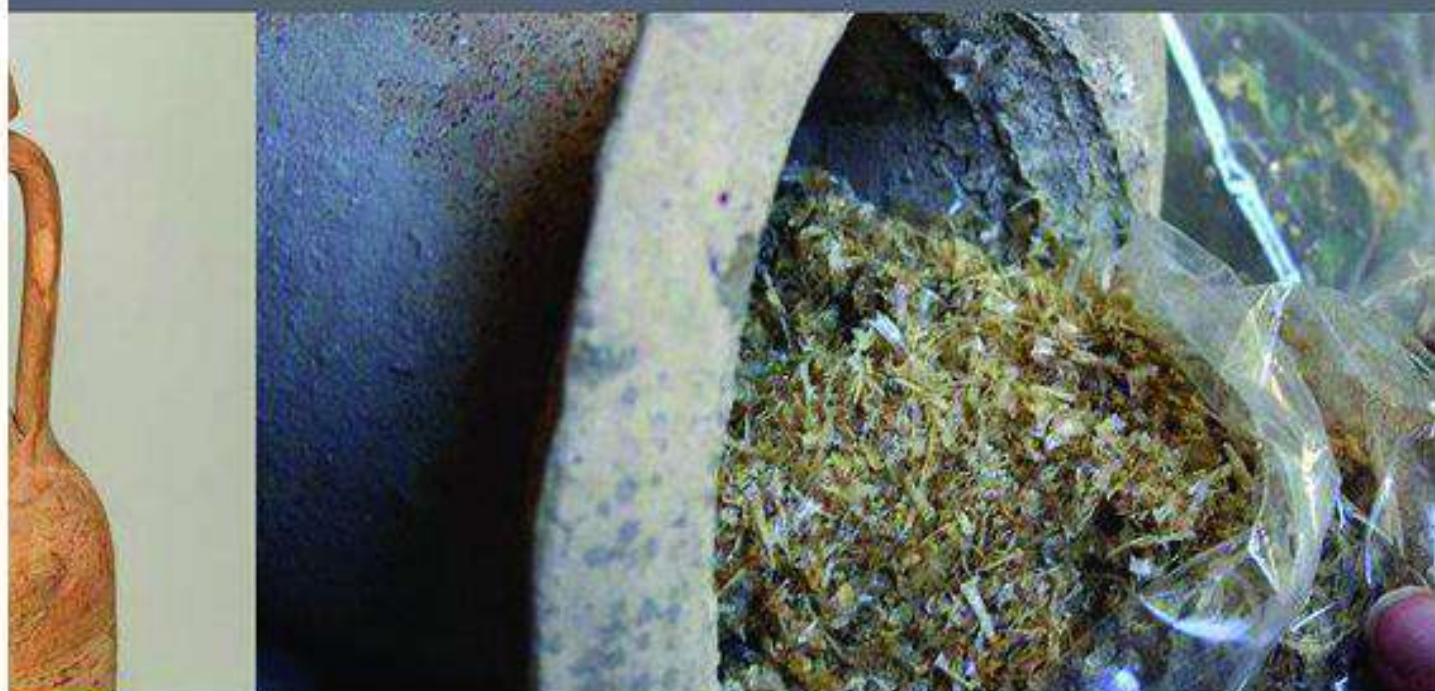


**ROMAN AMPHORA CONTENTS
REFLECTING ON THE MARITIME TRADE
OF FOODSTUFFS IN ANTIQUITY
IN HONOUR OF MIGUEL BELTRÁN LLORIS**

PROCEEDINGS OF THE ROMAN AMPHORA CONTENTS INTERNATIONAL
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The contents of ancient Graeco-Italic amphorae. First analyses on the amphorae of the Filicudi F and Secca di Capistello wrecks (Aeolian Islands, Sicily)

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Abstract: The Graeco-Italic amphorae — types IV and V — (Van der Mersch 1994 classification) of Italic origins are considered as wine-amphorae, but no concrete tests for the presence of wine within them have existed until now. The recent re-examination of the cargos of the Filicudi F (300-280/250 BC) and Secca di Capistello (300-280 BC) wrecks (Aeolian Islands), within the *Immensa Aequora* project (www.immensaequora.org), in collaboration with Museo Eoliano L. Bernabò Brea di Lipari, has made it possible to study these most-interesting wrecks, enabling for the first time the collection of new information on the area of the amphorae' origins (Olcese 2010). Different types of samples have been taken in order to identify the content of the amphorae with the gas chromatography-mass spectrometry (GC-MS) method. The amphorae were waterproofed by pitch from coniferous species and contained red wine.

