

On Land and Sea. Production and Trade of Wine from Campania (3rd BC – 1st AD): Some New Archaeological and Archeometric Data about Amphorae

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The *Immensa Aequora* Project: Aims

This contribution looks at certain aspects of the production and trade of wine-bearing amphorae from Campania in the Hellenistic and Roman periods.¹ These aspects were studied as part of the *Immensa Aequora* Project (www.immensaequora.org), which consists of a series of interconnected sub-projects; their purpose is to study the production centres and the distribution of ceramics made in south-central Tyrrhenian Italy between the 4th century BC and the 1st century AD, using archaeological, epigraphic and archaeometric methods.²

Due to the scope of the research and the inherent difficulty in summarizing many different data sets, this paper offers a preliminary and limited synthesis of the amphorae considered here, without an exhaustive review of the numerous data points and the research carried out previously by other authors. Moreover, for details and, above all, laboratory data, this contribution refers to forthcoming and existing publications, which are cited here.³

Campania: Ongoing Research on Production Centres, Amphorae and Wine

The map in fig. 1 highlights some of the principal sites of ceramic production in Campania. It is certainly incomplete, and in particular lacks a full picture of the amphora production centres, which are indicated in red; the ongoing project has only looked at some of these.

The area that stretches from Mondragone and Capua, down to the Gulf of Naples is where forms of agricultural development emerged very early on that led to the systematic production of wine.⁴ While Rome turned her path of conquest southward, already in the 3rd century BC the products from the Gulf of Naples and Campania were making their way to the markets of the southern and even northern Tyrrhenian region.⁵

The areas chosen for the project were all important centres of wine production, in some cases since the period of Greek colonisation. Wine, together with ceramics, plays a central role in our research, thanks also to the study of systems of production such as the rock-cut units, widely attested in Campania and the Mediterranean, which are important indicators of wine production.⁶ A recent line of research is also concerned with the analysis of amphorae and rock-cut units using the GC-MS method.⁷ By verifying the substances contained within them, alongside laboratory tests to determine the origin of the container on a consistent number of amphorae from multiple shipwrecks, we

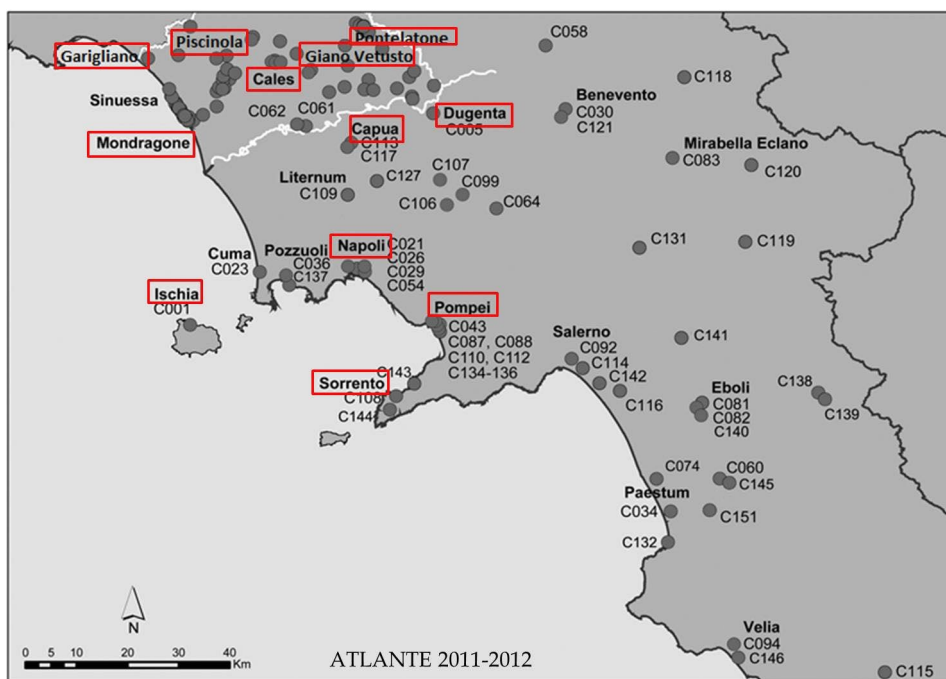


Fig. 1: Map of the ceramic production sites in Campania (indicated in red the amphora workshops) (Atlante 2011–2012, 256 Carta 3).

are able to reconstruct the trade networks between centres of production and sites of consumption more completely.

In this paper, we will only briefly present some data related to certain contexts in three key areas: *Ischia and the Gulf of Naples*, *Northern Campania*, and *the area of Mt. Vesuvius*, limited to some stamped amphorae traditionally attributed to Pompeii. Additionally, the aim is to summarize several preliminary results, including those from the laboratory, on the distribution of amphorae from these areas.

Ischia / Gulf of Naples: Production and Circulation of Graeco-Italic Amphorae and Wine (3rd century BC)

Beneath the modern Basilica of Santa Restituta in Lacco Ameno (Ischia),⁸ only a short distance from the sea, seven kilns have been discovered (from mid-late 8th to 3rd–2nd century BC). The best documented phase coincides with the Hellenistic period, when the kilns produced Graeco-Italic amphorae (types van der Mersch III, IV, V, V/VI, and possibly VI) many of which were stamped.

Among the Graeco-Roman amphorae found at Ischia, at least two chemical groups have been identified, and four mineralogical groups that have already been described and published; these groups are in part local, and in part imported from other centres on the Gulf of Naples, perhaps Naples herself.⁹ Ancient Graeco-Italic amphorae from Ischia and Naples are important indicators of the economic and commercial conditions

between the end of the 4th and the beginning of the 3rd century BC, in which Rome turned its attention towards the South and extended its influence to *Neapolis* and the Gulf of Naples, acting as a stabilizing force in the Tyrrhenian Sea. During this period, the area, taking advantage of the alliance with Rome following the *Foedus Aequum* of 326 BC, saw its foreign trade relations expand remarkably, a fact evidenced also by coinage and by an increase in activity at the Neapolitan mint.¹⁰

The exportation of wine from the Gulf, and more generally from Campania, and the need to normalise/standardise the container that it was packaged in, can perhaps explain the appearance of new types of containers – the Graeco-Italic amphorae – and the stamping in Greek adopted in this area between the end of the 4th and beginning of the 3rd centuries BC. The epigraphic stamps on the Ischia amphorae are of great interest, since they inform us about the organisation of production and the economic and social realities on the island during the Hellenistic period. More than three hundred stamps have been identified that bear Greek and Oscan names, written in Greek.¹¹ The situation is in some ways analogous to that found in the Aegean area from the end of the 4th century BC when new forms of amphorae similar to the Graeco-Italic ones also appeared (“mushroom rims”) and on which the stamps sometimes use the same iconography or names that appears on coins.¹²

Occasionally, the names on the amphora stamps of Ischia are the same as those found on bricks, sometimes preceded by the abbreviation ΔH (*demosios o demosia*);¹³ open letters and monograms in some cases seem to correspond to those that appear on coins from Naples between the end of the 4th and beginning of the 3rd centuries BC, and involved the same figures, perhaps public ones: further research is needed.

