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Use and reuse of amphorae. Wine residues in Dressel 2–4 amphorae from Oplontis Villa B (Torre Annunziata, Italy)

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ABSTRACT

Under the aegis of the ongoing international Oplontis Project we carried out organic residue analyses on thirteen samples from eleven Dressel 2–4 amphorae recovered at Villa B at Oplontis (Torre Annunziata, Southern Italy) in order to identify their content and to characterize their visible lining. Although the content of Dressel 2–4 amphorae is usually thought to be wine, no residue analyses have been carried out until now to verify it. Analyses were carried out with Gas chromatography coupled to mass spectrometry.
The results of the analyses indicate that all the amphorae were coated with Pinaceae products which had undergone different stages of preparation. Moreover, they confirm that Dressel 2–4 contained wine, or its derivatives, as wine markers were identified in all the samples. The data we obtained demonstrated that the amphorae analyzed were not new vessels, expressly made to trade the wine produced in the surrounding area, but were ready to be reused.

1. Introduction and archaeological site

Wine was one of the most important beverages produced, traded and consumed in the ancient Mediterranean. In particular, during the Roman Republic and the Early Roman Empire (3rd century BC–1st century AD), the Vesuvian area was probably one of the most famous regions in the Mediterranean for grape growing and wine making. The wines of the Mt. Vesuvius were exported and appreciated everywhere in the Roman world (i.e. Arthur, 1991, 1995; Arthur and Williams, 1992; Tchernia, 1986). In the first century AD the Roman scholar Pliny the Elder wrote that in Campania several cultivars of grapevines were cultivated, such as *Vitis Hellenica*, *Aminea Gemina*, *Vitis Apiana*, *Aminea Lanata* (*Historia Naturalis* 3.9; 14.9), varietals that were also known to other Roman writers such as Cato the Elder, Virgil and Columella (Cato the Elder, *De Agricultura* 106; Virgil, *Georgics* 2.097-100; Columella, *De Re Rustica* 3.7).

Along the slopes of Mount Vesuvius, archaeological research shows that the town of Pompeii and its district were the main winemaking centers (Jashemski, 1979, Jashemski et al., 2002). The *suburbium* was in fact characterized by the presence of several farmhouse estates with winepresses and *dolia* suggesting the production of wine (De Caro, 1994).

As for the vessels used for wine trade in antiquity, amphorae (together with *dolia*) were mostly used for sea trade, although the use of containers of organic materials such as wooden barrels or animal skin containers (*culeus*) must not be discarded. There are several famous amphorae types used for wine transport during the Early and Middle Roman Empire, such as the Gallic Gauloise 4 amphorae and the Italic Dressel 1. Among the different amphorae types, the Dressel 2–4 played a crucial role in the transport of wine, as several scholars have demonstrated. This is particularly true for those classified as Vesuvian Dressel 2–4 amphorae, which were produced in the Vesuvian area of the ancient Campania in Southern Italy (Arthur, 1991, 1995; Bertoldi, 2012; Olcese, 2012; Panella and Fano, 1977; Tchernia, 1986; Williams and Peakok, 2005; Zevi, 1966).

Although the content of Dressel 2–4 amphorae is usually assumed to be wine, no residue analyses have been carried out with updated techniques to verify it. For this reason, under the aegis of the ongoing international Oplontis Project (Clarke and Muntasser, 2014; Thomas et al., 2013, Thomas, 2015, 2016; Gazda, Clarke, 2016; van der Graaff et al.,

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2016), we carried out organic residue analyses on a selection of Dressel 2–4 amphorae recovered from the warehouse and settlement complex known as Oplontis B (Torre Annunziata, near Pompeii, Southern Italy) in order to identify their content and to characterize their visible lining (Fig. 1).

The aim of our study was to test whether or not the Dressel 2–4 amphorae actually contained wine, as the type is commonly thought to do. Moreover, there was another interesting aspect regarding amphorae at Oplontis B: we sought to obtain data that could clarify whether the amphorae were being re-used or were new vessels, expressly made to transport the wine produced in the surrounding area overseas.

