Eau de Cleopatra
Mendesian Perfume and Tell Timai

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Sir Lawrence Alma-Tadema, *The Meeting of Antony and Cleopatra*. Photograph in the public domain.

Cleopatra VII, the last of the Ptolemaic rulers of Egypt, reveled in perfume (Plutarch, Life of Marcus Antonius *26.2). She even used it in her seduction of the Roman general Marc Antony. Sailing up the river Cydnus to meet him, she reclined in a canopy spangled with gold, adorned like Venus in a painting. Boys dressed as cupids fanned her and wondrous scents from incense offerings wafted along the riverbanks. Not long after her death in August 30 BCE, a book circulated under her name called* Cleopatra's Cosmetic, *full of recipes for fragrant oils and cleansers (Totelin 2017: 114–18).*

Cleopatra's fondness for perfumes was part of Egypt's long tradition of fragrant remedies and exquisite scents, going back to the beginning of dynastic history (ca. 3100 BCE). Egyptian fragrances were famous throughout the ancient world. The base for perfumes and unguents was vegetable oil or animal fat rather than our modern alcohol. Scents were created through smoke from burning fragrant resins, barks, and herbs ("perfume" derives from *per fumum* "through smoke"), or through maceration by steeping resins, flowers, herbs, spices, and wood. These have antifungal and antibacterial properties and could eliminate body odor and produce soft and fragrant skin. One of the world's first perfume recipes records the instructions for a fragrance called *kꜣp.t* in Egyptian, rendered in Greek as *kyphi.* The earliest mention of *kyphi* goes back to the building of the pyramids. Its preparation is recorded in pEbers 852; Edfu II, 203–204; Edfu II, 211–212; Philae III, 48a–c (fig. 1). The earliest *kyphi* recipe (pEbers 852) contains resins, berries, and roots, which were ground, made into a mixture, and burnt. The burning of the exudation of this perfume mixture purified and scented the air in one's home, and cleaned and perfumed clothing; it was even used as chewing gum.

> *Kyphi* to make the smell of the house and clothing pleasant: dry myrrh, juniper berries, incense [*sntr*], wood of camphor, *Pistacia* resin, reed of Djahy (Canaan) (sweet flag), ? (unknown), ? (unknown), and styrax are ground (until) smooth, made into a mixture, some of it is placed on top of fire. (pEbers 852, trans. Goldsmith)

The Egyptians recorded the recipes of perfumes in hieroglyphic texts, but their precise ingredients and process of preparation remain a mystery. Strict rules and regulations in the temple precincts governed the manufacturing of fragrant offerings.

Figure 1. The Room of Perfume in the Ptolemaic Temple of Edfu. Photograph by Jay Silverstein.

Figure 2. The Nile Delta showing the location of Thmouis and Mendes and the nomes of Lower Egypt. Map by Jay Silverstein.

I am coming toward you Isis the great, mother of the god, mistress of Dendera [*ỉʿtdi*]. I am bringing you the mistress of Punt carrying vessels of (aromatic) oil [*md.t*] filled with camphor [*ti-šps*] for your *ka*, cooked by Shesmu, put in order by the Ibis, produced in accordance with all the instructions, provided with his divine discharge and resins of Punt, mixed by Horus, lord of the laboratory. The drops inside them form a union with your hair. The scent becomes one with your body. (Dendera IV, 130, 11–15, trans. Goldsmith)

The ingredients of the seven or ten sacred oils of ancient Egyptian perfumery remain uncertain. The names of these oils, used in funerary rites to embalm the dead and in temple rituals to anoint the divine image, are attested from the Old Kingdom

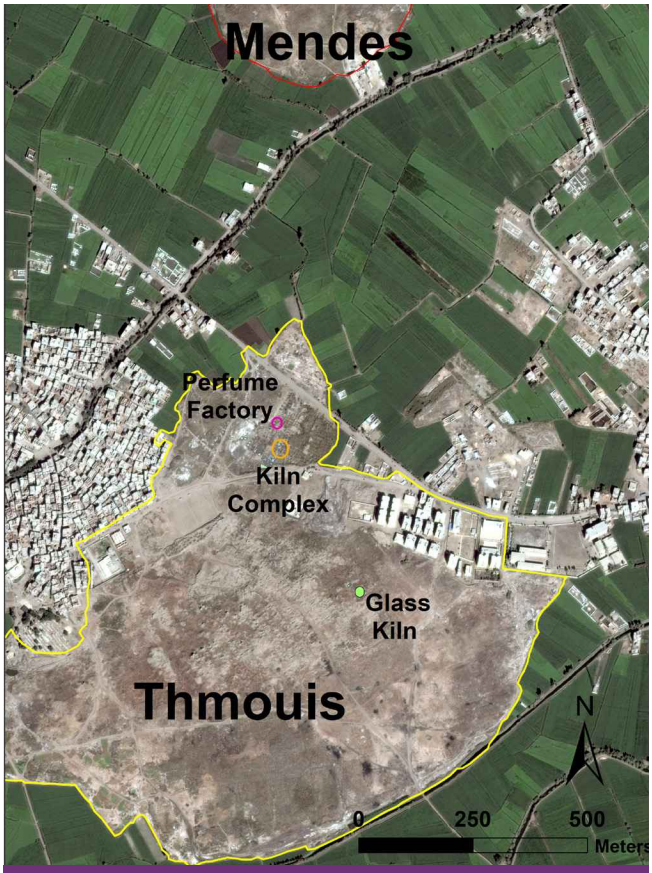

Figure 3. Map of Mendes area. Map by Jay Silverstein.