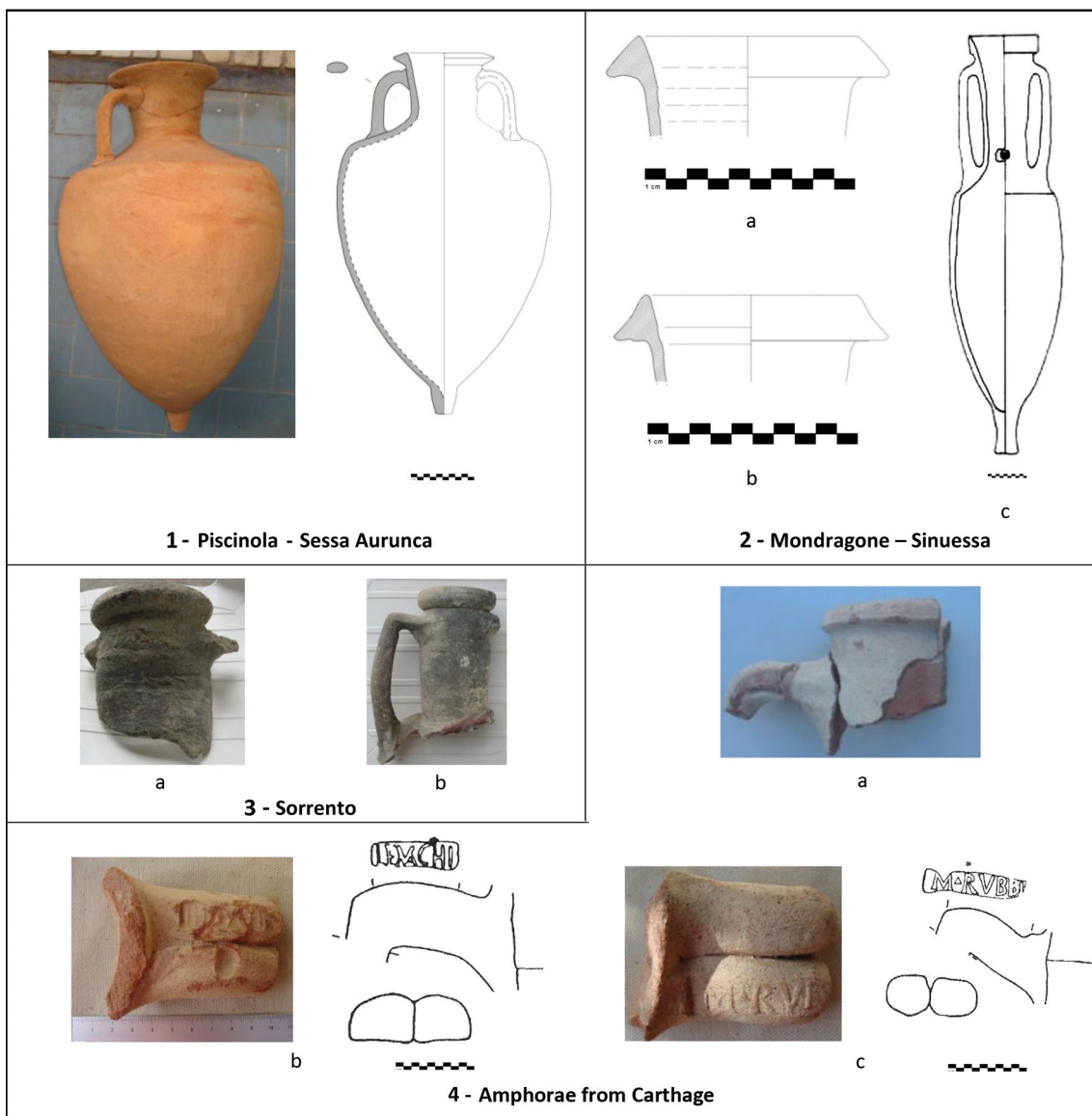
The data from Ischia has recently been integrated with that related to Graeco-Italic amphorae from Naples, which are in some cases similar or identical, thus possibly of local production,¹⁴ which seems to confirm the hypothesis already used for Ischian material: that of a “system” of production in the Gulf of Naples, which was regulated by the Roman state.¹⁵

The production of Dressel (from now on “Dr.”) 1 and Dr. 2–4 amphorae, both at Naples and in the Gulf, requires further study. These types have been recognized by their fabrics at various consumption sites around the Mediterranean and beyond, but their compositions have not yet been characterised in the areas of production.

Sorrento

Sorrento is known from literary sources for its production of *Surrentinum* wine, which was stored in amphorae, and of fine pottery also produced in the city.¹⁶ The distribution of Sorrentine production centres is largely unrecorded. However, one of these, during the Roman period, was located south of the Forum (1st century BC). Remains of a large kiln and dumps filled with numerous fragments of Dr. 2–4 amphorae were found near Villa Fiorentino and in Corso Italia (tab. 1.3).¹⁷

Amphorae from Sorrento can be distinguished by their fabric and in the laboratory. Mineralogically they are compatible with the local geology; the three



Tab. 1: Amphorae from production/consumption sites studied within the *Immensa Aequora* Project: 1) Piscinola – Sessa Aurunca area; 2) Mondragone – Sinuessa workshops; 3) Sorrento workshop; 4) amphorae from Carthage (Rakob excavations).

most important contents are volcanic rocks, clinopyroxene and feldspars (sanidine and plagioclase).¹⁸

Area around Mt. Vesuvius: Dr. 2–4 Amphorae with and without Stamps

Another area well-known for producing amphorae that travelled widely is that around Mt. Vesuvius, where the cultivation of grapes and wine production has been attested since the 9th century BC.¹⁹



Fig. 2: Map of the distribution of the Dr. 2-4 amphorae stamped by *L. Eumachius*.

The production of Dr. 1, Dr. 2-4 and, most likely, of Graeco-Italic amphorae is generally attributed to the area around Mt. Vesuvius, though workshops where they were produced have not been found. The fabric of these amphorae, which were widely traded, has been called “*Black sand fabric*”²⁰ from its characteristic aspect of being dark red with numerous volcanic inclusions.

This fabric also appears in the francophone bibliography as “*à pate rouge et minéraux noirs*” or “*Eumachi*”, since it is a characteristic of amphorae stamped with *Eumachi* (L.EVMACHI, pointing to *L. Eumachius*, Augustan-era producer of amphorae as well as father of *Eumachia*, the public priestess of Venus, who built a public building in the Forum of Pompeii).²¹ The amphorae have been attributed to Pompeii/the area around Mt. Vesuvius,²² also because of the abundance of attested bricks in the area with the stamp L.EVMACHI EROT(IS),²³ and because it is a fabric known in other amphorae (for example Dr. 1) and is broadly compatible with the geological characteristics of the Somma-Vesuvius area.²⁴

The distribution of the amphorae with the stamp L.EVMACHI (fig. 2) concerns numerous sites in the Mediterranean and some shipwrecks, including the Grand Ribaud D,²⁵ from the end of the 1st century BC.