Key words: Filicudi F wreck; Capistello wreck; Aeolian wrecks; ancient wine; Graeco-Italic amphorae.

1 The Wrecks and Their Cargos

The ancient Graeco-Italic amphorae — types IV and V (Van der Mersch 1994 classification) — of Italic origin are presumed to be wine-amphorae, but no concrete tests for the presence of wine within them have existed until now.

For a number of years, the *Immensa Aequora* project (www.immensaequora.org) sought to reconstruct the economies and trade in the western Mediterranean basin (Olcese 2013, 2017, 2020 and forthcoming a and b; Olcese *et al.* 2013)¹ using a multidisciplinary approach; Sicily is one of the sample areas for the study of ceramics production and viticulture (Olcese, Razza and Surace 2015, 2017; Brun, Garnier and Olcese 2020; Olcese *et al.* 2020).² The recent re-examination of the cargos of the Filicudi F and Secca di Capistello wrecks (Aeolian Islands) (Figure 1), as part of the *Immensa Aequora* project in collaboration with Museo Eoliano L. Bernabò Brea of Lipari, has made it possible to study these most-interesting wrecks, enabling for the first time the collection of new information on the area of the amphorae' origins (Olcese 2010: chapter



FIGURE 1. LOCATION OF THE FILICUDI F AND SECCA DI CAPISTELLO WRECKS (MAP *IMMENSAEQUORA* PROJECT).

VII with contributions by I. Iliopoulos and G. Montana; Olcese forthcoming a and b).

Furthermore, two series of analysis (GC-MS) have been carried out on the amphorae types IV and V, in order to verify what their contents actually were.

1.1 Filicudi F

The wreck, which was partly excavated by N. Lamboglia, is located around the Secca di Capo Graziano, Filicudi Island, Aeolian Islands (Lamboglia and Pallarés 1983; Bernabò Brea and Cavalier 1985; Parker 1992).³ The cargo includes Graeco-Italic amphorae Van der Mersch type

¹ Thanks to Museo Eoliano 'L. Bernabò Brea' Lipari, Dr F. Pallarés Salvador (director of the excavation with N. Lamboglia), and A. Razza and D. M. Surace for help in revising and editing this article.

² The latest results from the archaeological and archaeometric studies have been presented as part of the panel 'A. Making Wine in Western-Mediterranean B. Production and the Trade of Amphorae: some new data from Italy' (organised by the presenters and J.-P. Brun) at the AIAC 2018, XIX International Congress of Classical Archaeology, held at Cologne and Bonn from 22 to 26 May 2018 (Brun, Garnier and Olcese 2020).

³ The chronology was proposed on the basis of the black glazed ceramics (Morel 1981: 62) and van der Mersch agrees (1994: 74).

IV,⁴ black gloss pottery (*skyphoi* and small bowls) and household ware (Figure 2) (Cavalier and Albore Livadie 1985: 89–91; Olcese 2010: 231–239; Olcese 2020; Olcese in preparation). The amphorae that have been stamped present peculiar characteristics: the body is elongated and tapered, the neck cylindrical, the lip section is triangular and elongated. Recently the shipwreck has been reviewed and analyses have been performed on part of the cargo (Olcese 2010; Olcese forthcoming a).