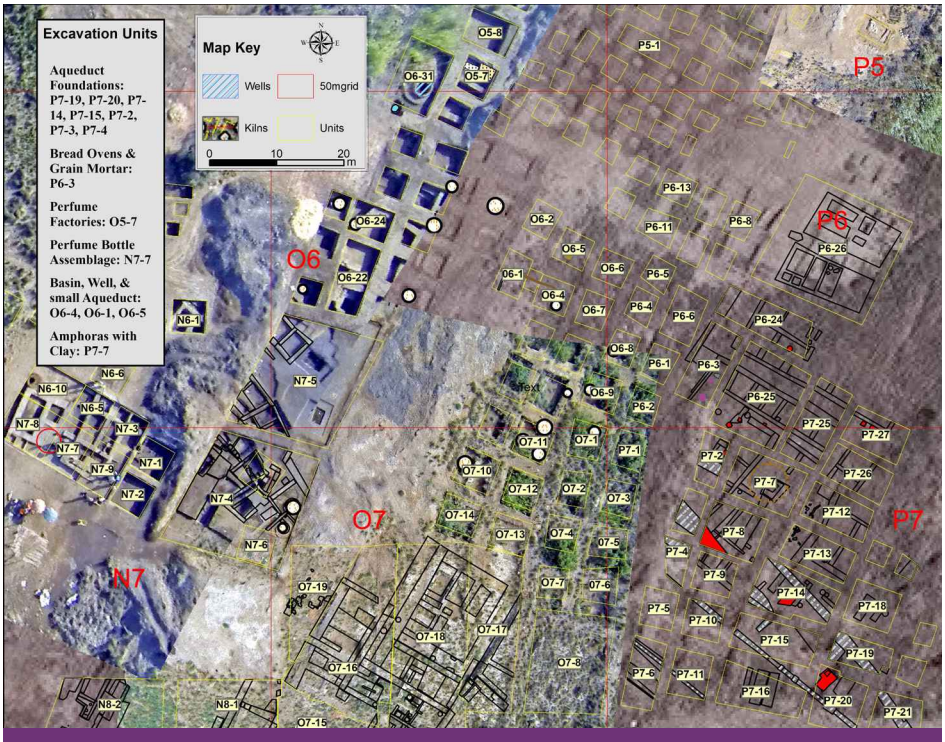

Figure 4. Map of North Area and kilns. Map by Jay Silverstein.

until the Ptolemaic period, but most are known only by their names. With the Greek conquest of Egypt in the fourth century BCE and the rise of the Roman Empire in the first century BCE, the Egyptian tradition of perfume-making made its way into the Greek and Latin written record. However, the perfume recipes described by classical authors represent a Greek or Roman perception of ancient Egyptian perfumery and are not necessarily identical to ancient Egyptian recipes.

In the Ptolemaic period, Mendes, a city in the Nile Delta, was a major center of the perfume trade. Pliny the Elder (23–79 CE), who perished in the eruption of Mt. Vesuvius, and the physician Dioscorides (ca. 40–90 CE) discuss Egyptian perfumes. They say the finest, the "Chanel No. 5" of Greco-Roman Egypt, the Mendesian, took its name from the city where it was made. Produced at Mendes/Thmouis (Tell Timai), the capital of the XVI Lower Egypt Nome, the Mendesian was for over five centuries the most well-known and popular fragrance in the ancient world (Pliny, *Natural History* 13.2.5; Dioscorides, *On Medical Materials* 1.59.1–3; Galen, *On Compound Drugs according to Place* 2.2, 12.570 K.; Athenaeus, *The Deipnosophists* 15.38; Aetius of Amida, *Medical Books* 1.126; Paul of Aegina 7.20.31; cf. Theophrastus, *On Scents* 4.29–30). Pliny records that this fragrance shifted the world's olfactory focus: "In ancient times the most highly praised perfumes came from the island of Delos, but later they came from Mendes" (*laudatissimum fuit antiquitus in Delo insula, postea Mendesium*, *Natural History* 13.2.4).

But what made the Mendesian the "Chanel No. 5" of late antiquity? The efforts of the excavations at Tell Timai in Egypt by archaeologists Robert Littman and Jay Silverstein, and experimental archaeology in Berlin by Egyptologist Dora Goldsmith and historian of Greco-Roman philosophy and science Sean Coughlin may reveal the answer.

Archaeological Discoveries at Tell Timai

In 2009, Littman and Silverstein of the University of Hawai'i began excavating the ancient city of Thmouis (Tell Timai) (fig. 2). Thmouis (Θμοῦις) is the Greek rendering of the Egyptian  *t3 m3wi*, "New Land." Thmouis is the southern extension of Mendes, a city settled since at least the fourth millennium BCE that once was the capital of Egypt (Redford 2010). In the fifth century BCE the Greek traveler and father of history, Herodotus (*Histories* 2.166) visited Thmouis. During the Ptolemaic period, Thmouis usurped authority from Mendes as the seat of the nomarchy. Mendes continued as a religious center but declined in influence throughout the Greco-Roman period (Blouin 2014;

Figure 5. Timai kiln workshop. Photograph by Jay Silverstein.

Figure 6. Red-Figure sherd. Magazine Tell el Ruba. Photograph by Robert Littman.

Littman and Silverstein 2017). Today, the ancient name is preserved in the modern town, Timai El Amdid, adjacent to the tell. Thmouis once ranked among the most important cities in Egypt (Ammianus Marcellinus, *Roman History* 22.16), renowned throughout the ancient world for one product, a perfume called the Mendesian (de Rodrigo 2000). Its central location in the Nile Delta made it an emporium where exotic spices flowed from India, Arabia, and Africa fueling the perfume industry. Ships sailed from Thmouis to Alexandria and across the Mediterranean carrying this most valuable fragrance.

The northern portion of Tell Timai was leveled in the early twentieth century by *sebakheen*, people who mined mudbrick to extract nitrates (Holz et al., 1980; fig. 3). The *sebakheen* exposed a horizon dating from the third to mid-first century BCE, spanning the entirety of Ptolemaic control of Egypt. Archaeology is exposing how Thmouis fit into the history of the perfume industry of the ancient world.

A Hellenistic kiln complex associated with the manufacture of perfume bottles dominated the northeastern portion of the tell (Grid O7; fig. 4). Approximately 20 kilns and ancillary structures (wells, aqueducts, basins, and ovens) were identified

Figure 7. Late period assemblage. Magazine Tell El Ruba. Photograph by Nicholas Hudson.

in open salvage excavations conducted by Egyptian authorities. Additional kilns in undocumented areas between the observed kilns likely existed. The kilns consisted of circular mud-brick structures where the interior of the single-brick walls were heat-stressed; slag and charcoal were common inside the kilns and surrounding areas. Interior diameters ranged from 1.3 to 1.7 m (fig. 5). One imported Attic Red Figure sherd was found associated with the kilns (fig. 6). Assemblages of Late period vessels date the earliest use of the area to at least to the fourth century BCE (Hudson 2014a, 2014b, 2016). The use of these kilns terminated with a destruction and leveling event that uniformly truncated the kilns in the early second century BCE, preserving approximately 65 cm of depth of the kiln-use strata (Littman and Silverstein 2017). Because of *sebakheen* activity, it is unknown what was on top of the kilns, although there are intrusive walls, Roman wells, and other Roman foundation architecture. Derelict and repurposed kilns suggest continuous use of the area until the leveling event in the first quarter of the second century BCE.