In addition to a few examples of Dr. 2-4 unstamped amphorae from the urban area of Pompeii, some amphorae from Carthage have also been sampled within our project among the materials from excavations carried out by F. Rakob and M. Vegas: a Dr. 1 with a *titulus pictus* and two Dr. 2-4, stamped EVMACHI and L.EVMACHI²⁶ (tab. 1.4b).

Another example of Dr. 2–4 from the same context in Carthage, subjected to mineralogical analysis, is stamped with the mark M.RVBBI/M.RVB BL – ?– (tab. 1.4c):²⁷ the final part of the stamp is not very legible and refers to a *M. Rubellius Blandus*, of the *Rubelli* family, according to Martin-Kilcher.²⁸ The amphora from Carthage with this stamp, documented at Alesia and on the Grand Ribaud D²⁹, has a comparable mineralogical composition and probably the origin as the amphorae stamped *L.Eumachi* from the same context. Another unmarked Dr. 2–4 amphora from Pompeii, subjected to mineralogical analyses, also belongs to this group.³⁰

The amphorae from Carthage and the one from Pompeii have a similar composition, whose characteristics fully correspond to the definition of *Black sand* in the bibliography: elongated pores, orientated parallel to the external surface, and several, almost-exclusively volcanic inclusions, particularly volcanic rocks, which represent around the 30–35% of the inclusions.³¹

Another unstamped example of Dr. 2–4 has a different composition (tab. 1.4a). Further laboratory investigation could clarify if the Dr. 2–4 amphorae that do not fall into the mineralogical *Black sand/Eumachi* belong to the chemical group known as “*Eumachoid B*”, noted in the bibliography and frequently attested in Gaul, whose origin is unknown, but could not be Pompeii. The amphorae from this group, found at different sites around Gaul,³² are only distinguishable from the *Black sand/Eumachi* group thanks to chemical analyses: in fact, they have lower K₂O values and higher CaO.

Northern Campania (Province of Caserta)

Northern Campania (in particular, the *ager Falernus*), a subject of research as part of the *Immensa Aequora* Project, is an important area for wine production; over the course of the centuries, the region produced various types of amphorae, including Graeco-Italic, Dr. 1 and 2–4, and even later.³³ The characteristics of the fabrics of the types produced in this area are not well known. Often, they have not even been characterised in the lab, except for some cases noted in the bibliography, such as the case of Mondragone, which is discussed below.

Piscinola – Sessa Aurunca

Archaeological investigations carried out in the territory of Sessa Aurunca, along the strip between the base of the Roccamonfina massif and the Garigliano, led to the discovery of a necropolis at Piscinola. 59 tombs have been found (dating to between the 5th century and the late 4th century BC).³⁴

The materials include a Graeco-Italic wine amphora, similar to type van der Mersch IV (end of the 4th century BC) (tab. 1.1), grouped with black figured or glazed drinking vessels. Mineralogical analyses conducted on a sample of Graeco-Italic amphorae in this context display a composition that is compatible with local geology.³⁵ Graeco-Italic amphorae type IV and V, similar but distinct from the Gulf amphorae because of their different fabrics, have also been documented in the area around *Cales* and *Capua*.³⁶

Mondragone

The area of Mondragone has been the focus of excavations and surface surveys over the years, which have contributed to identifying structures in some areas, and concentrations of ceramic materials in others, often related to manufacturing activities.³⁷ In this area, Graeco-Italic and Dr. 1 amphorae have been found, which, on the basis of laboratory data, could have been exported during the Late Republican period to Gaul and Switzerland, where the first chemical (XRF) and mineralogical analyses were carried out.³⁸

Different clays were used in the manufacturing of Graeco-Italic and Dr. 1 amphorae from Mondragone. These clays are distinguishable by different amounts of CaO and, in general, by a high proportion of sanidine, glass and volcanic rock fragments;³⁹ three principal petrographic groups are known: the first two contain almost exclusively Graeco-Italic amphorae (including some wasters) (tab. 1.2a–b), and a few Dr. 1 (tab. 1.2c). The third group, on the other hand, includes only amphorae Dr. 1 B, of which a few are stamped (with the stamp HI).

The amphorae that have been studied in our project have a petrographic composition compatible with the geological formations that populate the area of Mondragone itself.⁴⁰

Rocca d'Evandro

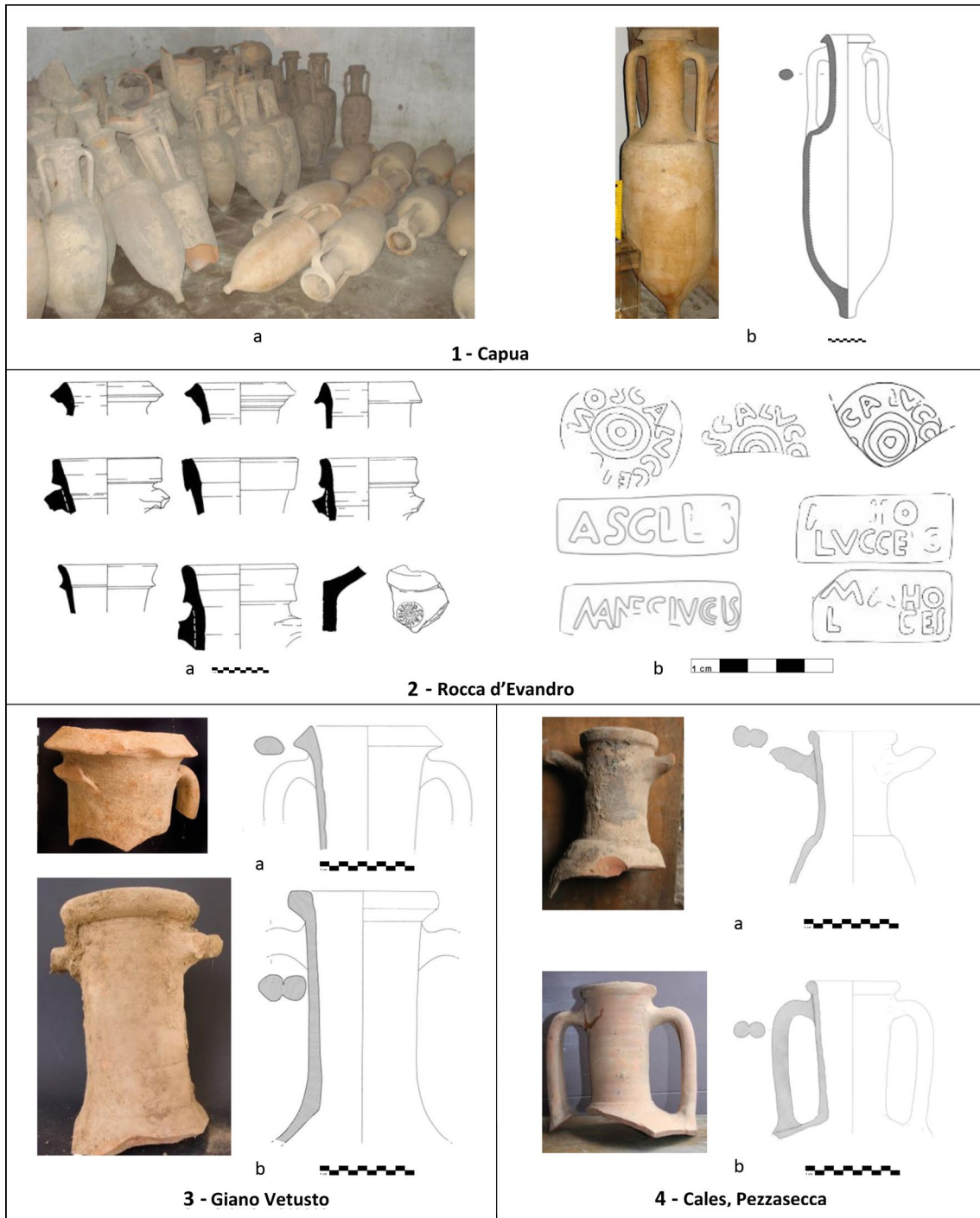
Studies on the Rocca d'Evandro site, situated on the edge of the Liri Valley, have allowed us to identify a concentration of archaeological materials on the surface, related to four furnaces, and other evidence pertinent to the production of Graeco-Italic amphorae, Dr. 1 A, B and Dr. 2–4 (between the 2nd century BC and the start of the 1st century AD), which would have been used to hold Falernian wine and were possibly traded through the port of Minturno.

