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* **Bu liste Lycus Dergisi'nin 2021 yılındaki sayılarında "yayımlanabilir" veya "yayımlanamaz" nitelikte bulunan makalelere değerli katkılarıyla görüş bildiren hakemleri içermektedir. Nitelikli yazıların dergimizde yer almasını ve okurla buluşmasını sağlayan bütün hakemlerimize şükranlarımızı sunarız.**

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İÇİNDEKİLER

CONTENTS

•Sayı/Issue 4 •Aralık/December 2021

ARAŞTIRMA MAKALELERİ/RESEARCH ARTICLES

KAZI ve ARAŞTIRMALAR/EXCAVATIONS AND SURVEYS

DERLEME/REVIEW ARTICLE

LYCUS DERGİSİ'NİN AMACI, KAPSAMI VE YAYIN POLİTİKASI

Amaç

Lycus Dergisi, her yıl Haziran ve Aralık aylarında olmak üzere yılda iki sayı olarak yayımlanan, bilimsel ve hakemli bir e-dergidir. Lycus Dergisi; başta Anadolu Arkeolojisi, Antik Dönem Tarihi Coğrafyası, Prehistorya, Protohistorya, Önasya ve Klasik Arkeoloji, Müzecilik, Eskiçağ Tarihi, Epigrafi, Nümizmatik, Antropoloji, Arkeometri, Koruma-Onarım, Mimarlık Tarihi gibi alanların konularını kapsayan, disiplinler arası çalışmaları yayımlamayı amaçlamaktadır.

Kapsam

Lycus Dergisi, Anadolu Arkeolojisi, Tarihi Coğrafyası olmak üzere Prehistorik Dönem'den başlayarak, günümüze kadar olan kültür mirası, buluntular, arkeolojik kazı ve yüzey araştırmalarının sonuçları, restorasyon, konservasyon, müzecilik, antropoloji, epigrafi, etno-arkeoloji gibi bilimsel çalışmaları kapsar. Bunların dışında ilk defa yapılan tespitler, uygulamalar ve analiz çalışmalarının yer aldığı yazıları içerir.

Yayın Politikası

● Lycus Dergisi, Haziran ve Aralık ayı olmak üzere yılda iki sayı olarak yayımlanır. Hakem değerlendirme sürecinden olumlu görüş alan makaleler, yıllık yayın için belirlenen hedefi aşması durumunda bir sonraki sayıda yayımlanması amacıyla havuzda bekletilir. Makalelerdeki öncelik, yazar tarafından çalışmanın gönderildiği tarih ve makale niteliği göz önüne alınarak belirlenir.

● Lycus Dergisi'ne gönderilen çalışmaların daha önce herhangi bir yayın organında yayımlanmamış olması ve sisteme eklendiğinde bir başka yayın organının değerlendirme aşamasında bulunmaması gerekir. Yayımlanmak üzere gönderilen çalışma, yazarın tezinden (lisans/yüksek lisans/doktora) üretilmişse veya bilimsel bir kongre/toplantıda sunulmuşsa bunun başlığa konulacak dipnot ile açıklanması gereklidir. Bu çalışma, yayın kurulu tarafından uygun görüldüğü takdirde tarih ve yer bildirmek şartı ile kabul edilebilir.

● Başvurunun yapılmasından, yazının yayımlanma aşamasına kadar geçen süreçteki bütün işlemler elektronik ortamda (https://dergipark.org.tr/lycus) gerçekleşir. Herhangi bir yazının elektronik sisteme eklenmesi, çalışmanın yayımlanması için başvuru olarak kabul edilir ve değerlendirme süreci başlar. Yazarlar yayımlanmak üzere gönderdikleri çalışmaların yayın haklarını, Pamukkale Üniversitesi Arkeoloji Enstitüsü bünyesindeki Lycus Dergisi'ne devretmiş olurlar. Lycus Dergisi'nde yayımlanan çalışmaların telif hakkı dergiye ait olup referans gösterilmeden aktarılamaz, çoğaltılamaz ve dergi yönetiminden izin alınmaksızın bir başka yayın organında yayımlanamaz. Yayımlanan çalışmalar için yazarlara telif ücreti ödenmez.

● Lycus Dergisi'nde yayımlanmış yazılardan kaynaklanması muhtemel herhangi bir bilimsel, etik ve hukuki sorumluluk, yazar/yazarlara aittir. Bu hususta Dergi, herhangi bir hükümlülük kabul etmez.

● Dergiye gönderilen yazıların dergi kurallarına göre düzenlenmiş olması gereklidir. Yayın alt komisyonu, yazım kurallarına uymayan yazıları yayımlamama veya düzeltmek üzere yazar/yazarlara iade etme yetkisine sahiptir. Lycus Dergisi'nde yayımlanacak makalelerin yazarlarının TELİF HAKKI DEVRİ FORMU'nu eksiksiz doldurarak, ıslak imza ile adresimize göndermeleri gerekmektedir. Çalışma Dergi'ye gönderildikten sonra, hiçbir aşamada, Telif Hakkı Devri Formu'nda belirtilen yazar adları ve sıralaması dışında yazar adı eklenemez, silinemez ve sıralamada değişiklik yapılamaz.

YAZIM KURALLARI

1. Makaleler World ortamında, Times New Roman harf karakteri kullanılarak yazılmış olmalıdır. Yunanca alıntılar dışında tüm metin tek yazı karakteri ile oluşturulmalıdır.
2. Metin 11 punto; özet, dipnot, katalog 9 punto; kaynakça 10 punto olmalı, tek satır aralıkla yazılmalıdır.
3. A4 boyutundaki yazılarda, sayfanın solundan ve üstünden 3 cm, sağından ve altından 2 cm boşluk bırakılmalıdır.
4. Ana başlık metnin yazıldığı dilde, 11 punto, düz ve kelimelerin ilk harfi büyük harfler ile ortalanarak, koyu yazılmalıdır. Yabancı dildeki başlık, ana başlığın bir alt satırında, 12 punto, italik ve kelimelerin ilk harfi büyük harfler ile ortalanarak, koyu yazılmalıdır.
5. Başlık altında, ortalanarak yazar/yazarların isimleri, 10 punto ve koyu yazılmalıdır. Yazar isimleri yıldızlı dipnot (*) ile dipnotta gösterilmeli, dipnotta ise yazarın akademik unvanı, çalıştığı kurumun adı, adresi ve e-posta adresi ile ORC-ID numaraları belirtilmelidir.
6. Yazar isimlerinin altında, 200 kelimeyi aşmayacak şekilde, ancak en az 150 kelimelik özet yazılmalıdır. Özette çalışmanın amacı, içerik ve sonuçları hakkında kısa ve açıklayıcı bilgiler bulunmalıdır. Özetin altında en az 4, en fazla 6 kelimeden oluşan anahtar kelimeler verilmelidir. Yabancı dildeki çalışmalarda metnin kaleme alındığı dilde ve Türkçe özet, Türkçe yazılmış çalışmalarda ise metin dilinde ve İngilizce özet yer almalıdır.
7. Dipnotlar sayfanın altında verilmeli ve makalenin başından sonuna kadar sayısal süreklilik izlemelidir.
8. Metin içerisindeki alt başlıklarda kelimelerin ilk harfi büyük, diğer harfleri küçük olmak üzere 11 punto olmalı ve koyu yazılmalıdır.
9. Çalışmanın tamamı, özet, kaynakça ve figürler ile birlikte 20 sayfayı geçmemeli, sağ alt köşeye sayfa numarası eklenmelidir. Bu sınırlamayı aşan çalışmalarda, editörlerin takdir hakkı göz önüne alınacaktır.
10. Makalede kullanılacak fotoğraf, resim, çizim ve harita gibi görsel verilerde "Fig." kısaltması kullanılmalı, numaralandırmada süreklilik gözetilmelidir. Metnin içinde kullanılan "Fig." ibaresi parantez içerisinde yer almalıdır. İkiden fazla figür belirtiliyorsa, iki rakam arasına boşluksuz tire (Fig. 2-4) konulmalıdır. Figür çözünürlükleri 300 dpi'den aşağı olmamalı ve JPEG formatında gönderilmelidir. Figürlerin listesi metnin sonunda, kaynakça bölümünün öncesinde yer almalıdır.
11. Kaynakça, makalenin sonunda bulunmalıdır. Kaynakçanın devamında, varsa figürler yer alır.
12. Makaleler, editörlerin önerileri doğrultusunda seçilen çift taraflı-kör hakemlik (gerektiğinde 3. hakeme gönderilebilir) ilkesine uygun olarak değerlendirilmektedir. Yazarın kimliğinden bağımsız olarak değerlendirilen yazılar için hakemlerin gerekli gördüğü düzeltme ve görüşler yazara iletilir. Yazım kurallarına uygun olmayan makaleler ise işleme konulmadan, yazarına iade edilecektir. Yazar, hakemlerden gelecek değişiklik, düzeltme ve ilaveleri yapmayı taahhüt etmiş sayılır.
13. Yayımlanan yazıların bilimsel sorumluluğu yazar/yazarlara aittir. Bu çalışmalar doğrudan ya da dolaylı olarak Lycus Dergisi'nin görüşü niteliği taşımaz.
14. Dipnot kaynakları aşağıdaki kurallara göre hazırlanmalıdır;
    Tek Yazarlı Kaynak Gösterme: İnan 1987, 121.
    İki Yazarlı Kaynak Gösterme: Şimşek – Duman 2007, 75.
    İkiden fazla yazarı kaynak gösterme: Hobbs v.d. 1998, 358.
    Birden fazla kaynaktan yapılan alıntıyı gösterme: Kadıoğlu 2006, 152; Ismaelli 2009, 25.
    Birden fazla soy ismi taşıyan yazarı kaynak gösterme: Dönmez-Öztürk 2006, 95.
    *Dipnotlarda sayfa numaraları verilirken, tam aralık verilmeli (İnan 1987, 121-125), "vd., vdd." gibi kısaltmalar kullanılmamalıdır.