Perfume bottles (*lekythoi)* were one of the main products. A ceramic assemblage including four *lekythoi* and a decanter were found in a fourth- to third-century BCE building context (Grid N6/7) west of the kiln complex (fig. 7; Hudson 2016). Nicholas Hudson (2014b: 243) calculated approximately 40 percent of the 75 diagnostic ceramics from the lower kiln level represented "personal use" wares such as perfume bottles, compared to 3 percent of the assemblage representing cooking vessels. This supports production rather than residential context. Hudson notes the assemblage was dominated by small squat vessels, resembling Athenian squat *lekythoi* and other Egyptian and Levantine

Figure 8. Fusiform bottle. Photograph by Jay Silverstein.

Figure 9. Perfume factory. Photograph by Jay Silverstein.

forms, which he labeled Thmuisian bottles. Form and volumetric analysis of the vessels indicates they were likely used for unguents (Hudson, Gentelli, and Trampier 2018: 5, fig. 2). Extrapolating from two letters from the third century BCE Zenon archive, he suggests that units of measure of perfume included *hin* (ca. 0.46 L) and *kotyle* (ca. 0.27 L). The *alabastra* containers used to carry the perfume were defined as ½ *hin*, or approximately one *kotyle,* suggesting a range of standard measures for perfume as a unit between 0.22 and 0.27 L. The volume of the squat jars from the kiln complex ranged from 0.21 to 0.24 L, consistent with the references in the Zenon archive.

Two distinct categories of Thmuisian bottles from the kiln complex were present, one made from clay consistent with the local Nile silt like other local wares; the other consisted of Thmuisian-style bottles made from burnished fine marl clays dissimilar to the silts of the Delta. One fine ware vessel base exhibited signs of misfiring (warping and cracking), suggesting local production rather than importation (Hudson, Gentelli, and Trampier 2018: 3–4). The fine bottles represented a small fraction (four sherds) of the eight metric tons of analyzed ceramics with sherds recovered from a late fourth-century BCE context. Hudson concluded that these fine bottles were produced only briefly in limited quality.

East of the kilns, the lower strata of an area traversed by later Roman aqueducts, evidenced by red brick foundations aligning northwest to southeast, revealed a Hellenistic residential neighborhood. Below a floor in Unit P7-7, two imported amphoras, likely from Cnidus, were found (Hudson, Gentelli, and Trampier 2018). The tops of the amphoras were broken off, apparently during leveling for construction of the Hellenistic floor that overlay the amphoras. Within the amphoras was a yellow marl clay (Munsell 2.5YR 7/3). The best-preserved amphora held about two kilograms of the marl clay. The clay itself included white chalky lumps suggesting that it was raw unprocessed clay (Hudson, Gentelli, and Trampier 2018:6). This clay appeared to match the paste of the fine bottles recovered from the kilns to the west in Grid O7. The pair of amphoras had the same late fourth-century temporal context as the fine ware sherds.

A sample of the clay, fragments of a Nile silt fabric bottle, and a sample of a fine bottle were analyzed by Laboratory of the Housing and Building National Research Center in Cairo. Preparation of samples followed the American Society for Testing and Materials standard C114 for quantitative analysis. X-ray fluorescence (XRF) analysis yielded a quantified chemical trace element fingerprint of the samples (Hudson, Gentelli, and Trampier 2018). The results provided major and minor oxide groups, chemicals known to serve as distinguishing markers for Egyptian ceramic materials (Temraz 2005; Redmount and Morgenstein. 1996). Discriminate and factor analysis identified two groups, one from the Nile silt ceramic and the other from the marl clay and the fine bottle samples. Comparison of trace elements of the samples to known clay sources in Egypt showed the Nile silt fabric to be

Figure 10. Perfume factory hoard. Magazine Tell El Ruba. Photograph by Jay Silverstein.

consistent with the clays of the Nile Delta. The second group was consistent with the geological samples analyzed by Mostafa Gouda M. A. Temraz (2005) from the Edfu-Esna region located 800 km south of Thmouis (Hudson, Gentelli, and Trampier 2018).

After the closing of the O7 kiln area in the first quarter of the second century BCE a data gap on manufacturing activities exists until the Roman period. In the well-preserved portions of the central tell, evidence of baths, a gymnasium, a theater, various temples, a church, a fort, and a nilometer attest to the development of Thmouis throughout the Greco-Roman period. During the Roman period the material of perfume bottles likely would have transitioned from clay to glass, but aside from one glass kiln (Gentelli and Medhat 2017) with associated evidence of Roman-style green fusiform perfume bottle manufacture (fig. 8), evidence of a later, large-scale bottle industry is yet to be discovered (cf. Anderson-Stojanović 1987). The perfume would not have been manufactured at the kiln complexes since perfume manufacture requires a different dedicated facility. There is one prospective perfume factory in the northern portion of the tell at Unit O5-7.

In another rescue excavation 30 m west of the kilns, a manufacturing area was discovered, apparently dedicated to liquids. It consisted of two rows of reused amphora bases and two vats or ovens with amphora neck piping or flues (fig. 9). This factory had been built on top of the leveling and destruction layer that ended the kiln area in the early second century BCE. In a deeper cut, at the level of the destruction layer, were remains of an older factory of the same design, destroyed and buried when the land was leveled for reconstruction. A few meters north of the manufacturing feature and within the same stratum (Unit O5-8), a pot filled with 71 silver tetradrachms and gold and silver jewelry allowed for the dating of the facility.

Abandonment of treasure hoards prompts the question of why such wealth would remain unclaimed while the site was occupied (fig. 10). The tetradrachms in the hoard ranged in date from 110 to 61 BCE and included coins minted by Ptolemy X and Ptolemy XII, providing a *terminus post quem* of ca. 60 BCE during the reign of Ptolemy XII Auletes.