Mineralogical analyses have confirmed that all the Graeco-Italic amphorae have a composition compatible with the clays of Ischia and the Gulf of Naples (I. Iliopoulos and G. Montana in Olcese 2010; Olcese forthcoming a and b). The recent discoveries made during excavations for the Neapolitan underground could actually confirm the hypothesis that some of the amphorae from the Filicudi F were produced in the city's workshops, although for the moment we cannot exclude other centres of production as possible points of origin (Giampaola and Febbraro 2011–2012; Pugliese 2014).

Epigraphic data: ΓΑΡ crown M (Olcese 2010: 112–114, 297–298),⁵ ΖΩ (Olcese 2010: 126–129),⁶ ΜΕΓ (Olcese 2010: 236), ΠΥΘΕΑ (Olcese 2010: 144),⁷ ΧΑΡΗ (Olcese 2010: 156–161)⁸ stamped on many Graeco-Italic amphorae.

Some of the stamps are attested also in Ischia, in the craft quarter of Santa Restituta, and in Naples (Olcese 2010: chapter V; Olcese 2019). The stamp ΓΑΡ crown M, in particular, is present on some amphorae and is sometimes found impressed twice, on the bend of the handle, sometimes even vertically, parallel to the handle (Olcese 2010: 112–114, 297–298).

Dating: 300–280 BC.

1.2 *Secca di Capistello*

The wreck, which has been partly excavated, bringing to light part of the wooden hull, is located near the southern end of Lipari island (Aeolian Islands), about 300m from the coastline, near the *Secca di Capistello*.

The cargo, already partially reviewed in publication by H. Blanck and other researchers (Frey 1977; Blanck 1978; Frey, Hentschel and Keith 1978; Albore Livadie, Cavalier and Van der Mersch 1985: 53–64; Parker 1992: 396; Frey 2003; Morel 2004; Olcese 2010: 241–248; Olcese

2020), includes Graeco-Italic amphorae Van der Mersch type V, and black gloss pottery (Figure 3). The amphorae are stamped in Greek and present similar, but different morphological and compositional characteristics from the Filicudi F, such as the way they are stamped.

C. Van der Mersch, on the basis of the stamps, attributed the amphorae from the wreck to the Greek section of Sicily, though admitted that it was difficult to identify the cities that produced them (Van der Mersch 1985: 64). Recent mineralogical analyses have allowed for the attribution of the amphorae at the *Secca di Capistello* wreck to Campania and, in particular, to mineralogical group IIa of the pottery recovered in Ischia, to which also some Graeco-Italic amphorae of the Gulf of Naples belong (I. Iliopoulos and G. Montana in Olcese 2010; Olcese forthcoming a).

Epigraphic data: ΒΙΩ (Olcese 2010: 109–110), ΔΙΩ (Olcese 2010: 116–119), ΕΥΞΕΝΩ (Olcese 2010: 121–122), ΠΑΡΗ (Olcese 2010: 143), ΠΑΡ (Olcese 2010: 140–142), ΠΙΣΤ,⁹ ΠΟΠ or ΠΟΡ (?) (Olcese 2010: 144), ΠΤΥ (Olcese 2010: 244),¹⁰ ΧΑΡΗΣ between *caducei* (Olcese 2010: 110, 244), stamped on handles of Graeco-Italic amphorae.

Some of these stamps have also been documented on Ischia (in low numbers) and at Naples (Olcese 2010, 2019). The most commonly attested stamp among the amphorae uncovered on the *Secca* shipwreck is ΠΑΡΗ, having 12 documented examples; it has also been noted on Ischia, among the materials from the Gosetti dump; ΠΑΡ, on the other hand, is present on Ischia, although the matrix of the stamp is different, and is impressed on the shoulders of 4 amphorae from the shipwreck.

Dating: 300–280 BC.

2 Amphorae analysed by organic analyses

In order to determine the original content and the nature of the foodstuffs being traded, two series of chemical analyses have been conducted, the first one dealing with the sediment directly taken directly from the amphorae, the second one using sherds of the fragmented walls of the amphorae even if no visible residue was present on the inner sides.