2. The archaeological site

The site of Oplontis B lies approximately 300 m to the east of Villa A and is a Roman complex destroyed by the 79 CE eruption of Vesuvius (Fig. 2). Although it is located very close to the luxurious and sprawling Villa A (Thomas and Clarke, 2007, 2008, 2009), and also flourished with at least three phases of development between the first century BC and 79 CE, Oplontis B has a very different history and function than its better known neighbor (Clarke, 2010; Fergola, 2003; Lagi, 2015; Thomas, 2015; Gazda, Clarke, 2016; van der Graaff, 2016).

Whereas Villa A is clearly a luxury villa designed for *otium*, or leisure, Oplontis B possibly functioned as a commercial complex, such an *horreum* or an emporium or a distribution center, the only known building of its type on the Bay of Naples (Lagi, 2015; Thomas, 2015). Di Maio's section drawing of Oplontis B shows the relatively low level at which it stood in Roman times, a position that was clearly less panoramic than that of Villa A but one with easy access to the sea and therefore more functional for commercial activities (Di Maio and Muntasser, 2016). The presence of two nearby roads and a row of town houses to the north suggests that the main courtyard, where excavators recovered the majority of the amphorae, occupies a position in a small settlement or town near the seashore, perhaps even the town of Oplontis itself (De Caro, 1994; Thomas 2015, 2016; Thomas, Clarke 2011). Abundant botanical materials were recovered at the site: i.e. pomegranates, hay, and walnuts (Ricciardi 1979). Pomegranates and hay were preserved stocked in alternative layers in one of the rooms (Ricciardi 1979).

Beyond the unique architecture of Oplontis B, a significant aspect of this site is the fact that the courtyard and ground-level rooms preserved over 1200 amphorae. Imported amphora types present at Oplontis B include Cretoise 1, 2, and 4, Dressel 5, Dressel 8, Ostia LIX, Schoene-Mau XIII, and Gauloise 5. However, the most prevalent amphora type by far was the Dressel 2–4, particularly the Vesuvian Dressel 2–4 (Muslin, 2016).

The excavators digging in the 1980s found groups of amphorae separated into three main stages of processing in the peristyle: dirty ones whose contents had been emptied, washed ones set upside down for drying, and filled or refilled ones that were sealed and ready for transport (Muslin 2016). Many of these, especially the ones found in the 1984 excavations of the northwest corner of the peristyle, were stacked upside down (Clarke, 2016, Fig. 3). Some of the amphorae preserved cork stoppers, while others had tap holes drilled into the lower walls, presumably for draining the contents without damaging the amphora necks. These holes could be later plugged, allowing for reuse of the vessel for new contents. The fact that some of the Dressel 2–4s display signs of repair for reuse after workers cut small holes in the body to tap them suggests that the amphorae themselves must have carried some value (Muslin, 2016).

A selection of eleven Dressel 2–4 amphorae were analyzed to test whether or not they carried wine and identify the origin of the organic coating. Oplontis B provided a perfect context where amphorae can be analyzed, as the amphorae were preserved in situ since the Vesuvian eruption of 69 CE and after they were excavated they were not restored nor moved from the site, with the only possible contamination coming from plastic, or rain filtering from the roof of the rooms where the amphorae are stored. In the case of samples OPL 1 and OPL 4, they were not moved from the original location and are still preserved in the volcanic materials of the eruption.

