COSMETIC PRODUCTS IN ROMAN FUNERARY CONTEXTS FROM TOMIS: PRELIMINARY INVESTIGATION OF THEIR CHEMICAL COMPOSITION

Dedicated to the memory of Constantin Chera

Alexandra ȚÂRLEA
Department of Ancient History, Archaeology and History of Art,
Faculty of History, University of Bucharest
alexandra.tarlea@istorie.unibuc.ro
ORCID ID: https://orcid.org/0000-0001-8239-9745

Laurențiu CLIANTE
Museum of National History and Archaeology, Constanţa, Romania
cliante@gmail.com
ORCID ID: https://orcid.org/0000-0002-9104-0686

Aurelia PARASCHIV
Museum of National History and Archaeology, Constanţa, Romania
aura.paraschiv@gmail.com
ORCID ID: https://orcid.org/0009-0006-7243-116X

Daniela CRISTEA-STAN
"Horia Hulubei" National Institute for Nuclear Physics and Engineering, Măgurele, Romania
daniela@nipne.ro
ORCID ID: https://orcid.org/0000-0001-7537-5884

Irinel BADEA
Faculty of Chemistry, University of Bucharest
irinel.badea@chimie.unibuc.ro
ORCID ID: https://orcid.org/0000-0003-3503-9856

Mihaela BULEANDRA
Faculty of Chemistry, University of Bucharest
mihaela.buleandra@g.unibuc.ro
ORCID ID: https://orcid.org/0000-0001-9288-1842

Abstract: A large number of glass vessels were recovered from funerary contexts, during older excavations in the Roman necropolises of Tomis (Constanţa, Romania), conducted by late Dr. Constantin Chera, from the Museum of National History and Archaeology Constanţa. This batch of archaeological material is currently under research, and it is hoped to be published in the near future. Among these glass grave goods, three containers were still preserving remains of their original contents, presumably cosmetic products, and they represent the focus of the present paper. The results of preliminary investigations, using the X-Ray Fluorescence (XRF) technique and the Headspace Chromatography – Mass Spectrometry (HC-MS) technique, of their composition are presented and discussed.

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Rezumat: Un mare număr de vase de sticlă au fost descoperite în contexte funerare, în cursul unor săpături mai vechi în necropolele romane ale cetății Tomis (Constanța, România), coordonate de regretatul dr. Constantin Chera, de la Muzeul de Istorie Națională și Arheologie Constanța. Acest lot de materiale arheologice se află în prezent în cercetare, și se speră că va fi publicat în viitorul apropiat. Printre aceste piese de inventar funerar, trei vase, datate în secolele II-III p.Chr., încă mai păstrau ceva din conținutul original, și acestea reprezintă punctul central al acestui articol. Rezultatele unor investigații preliminare, folosind tehnicile XRF și HC-MS, asupra compoziției acestor conținuturi, sunt prezentate și discutate aici.

Keywords: Roman glass containers, cosmetic products, compositional analyses, XRF, HC-MS, Tomis

Cuvinte-cheie: vase de sticlă romane, produse cosmetice, analize de compoziție, XRF, HC-MS, Tomis

INTRODUCTION

A large number of glass vessels were recovered from funerary contexts, during older excavations in the Roman necropolises of Tomis (Constanţa, Romania), conducted by late Dr. Constantin Chera, from the Museum of National History and Archaeology Constanţa. This batch of archaeological material is currently under research, and it is hoped to be published in the near future.

Among these glass grave goods, three containers, dated to the 2nd – 3rd c. AD, were still preserving remains of their original contents, and they represent the focus of the present paper.

FIND CONTEXT

The necessary information for connecting the analysed samples to their original context was gathered on one hand from the tags associated with the glass grave goods in the bags and plastic boxes in which the archaeological material was deposited, and on the other hand from the excavation journals of Dr. Constantin Chera.

It should be emphasised that the archaeological material discussed here belongs to three funerary contexts excavated in 1995, 1997, and 2003. This period, as the one before 1989, was still characterised by an unfortunate general lack of funding and appropriate means for archaeological excavations and subsequent preservation and research of finds in Romania. Therefore, the archaeologists were forced to make do with what they had at their disposal. As a result, it is not surprising that tags were frequently written on re-used pieces of paper, fragments of notebooks or newspaper pages, or pieces of paper bags. The writing was often in pencil, or, even worse for long-term preservation, in earlier instances in chemical pencil, which does not react well in conditions of humidity, making the information illegible. The archaeological material was kept in re-used boxes, usually made of cardboard. The archaeologists kept their excavation journals on old notebooks, used sometimes for multiple campaigns, and economically written.

This variation in the quality of materials and utensils used for recording and preserving the archaeological material can be noticed also in this specific case.

Tomis 1

The glass vessel is a bell-shaped *unguentarium*, blown, colourless, with the body completely preserved and the neck broken. Its content is still preserved inside. Probably in association with the fact that this specific item received an inventory number, the tag was written at some point on computer and then printed. The margins indicate that the tag was cut from a larger sheet of paper (Fig. 1).