15. Kaynakça aşağıdaki kurallara göre hazırlanmalıdır;

● Kitap kaynak gösterme:

Bailey 1980

D. M. Bailey, *Roman Lamps Made in Italy, A Catalogue of the Lamps in the British Museum II*, London, 1980.

Demirhan-Erdemir 2015

A. Demirhan Erdemir, *Prehistorik ve İlk Çağlarda Tıp*, İstanbul, 2015.

Humann v.d. 1898

C. Humann – C. Cichorius – W. Judeich – F. Winter, *Altertümer von Hierapolis*, Berlin, 1898.

● Çeviri Yapılmış Kitabı Kaynak Gösterme:

Deighton 2005

H. J. Deighton, *Eski Atina Yaşantısında Bir Gün*, Çev. H. Kökten-Ersoy, İstanbul, 2005.

Magie 2001

D. Magie, *Anadolu'da Romalılar I, Attalos'un Vasiyeti*, Çev. N. Başgelen – Ö. Çapar, İstanbul, 2001.

● Editörlü Kitapta Bölümü Kaynak Gösterme:

Atila – Gürler 2010

C. Atila – B. Gürler, "Bergama Müzesi'nde Bulunan Roma Dönemi Cam Eserleri", *Metropolis İonia II Yolların Kesiştiği Yer Recep Meriç İçin Yazılar/The Land of the Crossroads Essays in Honour of Recep Meriç*, Ed. S. Aybek – A. K. Öz, İstanbul, 2010, 47-53.

● Makale Kaynak Gösterme:

Başaran 1990

S. Başaran, "1988 Yılı Enez Kazısı Çalışmaları",*11. Kazı Sonuçları Toplantısı* 2, Ankara, 1990, 107-123.

Kaya 2009

M. A. Kaya, "Anadolu'da Roma Egemenliği (IÖ 205-25)", *Doğu Batı Dergisi* 49, Ankara, 2009, 195-234.

Murat 2003

L. Murat, "Ammihanta Ritüelinde Hastalıklar ve Tedavi Yöntemleri", *Archivum Anatolicum* 4/2, 2003, 89-109.

Şimşek – Duman 2007

C. Şimşek – B. Duman, "Laodikeia'da Bulunan Ampullalar", *Olba* XV, İstanbul, 2007, 73-101.

● Yayımlanmamış Tez Çalışmasını Kaynak Gösterme:

Söğüt 1998

B. Söğüt, *Kilikya Bölgesi'ndeki Roma İmparatorluk Çağı Tapınakları*, Selçuk Üniversitesi, Sosyal Bilimler Enstitüsü, Yayımlanmamış Doktora Tezi, Konya, 1998.

Erön 2007

A. Erön, *Anadolu'da Roma Dönemi Tapınaklarında Görülen Bezemeli Frizler*, Adnan Menderes Üniversitesi, Sosyal Bilimler Enstitüsü, Yayımlanmamış Yüksek Lisans Tezi, Aydın, 2007.

● Antik Dönem Metinlerini Kaynak Gösterme:

Antik döneme ait edebi bir metinden yapılan alıntılar, dipnot yerine metin içerisinde ve parantez içerisinde "Plinius (*nat.* V.105)", "Strabon (XII.8.16)" verilmelidir. Metin ya da dipnot içerisinde kullanılan antik dildeki terimler ya da kısa cümleler italik olarak verilmelidir. Antik kaynaklar *Der Neue Pauly*'de verilen standartlara uygun olmalıdır.

16. Dipnot ve kaynakçada bir yazarın aynı yılda yayımlanmış birden fazla eseri kullanılacaksa, yıldan sonra alfabenin başlangıç harfinden başlayarak küçük harf ekleyerek (Şimşek 2002a, 3; Şimşek 2002b, 231) numaralandırılmalıdır.

17. Başvurular https://dergipark.org.tr/lycus adresi üzerinden yapılmalıdır; bununla birlikte gerektiğinde lycus@pau.edu.tr e-posta adresinden de yapılabilir.

AIM, SCOPE AND PUBLICATION POLICY OF LYCUS JOURNAL

Aim

The Lycus Journal, published twice a year, in June and December, is a double blind peer-review scientific open-access e-journal. The Lycus Journal aims to publish interdisciplinary studies covering the areas such as Anatolian archaeology above all, ancient historical geography, prehistory, protohistory, Near Eastern and classical archaeology, museology, ancient history, epigraphy, numismatics, anthropology, archaeometry, conservation-restoration, architectural history.

Scope

The Lycus Journal covers scientific studies in Anatolian archaeology and historical geography from the prehistory through the present encompassing cultural properties, finds, results of archaeological excavations and surveys, restoration, conservation, museology, anthropology, epigraphy, and ethno-archaeology. In addition, articles covering first-time attestations, implementations and analyses are included.

Publication Policy

● Lycus Journal is an open-access journal published twice a year – in June and December. Manuscripts admitted through the peer review process may be kept in the pool for the next issue in case there is an excess number of articles for the concerned year. Priority is given according to the articles' submission dates and their quality.

● Manuscripts submitted to Lycus Journal must not be already published elsewhere and must not be in the process of evaluation by another publication. In case the manuscript submitted was derived from undergraduate, master's or doctoral dissertation of the author or it was already presented at a scientific congress/meeting this must be explicitly stated with a footnote inserted to the title. Such works may be accepted on the condition that place and date be stated if the publishing committee approves.

● The entire process from the submission to the publishing stage is carried out electronically (https://dergipark.org.tr/lycus/). Any manuscript uploaded to the electronic system is considered an application for publishing and the evaluation process starts. Thus, authors transfer the copyright of their work to the Lycus Journal published by the Institute of Archaeology of Pamukkale University. Copyright of studies published in the Lycus Journal belongs to Lycus Journal and they cannot be transferred or copied elsewhere without giving reference, or cannot be published elsewhere without getting prior written consent of the Journal administration. Authors are not charged any fees for publication and are not paid any royalty for their published studies.

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1. The manuscripts need to be submitted in MS Word using Times New Roman font. Apart from citations in Greek, the entire text needs to comprise a single font.

