

**THE IMPLICATIONS OF CONTENT ANALYSIS FOR THE  
INTERPRETATION OF UNGUENTARIA IN MUSEUM  
COLLECTIONS**

by

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## ABSTRACT

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Under the Supervision of Dr. Bettina Arnold

Scent has traditionally been an ephemeral component of rituals in ancient societies, including burial and other practices associated with the anointing of the body (Classen et al. 1994: 43; Houston and Taube 2000: 271). This thesis investigates the possible signifiers and social impact such scents might have had for individuals participating in such rituals by using the little explored approach of sensory archaeology. A discussion of the correlation between olfaction and the triggering of both the experiential and emotional aspects of memory contributes to a broader view of these rituals in the anthropological literature (Classen et al. 1994), while Houston and Taube's work on scent in Mayan rituals provides a framework for applying sensory archaeology to Classical contexts (2000). Vessel contents are used as a proxy in this thesis for reconstructing the particular olfactory atmosphere associated with mortuary ritual in late Greek and early Roman cultural contexts. The residue spectra derived from the visible contents of twenty-seven out of a total of thirty-nine small glass and ceramic vials from collections at the Milwaukee Public Museum (MPM) are compared to other unguentaria residue studies as well as Greek and Roman written sources in which scented unguents, oils, perfumes, creams, and cosmetics are described to test the archaeological classification of this vessel category. Stylistic conventions are tested against data derived from content analysis rather than solely on the basis of assumed function implied by form. The chemical characterization of the contents of these vessels relies on the use of inductively coupled plasma-mass spectrometry (ICP-MS) and Fourier transform-infrared spectroscopy (FTIR). FT-IR was chosen for its successful application in a recent residue

study of unguentaria (Ribechini et al. 2008a-b) while ICP-MS analysis was performed based upon its widespread application to the determination of sample origin.

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# TABLE OF CONTENTS

Chapter 1: Introduction .....	1
Research Problem.....	1
Research Overview .....	2
Research Questions .....	2
Limitations and Assumptions.....	3
MPM Vessels .....	4
Literature Review .....	5
Terminology .....	6
Chapter 2: History and Background .....	11
Unguentaria: Forms, Functions, Materials, Contents.....	11
Ceramic Vessel Forms .....	13
Glass Vessel Forms .....	16
Materials: Ceramic.....	19
Materials: Glass .....	21
Archaeological Evidence .....	26
Funerals in the Early Roman Empire .....	27
Fragrance and Funerals .....	36
Popular Perfumes in the Roman World .....	40
Cost of Perfumes and Incense .....	41
Chapter 3: Methods.....	44
Sampled Vessels.....	44
Comparative Analysis .....	45
Residue Analysis .....	46
Expected Vessel Contents.....	48
Conventional Protocol for Analysis.....	55
Chapter 4: Analysis.....	64
Comparative Studies .....	64
Residue Analysis .....	65
FT-IR.....	66
ICP-MS .....	73
Outcomes for Original Research Questions .....	77
Comparing Other Unguentaria Content Studies.....	78
Chapter 5: Discussion and Conclusion .....	80
Form Versus Function.....	80
Scents of the Past.....	81

Future Research.....	83
References.....	86
Appendix A: Unguentarium Reports and Museum Documentation.....	93
MPM Wings Publication.....	93
MPM Destructive Sampling Agreement.....	94
Unguentaria Reports.....	95
Appendix B: Unguentaria Photos.....	135
Appendix C: FT-IR Spectra.....	150
Appendix D: ICP-MS Spectra.....	167

## LIST OF FIGURES

Chapter 1	
1.1 Examples of glass and ceramic unguentaria .....	6
Chapter 2	
2.1 Roman iconographic representations of unguentaria.....	11
2.2 Ceramic unguentaria forms.....	12
2.3 Earliest unguentaria form.....	13
2.4 Slender fusiform unguentaria.....	14
2.5 Approximate chronology of ceramic unguentaria present in MPM collection.....	15
2.6 Similar vessel forms represented in ceramic and glass.....	16
2.7 Glass vessel chronology.....	17
2.8 Modified glass vessel chronology used for this study .....	18
2.9 Dried botanical contents .....	20
2.10 Pontil mark.....	25
2.11 Bi-colored glass unguentarium in MPM collection .....	26
2.12 A grave good assemblage at Empúries .....	27
2.13 Lying-in-state relief, Tomb of the Haterii.....	29
Chapter 3	
3.1 ICP-MS calibration model using cobalt (Co) .....	57
3.2 Expanded view of ICP-MS calibration model using cobalt (Co) .....	57
3.3 Author collecting samples at the MPM .....	60
Chapter 4	
4.1 Coarse tempered fusiform unguentarium.....	64
4.2 MPM ceramic unguentaria fabrics.....	65
4.3 Modern gum mastic compared against archaeological sample.....	65
4.4 Spectrum of pine oil standard .....	66
4.5 Spectrum of MPM Cat. #N15299 sample characteristic of Group 1 spectra.....	69
4.6 Spectrum of sample from MPM Cat.# A53912 .....	70
4.7 Spectrum for frankincense oil standard .....	71
4.8 Spectrum for cinnamon oil standard.....	71
4.9 MPM Cat. #A53913 spectrum compared to myrrh spectrum.....	72
4.10 MPM Cat. #A53912 spectrum compared to olive oil spectrum .....	72
4.11 Possible cosmetic container for argentiferous galena.....	73
4.12 Possible cosmetic container for stibnite.....	73

4.13 ICP-MS spectrum showing significant counts of Ag .....	75
4.14 ICP-MS spectrum showing significant counts of Sb .....	75
4.15 ICP-MS spectrum showing significant counts of Cu.....	76
4.16 ICP-MS spectrum showing significant counts of Sn .....	76
Chapter 5	
5.1 Sampled vessels with identical contents .....	80
5.2 FT-IR spectrum for galbanum .....	82

## LIST OF TABLES

Chapter 1	
1.1 MPM Unguentaria Donor and Accession Information.....	4
1.2 Expected Vessel Contents: Resins .....	9
1.3 Expected Vessel Contents: Oils .....	9
1.4 Miscellaneous Expected Vessel Contents.....	9
1.5 Expected Vessel Contents: Botanicals.....	9
Chapter 2	
2.1 Minerals and Oxidation States Used to Achieve Colored Glass.....	22
2.2 Variations on Ancient Perfume Recipes .....	40
Chapter 3	
3.1 Sampled Unguentaria at MPM.....	44
3.2 ICP-MS Operating Conditions on the Micromass Instrument.....	56
Chapter 4	
4.1 Total MPM Unguentaria Collection: Material and Style.....	64
4.2 Aromatic Standards Used for Residue Analysis .....	65
4.3 Abbreviated Table of Group Frequencies for Organic Functional Groups .....	67
4.4 Comparison of ICP-MS Results Noting Strong and Weak Counts .....	74

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## **Chapter 1: Introduction**

### **Research Problem**

This thesis focuses on a subset of the thirty-nine unguentaria vessels in the collections of the Milwaukee Public Museum (MPM) for three purposes: to determine whether vessel content analyses of glass and ceramic vessels of this type will yield fruitful results, to outline a potential sensory approach to Greek and Roman mortuary rituals based on the results of the content analysis, and to contribute to the “form versus function” debate (Chilton 1999; Skibo 1992) in ceramic and other container analyses. The twenty-seven glass and ceramic unguentaria vessels tested encompass the range of styles documented for both of the main vessel forms. Sampling and chemical analysis were based upon the presence of visible residual contents. Because this collection of vessels is eclectic and information regarding the exact date and cultural contexts of the individual vessels is limited, this study was not concerned with establishing specific temporal or cultural contexts. The majority of the glass forms are Roman types and post-date 100 BC, so even without exact cultural context information, residue analysis can be applied to test presumed form/function relationships.

This thesis outlines a unique application of sensory archaeology theory to the olfactory elements that may have accompanied Classical mortuary rituals, as this theoretical approach has not previously been applied in this context. Residue analysis is used to test the function of these vessel forms, which has traditionally incorporated potentially misleading descriptive terminology that assumes function based on the vessels’ presumed contents (e.g. unguents or tears). This study includes an attempt to

replicate the original vessel contents by adding an experimental application of sensory archaeology to our understanding of Roman funerals and mourning rites.

### **Research Overview**

One of the goals of this project was to identify the original contents of the selected sample of MPM unguentaria vessels, which were found in various Greco-Roman contexts ranging from the 4<sup>th</sup> century BC to the 3<sup>rd</sup> century AD. While contents of these vessels are largely unknown, the fact that these bottles are still intact and in excellent condition strongly suggests that most of them come from mortuary contexts rather than settlements, where especially the fragile glass vessels would have likely been discarded when broken. By using the vessel contents as a proxy for the scents present in the past, this research also aimed to identify some of the fragrances that might have been present in Greek and Roman mortuary rituals based on the olfactory aspects of such rituals described in Classical texts.

The methods used in this study first verified each vessel's designation as assigned by the MPM catalog entries based upon its style, shape, dimensions, cultural context, and date, followed by a chemical residue analysis of the contents, culminating in a comparison of the analysis results with the expected vessel contents most often associated with these ceramic and glass forms listed in Classical texts. The results suggest that only two possible uses existed for this class of vessels to be tested.

### **Research Questions**

The following research questions were addressed through the comparative analysis of the vessel forms and contents:

*Research Question 1: What were the contents of the unguentaria tested in this study?*

Possible Outcomes:

- 1) The tested vessels contained expected substances based on written sources.
- 2) The tested vessels contained unidentifiable substances.
- 3) The tested vessels contained identifiable oils, unguents, perfumes, or cosmetics consistent with their classification.
- 4) The tested vessels contained other identifiable substances not associated with the vessel type implied by the assigned classification.
- 5) The contents could not be determined.

*Research Question 2: Can the contents of unguentaria be used as proxies for scents present in past rituals?*

Possible Outcomes:

- 1) The tested vessels contained no identifiable substances and cannot be used to predict scents associated with rituals of the past.
- 2) The tested vessels contained residues of aromatic substances that are associated with mortuary behaviors or other ritual activity as documented in contemporary written sources, and thus can be used as proxies for scents associated with documented rituals.
- 3) The tested vessels contained residues of non-aromatic substances, and thus cannot be used to predict scents associated with documented rituals.
- 4) The contents of the tested vessels could not be determined, and thus cannot be used to approximate the scents associated with rituals of the past.

*Research Question 3: To what extent can olfactory elements involved in mortuary rituals of the Greek and Roman world be reconstructed based on these analyses?*

Possible Outcomes:

- 1) Vessels contained no identifiable substances related to the possible olfactory elements associated with mortuary ritual.
- 2) Vessels contained residues of non-aromatic substances that do not appear to relate to the olfactory elements of mortuary ritual.
- 3) Vessels contained the residues of identifiable aromatic substances consistent with scents associated with mortuary rituals in Classical contexts as described in contemporary texts.
- 4) Vessel contents could not be determined and thus any olfactory elements associated with mortuary ritual cannot be determined.

### **Limitations and Assumptions of Research**

One of the limitations encountered in this project concerned the possibility that none of these vessels contained substances mentioned in textual sources or expected based on ethnographic sources. Another lay in the fact that the site contexts of the sampled vessels

are largely unknown and specific geographic and temporal information is unreliable for most pieces. The final limitation encountered in this thesis project was the inability to sample certain vessels containing residues due to their extremely fragile and weathered state.

This project was based on three assumptions: 1) the contents of these vessels are representative of their associated time period; 2) the interiors of the vessels had not been cleaned or altered in any way post-excavation (vessels suspected of being cleaned or altered were promptly removed from the list of chemically analyzed bottles, although they were still included in the qualitative comparison of vessel forms); 3) the third assumption was that the vessels were used for only one purpose and do not contain mixed residues or residues that would not have preserved.

### **MPM Vessels**

Thirty-nine glass and ceramic vessels were chosen based on typologies presented by Anderson- Stojanović (1987) and Fleming (1997;1999) in order to provide the broadest range of vessel types and dates. These thirty-nine vessels were obtained from the following donors:

**Table 1.1. MPM Unguentaria Donor and Accession Information**

<b>Donor</b>	<b>Date</b>	<b>Accession</b>	<b>Vessel(s)</b>	<b>Donor</b>	<b>Date</b>	<b>Accession</b>	<b>Vessel(s)</b>
Aladdin House, Ltd.	1972	23027	N20280	Milwaukee Downer College	1964	19173	N12545, N12883, N12885
Norak Balassan	1972	22949	N20194	Nat. Museum of Hungary	1965	19612	A53911, A53912, A53913
Boston Store	1965	19977	A54081	Raymond F. Newman	1962	18463	N11376
I.A.Dinerstein	1973	23307	N20915	Norman H. Ott	1974	23571	N21774
William Frankfurth	1916	213	A16175, A16177	Elizabeth A. Plankinton	1901	(A10436)	A10436

S. Jun Kunc III	1958	17814	N10892	Leroy Segall	1967	210194	N15299
Joe Kurtz	1934	11340	E40485	W.A. Titus	1916	5253	A15779, A15780, A15849
Harold W. Landwehr	1966	20026	A54160	Geo B. Welsher	1932	10861	E9974, E9975
Ruth Lozoff	1972	23026	N20274	Elmer & Nanette Winter	1965	19746	A54021a/b
Jorie Lueoff	1976	24259	N23703	*Robert G. Lietz	1967	21093	N15388
Edmund H. Mensing	1947	16671	N10365	*Malcom K. White	1967	20643	N14629
E.R. Leopardi	1967	21500	N16081, N16086, N16094, N16096, N16098	E.R. Leopardi	1968	21501	N16126, N16136, N16141

\*Donor purchased vessel from Maltese antiquities dealer, E.R. Leopardi.

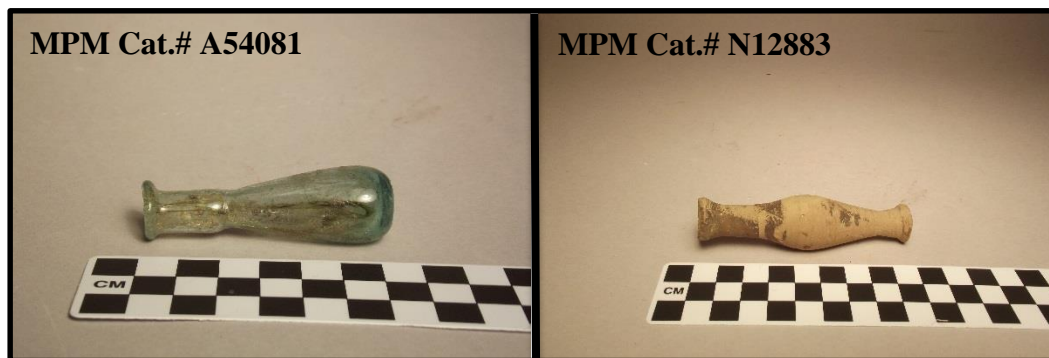
## Literature Review

Extant literature about unguentaria has mainly focused on ceramic examples, largely due to the work of Virginia Anderson- Stojanović (1987) and the Athenian Agora series, in particular Susan Rotroff's work (1997, 2006). The classification of the ceramic unguentaria analyzed in this thesis was based mainly on the work of these two authors. The classification of the glass unguentaria analyzed in this thesis was based on typologies established by Stuart J. Fleming (1997, 1999), Gladys D. Weinberg and Marianne Stern (2008) (Stern 1999). The chemical analysis of perfume vessels was based mainly on a 1994 study by MASCA on Greek "Plastic" (molded) vases and the work of chemists Erika Ribechini and Maria Colombini (2008a-b, 2009a-b). Ancient written sources about the use of perfumed oils in daily life and religious rites provided the foundation for developing a sensory archaeology approach to this thesis project in combination with sources describing Roman mortuary customs and the associated obligations and festivals requiring the use of particular scents in the memorial offerings to the dead.

## Terminology

The following terms are used throughout the thesis:

Unguentaria: Small glass or ceramic bulbous or spindle shaped bottles with an average height between 8 and 20 cm and proportionally long necks. Due to their long necks, these vessels are assumed to have held perfumes, oils, or other liquid contents subject to evaporation or loss of essential olfactory elements. Vessels with extremely high necks are generally thought to provide an advantage for accurately pouring liquids, and those with a restricted orifice are “useful for keeping...liquids inside...[and] can be easily closed with a lid or stopper...[suggesting] infrequent access or longer periods before the content is needed” (Rice 1987: 225, 241) These vessels are frequently encountered as grave offerings in the Mediterranean world between the fourth century BC and third century AD (Anderson-Stojanović 1987).



**Figure 1.1. Examples of glass and ceramic unguentaria from the MPM.**

Sensory Archaeology: This is an umbrella term for “ways of understanding the past by investigating the effects of places and things on people’s senses. It considers the potential roles that textures, smells, sounds, tastes, and other less tangible visual qualities, like shimmer, played in informing the choices people made in past societies” (Day CAI 2010: “Read More”; MacGregor 1999).

**FT-IR:** Fourier-transform infrared spectroscopy. IR is passed through a sample where light is partially absorbed by the sample as a function of the presence of absorbing molecules. The pattern of absorption for a given molecular structure creates a ‘fingerprint’ that allows for identification.

**ICP-MS:** The inductively coupled plasma-mass spectrometer atomizes and ionizes samples by passing them through plasma at temperatures ranging around 9,000 K. The instrument’s high sensitivity allows for the identification of metals down to the parts-per-trillion level. Samples are passed through the plasma on a stream of argon gas where the resulting individual ions are recorded based on their atomic mass to electric charge ratios. The concentrations within the samples are quantified by comparison to a reference material—for this study, cobalt (Co) and lead (Pb) were used.

**Perfuming Terms:** Terms below are based on Calkin and Jellinek’s *Perfumery: Practice and Principles* (1994).

### ***Oil Extraction Processes***

***Cold-Pressing:*** To press seeds, nuts, or grains at the lowest possible temperature without applying any external heat sources.

***Enfleurage:*** Floral perfumes are extracted by placing directly on or in close proximity to a layer of animal fat which absorbs the fragrance.

***Infusions:*** Prepared by macerating plant or animal materials in water or oil.

***Tinctures:*** Prepared by macerating plant or animal materials in alcohol.

***Maceration:*** To soften by soaking in liquid.

### *Components of a Perfume*

*Base Note:* In a perfume blend, the base note is said to form the “heart” or basic character of the composition. Base notes are products of low volatility and high tenacity.

*Carrier Oil:* Vegetable oils used to dilute essential oils before application to the skin.

*Fixative:* Evaporation-retarding substances, such as those found in balsam resins or costus oil.

*Middle Note:* In a perfume blend, the middle notes are perceived after the first impact of the top notes have lessened, and are made up of products of intermediate volatility and tenacity.

*Tenacity:* The long-term effectiveness of the fragrance in the perfumed product or on the surface to which the product has been applied.

*Top Note:* In a perfume blend, the top note describes the immediate effect of a fragrance upon the sense of smell. This expression is commonly used in connection with the olfactory impact of a fragrance upon application to the skin. Careful consideration of this top note is highly important in the design of a modern fragrance since the initial sales appeal may be totally dependent upon its quality. Physically, the top note is the most volatile material in the composition of the fragrance oil and is often deliberately accentuated by the use of highly volatile chemicals.

*Volatility:* Refers to the rate of essential oil evaporation and the property of being freely diffused in the atmosphere.

Expected Vessel Contents: Donato and Seefried provide all of the historical and botanical information presented below (unless otherwise noted) for the plants most

frequently encountered in scented unguents of the ancient world, specifically in Greece, Rome, and Egypt, up through the first century AD (1989: 24-45).

**Table 1.2. Expected Vessel Contents: Resins**

Balsam	Frankincense	Gum Benzoin	Myrrh	Styrax
Cinnabari-Cinnabar	Galbanum	Gum Mastic	Opoponax	Turpentine

These resins would have been prized for their fragrance, as well as their use as a fixative in aromatic mixtures (Castel et al. 2009: 328).

**Table 1.3. Expected Vessel Contents: Oils**

Balanos	Grapeseed	Olive (Omphacium)	Safflower
Bitter Almond	Moringa	Poppy	Sesame

Oils were used as a carrier for perfume ingredients.

**Table 1.4. Miscellaneous Expected Vessel Contents**

Beeswax	Hydrocerussite	Malachite	Red Ochre
Chalk	Hematite	Mica	Tin Dioxide
Galena	Kohl (various)	Mercury	Zinc Oxide

With the exception of beeswax (used as a carrier), the minerals listed here were used to provide color and luster to ancient cosmetics and scented beauty products (Stewart 2007).

**Table 1.5. Expected Vessel Contents: Botanicals**

Aromatic Reed	Costus	Laurel	Nard (Spikenard)
Artemisia	Cyperus	Lavender	Oenanthe
Bergamot	Cypress	Lily	Orris Root
Calamus	Fenugreek	Marjoram	Parsley
Cardamon	Ginger	Malobrathrum	Rose
Cassia	Gladiolus	Maro	Rose Wood

Cinnamon	Henna	Melilot	Saffron
Coriander	Labdanum	Myrtle	

Botanical ingredients are chosen for their scent, and in the case of Calamus, it was used as a thickener and fixative (Castel et al. 2009: 328).

Testing all of the listed expected vessel ingredients is beyond the scope of this project, but through a combination of inorganic (ICP-MS) and organic (FT-IR) analytical techniques, the presence of the minerals above may be indicated. The presence of any of thirteen essential oil standards covering a sampling of carrier oils (olive), botanicals (bergamot, calamus, cardamom, cassia, cinnamon, spikenard) and resins (frankincense, galbanum, labdanum, myrrh, opopanax, pine) would contribute to the “form versus function” debate implied by the name “unguentarium” by testing for commonly used (and presumably more resistant to degradation over time) perfume ingredients (Skibo 1992). This thesis project was able to challenge such assumptions by looking for patterns in how the resulting vessel contents changed as unguentaria went through shifts in style and material, as well the differences in the contents of unguentaria from various regions within the Early Roman Empire. Additionally, this study aims to demonstrate how even museum collections that lack donor information can still contribute greatly to the body of knowledge on ancient perfuming trends (Hilton 2009; Newbury 2014).

## Chapter 2: History and Background

### *Unguentaria: Forms, Functions, Materials, Contents*

Though the term *unguentaria* implies that these vessels were used to store unguents (scented oil-based salves), these vessels likely had multiple cosmetic, medical, and ritual applications beyond that of holding perfumes or cosmetics (Fig. 2.1). For this study, the term unguentarium was retained because it conveys the least limiting implications regarding vessel contents and use when compared to other synonyms for this vessel type. The other commonly encountered terms include balsamarium, which implies that the vessels contained balsam resins, and lacrimarium/lachrymatory/tear bottle, which alludes to the fact that these vessels are frequently found in funerary contents and in some ancient texts are described as holding the tears of mourners' (including the biblical passage: "you have kept count of my tossings, poured my tears in your bottle...") (Psalms 56:8).



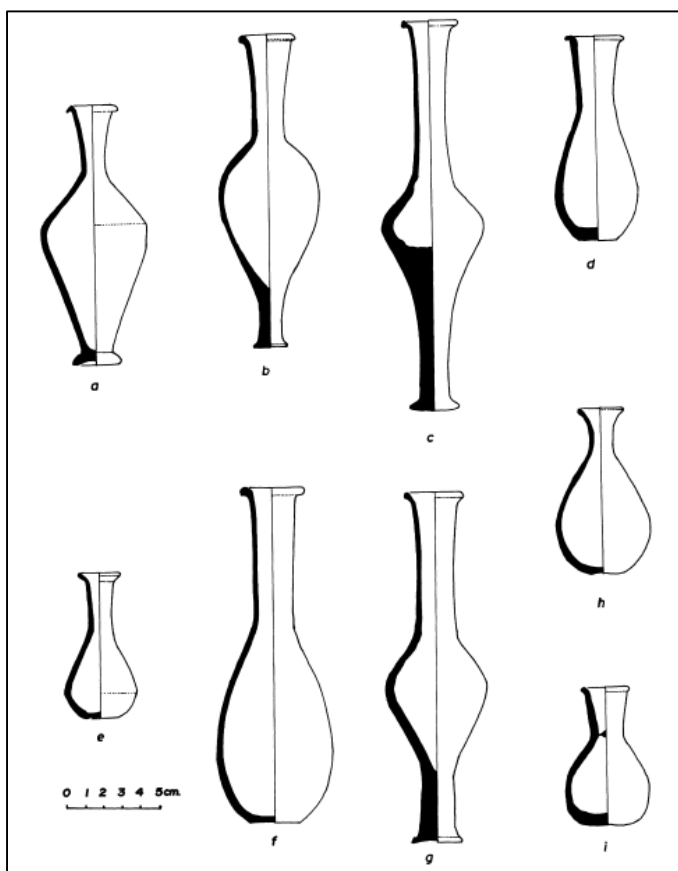
**Figure 2.1. Roman iconographic representations of unguentaria.**

In Fig. 2.1, we see unguentaria being used by male and female actors in medicinal (A—Piriform, Rome c. 30 CE), offertory (B—Piriform, Proconnesus [near Istanbul] 150 AD),

and cosmetic (C—Fusiform, Rome, late 1<sup>st</sup> c. BCE) capacities (McManus 2003). Fig 2.1 is only intended to give a brief introduction to iconographic representations of unguentaria usage—future research would benefit from a thorough survey of the temporal and regional evidence for the use context of these types of vessels, including surveying such images for information regarding the age, gender, and social role of those making use of unguentaria.

### Formal description

Unguentaria are small glass or ceramic vessels that range in height from 8 to 20 cm and exhibit two main body styles: piriform (spindle shaped) or bulbous (fusiform) (Anderson-



**Figure 2.2. Ceramic unguentaria forms (Anderson-Stojanović 1987: 107).**

Stojanović 1987). The diagram below (Fig. 2.2) provides examples of fusiform vessels (d, e, f, h, and i) and piriform vessels (a, b, c, g). A test-tube shape is also found among the earliest glass unguentaria. These vessel forms are frequently encountered in mortuary contexts (ibid.) but have also been recovered in the excavation of abandoned wells containing human remains in Roman contexts (Weinberg and Stein 2009). These vessels are characterized by “proportionately

long necks” which would have made the extraction of viscous materials difficult, but not impossible. These small bottles were commonly known as ampullae or alabastra in antiquity, though the latter is an all-purpose term for bottles of all sizes and is even less useful for classification than the term unguentarium (Stern 2001: 43).

### Ceramic Vessel Forms

s Ceramic unguentaria are grouped into nine distinct vessel forms using Anderson-Stojanović’s classification system (1987). The fusiform vessel with the globular body



(Fig. 2.3) is the earliest known unguentarium form and examples have been excavated in Spain at sites dating to the mid-fifth century BC. This form is not encountered in Eastern Mediterranean sites until the late fourth century BC (ibid.: 108), but it is represented in the MPM collection [MPM Cat. #A15779 (Fig. 2.3)].

The progression of forms into those with longer and thinner necks and pedestal feet appears

**Figure 2.3. Earliest unguentaria form.**

to begin in Spain and the Western Mediterranean during the fourth century, but these

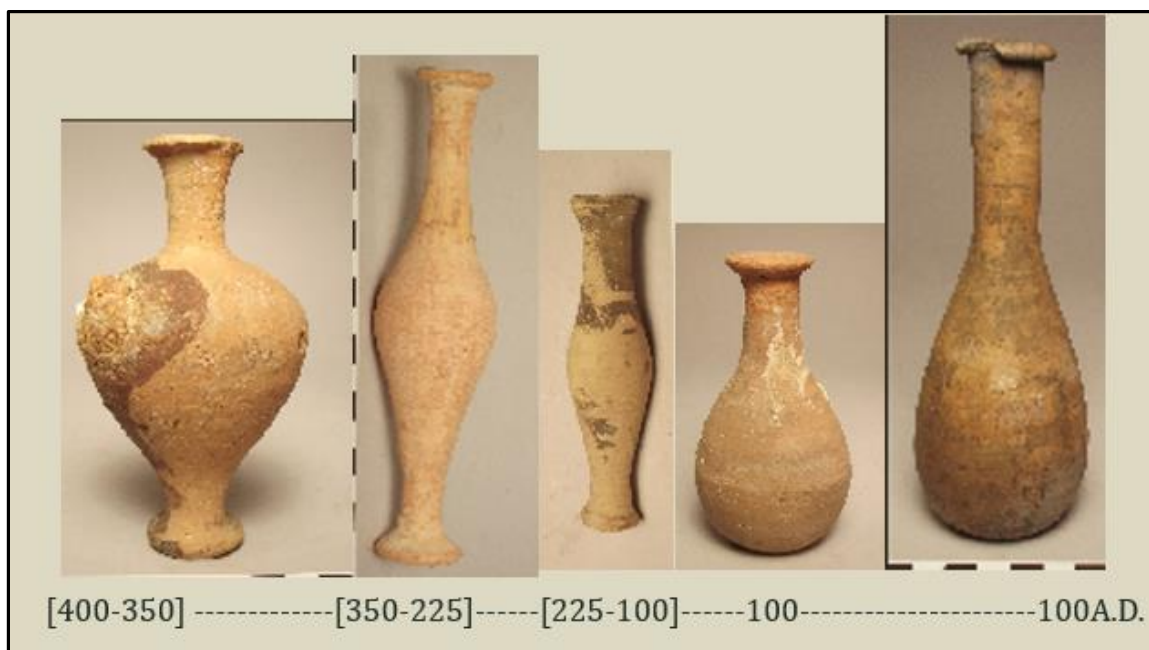
forms are not present in Greece until the late fourth century and into the early third century BC (ibid.). Anderson- Stojanović suggests that some unguentaria styles may be specific to certain geographical regions, a notable example being vessels found with small basket handles at the shoulder, and notes that “it is not unusual, in fact, to find several different forms of the fusiform unguentaria in contemporary use” (ibid.: 109). These rarer forms were not encountered in the MPM collection. One of the latest ceramic unguentaria forms found in Greece, the shorter slender fusiform, is represented by MPM vessel Cat. #N12883, A54021a and A54021b (Fig.2.4).



**Figure 2.4 Slender fusiform unguentaria.**

The last ceramic unguentarium vessel form to occur chronologically is the piriform, or bulbous shaped unguentarium (Fig. 2.5). This vessel form exhibited the shortest time span of popularity, with the first examples encountered in Greece after 50 BC and falling out of favor by the end of the first century AD (ibid.: 112). Anderson- Stojanović suggests

that the bulbous shaped ceramic unguentaria are a response to rounded glass vessel shapes that arrived with the invention of glassblowing in 75 BC (ibid.: 111).



**Figure 2.5. Approximate chronology of ceramic unguentaria present in MPM collection (after Anderson- Stojanović 1987).**

Another interesting point regarding the transition of unguentaria materials from ceramic to glass is the fact that unguentaria forms were inspired by shapes produced in both materials (Fig. 2.6). It is important to note that the fusiform, or spindle-shaped, vessels would not have been able to stand upright on their bases, necessitating that they be stored in such a manner that they did not tip over. This suggests that the fusiform vessels were either intended for single-use only, or that they were stored in boxes (perhaps containing medicines), suspended by a cord attached to the vessel neck or placed in a stand to hold cosmetic powders and unguents.

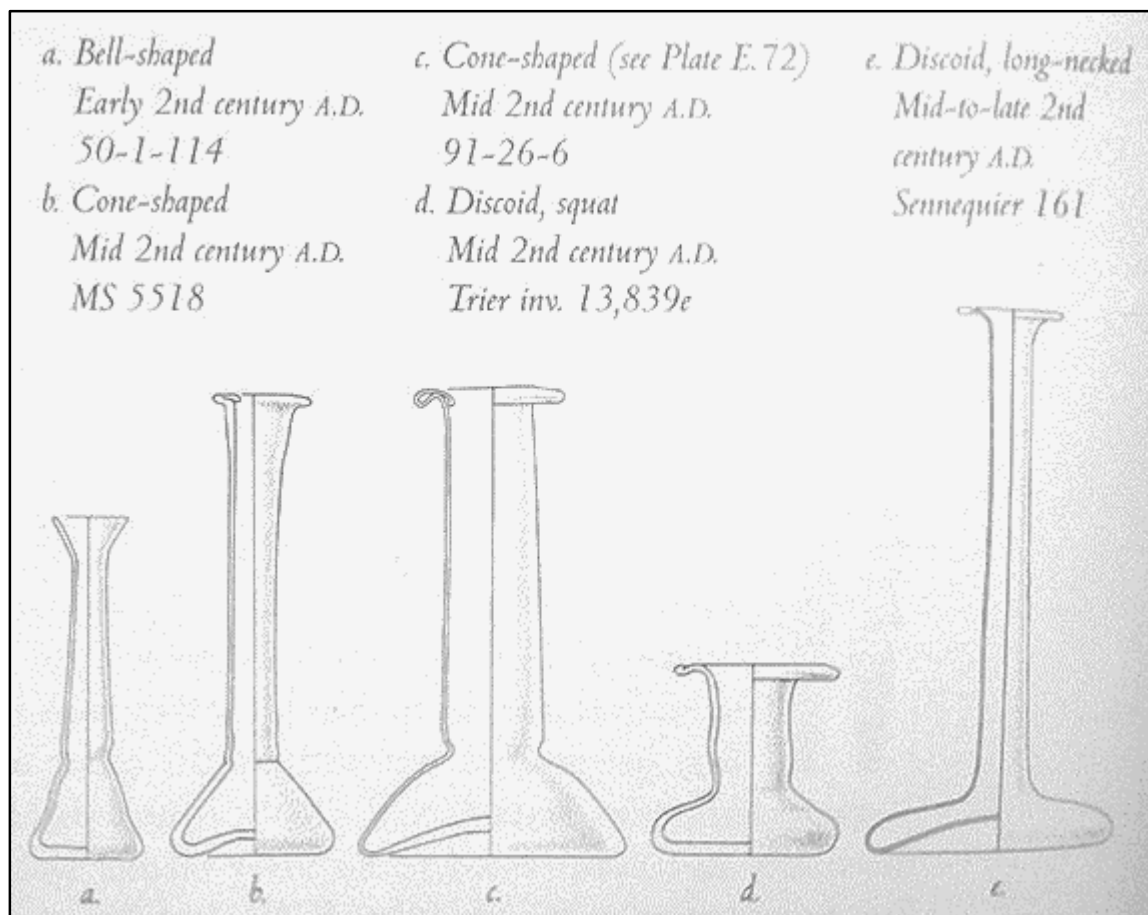


a. MPM Cat.#N16126    b. MPM Cat.#N16086    c. MPM Cat.#N16136    d. Beirut

**Figure 2.6a-d. Similar vessel forms represented in ceramic(a, b) and glass (c, d).**  
 [Glass fusiform vessel, Beirut National Museum].

### Glass Vessel Forms

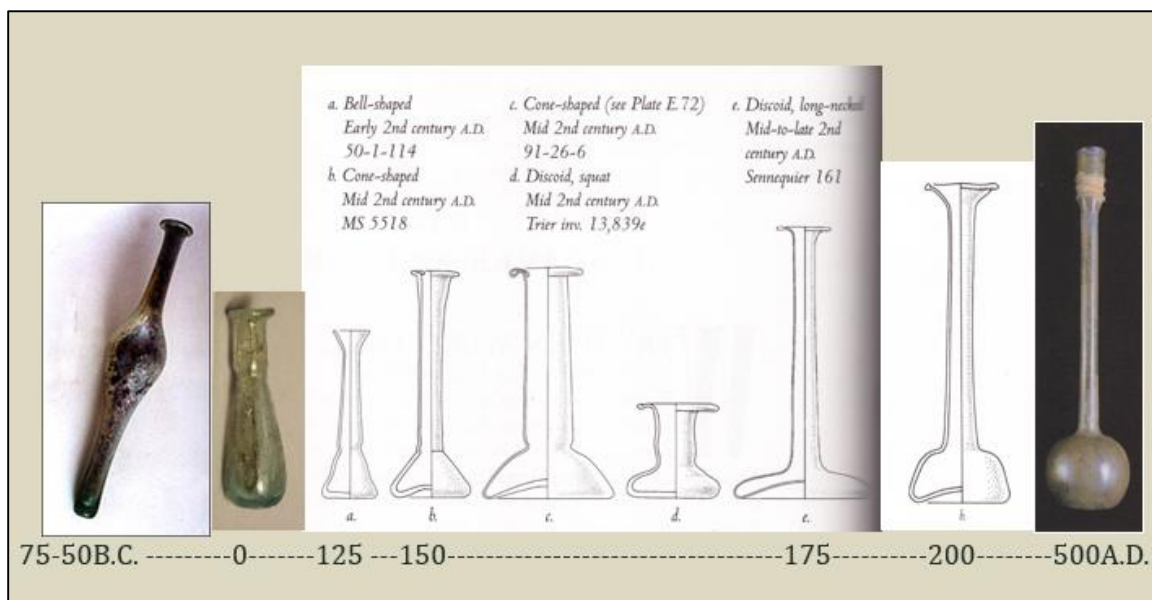
Glass blowing was introduced in 75 B.C., as the glass technology of “*flatu figurare*, or shaping by breath” spread out from the city of Sidon (off the coast of southern Lebanon) and the production of piriform vessels in free-blown glass was perfected in the regions along the Syro-Palestinian coast and Italy (Stern 1999: 443). These early manifestations of blown-glass unguentaria are thought to be modeled upon the previous ceramic piriform iterations, though practical considerations suggest that piriform and tubular shapes are the easiest to produce with a glass-blowing rod, and required the least amount of effort from the glassblowers (Stern 2001: 43). The chronology of glass unguentaria follows a broad trend that transitions from small bulbous bodies and short, thin necks to increasingly wider and flatter bodies with longer and even thinner necks (see Fig 2.7).