Fig. 1. The fragmentary bell-shaped *unguentarium* and its tag (photo by L. Cliante)

Fig. 2. The base of the bell-shaped *unguentarium* with the inventory number written in black ink (photo by A. Paraschiv)

The information on the tag contains the following details:

- inventory number ("Inv. 46777")
- date of excavation: July 10th, 1997 ("10.07.1997")
- find place: Mircea cel Bătrân Street (in the abbreviated form "Str. Mircea"), with the more precise location – the Library ("Biblioteca")
- the grave: grave/burial no. 3 ("M3"), with an interesting detail – skeleton 0 ("sch. 0")
- supplementary, the abbreviated word "Clis." ("Clişeu") indicated that a photo of the item was taken and existed in the photographic archive of the museum
- details about the item: glass vessel in the shape of a bell with substance ("vas sticla clopot cu substanta")

The information on the vessel itself, written in black ink on the base, indicates the inventory number – 46777 (Fig. 2).

The information extracted from the excavation journal contains the following data. A rescue excavation started on July 10th 1997 on Mircea cel Bătrân Street (Biblioteca), bringing to light an important number of funerary structures. The deceased were placed in wooden coffins, inside niches blocked with stone slabs or large tiles. A note indicating that on July 17th were already recovered six skulls, and two more on July 18th, shows that the excavation lasted at least nine days. There were identified five burials (M1-M5), of which one partially destroyed a sixth, earlier, burial (named M0).

The important details from the point of view of the present discussion regard the find identified as "burial 0" (M0). On July 10th, C. Chera noted that burial 3 (M3), inhumation in a niche blocked by two large stone slabs, cut a previous burial, also in a niche, which received the name of M0. The surviving human bones in M0 were from the pelvis down. Associated with this destroyed skeleton, there were found **a glass bell-shaped vessel left without neck**, placed near the legs of the deceased on the right, and a small ceramic mug and ceramic lamp placed near the legs on the left. There were also recovered coffin nails and small nails, as well as bronze rivets from shoes (Fig. 3).

Tomis 2

The glass vessel is a candlestick *unguentarium*, almost completely preserved, only the rim being broken. Its content was presumably removed after finding, and the vessel is currently empty and clean. The tag was written in pen, on a piece of paper, which seems cut from a notebook (Fig. 4).

The information on the tag contains:

- date of excavation: November 18th, 2003 ("18.11.2003")
- find place: Călugăreni Street, with the more precise location – RAJA ("Călugăreni RAJA")
- the grave: grave/burial no. 1 ("M1")

The information extracted from the excavation journal contains the following data. On November 18th 2003, the rescue excavations conducted on Călugăreni Street, in the area of the RAJA building, brought to light three burials.

The one concerning the present discussion is burial 1 (M1), inhumation in an unblocked lateral niche. The bones were found disturbed, the archaeologist noting that the position of the hands could not be established anymore. The funerary structure was only partially excavated, due to the fact that a part was caught in the profile of the excavation trench. Among the surviving/recoverable grave goods are mentioned a coin at the legs of the deceased, and towards the entrance of the niche a small ceramic lamp and **a glass candlestick vessel with oily substance inside** (Fig. 5).

Tomis 3

The glass vessel is broken in a large number of small fragments, with some parts missing; the surviving pieces were placed together in a bag. Therefore, it is impossible to determine with certainty the type and shape of vessel; only that it was made of very thin colourless glass. The powdery content is present attached to the glass shards, and also mixed with them.

The information on the tag contains:

- date of excavation: October 18th, 1995 ("18.10.1995")
- find place: Răscoalei Street ("Str. Răscoalei")
- grave: grave/burial no. 2 ("M2")

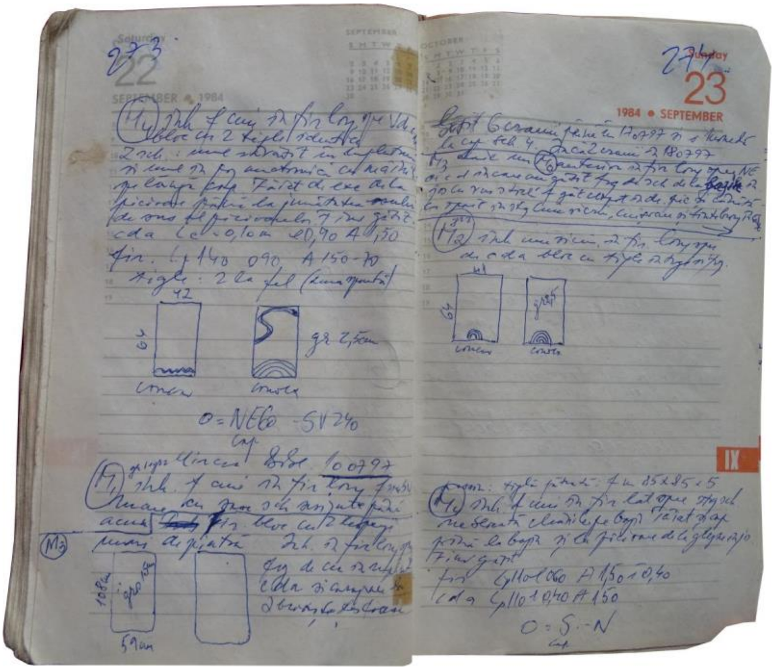

Fig. 3. Page from the excavation journal 1989-1999 of C. Chera, with relevant information regarding the burial and its grave goods (photo by L. Cliante)

Fig. 4. The fragmentary candlestick *unguentarium* and its tag (photo by L. Cliante)