2. The main text must be 11 pt; abstract, footnotes and catalogues 9 pt; bibliography 10 pt in size and single line spacing.

3. The document needs to be arranged as A4 in size with margins of 3 cm from top and left and 2 cm from right and bottom.

4. The main title needs to be 11 pt, bold, centred, with initials of each word capitalized, in the language of the manuscript. The title in foreign language needs to be in the net line after the main title, 11 pt, bold, centred, with initials of each word capitalized, and all in italics.

5. The name(s) of the author(s) need to be 10 pt, bold and centred. The names need to elaborated in a footnote marked with an (*). The footnote needs to state the academic title of the person, his/her affiliation's name and address, e-mail address and ORC-ID number.

6. After the author-name(s) must come the abstract, not less than 150 and not more than 200 words. The abstract needs to state the aim, scope and results of the study briefly. Under the abstract, the keywords– minimum four and maximum six – must be listed. Non-Turkish articles need to have abstract in the language of the article and Turkish; articles in Turkish need to provide abstracts in Turkish and English.

7. Footnotes need to be given at the bottom of each page and continue uninterruptedly from the beginning through the end.

8. Titles of sub-chapters need to be 11 pt in size, bold, and initials of each word capitalized.

9. The entire manuscript must not exceed 20 pages including abstracts, bibliography and plates/figures. Page numbers must be inserted in the centre at the bottom. Manuscripts exceeding these limits are subject to the decision of the editors.

10. Artwork such as photographs, illustrations, images and maps to be used in the manuscript need to be indicated as "Fig." with continuous numbering. When they are referred to in the text they must be given within parentheses. When more than two consecutive figures are referred, they need to be joined with a dash without spaces (i.e. Figs. 2-4). The images must be submitted minimum 300 dpi and in JPEG format. Figure list must be also given at the end of the text before the bibliography.

11. The bibliography must be given at the end of the manuscript. It is followed by the figures/plates, if applicable.

12. Manuscripts are evaluated on the basis of double blind peer reviews proposed by the editors; in case necessary, a third blind peer review may be asked. Independent of the author's actual identity, revisions and opinions of the referees are forwarded to the author(s). Manuscripts not abiding by the guidelines will be returned without any processing. The author(s) is/are considered to have committed to do the revisions, changes and additions proposed by the referees.

13. Scientific liability of published articles rests on the author(s). These studies do not necessarily represent the opinion of the Lycus Journal directly or indirectly.

14. Footnote references must be prepared as follows:

Single author reference: İnan 1987, 121.

Two-author reference: Şimşek – Duman 2007, 75.

Multiple-author reference: Hobbs *et al.* 1998, 358.

Multiple source referencing: Kadıoğlu 2006, 152; Ismaelli 2009, 25.

Author with multiple surnames: Dönmez-Öztürk 2006, 95.

N.B. References in the footnotes must have clearly designated page numbers; abbreviations such as "ff." must not be used.

15. Bibliography must be prepared as follows:

- Books:

Bailey 1980

D. M. Bailey, *Roman Lamps Made in Italy, A Catalogue of the Lamps in the British Museum* II, London, 1980.

Demirhan-Erdemir 2015

A. Demirhan Erdemir, *Prehistorik ve İlk Çağlarda Tıp*, İstanbul, 2015.

Humann v.d. 1898

C. Humann – C. Cichorius – W. Judeich – F. Winter, *Altertümer von Hierapolis*, Berlin, 1898.

● Translated works:

Deighton 2005

H. J. Deighton, *Eski Atina Yaşantısında Bir Gün*, Transl. by H. Kökten-Ersoy, Istanbul, 2005.

Magie 2001

D. Magie, *Anadolu'da Romalılar* I, *Attalos'un Vasiyeti*, Transl. by N. Başgelen – Ö. Çapar, Istanbul, 2001.

● Referencing chapters in edited works:

Atila – Gürler 2010

C. Atila – B. Gürler, "Bergama Müzesi'nde Bulunan Roma Dönemi Cam Eserleri", *Metropolis İonia* II *Yolların Kesiştiği Yer Recep Meriç İçin Yazılar / The Land of the Crossroads Essays in Honour of Recep Meriç*, Eds. S. Aybek – A. K. Öz, Istanbul, 2010, 47-53.

● Articles in periodicals or periodic series:

Başaran 1990

S. Başaran, "1988 Yılı Enez Kazısı Çalışmaları", *11. Kazı Sonuçları Toplantısı*, vol. 2, Ankara, 1990, 107-123.

Kaya 2009

M. A. Kaya, "Anadolu'da Roma Egemenliği (İÖ 205-25)", *Doğu Batı Dergisi* 49, Ankara, 2009, 195-234.

Murat 2003

L. Murat, "Ammihanta Ritüelinde Hastalıklar ve Tedavi Yöntemleri", *Archivum Anatolicum* 4/2, 2003, 89-109.

Şimşek – Duman 2007

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● Referencing ancient sources:

Citations from ancient sources must be given within parentheses within the text – not in the footnote: (Pliny, *nat. his.* V.105), (Strabo, XII.8.16). Terms or short sentences in ancient languages cited within the text or footnotes must be given in italics. Ancient sources must be abbreviated according to the standards of *Der Neue Pauly*.

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Notes on Late Roman Unguentaria from Hierapolis in Phrygia (Turkey): a Contribution to the Study of the Contents

Phrygia Hierapolisi'nden Geç Roma Unguentariumları Üzerine Notlar: İçerik İncelemesine Bir Katkı

Grazia SEMERARO*

A. Maria Valentina AQUILINO**

Abstract

The paper presents the results of a functional study of Late Roman unguentaria from Hierapolis in Phrygia, which includes the chemical characterisation of organic residues found in 30 stamped vessels by means of the GC-MS technique. Evidence from recent archaeological and archaeometric analyses suggests that LRUs were manufactured in western Anatolia. The study, centred on the identification of chemical biomarkers, aims to understand the formulation of the actual contents of the unguentaria, together with the production techniques used for balms and ointments. A key substance present in the LRUs analysed is storax resin, obtained from Liquidambar orientalis, a deciduous tree endemic to south-western Turkey and the island of Rhodes. The pharmacological characteristics of storax resin – well known in antiquity for its healing properties – are also discussed.

Keywords*: Hierapolis of Phrygia, Late Roman Unguentaria, GC-MS, Styrax officinalis, Liquidambar orientalis.*

Özet

Bu makale, Phrygia Hierapolisi'ndeki Geç Roma unguentariumlarının, 30 damgalı örneğinde bulunan organik kalıntıların GC-MS tekniği ile kimyasal özelliklerini içeren işlevsel bir çalışmanın sonuçlarını sunmaktadır. Yakın tarihli arkeolojik ve arkeometrik analizlerden elde edilen kanıtlar, LRU'ların Batı Anadolu'da üretildiğini göstermektedir. Kimyasal biyobelirteçlerin tanımlanmasına odaklanan çalışma, balzam ve merhemler için kullanılan üretim teknikleri ile birlikte unguentariumların içeriğinin formülasyonunu anlamayı amaçlamaktadır. Analiz edilen LRU'larda bulunan önemli bir madde, Türkiye'nin güneybatısında ve Rodos adasına özgü yaprak döken bir ağaç olan Liquidambar orientalis'ten elde edilen günlük ağacı (storax officinalis) reçinesidir. Antik çağda iyileştirici özellikleriyle iyi bilinen günlük ağacı (storax officinalis) reçinesinin farmakolojik özellikleri de tartışılmaktadır.

Anahtar Kelimeler*: Phrygia Hierapolisi, Geç Roma Unguentariumları, GC-MS, Styrax officinalis, Liquidambar orientalis.*

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Introduction

This paper presents the preliminary results of a functional study of the Late Roman *Unguentaria* (hereinafter: LRUs), discovered in the course of the excavations in Hierapolis of Phrygia (Fig 1). Despite being widespread in Asia Minor and the Mediterranean basin from the 5th to the 7th centuries AD, characterisation of this class of container remains problematic, especially regarding the area of production and the nature of the contents[1]. The presence of stamps on some specimens represents a further element of complexity, since they mainly consist of monograms that are difficult to read.