3. Materials and methods

A total of thirteen samples from eleven amphorae were analyzed. Two amphorae were recovered in situ from the pile of upside down amphorae located in the NW corner of the peristyle (OPL 1 and OPL 4); all the others but one of the amphorae were excavated in this corner, either as part of Group IV or Group III, named in the *Giornale di Scavo* of July 1984 (Muslin, 2016). These groupings may indicate stacks or rows but this is unclear from the label information. The presence of a cork located where the spike meets the body of one of the amphorae analyzed (OPL 12) suggests that the spike of this amphora was resting inside that of another amphora, as part of this storing practice. On the other side we

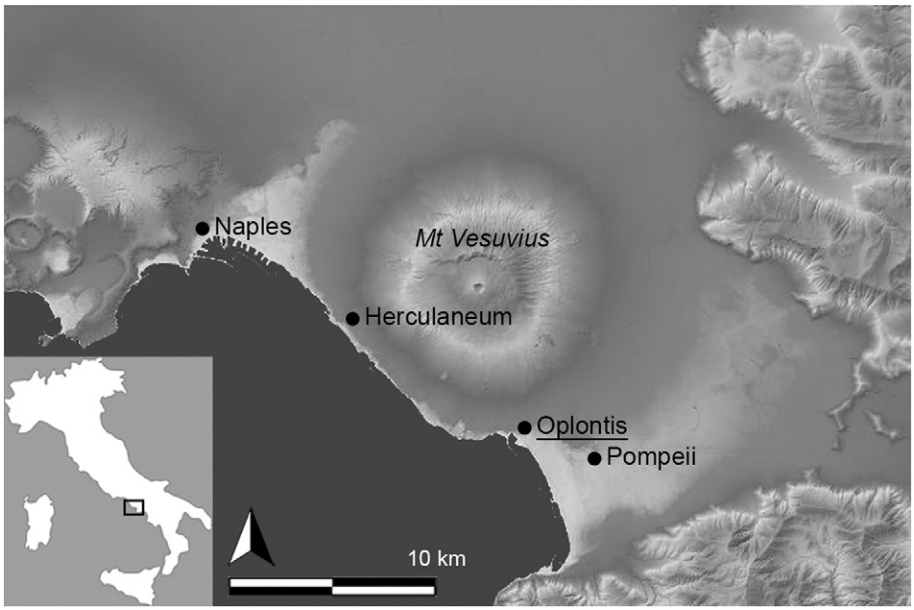

Fig. 1. Location of Oplontis.

Fig. 2. Map of Oplontis B with trenches and areas color marked.
Plan: Jess Galloway, after Van der Graaf (2016:65).

have evidence that at least two of the amphorae analyzed were sealed with a cork (OPL 7-173 and OPL 22). When we sampled the amphorae, most of them were no longer in their original location. The two amphorae (OPL 1 and OPL 4) sampled in situ were taken from the first row of the upside down amphorae in the NW corner, and were selected because it was possible to reach them without removing the modern barriers. OPL 1 shows the hole that was used to empty amphorae of its original content. Only one of the analyzed amphorae (OPL 1-167B) did not show the original location in the label and therefore we do not have any information on the original find spot. All of the amphorae showed a visible lining (Table 1), suggesting the use of pitch for the waterproofing of the vessels. Amphorae OPL 7-173 and OPL 22 preserved evidence of a cork stopper in the neck. Eleven samples were taken from the interior of the amphorae walls. One sample was taken from the solid residue preserved in the bottom of one amphora (OPL 12 solid residue) and one from a fragment of preserved cork lid of one amphora: the cork was stuck to the point of amphora OPL 12 (Table 1, Fig. 4).

Fig. 3. Amphorae stored upside down in the courtyard of Oplontis Villa B.
After Clarke 2016, Fig. 4.10.

Sample OPL 11 comes from an amphora with a *titulus pictus* in red pigment on the shoulder. One can read the Latin letters *CEL*; it is currently under study. All the samples were pulverized. The powdered samples were subjected to different extraction methods: a. The total lipid extract (TLE) was obtained on 2 g of pulverized sample following the procedure described by Mottram et al. (1999), using chlorophorm/methanol (2:1, 3 × 3 mL), and its hydrolysis was obtained following Pecci et al. 2013b using KOH in MeOH; b. For the identification of wine markers, the method of Pecci et al. (2013a) was used: 500 mg of the powdered sample was extracted with KOH (1 M, 3 mL) in water, in a sonicated bath at 70 °C for 90 min. After cooling and centrifugation, the supernatant was recovered and acidified with HCl. Ethyl acetate was added to the acidified solution (3 mL × 3) and mixed by vortexing. The supernatant was recovered and dried using a gentle stream of nitrogen; c. A two-step protocol for wine residues extraction modified from Garnier and Valamoti (2016), was tested on two samples (7-173 and

Table 1
Analyzed amphorae typology and fabrics.