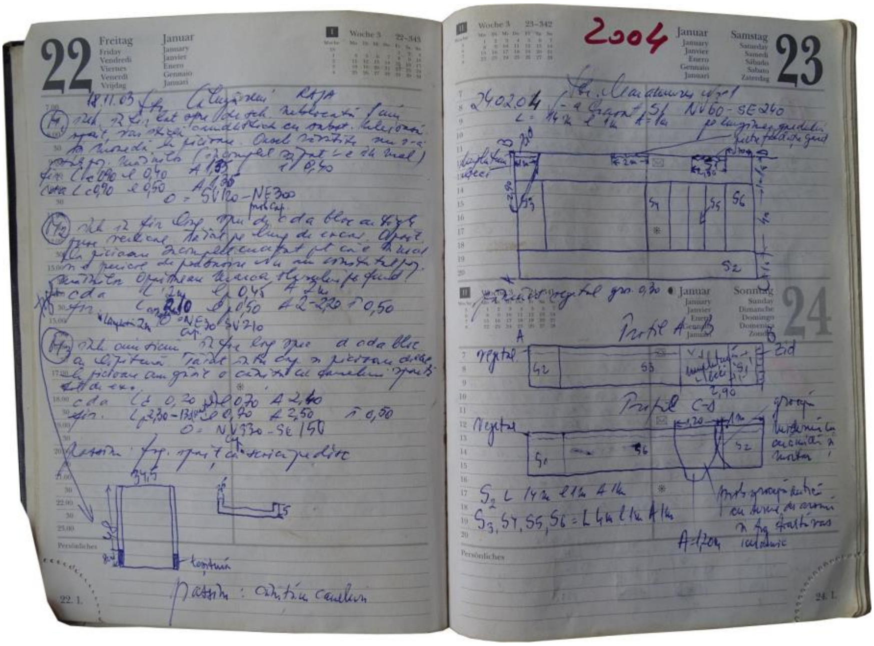

Fig. 5. Page from the excavation journal 2002-2003 of C. Chera, with relevant information regarding the burial and its grave goods (photo by L. Cliante)

The information extracted from the excavation journal offered the following details. A rescue excavation started on October 6th 1995 on Răscoalei Street, bringing to light two burials (M1-M2). It should be supposed that the excavation of these funerary structures lasted at least until October 18th, the date written on the label of the vessel under discussion here. The next notation in the notebook is from October 25th 1995, dealing with another funerary context found in the same location.

Burial 2 (M2) is the one of interest for the present discussion, in conformity with the tag associated with the destroyed vessel. The grave, consisting of a simple pit with threshold, contained two skeletons, one adult and one child. The grave goods associated with the adult and mentioned in the notebook as placed at the legs are: small ceramic mug, **destroyed glass vessel**, glass jug, beads, glass plate with another **destroyed glass vessel placed inside**, small bronze vessel, bone ring. The grave goods associated with the child and placed also at the legs are: glass vessel, another **destroyed glass vessel**, ceramic lamp. The problem in this case is that it is impossible to determine which of the three vessels described as destroyed (in fact the very expressive term used in the journal is "ground", indicating the degree of deterioration of these vessels) is the one still preserving the powdery substance inside, as no special mention is made in the notebook (Fig. 6).

THE SAMPLES

Tomis 1

A small sample was extracted from the fragmentary bell-shaped *unguentarium*. The vessel still contains a fatty/waxy substance, filling part of the vessel's body. The content is slightly visible through the glass walls. The saponification of the content resulted in an inhomogeneous aspect, with whitish-grey, brownish, and reddish streaks, and an almost black pellicle in some areas (Figs. 7-9).

Tomis 2

The sample was extracted from a fatty/waxy mass, orangey-red in colour, preserved in paper and plastic bag. The substance was presumably removed after finding from the vessel holding it. The connection between this content and its original container was determined combining the information on the paper in which the substance was kept with the label associated with the vessel. The confirmation was obtained based on the notation made by C. Chera in the excavation journal at the moment of the find, as mentioned above. The glass candlestick *unguentarium*, preserved almost completely, without rim, described in the journal as containing an oily substance, is currently empty and clean (Figs. 10-11).

Tomis 3

A small sample was collected from the bag containing the remains of the vessel. The glass vessel is broken in a large number of small fragments, with some parts missing. Therefore, it is impossible to determine the type and shape of vessel. It can be presumed, based on the surviving fragments, that it had a relatively long and narrow neck, without marked constriction between neck and body, which could have been conical or ovoid. It was made of thin colourless glass. Some powdery content is still present, attached to the glass shards and also mixed with them. The content presents itself as a white to beige white, very fine, homogeneous powder, partially forming small agglomerations. It has a slight lustre when seen against light (Figs. 12-14).

Various methods of investigation were used in the last decades for determining the composition of ancient cosmetic products, single or in many instances in combination, as required by the complexity of substances combining organic and inorganic ingredients[1].

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1 For a review of the analytical techniques employed in the case of cosmetics, see Ribbechini et al. 2011.