The second series of analyses looked at five samples presented below (Figure 4), three of which come from amphorae related to the Filicudi F wreck,¹¹ and two from the *Secca di Capistello*.¹²

⁴ All the amphorae are Greco-Italic except for one, which is a Punic type.

⁵ Based on the examples from Ischia, it was not clear whether the first letter was a Π or a Γ, but the stamps from the shipwreck seem to confirm that it is a Γ and not a Π as previously proposed by van der Mersch (1994: 174) and recently by Pugliese (2014: 91), but the uncertainty remains.

⁶ It is one of the most commonly attested stamps on Ischia, perhaps as an abbreviation of the name ΖΟΙΑ(ΟΣ).

⁷ On Ischia, there have been found two stamps reading ΠΥΘΕ; we cannot be certain whether they can be connected to the stamp from the Filicudi. At any rate, the characters and the fabric of the amphorae stamped with ΠΥΘΕ are analogous to those stamps with the crown, and allow us to hypothesize a common origin for the containers.

⁸ It could have a connection to a group of stamps from Pithecusa that have also been documented at Naples (Pugliese 2014).

⁹ At Ischia, the stamp ΠΙΣ has been documented from the Gosetti dump, cat II B.66 ([]ΙΣ- ?).

¹⁰ The stamp appears in publications from the shipwreck, but it has not been found among the Museum's materials.

¹¹ The first series of analysis included two other samples from Filicudi F wreck which were not adapted to the determination of the original contents of amphorae:

Amphora F24 bis (17643): Intact amphora of the Graeco-Italic type IV. Stamp with ΠΥΘΕΑ in the rectangular cartouche pressed on the bend of one of the handles.

Amphora F63 (17642): Intact amphora of the Graeco-Italic type IV. Stamp with ΓΑΡ/ΠΑΡ crown M in the rectangular cartouche pressed on the bend of one of the handles. Letters A and P are in nexus.

¹² The first series of analysis included another sample from *Secca di*



FIGURE 2. GRAECO-ITALIC AMPHORAE VAN DER MERSCH TYPE IV FROM FILICUDI F WRECK IN ARCHAEOLOGICAL MUSEUM OF LIPARI (OLCESE 2010, *IMMENZA AEQUORA* PROJECT).



FIGURE 3. GRAECO-ITALIC AMPHORAE VAN DER MERSCH TYPE V FROM SECCA DI CAPISTELLO WRECK IN ARCHAEOLOGICAL MUSEUM OF LIPARI (OLCESE 2010, *IMMENZA AEQUORA* PROJECT).

2.1 Amphorae Analysed from the Filicudi F

Amphora F20 (17621)

Intact amphora of the Graeco-Italic type IV. Two stamps reading $Z\Omega$ in the quadrangular cartouche ($2 \times 15.5\text{cm}$ and $1.8 \times 1.3\text{cm}$) impressed obliquely on the bend of both handles. Signs of a thumbprint on the base of each handle.

Measurements: total height, 74cm; diameter of the outer lip, 18cm; diameter of the inner lip, 12cm; neck, 16.2cm; handle, 18cm; pointed base, 6.8cm.

Amphora F53 (17693)

Body of a type IV Graeco-Italic amphora with pointed base.

Measurements: total height, 56cm; pointed base, 7cm.

Amphora F75 (17701/1)

Part of the neck without the lip and with the handles, part of the shoulder of a type IV Graeco-Italic amphora. Four stamps reading *MEI* in reverse script across the rectangular cartouche ($3 \times 1\text{cm}$), two for each handle, stamped both on the bend of the handle and on the base each handle.

Measurements: neck, 16.5cm; handle, 17.5cm.

2.2 Amphorae Analysed from the Secca di Capistello

Amphora LIP/SEC 70 (12393)

Neck with lip and handles of a type V Graeco-Italic amphora. Stamp with $XAPH\epsilon$ and a caduceus in reverse script on the rectangular cartouche ($4.5 \times 1\text{cm}$) pressed obliquely on the bend of one of the handles. Signs of a thumbprint on the base of each handle.