**Figure 2.7. Glass vessel chronology (Fleming 1999: 68).**

As Fleming notes, the changes in the shape and decoration of early Roman glassware were “conservative” throughout the first century AD, mainly consisting of “minor modifications” of the piriform shape, while the alterations of the second century AD were a gradual evolution in “two directions that modified the body’s shape from a flare-mouthed bell to either a wide-mouthed cone or a squat discoid...[with] the base now often concave, becoming more exaggerated in that sense as time went on... The neck became far more extended, presumably to prevent the evaporation of the contents” (1999: 68). Earlier unguentaria often had shear-cut rims, which eventually transitioned into folded or crimped rims during the late second century AD (see Fig. 2.7, 2.8) (ibid: 50). The glass

fusiform unguentarium from the collections of the Beirut National Museum (Fig. 2.6d) was excavated from a first century BC site in Tyre, while other such examples have been recovered from fourth century graves at the cemetery of Beit She'an in Northern Israel (Fleming 1999: 99).



**Figure 2.8: Modified glass vessel chronology used for this study (after Fleming 1999).**

The extended temporal range for dated examples of glass fusiform vessels suggests that they remained a regionally popular style in the Near East for a much longer period of time than elsewhere in the Roman Empire. This also means that examples listed on antiquities websites and on the Museum of Fine Arts Boston's online collections catalog that date glass fusiform vessels from the third to fourth centuries A.D. may not be accounting for the lengthy popularity of this regional style and may be basing vessel classifications on earlier, since corrected, chronologies.

### Materials: Ceramic

Unlike the glass vessels, ceramic unguentaria are rarely associated with lead stoppers and the material mechanism used to keep the contents from spilling out of these vessels is not currently known (ibid: 114). In general, the ceramic fusiform unguentaria in the MPM collection were not able to stand upright without assistance, with the exception of two vessels, A15779 (Fig. 2.3) and N16094. It is possible that these bottles were originally sealed with cork, wood, or wax stoppers, none of which would necessarily leave visible traces. It is also suggested that a cord may have been tied around the neck of the unguentaria and that they were suspended in order to keep them upright (ibid.). For ceramic fusiform shaped unguentaria, the inability to be free-standing could imply that they were primarily intended to be single-use only--appropriate primarily for short-term use as grave goods or votive offerings. One indication that these vessels were intended as funerary goods is the lack of an inner coating of resin lining the vessel that allows storage of liquids over long periods of time (Fleming 1999: 116). Unguentaria are a common grave good encountered in the Classical world from the late fourth century BC until the third century AD, but they are not found in all associated graves of this period in Greek and Roman contexts (Saraçoğlu 2011).

The majority of ceramic unguentaria are assumed to have been manufactured locally, and a variety of clays, widely ranging fabric porosities, and slips are encountered. Rotroff specifically addresses two early examples from Hellenistic contexts: black unguentaria and gray unguentaria (1997: 177). The earliest of the black unguentaria have vestigial handles, a clear reference to the fact that their forms were originally modeled

after amphorae (ibid), which is somewhat suggested by the shape of the vessel shown in Fig. 2.3. In the Agora excavation units, the black unguentaria come into popularity around 325 BC, replacing palmette lekythoi (ibid). Specific to Athens, a fine gray fabric with a red core became commonly used to manufacture unguentaria, the low porosity of which made the fabric ideal for long-term storage, eventually replacing glazed ware unguentaria (ibid:176). Rotroff notes that by 275 BC, the shape of ceramic unguentaria at the Agora had transitioned into forms with concave bases and black unguentaria are no longer encountered (ibid: 177).

#### *MPM Ceramic Unguentaria*

Out of the twelve ceramic unguentaria in the MPM collections, eight vessels are fusiform (spindle) shaped, while the remaining four are piriform, or bulbous shaped (see Fig. 2.6 a, c). The fabric of these ceramic unguentaria (based on their catalog descriptions) is mainly comprised of red buffware (n=4) and red-orange clay (n=4). Grey/brown buffware with a black glazed neck is the next most frequently represented fabric (n=2),



**Figure 2.9. Dried botanical contents.**

and there are singular representations of orange buffware and a coarse green/grey clay. Four of the red buffware unguentaria in the MPM collection also had red painted necks. All vessels lack an inner glaze that might have rendered them water-tight, though as previously mentioned, the fine

fabric of Athenian ceramic unguentaria would have made them suitable for long-term storage of liquids, even without an inner sealant. Ceramic vessels with similarly fine

fabric are encountered within the MPM's collections (see Fig. 2.4). One vessel (N12885) contained the remains of dried unidentified botanicals (see Fig. 2.9).

#### Materials: Glass

The basic recipe used to produce soda-lime glass has been reconstructed from the analysis of glass debris found at Jalame (N. Israel), a glassmaking workshop active in the fourth century AD, and requires a blend of two parts beach sand to one part natron (or another sodium-rich material) (Fleming 1999:139). In order to make glassmaking a cheap and efficient process, manufacturing workshops were often located along the coast in order to readily access beach sand (ibid: 138). The quartz in beach sand naturally provides the necessary silica, while the lime component is supplied by the calcium carbonate from the crushed shells of crustaceans and mollusks (ibid: 139). The soda content was frequently obtained from *mercatores nitri*, "soda merchants," who sold glassmakers the soda they needed either in the mineral form of natron or the calcined ashes of the kelp plant, which also yielded a cheap source of soda ash (sodium carbonate) (ibid: 139). The naturally occurring colors found in soda-lime glass come from impurities in the beach sand, such as those found in iron and sulfur-rich minerals, which influence the final coloration of the glass (ibid: 138). The saturation of glass color is based partially on the concentration of mineral impurities in the glass and the extent to which the vessel was fired within an oxidizing or reducing state, while shifts in hue result from the latter process as well as the combined presence of various impurities (ibid). At an average concentration of 0.3%, the iron-bearing minerals provide lighter hues of "light aquamarine to green" except in cases where the glass is very thick and darker shades are produced (ibid). Fleming suggests natron is the most likely source for sulfur impurities,

and that at levels from 0.2% to 1.4%, the aqua-blue coloring provided by the iron-content is shifted into a “light-to-medium green” (1999: 138). Iron-sulfur compounds reach higher levels in oxygen-poor reducing state furnaces, and the coloration of glass will progress from green to amber to black, depending on the extent of anoxia in the furnace (ibid). For other glass colors generated in the workshops of the early Roman empire, various minerals were added to glass melt in reduced or oxidized states in the formulas in Table 2.1 (ibid: 140-144).

**Table 2.1. Minerals and Oxidation States Used to Achieve Colored Glass**

Purple:	Pyrolusite (oxidizing state)
Colorless:	Pyrolusite (reducing state)
Blue: Egyptian Blue	Copper-rich minerals (CaCuSi <sub>4</sub> O <sub>10</sub> ); Cobalt (oxidizing state)
Red:	Copper-rich minerals (reducing state)
White:	Antimony-rich minerals (oxidizing state)
Yellow:	Antimony-rich minerals + Lead (oxidizing state)

Stern mentions a recent study of Roman glass vessels that suggests that the chemical composition of vessels from different areas and centuries is so uniform that the same source of sand must have been used to make the glass, concluding that a limited number of glassmaking workshops were consistently active in antiquity (1999: 454). Specific examples of raw glass types include the characteristic ‘natural’ blue-green coloration of “Judean glass” and the higher quality, purposefully decolorized, “Alexandrian glass” (ibid: 461). It is important to note that the phrases “Judean” and

“Alexandrian” are not necessarily indicative of the origins of the raw glass, and even though these locations were widely known for their glassmaking workshops, the terms were used rather as trade names for the color and quality of the raw glass (ibid).

*Free-Blown Glass Techniques and Workshops*

The glassblowing technique replaced the former glassmaking approach of creating core-formed glass vessels:

trailing molten glass around a core of clay, mud, [dung], sand, and organic material made in the shape of the desired vessel. Threads of colored glass are usually trailed onto the surface for decoration. The exterior surface of the vessel is smoothed by marvering while the glass remains hot and pliable. Finally, the core is removed after [annealing] is complete (Grossmann 2002: 4).

In contrast to the core-forming technique, free-blown glass allowed the interior of vessels to remain sanitary and free of contaminants, making them ideal for storing cosmetic, medicinal, or perfumed substances in ways that were superior to porous ceramic or core-formed bottles (Stern 2001: 43).

The workshops devoted to glass-blowing first appear during the first century, spreading west from the initial site of Sidon (Lebanon) as glassblowers set up the first workshops in Italy, Dalmatia (Croatia), and the Ticino Valley region in southern Switzerland (Stern 1999: 443). Later on, many locations such as those at Avenches, Lyon, Saintes, Campania, Cologne, Bet She’an, Jalame, and Sardis were known for their glassblowing workshops, though Alexandria remained slow to adopt the blown glass technology (ibid). Stern mentions a few known individuals that were integral in introducing glassblowing from Sidon to Italy, named by Ariston, Artas, Philloppos, Neikoon, and Eirenaios (ibid). Unfortunately, free-blown glass does not lend itself well to adding a maker’s mark, unlike later Roman mold-blown glass, so the makers of individual free-blown vessels are difficult to ascertain.

The glass used to create free-blown vessels was obtained from raw glass ingots that were melted in small furnaces which, based upon those recovered from Roman period sites like Avenches, had an interior circumference no wider than 45-65 cm with one working horizontal port that would have restricted use to a single glassblower at a time (Stern 1999: 455). By comparison with modern versions of these furnaces still used in Cairo, Egypt in the 1960s, it can be assumed that they burned a steady amount of fuel, about one-third of a ton of dry compact wood per day (ibid: 452). The high temperatures needed to blow glass require that the glass be heated to 1050°C to 1150°C and be held at a steady temperature. Much of the molten glass adheres to the sides of the crucible, with high amounts of wasted glass based on the following example, where a batch of 450 kg of raw glass produced only 1,080 blown vessels collectively weighing 250 kg, making the average amount of lost raw glass at around 40-45% of the starting amount (ibid: 463).

Glassblowing techniques relied upon the use of ceramic blowpipes during the earliest days of the technology, which would have been commonplace in most Roman glass workshops by the year 70 AD (ibid: 447). The weight of heavier blown glass vessels suggests that ceramic pipes would not have been strong enough to hold them, and evidence for iron blowpipes is represented by the iron oxidation present inside the workshop waste and in excavations of iron pipes of varying diameters that may have been as short as three meters in length (ibid). Using the blowpipe to attach a gob of molten glass, the hot glass is rolled back and forth on a smooth surface during the “marvering” process in order to shape the glass prior to blowing (CMOG). Once the desired shape was achieved, the glassworker blew into the pipe and expanded the hot glass with their breath to create the vessel. Once the overall shape was created, metal tools were used to flatten

the base of the piece and cold drops of water were splashed on to the glass closest to the pipe mouth in order to help it break cleanly. The use of a pontil rod, or punty, is debated (the case has been made that the glassblower could attach the newly broken glass surface at the end of the pipe onto the vessel base) but regardless of whether a separate pontil was used or not, the next step in glassblowing required that the base of the vessel be attached to a rod and reinserted into the furnace in order to soften the glass on the broken neck of the vessel (Stern 1999: 448). Once pliable, metal tools were inserted into the neck and the vessel mouth was manipulated into the finished shape. After the pontil rod was removed, the vessel was allowed to cool gradually in an annealing oven, which lasted anywhere from 18 to 20 hours. This glassmaking process could create scars on the base of vessels, known as ‘pontil marks’ or ‘annular scars’.



**Figure 2.10. Pontil mark.**

deformation caused during the attachment of a pontil, usually appear as gashes or ridges in the bottom of the glass which can impede its ability to stand upright (ibid). The annular scars are circular and may be caused either from a pontil rod or from reattaching the blowpipe to the

bottom of the vessel as is mentioned

above. Pontil marks are not always present on unguentaria, and in particular the bell-shaped unguentaria of the mid-second century are not associated with pontil marks, nor are the tubular unguentaria shapes (Weinberg 1962: 131). Conversely the conical bodied

unguentaria and those with a “squat, round body” are almost always found with pontil marks on their bases (ibid: 130), and are found in this research collection [MPM Cat. #A53912 (Fig. 2.10)].

### *MPM Glass Vessels*

The glass unguentaria in the MPM collections (n=27) are almost evenly divided between test-tube (n=10) and piriform shapes (n=17). Due to the effects of iridescent weathering, many of these glass vessels have the appearance of having been made with multiple colors of glass in shades of lavender, yellows, opaque whites, blues, and reds. When inspected more closely, however, the original glass color can be determined to be soda-



**Figure 2.11. Bi-colored glass unguentarium in MPM collection.**

lime glass with vessels ranging from pale translucent green colors to deep translucent blue-green to dark opaque emerald green (N20274). One vessel in particular (N12545) was opaque blue with a band of opaque yellow around the neck (see Fig. 2.11), which suggests

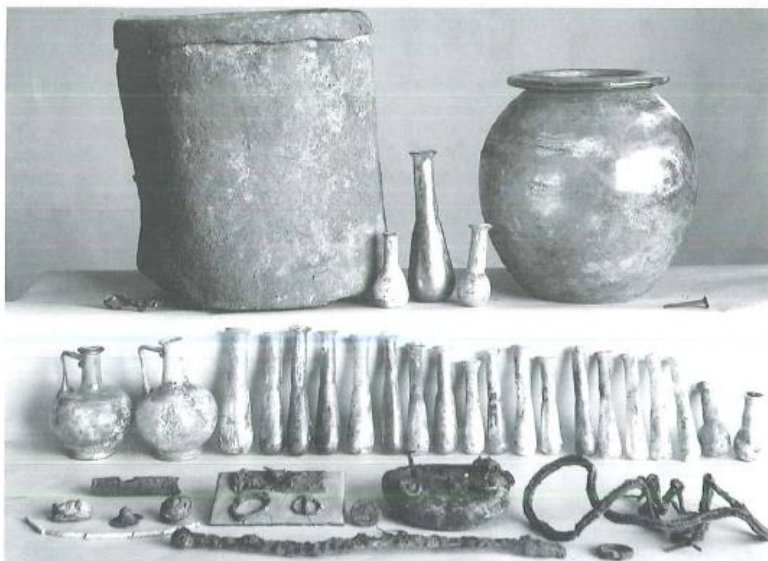
the presence of antimony and lead in an oxidizing state in the yellow glass and higher levels of copper in the blue glass, as indicated in Table 2.1.

### **Archaeological Evidence**

As mentioned previously, it is most likely that these delicate glass unguentaria were recovered from grave contexts where they would have been relatively protected from damage. Since the unguentaria in this study come from collections whose archaeological context is largely unknown, we must use examples of unguentaria found during

excavations that fit the temporal ranges and regions represented in the MPM collections.

At the Mediterranean coastal Iberian site of Empúries (occupied from 575 BC to sixth c.



**Fig. 2.12. A grave good assemblage at Empúries (Castanyer 2012: 95).**

AD), excavated graves contained elaborate sets of objects (Fig. 2.12) including up to 23 glass test-tube unguentaria in a single grave and both glass and ceramic test-tube and piriform unguentaria are known

(Castanyer 2012: 95). This impressive set of unguentaria found within a single grave hints at the ability of unguentaria to display the status of the deceased, but presumably only when presented in larger quantities. Larger sets of unguentaria within a single grave might also reflect the complexity of the preparation rituals for the corpse where multiple stages might necessitate the use of multiple unguents or scents, or possibly multiple sets of mourners ritually interacting with the grave at the time of burial.

### **Funerals in the Early Roman Empire**

Here the funerary rites of early Imperial Rome (31 BC – 312 AD) are discussed with special attention given to the roles of scent and fragrances. Perfumes, unguents, and oils associated with Roman death-rituals are also described in terms of their cost, as well as the systems in place to ensure the use of fragrant offerings in proper burial rites. These funerals were public events used to publically display both piety and wealth and the

costliness of the scents used adds an additional layer of meaning to the endeavor to understand olfaction in mortuary rites, as the shared experience of breathing in rare and expensive fragrances would reinforce the status of the deceased, or that of their patron, in the minds of mourners (Bodel 1999: 259). The respective costs of both rare and common perfuming ingredients are explored later in this section to address one of the ways this study can contribute to the question of whether unguentaria were being used exclusively by wealthy individuals. Expensive ingredients would suggest widespread use of unguentaria among unlikely among the poor, though one cannot discount the possibility that sturdier ceramic unguentaria may have been discarded and repurposed.

#### *Early Imperial Funerals*

Toynbee defines *funus* as “all that took place between the hour of death and the performance of the last post-burial ceremonies...[and] includes, furthermore, the questions of who paid the expenses of the funerals of...various types and of the extent to which the State regulated funerals by legislation” (1971: 43). Here the various types of Roman funerals are described, with a subsequent discussion of how these unguents and funerary oils of varying quality were available to rich and poor alike in the Roman world through burial clubs and offerings to the anonymous dead via *columelle* pipes.

#### *Funus Translaticum*

##### Pre-Pompa

Near the hour of death, friends and family crowded around the death-bed in order to convey their emotional support and to grieve while the “nearest relative present gave the last kiss to catch the soul, which...left the body with the final breath” before finally closing the eyes of the deceased (ibid: 44). The name of the deceased would be

periodically called out and lamented (*conclamare*) throughout the rite until the body was either inhumed or cremated. The body was taken out of bed and set upon the ground

(*deponere*) where it was washed, anointed, and dressed according to the social position of the deceased, with a coin in the mouth as fare money to cross the Styx (*ibid*).

Wealthier individuals remained lying-in-state for up to seven days and were placed upon a “grand bed,” or funerary couch (*lectus funebris*) (*ibid*). The corpse was



**Figure 2.13. Lying-in-state relief, Tomb of the Hatarii (Bodel 1999: 266).**

then displayed in a supine position to mourners (*collocare*) in the atrium of the house with the feet facing toward the house door. Toynbee describes a marble relief found in the “Tomb of the Hatarii” dating to the late-Flavian period (Fig. 2.13) showing a woman lying-in-state on a *lectus* placed high upon a platform, surrounded by torches, candelabras, garlands of fruit and flowers, and hired female mourners (*ibid*: 45). Incense burners are alight in the foreground of the relief and an acanthus leaf is displayed in the doorway, likely serving as a public sign that a death has occurred in the family (*ibid*).

Rushforth posits that the candelabras surrounding the corpse in scenes such as this one, in addition to their obvious practical use, had a cultic purpose in “attending the dead” as part of a “cult of the dead by means of light” where light was symbolic of deities and/or spirits, including that of the deceased (1915:163).

During the *collocatio* period, at the height of the grieving, the aforementioned female mourners would “cry, beat their breasts, tear their hair, scratch their cheeks, rend their clothing, cover themselves with dirt, roll on the ground, and bang their heads on the floor” while the family members “throw themselves on the corpse, clutching and addressing the body as if it could respond” (Bodel 1999: 265). Lucian’s observations in *De Lectu* highlight the fact that the behavior of the hired mourners was not for the benefit of the deceased person so much as it was intended to provide a sufficient spectacle of grief to the others present (ibid). Upper-class individuals would have had their funeral arrangements handled by undertakers (*libitinarii*) and morticians (*pollinctores*), while the poor were “carried out on a cheap bier (*sandapila*) by *vespilliones*” (Toynbee 1971: 45). The name for the morticians, *pollinctores*, alludes to their practice of applying pollen to the face of the corpse in order to counteract the discoloration of death, while the name *vespilliones* refers to the practice of burying the poor late at night, during the *vespertino tempore* (Bodel 2000: 138).

### Pompa

Traditionally, Roman funerary processions (*pompa*) were carried out at night by torchlight, but as time passed only burials of the poor and of children continued to occur at night (Toynbee 1971: 47). Attendees were dressed all in black (*lugubria*) and the wealthy deceased had their *lectus* carried out on a bier (*feretrum*) by as many as eight individuals selected from the friends, family, or recently freed slaves of the dead person. The less well-to-do typically had four attendants to transport their *feretrum* (ibid). Those carrying the bier were directed by a *dissignator* while musicians marched alongside of it, typically made up of pipers (*tibicines*), a trumpeter (*tubiceni*), horn-blowers (*cornicines*),

and hired mourners singing dirges (*praeficae*) (ibid). Another important component of the funerary rite was the creation of a life-like mask (*imago*) made to resemble the deceased—whether or not these masks were molded directly on the face of the corpse, in the style of a “true death mask,” is not currently known (ibid). These masks would have not only been displayed in a place of honor in the home, they would also have been worn by family members during the processions at later funerals, with masks worn by the living relative most closely resembling the face pictured on the mask (ibid).

### Inhumation and Cremation

The disposal of the corpse took place outside of Rome, both as a precaution against the defilement of the graves and to maintain sanitation (ibid: 48). The Campus Martius was considered to be far enough removed from the heart of the city to house the tombs of emperors and elite citizens, while during the Republic the *Porta Equilina* was the site of several potter’s fields and *puticuli*, which were mass grave-pits containing the unburned bodies of the poor and slaves (ibid: 49). Burials of the poor took place in trench-graves (*fossae*), while Jews, early Christians, and some pagans were interred in underground vaults, known as *hypogea*, or catacombs (ibid). During the second century AD the rich were entombed in ornately carved stone sarcophagi, while those with less money made do with sarcophagi made out of terracotta, lead, or wood (Carlos Galvao-Sobrinho, personal communication 2012). If the body was to be cremated, a small portion, usually the little finger, was removed as the *os resectum*, and this portion was inhumed.

Crematory workers (*ustores*) prepared the body for burning on a pyre of wood and papyrus, along with any gifts and animal sacrifices for the deceased (Toynebee 1971: 50). After the fire died down, the ashes were quenched with wine and collected by relatives

for storage in “ash-chests” made out of a wide variety of materials, ranging in cost according to the family’s means (ibid). Additionally, depending on the family’s finances, the ash-chests would have been buried in the earth under an amphora (Graham 2006: 92), a grave marker or tumulus, or they might have been housed within a chamber-tomb or in a *columbaria* niche (Toynbee 1971: 50).

Cremation was considered to be the “Roman custom” (*Romanus mos*) and was practiced in Rome as early as 1000 BC (Carroll 2006: 5; Morris 1992: 52). Circa AD 60-70, characters in the *Satyricon* mention inhumations as being a “Greek custom” (*Graeco more*) which is also consistent with archaeological findings from the eastern Mediterranean (Carroll 2006: 6). In later times, around the early second century, inhumation becomes increasingly popular for elites, possibly linked to the inhumation of Emperor Hadrian (ibid: 7).

### Post-Disposal

According to Roman law, a grave was not officially recognized until a pig had been sacrificed at the spot, thus becoming sacred (*locus religiosus*) (Toynbee 1971: 4). Other regulations required of the deceased’s family included an immediate personal purification “by fire and water” (*suffitio*), a mandatory grave-side funeral feast (*silicernium*) and the beginning of a period of house-cleansing (*feriae denicales*) (ibid: 51). Nine days later, a meal, the *cena novendialis*, was eaten at the site of the grave along with a libation to the *Manes*, or spirits of the dead, to signify the end of the full mourning period (ibid).

Families also gathered grave-side to share a meal on the anniversary of the deceased’s birthday (*dies natalis*) in addition to other festivals of the dead, in particular *Parentalia* in February, *Violaria* occurring at the end of March, and *Rosaria*, which was celebrated at

the end of May (ibid: 64; Carroll 2006: 4). Expensive mausolea were often equipped with private kitchens and eating chambers to accommodate these festivals, and the dead were thought to directly take nourishment from the food and drink, as evidenced by the coffins that commonly included holes, or terracotta and lead pipes (*profusio*), that allowed food and drink to be poured directly onto the corpse (Toynbee 1971: 51-52). Evidence in coeval mausolea of candelabras near the sarcophagi suggests that the lighting of candles was also a part of remembrance ceremonies (Rushforth 1915:153). This is echoed in Toynbee's description of the "provision [that] could be made for the lighting of lamps at the grave on the Kalends, Ides, and Nones of every month" (1971: 63). Among the grave goods left by the family in order to honor and comfort the deceased were: gaming pieces, flagons, bottles, eating utensils, deity figurines, toys, toiletries, jewelry, weapons, lamps, cooking vessels, mirrors, distaffs, funerary portraits, perfume, cosmetics, etc. (ibid: 53-54). Cenotaphs were buried in the event that a body was not recovered (drowning victims for example) in order to provide the soul with a "dwelling place" and the family with a sacred place where they could commune with the dead (ibid).

### Burial Clubs

While the topic of burial clubs could be afforded its own section, because these groups, also known as *collegia*, were primarily used by the lower-class members of society, including slaves and freedmen, its discussion seems appropriate here. On June 9, 136 CE, a decree issued from Lucius Caesennius Rufus directed the worshippers of Diana and Antinoüs to "pay an initiation fee of 100 sesterces and an amphora of good wine, and...pay monthly dues of 5 *asses*. [If dues are not paid] for six consecutive months...his

claim to burial shall not be considered even if he has provided for it in his will. It was voted further that upon the decease of a paid-up member of our body there will be due him from the treasury 300 sesterces, from which sum will be deducted a funeral fee of 50 sesterces to be distributed at the pyre [among those attending]; the obsequies, furthermore, will be performed on foot” (Ascough et al. 2012: 310).

This is only one example of how a burial club was set up in order to cover the costs of burying its members; another Roman *collegium* dated to 60 AD was dedicated to the god Silvanus, and hints at differences in membership dues among these clubs and the varying costs of funerals that they would provide (Carroll 2006: 45). The burial club of Silvanus had a membership fee of 240 sesterces and provided a funeral costing 560 sesterces as long as at least 50 sesterces were left to the club in the deceased’s will (Carroll 2006:45). These *collegia* were frequently established by professional guilds and religious orders and often buried members within communal *columbaria*, though individual tombs are also known (ibid: 47; Toynbee 1971: 55). By joining these clubs, poor members, or those without family, could be assured of a proper burial and could avoid the anonymous fate of bodies dumped into an open pit burial (*puticuli*).

#### *Funus Militare*

Soldiers killed in battle were collectively buried or cremated, though this cost was sometimes covered through the charity fund set up by fellow soldiers. Generals would be additionally honored “by a *decursio* in the form of a ride or march round his funeral pyre or cenotaph” (Toynbee 1971: 55).

### *Funus Publicum*

These were a special form of *funus indictivum* (wherein a herald summoned all citizens to attend) to honor the dead with a panegyric and sung dirge, occasionally accompanied by games and free feasts as commemorative spectacles (ibid, 56). *Funus publica* were paid for by the State, and were granted to important foreign prisoners, benefactors of the State, and in the provincial areas, anyone who had “rendered signal service to their cities,” regardless of their gender (ibid).

### *Funus Imperatorium*

This type of public funeral was rarely granted to anyone who was not an emperor or part of the imperial family, though exceptions were occasionally made. The *funus imperatoria* was incredibly lavish and the period for lying-in-state was somewhat different, as the bodies of emperors, namely Julius Caesar and Septimius Severus, were reported to have been represented by life-sized wax effigies (Toynebee 1971: 58-59). The *imago* masks also took on a heightened theatricality in these *pompa*, and the spatial organization of these processions has been described as visually mimicking the “temporal progression and transitional nature of the rite [it represents]” (Bodel 1999: 264). In these obsequies, three main parts are considered:

First...the ancestors, resplendent in their official garb and arranged in chronological order, beginning with the earliest and ending with the actor who impersonated the deceased. Next came the bier with the corpse, likewise decked out in finery and thus visibly linked to the ancestors whose ranks it now joined, but borne, still, on the shoulders of the living, who were distinguished by the darkened clothes of mourning. Finally, family members, and other mourners, dirty and disheveled, came behind...at the funerals of the rich, performers dressed as satyrs preceded the bier and dancing a parodic dance called the *sicinnis*, in which they mocked and mimicked the serious movements of the other participants (ibid).

Another example of a comic element in the imperial *pompa* is given in Suetonius' *The Twelve Caesars*, where he discusses Vespasian's funeral in which the "famous comedian Favor, who had been chosen to wear his funeral mask in the procession and give the customary imitations of his gestures and words, shouted to the stewards, 'Hey! How much will all this cost?' 'Ten million sesterces' they answered. 'Then I'll take a hundred thousand down, and you can just pitch me into the Tiber'" (Vespasian 19). This passage is also useful for its mention of how costly an emperor's funeral could be. One of these *funus imperatoria*, that of Poppaea, wife of Nero, was notable both for its extravagant cost and the role that incense and fragrance played, discussed further below.

### **Fragrance and Funerals**

As mentioned above in the thorough description of Roman funeral rites, anointing oils were used on the body prior to the lying-in-state and scattered flowers, incense and perfumes were used during this period and throughout the *funus*. The brief mention of the acanthus leaf display on the relief of the Tomb of the Haterii is followed up by a statement from Pliny, where he mentions cypress boughs as being "consecrated to Dis; and so placed outside the doors of houses as a sign of mourning" (N.H. 16.60.139). It is not clear whether cypress was the main plant chosen for mourning displays, or if acanthus or pine were used just as frequently.

### *Pagan Rome*

#### References to Anointing Oils

In the *Satyricon*, Trimalchio enacts his mock funeral in front of dinner guests and asks for "some ointment, and a sample from that jar which is to be poured over my bones' ...at once he opened a jar of ointment and anointed us all..."(Hope 2006: 119). The exact

composition and components of this ointment are not described, but it is likely to have contained myrrh based on upon comparisons with anointing oils in the New Testament, explored further below.

#### References to Processional Scents

Passages from Pliny, Martial, and Statius discuss the importance of cassia, cinnamon, myrrh, saffron, and frankincense for burning on the funeral pyre. In his *Natural History*, Pliny describes the sacred quality of some scents as being related to their costliness:

Luxury has made them [cinnamon and cassia] sacred even at people's deaths. They are thought to have been made by the gods for burning with the dead. Those knowledgeable about the matter have said that more than a year's supply was burned by the Emperor Nero on the last day of his wife Poppaea. It is estimated that throughout the entire world every year as much is given at funerals, heaped and piled in honor of the corpse, as is given little by little to the gods (12.41.83).

Statius gives further examples of spices and resins used on the funeral pyre of Flavius Ursus' favorite slave, in the poem's lines: "No servile flames for you. The fire consumed fragrant forests of incense and saffron, and cinnamon stolen from the Phoenix, and the juices that drip from Assyrian herbs, as well as your master's tears..." (Hope 2007:112). The poetry of Martial goes on similarly to say, "When the insubstantial pyre was being built with papyrus that was soon to be burned and his tearful wife was buying myrrh and cassia...shameless Zoilus, empty your dirty pockets of the unguents and the cassia and the myrrh smelling of funerals and half-cremated frankincense you took from the pyre and the cinnamon you snatched from the Stygian couch" (ibid: 113).

#### References to Scented Funerary Offerings

Ausonius stresses the importance of other fragrances and flowers, such as the rose, spikenard, and balsam in his epitaph, "Sprinkle my ashes with pure wine and fragrant oil of spikenard: Bring balsam, too, stranger, with crimson roses. Tearless my urn enjoys

unending spring. I have not died, but changed my state” (Toynbee 1971: 63). Funerary offerings were required on the Kalends of April, May, June, July, August, and October, which primarily included food, wine, fruits, and flowers (violets and roses especially) (ibid: 62-63; Schrumph 2006: 113). In Ausonius’ epitaph, he addresses the fellow members of his burial club, who would have been the “strangers” responsible for making these offerings (ibid).

### *Jewish-Roman Practices*

Deborah Green, who has analyzed passages of the Torah to better understand the role of the scents and spices in Jewish burial customs, explores the presence of perfume bottles in Jewish graves of the early Roman Empire (2008). The use of oils and perfumes in Jewish funeral rites are very similar to those used in the practices of pagan Romans. Green explains that after the destruction of the Second Temple, Diasporic Jews often adopted Hellenistic customs against the wishes of the rabbis, but also points out that many of these rabbis were equally as “Hellenized” and “influenced by Roman culture as the other local and Diasporic Jews” (ibid: 154). She gives examples of the Jewish appropriation of lighting incense after meals and the use of decorated sarcophagi with Hellenistic designs (ibid:153). Three main ways in which scented oils were utilized in Jewish funerals are highlighted in the anointing of the body, burning during the funeral procession, and as a sprinkled offering over the deceased during commemorative graveside meals (ibid: 168). Green states that the oils and ointments used in burial rites were not used primarily to disguise the stench of the rotting corpse, as adherence to Jewish law requires that all individuals be buried as soon as possible, and powerful odors of putrefaction do not occur until about ten to twenty days after death unless a person has

died of intestinal disease or while menstruating (2008: 166). The use of incense in the funeral procession was originally confined to those burials producing a greater stench, as mentioned above, though eventually all Jewish burials were honored with incense to be carried before the bier (ibid: 165).

As in Roman graves, unguentaria are frequently found within walled Jewish catacomb burials, as well as in pagan graves throughout the Empire (ibid: 155; Fleming 1999). Broken glass from these bottles was also used to decorate the mortar used to seal the catacomb niches (De Santis 2001: 240). These bottles likely represented the personal property of the deceased, or grave goods placed in the grave to bring comfort to the dead in the afterlife. Within a Jewish context, these bottles would have been seen as “ritually unclean,” which may provide an additional explanation for the bottles’ presence, as they would have been left in the grave after making offerings to avoid any contact with spiritual contamination (ibid: 170).

#### References to Anointing Oils

From New Testament passages, we are made aware of the importance of myrrh, aloes (wood aloes) and nard (spikenard) oil in the preparation of the body after death. In the chapter of John, Jesus’ body is described as being anointed with a “mixture of myrrh and aloes, weighing about a hundred pounds...[then wrapping] the body of Jesus...with the spices in linen cloths, according to the burial custom of the Jews” (19:39-40). Before Jesus’ death, he is anointed by a woman in Bethany who “came to him with an alabaster jar of costly ointment, and she poured it on his head as he sat at the table” (Matthew 26:10-12). Jesus explains to his disciples that “by pouring this ointment on my body she has prepared me for burial” (ibid). The chapter of Mark further describes this ointment as

a “very costly ointment of nard..[which might] have been sold for more than three hundred denarii” (14:3-5).

### Popular Perfumes in the Roman World

Many of the sought after scents in Early Imperial Rome were Egyptian recipes, and were widely famous throughout the empire. Similar to modern times, many of these perfumes were based on floral scents, more specifically: Susinum (lily based), Irinum (iris based), Cyprinum (henna based), Sampsuchinum/Amaracinum (marjoram based), Myrtinum (myrtle based), Rhodinum (rose based) (Manniche 1999). Other perfumes contained spicy or resinous scents, specifically: Mendesium (balanos oil with myrrh and cassia), Cinnamominum (containing cinnamon and cassia oils), and more complex mixtures such as Metopion and Megaleion:

**Table 2.2. Variations on Ancient Perfume Recipes (after Manniche 1999: 67; 76)**

Recipes	Pliny	Discorides	Theophrastus
METOPION	Bitter almonds, omphacium, cardamom, camel grass, sweet flag, honey, wine, balsamum seed, galbanum, resin*	Bitter almond oil, omphacium, cardamom, camel grass, sweet flag, honey, wine, myrrh, balsamum seed, galbanum, turpentine resin	-----
MEGALEION	Balanos oil, resin*, cassia, balsam, sweet flag, camel grass, wood balsam	Balanos oil, resin*, cinnamon, myrrh, carpobalsam, sweet flag, camel grass, wood balasam, costus, spikenard, amomum	Balanos oil, burnt resin*, cassia, cinnamon, myrrh

\*unspecified plant species

Some perfumes were associated with specific regions of manufacture, Irinum, the iris-based perfume, was said to have originated in Illyria (western Balkans), for example, and

it was thought that the highest quality iris plants grew in that region according to Pliny and Theophrastus (ibid.). As popular as fragrance was in the ancient world, it is interesting to note that perfumers were not held in high regard, holding roughly the same social standing as other tradesmen (Brun 2000: 277).

### **Cost of Perfumes and Incense**

Perfumes could be considered a Roman obsession, with all manner of items doused in scent, from ship's sails, to weapons, and even one's pets (Donato and Seefried 1989: 55). The most expensive perfumes of the day were sold for up to HS1600 per pound, and many contained several rare ingredients (*Regale Unguentum* is one such example) (ibid: 15). Pliny mentions the market value of spices, resins, and oils in his *Natural History*, with some attention paid to the difference in spice quality and its corresponding price range. The differences in price based on Pliny's listed countries of origin for these spices are frequently incorrect and therefore are not included in this discussion (Sidebotham 1997: 34). However, he estimated that Rome spent around 100 million sesterces per annum on incense from Arabia alone (ibid). Of the popular resins and oils mentioned earlier, one of the most expensive was spikenard or nard oil, which cost anywhere from 100, 75, to 40 denarii per pound depending on its quality (Pliny N.H., 12.26.42-44). Myrrh was priced at a range from 3 to 50 denarii, and was frequently "adulterated with pieces of mastic, and other gums; and drugged with the juice of wild cucumber" (12.35.16). The best quality frankincense sold at 6 denarii per pound (NH 12.32), wood cinnamon was 10 denarii a pound (NH 12.42.92), while cassia was valued at a range of 5 to 50 denarii a pound (NH 12.43.95-97). Pliny does not give a price for saffron, but notes that this costly spice was frequently adulterated with marigold petals (NH 21.17).