This possible manufacturing area was in operation during the third century BCE, with a second incarnation running from ca. 175 to 55 BCE. Likely this was a location of fragrance manufacturing. Residue samples were taken from the exposed amphorae. Analysis of these organic compounds should provide insights into the nature of the ingredients. This will provide a unique body of data that can be compared to the ingredients of Mendesian perfume described in the literary sources.

The Mendesian in Greco-Roman Sources

Literary accounts of the Mendesian exist only in Greek and Latin writings. Greeks and Romans, however, considered the perfume emblematic of Egypt. What, then, is the relationship between the Mendesian of Greco-Roman sources and Egyptian perfumery? Did the Mendesian predate Ptolemaic Egypt, or was it an Egyptian-styled product manufactured by Greeks? A comparison of Greco-Roman records with Egyptian sources offers insights into the perfume's roots.

The earliest authors whose work is extant to mention the Mendesian lived during the mid-first century CE (table 1): Dioscorides describes a perfume called "Mendesian" (μενδήσιον) in *On Medical Materials*; and Pliny mentions a "Mendesian" (*mendesium*) in his *Natural History*. The Mendesian, however, may have entered the Greek world several centuries earlier. In his work *On Scents*, Theophrastus (fourth to third century BCE) mentions a perfume called "Megalium" (μεγαλεῖον) with ingredients nearly identical to the Mendesian. Galen of Pergamum (second century CE), moreover, reports that "Megalium" and a perfume called "Egyptian" (Αἰγύπτιον) were synonyms for "Mendesian" (Galen, *On Compound Drugs according to Place* 2.2, 12.570 K., see also Erotian, *Hippocratic Vocabulary* 96.7–9). Taken together, this evidence suggests the Mendesian or something like it was well-known by the fourth century BCE.

Greco-Roman sources (see table 1) consistently list four ingredients: oil of *balanos*, myrrh, cassia, and resin. Some also mention cinnamon (fig. 11):

> Theophrastus: "[They say] the Megalium is compounded of burnt resin and oil of *balanos*, mixed with cassia, cinnamon, and myrrh. This perfume and the Egyptian take a great deal of work since the mixture contains so many and such expensive ingredients. For the Megalium, the oil is even boiled for ten days and ten nights, and then the resin and other ingredients are thus added, since it is more receptive when it has been boiled down" (*On Scents* 4.29–30; trans. Coughlin).

> Piny the Elder: "[The first perfume to be prepared] was from bryony and oil of *balanos*…. Afterward it was the Mendesian, which combined oil of *balanos*, resin, and myrrh" (*Natural History* 13.2.8; trans. Coughlin).

> Dioscorides: "The perfume called Mendesian is prepared from oil of *balanos*, myrrh, cassia, and resin. Some people throw in

Table 1. Synopsis of the Mendesian in Greco-Roman Sources.

Mendesian Ingredients	Theophrastus (4th to 3rd c. BCE, as Megalium, μύρον Μεγαλεῖον)	Dioscorides (1st c. CE)	Pliny (1st c. CE)	Erotian (1st c. CE)	Crito of Heraclea (1st c. CE)	Galen (2nd c. CE)	Athenaeus of Naucratis (2nd c. CE)	Aetius of Amida (5th/6th c. CE)	Paul of Aegina (7th cc CE)
Oil	balanos oil (ἔλαιον βαλάνινον)	balanos oil (ἔλαιον βαλάνινον)	balanos oil (oleum balaninum)	Reports a synonym: the Egyptian perfume (μύρον Αἰγύπτιον)	Included a recipe in his work on Cosmetics.	Unspecified aromatics (ἀρώματα) and lily (κρίνον). Reports synonyms: White Egyptian Perfume (μύρον Αἰγύπτιον λευκόν); Lily Perfume (κρινόμυρον); Susinum (σούσινον μύρον); Megalium (Μεγαλεῖον); Egyptian (Αἰγύπτιον)	Mentioned but lists no ingredients.	perfume-nut oil (ἔλαιον μυροβαλάνινον)	balanos oil (ἔλαιον βαλάνινον)
Aromatics	myrrh (σμύρνα) cassia (κασία) cinnamon (κινάμωμον)	myrrh (σμύρνα) cassia (κασία) cinnamon κινάμωμον (optional)	myrrh (murra)					myrrh (σμύρνα) cassia (κασία)	myrrh (σμύρνα) cassia quill (σῦριγξ κασίας) cinnamon (κινάμωμον)
Resin	burnt resin (ῥητίνη κεκαυμένη)	resin (ῥητίνη)	resin (resina)					resin (ῥητίνη)	terebinth resin (τερεβινθίνη [sc. ῥητίνη])

a little bit of cinnamon after the other ingredients have been weighed out." (*On Medical Materials* 1.59.1–3; trans. Coughlin).

Aetius of Amida: "Mendesian is very softening and relaxing for bodies and productive of pus. It is made from oil of *myrobalanos*, myrrh, cassia, and resin. After fixing it, some people also sprinkle cinnamon onto it" (*Medical Books* 1.126; trans. Coughlin).

Paul of Aegina: "Mendesian is so named because it was invented at the place in Egypt where Mendes was worshiped. It is made with 10 pounds of oil of *balanos* (another recipe has 10 pints); 3 ounces each of myrrh and cassia quill; 1 pound of terebinth (some have 10 pounds); 3 ounces cinnamon. This perfume is not boiled; instead, the dry ingredients are added [to the oil] and stirred for 60 days. Next, after it has been melted in part of the oil, the pine resin is added. Then, it is stirred for another 7 days and stored" (*Medical Compendium in Seven Books* 7.20.31; trans. Coughlin).

While identifications for most ingredients are uncontroversial, disagreement exists concerning oil of *balanos*. Literally "oil of the perfume nut" (βαλάνινον or μυροβαλάνινον ἔλαιον), *balanos* was identified as *Balanites aegyptiaca* (L.) Delile in the nineteenth and early twentieth centuries (e.g., Hort 1916: 443). The consensus now is that *balanos* refers to a species of *Moringa,* perhaps *M. peregrina* Fiori*,* that is, the ben tree (e.g., Keyser and Irby-Massie 2008: 1041; Haars 2018: 195), although some scholars continue to maintain it is *Balanites* (Squillace 2015).