Measurements: diameter of the outer lip, 17cm; diameter of the inner lip, 11cm; neck, 12.5cm; handle, 12.5cm.

Amphora LIP/SEC 76 (12390)

Type V Graeco-Italic amphora. Stamped with $\Delta I\Omega$ on the rectangular cartouche ($3.5 \times 1.5\text{cm}$) pressed in oblique on the bend of one of the handles.

Measurements: diameter of the outer lip, 17cm; diameter of the inner lip, 11.5cm; neck, 13cm; handle, 13.5cm.

3 Method and Results

3.1 Methodology

To determine the content of Graeco-italic amphorae traded in the both shipwrecks of Filicudi F and Secca di Capistello, two series of analyses have been organised according the availability of the material; a first series consisted of the analysis of the sediment contained in the amphorae, the second one dealt with the organic invisible residues absorbed in the inner sides of the amphorae.

Capistello wreck which was not adapted to the determination of the original contents of amphorae:

Amphora 12829: Type V Graeco-Italic amphora. Stamped with ΠAPH on the rectangular cartouche pressed on the bend of one of the handles.

The study previewed the implementation of the double-step protocol for the extraction and the analysis of the two successive extracts by GC-MS. Briefly, both types of samples have been extracted according the classical method, using organic solvents under ultrasonication (Charters *et al.* 1995), then submitted to an acido-catalysed extraction (Garnier and Valamoti 2016). The second step allows the solubilisation of precipitated or insoluble markers such as fruit markers including grape and wine, and the hydrolysis and the extraction of macromolecules like vegetal waxes. This allows us to apprehend the pollution degree of each sample. Each extract is then analysed by gas chromatography-mass spectrometry (GC-MS). This method allows the identification of each individual molecular marker according its mass spectrum, markers being previously separated by chromatography. A second step for interpreting chemical data consists of the identification of materials according the molecular associations previously established.

3.2 First analysis series

A first series of three samples of sediment contained in the amphorae and consisting of mainly small seashells, easy to collect, has been analysed. These samples have not been in direct contact with the content because they got inside the amphora after its opening when the stopper had been broken, and the original liquid content disappeared by dilution in the sea. All the material that entered the amphora after it was opened couldn't have been in contact with and absorbed the original content. Only the lining materials such as pitch, already present on the inner sides, could, by the physical diffusion process, have absorbed the new content. For this reason, only the first extraction-analysis step has been implemented, because it is inappropriate to search for wine in such samples. Therefore, their analysis allows us to evaluate the methodology and especially the choice of samplings.

The three samples 12829 (Secca di Capistello), 17642 et 17643 (Filicudi F) reveal a similar chemical composition, with free and methylated diterpenic acids, their oxidation markers (3-, 7-, and 15-hydroxy dehydroabietic acids), and aromatic polyhydrocarbons, all being markers of pitch from coniferous (Figure 5). No markers from wax, animal fat, or vegetal oil were detected.

The organic analysis of the actual 'content' of the amphorae indicates the presence of pitch from coniferous trees, i.e. the waterproofing material using for lining the inner walls of the amphorae in great amounts, but no trace of the real content has been detected using this simple sampling method.

3.3 Second series of analysis: amphora sherds

To access to the original data of the content, it is essential to take samples from supports which were directly in contact with the original contents, i.e. the internal walls







| FILICUDI F | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Amphora F20 (17621) | Amphora F53 (17693) | Amphora F75 (17701/1) |
|   |  |   |
| SECCA DI CAPISTELLO | | |
| Amphora LIP/SEC 70 (12393) | Amphora LIP/SEC 76 (12390) | |
|   |   | |

FIGURE 4. TABLE OF SOME OF THE ANALYSED AMPHORAE FROM THE WRECKS FILICUDI F AND SECCA DI CAPISTELLO (PHOTO IMMENSA AEQUORA PROJECT).