Inscriptions referring to two commemorative statues placed in the city forum of Misenum by Q. Cominius Abascantus make clear demands for how these statues are to be honored and cared for and the specific kinds of oils and flowers to be used as offerings (D'Arms 2000: 127; Schrumpf 2006: 113). Here, Cominius used the honoring of the statues he built, instead of public graveside rites, to establish his memory in the minds of his fellow citizens. He insisted that the statues be cleaned and anointed with at least one pound of nard oil and adorned with violets and roses (D'Arms 2000: 138; Schrumpf 2006: 113). This inscription provides a useful reference for the cost of nard oil, which is listed at a value of HS24 per pound, though this is a bit low compared to Pliny's estimate (Schrumpf 2006: 113). Unfortunately, the price of the violets and roses refers to an unknown amount, but are quoted as costing HS16 each (ibid). Schrumpf tallies the total cost of the offerings requested for Cominius' statues at HS600, with far more money allocated to sacrifices than to oils and flowers (ibid: 114).

Adding up the number of Kalends from April through October, plus the festivals of *Violaria*, *Rosaria*, *Parentalia*, as well as the birthday and deathday of the deceased yields a total of at least twelve required dates for funerary offerings. Depending on the quality of the spices, perfumes, and incenses being offered to the dead, these rites would quickly become quite costly. It is likely that individuals during this time gave the best offerings that they could afford to avoid snubbing the deceased while still remaining within their budget. For the potter's fields and *puticuli*, an effort to honor these anonymous dead can be seen in the *columelle*, which are basalt or tufa stones shaped into an abstract human torso and head to serve as a nameless marker to be placed above cremated remains (Carroll 2006: 59). Though nameless, the *columelle* still contained a

lead or tile pipe in order to convey libations to the underworld (ibid). This marker style was frequently associated with roughly demarcated family plots, though many non-related individuals were also secretly buried within the plot boundaries (ibid: 61). Even though there was clearly a vast difference in the quality of the burial rites available to the rich and poor of Rome, knowing that the *columelle* were able to distribute libations to the anonymous poor is a sign that some of the perfumes, oils, and unguents needed to honor the dead would have been marginally available to all, even the poorest of Rome.

## Chapter 3: Methods

### Sampled Vessels

Twenty-seven unguentaria (Table 3.1) from the collections of the Milwaukee Public Museum were sampled after permission was obtained for destructive testing analysis (see Appendix A). Out of a total of thirty-nine vessels identified as being in the necessary date range, the twenty-seven chosen for sampling were selected based on the presence of visible internal residue, as well as on their ability to represent stylistic shifts over time in both ceramic and glass. The vessels in this study come from the MPM collections in the Anthropology Department (A), the Ethnography collection (E), and a special collection within the History Department--the Nunnemacher collection (N), named after Rudolph Nunnemacher, a wealthy collector living in Milwaukee around the turn of the 20<sup>th</sup> century.

**Table 3.1. Sampled Unguentaria at MPM (N=27)**

Collection	Catalog	Accession	Material	Style	Location	Estimated Date**
<b>Ceramic fusiform vessels for comparison with glass types</b>						
N	14629	20643	Ceramic	Fusiform	Malta	500-200 BC
A	54021A	19746	Ceramic	Fusiform	Puteoli	400-300 BC
A	54021b	19746	Ceramic	Fusiform	Puteoli	400-300 BC
N	12883	19173	Ceramic	Fusiform	Rome	100 BC-100 AD
<b>Glass vessels (50 BC-400 AD) to test possible changes in function over time</b>						
A	15849	5253	Glass	Test-tube*	Phoenician	50 BC-100 AD
A	54081	19977	Glass	Test-tube*	Syria	0-100 AD
N	20280	23027	Glass	Test-tube*	Roman Empire	50BC-100 AD
N	21774	23571	Glass	Test-tube*	Roman Empire	50 BC-100 AD
N	16096	21500	Glass	Test-tube*	Malta	50BC-100 AD
N	20274	23026	Glass	Piriform	Roman Empire	150-400 AD
A	16177	213	Glass	Piriform	N/A	150-200 AD
A	16175	213	Glass	Piriform	N/A	150-200 AD
N	15388	21093	Glass	Piriform	Malta	150-250 AD
A	53912	19612	Glass	Piriform	Hungary	150-250 AD

A	53913	19612	Glass	Piriform	Hungary	200-400 AD
N	23703	24259	Glass	Piriform	Syria	200-400 AD
N	16141	21501	Glass	Piriform	Malta	250-400 AD
N	20915	23307	Glass	Piriform	Roman Empire	300 AD
<b>Vessels with significant residue most likely to yield baseline results</b>						
N	16126	21501	Ceramic	Piriform	Malta	600-400 BC
N	16081	21500	Ceramic	Piriform	Malta	500-300 BC
N	16136	21501	Ceramic	Fusiform	Malta	300-200 BC
A	10436	None	Glass	Piriform	Sidon	50-400 AD
N	20194	22949	Glass	Piriform	Gurgan, Iran	100-400 AD
E	39974	10861	Glass	Piriform	Cyprus	200-400 AD
N	10892	17814	Glass	Piriform	Syria	200-400 AD
N	15299	21014	Glass	Piriform	Malta	250-400 AD
N	10365	16671	Glass	Piriform	Syria	300-400 AD

\*This vessel style is descriptive, rather than based on an established type. \*\*Based on the MPM catalog.

### Comparative Analysis

A qualitative analysis of vessel style was conducted in order to ensure that the vessels in the sample were accurately identified and categorized by the MPM, as well as to ensure that the contents of these vessels could be compared against their forms to better approximate their intended functions. Sourcebooks on ceramic analysis provided a guide to vessel shape analysis and classification information was used to assist in the identification process (Rice 1987; Shepard 1956). More specific identifications (e.g. piriform versus bulbous) were based on Anderson-Stojanović's discussion of the chronology and function of ceramic unguentaria (1987). Pottery function with respect to the vessel type and content is also addressed in this study (Chilton 1999; Skibo 1992). As mentioned previously, sourcebooks on glass vessel shape analysis and classification proved valuable for this project since many of the MPM catalog ledger entries for the glass unguentaria were based on outdated early 20<sup>th</sup> century typologies that conflicted

with the known starting dates for glassblowing in the Mediterranean (Stuart J. Fleming [1997, 1999]; Gladys D. Weinberg [2009] and Marianne Stern [1999, 2009]).

The MPM unguentaria studied in this project were accessioned into the Anthropology, History, and Ethnology collections and are stored in the following MPM locations: Anthropology Storage, History Storage (also known as Lower Film Storage), Temples Tells and Tombs (TTT) cold storage, and the Africa Before Islam exhibit (ABI) located on the third floor. As part of an MPM internship in the summer of 2012, database entries for each unguentarium were created by the author and professional photos of each vessel were taken for later inclusion in the museum's KeEMU database.

Documentation for each vessel (including catalog ledgers, card catalogs, and donor files) was compared against the aforementioned glass and ceramic stylistic sourcebooks and vessel data were added or corrected as necessary before entry into KeEMU (see Appendix A).

## **Residue Analysis**

### *Overview*

Since this museum-based research collection is comprised of vessels with very little documentation regarding specific provenience or context within particular archaeological sites, conducting a residue analysis of vessel contents is limited to posing broader questions regarding changes in their use over time and the relationship between form and function. Addressing the difference encountered among the shifting vessel forms and materials throughout time was made possible by comparing the results of these vessels' chemical fingerprints obtained from the sampled traces of their original residues with the proviso that the date ranges are not exact.

### Organic Content

The Fourier transform-infrared spectroscopy (FT-IR) technique for identifying organic compounds is a standard method of residue analysis in archaeological studies. Organic residue analysis has become a widely used approach for identifying organic substances in archaeological contexts, growing increasingly popular since its first applications in the early 1990s (Evershed 2008: 896). The “chemical fingerprints” within complex organic compounds can be used to identify components down to a fairly specific level—in instances where plant resins are analyzed, for example, the plants can frequently be identified at the genus level, and can even be identified down to the exact species. Specific studies of archaeological aromatic organic compounds will be addressed in the next section.

### Inorganic Content

Inorganics are commonly measured using the ICP-MS technique, which allows one to measure trace levels of most metals with high sensitivity and specificity, along with their relative concentrations. Elemental analysis is frequently included in studies of archaeological cosmetics and pharmaceuticals as a way to provide complementary evidence for conclusions reached from organic analytical techniques, but currently ICP-MS remains under-utilized in such studies (Ribechini et al. 2011:1735).

### Performing Analyses

An inter-departmental collaboration with Dr. Joseph H. Aldstadt of the UW-Milwaukee Chemistry Department made it possible for this project to be carried out, with additional research assistance on FT-IR provided by Dr. Aldstadt’s graduate students Veronica Marco Alvarez and Lisa Kendhammer. In the initial stages of the research process, Dr.

Aldstadt suggested using FT-IR and ICP-MS analytical methods to yield a wider spectrum of data that could reveal both organic and inorganic vessel contents. As this study tests the assumption that unguentaria vessel types contained perfumes, makeup, or scented unguents, a research design sensitive to inorganic components allowed the presence of the metallic compounds frequently contained in the medicines and cosmetics of the Classical world to be identified (Stewart 2007).

#### *Expected Vessel Contents*

The small number of extant chemical characterization studies of unguentaria and aryballoi (see Ribechini et al. 2008b, 2009) have shown the presence of fatty acids and terpenoids, suggesting that unguentaria often contained oils (most likely olive) and resins from coniferous trees, most likely cedar, camphor, or cypress (Biers et al. 1994: 29).

These resins are known to have been used as incense, embalming agents, and in preparations of medicines and cosmetics in ancient Egypt, which were eagerly adopted throughout the Roman world during the early days of the empire (Ribechini et al. 2006: 1787). For this study, analytical standards of modern extra-virgin olive oil and essential oil of pine (*Pinus sylvestris*) were used in addition to more specialized perfume ingredients like galbanum, labdanum, and calamus root. Essential oils used in this study were obtained commercially from a vendor (New Directions Aromatics) that supplies the documentation of country of origin, method of distillation, and ensures the relative purity of each essential oil.

Donato and Seefried are the source of the historical and botanical information presented below (unless otherwise noted) for the plants most frequently encountered in

scented unguents of the ancient world, specifically in Greece, Rome, and Egypt, up through the first century AD (1989: 24-45).

## ***Resins***

### Balsams

Vegetable: *Commiphora opobalsamum*; *Balsamodendron opobalamum* (Burseraceae).

Parts Used: Twigs and buds are boiled to produce an oily resin.

Adulteration: Petre Iperico, seed juice, Cyprus rose, lentisk myrrh.

### Camphor

Vegetable: *Cinnamomum camphora* (Lauraceae).

Parts Used: Bark and leaves boiled to produce an oily resin which is added to perfumes, medicines, and incense, also used as an insect-repellant.

### Cinnabari-Cinnabar (Dragon's Blood\*; Red Sandalwood)

Vegetable: *Pterocarpus Draco* (; *Pterocarpus Santalinus* L. (Fabaceae)

Parts Used: Resin exudate; bark. Burned as incense and added to perfumes and in medicines which utilized its coagulant properties.

\*Note: Not to be confused with Cinnabar (HgS). Modern day "dragon's blood" resin is frequently harvested from the *Daemonorops* genus of rattan palms.

### Frankincense

Vegetable: *Boswellia carterii*; *B. sacra*; *B. thurifera*; *B. frereana*; and *B. bhaw-dajiana* (Burseraceae).

Parts Used: Resin exudate added to perfumes, medicines, and burned as incense.

### Galbanum

Vegetable: *Ferula galbaniflua*, *Ferula rubricaulis*, *Ferula Ceraophylla* (Umbrelliferae).

Parts Used: Resin exudate used in poultices, stomach remedies, and as balsam for chronic respiratory and urogenital mucosa.

### Gum Mastic

Vegetable: *Pistacia lentiscus* (Anacardiaceae).

Parts Used: Resin exudate used in cosmetics as a binder, and also as stomach-soothing chewing gum.

### Gum Benzoin

Vegetable: *Styrax benzoin* (Styracaceae)

Parts Used: Balsamic resin used in perfumes, medicines, and potable liquids.

### Labdanum

Vegetable: *Cistus ladinifer* (Cistaceae)

Parts Used: Resin exudate is used in perfumes for its fragrance and as a fixative.

Myrrh

Vegetable: *Commiphora mirha* L. (Burseraceae)

Parts Used: Resin exudate, known as Myrrh Eletta (pure), is encountered along with Myrrh in Sorte (conglomeration of resin tears mixed with misc. impurities).

Adulteration: Lentisk, gum and cucumber juice for bitter flavor.

Opobalsam

See entry under Balsam

Opoponax

Vegetable: *Opoponax Chironium* K. – *Pastinaca opoponax* L. (Umbrelliferae).

Parts Used: Oily gum-resin exudate used in perfumes. Juice of opoponax was commonly called “costgrass.”

Styrax

Vegetable: *Liquidambar orientalis* L.; *Liquidambar styracifula* L. (Hamamelidaceae).

Parts used: The resin exudate has a sharp, strongly aromatic and lightly spicy scent.

Adulteration: Turpentine, castor oil, olive oil, vegetal substance

Turpentine

Vegetable: *Pinus pinea* L.; *Pinus silvestris*; *Pinus nigricans* Host (Pinaceae).

Parts Used: Gummy-resin exudate used in perfumes for its “fresh and balsamic” scent. Also taken internally for chronic bronchial catarrh, in hepatic colic, and externally as a rubefacient.

**Oils**Balanos Oil

Vegetable: *Balanites aegyptiaca* (Zygophyllaceae).

Parts Used: The oil of Balanus is extracted from cold-pressed kernels and was prized for its low viscosity, making it an excellent carrier oil.

Bitter Almond Oil

Vegetable: *Amygdalin communis* var, *amara* L., (Rosaceae).

Parts Used: Oil obtained from the seeds was used as a carrier in perfumes and the powdered seeds were used in cosmetics to whiten and soften the skin.

Olive Oil

Vegetable: *Olea europaea* (Oleaceae).

Parts Used: Pits are cold-pressed to produce oil. Traditionally, unripe olives (August harvest) were used, and this oil was known as “onphacium”. Used as a fatty base or binder in many of the preparations listed here.

### Poppy Oil

Vegetable: *Papaveris seminis* (Papaveraceae).

Parts Used: Poppy seeds are cold-pressed to produce oil high in tocopherols, used as a carrier oil.

Adulterants: Poppy seed oil was frequently mixed in with olive and almond oils.

### Moringa Oil/Ben Oil

Vegetable: *Moringa oleifera* (Moringaceae).

Parts Used: Mature seeds are cold-pressed to make a colorless, odorless, edible oil that resists rancidity. This oil was preferred as a carrier oil for perfumes.

### Safflower Oil

Vegetable: *Carthamus tinctorius L.* (Asteraceae).

Parts Used: Seeds are cold-pressed to make a colorless, flavorless, edible oil frequently used in cosmetics.

### Sesame Oil

Vegetable: *Sesamum indicum* (Pedaliaceae).

Parts Used: Seeds are cold-pressed to make an edible oil also used in medicinal contexts as a base for salves.

## **Waxes**

### Beeswax

Approximate chemical formula:  $C_{15}H_{31}COOC_{30}H_6$ .

Use: Beeswax is gathered from the wax caps of honeycomb cells. For every ten pounds of honey, roughly one pound of wax is obtained. Beeswax is used as a base for cosmetic and medicinal salves (Ribechini et al. 2008a: 560; Ribechini et al. 2008b: 159).

## **Mineral Pigments**

### Hematite

Chemical formula:  $Fe_2O_3$

Use: Powdered hematite is naturally red, leading to its use as a pigment in cosmetics as a rouge. (ibid).

### Kohl

Chemical formula(s): Base of  $PbS$ ,  $Sb_2S_3$ . Other charred organic materials, such as Frankincense resin, were frequently used as an ingredient.

Use: Kohl is a dark cosmetic eyeliner paste (ibid).

### Mica

Chemical formula(s):  $X_2Y_{4-6}Z_8O_{20}(OH,F)_4$  in which X is [K](#), [Na](#), or [Ca](#) or less commonly [Ba](#), [Rb](#), or [Cs](#); Y is [Al](#), [Mg](#), or [Fe](#) or less commonly [Mn](#), [Cr](#), [Ti](#), [Li](#), etc.; Z is chiefly [Si](#) or Al, but also may include [Fe<sup>3+</sup>](#) or Ti.

Use: Due to the reflective and refractive properties of mica, it is used to provide a shimmering or opalescent quality to cosmetics (Klein and Dutrow 2008: 527).

***Blossoms, Barks, Roots, and Seeds***Aromatic Reed

Vegetable: Various species, examples are *Andropogon Schoenatus L.*, *Schoenus mariscus L.*

Parts used: The flowers are prized for their rose-like scent as well as medicinal applications for stomach pains and bladder infections.

Artemisa

Vegetable: *Artemisia Abrotanum L.* (Compositae).

Parts used: Leaves, flowering tops. Essential oils, resins, and tannins are also rich in vitamins A, B, B2, C. Herb was noted for its “fresh strong scent”.

Bergamot

Vegetable: *Citrus bergamia.* (Rutaceae).

Parts used: Fruit rind used to extract essential oils. Grown in a small coastal region in Calabria, Italy.

Calamus

Vegetable: *Acorus Calamus L.* (Araceae).

Parts used: Rhizome. Calamus plants produce a fragrant volatile oil from their idioblasts, which are isolated plant cells containing non-living substances. Oil also used in medicines as an emetic, laxative, and diuretic.

Cardamom

Vegetable: *Elettaria Cardamomum L;* (Zengiberaceae)

Parts used: The seeds are used to extract essential oils which have a “spicy and camphorous odor.”

Cassia

Vegetable: *Cinnamomum Cassia, Nees.*

Parts used: Dried bark. Used for a lighter, more delicate scent than that of *Cinnamom Zeylanicum Nees.* See entry under Cinnamon for medicinal usage.

Cinnamon

Vegetable: *Cinnamom Zeylanicum Nees; Cinnamomum Loureirii Nees* (Lauraceae).

Parts used: Dried bark is extracted in oil to create “Oleum Cinnamom” which has a more “spicy and aromatic” scent.

Costus

Vegetable: *Saussurea lappa, (Clarke), Aplotaxis lappa D.C.* (Compositae).

Parts used: Root has a “characteristic and lasting scent, reminiscent of iris, violet, and fatty acids.” Also used as a fixing agent. Roots are dried and roasted to prevent germination.

Cyperus

Vegetable: *Cyperus rotundus* or *Cyperus longerus* L., *Ligustrum vulgare* (Oleaceae).

Parts used: Leaves, which have a scent similar to that of Nard. The roots were also extracted and used as a “lavender water” with a violet-like scent.

Cypress (Mediterranean)

Vegetable: *Cupressus sempervirens* (Cupressaceae)

Parts used: Dried wood. Used in construction and as a fumigant during cremation rites.

Fenugreek

Vegetable: *Trigonella foenum graecum* L. (Leguminosae).

Parts used: Seeds were used for their sweet and spicy scent, also as a component of skin emollients and tonics.

Ginger

Vegetable: *Zingiber officinalis* (Zingiberaceae).

Parts used: The essential oil found in the rhizome is extracted by mixing the rootstock in wine for its use in perfumery. Medicinally, the rhizome is used as a stomachal and carminative.

Gladiolus

Vegetable: *Gladiolus communis* L. (Iridaceae).

Parts used: Flowers, which have a scent similar to that of Nard. Cypriot, Naxian, and Phoenician sources of gladiolus were the considered to be the most fragrant.

Henna

Vegetable: *Lawsonia inermis* L. (Litraceae).

Parts used: Flowers are used a red dye for hair and nails and the water that was used in the flower extraction process was popularly used in perfumes.

Note: Alkanet is another common name for *Lawsonia inermis*.

Labdanum

Vegetable: *Cistus ladaniferus* L. (Cistaceae).

Parts used: Leaves and twigs are treated with boiling water and a blackish resin is collected off of the surface of the water. Labdanum has a “sweet, herb-like and balsamic scent” and is a good fixing agent.

Laurel

Vegetable: *Laurus nobilis* L. (Laureaceae).

Parts used: Leaf, tops and twigs. Laurel has a sweet scent and is also used medicinally as a sedative, antispasmodic, and anti-itch remedy.

Lavender

Vegetable: *Lavandula stoechas* (Lamiaceae).

Parts used: Flower spikes. Used medicinally and as a fragrance in perfumes.

Lily

Vegetable: *Lilium Candidum* (Liliaceae).

Parts used: Bulbs are used for their subtle scent, frequently blended with other floral scents in perfumes. Medicinally, lily is used as an emollient and expectorant.

Marjoram

Vegetable: *Majorana Hortensis*; *Origanum majorana L.* (Labiatae).

Parts used: Leaf and flowering top were extracted in oil and were squeezed of their juices. Marjoram oil was a popular component in many ancient perfumes. The essence oil of Marjoram has a scent similar to lavender and camphor.

Malobrachrum

Vegetable: *Laurus cassia L.* or *Laurus malabratum L.* or *Cinnomom tamela.*

Parts used: Leaves were extracted in oil or boiled in wine which was then used alone as a perfume and also as a breath-freshener and deodorant.

Maro

Vegetable: *Teucrium maro L.*; *Trifolium sipyleum L.*

Parts used: Leaves were strongly odorous, with Libyan Maro considered to be the most pungent variety.

Melilot

Vegetable: *Melilotus Officinalis* (Leguminosae).

Parts used: Blossomed tops have a fragrance reminiscent of vanilla and hay scents. Resin oil used as an anti-inflammatory, anti-spasmodic, astringent, diuretic, and sedative. Water used from distillation was used in eye-baths.

Myrtle

Vegetable: *Myrtus communis L.* (Myrtaceae).

Parts used: Leaf and flowering tops noted for their camphorous odor.

Nard

Vegetable: *Nardostachys jatamansi, D.*

Parts used: Leaf and rhizome. Rhizome is rich in essential oil which smells similar to musk. Leaves were edible and were considered be sweetly scented and to have a pleasant aftertaste.

Oenanthe

Vegetable: *Oenanthe pimpinellifolia L.* (Oenanthe).

Parts used: Flower. The flowers from the Oenanthe, or water dropwort, family are noted for their wine-like scent.

Orris Root

Vegetable: *Iris florentina L.*; *Iris germanica L.*; *Iris palladia Lam.* (Iridaceae).

Parts used: Rhizomes are dried and stored for at least two to three years for the violet and raspberry-like scent to develop fully. Bulbs are used in powdered form or as an essential oil from the rhizome of the Florentine Iris.

Rose

Vegetable: *Rose centifolia L.*; *Rosa Damascena* (Rosaceae).

Parts used: Petal. Characteristic scent has many tonalities: musk, violet, fruited.

Used a mounting agent in perfumes. Rose is also used medicinally as an astringent and antiseptic.

Rose Wood

Vegetable: *Ligni Rhodii*, *Convulvus scoparius L.* (Convulvulaceae).

Parts used: Wood, roots, leaf. In Spain, the plant was steeped in olive oil before pressing. In the perfume industry, the root is soaked in wine to extract the scent. Rose wood is a choleric and laxative.

Saffron

Vegetable: *Crocus sativus L.* (Iridaceae).

Parts used: Bright red stigmas. Saffron's heavy scent is considered to be sweet, spicy, floral, and herb-like. The volatile oil is a skin irritant and would be adulterated before applying as a perfume. Used as a dye. Medicinally, it was as a stomachal, carminative, anti-spasmodic, anti-hysterical, and eupeptic.

The following thirteen oils were selected based on their ability to show if the vessels were used for fragrances, as well as to provide a selection of aromatic ingredients that spanned the inexpensive (pine, olive oil) to the rare and costly (labdanum, spikenard). Popular, but physically delicate and extremely volatile botanical ingredients (such as rose, jasmine, lily) were avoided in this study due to their perceived inability to endure the aging and weathering processes these vessels would have undergone as grave goods.

*Conventional Protocol for Analysis*ICP-MS

The ICP-MS analysis provides a comprehensive elemental fingerprint for vessel samples, as mentioned in the above section "Inorganic Content," For this project, the ICP-MS

instrument was calibrated using two standards for cobalt and lead. Using two elemental standards that represent the approximate extremes of the mass-to-charge ratio range (59 through 208, covering the full  $m/z$  range) ensures a higher degree of accuracy in any elemental identification. The addition of trace amounts of Indium, an element not normally found on earth, served as an internal standard for calibration and calculating the rate of instrumental drift that naturally occurs when samples are continuously run for hour-long stretches (Skoog et al. 2007: 298).

*ICP-MS Analytical Support Information*

**Table 3.2. ICP-MS Operating Conditions on the Micromass Instrument.**

<b>ICP-MS Operating Conditions</b>	
Instrument	Micromass Platform ICP
Number of Replicates	4
Dwell Time	4 sec
Integration Time	1.5 min
<b>Plasma Conditions</b>	
Plasma Gas Flow	13.00 L/min
Nebulizer Gas Flow	1.00 L/min
Sample Flow	0.95 L/min
Hexapole Gas Flow - He	3.5 L/min
Hexapole Gas Flow - H <sub>2</sub>	3.5 L/min
Forward Power	1350 W
Ion Energy	2 eV

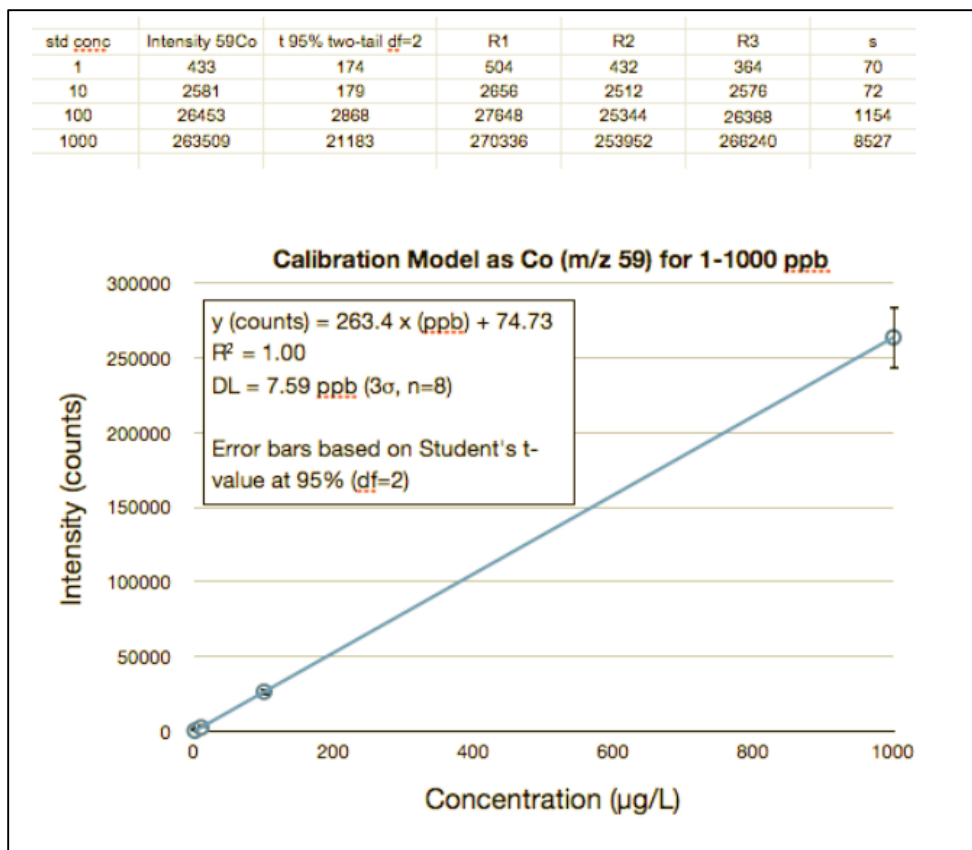


Fig. 3.1. ICP-MS calibration model using Cobalt (Co).

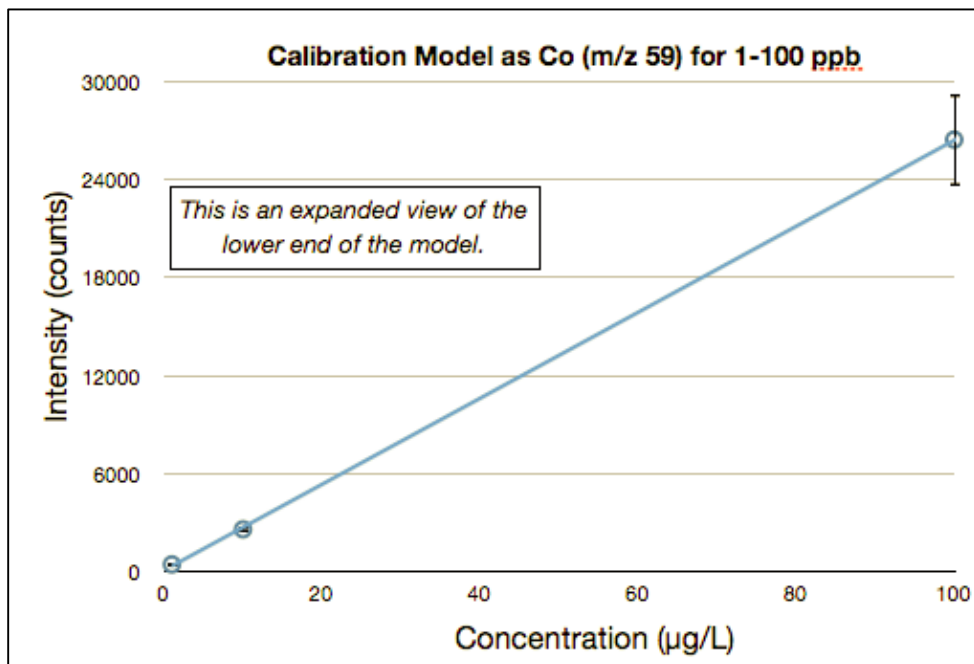


Fig. 3.2. Expanded view of ICP-MS calibration model using Cobalt (Co).

### FT-IR

In this analytical method, infrared energy is passed through a sample, where some of the radiation is absorbed by the sample while the rest is transmitted. Absorption intensity is calibrated by comparing the sample spectrum against that of the “background” atmosphere. This is then used to create a spectrum of the “percent transmitted” radiation that represents a unique molecular fingerprint (Skoog et al. 2007: 460). This analytical method is widely used due to the fact that it is quick and internally calibrated.

### Previous Archaeological Applications of Analytical Methods

Residue analysis has been applied to unguentaria only recently, with the exception of a GC-MS analysis of twenty-four Corinthian Plastic Ware vases conducted by the University of Pennsylvania Museum of Archaeology and Anthropology (MASCA) in the 1990s (Biers et al. 1994). This work and that of Italian chemist Erika Ribechini and her associates on the contents of seven Roman glass unguentaria (first century BC to first century AD) from the archaeological site of Oplontis (Naples, Italy) provided the initial inspiration for this research as well as a starting point for this analysis (2008b). The application of GC-MS to vessel contents from a Roman villa in Pompeii (Naples, Italy), suggested that the site was used for balm manufacturing (Ribechini et al. 2008a: 168). Chemists were able to identify the presence of beeswax, pine resin, and another non-specified wax (ibid). The composition of the extracts obtained in the analysis was specific enough to indicate that the analyzed compound was the result of “maceration and/or enfleurage, in which lipid-based materials, such as beeswax, animal fat or

vegetable oils, were used to extract aromatic and fragrant substances from resins, flowers, spices and scented woods, in order to produce unguents and balms” (ibid.: 158). A GC-MS comparative analysis of both archaeological and modern frankincense samples (Evershed et al. 1991) was used to assist in the data interpretation process; chemistry-focused sources derived from essential oil and perfumery studies of GC-MS, ICP-MS, and Hexane extraction research on relevant botanical species, such as Costus, Cinnamon, Myrrh, Dragon’s Blood, Opoponax, Pine and Red Sandalwood were also consulted (see Table 2).

#### *Sampling Protocol and Procedures*

Based on his knowledge of sampling procedures designed by the EPA and CDC, Dr. Aldstadt and I worked together to design the sampling protocol that would be performed for this study. Prior to collecting samples, a petition for destructive testing was submitted to an MPM committee, and once approved, the MPM Registrar, Claudia Jacobson, provided me with a Destructive Sampling Agreement (see Appendix A).

All vessels were sampled according to the following protocol:

1. Wearing a clean pair of nitrile gloves, place the vessel to be sampled on a cushion that has been covered with a clean room wipe.
2. Remove a sterile cotton swab from its package and moisten it by a quick immersion in 10 mL of solvent.
3. Place the head of the swab on the walls near the base of the vessel and collect as much residue as possible using horizontal, vertical, and diagonal 'S'-strokes.
4. Withdraw the swab, remove the head, and seal it within a clean amber-colored glass vial.

5. Repeat process to ensure that every swab has a duplicate to cover any sampling contingencies.

6. Label the vial using the following system: MPM catalog #/Solvent Type (ex. A16177/HEX)

To establish a base-line measurement of the chemicals naturally present in the cotton



**Figure 3.3. Author collecting samples at the MPM.**

swabs or vials, as well as those present in the museum environment, Dr. Aldstadt recommended that we create three “trip-blanks” (cotton swab removed from package with swab head immediately (see Fig. 3.6) stored in a clean amber glass vial) and three “bench-blanks” (cotton swab removed from package, head placed in an amber vial and exposed to the air throughout the sampling process). In order to avoid any organic contaminants in these samples from using swabs with wooden handles, Dr. Aldstadt suggested using long plastic coffee stir-sticks with the cotton swab heads stuck into the ends. The sampling took place in the MPM Anthropology Lab and a clean surface for sampling was created by laying a protective layer of clean cloths over the lab table, with additional layers of clean wipes (Kimwipes) placed on the cloth to cushion the unguentaria. Three solvents were used: n-hexane, acetonitrile, and water. Each of the twenty-seven unguentaria was

swabs or vials, as well as those present in the museum environment, Dr. Aldstadt recommended that we create three “trip-blanks” (cotton swab removed from package with swab head

subjected to two swabs of each of the solvents for a total of six swabs per vessel. The first solvent used in the sampling process was n-hexane, followed by acetonitrile, lastly by water in accordance with the strength of their polarity (from least to greatest). The initial research plans had called for acetone to be used as one of the solvents, but after conferring with Dr. Aldstadt, acetonitrile was selected since it was less damaging to the vessel interiors and was closer to the middle of the polarity continuum between water and n-hexane.

### *Analysis of Samples*

All ICP-MS samples were run as dilute extracts in nitric acid. Dilute samples were prepared using 18 M $\Omega$ -cm deionized water obtained from a Barnstead Nanopure Infinity Ultrapure water system. FT-IR samples were extracted in reagent grade acetonitrile and rotary evaporated to 1.5 mL before running.

### FT-IR Spectroscopy

Complex organic molecule characterization was conducted using a Thermo Nicolet Nexus 670 FT-IR with Nexus 900 Raman attachment (Thermo Fisher Scientific, Pittsburgh, PA, USA) housed in the UW-Milwaukee Chemistry Department. Spectra consisted of an average of 128 scans with a resolution of 4 cm<sup>-1</sup> and were collected using OMNIC software and saved as .CSV files for export into Excel.

### ICP-MS

Thirty-six sample tubes were prepared with 10 mL of 0.75 M trace-element grade nitric acid. This allowed 27 vessels to be analyzed, along with a trip-blank, a bench-blank, as well as an acid-only tube for testing the purity of the acid. Out of the three solvents used to collect the vessel swabs, only small specks of material found on those swabs collected

with water were initially selected for ICP-MS analysis. A random sampling of swabs with n-hexane and acetonitrile collected from three vessels (2, 7, 19) was included in the ICP-MS analysis, bringing the total number of ICP-MS samples to thirty-six.

#### ICP-MS Sample Preparation Protocol:

1. Prepare two 250 mL beakers using 1.0 M trace-element grade nitric acid and one 250 mL beaker containing 18 M $\Omega$ -cm deionized water for use in a rinse bath sequence (to be emptied and refilled every ten samples).
2. Sanitize a pair of Teflon tweezers in the rinse bath sequence.
3. Use the tweezers to collect a tiny amount of residue present on a swab initially collected with a water solvent.
4. Place residue in a plastic test-tube filled with 10 mL 0.75M trace-element grade nitric acid.
5. Rinse tweezers clean in the test-tube.
6. Wipe off the tweezers with a fresh Kimwipe.
7. Run the tweezers through the rinse bath sequence for approximately 60 seconds, ending with the beaker filled with water so nitric acid is not introduced onto the vessel swabs.
8. Cover the test-tube snugly with Parafilm.
9. Repeat the process with a different vessel swab.

Twenty-four hours prior to running the samples through the ICP-MS instrument, the rack of test-tubes was placed under UV light to subject the residues photo decomposition.

*Identification of Chemical Signatures*

Using the results of the ICP-MS and FTIR analyses, the particular molecules identified were cross-checked against the spectra available in published databases, similar to the approach used by Martín-Gil et al. (2007: 65). A recent publication comparing archaeological and modern resin samples through FT-IR analysis proved especially helpful (Bruni and Gugliemi 2014). One research setback encountered in this project was that the majority of chemical characterization studies on archaeological residues focus on using an organic analysis technique not made available to the author [gas chromatography-mass spectrometry (GC-MS)], an issue discussed further in Chapter 4.

## Chapter 4: Comparative Analysis

### Overview

Even though not all of the unguentaria were structurally stable enough to sample, we can still use the total collection in order to investigate possible shifts in styles and materials in the MPM unguentaria collection (Table 4.1).