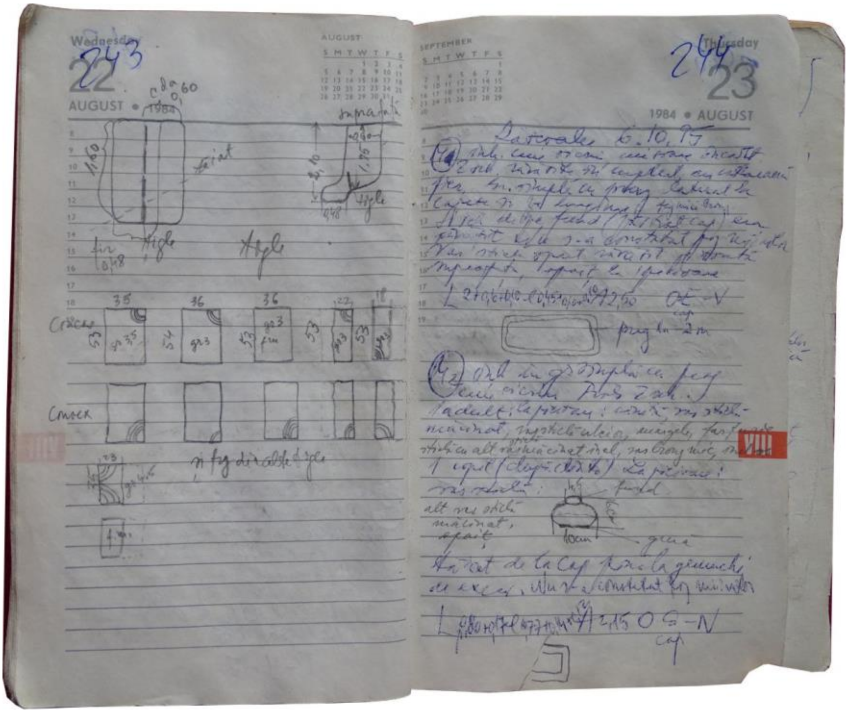

Fig. 6. Page from the excavation journal 1989-1999 of C. Chera, with relevant information regarding the burial and its grave goods (photo by L. Cliante)

Fig. 7. The bell-shaped *unguentarium* with its content – lateral view (photo by L. Cliante)

Fig. 8. The bell-shaped *unguentarium* with its content – view from above (photo by A. Paraschiv)

Fig. 9. Detail of the content sample from the bell-shaped *unguentarium* (photo by A. Ţârlea)

Fig. 10. The candlestick *unguentarium* – lateral view (photo by L. Cliante)

Fig. 11. Detail of the content sample from the candlestick *unguentarium* (photo by A. Ţârlea)

Fig. 12. Fragment of neck from the glass vessel (photo by A. Paraschiv)

Fig. 13. The mixture of glass shards and powder surviving from the destroyed vessel (photo by A. Paraschiv)

METHODS

X-Ray Fluorescence (XRF)

The composition of the three samples (Tomis 1, Tomis 2, and Tomis 3) was analysed using an ED-XRF handheld spectrometer Tracer 5i (Bruker Instruments), equipped with an Rh tube set behind a Be window, tension 6-50 kV, intensity 5-500 μA, acquisition time 60 and 90 seconds, respectively[2].

All three samples were analysed using the GeoExploration application, with an acquisition time of 90 seconds. The sample **Tomis 3** was also analysed using the Alloys 2 application, acquisition time 60 seconds.

Fig. 14. Detail of the content sample from the glass vessel (photo by A. Ţârlea)

Despite the obvious limitations of the method – among them the qualitative and semi-quantitative elemental analysis, surface analysis, and identification of only inorganic elements –, it was deemed as the most adequate for the first steps in analysing the samples from Tomis. The main advantage is its non-destructive character, essential when dealing with archaeological materials in general, as it allows obtaining interesting and useful insights into ancient technologies without further damaging the objects[3]. In this specific case – contents of ancient containers, the scarcity of such finds in the archaeological record and the reduced quantities of substances surviving in the vessels from Tomis make very problematic subjecting samples collected from them to destructive techniques.

Headspace gas chromatography – mass spectrometry (GC-MS)

A small part of sample **Tomis 1**, as being collected from the largest mass of substance of all three vessels, was subjected also to analysis using a destructive technique, in order to evaluate the chances of identifying something of the original organic component(s) of the ancient product.

The sample was analysed directly, without any preparation, using headspace gas chromatography-mass spectrometry (GC-MS). A Thermo Fisher Scientific Focus gas

2 Cristea-Stan et al. 2021.

3 Padfield 1972, 219.

chromatograph coupled with a Polaris Q ion trap mass spectrometer and a Triplus autosampler was employed for this purpose.

The system used a DB-5MS capillary column with the following specifications: 25 m in length, 0.25 mm in diameter, and 0.25 μm in film thickness. The oven temperature program began with an initial temperature of 60°C for three minutes. It then increased at a rate of 10°C per minute up to 200°C, which was held for two minutes. Finally, it increased at a rate of 12°C per minute up to a final temperature of 240°C. Helium was used as the carrier gas at a flow rate of 1 mL/min. The ion source and interface temperatures were set to 200°C and 250°C, respectively. The mass spectrometer operated in electron impact mode at 70 eV. Detection was carried out within an m/z range of 35–300, and the mass spectrometer operated in full-scan mode. Chromatogram analysis was performed using Xcalibur software supported by the NIST 11 database for compound identification. We used an alkane standard solution for gas chromatography (GC) (C8–C20 in hexane, Sigma-Aldrich, USA) to determine the Kovats indices (KIs).

RESULTS

The identification of the inorganic components of the three samples from Tomis using the XRF method

The result of the compositional analysis of sample Tomis 3 using the Alloys 2 application

The compositional analysis conducted on sample **Tomis 3** using the Alloys 2 application was the first to be conducted. It revealed high levels of calcium, strontium, as well as a strong presence of antimony. Other elements were also identified, such as tin and iron, as well as traces of copper, zinc, arsenic. The absence of lead should be emphasised at this point, an aspect that will be detailed later in the paper (Fig. 15).