Sample id	Form	Fabric/color/surface treatment
OPL 11	Campanian Dressel 2/4 Panella Fano Group 3	Black sand Vesuvian fabric (mix of red and buff clays) Munsell 5YR 7/6 white coating on exterior
OPL 22	Campanian Dressel 2/4 Panella Fano Group 3	Black sand Vesuvian fabric (mix of red and buff clays) Munsell 5YR 7/6 white coating on exterior
OPL 12	Campanian Dressel 2/4 Panella Fano Group 3	Black sand Vesuvian fabric Munsell 2.5YR 6/8 white coating on exterior
OPL 2_107	Campanian Dressel 2/4 Panella Fano Group 3	Black sand Vesuvian fabric Munsell 2.5YR 6/8 white coating on exterior
OPL 112_23	Campanian Dressel 2/4 Panella Fano Group 3	Black sand Vesuvian fabric Munsell 2.5YR 6/8 white coating on exterior
OPL 1_167	Campanian Dressel 2/4 Panella Fano Group 3	Black sand Vesuvian fabric (mix of red and buff clays) Munsell 5YR 7/6 white coating on exterior
OPL 7_173	Campanian Dressel 2/4 Panella Fano Group 4	Black sand Vesuvian fabric Munsell 2.5YR 6/8 white coating on exterior
OPL 2_168	Campanian Dressel 2/4 Panella Fano Group 3	Black sand Vesuvian fabric (mix of red and buff clays) Munsell 2.5YR 6/6 white coating on exterior
OPL 23_128	Campanian Dressel 2/4 Panella Fano Group 3	Black sand Vesuvian fabric Munsell 2.5YR 6/8 white coating on exterior
OPL 1	Campanian Dressel 2/4 Panella Fano Group 3	Black sand Vesuvian fabric Munsell 2.5YR 6/8
OPL 4	Campanian Dressel 2/4 Panella Fano Group 3	Black sand Vesuvian fabric Munsell 2.5YR 6/8

123-128), where the pitch was very thick, in order to better identify the presence of tartaric acid in the samples, and to eliminate free syringic acid (Garnier and Valamoti, 2016). For these samples Extraction b was carried out on the solid residue after the TLE (a) extraction. The difference from the method proposed by Garnier and Valamoti is that the extraction aimed at identifying the wine residues, which in our case is the same as extraction b. We also conducted analyses of blank samples following the same methods used for the analysis of archaeological samples.

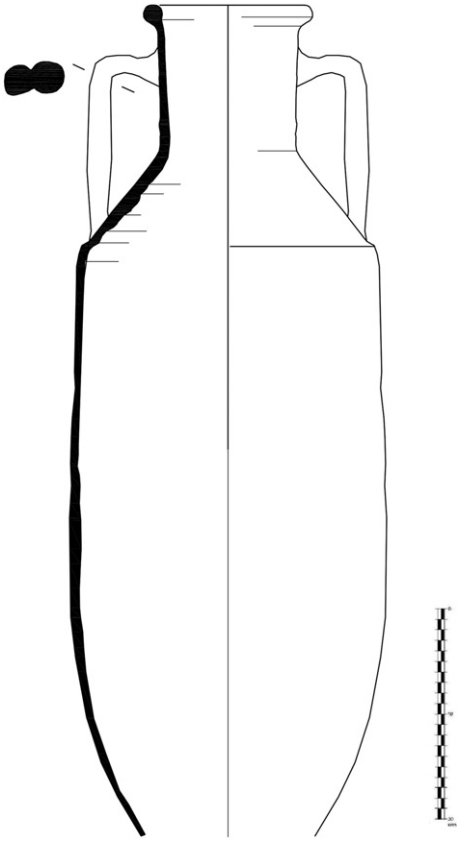

Fig. 4. Drawing of one of the amphorae analyzed. Luana Toniolo's drawing.