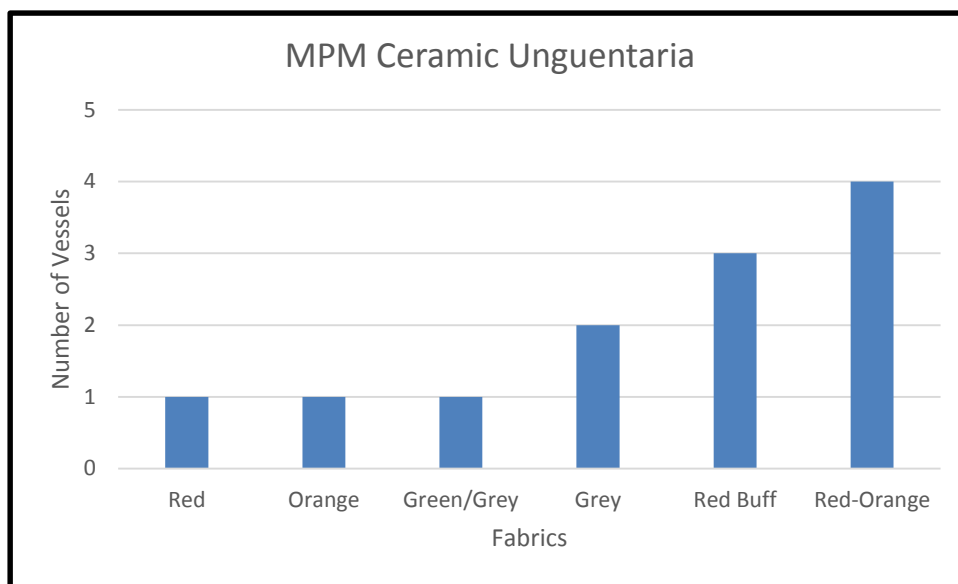
**Table 4.1. Total MPM Unguentaria Collection: Material and Style (N=39)**

Vessel Materials	Number of Piriform (Bulbous)	Number of Fusiform (Spindle)	Number of Test-Tube
Glass (N=27)	17	0	10
Ceramic (N=12)	4	8	0
Total	21	8	10



**Figure 4.1. Coarse tempered fusiform unguentarium.** exception, MPM Cat.#A15780, which has a coarse shell temper.

There are six different types of ceramic fabrics represented in the MPM unguentaria: red, red buff, red-orange, orange, green-grey, and grey. All of the ceramic vessels are fine tempered, with a single



**Figure 4.2. MPM ceramic unguentaria fabrics: N =12.**

## Residue Analysis

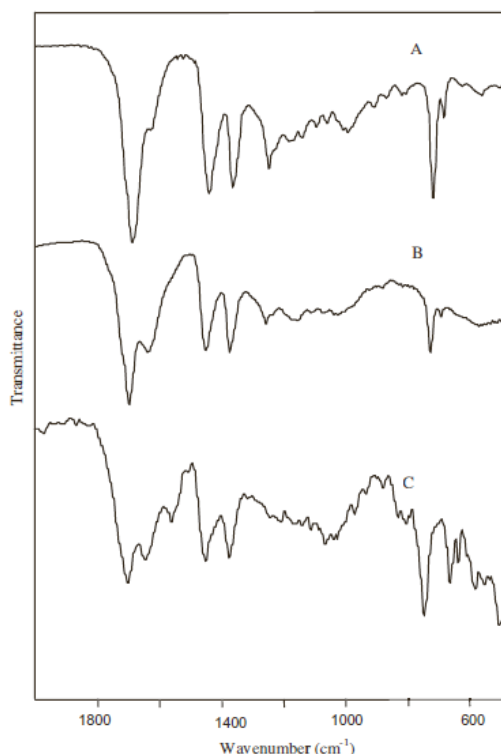
### *Overview*

One of the main research questions addressed in this study was to test the formal identification of unguentaria could be tested by determining their actual contents.

Chemical analyses of the vessels' interior residues were compared against identical analyses of thirteen aromatic standards typically used in perfumes and cosmetics of the time period based primarily on written sources. The research of Bruni and Gugliemi compared archaeological samples of frankincense and gum mastic

**Table 4.2. Aromatic Standards Used for Residue Analysis**

Bergamot	Cassia	Galbanum	Olive Oil	Spikenard
Cardamom	Cinnamon	Labdanum	Opoponax	
Calamus	Frankincense	Myrrh	Pine	



**Fig. 4.3. Modern gum mastic (a) compared against archaeological samples of gum mastic (b, c) (Bruni and Gugliemi 2014: 619).**

recovered from an early third century AD Roman grave in Milan against modern resin samples using FT-IR (2014). The comparison of the FT-IR spectra of those ancient and modern samples shows that while some of the fine spectral structures are lost over time and some peaks in the spectrum become attenuated through the aging and degradation of archaeological samples, there are still enough strong features present so that the samples are roughly identifiable (see Fig. 4.1) (ibid.). Both

ICP-MS and FT-IR analytical techniques yielded results that indicate that each of these twenty-seven vessels retained some traces of

their original residues and the analysis results are presented here.

### ***FT-IR***

Samples removed from these vessel residues were rotary evaporated down to 1.5 mL in an acetonitrile solvent and were analyzed twice using a Thermo Nicolet Nexus 670 system. The resulting FT-IR spectra presented here represent the average of the readings collected for each sample. FT-IR spectra demonstrate the normalized percentage of the transmitted light at each wavenumber ( $\text{cm}^{-1}$ ) throughout a range from 400 to 4000. A lower percentage of transmitted light indicates a stronger absorption of the beam,

revealing the presence of a functional group at that particular wavenumber. Though these functional groups occur at set frequencies throughout the overall range, the frequency range from approximately 1200 to 600  $\text{cm}^{-1}$  is known as the “fingerprint region” and is commonly used to identify compounds (Skoog et al. 2007: 460). It is important to note that relying upon the fingerprint region alone does not give an unambiguous identification of a chemical compound. Since there can be overlap between group frequencies, this can distort the overall appearance of the spectrum. To make identifications with greater confidence, the spectrum beyond the ‘fingerprint region’ must be acknowledged using correlation charts (Table 4.3) combined with another analytical technique, since relying on correlation charts alone is insufficient (ibid.: 464).

**Table 4.3. Abbreviated Table of Group Frequencies for Organic Functional Groups**

<i>Functional Group</i>	<i>Characteristic Absorption(s)(<math>\text{cm}^{-1}</math>)*</i>
Alkyl C-H Stretch	2950 - 2850 (m or s)
Alkenyl C-H Stretch	3100 - 3010 (m)
Alkenyl C=C Stretch	1680 - 1620 (v)
Alkynyl C-H Stretch	~3300 (s)
Alkynyl C≡C Stretch	2260 - 2100 (v)
Aromatic C-H Stretch	~3030 (v)
Aromatic C-H Bending	860 - 680 (s)
Aromatic C=C Bending	1700 - 1500 (m,m)
Alcohol/Phenol O-H Stretch	3550 - 3200 (broad, s)
Carboxylic Acid O-H Stretch	3000 - 2500 (broad, v)

Amine N-H Stretch	3500 - 3300 (m)
Nitrile C $\equiv$ N Stretch	2260 - 2220 (m)
Aldehyde C=O Stretch	1740 - 1690 (s)
Ketone C=O Stretch	1750 - 1680 (s)
Ester C=O Stretch	1750 - 1735 (s)
Carboxylic Acid C=O Stretch	1780 - 1710 (s)
Amide C=O Stretch	1690 - 1630 (s)
Amide N-H Stretch	3700 – 3500 (m)

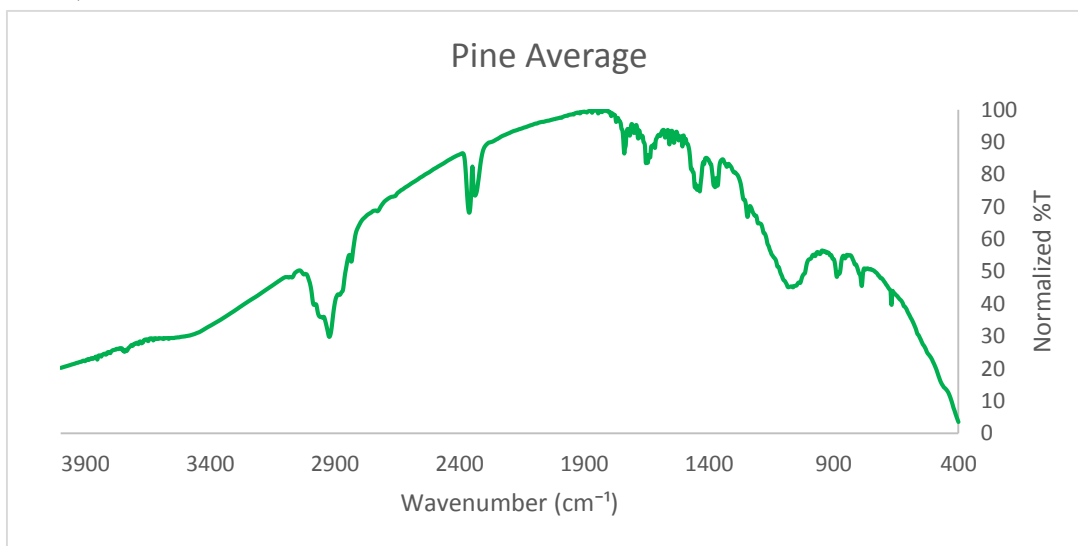
\*abbreviations for: strong, medium, broad, and variable

Additional complications arise from the fact that the original vessel contents were likely not pure compounds (and vessels may have been reused), hence the resulting spectra may represent the overlapping group frequencies of multiple ingredients. As stated previously, thirteen standards were chosen to provide spectra for comparisons against these unknown vessel contents: essential oils of bergamot, cardamom, calamus, cassia, cinnamon, frankincense, galbanum, labdanum, myrrh, opoponax, pine, and spikenard, along with extra virgin olive oil.

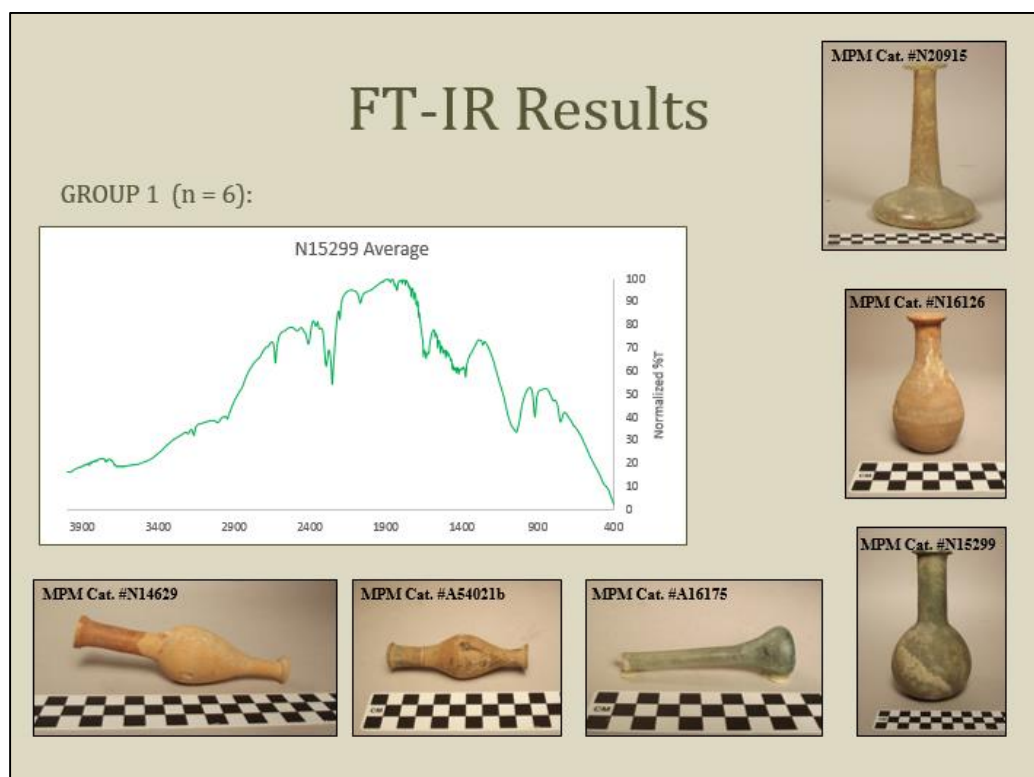
### ***FT-IR Results***

Apart from one vessel that displayed a relatively weak overall spectrum, the spectra of the twenty-seven vessels sampled can be divided into two distinct groups. The first group contained six vessels that displayed a high match when compared against the spectrum of the pine and spikenard essential oil (Fig. 4.5), while the remaining eighteen spectra appeared to be nearly identical, though showing slight differences in the strength of the light absorption along the same regions of the spectrum (Fig.4.9. 4.10). This

second grouping was the most complex to analyze. These spectra did not provide a one-to-one match against any of the standard spectra produced, though there were regions of similarity, most notably with the cinnamon, myrrh, and olive oil spectra (Figures 4.8-4.10).



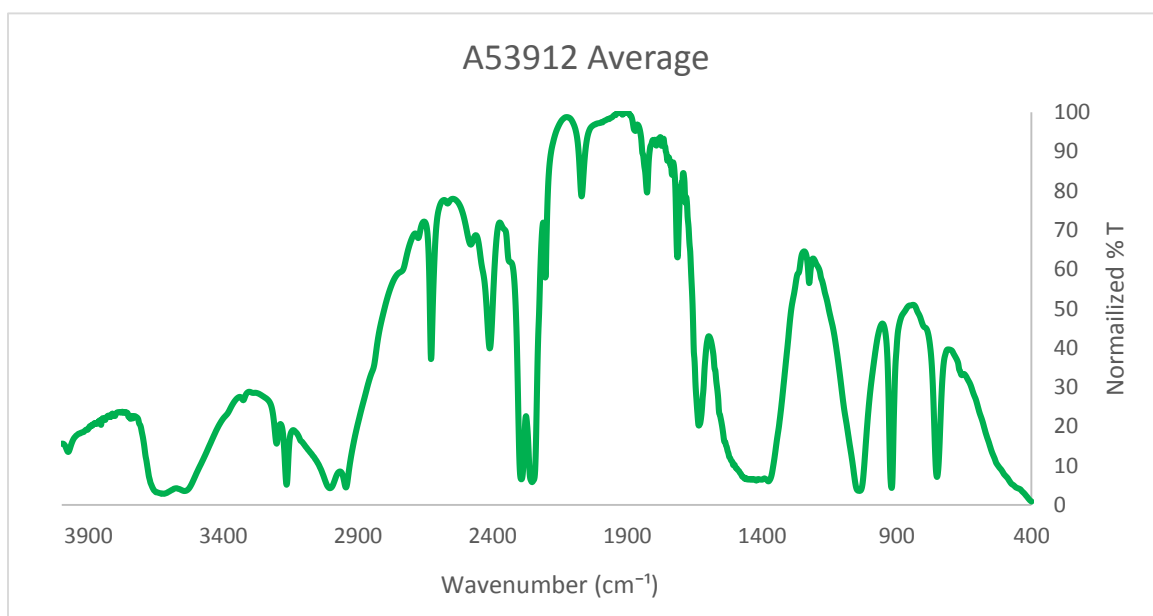
**Figure 4.4.** Spectrum of pine oil standard (*Pinus silvestris*).



**Figure 4.5.** Spectrum of MPM Cat. #N15299 sample characteristic of the Group 1 FT-IR spectra.

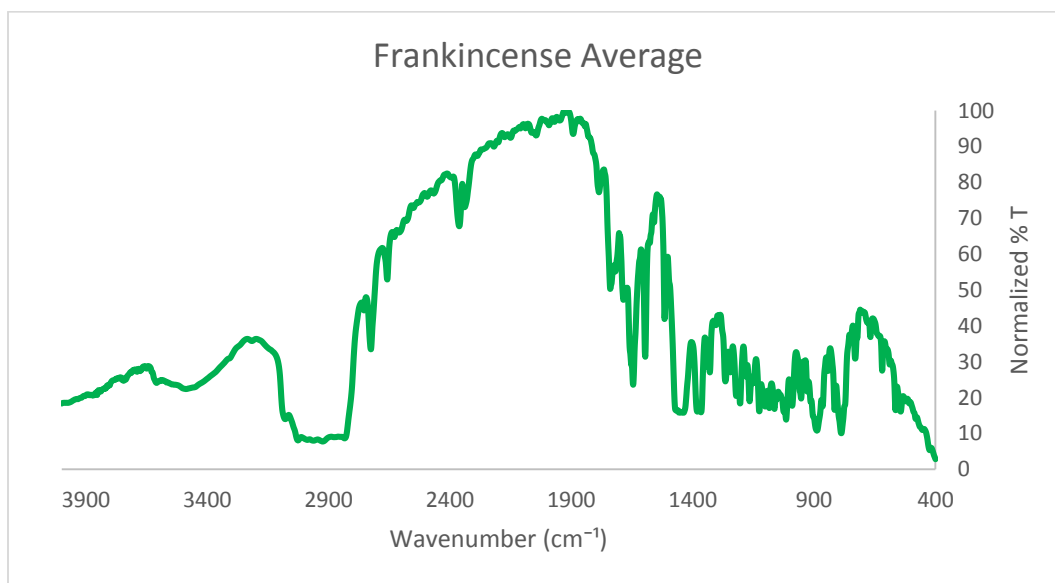
Even though sample N15299 (Fig.4.5), a typical example of the first grouping of spectra, looks remarkably similar to the pine standard spectrum (Fig. 4.4), there are subtle differences between the two that suggest the presence of an unknown component. This unknown ingredient does not appear to alter the pine spectrum significantly, likely indicating that it was either included in minimal amounts in the original contents, or was a substance that did not preserve well over time. This group is characterized by peaks in the aromatic C=C bending region at wavenumbers 1400 and 1800. Other samples in this group include those from MPM Cat. #N14629, N20915, N16126, A54021b, and A16175. As can be seen in Figure 4.5, vessels in this group include both glass and ceramic, as well as fusiform and piriform, unguentaria.

The second grouping of spectra can be seen in the sample taken from MPM Cat. #A53912 (Fig. 4.6). As this second group includes the remainder of the samples, we now know that there are similarities in the contents of unguentaria regardless of material, style, or geographic region in the Mediterranean world.

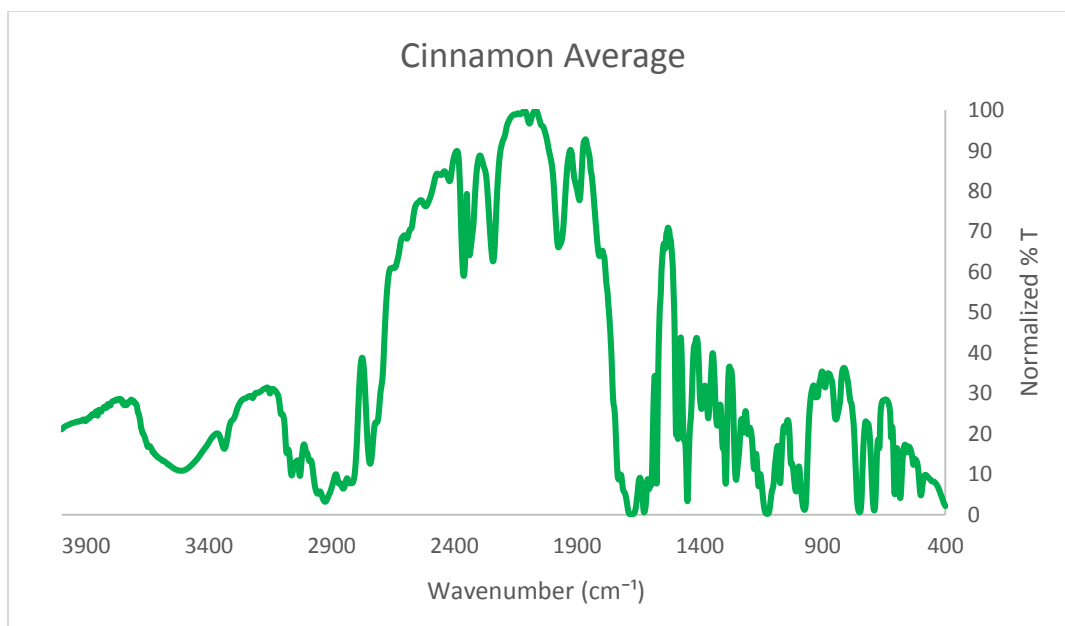


**Figure 4.6. Spectrum of sample from MPM Cat. #A53912.**

As stated previously, these spectra have elements in common with cinnamon, myrrh, and olive oil. Frankincense is a potential component, but given the three clear peaks in the frequency range of 1400-900  $\text{cm}^{-1}$ , the lack of spectral detail in these spectra throughout this range suggests that frankincense (Fig. 4.7) was not a likely ingredient.

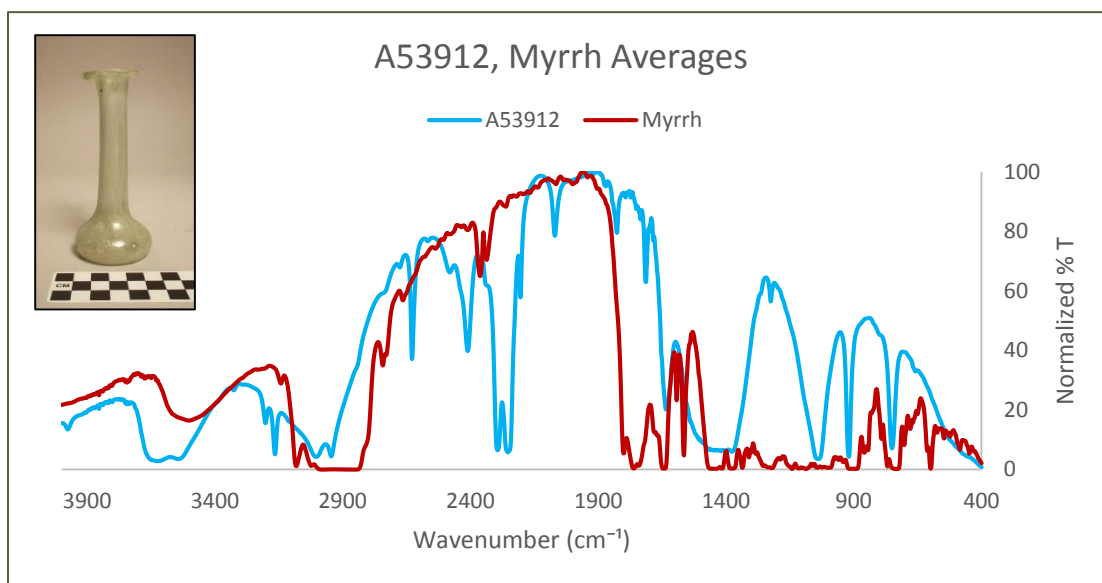


**Figure 4.7.** Spectrum for frankincense oil standard (*Boswellia carterii*).

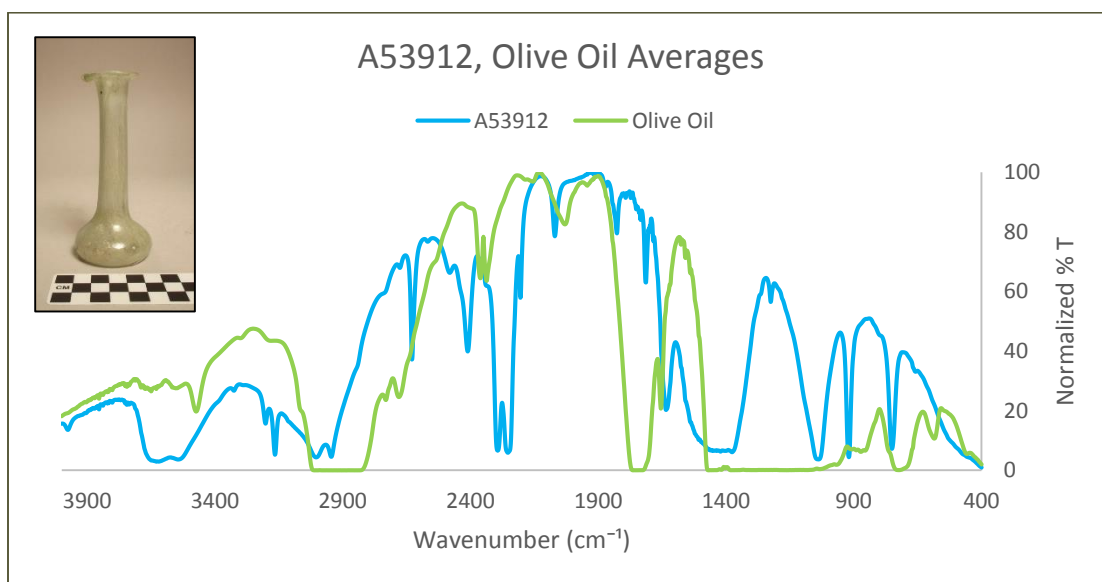


**Figure 4.8.** Spectrum for essential oil of cinnamon (*Cinnamom zeylanicum nees*).

When comparing the vessel spectra against these three standards, the greatest amount of overlap is seen with myrrh and olive oil (see Fig. 4.9-4.10).



**Figure 4.9. MPM Cat. #A53912 FT-IR spectrum compared to myrrh spectrum.**



**Figure 4.10. MPM Cat. #A53912 FT-IR spectrum compared to olive oil spectrum.**

Olive oil, the closest obtainable standard for omphacium (oil pressed from unripened olives) was a common carrier oil throughout the Mediterranean region.

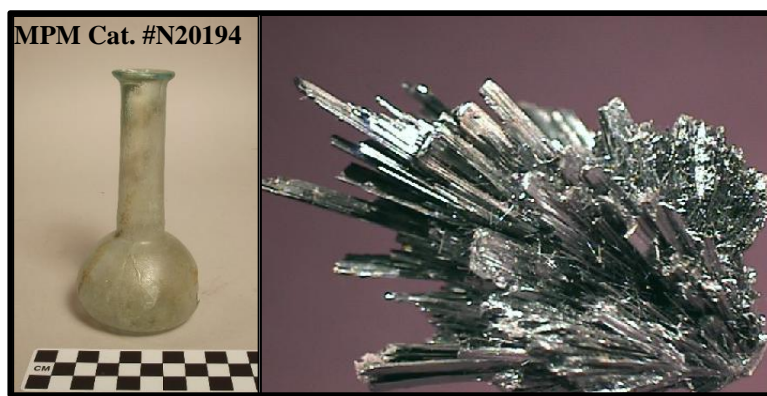
**ICP-MS**

The m/z ratios indicate that the following elements appear in all the tested unguentaria: Ba, Ce/Ar<sub>2</sub>, Cu, Fe, La, Mn/KO, Pb, Rb, Sn, Sr, Zn, with Ag, Cd, Cr, Gd, Nd, Sb, V, and Y occurring occasionally (see Table 4.4). Figure 4.13 is a rare example that contained significant counts (>500) of Ag (107, 109 m/z), with the silver likely originating from argentiferous galena (Fig. 4.11).



**Figure 4.11. Possible cosmetics container for argentiferous galena.**

Figure 4.14 shows significant counts of Sb (121, 123 m/z); antimony sulfide was historically known for its use in kohl eyeliner (see Fig. 4.12). Figure 4.15 shows



**Figure 4.12. Possible cosmetics container for stibnite.**

significant counts of Cu (63, 65 m/z), a common element in minerals such as azurite and malachite--both used in ancient cosmetics.

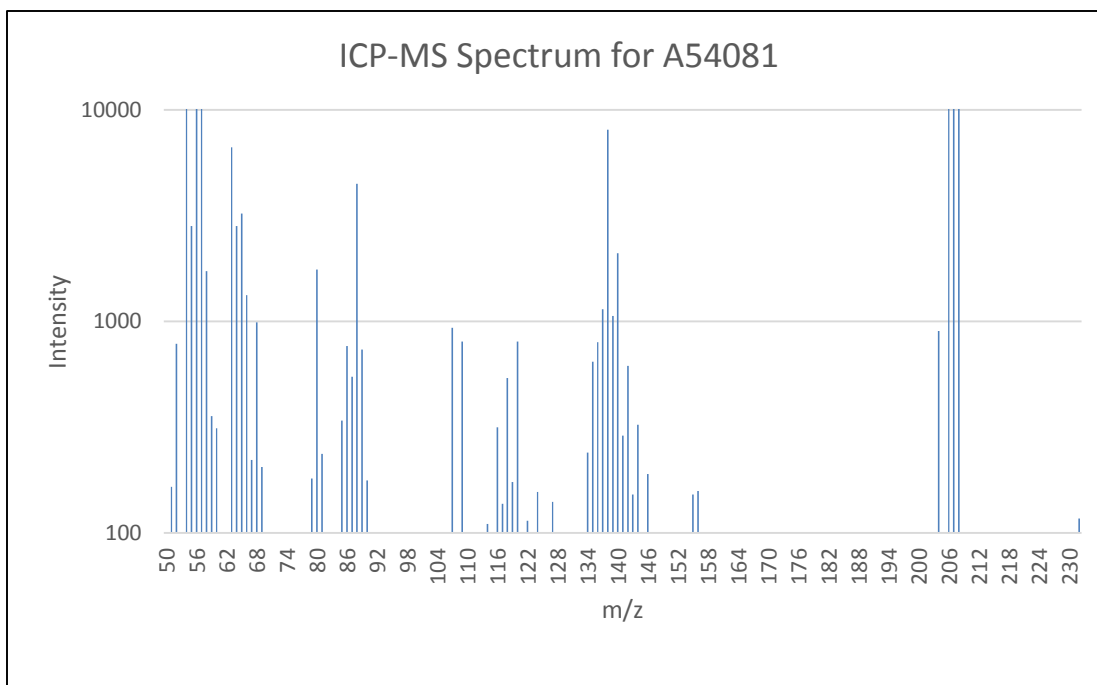
Figure 4.16 shows significant counts of

(116,118, 120 m/z); SnO<sub>2</sub> was prized for adding a creamy white luster to skin creams used in ancient Rome (Stewart 2007).

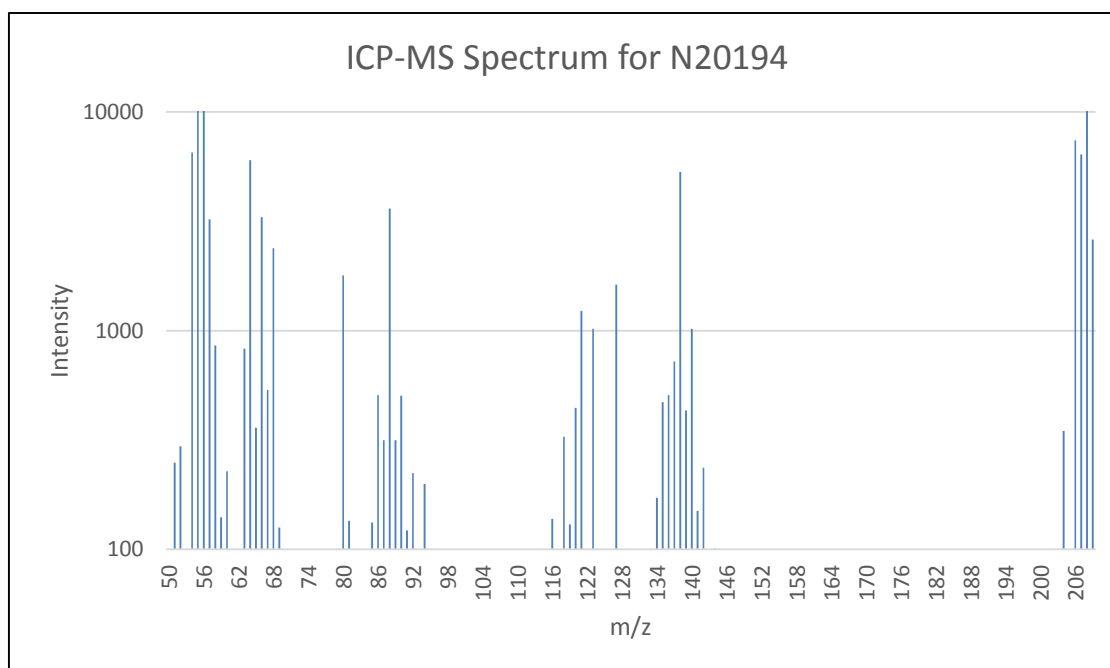
**Table 4.4. Comparison of ICP-MS Results Noting Strong (>1000) and Weak (<1000) Counts**

Vessels	Ag	Ba	Cd	Cr	Cu	Fe	Gd	La	Mn	Nd	Pb	Rb	Sb	Sn	Sr	V	Y	Zn
A54021b		S			W	S		W	S	W	S	W			S			W
N12883		S				S		W	S	W	W	W		W	S			W
N20280		S			S	S		S	S		S			S	S			W
A54081	W	W		W	S	S		W	W	W	S			W	S			S
N20274		S				S			S		S				W			
N14629		S			W	S		S	S	W	S				W			W
A54021a		S			W	S		S	S	W	W	S			S			W
N20915	W	S		W	S	S		S	S	W	S	W			S	W		S
N15388		S			W	S	S	S	S	S	S	S		S	S	W		W
N21774		S	S	W	S	S		W	S	W	S	S	W	S	S	W		W
N16141		S			W	S			S		S			W	S			W
A53913		S			S	S			S		S			W	W			W
N16096		W			W	S			S		S				W			S
A15849		S			S	S			S		S				S			S
A16177		S				S					S			S	S			S
A16175		W			S	S			S		S				W			S
A53912		S			S	S			S		S				S			S
N23703		S				S			S		S							S
N15299		S			S	S		W	S		S	W		S	S	W		W
N10365		S			S	S			S		S				S			S
N20194		S			W	S			S		S		S		S			S
N10892		S			W	S			S		S				S			S
E39974		S		W	S	S		W	S	S	S			W	S	W		S
A10436		S			W	S		W	S	W	S		W	W	S			S
N16081		S			S	S		S	S	S	S	W		S	S	W		W
N16136		S				S		S	S	W	S	S			S			W
A16126		S			S	S		W	S	W	S				S	W		W
BB		S				S					S							S
TB		S			S	S					S							S
N12883*		S		W	W	S		W	W	W	W	W			S	W	W	W
N12883**		W			S	S	W	S	S	S	W	W			S	W	W	W
A54021a*		S	W		W	S	W	S	S	W	W	W			S	W	W	W
A54021a**		S	S		W	S		W	S		W	S			S	W	W	W
N15299*		S		W	W	S		W	S		S	S		S	S	W	W	W
N15299**		S		W	S	S		W	S	W	S	W		S	S	W	W	W
HNO <sub>3</sub>		S			S	S					S				S			S

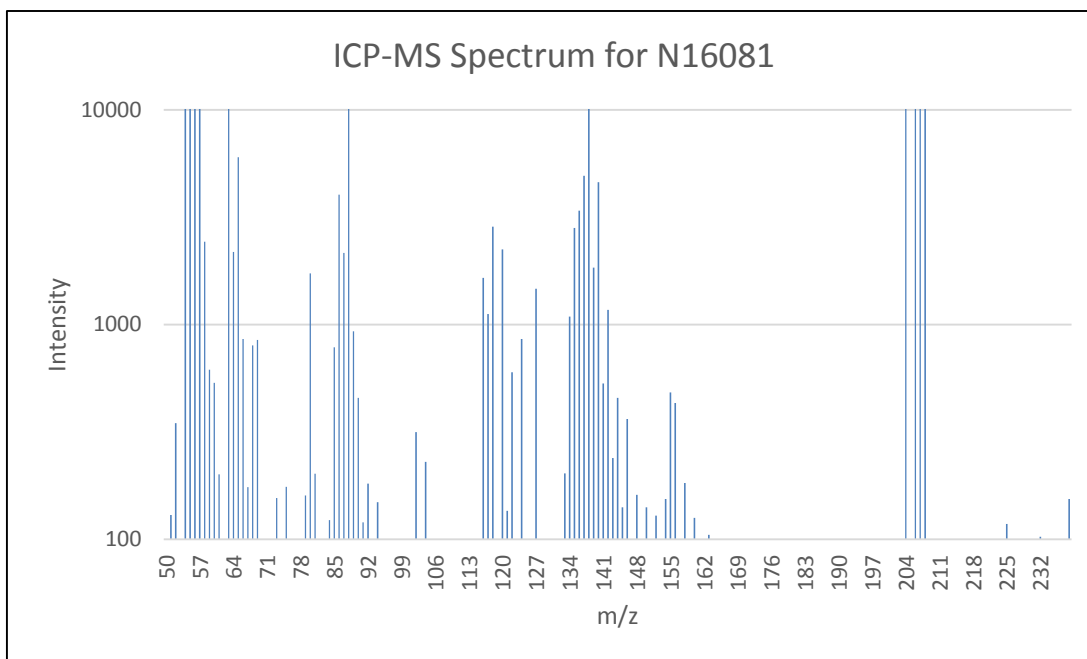
\*Collected with acetonitrile solvent. \*\*Collected with n-hexane solvent.