The results of the compositional analysis of the three samples using the GeoExploration application

The elements identified in the three samples, using the GeoExploration application, are presented in the table below, in wt% (Table 1). The results of the analysis reflect the complex composition of all three substances.

In the case of the sample **Tomis 3**, the white powder, the investigation using GeoExploration, placed against the result of the analysis conducted in the Alloys 2 mode, confirmed the massive presence of calcium in the composition and the presence of antimony, as well as various minor and trace elements.

Again, it should be noticed the absence of lead as more than a very slight trace (and, even more, inside the error range), this time in the case of all the samples.

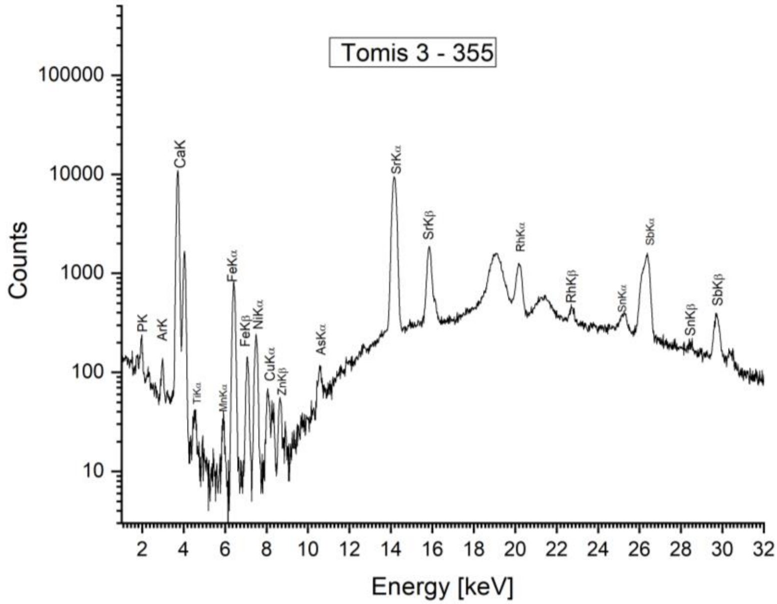

Fig. 15. Spectrum obtained for sample Tomis 3 using Alloys 2 mode

Table 1. The results of the XRF analysis using the GeoExploration application, expressed in wt% (■ major elements; ● minor elements; ▲ trace elements)

	Tomis 1	Tomis 2	Tomis 3
MgO	■	■	■
Al_2O_3	●	●	●
SiO_2	<LOD	■	■
P	▲	▲	●
S	▲	▲	▲
K_2O	<LOD	●	▲
Ca	■	■	■
Ti	▲	▲	<LOD
Mn	▲	▲	<LOD
Fe	▲	●	●
Ni	<LOD	<LOD	▲
Cu	▲	▲	▲
Zn	<LOD	▲	▲
As	▲	▲	▲
Sr	▲	▲	●
Sn	▲	▲	▲
Sb	<LOD	<LOD	●
Pb	▲	<LOD	▲

The identification of the organic component in sample Tomis 1 by using headspace gas chromatography – mass spectrometry (GC-MS)

The analysis, using headspace GC-MS, of a small part of sample **Tomis 1** led to the identification of an organic matter: 1,2-dipalmitoyl-glycerol (Fig. 16; 18-21).

As a diglyceride, its presence could be interpreted as a degradation product of other lipids. The original triglyceride (an ester of glycerol with three fatty acids) could be tripalmitin (Fig. 17), which represents an important component of animal and vegetal fats/oils.

Unfortunately, given the small size of the analysed sample, it was impossible to go further with the analyses for the moment.

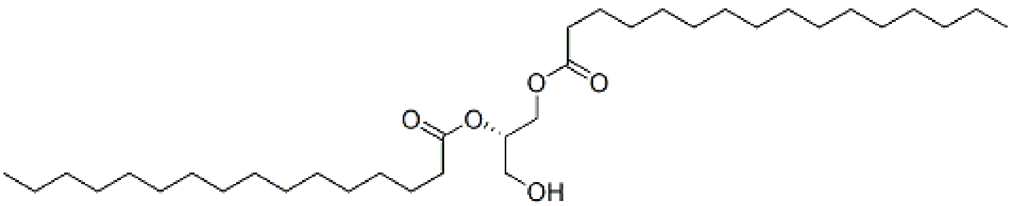

Fig. 16. The structure of the identified diglyceride

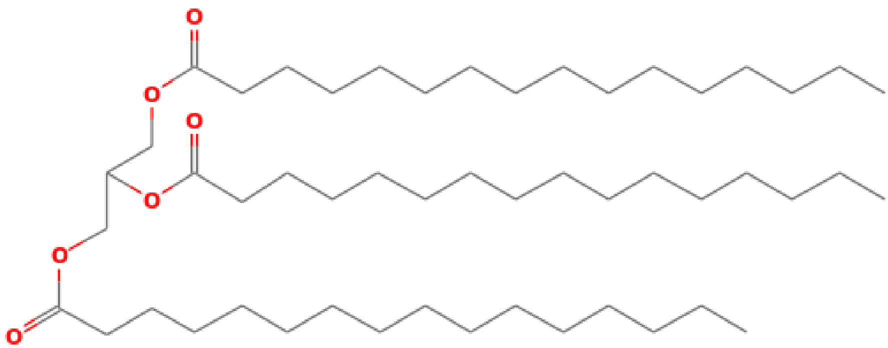

Fig. 17. The structure of tripalmitin, the triglyceride from which could have resulted the identified diglyceride