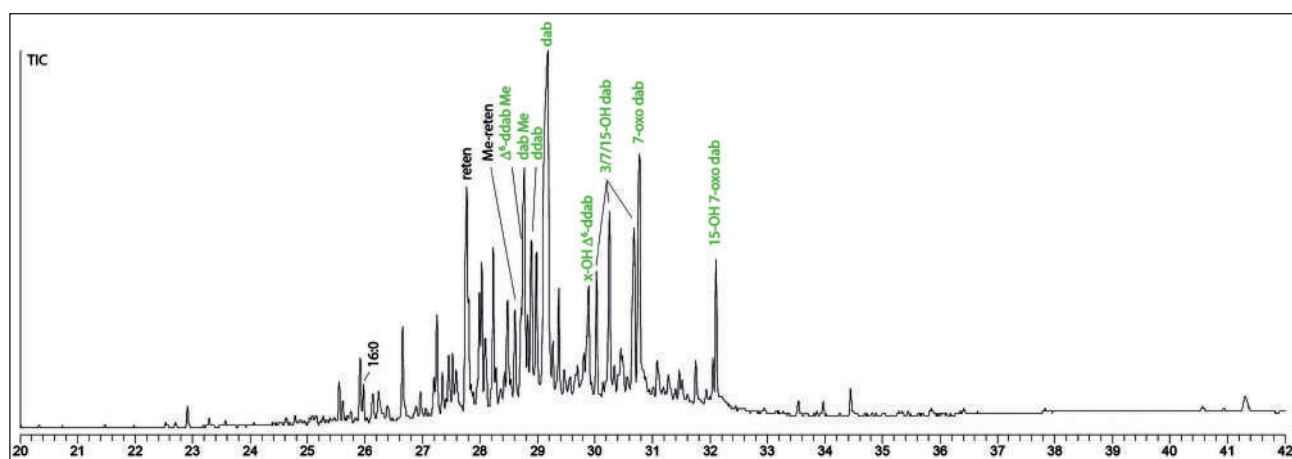


FIGURE 5. CHROMATOGRAM OF THE FIRST LIPID EXTRACT OBTAINED FROM THE ACTUAL 'CONTENT' OF THE AMPHORA NO.17693, TRIMETHYLSILYLATED (COLUMN ZB5-MSI 20M × 0.18MM, EIMS DETECTION AT 70 EV).