Concerning quantities and methods of production, only one source preserves both: Byzantine physician Paul of Aegina (seventh century CE). Paul's recipe likely derives from an earlier tradition, perhaps the *Cosmetics* of Crito of Heraclea (first century CE), which he cites several times and which included a recipe for the Mendesian perfume (Galen, *On Compound Drugs according to Place* 1.3, 12.446–449 K.). It cannot be known with certainty that Crito is Paul's source, but it remains an intriguing possibility. Regardless, Paul is the only witness to the Mendesian's quantities and methods.

The Origins of the Mendesian in Egyptian Records (see table 2)

Balanos: *Balanos* oil is identified with *bꜣḳ* in Egyptian.  *bꜣḳ* has been interpreted as moringa oil, most probably *Moringa peregrina* Fiori, found in the Eastern desert in Upper Egypt, the Sinai, Syria, and Israel.

Myrrh:  *ʿntyw*, "myrrh," was not native to Egypt, but came from Punt or the Levant. The myrrh used in Egypt could have been *Commiphora myrrha* or *Commiphora erythraea* from Djibouti, Eritrea, Somalia, and Ethiopia; or *Commiphora gileadensis* from the Levant, which scholars identify with the biblical balm of Gilead (Serpico and White 2000: 439–42). The scent of *ʿntyw* belonged to the olfactory landscape of religious festivals. *ʿntyw* is heavily featured in medical recipes in various forms for blood vessels, infected wounds, and skin and eye infections. Its strong antibacterial properties gave *ʿntyw* a vital role in embalming.

Cinnamon: *Cinnamomum verum* (true cinnamon) from Sri Lanka, southern India, and Myanmar and *Cinnamomum cassia* (Chinese cassia) from southeast China, Vietnam, Laos, and Myanmar were not available in Egypt until the Persian period. The original Egyptian ingredient must have been camphor, in Egyptian  *ti-šps*. Camphor and cinnamon both belong to the botanical genus of *Cinnamomum*, a part of the family of

Figure 11. Mendesian reproduced (counterclockwise from bottom left): mortar and pestle, myrrh, pine resin, desert date oil, cassia and cinnamon quills, completed perfume. Photograph by Dora Goldsmith and Sean Coughlin.

Table 2. Candidate ingredients in Egyptian for mendesian.

Ingredient	Candidates in ancient Egyptian	Revised identification	Botanical identification(s)	Sources
Balanos oil	*bꜣk*	Moringa oil	*Moringa peregrina* Fiori	Egypt, Levant
	išd	Desert date oil	*Balanites aegyptiaca*	Egypt
Myrrh	*ꜥntyw*	Myrrh	*Commiphora myrrha* *Commiphora erythraea*	Punt
			Commiphora gileadensis	Levant
Cinnamon, cassia	*ti-šps*	Camphor	*Ocotea usambarensis*	Punt
			Unknown	Levant
Pine resin	*ꜥš*	Cedar	*Cedrus libani*	Levant
	ḳd.t	Pine	*Pinus halepensis*	Levant

Lauraceae. Likely in late antiquity the Greeks saw cinnamon as a suitable substitute for camphor in Egyptian perfume remedies. Possibly the novelty of cinnamon and/or its wider availability prompted the Greeks to substitute it for camphor.

Pine: Two ancient Egyptian words have been interpreted as "pine":  *ꜥš* and  *ḳd.t*. Chemical analyses have great difficulty distinguishing between the genera cedar (*Cedrus*) and pine (*Pinus*). The Egyptians obtained *ꜥš* from the Levant in great quantities for making boats, coffins, furniture, jars, and statues.

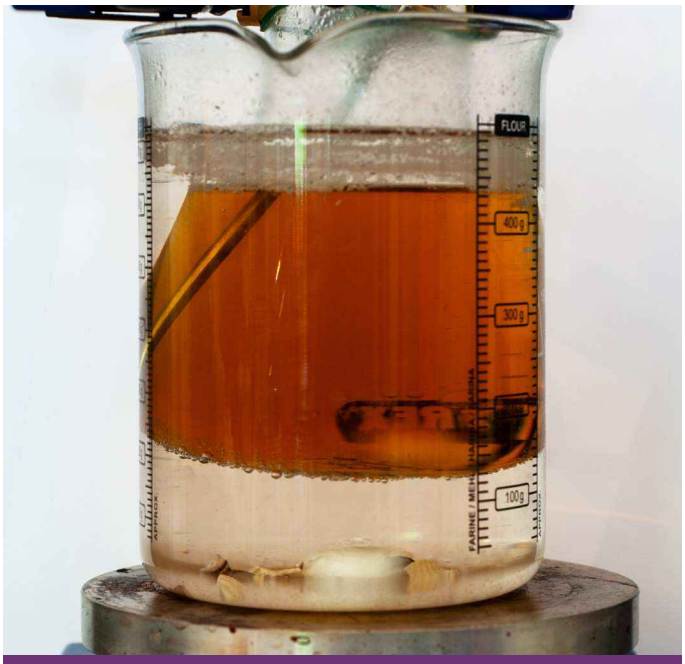

Figure 12. Heat-treatment of oils for ten days in bain-marie: at the bottom is the oil extracted from seeds of *Balanites aegyptiaca* (L.) Del. Photograph by Dora Goldsmith and Sean Coughlin.

From the Fourth Dynasty until the end of the Ptolemaic period, *ꜥš* was offered to the dead in tombs and to the gods in temples. *ḳd.t,* used in perfumery from the New Kingdom, appears in a list of *kyphi* ingredients delivered to the temple of Memphis. The Ptolemaic *kyphi* recipes state that the resin (*ḏdȝ* "fat") of *ḳd.t* was used in *kyphi*. If *ꜥš* is cedar and *ḳd.t* is pine, the written record suggests that cedar was used much more frequently. Cedar resin and wood were favored over pine resin and wood throughout their dynastic history. In the Greco-Roman period, pine resin and wood became more common in Egypt. The excessive use of cedar for its wood caused significant deforestation of cedar in antiquity, leading almost to its extinction in the Levant. Possibly in late antiquity, the scarcity of cedar prompted the substitution of pine resin in perfume recipes.