All the extracts were derivatized by adding 25 μL of *N*,*O*-bis(-trimethylsilyl)trifluoroacetamide (BSTFA, Sigma Aldrich) at 70 °C for 1 h. All the extracts were analyzed using a gas chromatograph CP3800 (Varian, Walnut Creek, CA, USA) equipped with a DB5 30 m, 0.25 mm (i.d.)–0.25 mm film thickness fused silica capillary column and a mass spectrometer Saturn 2000 (Varian, Walnut Creek, CA, USA) operated in the electron ionization mode (70 eV). The mass range was scanned in the range of *m*/*z* 40–600. The GC oven temperature was held at 50 °C for 1 min, then increased at 5 °C/min up to 300 °C and held isothermally for 10 min. Peaks identification was carried out by comparing spectra with the NIST (version 2.0) and standards of tartaric, succinic, malic and fumaric acids.

4. Results and discussion

As stated above, all the amphorae showed a visible coating. The results of the analysis confirm that all the amphorae were coated with Pinaceae products: the chromatograms of the three extracts of all the samples show their markers, namely dehydroabietic acid, didehydroabietic acid and 7-oxo dehydroabietic acid (see Table 2). While in sample OPL 2-168 there are only the markers of Pinaceae products but not of their heating, in sample OPL 112-123 retene is present indicating that Pinaceae resin was heated, probably during the production process or to soften the resin in order to better apply it to the amphorae. On the other side, in the total lipid extracts of samples OPL 11, OPL 12, OPL 22, and in the extracts (b) or (c) of samples OPL 23-128, 2-107, 1-167, 7-173 we identified methyl dehydroabietate, indicating that pitch obtained directly from the wood of Pinaceae was used to coat the amphorae (Mills and White, 1977; Colombini et al. 2005) (Fig. 5). Pitch is also abundant in the samples of the dark deposit in the bottom of amphora OPL 12 and the cork that was stuck to amphora OPL 12. No markers of the content of the amphorae were identified in these two samples. The possibility of identifying wine in resin/pitch samples has been discussed elsewhere (Stern et al. 2008; Mc Govern and Hall, 2016). In this case it is possible that the signal of the wine was covered by the abundant signal of Pinaceae products, or that no wine was present in the sample. In fact it is possible that no wine came into contact with the cork stopper, where the Pinaceae products were probably used to seal it, and or that the solid residue preserved in the bottom of amphora OPL 22 came from the sealing of the stopper and not from resin/pitch added to the wine. In the future special extractions for these kinds of samples should be performed. However, the results obtained for the two samples do not change the interpretation of the content of the amphorae, which was reliably identified through the analysis of the residues adsorbed by the ceramic matrix.

As for the residues preserved in the ceramic matrix of the eleven amphorae samples, we can confirm that no traces of oil or fish products were present in the samples. On the contrary, the results of the analyses allowed for the identification of succinic, and tartaric acids which are markers of the presence of fermented grape juice, i.e. wine or its derivatives (Garnier 2007; Garnier and Valamoti, 2016; Guash-Jané et al., 2004; Mc Govern et al. 2013; Pecci et al., 2013a, 2013b) in all the samples (Table 1, Figs. 5, 6 and 7). Together with these two acids there are other acids such as fumaric, maleic, malonic and vanillic acids in some samples. Although other fruits, such as tamarind, also contain tartaric acid (Barnard et al. 2011), the scarce diffusion of these products in the investigated area, as opposed to the wide diffusion of wine in the Western Mediterranean, suggests that the analyzed amphorae contained wine. Moreover, although wine and its derivatives (i.e. vinegar) share the same markers when analyzed with the method used here (Pecci et al. 2013a) it is likely that wine was transported in the amphorae, due

Table 2
Samples analyzed and summarized results of the analyses.