The site has been interpreted as a settlement held by the *gens Luccei*, whose name is present on the stamps of amphorae recovered here.⁴¹ The stamps on Dr. 1 amphorae are MOSCA LVCCEI [S?] (circular stamp), ANTIOCVS/ANTIOCVS LVCCEI, ASCL [LS?], MAHO LVCCEI [I] S, MANES LVCCIS, MELII LVC (rectangular stamps) (tab. 2.2), often with an abbreviated S (*servus*) at the end. The amphorae analysed within the *Immensa Aequeora* Project are Dressel 1 B.⁴²

Cales Pezzasecca

Cales, a Latin colony (334 BC), is primarily associated with the production of black glaze pottery, which was widely exported even beyond the Italian peninsula.⁴³ The excavations carried out on the site of ancient *Cales* have yielded traces of pottery workshops, dating from the Hellenistic period to Late Antiquity.

A project to study ceramic production at *Cales* has been underway for several years, in collaboration with the relevant Superintendency. The project also looks at the production site on the edge of Via Casilina, at the Pezzasecca site, surveyed by J.-P. Morel, bringing to light structural elements, kiln dumps and rejected pieces.⁴⁴



Tab. 2 : Amphorae from production sites in the province of Caserta studied within the *Immensa Aequora* Project: 1) Capua workshops; 2) Rocca d'Evandro workshops; 3) Giano Vetusto workshops; 4) Cales, Pezzasecca workshop.

The workshop, active from the end of the Republican to the early Imperial periods, also produced Dr. 2–4 amphorae of a type already found in other Campanian centres (tab. 2.4); their fabric, a calcareous one rich in crypto-crystalline calcite, has a composition pertinent to the local geology of the Roccamonfina Volcanic system.⁴⁵

Giano Vetusto

The site,⁴⁶ close to *Cales*, is probably linked to a large rural villa, and includes a craft production centre (dated from the second half of the second century BC to the third century AD). During the second half of the first century BC a kiln was constructed for the production of Dr. 2–4 amphorae: some fragments show a stamp on the neck that bears a *cognomen* of servile condition, the genitive CRESCENTIS, likely the slave who was in charge of the pottery workshop.

On the basis of the mineralogical analyses, all samples of Dr. 2–4 amphorae (tab. 2.3b) studied as part of the project are compatible with the local geology of Giano Vetusto and are different from those at other centres of production of Dr. 2–4 studied as part of the project.

Capua

We know from ancient sources that Capua produced high quality wine, called *Anadendrite*.⁴⁷

No workshops producing amphorae have been found in the area. In the depot of Porta Roma, a homogenous group of about 150 Dr. 1 amphorae was discovered, apparently without any stamps and mostly in good condition (tab. 2.1).

The shape of the amphora is similar to the type defined as Dr. 1 G, which combined the rim of the Graeco-Italic amphora and the body of the Dr. 1, identified in contexts from Gaul, and which circulated between the second half of the 2nd century BC and the beginning of the first, as some shipwrecks attest, such as S. Tropez and Cap Roux.⁴⁸

Even though the find context is probably not that of a production site, the mineralogical analysis performed suggests that their composition is compatible with the geology of Capua.⁴⁹

The Trade of Campanian Wine: Some Data from Cargoes of Shipwrecks and from Consumption Sites

The trade in ceramics and amphorae from different centres in Central South Italy and, particularly in Campania, is the focus of a new phase of the *Immensa Aequeora* Project,⁵⁰ which is still on-going; it concerns the comparative and multidisciplinary study of cargoes from 32 shipwrecks of Italian origin (3rd century BC–1st century AD) found in the western Mediterranean, by over 140 mineralogical analyses on Graeco-Italic, Dr. 1 and Dr. 2–4 amphorae (fig. 3).