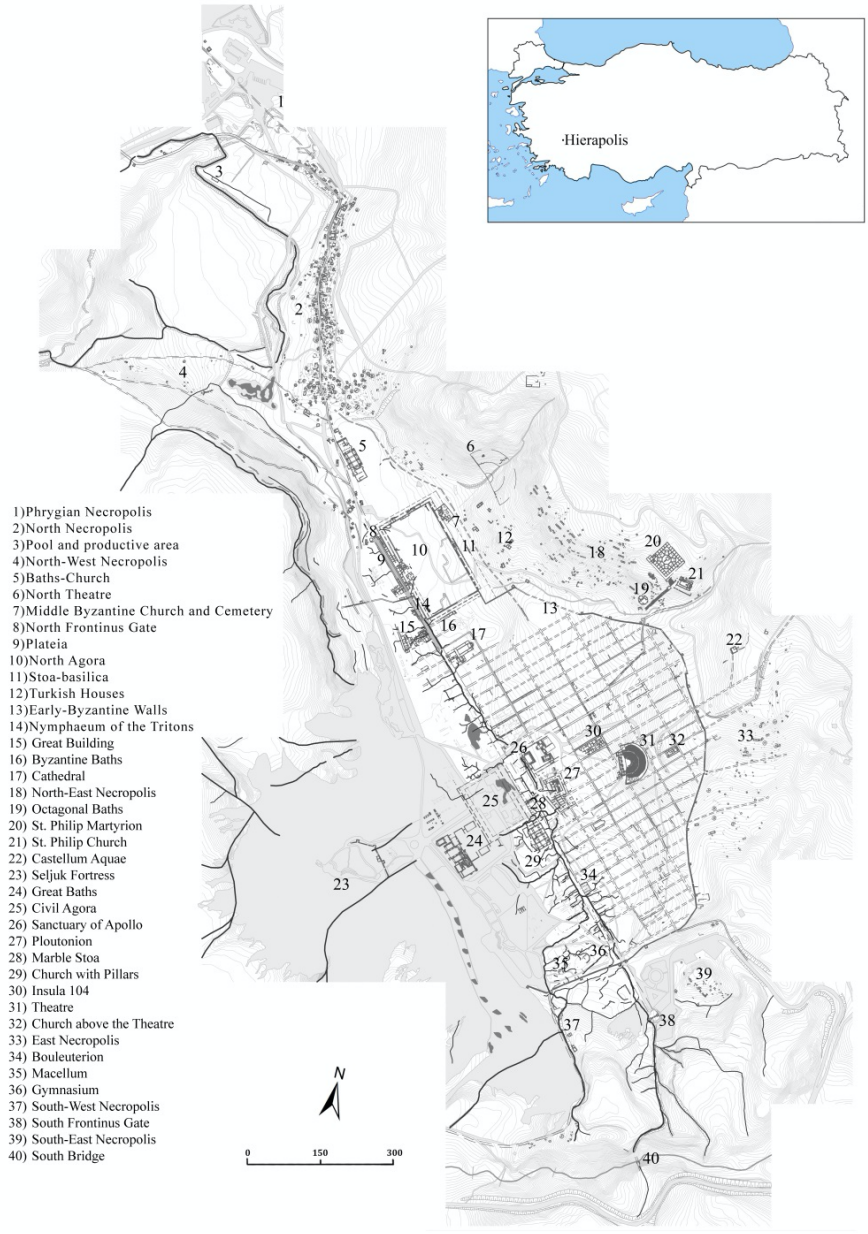

Fig. 1. Plan of Hierapolis in Phrygia.

Location of the main LRUs contexts: 20) Martyrion of Saint Philip; 26) Sanctuary of Apollo; 30) Insula 104.

[1] For the first systematic study and hypotheses on the involvement of ecclesiastical structures in production and commercialisation, see Hayes 1971; who proposes an area of production in Palestine, linked to the holy places forming the object of pilgrimage.

Recent Research in Asia Minor

The increasing number of finds from Asia Minor, together with the archaeometric study of the clays, now makes it possible to identify Western Anatolia as the main area of production of these artefacts. Particularly significant in this regard are the archaeometric analyses of materials from Ephesos[2] and Hierapolis[3], which suggest production sites in both the Ephesos region and the Valley of the Maeander, while production in Laodicea has been suggested on the basis of the study of numerous specimens unearthed during the excavation of Temple A[4]. Clear indications of significant local production are provided by the excavations of the major Phrygian city of Kibyra, where about 10.000 fragments of *unguentaria*, including numerous discards from the production process, were found[5]. On the other hand, the results of the analyses carried out in Sagalassos in Pisidia[6] are also interesting, as they exclude production in this city and its surrounding area, which was however an important centre of production for ceramics. In addition, among recent finds, the complex of more than 600 specimens from Bathonea[7] (a port near Istanbul) stands out.

Research following Hayes' study has also strengthened the evidence of a link with proto-Byzantine Christianity. Important data in this regard come from the contexts of Asia Minor, such as the cities of the Lykos Valley (Laodicea, Tripolis, Hierapolis) and from sanctuaries such as that of Myra, linked to the cult of St. Nicholas[8].

In Laodicea, the large number of *unguentaria* is associated with a context of strong religious significance, since more than 700 of these objects were found in the large underground chamber beneath Temple A, which was used in the proto-Byzantine period as an archive for the nearby cathedral[9]. From Tripolis comes an interesting group of *unguentaria*, for which descriptions have recently been published[10]. Three of them bear the image of St Philip, the apostle who was martyred and buried in nearby Hierapolis. Commenting on the first two stamped *unguentaria* found in Tripolis[11], F. D'Andria recalled the links with the cult that arose in Hierapolis around the tomb of the Apostle, recently discovered, emphasising the healing aspects associated with the figure of the Saint. An *unguentarium* with the same stamp was also found in Kibyra[12].

LRUs in Hierapolis

Hierapolis has also yielded further significant elements supporting the involvement of ecclesiastical structures in the processes of production and commerce of the *unguentaria* and – apparently – their contents. Among the materials found in the city is a specimen bearing the name of Bishop Erasinos[13] (Fig. 2, 11), already

[2] Lochner et al. 2005.
[3] Cottica 2000, 1005-1006.
[4] Şimşek – Duman 2007, 289-291.
[5] Özüdoğru – Dündar 2007; Akgül-Özarslan 2015, 187-188; Özüdoğru 2018, 41. The results of the recent research in this very important site are now presented in Özüdoğru 2020.
[6] Degeest et al. 1999, 252-253.
[7] Aydıngün 2017, 381.
[8] Türker 2005, 311: the *unguentaria* are seen in relation to the cult of the relics of the Saint on the part of pilgrims.
[9] Şimşek – Duman 2007, 286.
[10] Duman 2018, 353, fig. 17, nos. 33-34; Duman – Koçyiğit 2019, 96, figs. 139-140, 130-131, 177 (from the House of the Mosaics).
[11] D'Andria et al. 2017, 168-170.
[12] Akgül-Özarslan 2015, 205, fig. 12: despite the mistaken transcription of the inscription, the subject is easily recognisable from the photograph by means of comparison with those of Tripolis; for more details on the same stamp see Özüdoğru 2018, 43, fig. 35.
[13] Guizzi – Nocita 2015, 42.

known from a stamp found in Iasos and recently found also in Kibyra[14]. Together with the stamp of Bishop Severianos found in Rhodes and the one more recently in Kibyra[15], these attestations represent an important indication of the role played by bishops in the economic structures of the Byzantine administration.