Sample id	Typology	Part sampled	Evident coating	Wine (succinic and tartaric acids)	Pinaceae products	Notes
OPL 11	Campanian Black Sand Dressel 2–4 Panella Fano Group 3	Int wall	X yellow	X	Pitch	Epigraphy
OPL 12	Campanian Black Sand Dressel 2–4 Panella Fano Group 3	Int upper wall	X black	X	Pitch	
OPL 12-solid residue	Campanian Black Sand Dressel 2–4 Panella Fano Group 3				Pitch	
OPL 12-cork	Campanian Black Sand Dressel 2–4 Panella Fano Group 3				Pitch	Stuck to the spike of amphora 12
OPL 22	Campanian Black Sand Dressel 2–4 Panella Fano Group 3	Int wall	X black	X	Pinaceae products	Has a cork stopper
OPL 2_107	Campanian Black Sand Dressel 2–4 Panella Fano Group 3	Int wall	X black	X	Pitch	
OPL 112_23	Campanian Black Sand Dressel 2–4 Panella Fano Group 3	Int wall	X black	X	Pinaceae products	
OPL 1_167	Campanian Black Sand Dressel 2–4 Panella Fano Group 3	Int wall	X yellow	X	Pitch	
OPL 7_173	Campanian Black Sand Dressel 2–4 Panella Fano Group 4	Int wall	X black	X	Pitch	Has a cork stopper
OPL 2_168	Campanian Black Sand Dressel 2–4 Panella Fano Group 3	Int wall	X black	X (white)	Pinaceae products	
OPL 23_128	Campanian Black Sand Dressel 2–4 Panella Fano Group 3	Int wall	X black	X	Pitch	
OPL 1	Campanian Black Sand Dressel 2–4 Panella Fano Group 3	Int wall		X	Pinaceae products	In situ sampling (no drawing was possible)
OPL 4	Campanian Black Sand Dressel 2–4 Panella Fano Group 3	Int wall		X	Pinaceae products	In situ sampling (no drawing was possible)

to the fact that wine was usually transportedin amphorae and not vinegar.

As for the type of wine contained in the amphorae, the syringic acid present in six samples (2-107, 22, 12, 11, 23-128 and 73-173) could be free syringic acid or could derive from the presence of malvidine in the grapes and therefore be a marker of red wine. The presence of syringic acid in samples 123-128 and 73-173, where we applied the double step protocol to avoid identification of free syringic acid (Garnier and Valamoti, 2016), suggests that red wine was contained at least in the two amphorae. In three samples syringic acid is not identified. The literature states that the absence of syringic acid indicates a white wine content (Guash-Jané et al., 2006, Barnard et al., 2011) and this would suggest a white wine content at least for these amphorae.

In general, the data obtained with the analyses confirm that all of the amphorae analyzed contained wine and were coated with Pinaceae products. Recent studies have demonstrated that almost all the amphorae analyzed show residues of an organic coating, whether the coating is evident to the naked eye or not, and whatever was the content of the vessels (Barnard et al. 2011; Garnier et al. 2011; Mc Govern et al., 2013; Pecci 2009; Pecci and Cau, 2010, 2014; Pecci et al. 2010a, 2010b; Salvini et al. 2007; Romanus et al. 2009; Stern et al. 2008; Woodworth et al. 2015). In particular, it is important to underline that the presence of visible residues of resin/pitch is not necessary related with a wine content of the amphorae, as Stern et al. (2008) and Garnier et al. (2011) have shown. It is possible that the presence of a thick organic coating could be related to a wine content, because resin or pitch were used not only as sealants, but also as a preservative and to give flavor to the wine (Allevato et al. 2012; Mc Govern et al. 2013; McGovern and Hall 2016; Stern et al. 2008). In any case, in order to suggest the content of amphorae, residue analyses must always be performed, looking for all the residues preserved in the amphorae, including specific analyses aimed at identifying wine residues, and it is not possible to infer it just from a naked eye analysis, nor from the analysis of only the lipid fraction