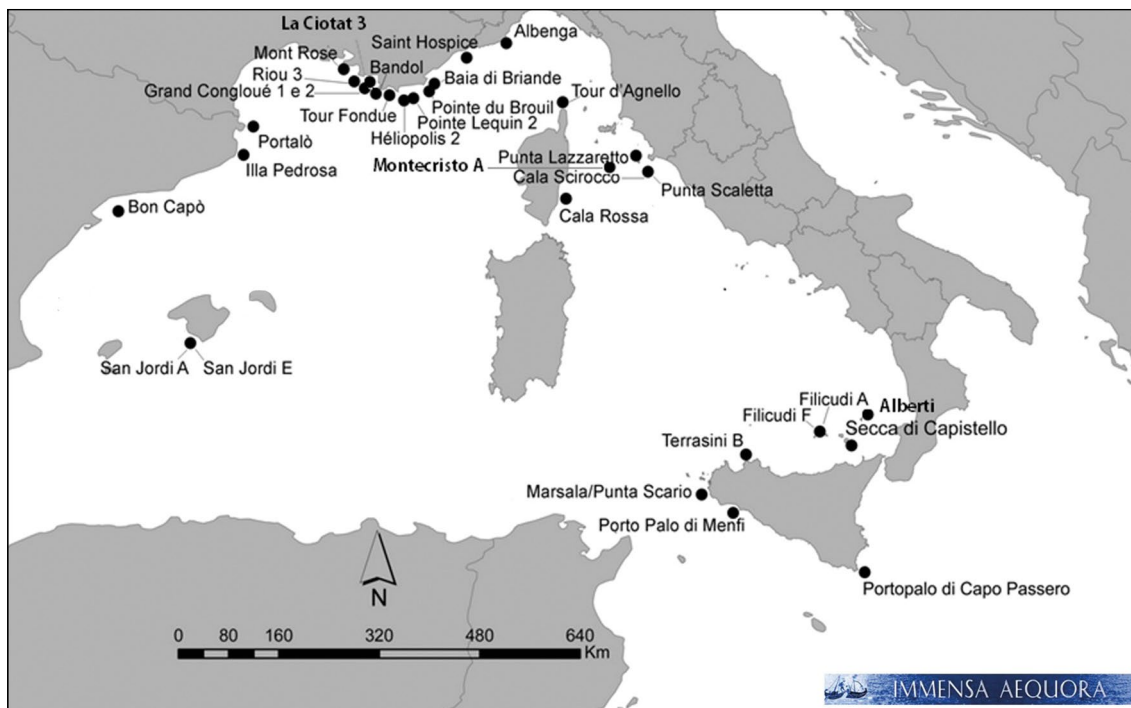


Fig. 3: Map of the sampled shipwrecks with amphorae of Tyrrhenian origin (Olcese 2020, 159 fig. 2).

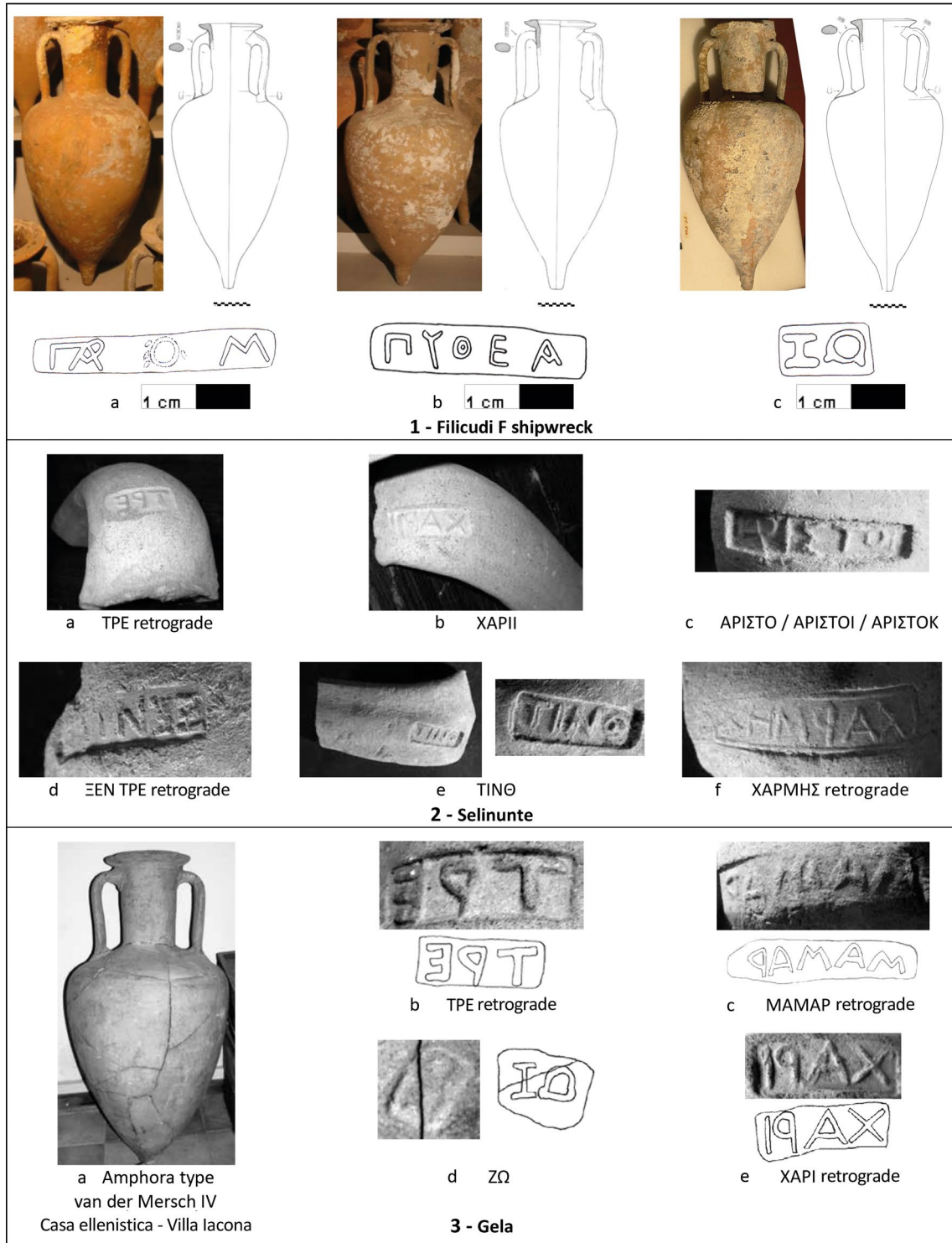
Mineralogical analyses of the amphorae from the shipwrecks and sites of consumption revealed the existence of groups and subgroups, in addition to a series of samples that could not be attributed to the principal identified groups. Mineralogical data, compared with those obtained from production centres in the course of the project, support the connection between the amphorae and their possible sites of origin.⁵¹

Even with the necessary caution, Campania's predominant role in the production of containers that were widely traded, and therefore also the foods contained within them, has been confirmed over the course of the centuries.

Wine and Graeco-Italic Amphorae from the Gulf of Naples in Sicily (and elsewhere) in the 3rd century BC

The first half of the 3rd century BC saw trade in products from Ischia/Gulf of Naples (and perhaps from some sites in northern Campania), from which come types van der Mersch IV and V amphorae stamped in Greek, recovered from the cargo of the Filicudi F wreck (tab. 3.1), from Secca di Capistello wreck and from some sites in Sicily.⁵² GC-MS analysis was used for the first time to identify their contents that consists of red wine.⁵³

Stamps known on Graeco-Italic amphorae from Ischia/Gulf of Naples were identified among materials found at Palermo, Selinunte and various centres in south-central Sicily, including Monte Adranone, Caltabellotta, Selinunte (tab. 3.2), Gela (tab. 3.3) and



Tab. 3: Amphorae and stamps from a shipwreck and production sites studied within the *Immensa Aequora* Project: 1) Filicudi F shipwreck; 2) Selinunte; 3) Gela.