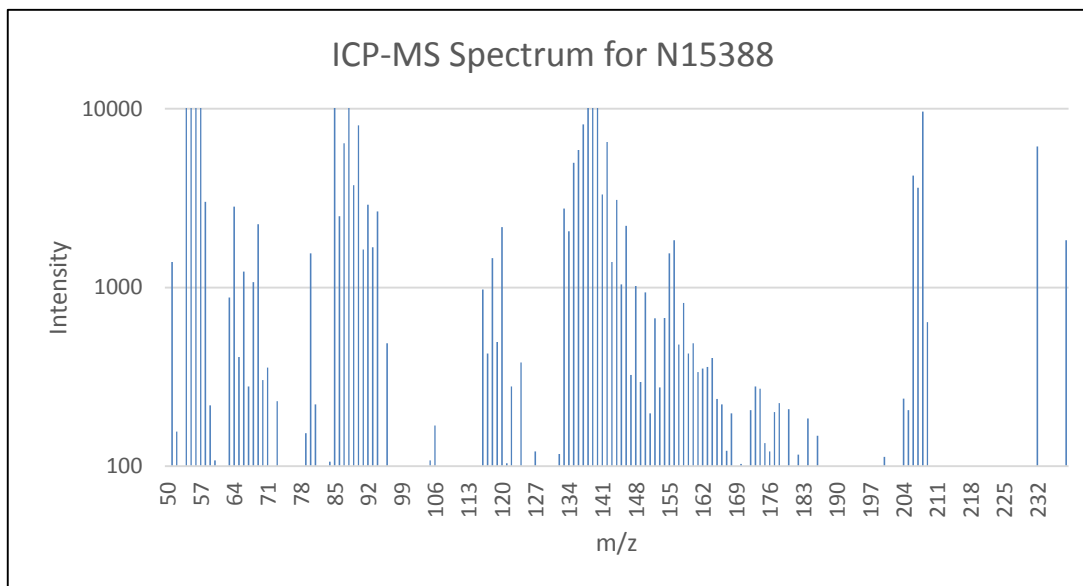
**Figure 4.13. ICP-MS spectrum showing significant counts of Ag (107, 109 m/z).**



**Figure 4.14. ICP-MS spectrum showing significant counts of Sb (121, 123 m/z).**



**Figure 4.15. ICP-MS spectrum showing significant counts of Cu (63, 65 m/z).**



**Figure 4.16. ICP-MS spectrum showing significant counts of Sn (116,118, 120 m/z).**

Other than the four ICP-MS spectra highlighted above, the other samples yielded results that showed elements (see Table 4.4) such as V, Sn, Ba, Ni, Pb, Zn that are not infrequently encountered in soil samples (Falciani et al. 2000).

### **Outcomes for Original Research Questions**

Revisiting the first research question after conducting chemical analyses yields the following answers to Question 1: What were the contents of the unguentaria tested in this study?

- 1) The tested vessels contained expected substances based on written sources.
- 3) The tested vessels contained identifiable oils, unguents, perfumes, or cosmetics consistent with their classification.
- 4) The tested vessels contained other identifiable substances not associated with the vessel type implied by the assigned classification.

There was some evidence for the presence of myrrh, olive oil, pine, and spikenard, so we can state that the unguentaria in the MPM contain some of the expected substances based on written sources (Outcome 1-1). While there is no one-to-one correspondence between the modern essential oils and the MPM samples, there are features within the FT-IR spectra (the aromatic C=C bending region) that indicate that the vessel contents were aromatic substances (Outcome 1-3). The presence of strong counts of Ag, Sb, Cu, and Sn in the aforementioned ICP-MS spectra are an indication that Outcome 1-4 might be correct as well, and unguentaria may potentially contain cosmetics.

*Research Question 2:* Can the contents of unguentaria be used as proxies for scents present in past rituals?

- 2) The tested vessels contained residues of aromatic substances that are associated with mortuary behaviors or other ritual activity as documented in contemporary written sources, and thus can be used as proxies for scents associated with documented rituals.

This outcome is only partially indicated. Without the ability to narrow down specific aromatic ingredients contained in these unguentaria, any attempt to use vessel contents as a proxy for the scents of past documented rituals would be heavily reliant upon textual sources instead of the chemical analysis results. Experimental reconstruction of recipes based on content analysis would be one way of achieving part of this goal (see Future Research below).

*Research Question 3:* To what extent can olfactory elements involved in mortuary rituals of the Greek and Roman world be reconstructed based on these analyses?

- 2) Vessels contained residues of non-aromatic substances that do not appear to relate to the olfactory elements of mortuary ritual.
- 3) Vessels contained the residues of identifiable aromatic substances consistent with scents associated with mortuary rituals in Classical contexts as described in contemporary texts.

This last question builds upon the previous one. Even if we are able to determine that there are aromatic substances in these unguentaria, if we cannot with certainty identify the exact mixture of ingredients, this question will be difficult to answer without resorting to experimental archaeology to attempt to recreate and artificially age the substances documented in the MPM vessels. Until this step has occurred, historical written sources continue to be the most accurate way to approximate the scents present in the past.

### **Comparing Other Unguentaria Content Studies**

The published articles of Italian chemists Erika Ribechini (2008a, 2008b, 2009) and Maria Perla Columbini (2009) were the primary sources of comparison (and inspiration) for this research, though a MASCA study of Corinthian “plastic” vases included unguentaria in a gas chromatography-mass spectrometry analysis (GC-MS) (Biers et al. 1994). Many of these studies relied on GC-MS analysis—an analytical method that was

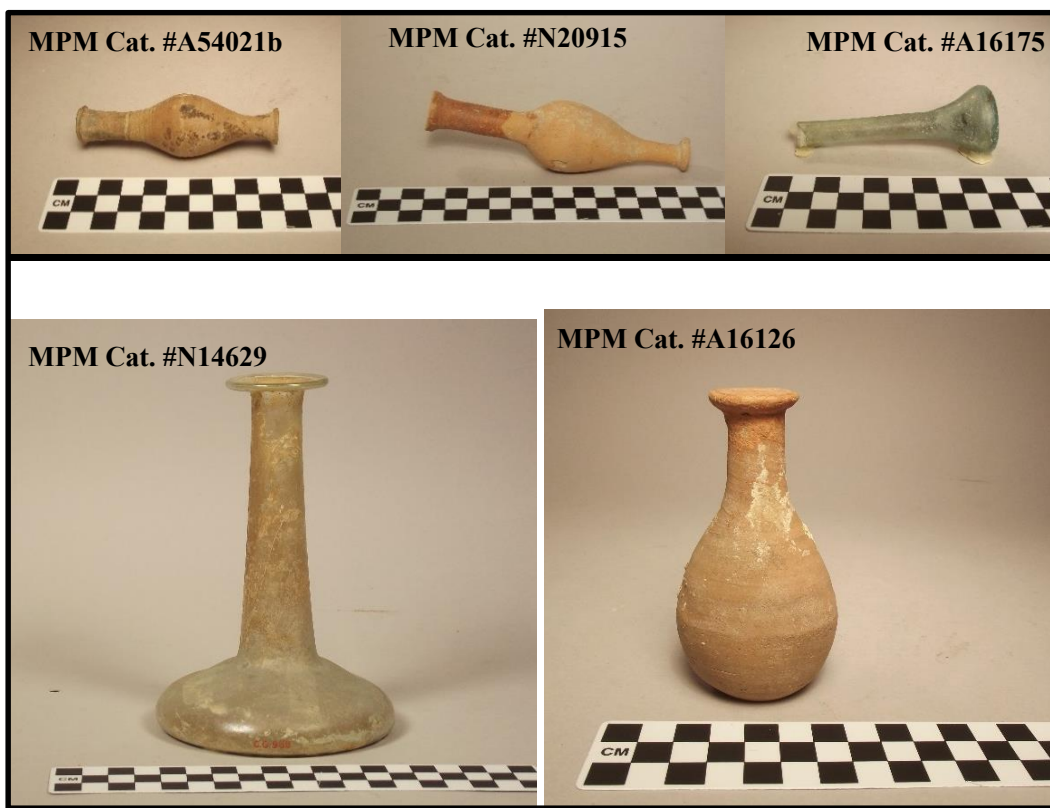
unavailable to the author during this research project. FT-IR was chosen as a substitute method for organic analysis instead. Without using GC-MS, it is impossible to directly compare the resulting spectra from earlier studies with the MPM sample results. Instead, a qualitative comparison of analytical results is necessary. None of the analytical chemists were able to identify a substance within their unguentaria without a margin of error, though strong suggestions for particular compounds were found.

GC-MS studies of a ceramic 5<sup>th</sup>-7<sup>th</sup> c. AD ceramic censer found in the Roman Egyptian Necropolis of Antinoe point to gum mastic as a main component of the censer's contents (Modugno et al. 2006: 1794), an ingredient also hinted at in the study of an elite Roman-type burial at Thessaloniki (Papageorgopolou et al. 2008.) Gum mastic was also indicated in the contents of an alabaster unguentarium found in an Etruscan burial at Chiusi (Columbini et al. 2009), though every one of these aforementioned authors clearly stated that gum mastic (*Pistacia lentiscus*) is not found as a single ingredient, but mixed with another substance, likely a pine resin, though some authors choose to use a less qualitative description, stating that they found “sesquiterpenes”, “triterpenoids” or “diterpenoids” in their residues—all molecules found in pine trees. The FT-IR results from this study that suggest the presence of pine strengthen the suggestion that terpenes were a frequently encountered ingredient in Roman unguentaria.

## Chapter 5: Discussion and Conclusions

### Form versus Function?

The results of the FT-IR analyses demonstrate that even vessels that differ in material, form, and provenience still share commonalities in their contents. The clearest subgroup, those samples whose FT-IR spectra most closely resemble that of pine



**Figure 5.1: Sampled vessels with identical contents.**

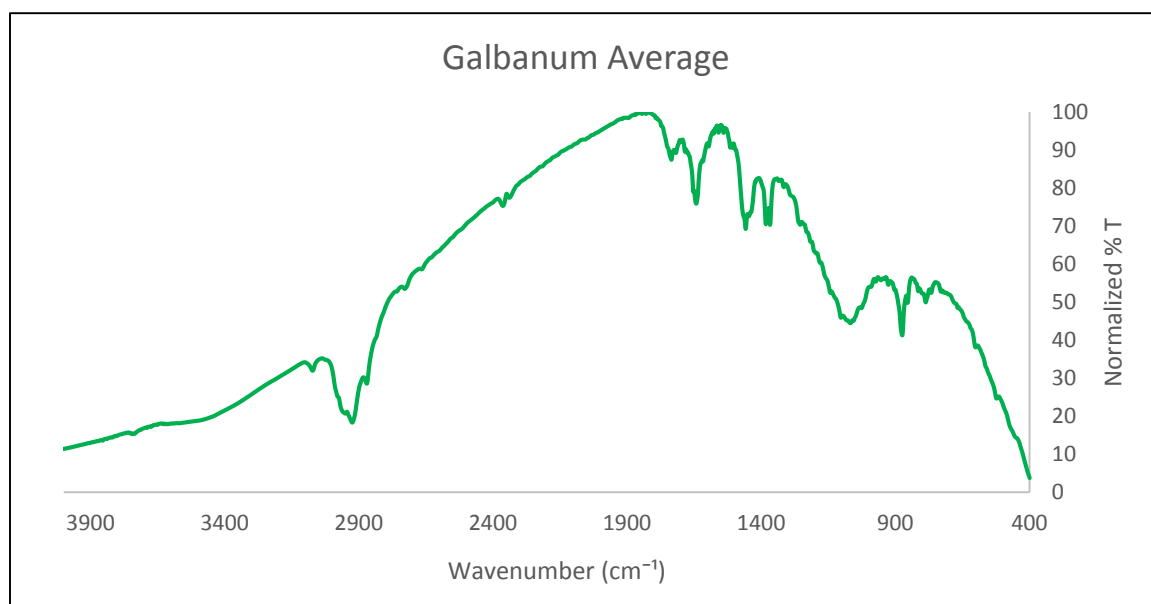
essential oil, can be seen in Fig. 5.1. The roughly similar FT-IR spectra of the other eighteen samples clearly suggest one of two scenarios. First, that despite their widely differing dates, materials, proveniences, and forms, these unguentaria (which we are assuming were part of grave good assemblages) were filled with standardized contents, which the FT-IR spectra suggest are aromatic in nature. The other possibility is that the results reflect widespread sample contamination, though the likelihood that a group of vessels stored under similar museum conditions should all contain a contaminant

resembling pine oil makes this a less likely explanation. Comparing contents from different regions, different time periods, and different materials and methods of construction, the results look very similar (see Table 5.1). The fact that eighteen of these samples (analyzed in the instrument non-sequentially) contained such similar spectra given the broad ranges of time, material, and location that they represent, seems to indicate that there was some consistency regionally and through time with respect to unguentaria contents in burials. Though we did not have access to archaeologically aged standards, the results of Bruni and Gugliemi's research comparing FT-IR spectra from modern and ancient resin samples gave us greater confidence in recognizing similarities with modern standards of myrrh, spikenard, and pine as suggested by the FT-IR spectra of our MPM samples. This is consistent with historic texts and is also supported by the fact that pine and myrrh have antibacterial qualities while spikenard was extremely costly (300 denarii/libbra) and potent odor enhancer.

### **Scents of the Past**

Surprisingly, the resinous tears of frankincense, prized as incense for Roman funeral pyres and processions (Hope 2006) were not indicated in the unguentaria contents according to the spectra resulting from this analysis. Equally surprising, given the assumption that these vessels were intended to hold costly perfumes, is the absence of sweet smelling perfuming extracts, oils, or resins such as calamus root, cardamom, cassia, cinnamon, labdanum, and opoponax. The more resinous standards were chosen for a perceived ability to withstand the degenerative forces of time, as opposed to the popular yet more ethereal floral scents of the time, like rose, lily, or iris. Galbanum remains a distant possibility (Fig. 5.2), though given the strong peaks in the majority of

the sample FT-IR spectra, the smaller peaks of the galbanum spectrum could easily be “lost” in the spectral features created by mixture with other aromatic ingredients.



**Figure 5.2. FT-IR spectrum for galbanum (*Ferula galbaniflua*).**

The presence of pine was also noted in several other unguentaria content studies (Biers et al. 1994; Ribechini et al. 2006). Myrrh and spikenard, as mentioned earlier, are both described in the Books of Matthew and Mark as holy anointing oils. The fact that these samples share consistency in their contents also suggests that these contents were viewed as traditional in mortuary contexts and were standardized in some way. Therefore, these types of vessels in the grave were less likely to be intended as personal tokens of affection, such as the deceased’s favorite perfume, for example. These consistencies also strengthen the hypothesis that the odors associated with preparing the corpse and the funeral ritual could have had a shared element of sameness regardless of where the funeral took place in the early Roman Empire. The smell of myrrh, spikenard, or pine anointing oils on the body would have mingled with the stench of the corpse to

create a unique and recognizable scent for mourners. Sensory archaeology, the olfaction of the past in particular, can therefore be approached from this foundational basis.

We have long understood there to be a link between olfaction and memory (Classen et al. 1994), and that certain scents have the power to trigger emotion; on this basis one could begin to view a recreation of the scents of the past through the proxy of chemical analysis as a step toward uncovering the “scentscape” of Roman funerary rituals. Work by Emma-Jayne Graham addresses the “re-embodiment of the Roman funeral” and stresses the need to not “side-line the senses and resulting embodied memories” (2011: 35). Perfumed scents served a variety in functions for such funerals, not only masking unpleasant smells, but also serving the ritual function of making the dead more spiritually pleasing for their entry to the spiritworld (Classen et al. 1994).

#### *Future Research*

Statistical analysis of the FT-IR spectra covered by this project could yield useful results, but was beyond the scope of the present study. Further exploration of the analytical chemistry data is sure to yield additional information about the vessel contents and their original uses. Using the sample swabs for analysis using GC-MS or FT-Raman would independently support the chemical identifications made thus far. If this project had not been constrained by time and financial limitations, DNA analyses of the MPM vessel contents could allow the types of plants used to make these scented unguents to be identified. More detail regarding the unguent ingredients could allow their region of origin to be narrowed down, giving further insight into the trade routes and economy of the Early Roman Empire with regard to perfuming ingredients and incense.

Another avenue for future research would be to compare the chemical analyses of the MPM samples against an assemblage with a known date that is more recent that contains comparable vessel types, for example 19<sup>th</sup> century glassware used for storing medicines and perfumes. One such collection could be found in the wreckage of a Civil-War era steamboat, the *Bertrand*, which sank in the Missouri River north of Omaha, NE in 1865 while shipping approximately 500,000 trade goods to the western gold fields (DeSoto National Wildlife Rescue 2013). Since the artifacts from the *Bertrand* are well-preserved, any medicinal or cosmetic vessels tested would be free of soil contamination and would provide a less polluted aged example of archaeological perfuming ingredients for comparison against the MPM samples.

Additionally, experimental archaeological techniques should be employed in an attempt to recreate these “unguents” and test their chemical signatures against the results obtained from the vessels to gain additional confidence in the identification of the vessels’ organic compounds. Any experiments that test newly created unguents against the spectra of archaeological vessel contents will need to artificially age the samples through a combination of UV light exposure and heat exposure. This step is necessary to approximate the natural molecular degradation that occurs in vessel contents over time, especially in archaeological samples that have been subjected to fluctuations in temperature and moisture over the span of several hundred years. Including an experimental portion would allow the olfactory environments present during Roman funerals and cadaver preparations to be recreated. Experimental archaeology, along with a thorough survey of the iconographic representations of unguentaria, will allow this

project to give a more tangible, sensory understanding of how these vessels were used in the past, relying on scent to transcend time and space.

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## APPENDIX A: UNGUENTARIA REPORTS AND MUSEUM DOCUMENTATION

### MPM Wings Publication, Fall 2013

#### Ancient Vessels Get Modern Treatment

Consider a bottle of perfume or cologne on your nightstand or a box of pills in your medicine cabinet. Chances are—you immediately know what's in it just by looking at it (thanks to writing, branding or other telltale signs). But what about before modern packaging? How does an archaeologist know what a vessel once held?

With advances in technology, archaeologists are now able to test the residue of ancient vials and bottles to determine what was once stored inside. This capability, and scholarly curiosity, led UWM Anthropology and Museum Studies graduate student Jenna Mortensen to further research on the unguentaria housed in MPM's Anthropology collection.

Unguentaria—or small Roman vials and bottles of glass or pottery—often held perfumes or medicines. Mortensen is testing the assumption that all vessels of this type contained materials related to body care or medicine. With the assistance of Professor Joseph H. Aldstadt III of the UWM Chemistry Department, Mortensen collected residue samples and is currently analyzing the findings to determine the contents of each container.

This research is being conducted as part of Mortensen's master's thesis—supervised by Professor Bettina Arnold of the UWM Anthropology Department and MPM Adjunct Curator—and may greatly enhance our knowledge of these vessels and their use in Ancient Rome.



*Jenna Mortensen works alongside Professor Joseph H. Aldstadt III.*

Member Newsletter, Fall 2013

## MPM Destructive Sampling Agreement

### Milwaukee Public Museum Destructive Sampling Agreement

The request by Jenna Mortensen for destructive sampling from the collections of the Milwaukee Public Museum (MPM) has been approved by the Milwaukee Public Museum. The project is to consist of sampling of internal residues of glass and ceramic bottles from MPM *unguentaria* to analyze substances contained within. Samples will be subjected to both ICP-MS and Raman spectroscopy at the UW-Milwaukee Chemistry labs in order to identify both the organic and inorganic compounds present in the bottles' original contents. SEE ATTACHED LIST of material to be sampled. Such sampling is subject to the following conditions:

1. The samples will be taken at MPM.
2. Sample vessels will be photographed prior to sampling to include overall images to establish condition prior to testing and images of location of testing if possible.
3. Only a portion of the residue will be removed for sampling allowing for future sampling of material if desired by MPM.
4. No alteration, sampling, modification or testing of any object is permitted without prior written authorization in the form of a signed MPM Destructive Testing Agreement. Under no circumstances is testing permitted in the absence of this agreement, including on the basis of verbal discussions with curators, collections managers, conservators or registrars.
5. Usable samples and unused portions of specimens or objects will be returned to MPM so that they may be saved for future use. Full documentation regarding the location, extent and kinds of sampling must be maintained and provided to MPM.
6. The researcher agrees that MPM will receive a complete copy of the analytical outcomes (including raw data in the form of graphs, computer printouts, etc.) resulting from the sampling or testing of MPM collections. Analytical outcomes should include not only the raw results but also details regarding the specific methodologies and instrumentation employed. The researcher also agrees to submit to the appropriate collections manager two copies of any published papers resulting from the research supported through the Destructive Sampling Agreement. In order to balance the interests of the researcher with those of the broader scholarly community, MPM will keep the results of tests confidential for a period of three years following testing; should another scholar propose similar tests within this period MPM will forward this request to the first researcher. MPM reserves the right to publish analytical results from such tests, or release the results to other scholars, if the researcher does not provide them to the scholarly community in a timely manner (generally three years from date of testing unless otherwise stated in this agreement).
7. All costs of the analysis, including packing and round trip shipping, are the responsibility of the researcher unless otherwise indicated otherwise in this agreement

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Portion Returned: \_\_\_\_\_

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Results Received (date): \_\_\_\_\_

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## UNGUENTARIA REPORTS



## Anthropology Report

A10436/A10436

**Catalogue No** A10436      **Acc No/Source/Method** [A10436] Plankinton, Miss Elizabeth (Gift)

**Other No Type**      **Other No**      **Catalogue Date** 03/25/1901

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Syria. Early Roman Empire. Piriform unguentarium made of medium green translucent blown soda lime glass with heavy opaque iridescence covering the majority of the body and neck in patches of white and in red, green, yellow, blue, and purple. Large rounded base, short wide tubular neck with flared lip.

Catalog ledger: One odor bottle, antique glass. Syria. Donor: Miss Elizabeth Plankinton.

**Object Date** 75 B.C. - 100 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Asia           Lebanon                Sidon

**Initial Culture** Roman

**Place Collected** Sidon      **Date Collected**

**Collector**

**Remarks** Donor: Miss Elizabeth Plankinton

**Notes** NOTES: Sidon is located in modern day Lebanon. The departmental designation and storage location was changed from Anthropology to History. The information for this entry is based upon my thesis research on vessel style and manufacture. Assigned dates (75 B.C. - 100 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997). - Jenna Mortensen, intern. 08/22/2012.



## Anthropology Report

**A15779/5253**

**Catalogue No** A15779      **Acc No/Source/Method** [5253] Titus, W. A. (Purchase)

**Other No Type**      **Other No**      **Catalogue Date** 11/28/1916

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Hellenistic Period. Ceramic fusiform unguentarium. Coarse reddish-orange fabric, micaceous with other small inclusions. Broad shoulders, tubular flaring neck with ring lip. Tapered body, wide flared foot. Thick brownish-orange localized mineral encrustation around the shoulder of the vessel, ringed with dark stains that extend down the vessel side, reaching the foot.

Catalog ledger: Pottery vessel. Ancient Greek-Roman. Height 5". [sketch of vessel in ledger].

**Object Date** 330 - 200 B.C.      **Period/Style** Hellenistic period

**Materials**      **Group**      **Sub Group**  
Ceramic      Earthenware

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Europe

**Initial Culture** Greco-Roman

**Place Collected**      **Date Collected**

**Collector**

**Remarks** Seller: W. A. Titus

**Notes** NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. Assigned dates (330 B.C. - 200 B.C.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Anderson-Stojanovic 1987). Diameter taken across the surface of the base. - Jenna



## Anthropology Report

**A15780/5253**

**Catalogue No** A15780      **Acc No/Source/Method** [5253] Titus, W. A. (Purchase)

**Other No Type**      **Other No**      **Catalogue Date** 11/28/1916

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Hellenistic Period. Ceramic fusiform unguentarium. Coarse reddish-orange fabric, micaceous with many other varied, small inclusions. Rounded body, thick tubular neck with flared lip, tapered base with uneven conical foot.

Catalog ledger: Pottery vase. Greek-Roman. Height 5 1/4". [sketch of vessel in ledger]

**Object Date** 330 - 200 B.C.      **Period/Style** Hellenistic period

**Materials**      **Group**      **Sub Group**  
Ceramic      Earthenware

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Europe

**Initial Culture** Greco-Roman

**Place Collected**      **Date Collected**

**Collector**

**Remarks** Seller: W. A. Titus

**Notes** NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. Assigned dates (330 B.C. - 200 B.C.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Anderson-Stojanovic 1987). Diameter taken across the surface of the base. - Jenna Mortensen, intern 09/5/2012.



## Anthropology Report

**A15849/5253**

**Catalogue No** A15849      **Acc No/Source/Method** [5253] Titus, W. A. (Purchase)

**Other No Type**      **Other No**      **Catalogue Date** 11/28/1916

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Phoenicia. Early Roman Empire. Test-tube shaped unguentarium made of translucent blue-green blown soda lime glass. Flared lip. Pale tan iridescence.

Catalog ledger: Glass tear bottle. Phoenician glass tear bottle from 500 - 300 B.C. Iridescent from long contact with the earth which starts disintegration and forms scales. Length: 5 7/8". Purchased from W.A. Titus.

**Object Date** 1 - 50 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Asia           Phoenicia  
(Lebanon and  
Syria)

**Initial Culture** Roman

**Place Collected** Phoenicia      **Date Collected**

**Collector**

**Remarks** Seller: W. A. Titus

**Notes** NOTES: Measurements have been updated from inches to cm. The term "unguentarium" is a synonym for both "lachrymatory" and "tear bottle". Information has been added to the object description that is not found in the catalog card and ledger which is based upon my thesis research on vessel style and manufacture. Assigned dates (1- 50 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997) -Jenna Mortensen, intern.



## Anthropology Report

A16175/213

**Catalogue No** A16175      **Acc No/Source/Method** [213] Frankfurth, Mr. William (Gift)

**Other No Type**      **Other No**      **Catalogue Date** 12/27/1916

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Early Roman Empire. Blue-green translucent blown soda lime glass piriform unguentarium. Bell-shaped body, thin tubular neck. Damaged--lip missing. Very little iridescence.

Catalog ledger: Bottle. Iridescent glass bottle, top broken. L 8.8 cm

**Object Date** 100 - 200 A.D.      **Period/Style** Roman

<b>Materials</b>	<b>Group</b>	<b>Sub Group</b>
	Glass	Soda lime glass

<b>Continent</b>	<b>Region or Next</b>	<b>Country or Next</b>	<b>State or Next</b>	<b>County or Next</b>	<b>City or Next</b>
Europe					

**Initial Culture** Roman

**Place Collected**      **Date Collected**

**Collector** Mr. William Frankfurth

**Remarks** Catalog ledger: Donor William Frankfurth by L. Frankfurth.

**Notes** NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. Assigned dates (100 - 200 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997). - Jenna Mortensen, intern. 08/16/2012.



## Anthropology Report

### A16177/213

**Catalogue No** A16177      **Acc No/Source/Method** [213] Frankfurth, Mr. William (Gift)

**Other No Type**      **Other No**      **Catalogue Date** 12/27/1916

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Early Roman Empire. Piriform unguentarium in translucent blue-green blown soda lime glass with short bell-shaped body, long tubular neck, and flaring lip. Minor pale purple iridescence.

Catalog ledger: Bottle. Iridescent glass bottle, lip broken. L 8.5 cm.

**Object Date** 100 - 150 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Europe

**Initial Culture** Roman

**Place Collected**      **Date Collected**

**Collector** Mr. William Frankfurth

**Remarks** Catalog ledger: Donor William Frankfurth by L. Frankfurth.

**Notes** NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. Assigned dates (100 - 150 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material. This vessel shape was very common in the early 2nd century A.D., especially in northern Gaul and the Rhineland (Fleming 1997). - Jenna Mortensen, intern. 08/16/2012.



## Anthropology Report

### A53911/19612

**Catalogue No** A53911      **Acc No/Source/Method** [19612] National Museum of Hungary (Exchange)

**Other No Type**      **Other No**      **Catalogue Date** 08/10/1965

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Hungary. Early Roman Empire. Pale green translucent blown soda lime glass piriform unguentarium. Thick long neck, slightly flared lip. Large round body with flat base.

Catalog ledger: Bottle, glass. Balsam bottle. #49 - 54.2.5 - Roman Period. Ht. 5", dia. 3". Roman, collected in Hungary.

**Object Date** 150 - 400 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Europe           Hungary

**Initial Culture** Roman

**Place Collected** Hungary      **Date Collected**

**Collector**

**Remarks** Exchange: National Museum of Hungary

**Notes** NOTES: Terms "balsam bottle", or "balsamarium" are synonyms for unguentarium. Measurements have been updated from inches to cm. Information has been added to the object description that is not found in the catalog card and ledger which is based upon my thesis research on vessel style and manufacture. Assigned dates (150- 400 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997) -Jenna Mortensen, intern. 08/28/2012.



## Anthropology Report

**A53912/19612**

**Catalogue No** A53912      **Acc No/Source/Method** [19612] National Museum of Hungary (Exchange)

**Other No Type**      **Other No**      **Catalogue Date** 08/10/1965

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Hungary. Early Roman Empire. Semi-opaque striated translucent pale green blown soda lime glass piriform unguentarium. Short bulbous body, thick tubular neck, uneven flaring lip. Brown and black inclusions in glass, reddish residue inside body of vessel.

**Object Date** 150 - 400 A.D.      **Period/Style** Roman

<b>Materials</b>	<b>Group</b>	<b>Sub Group</b>
	Glass	Soda lime glass

<b>Continent</b>	<b>Region or Next</b>	<b>Country or Next</b>	<b>State or Next</b>	<b>County or Next</b>	<b>City or Next</b>
Europe		Hungary			

**Initial Culture** Roman

**Place Collected** Hungary      **Date Collected**

**Collector**

**Remarks** Exchange: National Museum of Hungary

**Notes** NOTES: Measurements have been updated from inches to cm. Information has been added to the object description that is not found in the catalog card and ledger which is based upon my thesis research on vessel style and manufacture. Assigned dates (150 - 400 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997) -Jenna Mortensen, intern. 08/28/2012.



## Anthropology Report

**A53913/19612**

**Catalogue No** A53913      **Acc No/Source/Method** [19612] National Museum of Hungary (Exchange)

**Other No Type**      **Other No**      **Catalogue Date** 08/10/1965

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Hungary. Early Roman Empire. Translucent pale green blown soda lime glass piriform unguentarium. Elongated narrow tubular neck, small flared lip. Short flared body. Striated body.

Catalog ledger: Bottle, glass. Balsam bottle. #51 - 54.2.3 - Roman Period. Ht. 4 5/8", dia. 2".  
Collected in Hungary.

**Object Date** 200 - 400 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Europe           Hungary

**Initial Culture** Roman

**Place Collected** Hungary      **Date Collected**

**Collector**

**Remarks** Exchange: National Museum of Hungary

**Notes** NOTES: Terms "balsam bottle", or "balsamarium" are synonyms for unguentarium. Measurements have been updated from inches to cm. Information has been added to the object description that is not found in the catalog card and ledger which is based upon my thesis research on vessel style and manufacture. Assigned dates (200 - 400 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997) -Jenna Mortensen, intern. 08/28/2012.



## Anthropology Report

**A54021a/19746**

**Catalogue No** A54021a      **Acc No/Source/Method** [19746] Elmer & Nannette Winter Foundation (Gift)

**Other No Type**      **Other No**      **Catalogue Date** 09/28/1965

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Puteoli, Campania. Hellenistic Period. Ceramic fusiform unguentarium. Red buffware with buff-colored slip around body and red slip around lip. Slender elongated biconical body, tapering at the base with a thick tubular flaring neck, small flared pedestal foot, and rolled lip.

Catalog ledger: Pottery bottle, red buff, tall and slim. Red band on top. Ht. 3 7/8", dia. 1 1/6". 400 - 300 century B.C., Pozzuoli (Puteoli) Campania. Purchased at Bennetieri Art Gallery, Naples.

**Object Date** 400 - 300 B.C.      **Period/Style** Hellenistic period

**Materials**      **Group**      **Sub Group**  
Ceramic      Earthenware

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Europe           Italy      Campania           Pozzuoli

**Initial Culture** Greco-Roman

**Place Collected** Pozzuoli, Campania, Italy      **Date Collected**

**Collector**

**Remarks** Donor: Elmer & Nanette Winter Foundation  
Purchased from Bennetieri Art Gallery, Naples, Italy.

**Notes** NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. The assigned dates from the art gallery (400 B.C. - 300 B.C.) are not necessarily wrong, but based upon my opinion and research on previously documented and dated slender ceramic unguentaria (Anderson-Stojanovic 1987), these dates may be too early, as the smaller and more slender versions are commonly seen later in the chronolgy of ceramic unguentaria. Diameter taken across the surface of the base. - Jenna Mortensen, intern 09/5/2012.



## Anthropology Report

### A54021b/19746

**Catalogue No** A54021b      **Acc No/Source/Method** [19746] Elmer & Nannette Winter Foundation (Gift)

**Other No Type**      **Other No**      **Catalogue Date** 09/28/1965

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Puteoli, Campania. Hellenistic Period. Ceramic fusiform unguentarium. Buffware with light grey-brown slip around body and dark brown slip around lip. Thin white stripe around neck near the edge of the dark brown slip. Slender elongated biconical body, tapering at the base with a thick tubular flaring neck, small flared pedestal foot, and rolled lip. Small dark scattered mineral encrustations, ringed with dark stains, along the side of the body and extending towards the foot.

Catalog ledger: Pottery bottle, red buff, tall and slim. Black at top and base. Ht. 3 5/8", dia. 1 1/8". 400 - 300 century B.C., Pozzuoli (Puteoli) Campania. Purchased at Bennettieri Art Gallery, Naples.

**Object Date** 400 - 300 B.C.      **Period/Style** Hellenistic period

**Materials**      **Group**      **Sub Group**  
Ceramic      Earthenware

<u>Continent</u>	<u>Region or Next</u>	<u>Country or Next</u>	<u>State or Next</u>	<u>County or Next</u>	<u>City or Next</u>
Europe		Italy	Campania		Pozzuoli

**Initial Culture** Greco-Roman

**Place Collected** Pozzuoli, Campania, Italy      **Date Collected**

**Collector**

**Remarks** Donor: Elmer & Nanette Winter Foundation  
Purchased from Bennetieri Art Gallery, Naples, Italy.

**Notes** NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. The assigned dates from the art gallery (400 B.C. - 300 B.C.) are not necessarily wrong, but based upon my opinion and research on previously documented and dated slender ceramic unguentaria (Anderson-Stojanovic 1987), these dates may be too early, as the smaller and more slender versions are commonly seen later in the chronology of ceramic unguentaria. Diameter taken across the surface of the base. - Jenna Mortensen, intern 09/5/2012.



## Anthropology Report

### A54081/19977

**Catalogue No** A54081      **Acc No/Source/Method** [19977] Armitage, - Boston Store (Gift)

**Other No Type**      **Other No**      **Catalogue Date** 12/22/1965

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Syria. Early Roman Empire. Test-tube shaped unguentarium made of medium blue-green translucent blown soda lime glass. Narrower at the shoulder with a flaring neck. Prominent brown iridescence.

Catalog ledger: Glass perfume bottle. Roman Syria, 2nd - 4th c. A.D. Collected by Boston Store. Gift. Purchased through Milwaukee Art Center Sales Desk.

**Object Date** 1 - 50 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Asia           Syria

**Initial Culture** Roman

**Place Collected** Syria      **Date Collected**

**Collector**

**Remarks** Donor: Boston Store

**Notes** NOTES: Measurements have been updated from inches to cm. Information has been added to the object description that is not found in the catalog card and ledger which is based upon my thesis research on vessel style and manufacture. Assigned dates (1- 50 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997) -Jenna Mortensen, intern. 08/29/2012.



## Anthropology Report

E39974/10861

**Catalogue No** E39974      **Acc No/Source/Method** [10861] Welser, Jr., Mr. George B.

**Other No Type**                      **Other No**                      **Catalogue Date** 11/12/1932

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Balsamarium  
Lachrymatory

**Description** Unguentarium. Cyprus. Early Roman Empire. Glass piriform unguentarium. Large, flat-bottomed flask shape with long tubular neck and fluted lip. Clear pale green blown soda lime glass.

From catalog ledger: One glass tear bottle. Cyprus

**Object Date** 125 - 300 A.D.                      **Period/Style** Roman

<b><u>Materials</u></b>	<b><u>Group</u></b>	<b><u>Sub Group</u></b>
	Glass	Soda lime glass

<b><u>Continent</u></b>	<b><u>Region or Next</u></b>	<b><u>Country or Next</u></b>	<b><u>State or Next</u></b>	<b><u>County or Next</u></b>	<b><u>City or Next</u></b>
Asia		Cyprus			

**Initial Culture** Roman

**Place Collected** Cyprus                      **Date Collected** 1932

**Collector** Mrs. Geo B. Welsher

**Remarks**

**Notes** NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. Assigned dates (125 - 300 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material. The catalog's item description: "tear bottle" is a colloquial synonym for unguentaria vessels.  
- Jenna Mortensen, intern. 08/13/2012/



## Anthropology Report

**E39975/10861**

**Catalogue No** E39975      **Acc No/Source/Method** [10861] Welser, Jr., Mr. George B.

**Other No Type**      **Other No**      **Catalogue Date** 11/12/1932

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Cyprus. Early Roman Empire. Glass piriform unguentarium. Small, short-necked, bulbous body, uneven lip. Blown pale green soda lime glass with large patches of white opaque iridescence.

From catalog ledger: One glass tear bottle. Cyprus.

**Object Date** 175 - 300 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Asia           Cyprus

**Initial Culture** Roman

**Place Collected** Cyprus      **Date Collected** 1932

**Collector** Mrs. Geo B. Welsher

**Remarks**

**Notes** NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. Assigned dates (175 - 300 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material. The catalog's item description: "tear bottle" is colloquial synonym for unguentaria vessels.  
- Jenna Mortensen, intern. 08/13/2012/



## Anthropology Report

### E40485/11340

**Catalogue No** E40485      **Acc No/Source/Method** [11340] Kurtz, Joe

**Other No Type**                      **Other No**                      **Catalogue Date** 05/08/1934

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Balsamarium  
Lachrymatory

**Description** Unguentarium. Early Roman Empire. Ceramic piriform unguentarium. Wheel-made; ovoid body on a flat base, with a tall narrow neck; flaring lip; red clay, abraded surface.