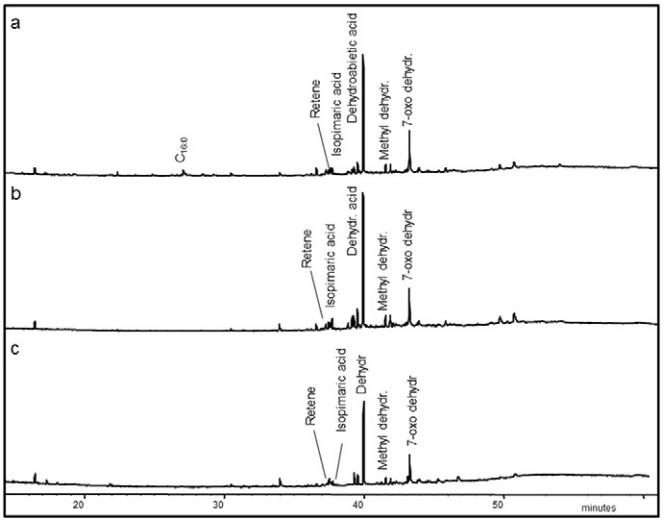

Fig. 5. Chromatogram of the total lipid extract of samples OPL 22 (a), OPL 11 (b) and OPL 12 (c) where heated Pinaceae pitch markers are present.

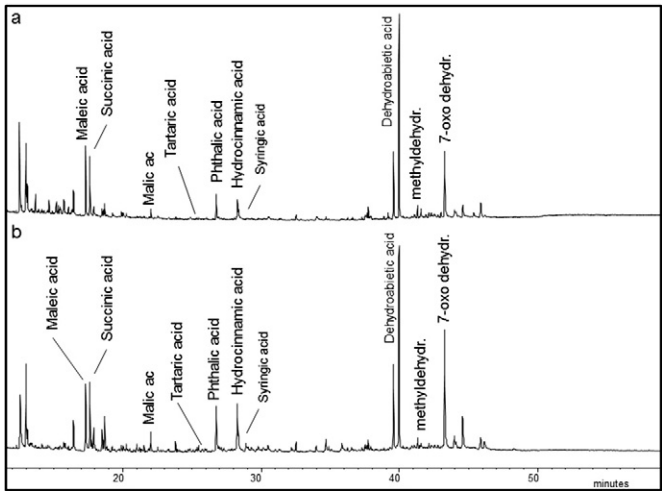

Fig. 6. a. Chromatogram of extract b of sample OPL 11; b. Chromatogram of extract b of sample OPL 12.

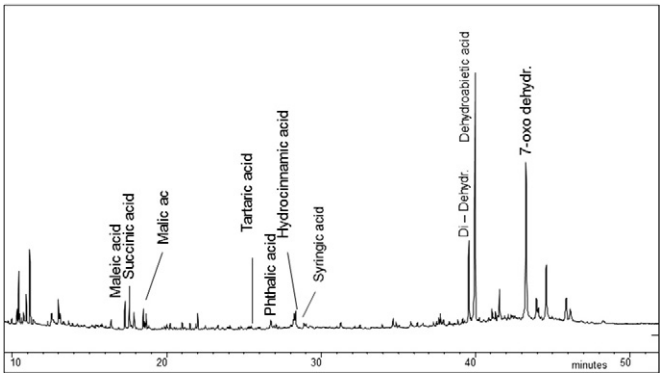

Fig. 7. Chromatogram of extract b of sample OPL 22.

or with FTIR (Barnard et al. 2011; Garnier and Valamoti, 2016; Guash-Jané et al., 2004; Pecci et al. 2013a, 2013b; Mc Govern et al. 2013).

The presence of Pinaceae products in the amphorae at Oplontis B correlates with the recovery of two copper alloy pots filled with pitch that were suspended over a heating element, possibly a small oven (Lagi 2015; Thomas, 2016; Muslin 2016).