Licata,⁵⁴ between the end of the 4th and the 3rd centuries BC (tab. 4.4), although the extent of the phenomenon is not known.

In the most ancient phase of distribution of ceramics/amphorae from the Gulf of Naples, it seems that the route that led to Sicily, and perhaps also North Africa, went through Capo Lilibeo.

In light of data from material culture, the third Romano-Carthaginian treaty (306 BC) can perhaps be better understood.⁵⁵ Sicilian markets were closed to Rome, and there was a desire to limit the distribution of products – perhaps even those from the Gulf of Naples and from Campania – in general by businessmen who were pushing for an invasion of the markets controlled by Carthage.

Some amphorae from 3rd century BC shipwrecks (i.e. the Tour Fondue and Bon Capò wrecks),⁵⁶ and from more recent shipwrecks, of the middle and second half of the 2nd century BC, can also be ascribed to the Gulf of Naples. Trade in Campanian products in the most ancient phases included, as is known, also other types of ceramics, such as black glaze pottery of the 3rd century BC, and has been confirmed by the chemical analyses carried out by M. Picon on the black glaze pottery from Olbia de Provence.⁵⁷

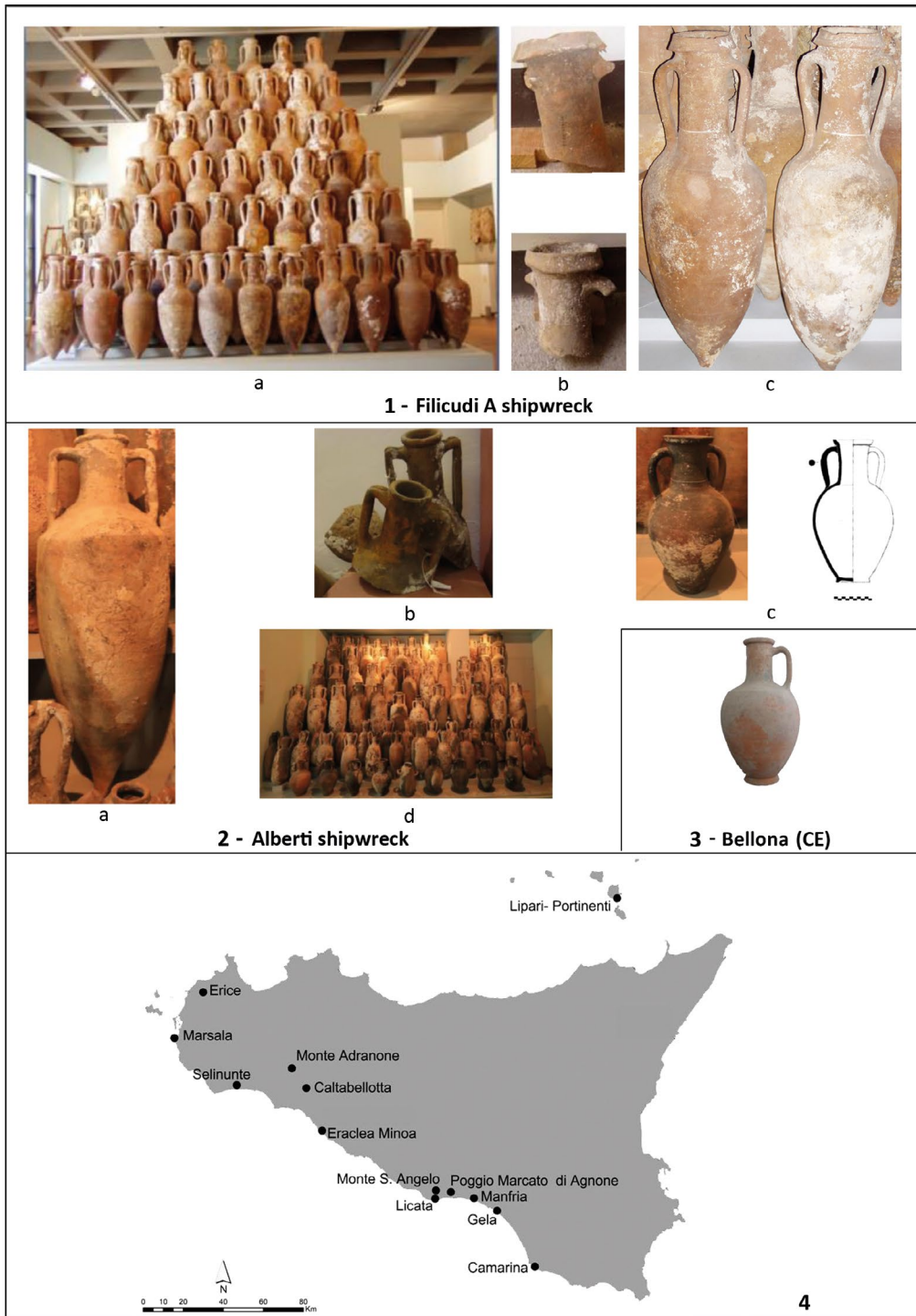
The Increase in the Distribution of Campanian Wine: 2nd and 1st centuries BC

In the 2nd century, within the sample-set of the shipwrecks under consideration, some cargoes have been found to consist of amphorae whose mineralogical compositions are close to those of ceramics produced in the area of Vesuvius, such as in the case of many of the transport amphorae from the Filicudi A (tab. 4.1).⁵⁸ In other cases, the compositions of the amphorae are similar to those of ceramics produced in the coastal zone between Mondragone and Sinuessa, or inland northern Campania.

Although amphorae with *Black sand fabrics* have been easily identified even before by their characteristic aspects, the amphorae from northern Campania and the area of Mondragone, connected to well-known wines such as Falernian, nevertheless until recently have only rarely been identified at sites of consumption, unless mineralogical analyses have been carried out. Thanks to the mineralogical study of the amphorae found in Gallic sites of the 2nd and 1st centuries BC on the Rhine valley, in the area of Basilea,⁵⁹ a greater percentage of amphorae is attributed to the area of Mondragone (about 20%), alongside containers from other, unidentified sites along the Tyrrhenian coast. Archaeological contexts at Lyon, dated to between 160 and 140 BC, reveal the presence of amphorae from the region of Mondragone at a similar percentage.⁶⁰ On the other hand, the situation is different at some sites in the south of France, such as Aix and Martigues, where the *Black sand* amphorae account for almost 40%.⁶¹

A subdivision of the market and areas of preferred contact is beginning to take shape and should be studied in detail.