Catalog ledger: One earthenware vase. Classical Greek or Roman used for oils or perfume.

**Object Date** 100 B.C. - 75 A.D.                      **Period/Style** Roman

**Materials**                      **Group**                      **Sub Group**  
Ceramic                      Earthenware

**Continent**                      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**

**Initial Culture** Roman

**Place Collected**                      **Date Collected**

**Collector**

**Remarks**

**Notes** NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. Assigned dates (100 B.C. - 75 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material. - Jenna Mortensen, intern 08/13/2012.



## Anthropology Report

**N10365/16671**

**Catalogue No** N10365      **Acc No/Source/Method** [16671] Mensing, Dr. Edmund H.

**Other No Type**      **Other No**      **Catalogue Date** 09/18/1947

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Balsamarium  
Lachrymatory

**Description** Unguentarium. Syria. Early Roman Empire. Pale green translucent blown soda lime glass with bright green, white, pink, and blue iridescence. Broad rounded conical body with a short thin neck and flared lip. Damaged lip. Reddish-brown internal residue.

Catalog ledger: One glass vase. Droop body, cylindrical neck. Green iridescence. Syrian, Roman Empire 3rd century (Syrian).

**Object Date** 200 -300 A.D      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Asia           Syria

**Initial Culture** Roman

**Place Collected** Syria      **Date Collected**

**Collector**

**Remarks**

**Notes** NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. Assigned dates (200- 300 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material. This bottle was not likely used as a vase as noted in catalog ledger. - Jenna Mortensen, intern. 08/16/2012



## Anthropology Report

**N10892/17814**

**Catalogue No** N10892      **Acc No/Source/Method** [17814] Junkunc, Jr., Mr. S.

**Other No Type**      **Other No**      **Catalogue Date** 1958

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Syria. Early Roman Empire. Mould blown glass stylized piriform soda lime glass unguentarium. Broad domed body, narrow shoulder, short flaring neck. Heavy iridescence in red, purple, orange, green, silver, gold, and brown.

Catalog ledger: Bottle, glass. Roman period. Syrian. Gold, silver, red iridescence. 3 7/8" high.

**Object Date** 125 - 300 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Asia           Syria

**Initial Culture** Roman

**Place Collected** Syria      **Date Collected**

**Collector** Mr. S. Junkunc III

**Remarks**

**Notes** NOTES: Measurements have been updated from inches to cm. Information has been added to the object description that is not found in the catalog card and ledger which is based upon my thesis research on vessel style and manufacture. Assigned dates (125 - 300 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997) -Jenna Mortensen, intern. 08/13/2012.



## Anthropology Report

**N11376/18463**

**Catalogue No** N11376      **Acc No/Source/Method** [18463] Newman, Mr. Raymond F.

**Other No Type**      **Other No**      **Catalogue Date** 08/23/1962

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Egypt. Early Roman Empire. Test-tube shaped blown soda lime glass unguentarium. Narrow neck, flared lip. Weakened and highly iridesced glass, mostly dull brown in color with two holes in the body of the vessel displaying green and gold iridescent coloration at their edges.

Catalog ledger: Bottle.Tear bottle shape- shows some iridescence, heavy incrustation. Tapered lip; round bottom. Height 3" 100 - 200 A.D. Roman. Collected in Egypt during early 20th c.

**Object Date** 75 B.C. - 50 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Africa           Egypt

**Initial Culture** Roman

**Place Collected** Egypt      **Date Collected** early 20th c.

**Collector**

**Remarks** Collected in Egypt during the early 20th century.

**Notes** NOTES: Measurements have been updated from inches to cm. The term "unguentarium" is a synonym for both "lachrymatory" and "tear bottle". Information has been added to the object description that is not found in the catalog card and ledger which is based upon my thesis research on vessel style and manufacture. Assigned dates (75 B.C. - 50 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997) -Jenna Mortensen, intern. 08/27/2012.



## Anthropology Report

**N12545/19173**

**Catalogue No** N12545      **Acc No/Source/Method** [19173] Milwaukee Downer College

**Other No Type**      **Other No**      **Catalogue Date** 07/21/1964

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Balsamarium  
Lachrymatory

**Description** Unguentarium. Villa Ludovisi, Rome. Early Roman Empire. Two-toned blown soda lime glass test-tube unguentarium with light blue-green body and yellow flared lip. Filled with dirt.

Catalog ledger: Tear bottle. Blue glass. L 3 1/4", dia. 1". 100 AD. Roman. Collected from Villa Ludovici, Rome in 1897.

**Object Date** 100 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Europe           Italy                     Rome

**Initial Culture** Roman

**Place Collected** Villa Ludovisi, Rome      **Date Collected** 1897

**Collector**

**Remarks**

**Notes** NOTE: Originally part of the Mary E. Merrill Collection at Milwaukee Downer College. Modern spelling "Ludovisi" is used. The term "tear bottle" is a colloquial synonym for unguentaria. - Jenna Mortensen, intern. 08/16/2012.



## Anthropology Report

**N12883/19173**

**Catalogue No** N12883      **Acc No/Source/Method** [19173] Milwaukee Downer College

**Other No Type**      **Other No**      **Catalogue Date** 09/22/1964

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Hellenistic Period. Ceramic fusiform unguentarium. Buffware with light grey-brown slip around body and dark brown slip around lip. Slender elongated biconical body, tapering at the base with a thick tubular flaring neck, small flared pedestal foot, and rolled lip. Single smear of dark brown slip along the side of the body.

Catalog ledger: Pottery bottle. Black on top on gray buff pottery; narrow tall form. 1st century A.D. Rome. Collected in 1887. Part of Mary E. Merrill Collection. Ht. 3 1/2", dia. 1".

**Object Date** 100 B.C. - 100 A.D.      **Period/Style** Hellenistic period

**Materials**      **Group**      **Sub Group**  
Ceramic      Earthenware

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**

**Initial Culture** Greco-Roman

**Place Collected**      **Date Collected** 1887

**Collector**

**Remarks** Part of Mary E. Merrill Collection.  
Donor: Milwaukee Downer College.

**Notes** NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. The assigned dates from the catalog ledger (100 B.C. - 100 A.D.) are not necessarily wrong based upon my opinion and research on previously documented and dated slender ceramic unguentaria (Anderson-Stojanovic 1987), as the smaller and more slender versions are commonly seen later on in the chronology of ceramic unguentaria. Diameter taken across the surface of the base. - Jenna Mortensen, intern 09/5/2012.



## Anthropology Report

**N12885/19173**

**Catalogue No** N12885      **Acc No/Source/Method** [19173] Milwaukee Downer College

**Other No Type**      **Other No**      **Catalogue Date** 09/23/1964

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Early Roman Empire. Ceramic piriform unguentarium. Wheel-made; ovoid body on a flat base, with a tall narrow neck; flaring lip; red clay, abraded brown slip. Dried plant material inside of vessel. Twine tied around the neck.

Catalog ledger: Red brown ware, bulbous base with long neck and flaring lip. Ht. 3 1/2", diam. 1 1/2". Rome; 1st century B.C. to 1st century A.D. Part of Mary E. Merrill Collection.

**Object Date** 100 B.C. - 75 A.D.      **Period/Style** Roman

<b>Materials</b>	<b>Group</b>	<b>Sub Group</b>
	Ceramic	Earthenware
	Other Plant Material	Twine
	Plant	

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**

**Initial Culture** Roman

**Place Collected**      **Date Collected**

**Collector**

**Remarks** Part of Mary E. Merrill Collection.  
Donor: Milwaukee Downer College

**Notes** NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. Assigned dates (100 B.C. - 75 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Anderson-Stojanovic 1987). - Jenna Mortensen, intern 09/5/2012.



## Anthropology Report

**N14629/20643**

**Catalogue No** N14629      **Acc No/Source/Method** [20643] Whyte, Mr. Malcolm

**Other No Type**      **Other No**      **Catalogue Date** 03/10/1967

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Malta. Hellenistic Period. Ceramic fusiform unguentarium. Buffware with buff-colored slip around body and red slip around lip. Slender elongated body, tapering at the base with a thick tubular flaring neck, long thin tubular leg and small flared pedestal foot. Rolled lip.

Catalog ledger: Guttos. Roman Malta (Punic). Pottery guttos of orange buff clay. High fired. Tall, slender dart shape with conical foot and spreading lip. Red painted neck. Ht. 5 1/8", diam. 1 3/8". 5th - 3rd century B.C. Collected in Malta and purchased from E.R. Leopardi.

**Object Date** 500 - 200 B.C.      **Period/Style** Hellenistic period

**Materials**      **Group**      **Sub Group**  
Ceramic      Earthenware

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Europe           Malta

**Initial Culture** Greco-Roman

**Place Collected** Malta      **Date Collected**

**Collector**

**Remarks**

**Notes** NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. The designation of this vessel as a "guttus" is incorrect and that term is used for handled vessels of a much different size and shape. The assigned dates from the Leopardis (500 - 200 B.C..) are not necessarily wrong, though based upon my opinion and research on previously documented and dated slender ceramic unguentaria (Anderson-Stojanovic 1987) these dates may be too early as the slender form arrives later on in the chronology of ceramic unguentaria. Diameter taken across the surface of the base. - Jenna Mortensen, intern 09/5/2012.



## Anthropology Report

**N14658/20652**

**Catalogue No** N14658      **Acc No/Source/Method** [20652] Frank, Mr. Arthur J.

**Other No Type**      **Other No**      **Catalogue Date** 03/17/1967

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Malta. Early Roman Empire. Translucent colorless blown soda lime glass piriform unguentarium. Squat bell-shaped body, extremely thin long neck, lop-sided flared rolled lip. Very little iridescence.

Catalog ledger: Unguentaria. Egypt, Ptolemaic period. Glass, round conical base with curved tubular neck and flaring lip, H: 3 inches, Diam: 7/8 inches. 3rd - 1st century B.C., Collected in Malta, purchased from E.R. Leopardi.

**Object Date** 100 - 200 A.D.      **Period/Style** Roman

**Materials**

**Group**

Glass

**Sub Group**

Soda lime glass

**Continent**

Europe

**Region or Next**

**Country or Next**

Malta

**State or Next**

**County or Next**

**City or Next**

**Initial Culture**

Roman

**Place Collected** Malta

**Date Collected**

**Collector**

**Remarks**

**Notes** NOTE: Source: Edith Fairchild Frank; purchased of E. R. Leopardi - Malta.

NOTE: This data entry record was created by scanning the paper catalogue "A Guide to the Egyptian Collection at the Milwaukee Public Museum - 1989" and using OCR (optical character recognition) software. The catalogue is in the possession of Carter Lupton, Head of History. He has the only copy. DLM 04/2007

NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. Unguentarium is the singular form, while "unguentaria" is the plural form. Assigned dates (100 - 200 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997), this vessel appears to be a variant of a popular northern Gaulish unguentaria style, and as this vessel was collected in Malta, there is no clear reason to associate this vessel with Egypt. - Jenna Mortensen, intern. 08/16/2012.



## Anthropology Report

**N14659/20652**

**Catalogue No** N14659      **Acc No/Source/Method** [20652] Frank, Mr. Arthur J.

**Other No Type**      **Other No**      **Catalogue Date** 03/17/1967

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Malta. Early Roman Empire. Blue-green translucent blown soda lime glass test-tube unguentarium with opaque tan mineral deposits along one side and into the interior of the vessel. Purple and green iridescence. Narrower at the shoulder with a flared lip.

Catalog ledger: Glass Ampulla. Egypt, Ptolemaic period. Glass, round bottomed tubular vessel with flaring lip, H: 3 3/4 inches, Diam: 7/8 inches. 3rd - 1st century B.C. . Collected in Malta, purchased from E.R. Leopardi.

**Object Date** 1 - 50 A.D.      **Period/Style** Roman

**Materials**

**Group**

Glass

**Sub Group**

Soda lime glass

**Continent**

Europe

**Region or Next**

**Country or Next**

Malta

**State or Next**

**County or Next**

**City or Next**

**Initial Culture** Roman

**Place Collected** Malta

**Date Collected**

**Collector**

**Remarks** Donor: Edith Fairchild Frank

NOTE: Source: Edith Fairchild Frank; purchased of E. R. Leopardi - Malta.

NOTE: This data entry record was created by scanning the paper catalogue "A Guide to the Egyptian Collection at the Milwaukee Public Museum - 1989" and using OCR (optical character recognition) software. The catalogue is in the possession of Carter Lupton, Head of History. He has the only copy. DLM 04/2007

NOTES: Catalog ledger and card lists item as an "ampulla", but this is a broad term meaning "bottle" while the term "unguentarium" is the vessel type. Measurements have been updated from inches to cm. Dates listed in catalog card and ledger are incorrectly listed as 3rd -1st century BC, Ptolemaic Period, before blown glass was invented.

Information has been added to the object description that is not found in the catalog card and ledger which is based upon my thesis research on vessel style and manufacture. Assigned dates (1- 50 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997) -Jenna Mortensen, intern. 09/5/2012.



## Anthropology Report

**N15299/21014**

**Catalogue No** N15299      **Acc No/Source/Method** [21014] Leopardi, E. R.

**Other No Type**      **Other No**      **Catalogue Date** 10/24/1967

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium  
Ampulla

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Malta. Early Roman Empire. Large opaque light green blown soda lime glass piriform unguentarium. Broad bulbous base, large tubular neck, flared lip. Some brown iridescence.

Catalog ledger: Ampulla. Malta. Roman period. Heavy green glass ampulla with bulbous bottom, thick tubular neck, and flattened ring lip. Ht. 6 1/4 ", dia. 3 1/2", 3rd c. B.C. - 3rd c. A.D. Donors: Mr. and Mrs. Leroy Segall.

**Object Date** 1 - 150 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Europe           Malta

**Initial Culture** Roman

**Place Collected** Malta      **Date Collected**

**Collector** E. R. Leopardi

**Remarks** Catalog ledger: Donated by Mr. and Mrs. Leroy Segall

**Notes** NOTES: Catalog ledger and card lists item as an "ampulla", but this is a broad term meaning "bottle" while the term "unguentarium" is the vessel type. Measurements have been updated from inches to cm. Dates listed in catalog card and ledger are incorrectly listed as 3rd century B.C. as glass blowing was not invented until the 1st c. B.C.

Information has been added to the object description that is not found in the catalog card and ledger which is based upon my thesis research on vessel style and manufacture. Assigned dates (1 - 150 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997) -Jenna Mortensen, intern. 08/22/2012.



## Anthropology Report

**N15388/21093**

**Catalogue No** N15388      **Acc No/Source/Method** [21093] Leopardi, E. R.

**Other No Type**      **Other No**      **Catalogue Date** 12/06/1967

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Malta. Early Roman Empire. Piriform unguentarium made of translucent pale green blown soda lime glass. Small bell-shaped body with long tubular neck and flared lip.

Catalog ledger: Unguentaria. Malta. Clear glass. Bell shaped base, thin tubular neck, flaring lip. Ht. 5", diam. 1 1/2", Punic Period, 4th - 3rd c. B.C., Malta. Purchased from E.R. Leopardi, donated by Robert G. Lietz, Donald H. Sachs, and Eldon G. Wolff in memory of John F. Luedtke.

**Object Date** 100 - 150 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Europe           Malta

**Initial Culture** Roman

**Place Collected** Malta      **Date Collected**

**Collector** Mr. E. R. Leopardi

**Remarks** Catalog ledger: Donated by Robert G. Lietz, Donald H. Sachs, and Eldon G. Wolff in memory of John F. Luedtke.

**Notes** Credit Line: In memory of Margarrett V. Stafford.

NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. Assigned dates (100 - 150 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material. This vessel shape was very common in the early 2nd century A.D., especially in northern Gaul and the Rhineland (Fleming 1997). - Jenna Mortensen, intern. 08/22/2012.



## Anthropology Report

**N16081/21500**

**Catalogue No** N16081      **Acc No/Source/Method** [21500] Leopardi, E. R.  
**Other No Type**      **Other No**      **Catalogue Date** 09/10/1968

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Early Roman Empire. Ceramic piriform unguentarium. Micaceous red buffware. Wheel-made; round body with a flat base; tall narrow neck; flaring lip; abraded red slip on neck and lip.

Catalog ledger: Pottery ampulla. Malta. Punic Period pottery ampulla. Red buffware with red paint on lip and neck. Globular body with thin, flaring neck and wide lip. Ht. 4", dia. 2". 5th - 3rd century B.C. Collected in Malta.

**Object Date** 100 B.C. - 75 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
 Ceramic      Earthenware

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
 Europe           Malta

**Initial Culture** Roman

**Place Collected** Malta      **Date Collected**

**Collector**

**Remarks**

**Notes** NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. Catalog ledger and card lists item as an "ampulla", but this is a broad term meaning "bottle" while the term "unguentarium" is the vessel type. Assigned dates (100 B.C. - 75 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Anderson-Stojanovic 1987). - Jenna Mortensen, intern 09/5/2012.



## Anthropology Report

### N16086/21500

**Catalogue No** N16086      **Acc No/Source/Method** [21500] Leopardi, E. R.

**Other No Type**                      **Other No**                      **Catalogue Date** 09/10/1968

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Malta. Early Roman Empire. Pale yellow-green translucent blown soda lime glass piriform unguentarium. Large bulbous body, thick tubular neck with flat lip. Extensive silvery iridescence with large opaque white patches of iridescence.

Catalog ledger: Glass ampulla. Malta. Roman Period. Pale yellow-green glass. Squat, globular body. Thin tubular neck and flat ring lip. Ht. 3 1/2", dia. 2 5/8". 3rd century B.C. - 3rd century A.D. Collected in Malta by E.R. Leopardi.

**Object Date** 150 - 300 A.D.                      **Period/Style** Roman

**Materials**

**Group**

Glass

**Sub Group**

Soda lime glass

**Continent**

Europe

**Region or Next**

**Country or Next**

Malta

**State or Next**

**County or Next**

**City or Next**

**Initial Culture**

Roman

**Place Collected** Malta

**Date Collected**

**Collector** Mr. E. R. Leopardi

**Remarks**

**Notes** NOTES: Measurements have been updated from inches to cm. Catalog ledger and card lists item as an "ampulla", but this is a broad term meaning "bottle" while the term "unguentarium" is the vessel type. Information has been added to the object description that is not found in the catalog card and ledger which is based upon my thesis research on vessel style and manufacture. Assigned dates (150 - 300 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997) -Jenna



## Anthropology Report

**N16094/21500**

**Catalogue No** N16094      **Acc No/Source/Method** [21500] Leopardi, E. R.

**Other No Type**      **Other No**      **Catalogue Date** 09/11/1968

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Malta. Hellenistic Period. Ceramic fusiform unguentarium, rounded biconical body, tapering base, flared pedestal foot, thick tubular neck with flared lip. Green-gray slip. Heavy white and tan mineral deposits along one side and extending into the interior of the vessel.

Catalog ledger: Pottery Guttos. Gray-brown ware with gray-green coloring. Stocky, dart-shape with flat conical foot. Stocky flaring neck with flat lip. Ht. 5 1/4", dia. 2". 5th - 3rd century B.C. Punic Period. Collected in Malta by E.R. Leopardi.

**Object Date** 330 - 200 B.C.      **Period/Style** Hellenistic period

**Materials**      **Group**      **Sub Group**  
Ceramic      Earthenware

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Europe           Malta

**Initial Culture** Greco-Roman

**Place Collected** Malta      **Date Collected**

**Collector** Mr. E. R. Leopardi

**Remarks**

**Notes** NOTE: This piece was listed on the Anthropology storage sheet as a vase.

NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. Assigned dates (330 B.C. - 200 B.C.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Anderson-Stojanovic 1987). Diameter taken across the surface of the base. - Jenna Mortensen, intern 09/5/2012.



## Anthropology Report

N16096/21500

**Catalogue No** N16096      **Acc No/Source/Method** [21500] Leopardi, E. R.

**Other No Type**      **Other No**      **Catalogue Date** 09/11/1968

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium  
Ampulla

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Malta. Early Roman Empire. Glass "test-tube" unguentarium. Blue-green; translucent soda lime glass. Round bottom. Tubular base. Narrow at shoulder. Tubular neck, flaring lip. Prominent brown iridescence.

Catalog ledger: Glass ampulla. Blue green glass, flaring lip, tubular neck. Ht. 3 7/8", dia. 3/4". Clear round bottomed tubular base narrow at shoulder. 4th - 3rd c. B.C. Punic Period. Collected in Malta by E.R. Leopardi.

**Object Date** 1 - 50 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Europe           Malta

**Initial Culture** Roman

**Place Collected** Malta      **Date Collected**

**Collector** Mr. E. R. Leopardi

**Remarks**

**Notes** NOTES: Catalog ledger and card lists item as an "ampulla", but this is a broad term meaning "bottle" while the term "unguentarium" is the vessel type. Measurements have been updated from inches to cm. Departmental designation and storage location was changed from History to Anthropology. Dates listed in catalog card and ledger are incorrectly listed as 4th -3rd century BC, Punic Period. Information has been added to the object description that is not found in the catalog card and ledger which is based upon my thesis research on vessel style and manufacture. Assigned dates (1- 50 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997) -Jenna Mortensen, intern. 08/13/2012.



## Anthropology Report

### N16098/21500

**Catalogue No** N16098      **Acc No/Source/Method** [21500] Leopardi, E. R.

**Other No Type**      **Other No**      **Catalogue Date** 09/11/1968

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Malta. Early Roman Empire. Blue-green blown soda lime glass "test-tube" style unguentarium. Lip missing. Narrow shoulders, flaring neck. Glass coloration darkest near the bottom. Brown-black internal residue. Patches of opaque white iridescence along sides and bottom of vessel.

Catalog ledger: Glass ampulla. Greenish clear glass. Ht. 4 1/4", dia. 1". Round bottomed tubular base. Tubular neck mostly missing. 4th - 3rd century B.C. Punic Period. Collected in Malta by E.R. Leopardi.

**Object Date** 1 - 50 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Europe           Malta

**Initial Culture** Roman

**Place Collected** Malta      **Date Collected**

**Collector** Mr. E. R. Leopardi

**Remarks**

**Notes** NOTES: Catalog ledger and card lists item as an "ampulla", but this is a broad term meaning "bottle" while the term "unguentarium" is the vessel type. Measurements have been updated from inches to cm. Dates listed in catalog card and ledger are incorrectly listed as 4th -3rd century BC, Punic Period. Information has been added to the object description that is not found in the catalog card and ledger which is based upon my thesis research on vessel style and manufacture. Assigned dates (1- 50 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997) -Jenna Mortensen, intern. 09/5/2012.



## Anthropology Report

**N16126/21501**

**Catalogue No** N16126      **Acc No/Source/Method** [21501] Leopardi, Mrs. E. R.

**Other No Type**                      **Other No**                      **Catalogue Date** 09/10/1968

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Malta. Early Roman Empire. Ceramic piriform unguentarium. Wheel-made, ovoid body, flat base, thick neck, flared lip. Reddish-orange core exposed at lip with the neck and body covered in gray slip. White opaque surface stains around shoulders.

Catalog ledger: Pottery ampulla. Brownish pink ware. Fat globular body with heavy flaring neck, ring lip. Ht. 4". dia. 2". 7th - 5th century B.C. Punic Period. Collected in Malta by Guido de Piro D'Amico c/o E.R. Leopardi.

**Object Date** 100 B.C. - 75 A.D.                      **Period/Style** Hellenistic period

**Materials**                      **Group**                      **Sub Group**  
Ceramic                      Earthenware

**Continent**                      **Region or Next**                      **Country or Next**                      **State or Next**                      **County or Next**                      **City or Next**  
Europe                                           Malta

**Initial Culture** Roman

**Place Collected** Malta                      **Date Collected**

**Collector** Guido D. D'Amico

**Remarks**

**Notes** NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. Assigned dates (100 B.C. - 75 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Anderson-Stojanovic 1987). Diameter taken across the surface of the base. - Jenna Mortensen, intern 09/5/2012.



## Anthropology Report

### N16136/21501

**Catalogue No** N16136      **Acc No/Source/Method** [21501] Leopardi, Mrs. E. R.

**Other No Type**      **Other No**      **Catalogue Date** 09/10/1968

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Malta. Hellenistic Period. Ceramic fusiform unguentarium. Buffware with reddish buff-colored slip around body. Large biconical body, tapering at the base with a thick tubular flaring neck, small flared pedestal foot. Rolled lip.

Catalog ledger: Pottery guttus. Roman Malta (Punic). Red buff pottery ware with red lip and neck. Dart shaped body with flat conical foot. Long slender neck with ring lip. Ht. 6 3/4", dia. 1 1/2". 3rd century B.C. Collected by Guido de Piro D'Amico.

**Object Date** 300 - 200 B.C.      **Period/Style** Hellenistic period

**Materials**      **Group**      **Sub Group**  
Ceramic      Earthenware

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Europe           Malta

**Initial Culture** Greco-Roman

**Place Collected** Malta      **Date Collected**

**Collector** Guido D. D'Amico

**Remarks**

**Notes** NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. The designation of this vessel as a "guttus" is incorrect and that term is used for handled vessels of a much different size and shape. The assigned dates from the Leopardis (300 - 200 B.C..) are not necessarily wrong, based upon my opinion and research on previously documented and dated ceramic unguentaria (Anderson-Stojanovic 1987). Diameter taken across the surface of the base. - Jenna Mortensen, intern 09/5/2012.



## Anthropology Report

**N16141/21501**

**Catalogue No** N16141      **Acc No/Source/Method** [21501] Leopardi, Mrs. E. R.

**Other No Type**      **Other No**      **Catalogue Date** 09/10/1968

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Malta. Early Roman Empire. Piriform unguentarium made of translucent pale green blown soda lime glass. Broad flattened dome body with long tubular neck and flared lip.

Catalog ledger: Glass unguentaria. Rounded conical base, long tubular neck. Greenish clear glass, flat slanting lip. Ht. 5 7/8", dia. 3". 4th - 3rd century B.C. Punic Period. Collected in Malta by Guido de Piro D'Amico.

**Object Date** 200 - 400 A.D.      **Period/Style** Roman

<b><u>Materials</u></b>	<b><u>Group</u></b>	<b><u>Sub Group</u></b>
	Glass	Soda lime glass

<b><u>Continent</u></b>	<b><u>Region or Next</u></b>	<b><u>Country or Next</u></b>	<b><u>State or Next</u></b>	<b><u>County or Next</u></b>	<b><u>City or Next</u></b>
Europe		Malta			

**Initial Culture** Roman

**Place Collected** Malta      **Date Collected**

**Collector** Guido D. D'Amico

**Remarks**

**Notes** NOTE: Measurements have been retaken and converted from inches to cm. Dates for this vessel have been revised. The information for this entry is based upon my thesis research on vessel style and manufacture. Assigned dates (200 - 400 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997). - Jenna Mortensen, intern. 08/16/2012.



## Anthropology Report

**N20194/22949**

**Catalogue No** N20194      **Acc No/Source/Method** [22949] Balassan, Norik

**Other No Type**      **Other No**      **Catalogue Date** 05/05/1972

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Gurgan, Iran. Early Roman Empire. Translucent bright blue-green blown soda lime glass piriform unguentarium. Elongated neck, flared lip. Bulbous body. Evidence of previous repairs on vessel body.

Catalog ledger: Roman glass bottle. 5" high. Roman glass bottle - translucent blue-green multi-hued iridescence. Broken. 1st - 4th century A.D. Roman, Collected in Gurgan, Iran.

**Object Date** 200 - 400 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Asia           Iran                     Gurgan

**Initial Culture** Roman

**Place Collected** Iran      **Date Collected**

**Collector**

**Remarks**

**Notes** NOTES: Measurements have been updated from inches to cm. Information has been added to the object description that is not found in the catalog card and ledger which is based upon my thesis research on vessel style and manufacture. Assigned dates (200- 400 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997) -Jenna Mortensen, intern. 08/28/2012.



## Anthropology Report

**N20274/23026**

**Catalogue No** N20274      **Acc No/Source/Method** [23026] Lozoff, Mrs. Ruth

**Other No Type**      **Other No**      **Catalogue Date** 07/14/1972

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Early Roman Empire. Medium green blown soda lime glass piriform unguentarium. Elongated neck, flared lip. Heavy corrosion and texturing of glass with full coating of light green, and streaks of tan, iridescence. Rough textured surface.

Catalog ledger: Flask. Roman Empire. Glass. Pear shaped flask with brilliant 2mm green iridescences. Elongated, flaring neck. 5 3/4" high. 1st - 4th century A.D.

**Object Date** 100 - 200 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**

**Initial Culture** Roman

**Place Collected**      **Date Collected**

**Collector**

**Remarks**

**Notes** NOTE: Trust Fund 602.17B; Ck. # 1358, 7/12/72.

NOTES: Measurements have been updated from inches to cm. Information has been added to the object description that is not found in the catalog card and ledger which is based upon my thesis research on vessel style and manufacture. Assigned dates (100 - 200 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997) -Jenna Mortensen, intern. 08/13/2012.



## Anthropology Report

**N20280/23027**

**Catalogue No** N20280      **Acc No/Source/Method** [23027] Milwaukee Public Museum, Nickelodeon Fund (Purchase)

**Other No Type**      **Other No**      **Catalogue Date** 07/14/1972

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Early Roman Empire. Translucent blue-green soda lime glass "test-tube" unguentarium with prominent brown, silver, and bright purple iridescence. Rounded and elongated body with narrowing at the shoulder and a flaring lip.

Catalog ledger: Vial-glass. Elongated shape vial with brilliant multi-hued iridescence and silver exterior patches. 5" high. 1st - 4th century A.D. Roman Empire.

**Object Date** 1 - 50 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**

**Initial Culture** Roman

**Place Collected**      **Date Collected**

**Collector**

**Remarks**

**Notes** NOTE: Trust Fund 603.78; Ck. # 1358, 7/12/72.

NOTE: The dates for this entry are based upon my thesis research on vessel style and manufacture. Assigned dates (1 - 50 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997). - Jenna Mortensen, intern. 08/16/2012.



## Anthropology Report

### N20915/23307

**Catalogue No** N20915      **Acc No/Source/Method** [23307] Dinerstein I. A. (1973)

**Other No Type**      **Other No**      **Catalogue Date** 06/12/1973

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Early Roman Empire. Piriform unguentarium made of translucent pale green blown soda lime glass. Broad flattened dome body with long tubular neck and flared lip. Extensive silver and pale orange iridescence.

Catalog ledger: Bottle. Roman Empire. Glass. Squat bottle with long narrow neck and flared lip, clear glass with iridescent patina. 6" high, 4" base diam., 1 5/8" inches diam. top. A.D. 300, Roman Empire. Part of I.A. Dinerstein collection.

**Object Date** ca. 300 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**

**Initial Culture** Roman

**Place Collected**      **Date Collected**

**Collector** I. A. Dinerstein

**Remarks** Part of I.A. Dinerstein collection.

**Notes** NOTE: Written on catalog card: G 72.x

NOTE: Measurements have been retaken and converted from inches to cm. The given date of this vessel (300 A.D.) falls within an expected range of 200 - 400 A.D., as is suggested based upon research on vessels of similar style, material, and manufacturing technique. (Fleming 1997). - Jenna Mortensen, intern. 08/22/2012.



## Anthropology Report

**N21774/23571**

**Catalogue No** N21774      **Acc No/Source/Method** [23571] Ott, Norman  
**Other No Type**      **Other No**      **Catalogue Date** 06/22/1974

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Early Roman Empire. Test-tube shaped unguentarium made of medium blue-green translucent blown soda lime glass. Narrower at the shoulder with a flaring neck. Missing lip. Prominent brown iridescence.

Catalog ledger: Bottle, tear. Roman Empire. Glass tear bottle, elongated bulbous shape, clear glass with green patina. Top missing. Length 2 1/2 inches, top width 1/2 inch. 100 - 300 A.D. Roman Empire.

**Object Date** 1 - 50 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
 Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**

**Initial Culture** Roman

**Place Collected**      **Date Collected**

**Collector**

**Remarks** Donor: Norman H. Ott.

**Notes** NOTES: Measurements have been updated from inches to cm. Departmental designation and storage location was changed from History to Anthropology. The term "unguentarium" is a synonym for both "lachrymatory" and "tear bottle". Information has been added to the object description that is not found in the catalog card and ledger which is based upon my thesis research on vessel style and manufacture. Assigned dates (1- 50 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997) -Jenna Mortensen, intern. 08/13/2012.



## Anthropology Report

**N23703/24259**

**Catalogue No** N23703      **Acc No/Source/Method** [24259]

**Other No Type**      **Other No**      **Catalogue Date** 09/15/1976

**Obj Display Name** Unguentarium

**Object Thesaurus Name**

Bottle  
unguentarium

**Object Alternate Name**

Lachrymatory  
Balsamarium

**Description** Unguentarium. Syria. Early Roman Empire. Glass piriform unguentarium. Small squat bell-shaped body with long narrow neck and flared lip. Translucent blue-green blown soda lime glass with tan iridescence.

Catalog ledger: Glass bottle. 5 1/2" domed base, 1/2" diameter with long thin neck, flared lip. Aqua and tan iridescence showing effect of burial. Perfect condition. Ca. 1st - 4th century A.D. Syria.