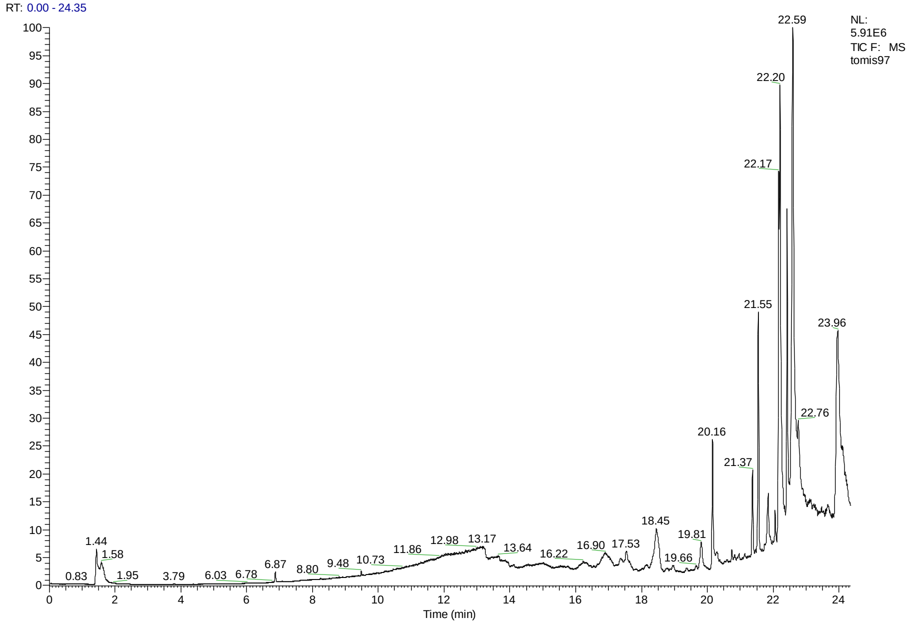

Fig. 18. Chromatogram of the analysed sample Tomis 1

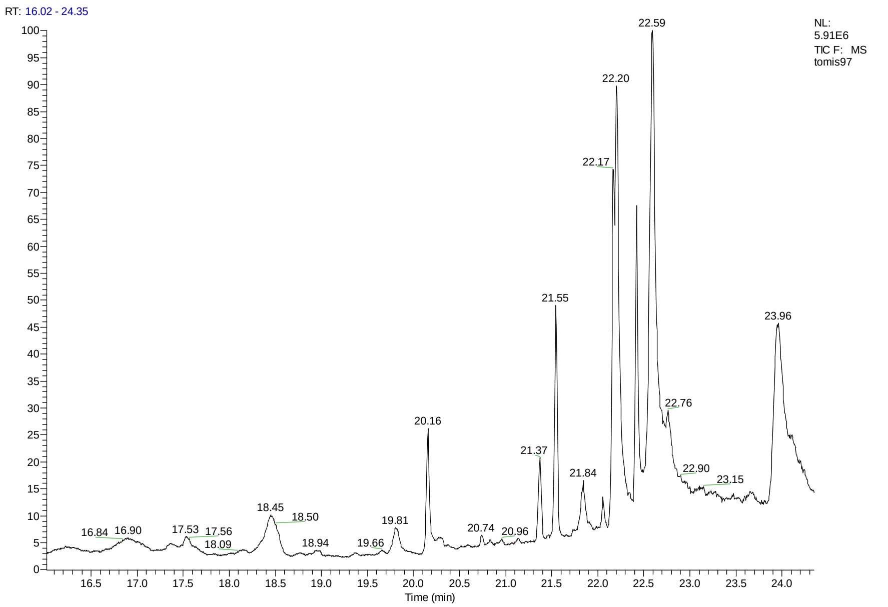

Fig. 19. Chromatogram of the analysed sample Tomis 1

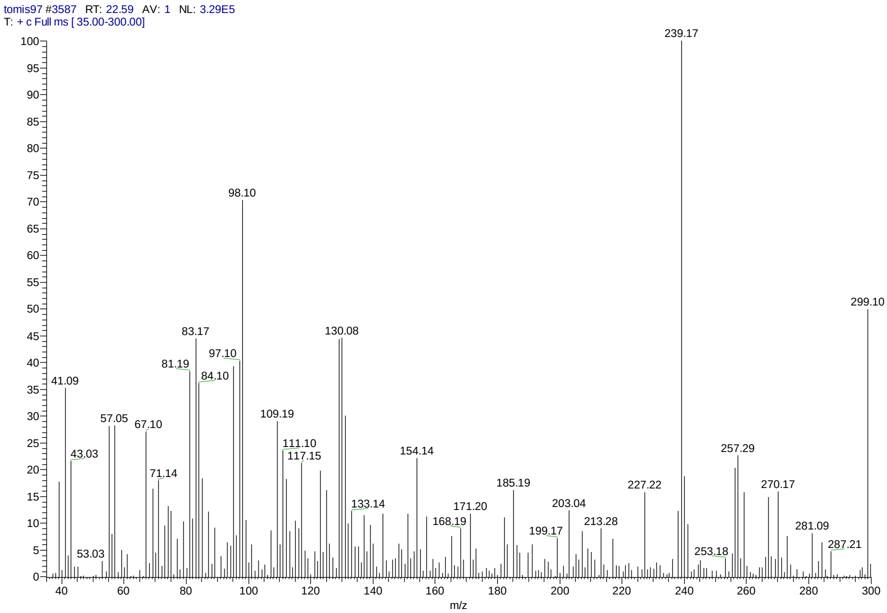

Fig. 20. Chromatogram of the analysed sample Tomis 1

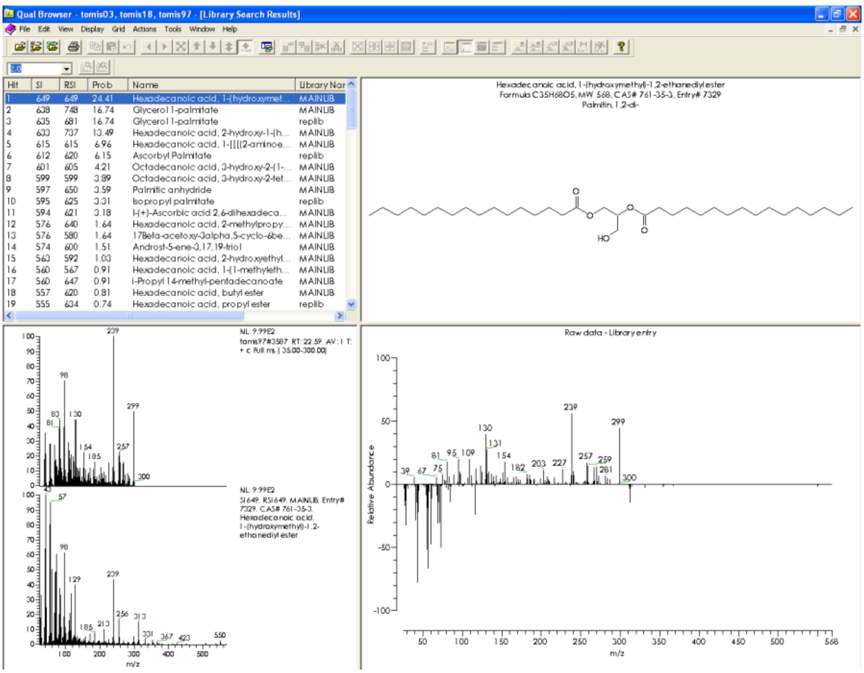

Fig. 21. The mass spectrum of the analysed sample Tomis 1

DISCUSSION

Although, as already stated, this represents only the first step in a series of analyses designed to determine with higher accuracy the composition of the cosmetic products found in Tomis, the results obtained so far are encouraging.

All three substances, despite the differences between them that are visible with the naked eye, are characterised by complex compositions. Even more, they also share the greatest part of the inorganic elements, in some cases only the percentages making the difference. This observation is interesting, given the fact that the fatty/oily/waxy texture and appearance of samples **Tomis 1** and **Tomis 2**, to which the identification of a diglyceride in the case of **Tomis 1** should be added, created another set of expectations from the results of the analysis.

The sample **Tomis 3**, XRF investigated in Alloys 2 and GeoExploration applications, proved to contain high percentages of calcium (> 11% Ca) and silica (> 7.5% SiO_2), as well as magnesia as another major element (> 2 % MgO) and alumina as minor element (0.58% Al_2O_3). It should be also remarked on the presence of antimony as a minor element (>0.6% Sb).

This combination could indicate a mixture of minerals, combining a base formed by calcite or gypsum with quartz and alumina. The quartz would have enhanced the whiteness and lustrous appearance of the powder, and the alumina would have offered a softer feel and higher degree of absorbency.