Egyptian sources lack a recipe for the Mendesian, but many of its ingredients, especially *bȝḳ*, *ꜥntyw*, and *ti-šps*, are frequently mentioned in connection with each other. *bȝḳ*, *ꜥntyw*, and *ti-šps* were often combined to make a perfume oil or unguent, which was offered to the gods in temples, the deceased in the afterlife, and used in mummification. The documents highlight the exclusive and celebratory character of the perfume for use on special occasions. This would explain why the classical sources call the Mendesian expensive and luxurious. The perfume was also

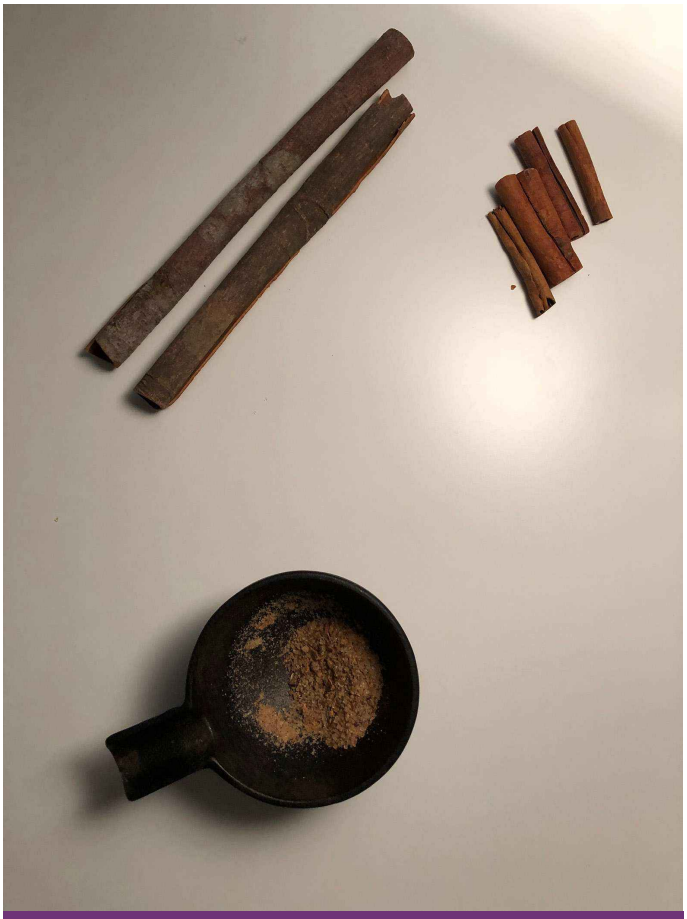

Figure 13. Grinding myrrh with mortar and pestle. Photograph by Dora Goldsmith and Sean Coughlin.

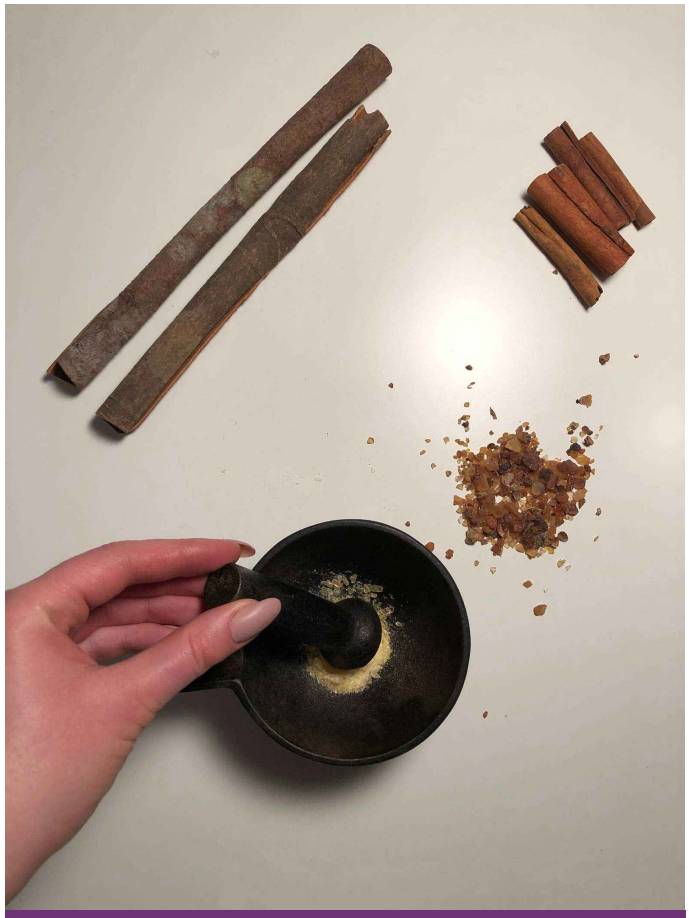

Figure 14. Grinding pine resin with mortar and pestle. Photograph by Dora Goldsmith and Sean Coughlin.

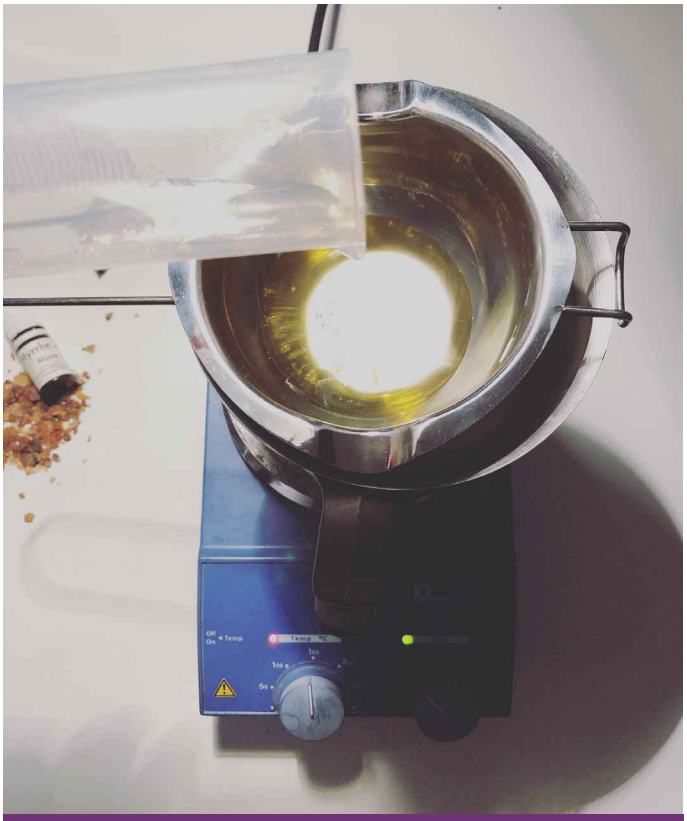

Figure 15. Warming moringa oil sample for dissolving aromatics and resins. Photo Dora Goldsmith and Sean Coughlin.