**Object Date** 100 - 300 A.D.      **Period/Style** Roman

**Materials**      **Group**      **Sub Group**  
Glass      Soda lime glass

**Continent**      **Region or Next**      **Country or Next**      **State or Next**      **County or Next**      **City or Next**  
Asia           Syria

**Initial Culture** Roman

**Place Collected** Syria      **Date Collected**

**Collector** Mrs. Jorie Lueoff

**Remarks**

**Notes** NOTE: The information for this entry is based upon my thesis research on vessel style and manufacture. Assigned dates (100 - 300 A.D.) are based upon my opinion and research on previously documented and dated bottles of similar shape and material (Fleming 1997). - Jenna Mortensen, intern. 08/16/2012

## APPENDIX B: UNGUENTARIA PHOTOS



MPM Cat. #A15849



MPM Cat. #A16175





MPM Cat. #A54021a



MPM Cat. #A54021b



MPM Cat. #A54081



MPM Cat. #E39974



MPM Cat. #E39975



MPM Cat. #E40485



MPM Cat. #N10365



MPM Cat. #N11376



MPM Cat. #N12545



MPM Cat. #N12883



MPM Cat. #N12885



MPM Cat. #N14629



MPM Cat. #N14658



MPM Cat. #N14659



MPM Cat. #N15299



CM

MPM Cat. #N15388



CM

MPM Cat. #N16081



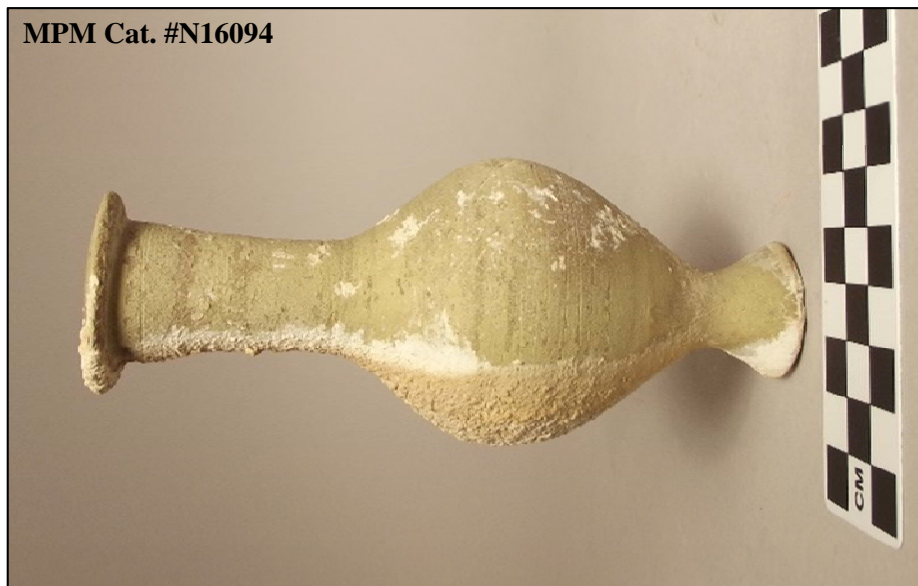
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CM

MPM Cat. #N16094



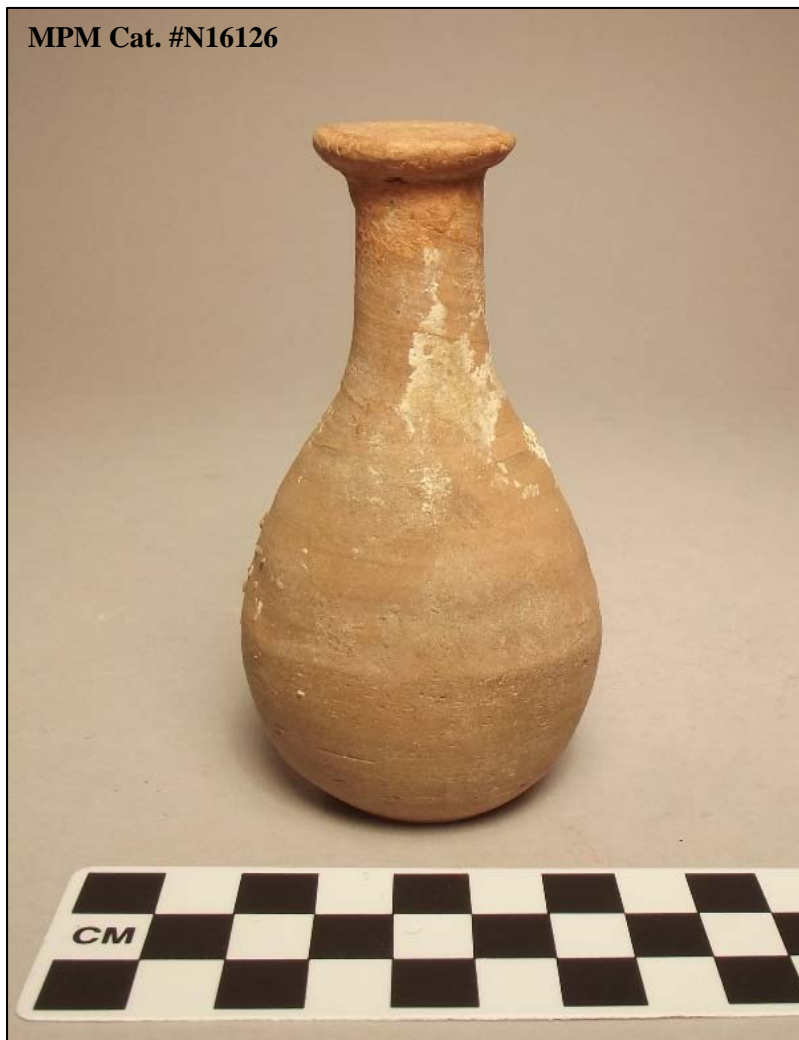
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MPM Cat. #N16098



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MPM Cat. #N16136





MPM Cat. #N20280



MPM Cat. #N20915



MPM Cat. #N21774

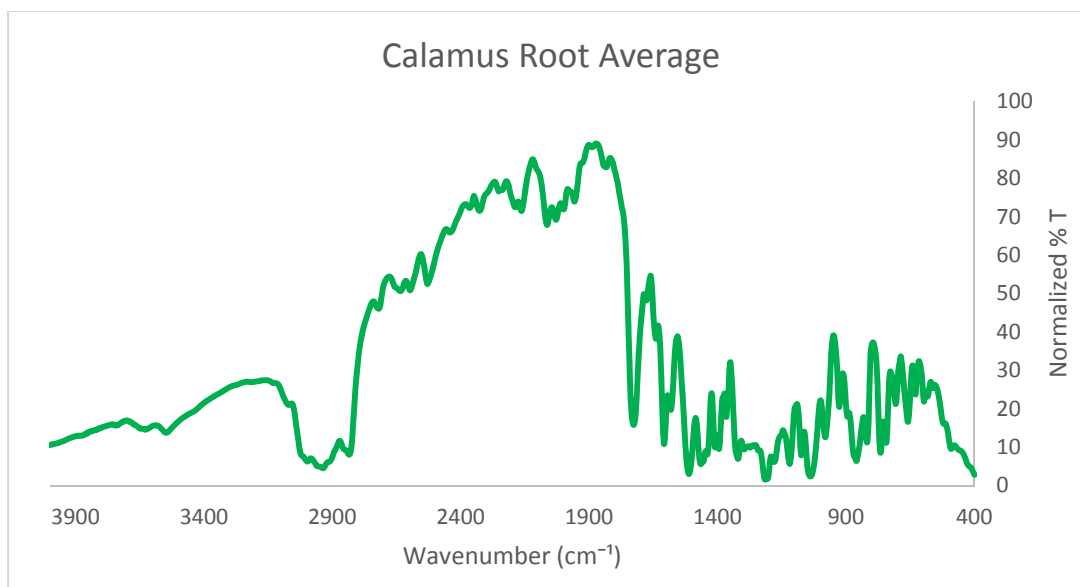
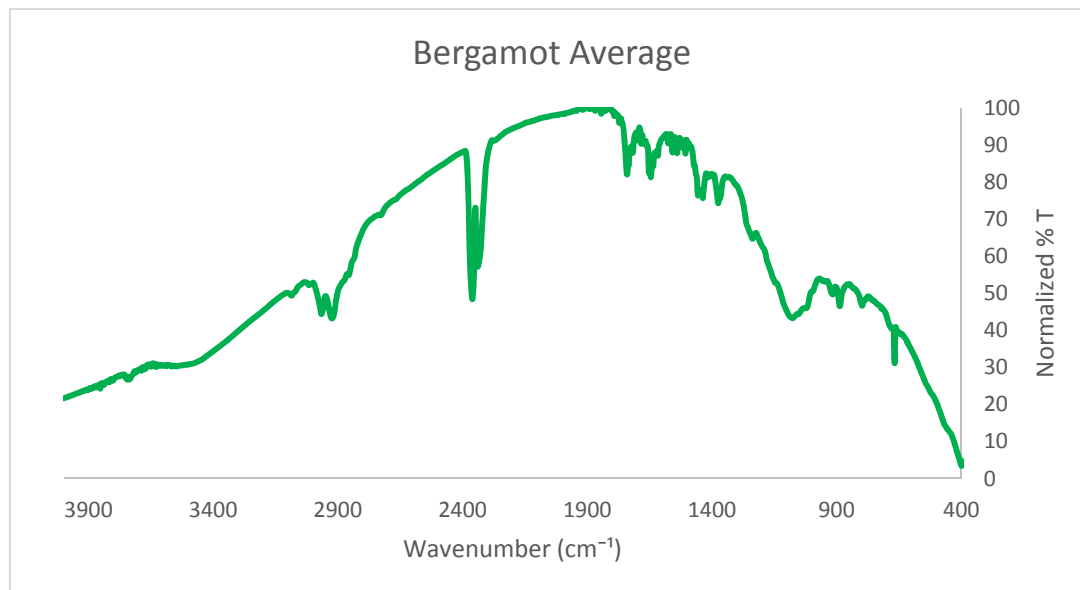


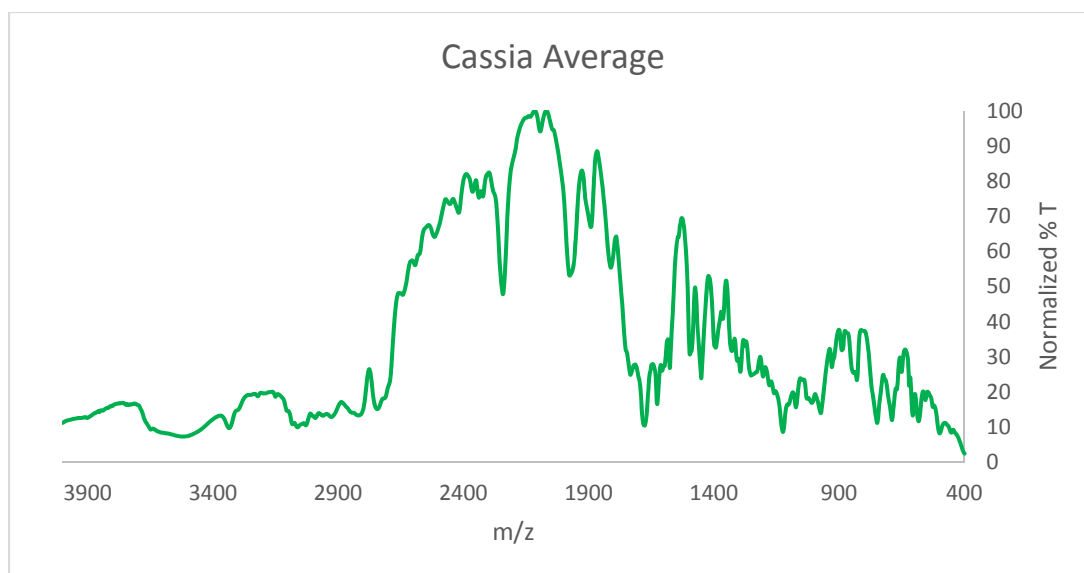
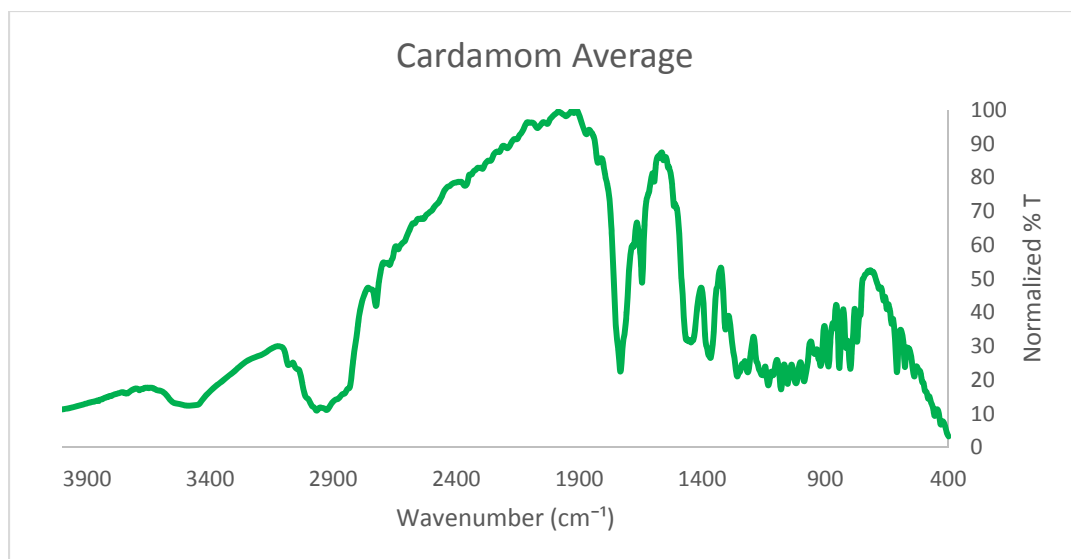
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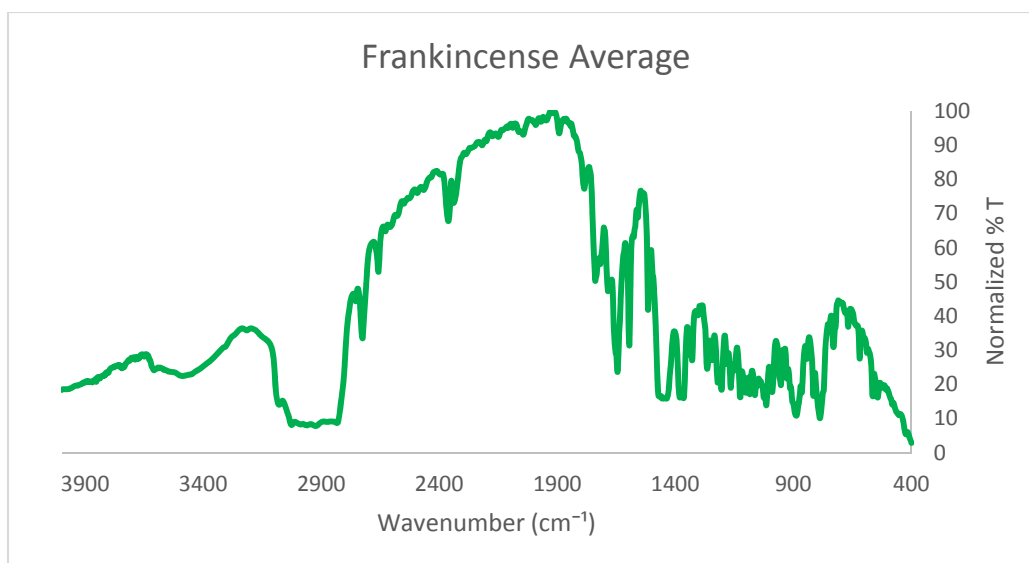
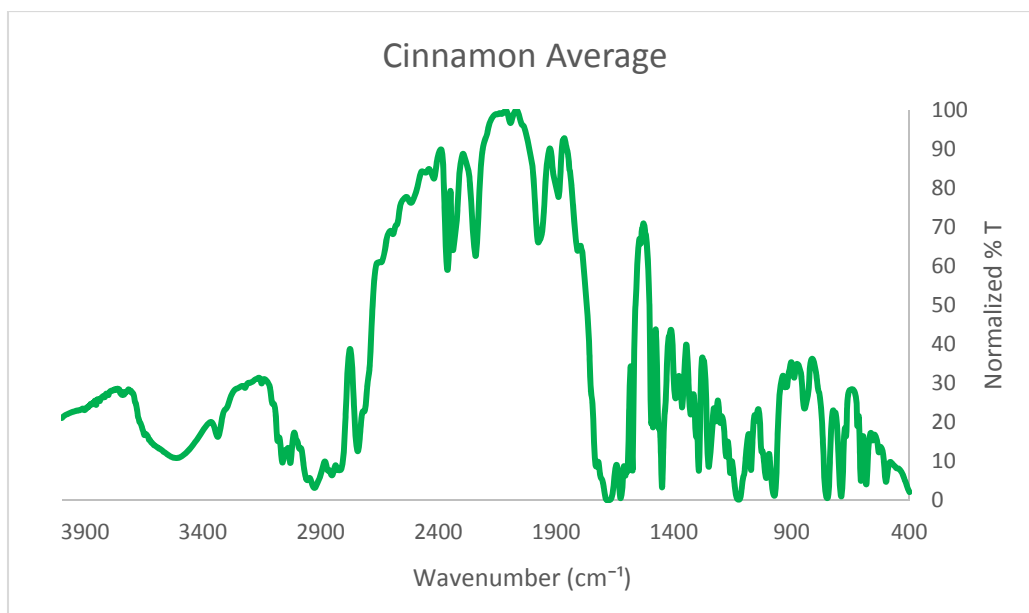


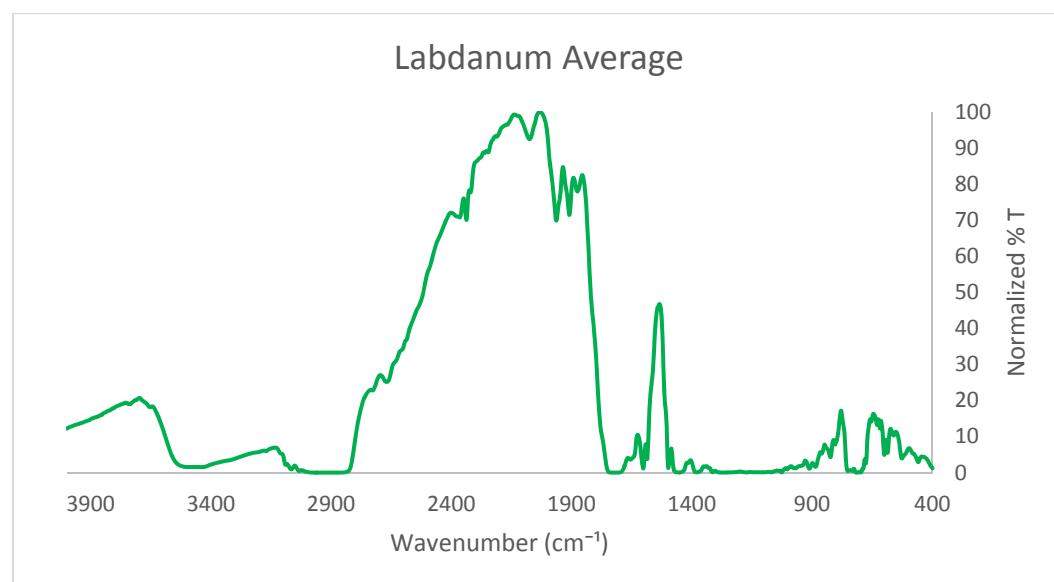
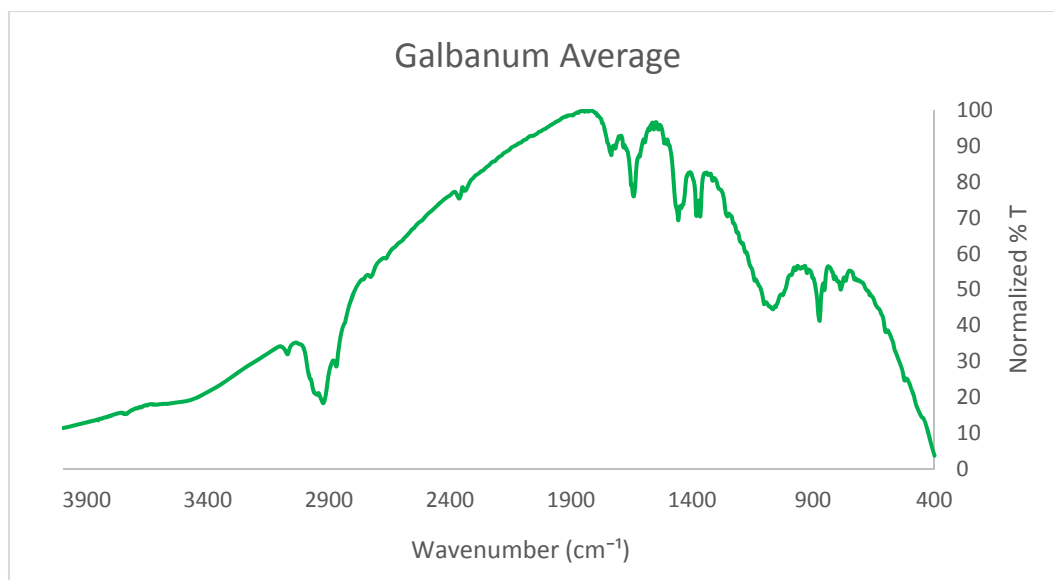
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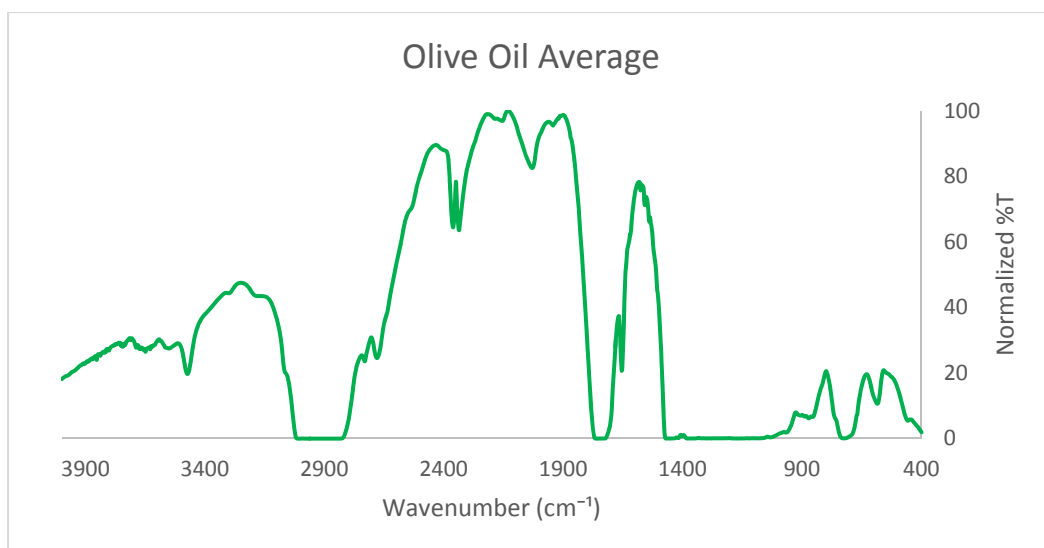
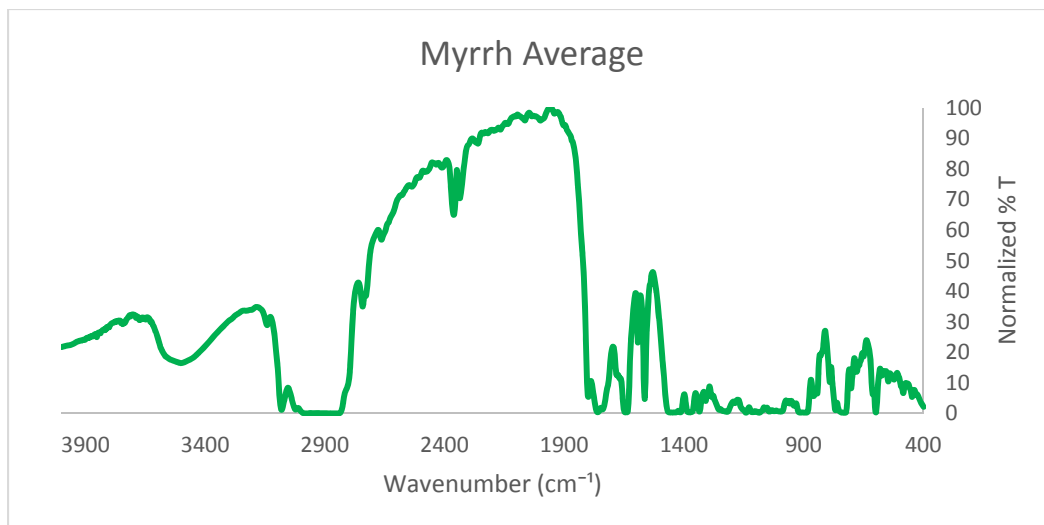


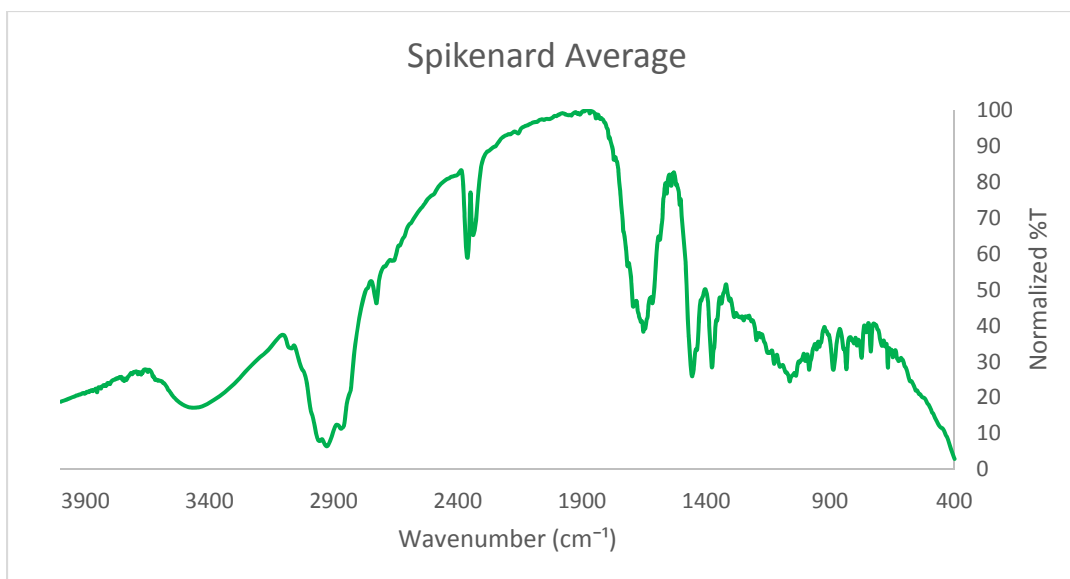
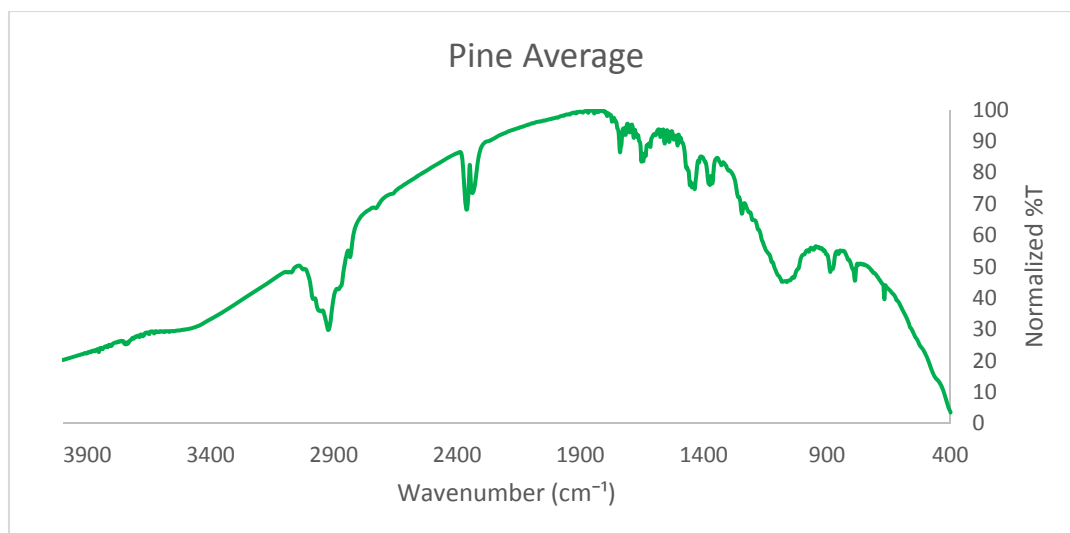
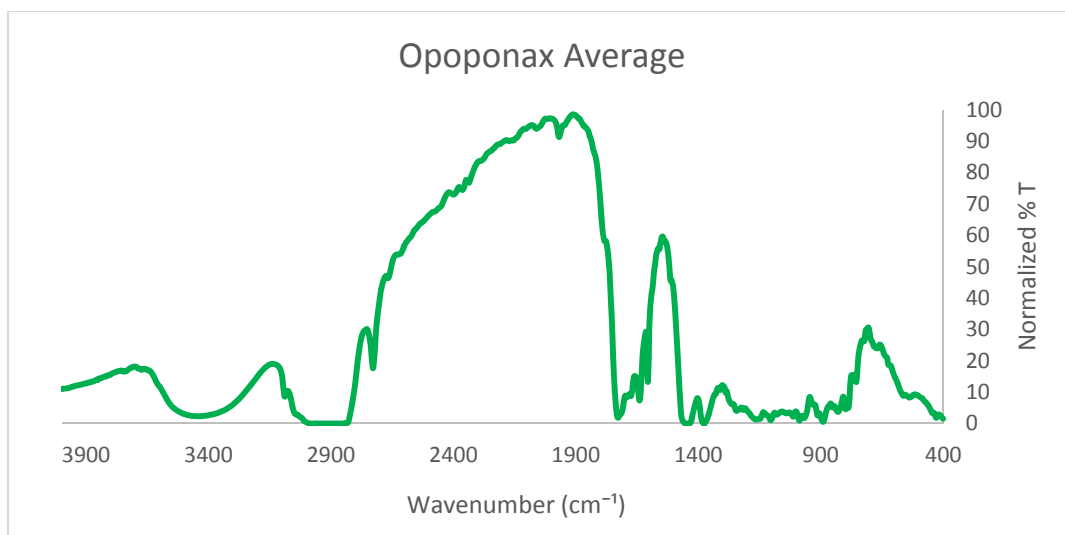
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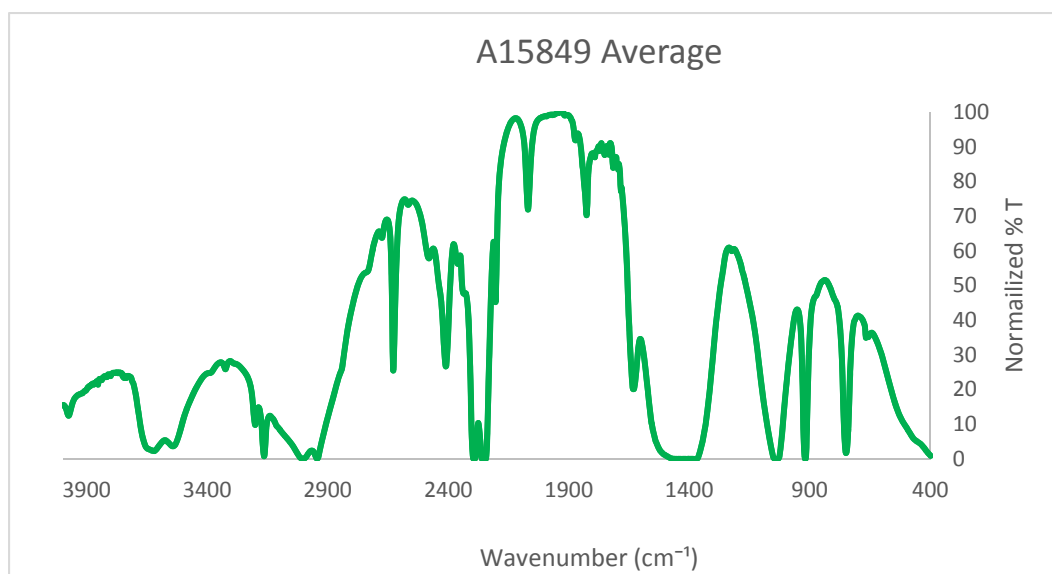
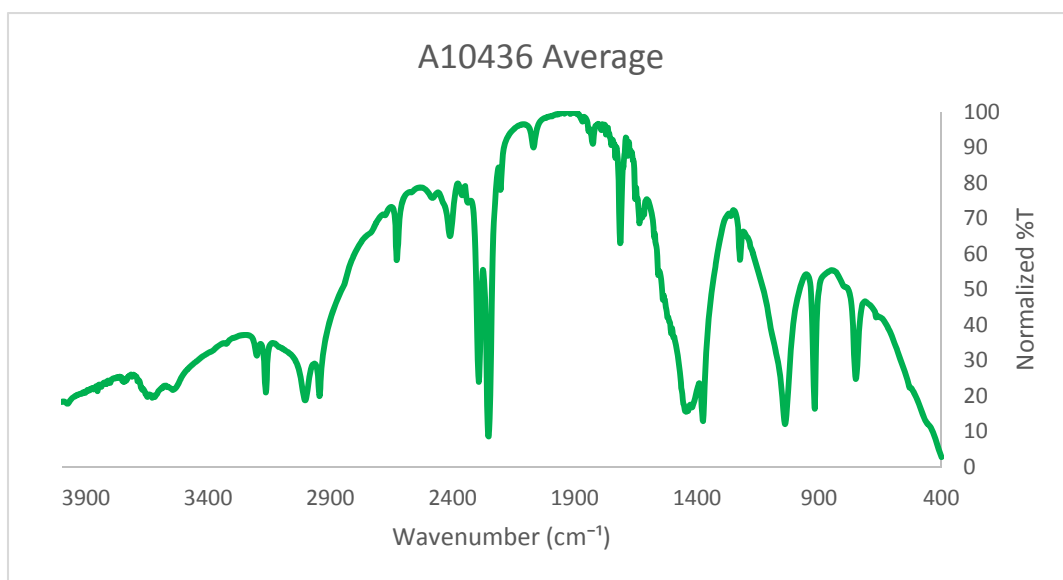


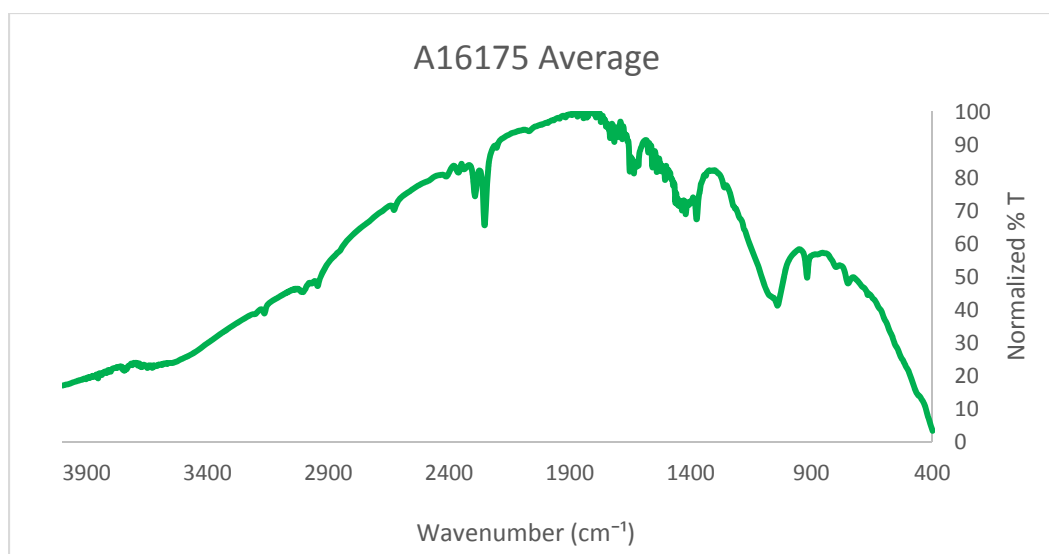
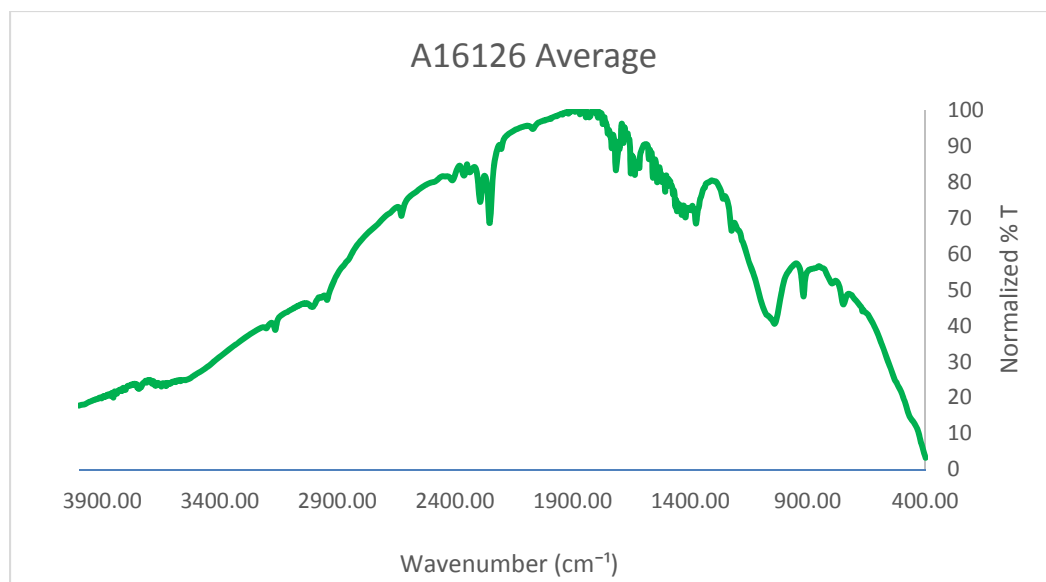


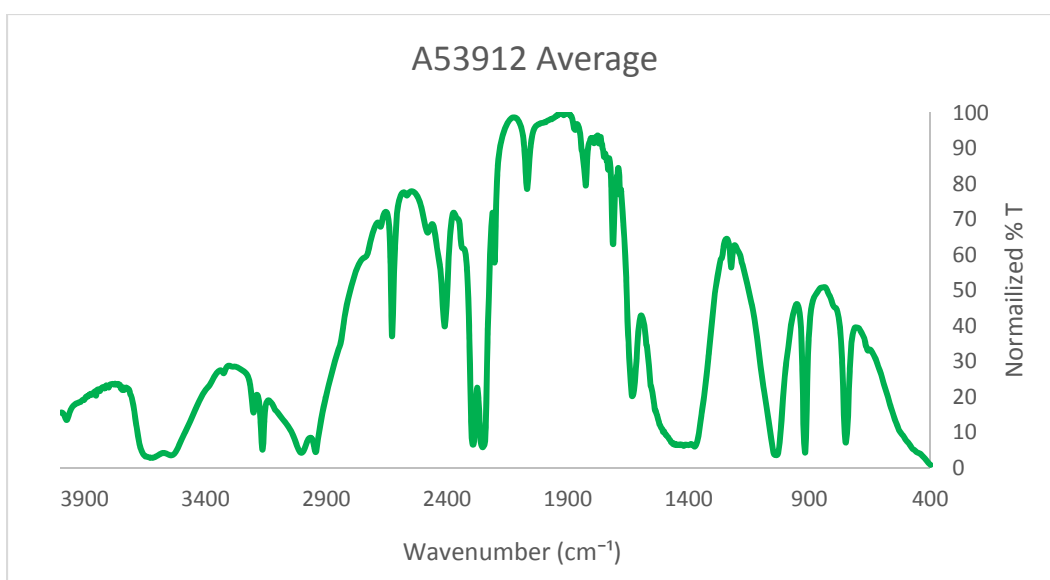
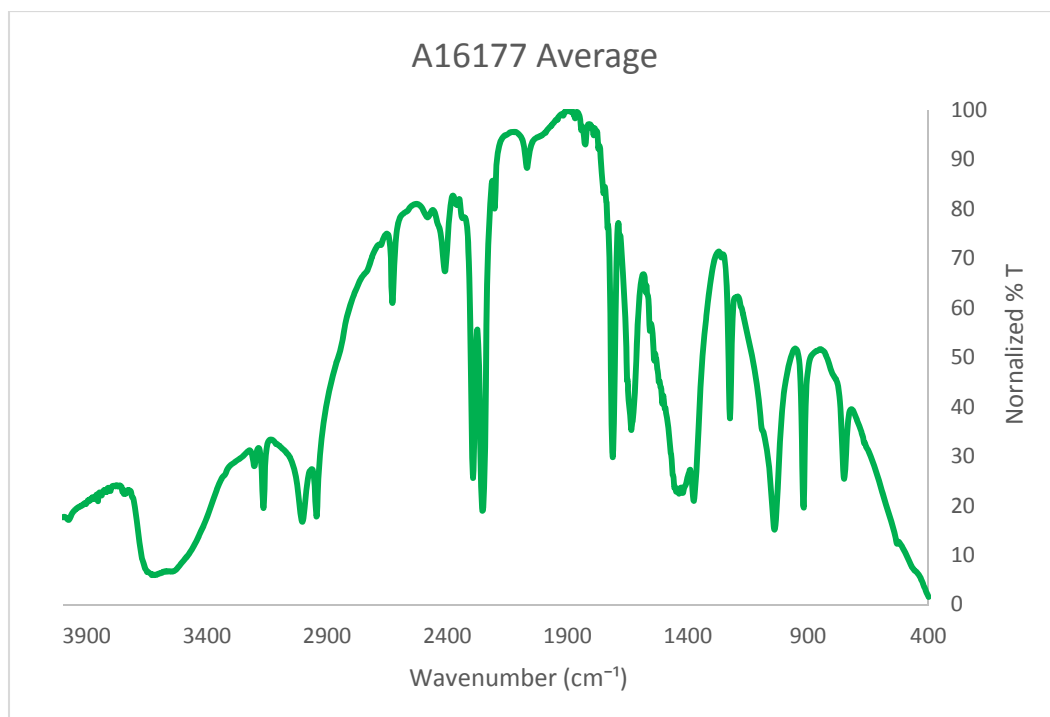