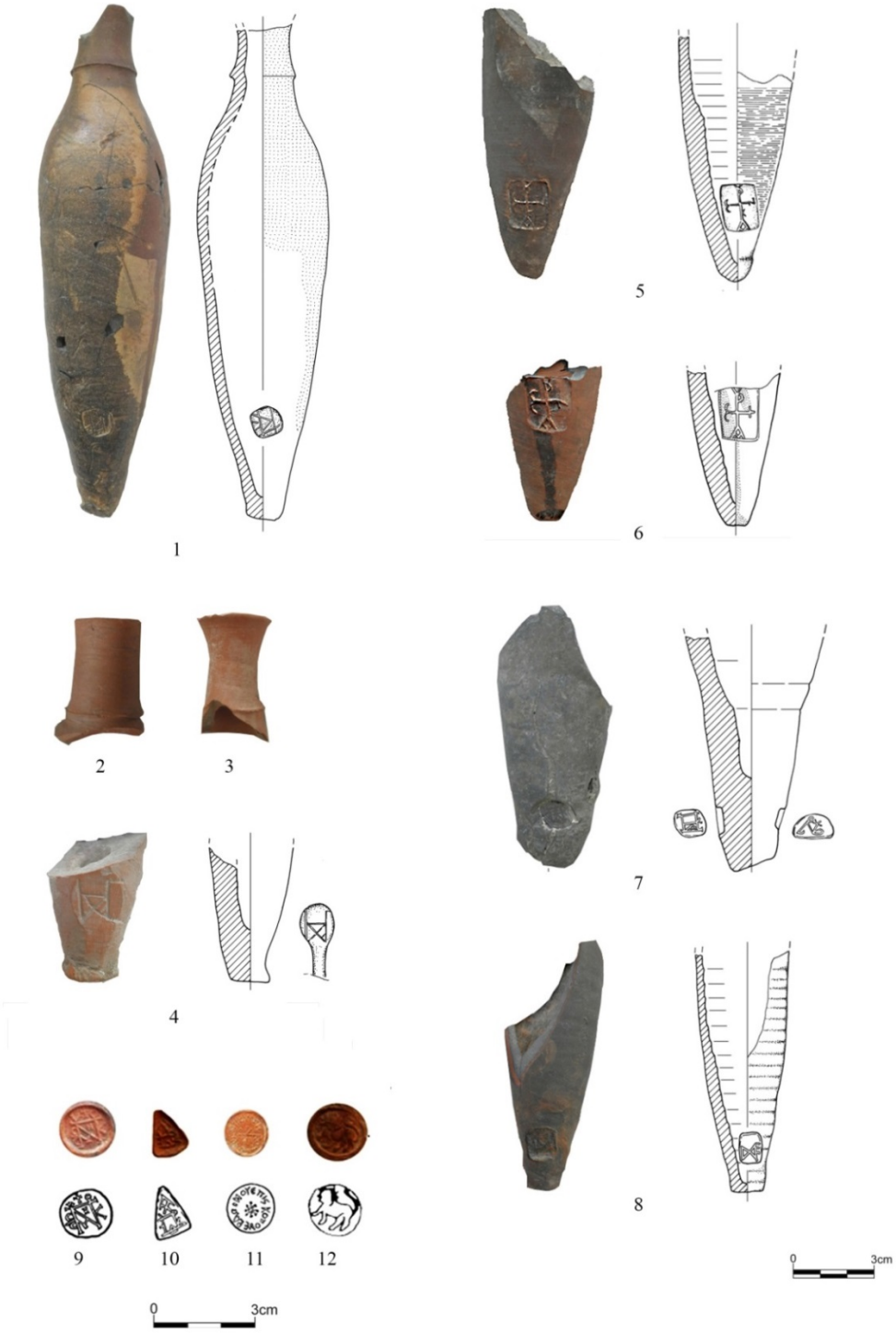

Fig. 2. Hierapolis of Phrygia.
LRU: 1 e 2 = Cottica 1998, 87,2 and 8; 3 = Cottica 2000, 1015,1. Sampled LRU (see fig. 5): 4=H24; 5= H6; 6= H9; 7=H28; 8= H23; 9=H8; 10=H2; 11= H17; 12= H13.

[14] Jasos: Baldoni – Franco 1995, 124; Kibyra: Özüdoğru 2018, 41.
[15] Hayes 1971, 244; Özüdoğru 2018, 41, fig. 37.

In addition, one of the most important contexts of discovery in Hierapolis is the *Martyrion* of St Philip[16], where about 95 specimens were found, notably in the rooms interpreted as chambers frequented by worshippers or pilgrims[17] and in the 6th-century *parekklesion*. Other LRU specimens come from recent excavations in the sanctuary complex of St Philip, the Octagonal Baths[18] and the area of the *Aghiasma* in particular[19].

A group of about 100 LRUs comes from 6th- and 7th-century contexts found in the residential area of *Insula* 104[20].

Lastly, the largest group is made up of materials found in the proto-Byzantine levels of the sanctuary of Apollo, which are currently being studied[21]. Most of the LRUs identified so far, about 170 specimens, come from deposits formed after the destruction of Temples B and C[22], which include materials dumped there in the 5th and 6th centuries AD in order to conceal the buildings of the pagan sanctuary. Like the abundant everyday ceramics found in the same layers, the LRUs are representative of objects used in the residential quarters located near the sanctuary (such as *Insula* 104).

Including the sporadic finds recovered by the excavations in other parts of the city, the number of *unguentaria* recorded so far amounts to about 370, most of which have no stamp. Only about fifty specimens are stamped[23], mainly with alphabetical characters or monograms that are difficult to read. Only one monogram has so far been resolved, with the reading of the name *Πέτρου πατρικίου*[24].

The morphological characteristics of the LRUs, particularly the conformation of the neck and rim, make them suitable for containing and pouring fluids, thick or thin. In order to better understand their function a research strategy was devised that integrates traditional archaeological study with the chemical determination of the contents. Indeed, the latter aspect appears not have been extensively explored and is not supported by the scientific publication of analytical data[25].

The study of the contents of the LRUs of Hierapolis made use of chemical analysis techniques (Gas Chromatography – Mass Spectrometry, hereinafter GC-SM) designed to characterise organic residues conserved in a ceramic matrix[26].

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[16] Cottica 2000. On the Sanctuary of St. Philip in Hierapolis, see: D'Andria 2011-2012; D'Andria 2017; D'Andria et al. 2017.
[17] Verzone 1978, 454.
[18] Caggia 2016, 692, fig. 4; Caldarola 2016, 720, fig. 5.
[19] Guizzi – Nocita 2015, 42.
[20] On *Insula* 104, see Zaccaria-Ruggiu 2019; on *unguentaria*, see Cottica 1998, 81-90, figs. 5-8; Toniolo 2019, 412-413, fig. 367, nos.151-161, p. 394.
[21] On the proto-Byzantine phases of the sanctuary of Apollo, see Semeraro 2007, 169-209; Semeraro 2012; Semeraro 2014, 11-29.
[22] On the destruction and dismantling of the temple buildings, see Semeraro 2014, 14-15.
[23] This matches the trend emerging from a comparison with occurrences in other archaeological sites: for example, in Sarachane out of 380 finds only 34 are stamped (Hayes 1992), while in Kibyra 1900 out of a total of 10.000 specimens were stamped (Özüdoğru 2018, 41).
[24] Guizzi – Nocita 2015, 41.
[25] GC-MS was performed on materials from *Bathonea* but the analytical results are not known. Kaya 2018, 41 makes reference to the substances detected (*methanone* and *phenantrene*) but the chromatograms are not provided.
[26] The analyses of the LRUs are part of a broader programme of research into organic residues on archaeological finds promoted by the current author and conducted in collaboration with the Laboratory of Organic Chemistry of the University of the Salento – DISTEBA, currently headed by prof. P. Stano, who we thank. On the research programme, see Semeraro - Notarstefano 2013, 57; Notarstefano 2012. The LRUs were analysed as part of the doctoral thesis of M.V. Aquilino: Aquilino 2017/18.

In anticipation of the results of analyses conducted in other sites, the data presented here can make a useful contribution to the debate, above all because they are accompanied by analytical chromatograms and a discussion of the components.

(G.S.)

Gas-chromatographic Analyses

Presented below are the results of the GC-SM analyses conducted on thirty samples, preferentially selected from the walls or the bottom of the vessels, i.e. the parts most in contact with the contents. The selection of the samples to be analysed was based on the presence of stamps, morphological traits and petrographic characteristics[27].