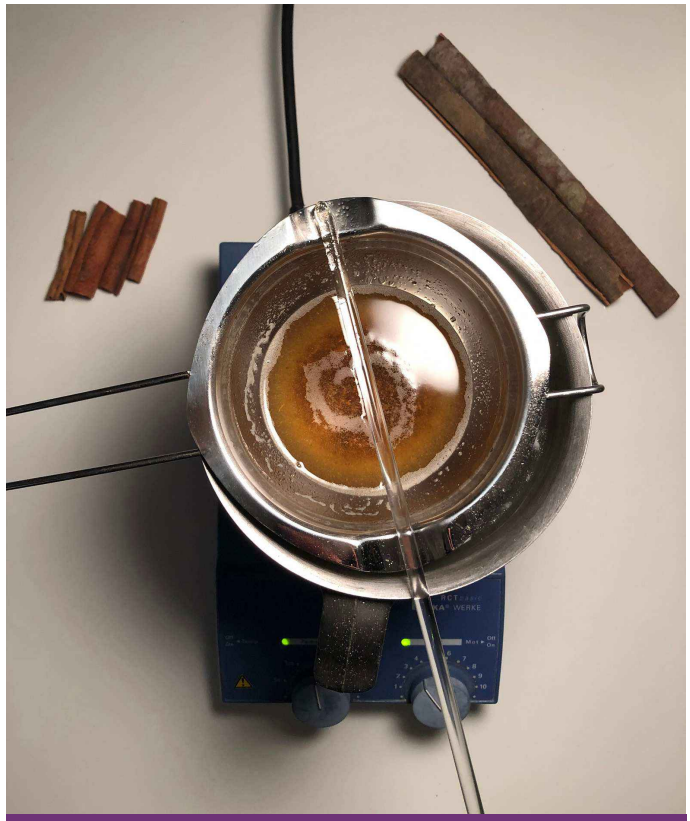

Figure 16. Dissolving resins in warm moringa oil. Photograph by Dora Goldsmith and Sean Coughlin.

known as "the fragrances of Punt" and "the pleasant unguent," giving the impression that it was a well-known product. Several inscriptions indicate that this perfume was commonly referred to as *ʿntyw*:

> Presenting myrrh [*ʿntyw*]. Words to be spoken: "Take yourself the jar filled with camphor oil [*ti-šps*]" (placed) on the forelegs of the lion, the ruler of Punt. You anoint your head. You anoint your body. Its fragrance is good for your Majesty. (Dendera III, 157, 1–3, trans. Goldsmith)

The main ingredient of this perfume was myrrh, cooked and made into an oil or unguent, most likely with moringa oil (*bꜣḳ*). Thus, the Egyptians considered "the base" or "heart" of this perfume *ʿntyw*, to which *ti-šps* was added. Curiously, a few classical sources treat cinnamon as an extra ingredient of the Mendesian, which could be added at the end, if one pleases. The texts reveal that *ʿntyw* as a manufactured perfume product was essential in ancient Egyptian perfumery. It was mostly cooked (*nwd*) to be made into an unguent or an oil.

> Words to be spoken: I come to you Ennead in the throne (Edfu), the great ancestors in the throne of Re. I am bringing you myrrh [*ʿntyw*] cooked [*nwd*] according to the requirements. Your smell is pleasant because of it. You are the gods, the lords of unguent, (with) beautiful faces and (of) sweet love. (Dendera IV, 30, 4, trans. Goldsmith)

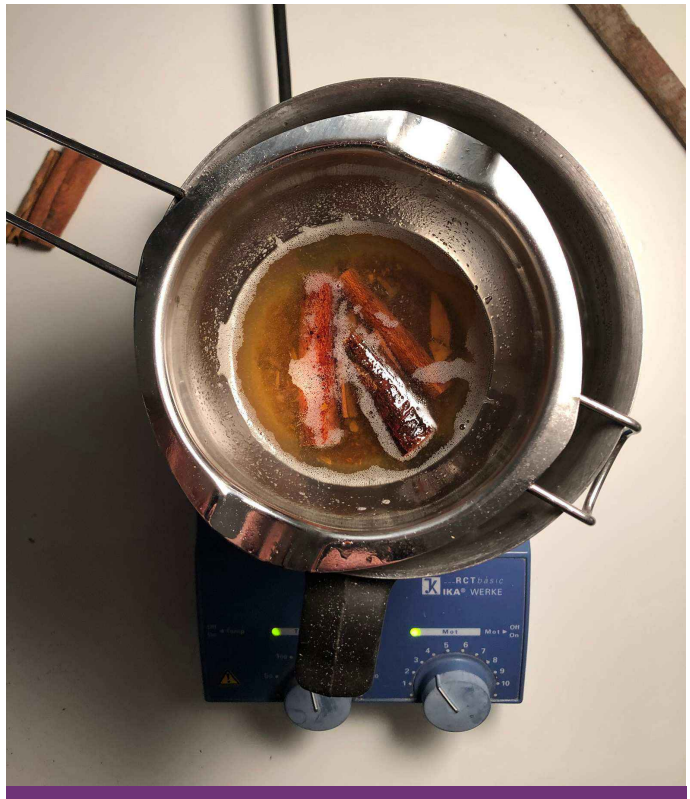

Figure 17. Adding cinnamon to sample. Photograph by Dora Goldsmith and Sean Coughlin.

Figure 18. Mendesian perfume sample ready. Photograph by Dora Goldsmith and Sean Coughlin.

Table 3. Candidate ingredients for Greco-Roman mendesian.

