetration of African production in Eastern Mediterranean follows two different routes. The return cargoes of amphorae towards Alexandria represent an important new trend beginning in the late second century. ARS imports toward Asia Minor and the Levant emerge in the mid third century. Another direct route to the Peloponnesus is perhaps partly linked with the trade in Euboean marble. Cabotage in the distribution of African commodities is difficult to gauge, except in certain specific cases, as in Sicily.

### Organization

If ceramic evidence prompts us to reflect on trade routes, it is less helpful for understanding the legal status of these exchanges. The model of a multi-layered Roman economy, proposed by D. Mattingly (2007), juxtaposing a regulated sector ('Imperial economy') and private sectors with two different levels ('Inter-provincial economy' and 'Provincial economy') is helpful in accounting for the complexity of the economic mechanisms that generated these exchanges. Notions of fiscal grain, imbricated commerce, return cargoes, and intraprovincial trade must find their proper place within it. Nevertheless, there remains much uncertainty about the operational interface between the state and elite driven economy on the one hand and the 'market economy' on the other. There are, for example presumptions that the *annona* introduced fluctuations in the supply of African oil to Rome transported in amphora. The institution of the *canon olearius* by Septimus Severus and the voluntary payment of a tribute in oil by the citizens of Lepcis Magna could be reflected in the stratigraphy of Monte Testaccio in an increase in the proportion of Tripolitanian amphorae. A century later, when Tripolitania is exempted from this tribute by Constantine, the volume of Tripolitanian amphorae in Roman contexts declines. (Vera 2015). On the other hand, it would be more risky -although not completely excluded- to link the appearance of Africana III amphorae around AD 300 with the introduction of *canon vinarius*. However, as recently stressed by A. Tchernia (2011), the division between the public and private sectors was not as clear in the minds of Romans as it is in ours. Applied to the distribution of African ceramics, the notion of regulated trade may have more a technical than essential significance. In the case of a secondary cargo of ARS arriving in Rome, it is impossible to decide whether the main cargoes of grain that it could accompany correspond to tax levies or private supplies. What is important is the demand, exercised by the state, the city of Rome or others cities of the western Mediterranean.

The domination of ARS imports in most of the Mediterranean consumption sites from the end of the second century onwards has often been interpreted as an example of the conquest of markets, justifying the hypothesis of an offer-driven Roman economy. Although Tchernia has sensibly challenged this view (2011: 372), it remains to explain the loss of ARS hegemony in the early fifth century in relation to other productions. When Phocaean Red Slip ware in Eastern Mediterranean and Gray Terra Sigillata in southern Gaul become more abundant than ARS does this mean that the former successfully competed in the market for the imported tableware, or that merely filled a gap created by the decline in ARS imports? For my part, I suggest that such shifts reflect a temporary inability for ARS to meet demand, making necessary the production of replacement finewares.

The fifth century transformation in the fineware market perhaps allows us to understand better the long-term phenomenon of African ceramic distribution. If the end of the *Annona* in 455 or the effects of a possible 'concurrence between the provinces' (Tchernia 2006) do not adequately explain the shifts in African amphora and tableware distribution at the beginning of the fifth century. Another determining factor could be the drop in the cargo volume capable of being absorbed by the consumption sites, first of all by Rome. As asserted by C. Wickham, although a partisan of the tax explanation: "the global fall in demand in most of the West was undoubtedly one of the reasons why African productions eventually failed" (Wickham 2005: 713). This may provide a new argument in favor of a Roman economy driven by demand and the merchants.

Indeed, the continuing supply of African amphorae and tableware of western Mediterranean during the fifth century, however reduced in quantity, and the revival of these exchanges in the Eastern and

Northern Mediterranean from the beginning of the sixth century onwards are indicative of merchants' adaptability. In effect, they pursued new trade routes, bypassing Rome, optimizing their shipments (using small -so called *spatheia*- amphorae as space fillers, sometimes regardless of travel safety), and finding new supply sources in Africa. It has been suggested that the Church invested in this new organization, but archaeological evidence is still weak (see Leone, this volume). In sum, African merchants exhibit considerable resilience in Late Antiquity in overcoming obstacles -“*acheminer ce qui fait défaut*” (Tchernia 2011).

### Conclusion

In view of the temporary weakness of direct evidence on the production of primary goods such as grain, oil, wine, fish products, ceramics will one of the more efficient tools for writing the economic history of Roman Africa. Recent advances in research allow us to better understand the places where the different types of amphorae, tableware, cookware, lamps, etc. were produced and their chronology, the primary goods of which they are proxies, as well as the details of their distribution. That said, there is still much to be done. Research on the traceability of the African ceramics needs to move forward with the help of archaeometry and archaeological field research. In the face the modern development, the continued study of African workshops of amphorae, tableware, cookware, etc. is a priority, particularly in the regions where the information is lacking (Algeria). Of course, this is the main task of our colleagues in Maghreb, but the wide distribution of African ceramics throughout the Mediterranean makes broad international collaboration indispensable. Lastly, particular effort must be made in the field of chemical analyses of amphora contents. It is unwise to continue speaking of African trade without knowing what the majority of these amphora types were transporting. Nevertheless the crucial step forward will only come from the development of the archaeology of the production. Archaeological surface survey is insufficient on its own to identify production sites. There is now an urgent need for excavation and associated palynological and archaeozoological research of farms, oil and wine presses, and fish product factories, in order to understand the exact nature of their productions and their precise chronologies through good stratigraphic work. We need in particular to better understand the link between the production of ceramics and their estates or urban contexts with the help of new technologies (Lidar detection). We have to move further and faster.

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#### Guide to further reading

Unfortunately, the small number of references used in this paper cannot be representative of the huge bibliography on African ceramics and their contribution to the economic history.

Typo-chronology: The main standard works, by John W. Hayes (1972) and A. Carandini (1981) on ARS, and C. Panella (1997) and S. Keay (1984) on amphorae, were not cited here, but the reader will find a general panorama in Bonifay 2004 (updating in Malfitana and Bonifay 2016).

Workshops: After the seminal work by D. Peacock and his team in the Tunisian Sahel region (1989 and 1990, references in Bonifay 2004), a second phase, well illustrated by Mackensen 1993 and Barraud *et al.* 1998, stressed on ARS workshops of the region of Carthage. The actual trend is a beneficial repossession by archaeologists of the Maghreb of this questioning: Ben Moussa 2007 (ARS), Nacef 2015, Jerray 2016, Ahmed 2019 (amphorae), and Amraoui (Algeria).

Archaeometry: the first works concentrated on ARS through chemical analyses (Mackensen and Schneider 2002 and 2006), while more recent research used petrographical analyses with good results on both amphorae and tableware (Capelli and Bonifay 2007, 2014 and 2016).

Amphora contents: last synthesis in Bonifay 2007 (updating in Malfitana and Bonifay 2016).

Publications of chemical analyses are still rare, the most valuable being Garnier *et al.* 2011 with a good discussion on the compatibility of pitch and oil.

Distribution: Publications on African ceramics throughout the former Roman Empire are countless.

Malfitana and Bonifay 2016 is a good, recent example of an integrated archaeological and archaeometrical research on the regional distribution of African ceramic, due to the central position of Sicily in the Mediterranean.

Economic interpretation: the best way to measuring the road already travelled and differences in perspective is to compare Carandini 1970 and Reynolds 2010 as well as Hobson 2015.

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Caption of the figure:

Fig. 1. Roman Africa. Main recognized areas of amphora and tableware production.