The GC-MS analyses returned results for 28 of the samples analysed[28], detecting the main fatty acids, i.e. palmitic, stearic and oleic (respectively C16, C18 and C18, Figs. 3-4), as well as animal and plant sterols, dicarboxylic acid and monoglycerides. It is important to emphasise the considerable variability in the proportions of these components, as illustrated by the chromatograms shown in Figs. 3 and 4. In consideration of this variability, the compounds making up the complex mixture of ingredients contained in the LRUs were first classified as being of plant or animal origin.

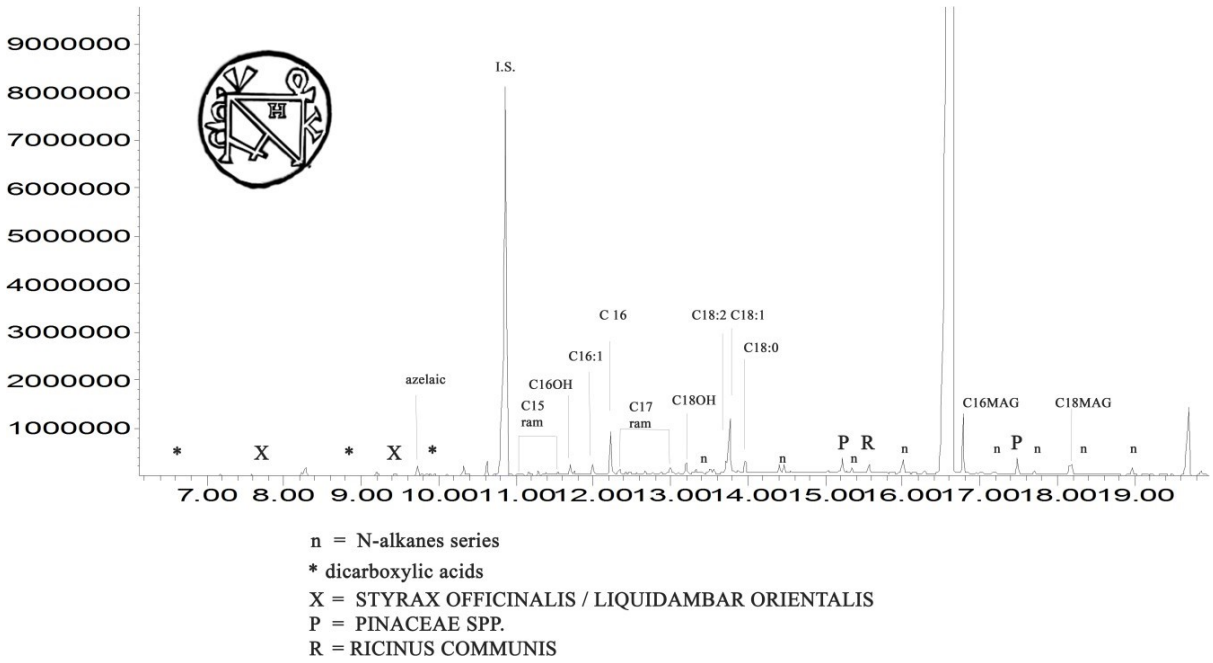

Fig. 3. Chromatogram of the sample H11

[27] On the quality of the ceramic paste reference was made to the classification in Cottica 2000.
[28] Two samples were excluded due to the abundant presence of modern contamination.

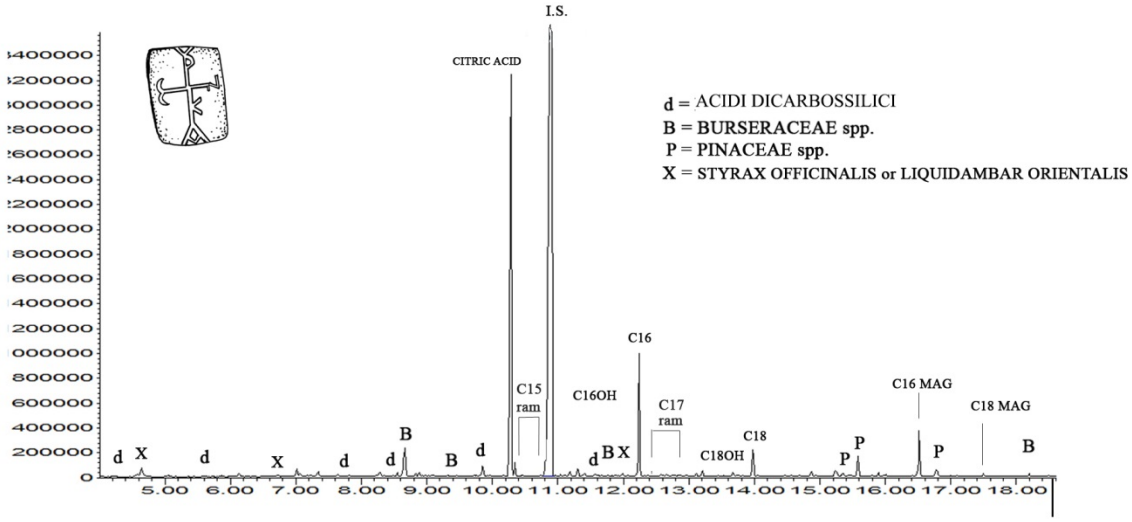

Fig. 4. Chromatogram of the sample H6

A small number of specimens (Cluster 1, Fig. 5) contained a preparation whose basic ingredient or excipient included a plant oil. In these samples, it is possible to observe a greater abundance of unsaturated fatty acids (oleic and linoleic acid, respectively C:D 18:1 and C:D 18:2), which suggests the presence of oil derived from olives or seeds[29], than saturated fatty acids (palmitic and stearic acid, respectively C16 and C18)[30]. Further evidence for this hypothesis is the presence of azelaic acid (Fig. 3), which results from the degradation of oleic acid[31]. In addition, in some samples, a marker characteristic of oil from the seeds of *Ricinus communis*, ricinoleic acid, was detected[32].

In terms of the excipient, most of the samples (Cluster 4, Fig. 5) have a chemical profile that indicates an animal fat (Fig. 4). The animal origin of the residue was determined on the basis of the prevalence of stearic acid (C18) together with the presence of odd- and branched-chained saturated fatty acids (C15br and C17br, characteristic of ruminants), traces of cholesterol and, in some samples, monoglycerides of stearic acid (C 18 MAG).

In both clusters, the plant component of the residue is highly varied. Detected in almost all the LRUs from Hierapolis were biomarkers associated with conifer resin, especially from *Pinaceae*[33]. This includes, albeit at trace level or in very low concentrations, compounds linked to the resin of *Cedrus libani* or *Cedrus atlantica* (Figs. 3-4, P)[34].

[29] On the determination of oil from olives and other seeds, see: Dudd et al. 1998, 1350; Copley et al. 2005, 863.
[30] The greater presence of stearic acid is a sign of animal origin.
[31] On the decay of oleic acid, see Regert et al. 1998.
[32] Ricinoleic acid was determined by comparing the fragmentation of the molecule detected with the data published in Copley et al. 2005, 864; Pecci et al. 2010, 618.
[33] The biomarkers are: abietic acid, dehydroabietic acid, di-dehydroabietic acid and 7-oxo-dehydroabietic acid. The molecules were recognised by means of a comparison with the NIST database, which runs the same software used for managing the Gas Chromatography-Mass Spectrometer used for the analyses.
[34] It was possible to detect traces, in sample H13 in particular, of compounds displaying fragmentation comparable with that of the sesquiterpenoids associated with himachalene: see Sarret et al. 2017, 223, fig. 3, who links them to the distillation of resin from *Pinaceae* and *Cedrus Libani*.