Name	Candidate Botanical Identification(s)	Source	Function
Balanos oil	*Balanites aegyptiaca* (L.) Delile	Sudan	excipient
	Moringa oleifera Lam.	India	
Cassia	*Cinnamomum aromaticum* Nees	Indonesia	aromatic
Cinnamon	*Cinnamomum verum* J. Presl	Sri Lanka	aromatic
Myrrh	*Commiphora myrrha* (Nees) Engl.	Somalia	aromatic/ fixative
Resin	*Pinus* sp.	China	fixative
	Pistacia terebinthus L.		

Myrrh oil or unguent (*ʿntyw*) was "very Egyptian"; it symbolized the true character of ancient Egyptian perfumery. This explains why the Mendesian is called "the Egyptian" in classical sources.

Experimental Archaeology: The Recreation of the Mendesian Based on Written Sources

In 2018–2019, two of the authors, Goldsmith and Coughlin, conducted replications of ancient recipes for the Mendesian. Their approach differed from recent studies of ancient perfumery (Donato and Seefried 1989; Castel et al. 2009) and took its cue from work in the history of alchemy (Principe 2013; Martelli 2013; Raggetti 2019). Rather than attempting to "reproduce" an interpretation of a recipe determined nonexperimentally (ultimately a circular procedure), the researchers designed experiments to test candidate materials and procedures and to yield different interpretations, therefore increasing the chances of discovering the chemical and olfactory reality behind the texts.

The starting point for their replications was Paul of Aegina's recipe. Experimental conditions were established by cross-referencing his quantities and methods with other Egyptian, Greek, and Latin sources and selecting the most plausible candidate. Plausible candidate materials, listed in table 3, were established by consulting botanical identifications in recent literature: Adams 1846; Amigues 2006; André 1985; Beck 2020; Berendes 1902; Haars 2018; Hort 1916; Keimer 1984; Keyser and Irby-Massie 2008; Lüchtrath 1988; Serpico and White 2000. Candidates tested are given in bold (see also fig. 11).

Methods

Preparing oils: 250 ml of each *Balanites* and *Moringa* oil were heat-treated by placing the oil in a glass flask and submerging in a water bath at approx. 90–100°C for 10 days (fig. 12). Oils were allowed to cool. 125 ml of each was aliquoted into glass jars. 125 ml of non-heat-treated *Balanites* and *Moringa* oil were also aliquoted (125 ml) into glass jars. In all, eight excipient samples were prepared: two 125 ml-preparations of heat-treated *Moringa*; two of heat-treated *Balanites*; two of non-heat-treated *Moringa*; two of non-heat-treated *Balanites*.

Preparing aromatics and fixatives: myrrh (24 g), cinnamon (24 g), cassia (24 g), and resin (96 g) were finely ground in a mortar (figs. 13 and 14).

Cold digestion: 3 g myrrh, 3 g cinnamon, and 3 g cassia were added to each of four samples of heat-treated and non-heat-treated *balanos* oil. Samples were sealed with lids and agitated daily for 60 days by repeated inversions until the sediment was dislodged from the bottom of the jar and allowed to mix freely. After 60 days, 50 ml from each sample was decanted into separate beakers and heated on a hot plate to 90°C. 12 g of resin were added to each and stirred until dissolved. These mixtures were returned to their respective samples and agitated until incorporated. Jars were agitated daily for another 7 days, press-filtered through cheesecloth, and stored in clean jars.

Warm digestion: A stainless-steel pot was filled with water and heated to boiling. 125 ml of untreated *Moringa* oil was placed in a stainless-steel melting pot, set on the pot of boiling water and heated to 90°C (fig. 15). 3 g of myrrh and 3 g of cassia were added (figs. 16 and 17). The mixture was stirred on the double

boiler with a glass rod for one hour. 50 ml was decanted into a second melting pot and placed on the boiling water. 12 g of resin were added and stirred until dissolved. The oil-and-resin mixture was added back to the sample and agitated until incorporated. The sample was pressed through cheesecloth while hot, 3 g of ground cinnamon were added, and the mixture was stored in a flask (fig. 18). The process was repeated for the remaining samples.

Preliminary Results and Discussion

Two methods of producing the Mendesian were tested: the cold digestion of Paul of Aegina and a warm digestion based on descriptions in Theophrastus and others, who state perfumes were produced in a bain-marie or on a low fire.

In total, four candidate excipients were tested. Since the identification of *balanos* oil is disputed, Goldsmith and Coughlin tested oils from both *Balanites* and *Moringa* species; moreover, because Theophrastus reports the oil for the Megalium (likely identical or similar to the Mendesian) was heat-treated before being used, they tested heat-treated and non-heat-treated samples of both oils. Oils were heat-treated by placing them in a bain-marie at 90–100°C for ten days continuously.

Perfumes produced with *Balanites* oil retained the olfactory profile of the oil, a characteristic nutty smell, with a small hint of cinnamon. The heat-treated *Balanites* had a more neutral odor than the non-heat-treated, suggesting the technique mentioned by Theophrastus was a refining technique. The *Moringa* oil had a far more neutral scent when not heat-treated; heat-treated *Moringa* smelled burnt. The non-heat-treated *Moringa* used in the cold digestion became contaminated by a white growth after several weeks in storage.

One constellation of variables produced a scent that was extremely pleasant, with a spicy base note of freshly ground myrrh and cinnamon and accompanied by sweetness. It has remained potent for nearly two years, a quality associated with Egyptian perfumes already in Theophrastus's time. This perfume was exhibited at the National Geographic Museum, Washington, DC between March 1, 2019 and September 15, 2019 in the framework of the exhibition Queens of Egypt (fig. 19). Even after thousands of years, the perfume that once might have been worn by Cleopatra does not cease to amaze us and finds its relevance in the modern world.

Figure 19. Photograph National Geographic Society exhibit, "Queens of Egypt."

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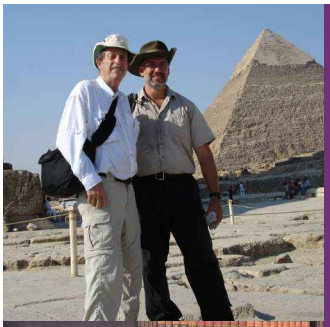

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