The intensification of viticulture and the production of wine in northern Campania in the 2nd century, where vine cultivation began early, has been documented by a high



Tab. 4: Amphorae from shipwrecks and production sites studied within the *Immensa Aequora* Project: 1) Filicudi A shipwreck; 2) Alberti shipwreck; 3) Dr. 2-4 from Bellona; 4) map of the Graeco-Italic amphorae from the Gulf of Naples found in Sicily and analysed in laboratory.

density of amphorae workshops,⁶² which is probably connected to the creation of plantations that was allowed by the division of the *ager publicus* by a programme of military and economic control of the southern part of the Tyrrhenian coast, and by the foundation of the colonies of 194 BC (such as *Volturnum* and *Liternum*).⁶³

In the 1st century AD, which has only been marginally considered in our project, the presence of Campanian amphorae (perhaps northern) is attested on the basis of mineralogical analyses on some shipwrecks such as the *Alberti shipwreck*, dated to the middle of the 1st century AD, recovered at Panarea (Aeolian Islands), currently under revision.⁶⁴ On this shipwreck, in addition to Dr. 2–4 amphorae (tab. 4.2a–b), Cretan amphorae type 4 were found. Also on part of the wreck there were numerous two-handled *amphorettes* (*lagynoi*) with flat bottoms (tab. 4.2c). These containers, which are also documented at Pompeii and *Camolodunum* and on the *limes* of the Rhine (Hofheim and Vindonissa), and in forts in the desert of eastern Egypt, were possibly used to contain and export wine of quality originating from inland Campania, as has been proposed recently.⁶⁵

Archaeometric studies are underway on examples from the Alberti wreck, but it is still interesting to presuppose that similar *lagynoi*, although up to now with only one handle, have been found during our studies between *Cales* and *Capua* (for example at *Bellona*, in the modern province of Caserta – tab. 4.3), an area in which it is possible that they were produced.⁶⁶

Notes

¹ Olcese 2007, 2015, 2017a, 2017b and 2020; Olcese et al. 1996, 2013a and 2013b, to whom reference is made for the previous bibliography. The new phase of the *Immensa Aequeora* Project has as its goal the publication of the volume *Atlas – Roman Ceramic Production Sites and Shipwrecks of Tyrrhenian Italy: Fabrics and Mineralogical Analyses*. *Immensa Aequeora* Fabrics Atlas (in preparation), comprising the analyses carried out on the ceramics of the production sites and wrecks. Thanks to D.M. Surace, collaborator of the project, for the editorial revision and the creation of the tables.

² For the purposes of the project and the first results, *Immensa Aequeora Workshop* 2013. The archaeometric methods used for the ceramics from the production sites are chemical (XRF) and mineralogical ones; only mineralogical for the ceramics from underwater contexts, to avoid problems due to alterations. For the chemical analyses the collaborations of M. Picon (†) first, and of V. Thirion-Merle in a successive phase, were fundamental. For the mineralogical part, the main contribution was that of I. Iliopoulos and, for many shipwrecks, of C. Capelli.

³ For the objectives underlying the creation of the ceramics database see Olcese – Picon 2002 and Olcese 2013a.

⁴ On these issues see, by way of example, Tchernia 1986 and 2011; Arthur 1982, 1991 and 1995; Crimaco 2009; Brun 2011.

⁵ For the data already published, Olcese 2010, 2015, 2017b and 2020.

- ⁶ Brun 2011; Olcese – Soranna 2013; Olcese et al. 2015 and 2017, as well as the additional contribution presented in this same session, AIAC 2018.
- ⁷ Garnier – Olcese forthcoming.
- ⁸ Olcese 2004, 2010, 2015 and 2017a; Olcese et al. 1996.
- ⁹ Olcese 2010; Pugliese 2014.
- ¹⁰ Olcese 2010, 76 f. and 293, with previous bibliography; Olcese 2017b. On the social and economic history of the territory of Naples, Lepore 1952, on its coinage, Cantilena et al. 1986.
- ¹¹ Olcese 2010, 2017a and 2019.
- ¹² Finkielsztejn 2006; Lawall 2011.
- ¹³ Olcese 2010, 73–76.
- ¹⁴ Pugliese 2014.
- ¹⁵ Olcese 2010, cap. IX; Olcese 2015; 2017b, 305–309.
- ¹⁶ Tchernia 1986, 344–347; Atlante 2011–2012, 369, with previous bibliography.
- ¹⁷ For the sources Tchernia 1986 [edition 2016], 334 f. and 344–347. For a summary on the Sorrento kilns, Atlante 2011–2012, 369–370; for the first archaeometrical data on the Dr. 2–4 of Sorrento, Olcese et al. 2013a, 55 f.
- ¹⁸ Iliopoulos in Olcese et al. 2013a, 55 f.
- ¹⁹ At Poggiomarino, Longola (Na), for example, Cicirelli et al. 2008; for the “*pompeianum*” vine, Pliny, HN XIV, 38; for Pompeii, Toniolo – Pecci in this volume.
- ²⁰ For example, Peacock 1977.
- ²¹ Tchernia – Zevi 1972; Panella – Fano 1977; Tchernia 1986; Hesnard et al. 1988; Zevi 1995; Freed 2000; Williams – Peacock 2005; Peña – McCallum 2009b; Iavarone 2012–2013; Iavarone – Olcese 2013. For the *gens Eumachia*, Castrén 1975, 165; Zevi 1995; lastly Nonnis 2015, 199, with previous bibliography. The “*Eumachi* type” definition has recently been questioned, especially when used for containers prior to the Augustan era, but also because this fabric appears to be attested in other production areas too (Martin-Kilcher et al. 2013, 392 f.); for this reason it is called “*Black sand (A and B) fabrics*”.
- ²² Tchernia – Zevi 1972, 40.
- ²³ CIL X, 8042, 48; Steinby 1979, 268; De Caro 1994, 84.
- ²⁴ Peacock – Williams 1986, 86–88; Hesnard et al. 1989, 29 and 38.
- ²⁵ For the distribution of the stamps on amphorae and bricks, van der Werff 1989, Appendix II and Iavarone – Olcese 2013, 222–224; for the shipwreck Grand Ribaud D, Hesnard et al. 1988, tav. XXII. For Ephesus, Bezeczký 2010, 86. A review of the Dr. 2–4 from Pompeii is currently underway within the *Immensa Aequora* Project (in collaboration with S. Iavarone and A. Razza).
- ²⁶ For the excavation, Karthago I (1991). The amphorae, sampled within the *Immensa Aequora* Project in collaboration with the DAI of Rome (Dr. P. von Rummel) and Dr. M. Vegas (excavation of Dr. F. Rakob), have the inventory numbers K79/277 and K90/75 (Martin-Kilcher 1993). Delattre already pointed out the recurrence of more than 40 L.EVMACHI stamps, with variants (Delattre 1894, 113).
- ²⁷ M.RVBB, inv.n. K79/108 (inventory project, CAR15), Martin-Kilcher 1993, 313, no. 101.
- ²⁸ A graffito from Pompeii names a *Rubellius Blandus* as *consul suffectus* of the year 17/18 AD (CIL IV, 1552).
- ²⁹ For Alesia, Callender 1965, 191, no. 1172; for the Grand Ribaud D shipwreck, Hesnard et al. 1988, tav. 22.