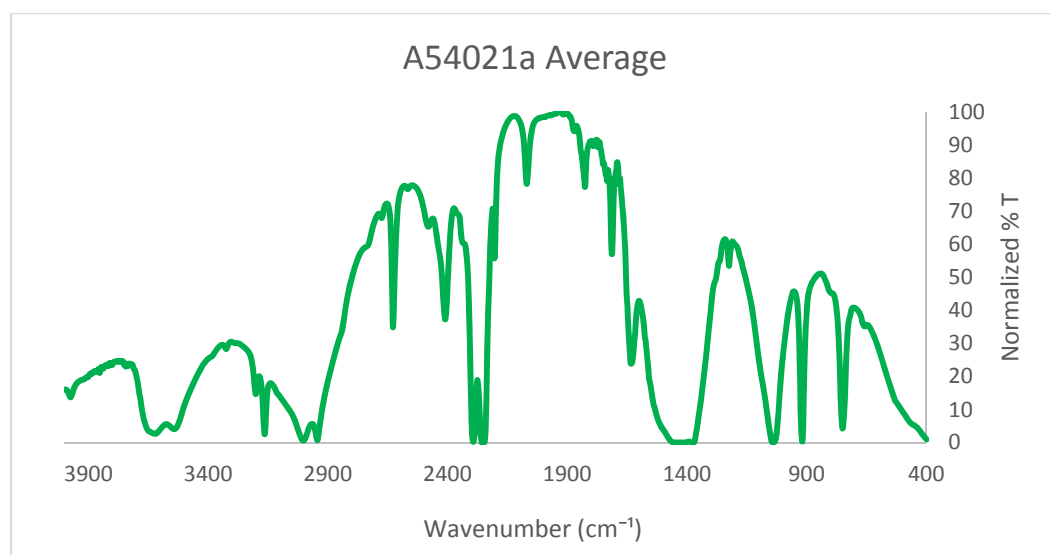
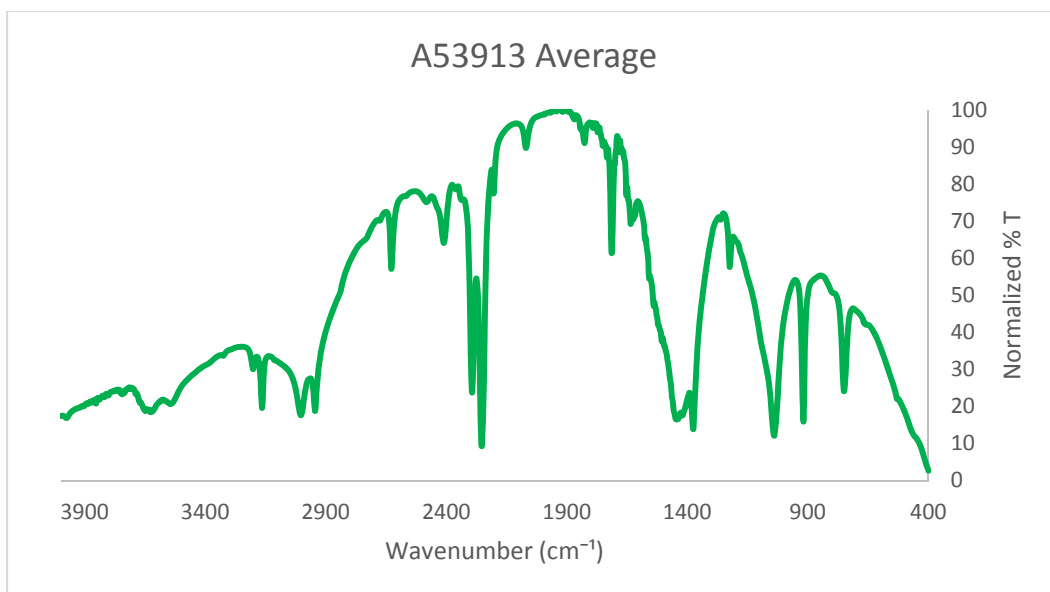


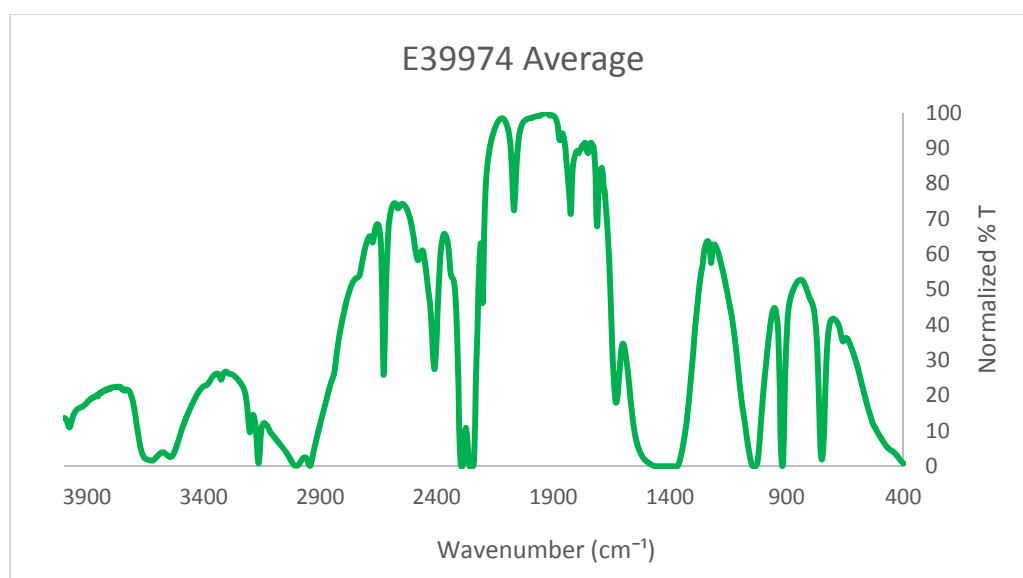
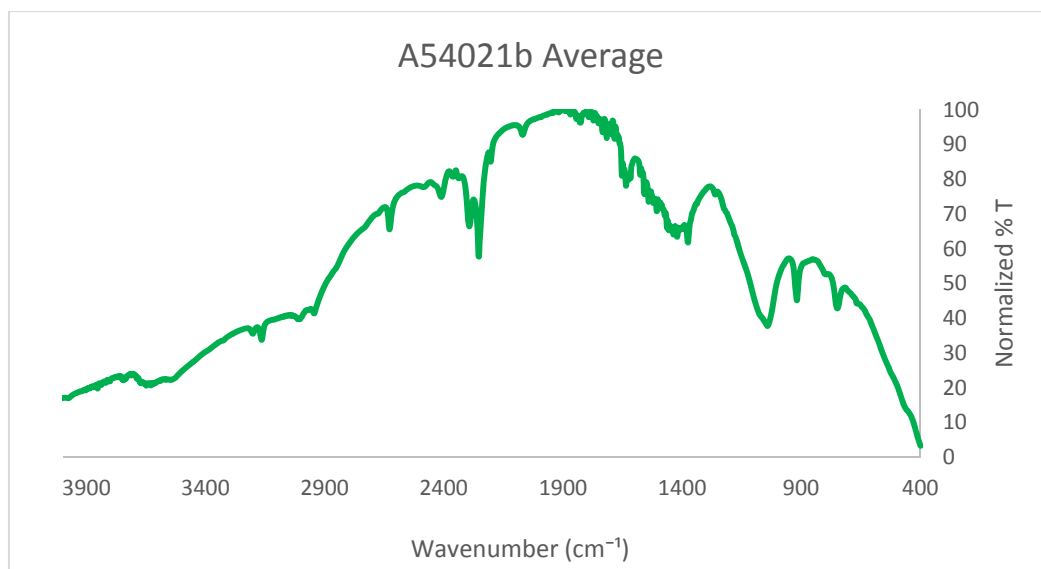


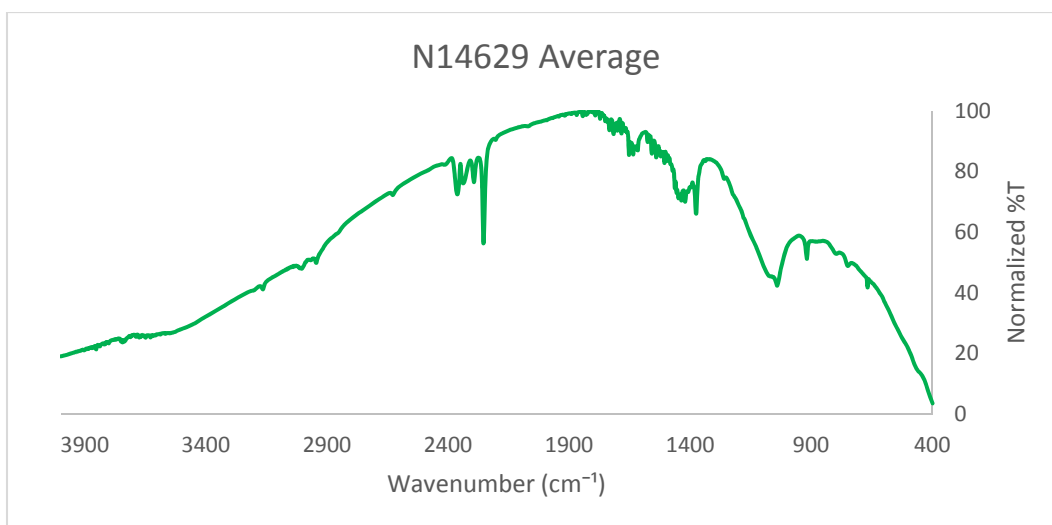
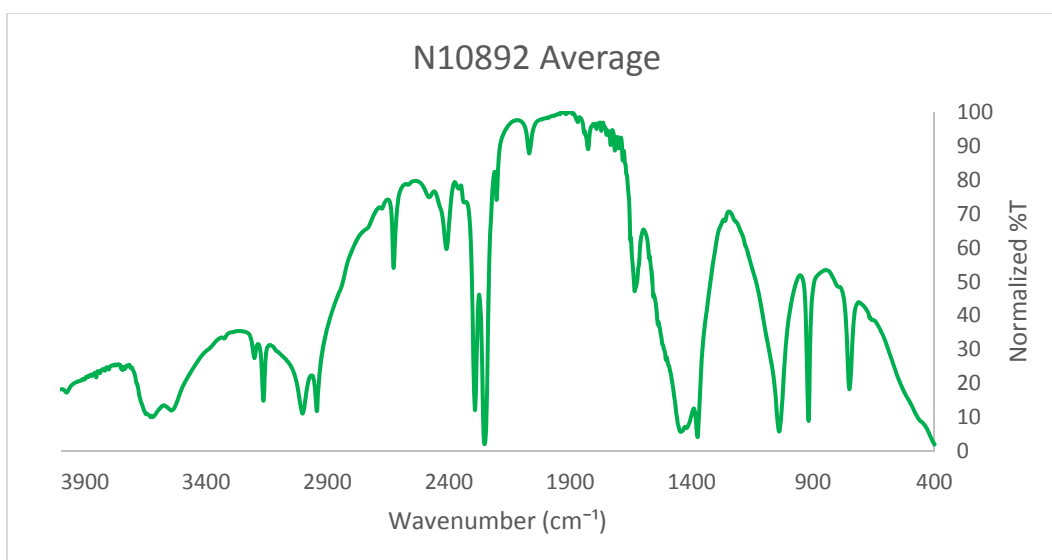
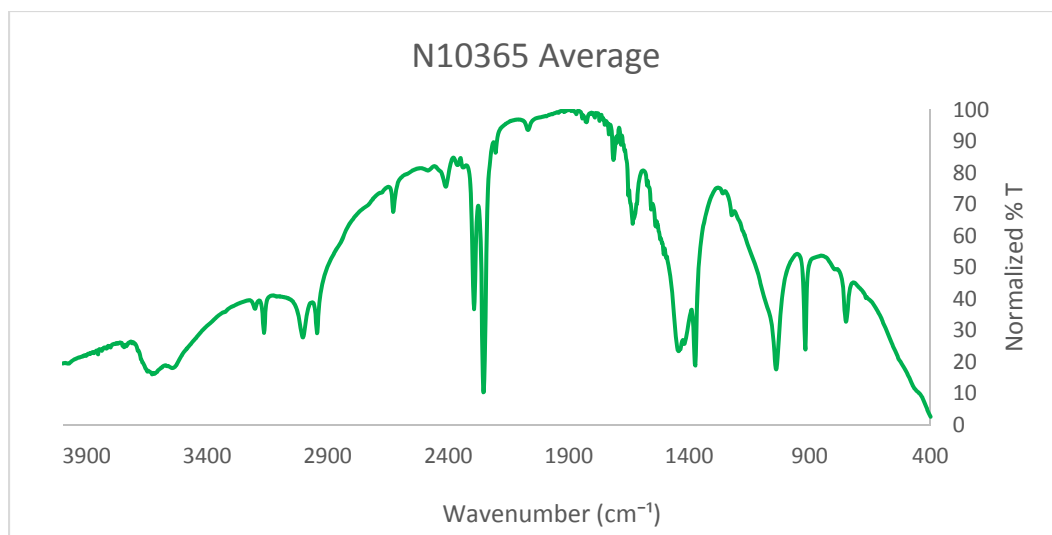
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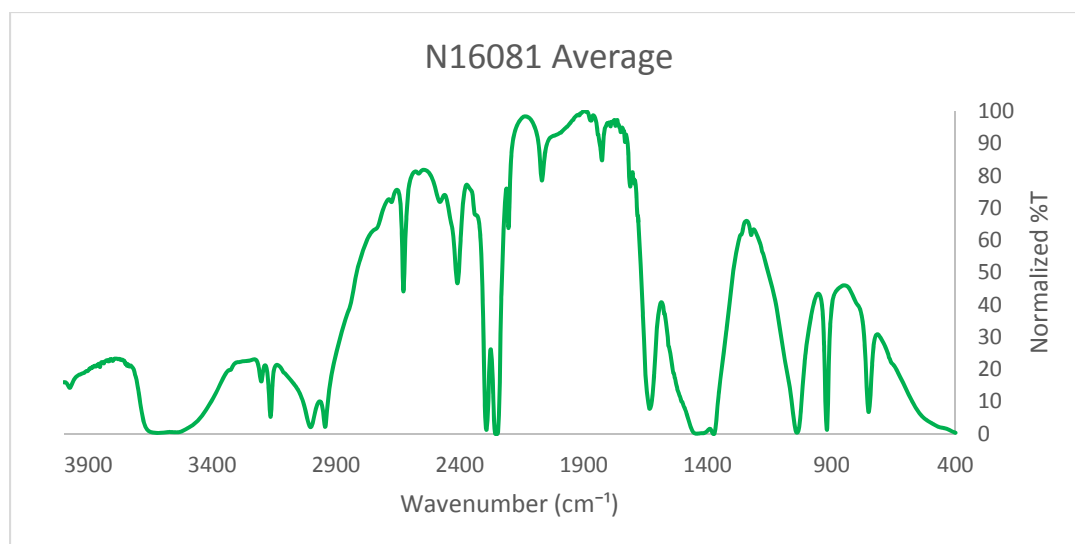
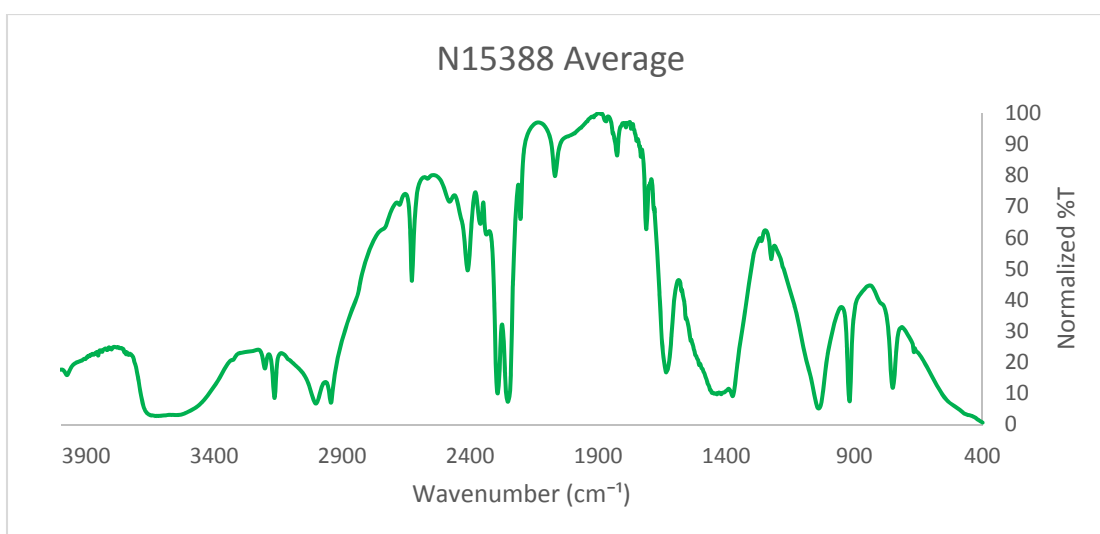
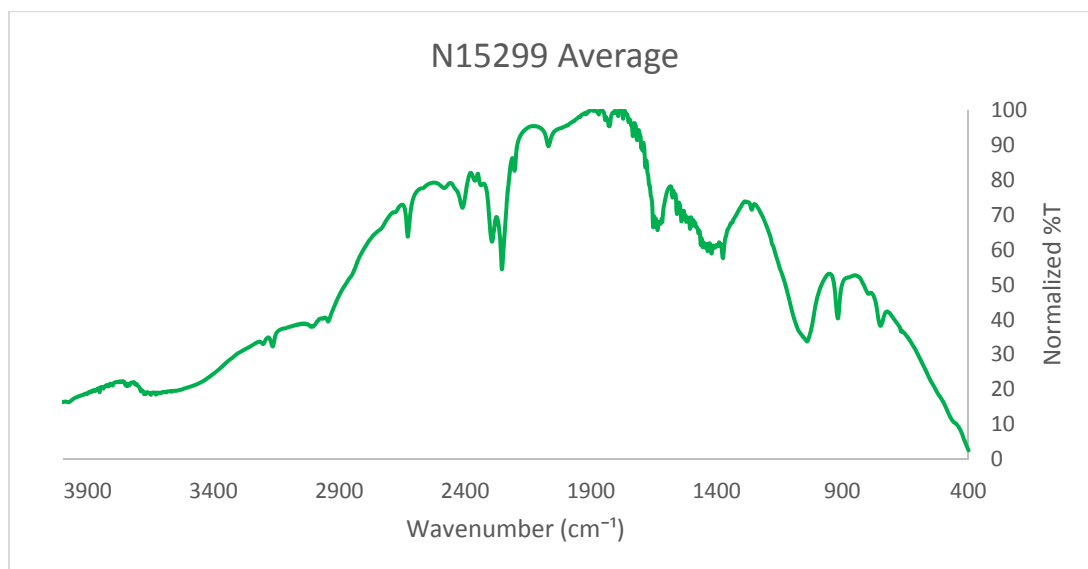


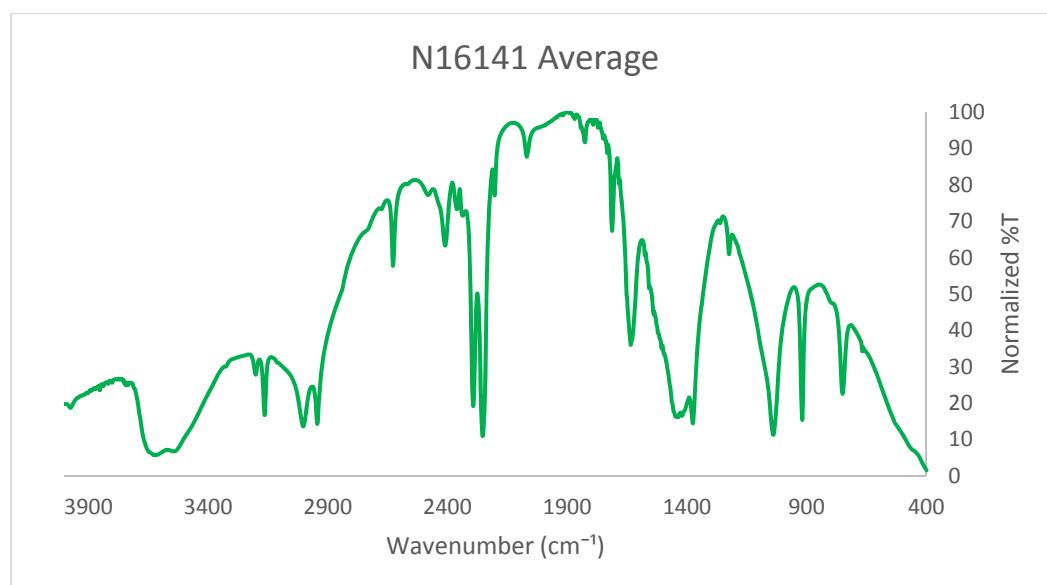
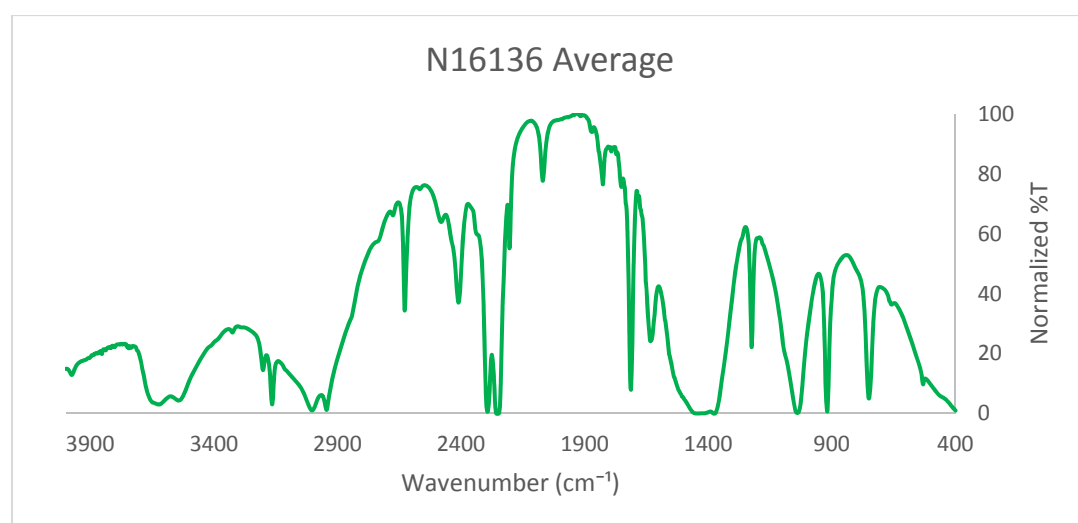
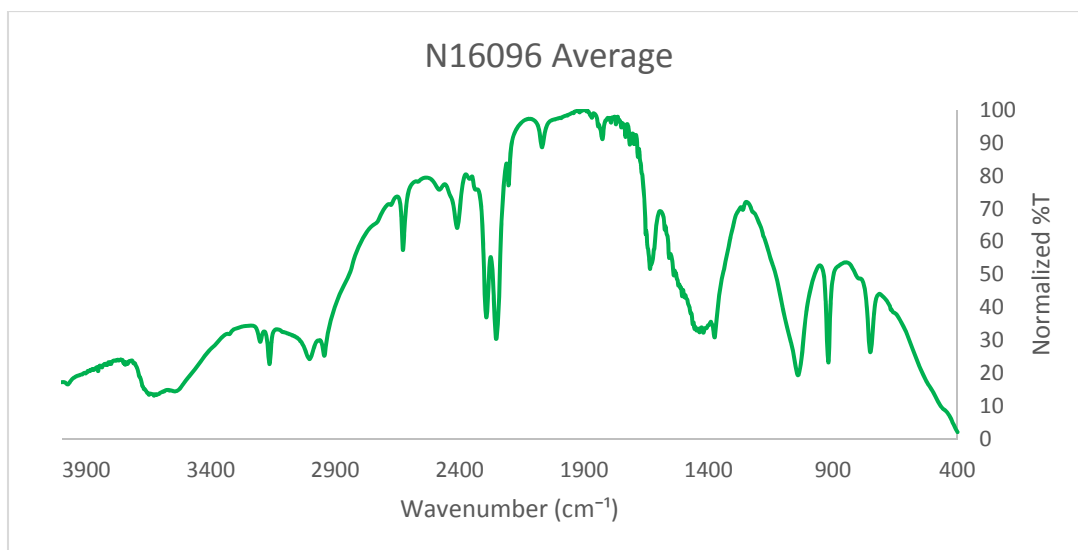


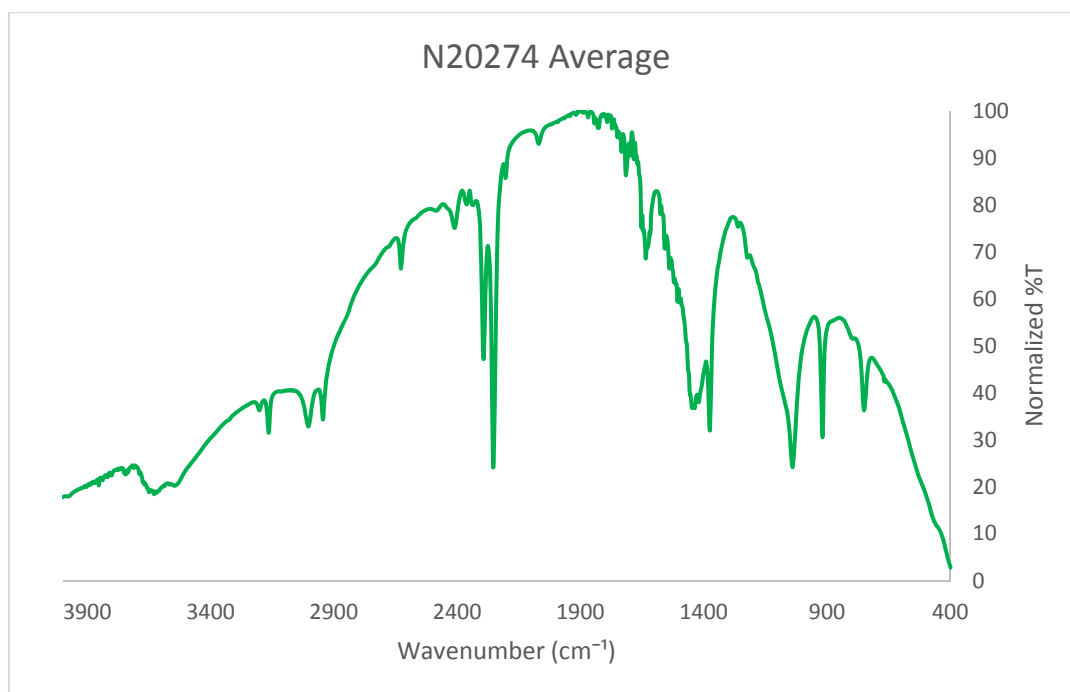
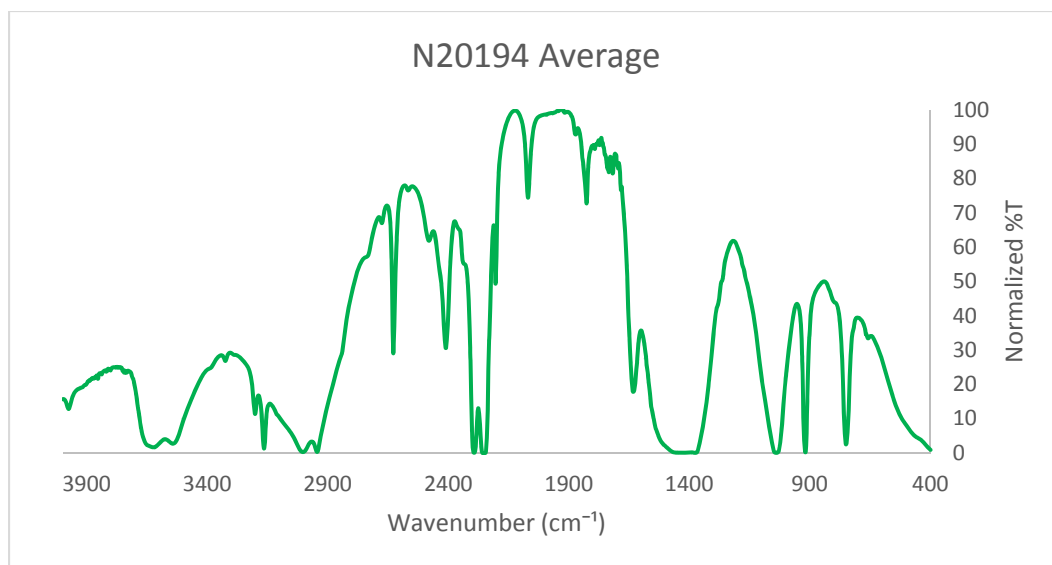


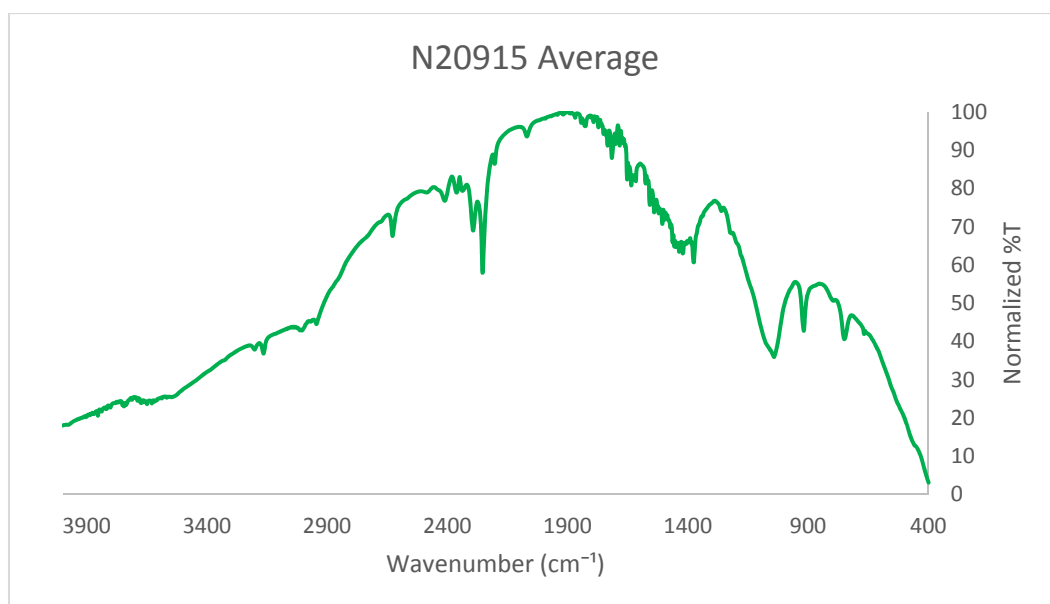
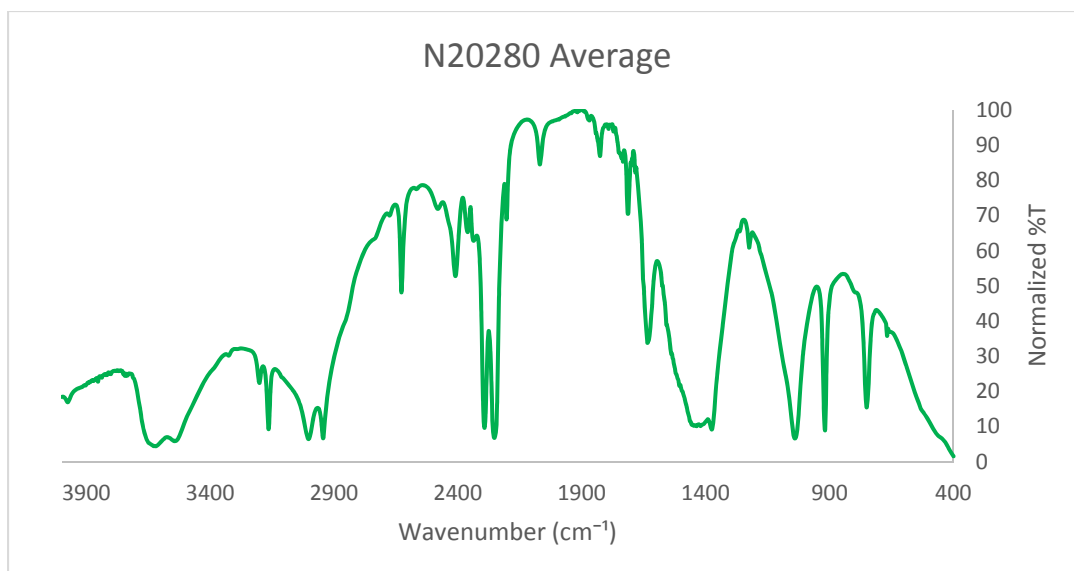


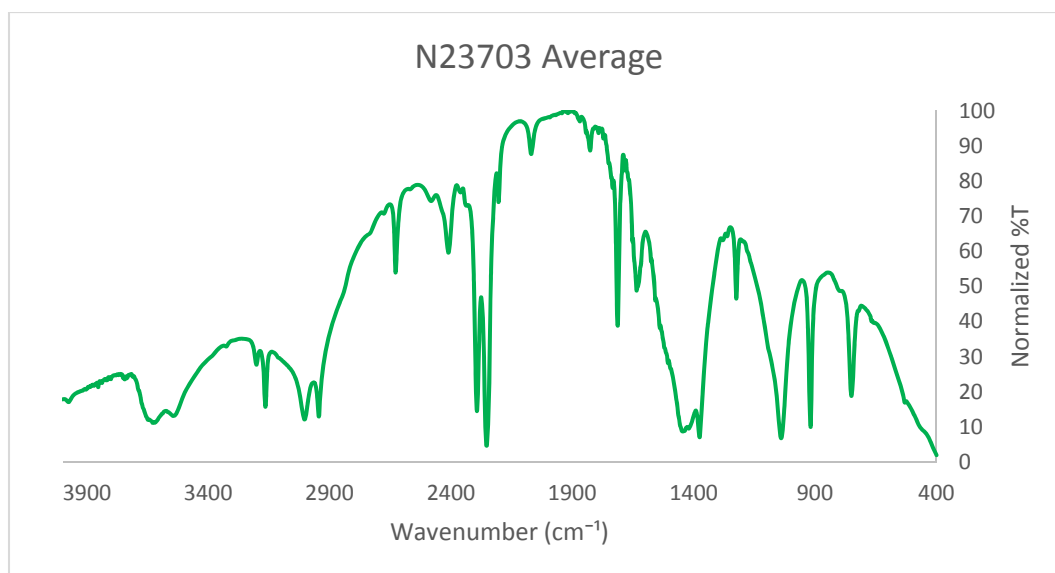
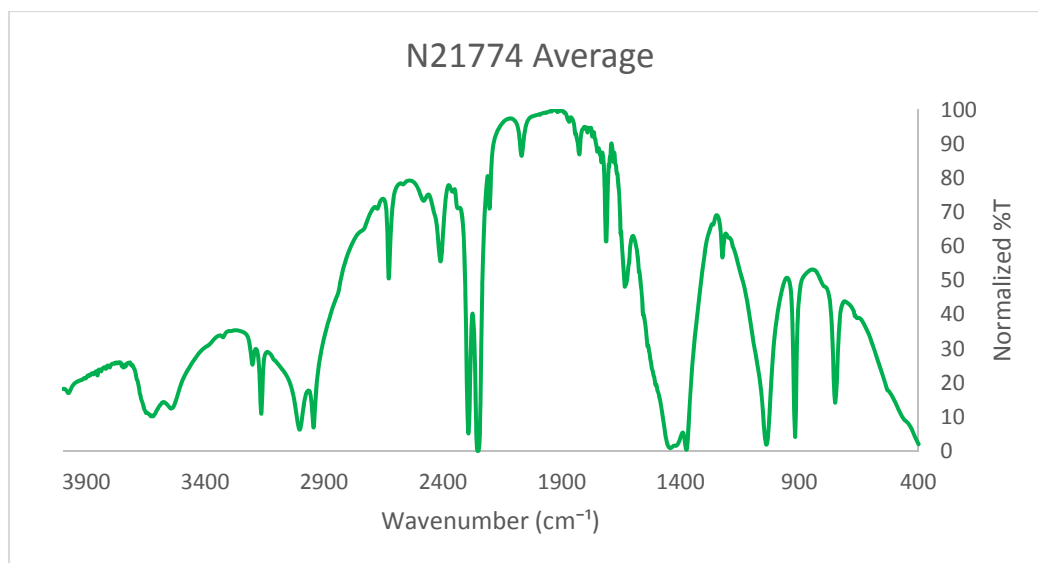












## APPENDIX D: ICP-MS SPECTRA

**Note:** In order to show detail below intensities of 10,000 counts, a semi-logarithmic scale has been used in order to show clearer details of counts throughout the mass-to-charge ranges of 50-238.