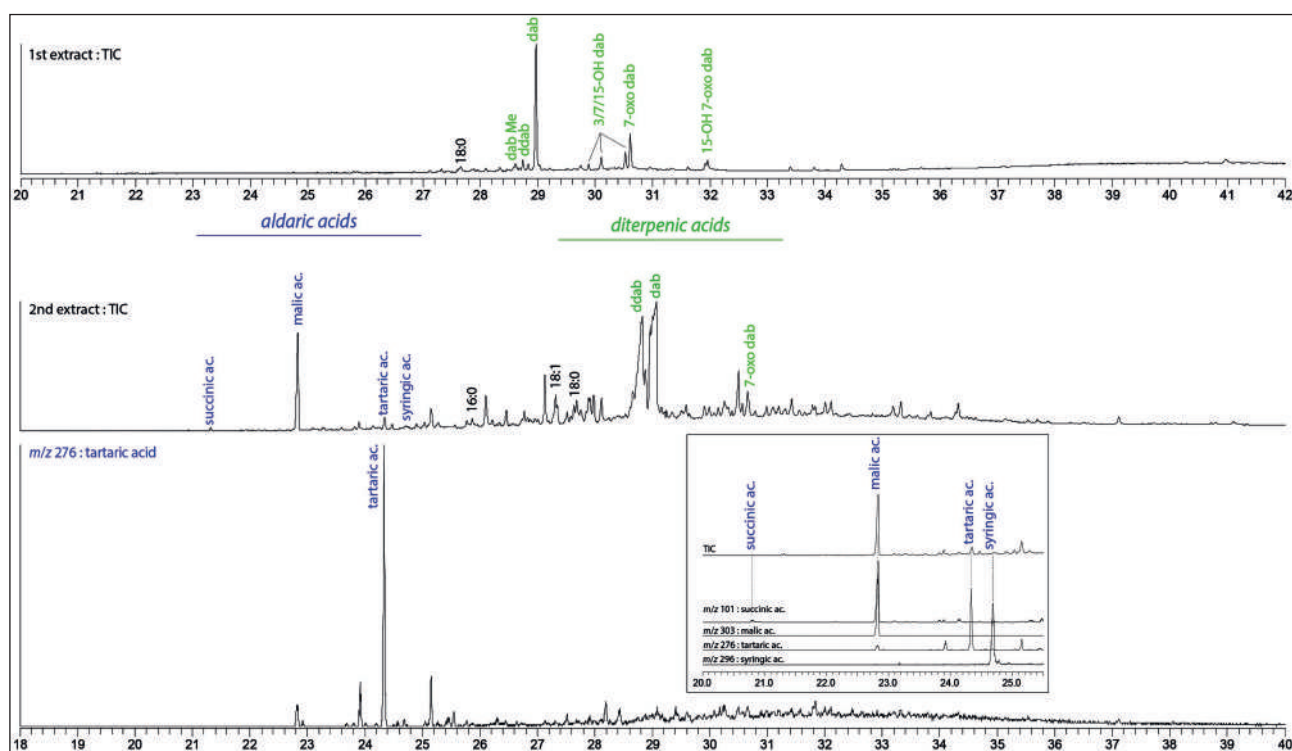


FIGURE 6. CHROMATOGRAMMS (ABOVE) OF THE FIRST LIPID EXTRACT FROM ABSORBED RESIDUES FROM THE INNER WALLS OF THE AMPHORA F-53, (BELOW) OF THE SECOND LIPID EXTRACT AND THE DETAIL OF ALDARIC ACIDS (COLUMN ZB5-MSI 20M × 0.18MM, EIMS DETECTION AT 70 EV).

of amphorae. In this case, the double-step protocol of extraction and analysis has been implemented.

The first lipid extracts of five amphorae (Capistello 12390 and 12393, Filicudi F-20, F-53 and F-75) are very close to those obtained from the first series of samples (Figure 5), consisting of diterpenic acids, widely dominated by the free and methylated dehydroabietic acid. Reten and methyl reten allow us to specify that it is about pitch from a conifer. No trace of wax, animal fat or vegetable oil is detected. Amphorae were thus waterproofed with the pure pitch, mixed with no other natural material. So, the amphorae did not contain oil.

The second stage allows for the access to other compounds presents in small amounts compared with the markers of the pitch, namely the aldaric acids coming from fruits (Figure 6). Diterpenic acids, dehydroabietic and Δ^6 -dehydro dehydroabietic, are the most common. The most interesting zone of the chromatogram is that of aldaric acids (*cf* insert of the Figure 6). Five amphorae show the presence of tartaric acid, thus grape, as well as syringic acid. This marker is released from the malvidin in the used conditions of extraction. Malvidin is present only in the skin of the black grapes, and in the pulp and the skin of *teinturier* grapes. It is thus a marker of black grape juice and red wine if there is fermentation. The

malic acid, in smaller quantities, is present in all the fruits, among those grapes. It is not thus diagnostic of the grape as tartaric acid. Succinic acid, identified in appreciable amounts in the amphora F-53, indicates fermentation. It is thus fermented must, i.e. wine.

4 Conclusion

If the first series of samples was not adapted to the determination of the original contents of amphorae, the second series consisting of fragments of walls of the amphorae allowed for the clear identification of pitch from conifers but also black grape juice/red wine. Five amphorae contained grape, and chemistry tells us it was a fermented beverage in one case (F-53). The studied Graeco-italic amphorae were waterproofed using pitch and transported some red wine.

From a methodological point of view, this study of two series from amphorae shows the importance of a good choice of samples. Even with successful protocols, a sample unsuitable for the question asked cannot bring any useful information. The samples must have been in direct contact with the contents. Also, an unsuitable protocol (such as a methodology implementing only the first classic extraction method) applied to a correctly chosen sample will never allow for the identification of materials derived from fruits or wine.

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