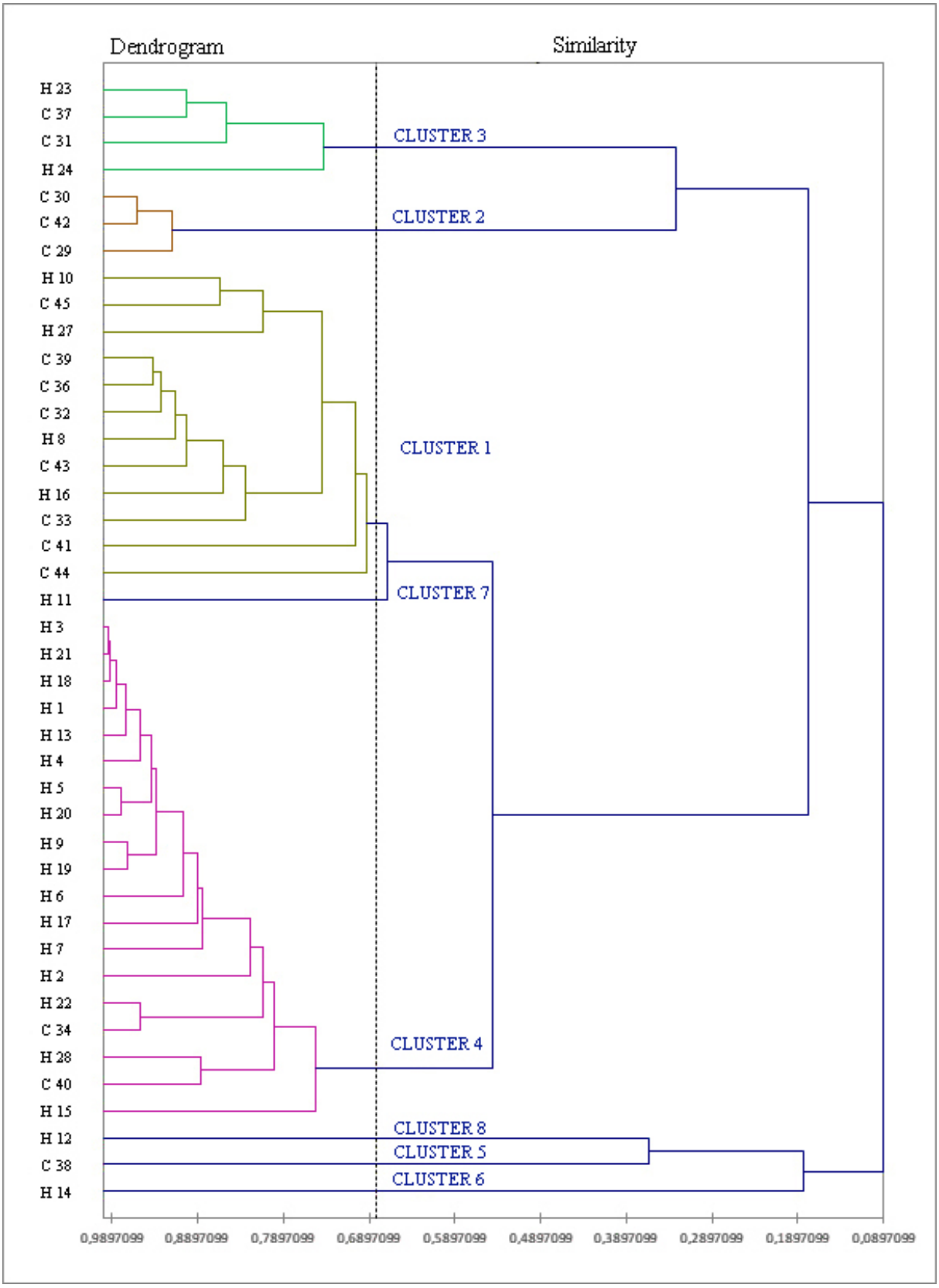

Fig. 5. Dendrogram of LRUs analyzed samples from Hierapolis (letter H) and Catania (C)

A group of *unguentaria* enabled the determination of biomarkers that characterise the molecular composition of the resins of benzoe and storax (Figs. 3-4, X). The former is secreted by a shrub of the *Styracaceae* family, *Styrax officinalis*, endemic to the Mediterranean; storax resin in contrast is extracted from a shrub of the *Hammameliaceae* family, *Liquidambar orientalis*, characteristic of the south-western coasts of Turkey[35]. Another variety of resin identified among the original plant components of the mixtures is produced from shrubs of the *Burseraceae* family[36], although in this case the biomarkers that enabled the identification are not exact enough to determine the species of shrub that secreted the resin. A terpene biomarker specific to the resin of *Pistacia Lentiscus* was detected in only three samples[37].

The quantitative data regarding the compounds detected in the archaeological samples also underwent multivariate statistical analysis by means of Agglomerative Hierarchical Clustering, in order to group the samples on the basis of similarity in their chemical composition[38].

In the dendrogram in Fig. 5, the data on the Hierapolis samples are shown together with those of a group of LRUs from the excavations of the Baths of the Rotonda in Catania[39], which also underwent GC-MS as part of the same project[40]. The analysis of the data is of particular interest because it makes it possible to verify that there are no substantial differences between the two groups of artefacts in terms of the composition of their contents.

As the dendrogram shows (Fig. 5), the LRU assemblage is divided into eight clusters containing samples with homogeneous characteristics in terms of their contents[41].

Most of the samples from Hierapolis belong to the second grouping, specifically to Cluster 1 (4 out of 12), Cluster 7 (only one *unguentarium*, from Hierapolis) and Cluster 4 (17 out of 19). The ramification of the dendrogram and the study of the similarity of the chemical characteristics of the *unguentaria* of each cluster make it possible to confirm the sharp distinction between the plant and animal components of the original contents, which had already emerged in the initial phases of the research, and to add new data.

It is possible to describe the lipid profile of the residue absorbed by the LRUs of Clusters 1 and 7 (samples H 8, 10 and 11) as a mixture based on plant oils including olive oil and castor oil. The other ingredients of the mixture include benzoin resin and, lesser concentrations, resin of *Pinaceae*. The residue is also characterised by the abundance of hydroxy acids of palmitic acid and stearic acid (C16OH and C18OH, Fig. 3), probably produced by the hydrolysis of undetermined

[35] On the differentiation between *Styrax officinalis* and *Liquidambar orientalis*, see Modugno et al. 2006, 301, table 1. The comparable biomarkers detected in the samples are benzoic acid, cinnamic acid, vanillic acid, 4-hydroxybenzoic acid, p-hydroxycinnamic acid, cinnamyl alcohol and oleanolic acid.

[36] The fragmentation of some molecules detected (α-Amyrenone, β-Amyrenone, ursa-9(11),12-dien-3-ol TMS) is comparable with data reported in Mathe et al. 2004, 281, table 2, I, VI, and Mathe et al. 2004, 239, table 2, I, and is believed to characterise resin from *Burseracee.* In some samples, carvacrol and o-cymene, recognised on the basis of comparison with data in De La Cruz-Cañizares et al. 2005, 183, tables 2,2 and 12, were also detected in low concentrations.

[37] This is the triterpene 3b-acetoxy-28-norolean-17-ene, identified by Assimopoulou – Papageorgiou 2005, 298, table 3, 20.

[38] The dendrogram, obtained using Microsoft Excel XLStat, represents the results of an analysis based on Agglomerative Hierarchical Clustering in accordance with similarity criteria.

[39] We thank Fabrizio Nicoletti for having enabled the study of this important assemblage. On the context, see Buda et al. 2015. The analysis of the *unguentaria* is the subject of the doctoral thesis by Viviana Spinella: Spinella 2018-2019.

[40] Aquilino 2017-2018.

[41] The Hierapolis samples are indicated in the dendrogram with the letter H followed by the sample number); those of Catania are indicated with the letter C.

plant waxes[42]. The predominance of oily substances suggests that the original formulation was an unguent, produced by maceration or infusion of plant parts – leaves or petals – in the oil, in accordance with techniques that are amply documented in the ancient literature[43].