As for the wine content of all the Dressel 2–4 amphorae analyzed, this datum is interesting for two different reasons. On one hand, it confirms that the first content of Dressel 2–4 amphorae was wine, corroborating the historical hypothesis on their content (Arthur 1991, 1995; Panella, Fano 1977; Tchernia 1986). On the other hand, it sheds light on one aspect often underestimated in the study of amphorae contents: reuse (Peña, 2007). Residue analysis has already provided evidence of the reuse of amphorae in the past, mostly when related to the presence of a plant oil and wine in the same amphora (Pecci 2009; Pecci et al. 2010a). In fact, as the ceramic matrix absorbs all the substances that come into contact with it, it is not possible to understand whether the residues identified in the amphorae were present at the same time, as part of a mixed content, or were contained in different moments. As for amphorae, the only situation in which residue analysis surely speaks about a certain reuse is the case in which oil and wine are identified in the same sample (Pecci 2009). While fish by-products and wine or fish by-products and oil could either be a unique content or two successive contents, wine and oil could not be contained at the same time in one vessel. If samples are taken in the lower part of the wall of the amphora (to avoid the possibility that the oil was used to seal the wine content on its surface, as ethnographic cases show), when we identify the bio-markers of these two substances we can affirm that the amphora was reused. Examples for this come from amphorae from the Late Antique phases of Florence and from Gortina (Pecci 2009, Pecci et al. 2010a).

At Oplontis B we face a different situation. The results show that among the amphorae analyzed, none were found without residues, suggesting that none of them was new. Moreover, the residue analysis of all the amphorae analyzed shows the evidence of only one content: wine. However, the archaeological context provides a further hint: as we stated above, two of the amphorae are still upside down and most of the others were likely in the same position (with the possible exception of OPL 1-167B). Moreover, the presence of holes in the wall of some of them, suggests that they were emptied. All these data suggest that the amphorae were empty and waiting to be filled again. Therefore, the presence of wine residues preserved in the ceramic matrix indicates that they were waiting to be reused. It is not possible to determine whether the amphorae had been filled with wine just once or more than once before being stored at Oplontis B, since, as stated above, we "see" the sum of all the contents of the amphorae, and wine + wine = wine. The reuse of the amphorae at Oplontis is "Reuse of Type A" of Peña (2007:vi): "reuse involving an application similar to the vessel's prime use application without any physical modification to it". In fact, it is likely that the Dressel 2–4 analyzed were waiting to be filled with liquids again (possibly with wine), and therefore the use of amphorae as transport containers would not be changed ("reuse involving an application similar to the vessel's prime use application").

5. Conclusions

Although the number of amphorae analyzed in this project is still small compared to the large amount of materials recovered at Oplontis B, the results yielded important findings. On one hand, they confirm the hypothesis that Dressel 2–4 amphorae likely contained wine. On the other hand, they provide evidence for the reuse of the amphorae analyzed. Further investigations are needed to better understand the phenomenon of reuse. It could be related to economic reasons, since reusing empty amphorae could be cheaper than buying new amphorae every time there was a new vintage to be shipped, as Lagi (2015) argues for the amphorae from Oplontis B. She also suggests that, being of mixed typologies, these amphorae were possibly used for the local market, where, unlike the case with overseas trade, the form of the amphora no longer guaranteed the certainty of its contents or their level of quality. However, the fact that most of the amphorae were Dressel 2–4 might also indicate the existence of a "trademark" for the wine transported in them.

Future development of DNA analyses applied to amphorae contents could provide interesting data to further investigate the theme of the provenance and quality of the wine contained in the different amphorae (Foley et al. 2012).

In order to make this possible, future studies at Oplontis B will broaden the number of amphorae analyzed, perhaps focusing on the vessels with epigraphic data and amphora types other than the Vesuvian Dressel 2–4. They will also integrate the residue analysis of amphorae contents with the characterization of the ceramics matrix to verify their origin and better understand the movement of ceramics and goods. Finally the data obtained with the study of the amphorae will be integrated in the broader study of the archaeological site in order to expand our knowledge of the function of Oplontis B and the production and consumption of agricultural products in the area.

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