The use of a mineral such as calcite as a base would also help explaining the presence of antimony as a natural occurrence in the mix, as well as the traces of iron or manganese. It is unclear if the presence of tin is a natural occurrence or it was an added ingredient. It was quite conspicuous in the Alloys 2 reading, but the second analysis, using the GeoExploration application, shows its presence only as traces. The use of tin oxide as an ingredient, most probably with the purpose of making a white cream translucent, was identified in the case of a cosmetic dated to the 2nd c. AD[4].

The use of calcite or gypsum by themselves, as a base for cosmetics, serving most probably as face powder, during Roman times, was proved by compositional investigations using a variety of techniques, conducted during the last decades. These minerals were used either as such, retaining their white colour, or coloured with vegetal dyes.

The investigation of six samples of white cosmetic powders dated to the Roman period showed the use of either calcite or gypsum. Calcite was identified in two samples from Alesia (a small glass container and a glass bird-shape vessel) and two

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4 Evershed et al. 2004.

from Amiens (glass flasks). Gypsum was identified in a sample from Pompeii and a sample from Cologne (in both cases in glass bird-shaped vessels)[5].

In the same time, analyses conducted on white and pink powders of Roman period, found in glass bird-shaped vessels and glass spherical vessels from Netherlands, show that more complex mixtures also occurred sometimes. Out of the 12 analysed contents, four were gypsum, three were chalk, one was quartz, one was a mixture of chalk and quartz, two were mixtures of gypsum and chalk, and one was a mixture of an aluminosilicate and quartz[6].