Cluster 4 includes 17 *unguentaria* discovered in Hierapolis, of which 16 are stamped. The molecular profile of the cluster indicates a mixture of fat from a ruminant mammal, a plant oil, probably olive oil, resins and other undetermined plant substances. Molecular markers of resin from *Pinaceae* were detected in significant concentrations in all samples of the cluster. The residue of sample H13 contains compounds associated with himachalene, i.e. biomarkers of the distillation of the resin of *Cedrus libani* or *atlantica*, belonging to the *Pinaceae* family[44]. Less abundant are indicators useful for the determination of benzoe resin, which however is attested in all the samples of the cluster, and resin from *Burseraceae,* prevalent in samples H3, 4, 6, 18, 20, 21 and 22.

The contents: formulation, ingredients and preparation techniques

The choice of excipients used in the preparations, either animal fat or seed/olive oil, suggests that the contents of the LRUs had two formulations: that of a fairly fluid unguent and that of a balm or pomade, thicker and more viscous.

From the archaeometric data it is possible to reconstruct one of the phases of production of the balm or salve, which required treatment of animal fat. This is based on one hand on comparisons with the *enfleurage* extraction technique[45], still used in the traditional perfume manufacture, and on the other hand on literary sources relating to ancient *pharmacopoeia. Enfleurage* makes use of the absorbent power of deodorised animal fat for the production of perfumed pomades. The use of animal fat in cosmetic or pharmaceutical preparations is cited in the ancient literary sources with reference to the preparation called *ἀρωματιστέον*, described in *De Materia Medica* (II, 76) by Dioscorides of Anazarbus[46]. The so-called Moschion's remedy[47], a semi-solid poultice used in the treatment of fractures (*καταγματικὴ ἔμπλαστρος*), is also based on a mixture of ingredients that include beef tallow, dry and liquid pine pitch, castor oil (*Ἔλαιον κίκινον*[48]) or olive oil, beeswax, terebinth resin, manna, sycamore sap, opopanax, galbanum, vinegar, verdigris and litharge.

Literary sources and the results of archaeometric analyses thus enable us to argue that aromatised fats were used in small quantities as ingredients in more complex mixtures: this would explain the detection of very low concentrations of animal fat biomarkers in the samples that have plant oils as an excipient.

That the unguents and balms contained in the LRUs had aromatic properties seems to be demonstrated by the presence among the components of the residues of all clusters of at least three varieties of resin, secreted by shrubs of the *Pinaceae*,

[42] Notarstefano 2012, 62.
[43] Theophr., Hist. Plant. IX, 11, 2; De Odor. 22.
[44] The fragmentation of the molecules of himachalene has parallels in Sarret et al. 2017, 423, fig. 3. On distillation, see Sarret et al. 2017, 427-428.
[45] Enfleurage entails pressing the raw material – flowers or petals – on a layer of fat spread over a flat surface. The fat and plant material are left in contact with each other for a few days, until the scent molecules have infused the fat. The operation is repeated, adding new plant material each time, until the fat reaches the degree of saturation required. See Burger et al. 2019, 3.
[46] For the preparation of the *ἀρωματιστέον* the softest subcutaneous fat from a calf or young bull was selected and then treated and aromatised by cooking for a long period to form an emulsion, with numerous ingredients including wine, flowers, tree bark, resin and beeswax.
[47] For one of the recipes of the poultice (*Μοσχίωνος καταγματική*), see: Guardasole 1997, 153-155. Variants can be found in Galenus, De Comp. Med. Per Gen., II:17 and Aëtius Med., Iatricorum Liber XV, 14, 258.
[48] A description of the pharmacological virtues of castor oil is found in Aëtius Med., Iatricorum Liber, I, 101, 6.

Burseraceae, *Styracaceae* and A*nacardiaceae* families, used in the ancient world for the preparation of perfumes and known for their pharmacological properties[49]

The use of *Pinaceae* resin is extensively documented from the archaeometric point of view[50], thanks to the broad spectrum of use made of this resin in the ancient world. Generally, the presence of *Pinaceae* resin derives from it being used to coat the container with a waterproof lining[51], and it was interpreted in this sense in the case of the GC-MS analyses conducted on the LRUs discovered in Ephesos and Sagalassos[52].

It should however be emphasised that, in other cases, *Pinaceae* resin was an ingredient of the mixture and not a coating[53].

In the case of the LRUs the two different formulations (unguent or balm) were however contained in the same type of artefact[54], with a long narrow neck, from which it would have been difficult to extract a solid preparation without using a spatula or an applicator.

(M.V.A.)

Conclusions

Of particular interest is the possibility of detecting biomarkers of benzoin and storax resin in the samples. While not disputing the importance of the data regarding the recognised pharmacological properties of both types of resin (which are natural antibacterials and antifungals)[55], we also wish to highlight here the geographical range of these plants, especially storax, extracted from *Liquidambar orientalis*, a shrub that grows on the alluvial plains of western Turkey and on the island of Rhodes. Today, patches of this plant can still be found in the area of Marmaris and the provinces of Aydın, Denizli and Burdur[56], geographical contexts in which the most numerous *unguentarium* assemblages were discovered and proposed area of production lies.

These data need to be studied further but they already make it possible to imagine a scenario in which the exploitation of natural resources known for their considerable pharmacological properties, such as storax[57] was at the heart of a strategy of production and long-range commercial distribution, as attested by the widespread presence of the *unguentaria* in the Mediterranean over a period of more than two centuries.

Future research will need to clarify many aspects. While the role played by ecclesiastical bodies in this context is evident[58], partly due to the importance of the bishops in the Byzantine administration, the relationship between the manufacture

[49] Colombini et al. 2009, 89; Sarret et al.2017; Stacey 2011; Mathe et al. 2004, 277; Ribechini et.al. 2011.
[50] For the relevant bibliography, see especially: Pollard – Heron 2008, 239; Colombini et al. 2005, 89.
[51] On the use of resin for waterproofing, see (among others): Notarstefano 2012, 24-27.
[52] Kimpe et al. 2004, p. 1507; Linke, Stanek 2005, 139 -141.
[53] Colombini et al. 2009, 1492-1493; Stacey 2011, 1758. Both papers conclude that *Pinaceae* resin was associated the contents of the vessel, probably a medicine. See also Sarret et al. 2017, 426: organic residue encrusted inside three flasks of Egyptian manufacture (Musée du Louvre).
[54] The same conclusion was drawn from the analyses of the organic residues in the Hellenistic Phoenician *amphoriskoi* from Tel Kedesh (Koh et al. 2020, 111).
[55] See the discussion of the pharmacological properties in Koh et al. 2020, especially 110 s. on storax (which is also found to have antitumoral properties and is currently being studied for its potential as a treatment for cancer, ibid.).
[56] https://www.gbif.org/species/3152825; http://www.euforgen.org/species/liquidambar-orientalis/ (date of consultation: September 2021).
[57] See the references to ancient sources, both Greco-Roman and biblical, in Koh et al. 2020, 110-111.
[58] Bernal-Casasola 2010: includes LRUs among the indicators of the ecclesiastical role in the organisation and control of manufacturing and long-range distribution; on the economic role of the ecclesiastical hierarchies. See also Volpe et al. 2015, 426-427.

of the containers and the production of the contents remains to be investigated. An important contribution to this theme might be provided by the study of the stamps, especially those discovered in the only production centre so far attested by archaeological evidence, i.e. Kibyra[59]. To the high number of specimens (1900) corresponds a wide variety of symbols and monograms that are not likely to be linked to the persons involved in the production of the artefacts (as in the case, for example, with the commercial amphorae of Brindisi[60], one of the most significant and best studied examples of the practice of stamping commercial containers). It seems more plausible to link the stamps to the producers of the contents, which were probably also the purchasers of the containers. In accordance with this hypothesis, the stamps are believed to have an 'administrative' function, serving to 'label' batches of containers produced to order in the ceramic workshops on behalf of those who managed the trade in unguents and balms. The role of the central Byzantine administration in the production chain, from the extraction of the resin to the creation of the finished product and relative sale requires further study.

(G.S)

[59] See supra, note 5.

[60] See Manacorda – Pallecchi 2012.

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