³⁰ Iavarone – Olcese 2013; Iavarone 2014. The Dr. 2–4 come from Forum Granaries and the garden of Domus IX.

³¹ I. Iliopoulos did the reading of the sections, in *Atlas*. The amphorae stamped with EVMACHI are distinguished by rather high chemical values of MgO and FeO, of K₂O e Al₂O₃ (see also Thierrin-Michael 1992, 70–72).

³² Hesnard et al. 1989, 41 and following; Thierrin-Michael 2007, 123 f.

³³ Arthur 1982, 1987 and 1991; Hesnard et al. 1989; De Caro – Miele 2001. For centres of ceramic production in northern Campania, cf. Atlante 2011–2012. Studies have been underway for a few years at *Cales* and Capua (Olcese et al. 2013a), in collaboration with the relevant Superintendency (see *infra*).

³⁴ For materials sampled as part of the project on Graeco-Italic amphorae (Olcese 2010, 36 f., 42, 277 f.) see Arthur 1991; De Filippis et al. 2013.

³⁵ For analysis of the Graeco-Italic amphorae, see Iliopoulos in Olcese 2010, 277 f.

³⁶ Data from on-going studies at contexts in *Cales* and Capua.

³⁷ For archaeological data on contexts in Mondragone, see Atlante 2011–2012, 306–323, with previous bibliography.

³⁸ The Graeco-Italic amphorae include multiple fabrics, from the fine variety with small white granules (carbonates) up to the coarse one rich in sanidines and volcanic rocks (Hesnard et al. 1989; Thierrin-Michael 1992, 63–66, and 2007, 123 f.; Thierrin-Michael – Picon 1994).

³⁹ Iliopoulos in *Atlas*.

⁴⁰ Iliopoulos in *Atlas*. This production is not very distinctive from the chemical point of view, because it is similar to reference groups of amphorae from different sites of production, such as Fondi and Cosa; distinguishing parameters are the two chemical elements K₂O and Fe₂O (Thierrin-Michael 2007, 123).

⁴¹ Chiosi – Gasperetti 1994; Atlante 2011–2012, 326–328 with bibliography; for the *Lucei* family, Nonnis 2015, 251.

⁴² According to I. Iliopoulos (in *Atlas*), near the site of Rocca d'Evandro, there are not many volcanic formations and this explains the presence of terminal grade volcanic minerals, while the fragments of volcanic rock are rare.

⁴³ De Caro – Miele 2001, 543–545. For the ceramics of *Cales*, Pedroni 2001, with previous bibliography.

⁴⁴ Morel 1989; a joint publication of the work is foreseen.

⁴⁵ Olcese et al. 2013a; Iliopoulos in *Atlas*. See also Guarino et al. 2011.

⁴⁶ Proietti – Crimaco 1991; Crimaco et al. 1994; Atlante 2011–2012, 304 f.; for the analyses, Iliopoulos in *Atlas*.

⁴⁷ Athenaeus (I, 31, d) that attributes the information to Polibio (XXXIV, 11.1).

⁴⁸ Loughton 2003. For this type (described in bibliography as *Black sand/falso Eumachi*) the production centres are unknown.

⁴⁹ Iliopoulos in *Atlas*.

⁵⁰ For the work program about shipwrecks, Olcese 2013b and 2020, 158–160; Olcese et al. 2013b; *Per incerta maris* forthcoming. For data regarding other wrecks, Cibecchini – Capelli 2013.

⁵¹ Iliopoulos in *Atlas*.

⁵² For the first data regarding the Eolian wrecks, Olcese 2010, 231–248, with previous bibliography.

⁵³ Garnier – Olcese forthcoming.

- ⁵⁴ Olcese 2010, cap. VIII, 265–276, and 2015, 192.
- ⁵⁵ For the Roman – Carthage treaties, Scardigli 1991. See also Bechtold 2007.
- ⁵⁶ Olcese 2010, chapter VII, with previous bibliography; *Per incerta maris* forthcoming.
- ⁵⁷ Picon 1988: the chemical analysis (XRF) have confirmed that the black glaze ceramics of the middle and second half of the 3rd century BC have the same compositions of those from the Gulf of Naples.
- ⁵⁸ Olcese et al. 2013b, 85–87; Iliopoulos in *Atlas*.
- ⁵⁹ Thierrin-Michael 2007; Martin-Kilcher et al. 2013.
- ⁶⁰ Thierrin-Michael 2007, 125.
- ⁶¹ Thierrin-Michael 2007, 125, with previous bibliography. For the circulation of Campanian Dr. 2–4 amphorae in the East, Lavall 2006 and Bezczky 2010; for Arabia and India, Davidde et al. 2004 and Tomber 2012.
- ⁶² See the location cards of the production sites, Atlante 2011–2012, 256.
- ⁶³ For the workshops between Mondragone and Sinuessa, Atlante 2011–2012, 255 and following, with previous bibliography; Pagano 1990; Crimaco 1991 and 1993; De Caro – Miele 2001.
- ⁶⁴ In collaboration with the Aeolian Museum Bernabò Brea of Lipari; for the shipwreck, *Archeologia Subacquea* 1985, 71–74.
- ⁶⁵ Brun 2007 and 2011. Thanks to J-P. Brun for the note about the amphorettes in the eastern desert of Egypt.
- ⁶⁶ The amphorette shown in tab. 4.3, next to those of the Alberti shipwreck, comes from Bellona, between *Cales* and Capua. The hypothesis that these containers were produced locally (and perhaps in other sites of Campania, for example in the Pompeian area), which could soon be verified by on-going laboratory analyses, does not exclude the possibility, but rather reinforces that of J-P. Brun, who maintains that small-scale amphorettes, connected to the export of *aminaia*, were produced in the middle valley of Volturno and at *Alifae*, Brun 2011, 113 f.

Image Credits

Fig. 1: Atlante 2011–2012, 256 Carta 3. – Fig. 2: *Immensa Aequora* Project. – Fig. 3: Olcese 2020, 159 fig. 2. – Tab. 1.1; 1.2a-b; 1.4; 2.1; 2.2b; 2.3-4; 3.1b; 4.1-3: *Immensa Aequora* Project. – Tab. 1.2c: Atlante 2011–2012, 308 tav. 3.XXI.6. – Tab. 1.3: Atlante 2011–2012, 369 foto 3.29. – Tab. 1.4b-c: stamps drawings by Martin-Kilcher 1993, 313 and 319. – Tab. 2.2a: amphora drawings by Chiosi – Gasperetti 1994. – Tab. 2.4b: drawing by Olcese et al. 2013a, 67. – Tab. 3.1: Olcese 2010, 233 f. – Tab. 3.2: Olcese 2010, 268 fig. VIII.2. – Tab. 3.3: Olcese 2010, 290 f. – Tab. 4.1b: Olcese et al. 2013b, 86 fig. 13. – Tab. 4.2c: drawing by Brun 2011, 120. – Tab. 4.4: Olcese 2015, 193 fig. 16.

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