Recent investigations, conducted on the content of similar bird-shaped vessels filled with pink powder, found in Austria, indicate that the vegetal dye was used on a base that was most probably alum[7].

The fact that aluminosilicates were in some cases used as a base for cosmetics is indicated also by older analyses conducted on samples of powder cosmetics recovered from a Roman sarcophagus found at Callatis (Mangalia, Romania)[8], so in a city neighbour with Tomis. The analyses conducted on four samples, corresponding to the four differently coloured cosmetics (yellow-red, ashy white, black, and vivid red), revealed the presence of calcium and magnesium aluminosilicates in all of them, in various concentrations. In the case of sample 1, yellow-red, it was advanced as probable main component a kaolin type mineral, while in the case of sample 2, ashy white, it was determined that, alongside aluminosilicate, the main component were calcium and magnesium phosphates[9]. The last mentioned result raises some questions, as it could indicate a mixture of a kaolin type mineral with an organic source of calcium and magnesium.

Therefore, a variety of minerals were considered appropriate for creating powders helping the ladies in obtaining a pale complexion[10] or as a base further coloured in order to create make-up for cheeks and lips[11].

Among further investigations, it is our intention to analyse the sample Tomis 3 under a polarising microscope, in order to determine more exactly the combination of minerals forming this cosmetic, especially as the identification of Mg and Si in the mix could also be indicative of the presence of talc among other ingredients. Also, if a

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[5] Welcomme et al. 2006, 553, Table 1.
[6] Hottentot, van Lith 2006.
[7] Hinker, Oberndorfer 2023.
[8] Rădulescu et al. 1973.
[9] Donato et al. 1975
[10] Van Elslande et al. 2008, 1873.
[11] Van Elslande et al. 2008, 1873.

large enough sample can be used, it should also be analysed for an eventual presence of an organic binder[12].

A final comment in the case of the composition of sample Tomis 3 regards the absence of lead, which could be identified neither in the Alloys 2 application, nor in the GeoExploration application[13]. From this perspective, the results match well both older analyses[14] and ones that are more recent. Not one of the white powders from the Netherlands showed more than traces of lead[15]. In the case of analyses conducted on white cosmetic powders of both Greek and Roman periods, the separation between them was extremely clear cut: all the cosmetics of the Greek period were lead-based (cerussite) – seven samples of 13, all the cosmetics of the Roman period were calcite-based or gypsum-based – six samples of 13. The authors themselves repeatedly emphasised that they did not found lead white pigments during the Roman period but only chalk or gypsum[16].

The samples **Tomis 1** and **Tomis 2** share between them and with sample Tomis 3 the identification of magnesia and alumina in their composition, as well as a series of minor and trace elements. These two samples share between them also the fact that most probably (certainly in the case of Tomis 1) were created using an **organic** binder. Still, there are also important differences between these two samples.

As it can be noticed consulting Table 1, sample **Tomis 1** is the one of the three substances most lacking in inorganic elements. The main absences in comparison with Tomis 2 are silica and potassium oxide. Otherwise, there is still a plethora of minor and trace elements identifiable in its composition. The combination of elements seems to indicate that – although it is quite certain that it was a fatty/oily/waxy cosmetic – the mixture was more complex. It is possible that to what could have been a face, body or hair unguent, some powders were added, for texture, consistency, own cosmetic/health qualities, or for prolonging the life of the product. The combination of identified elements would point towards small quantities of calcite/gypsum/chalk and kaolin or other similar white clay. It is unclear if the reddish/ochre parts are indicative of the presence of iron and copper as trace elements. New analyses should also try to

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12 Although all analyses conducted so far on powder cosmetics of Roman times indicated that no organic binder was used in their case (see, for example, Donato et al. 1975; Welcomme et al. 2006; Hottentot, van Lith 2006).

13 The value falls inside the error range of the device.

14 In the case of the samples from Callatis (Mangalia), the only one containing lead was the black powder, considered by the authors as being includable in the category of eye shadow cosmetics of kohl type (Donato et al. 1975, 11).

15 Hottentot, van Lith 2006, Table 1.

16 Welcomme et al. 2006, 555-556.

determine if vegetal components that could have influenced the colour were also present, and the presence of the diglyceride will be further investigated in an attempt to determine its origin.

Sample **Tomis 2** seems to be located between Tomis 1 and Tomis 3 from the point of view of its composition. The combination of elements seems to indicate a similar approach to this cosmetic during its production, with an organic binder and various organic and inorganic ingredients added to the mix. The larger range of inorganic elements points, for the moment, towards added quantities of calcite/gypsum/chalk and alumina or white clay, as in the case of Tomis 1, but also possibly potassium alum and talc. Its vivid colour could be a result of the presence of iron as a minor element, but, if possible, further investigations should be conducted, in order to determine if it is not rather a case of using a vegetal dye, such as madder or henna[17].

Further analyses should be conducted, if possible, on both samples Tomis 2 and Tomis 3, as the organic binder could in its turn prove to be a complex mixture of vegetal and/or animal ingredients[18].

The analysis of these samples should be seen as work in progress. It is to be hoped that further investigations can be conducted in the near future on these cosmetic products found in funerary contexts from Tomis and dated to the Roman period (2nd – 3rd c. AD).

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17 Both identified as dyes in powder cosmetics from the Netherlands – see Hottentot, van Lith 2006; the same question regarding the source of the vivid red colour at Donato et al. 1975, for their sample 4.

18 Ribechini et al. 2008.

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